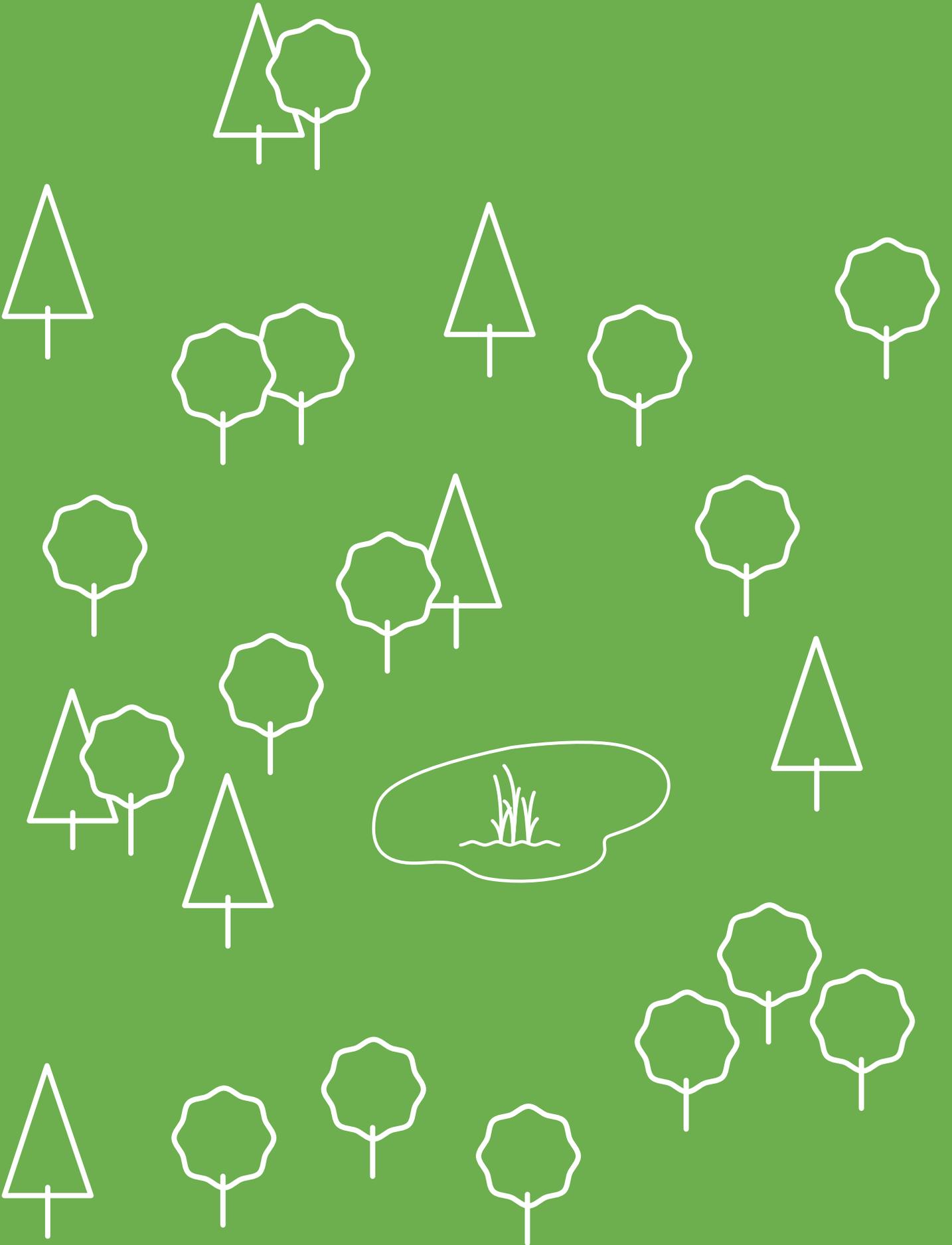


Natural Resources

Protecting our region's assets





Natural Resources

Protecting our region's assets

4 **About the Natural Resources snapshot**

6 **Value of ecosystem services**

8 **Challenges to our natural resources**

Climate change and emissions

Development

32 **Current conditions and trends**

Habitat

Parks and recreation

Water quality

Water supply

Air quality

68 **ON TO 2050 and natural resources**

About the Natural Resources snapshot



High-quality natural resources are critical for sustaining the region's economy and quality of life. The natural areas and water resources of northeastern Illinois provide valuable services to local communities, but continue to face serious challenges.

Since 2001, the region has lost 140,000 acres of farmland and natural areas to development. During this same time, the emerald ash borer decimated the region's ash tree population, and severe storms, flooding, and droughts affected communities, agriculture, and natural areas throughout the region.

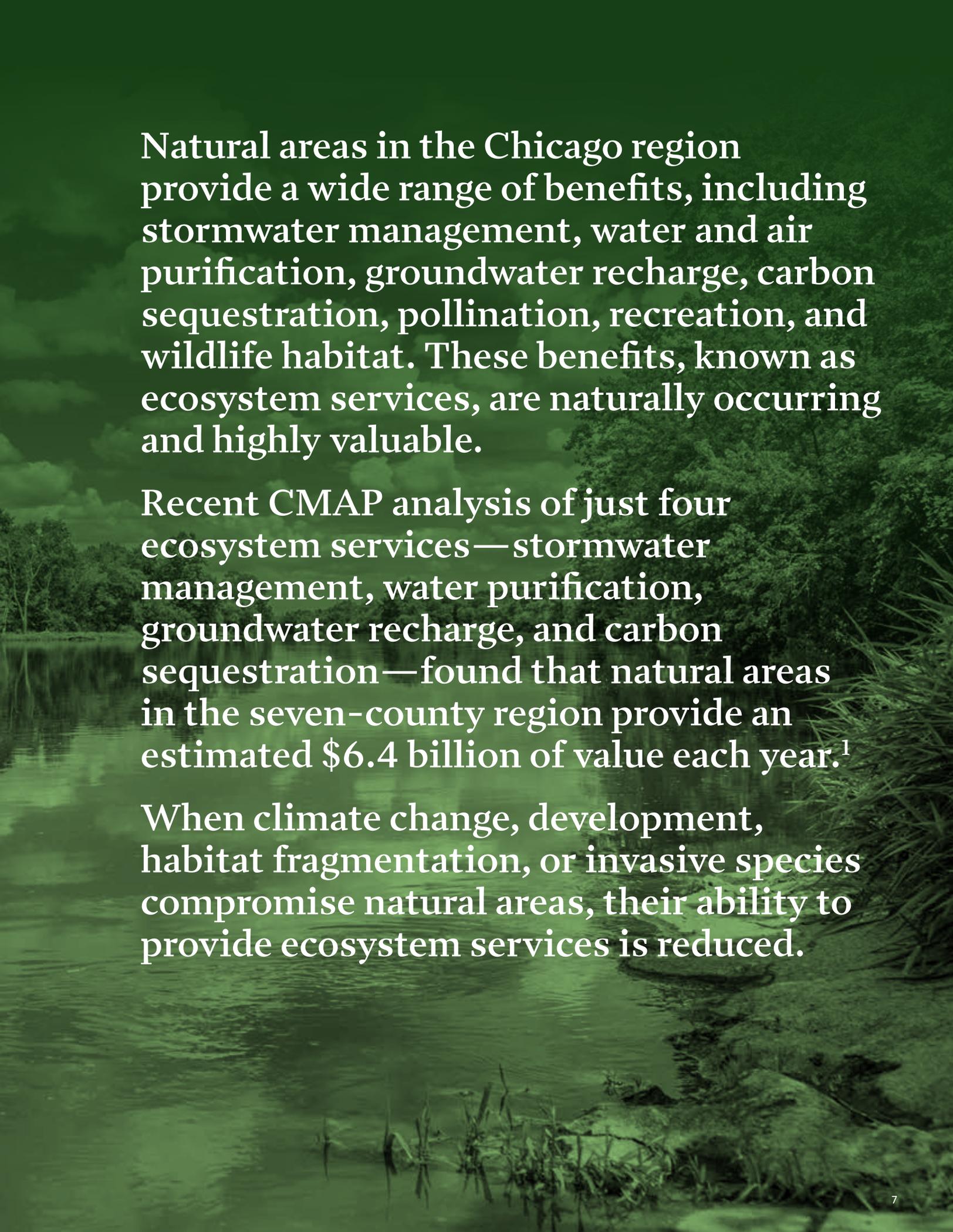
Governments, community and nonprofit groups, and private citizens have a long history of environmental action, and continue to respond to these threats and enhance the region's natural resources. From 2001-15, the region permanently preserved an additional 61,500 acres of natural and agricultural lands, building on a strong foundation of parks, forest preserves, and greenways pioneered by previous generations. Significant improvements have been made to air and water quality, and the region's residents have greater access than ever to parks, trails, and natural areas.

This snapshot report explores the current state of the region's air, land, and water resources, paying special attention to trends that are likely to continue during the years to come. The report is divided into two main sections: challenges to our natural resources, which focuses on climate change and development; and current conditions and trends, which explores the current state of natural resources in the region.

This report provides context to inform the environmental recommendations of ON TO 2050, northeastern Illinois' next comprehensive regional plan. ON TO 2050 will build on GO TO 2040's recommendations, with new strategies focused on water resources, stormwater and flooding, and climate resilience.

Value of ecosystem services



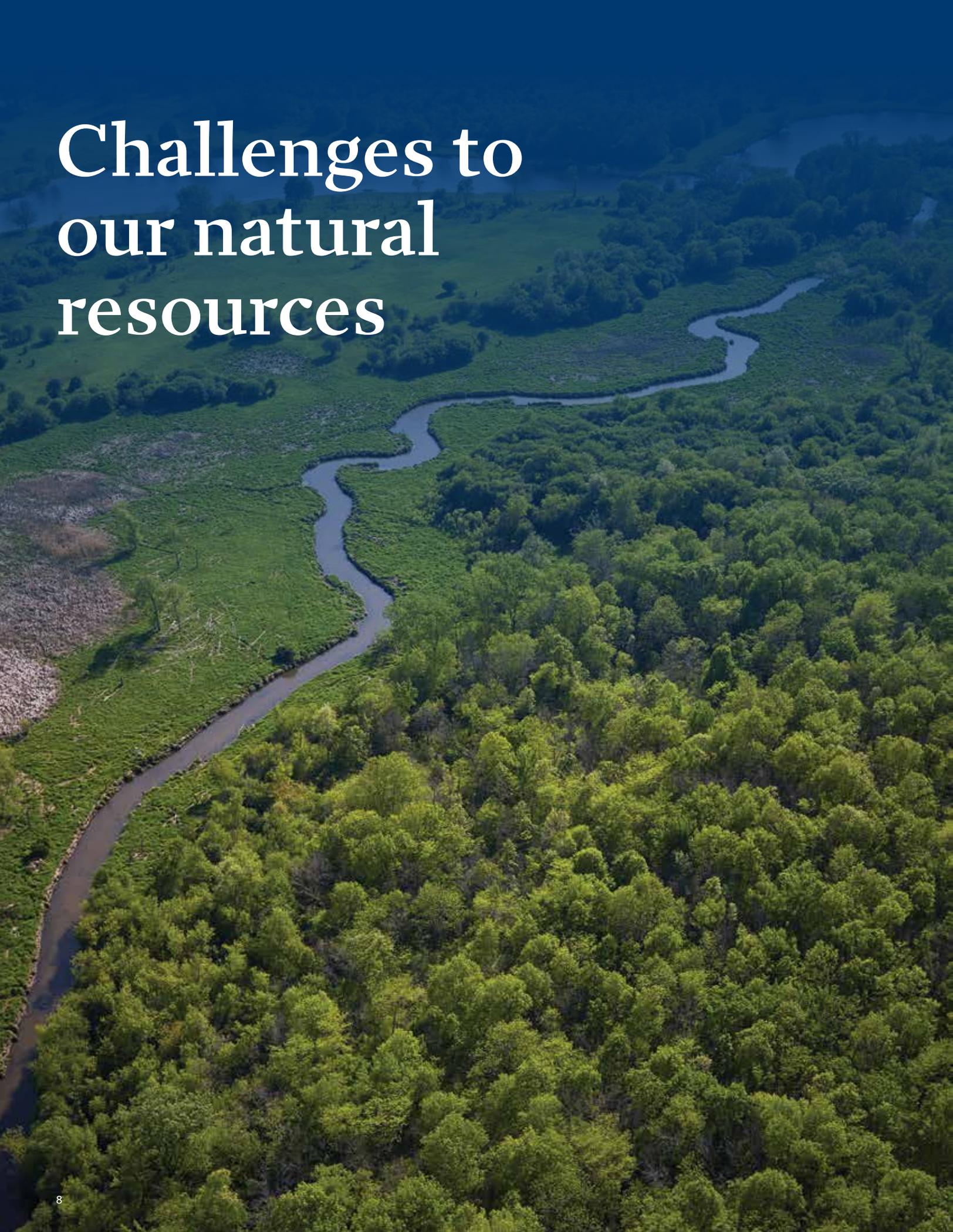


Natural areas in the Chicago region provide a wide range of benefits, including stormwater management, water and air purification, groundwater recharge, carbon sequestration, pollination, recreation, and wildlife habitat. These benefits, known as ecosystem services, are naturally occurring and highly valuable.

Recent CMAP analysis of just four ecosystem services—stormwater management, water purification, groundwater recharge, and carbon sequestration—found that natural areas in the seven-county region provide an estimated \$6.4 billion of value each year.¹

When climate change, development, habitat fragmentation, or invasive species compromise natural areas, their ability to provide ecosystem services is reduced.

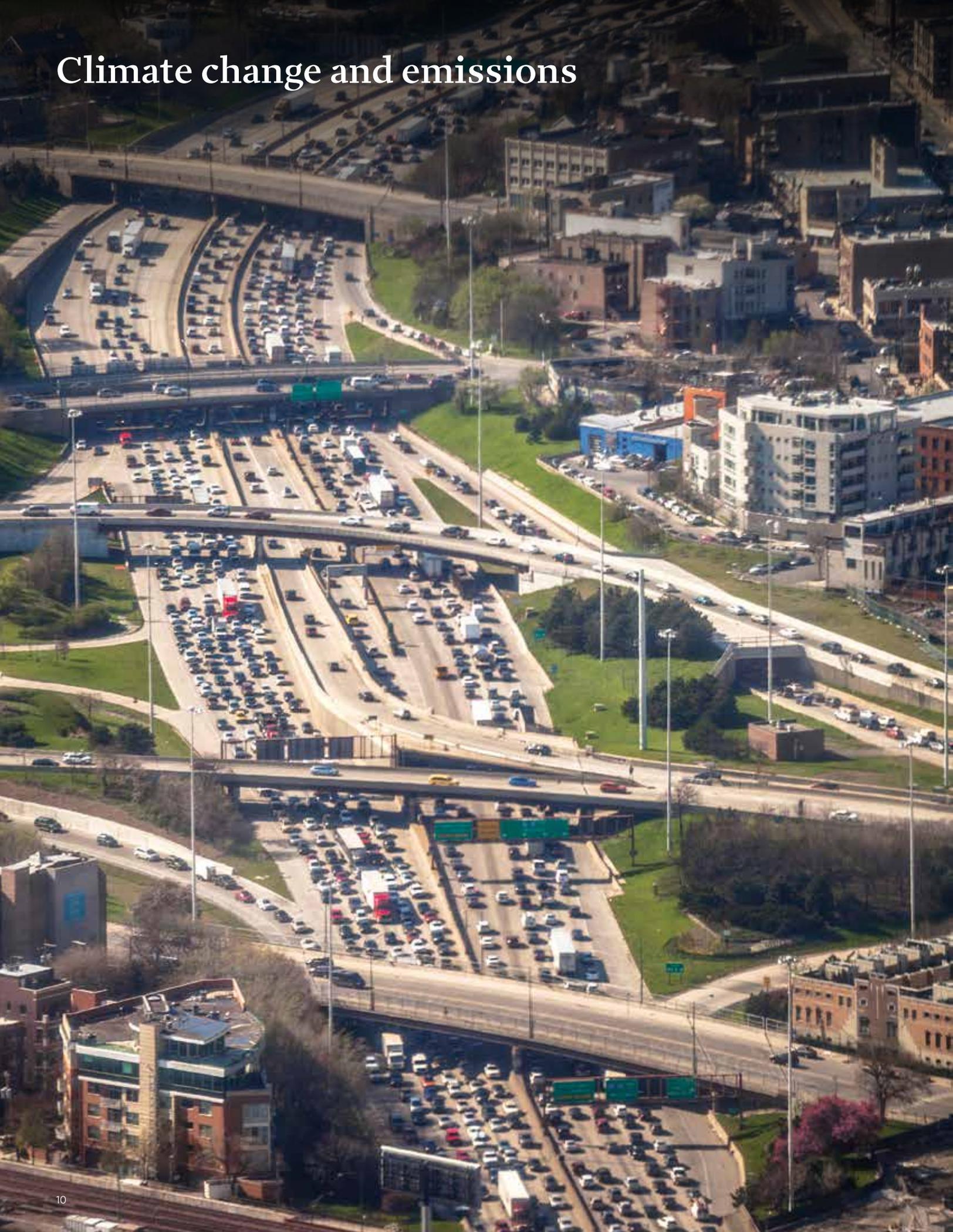
Challenges to our natural resources

An aerial photograph of a winding river flowing through a dense, lush green forest. The river meanders from the bottom left towards the top right, surrounded by thick vegetation. The lighting is bright, highlighting the vibrant green of the trees and the dark blue of the water.

A yellow LORIG road roller is shown paving a road. In the foreground, a worker is partially visible, operating the machine. The road roller has "LORIG" written on its side. In the background, another worker is visible, and there are utility poles and buildings under a clear blue sky.

Natural areas in the Chicago region face a complex array of challenges. Climate change and development stand out as the two main drivers of these challenges. Understanding the scope and scale of these drivers provides valuable insight into the current and future state of the region's natural resources.

Climate change and emissions



Northeastern Illinois has enjoyed a stable climate for several thousand years, allowing the region's natural areas, farms, and cities to thrive. Today's climate continues to be defined by hot summers and cold winters, but the region's weather is increasingly unpredictable. Powerful storms have become more common, as have heat waves and droughts. These changes are primarily due to increasing concentrations of greenhouse gasses in the Earth's atmosphere, and are likely to continue and intensify during the coming years.

Weather vs. Climate

The terms are sometimes confused, but weather and climate are quite different.

Weather refers to temporary atmospheric conditions, typically lasting a few hours or days. Thunderstorms, cold spells, heat waves, droughts, and blizzards are all examples of weather.

Climate refers to long-term atmospheric conditions, typically measured by 30-year "normals." Climate is the sum total of many weather events, occurring over a long period of time.

While it can be tempting to point to individual weather events as a sign that climate change is or is not happening, a single storm or heat wave is not a trend. Instead, climate scientists analyze records going back many decades to find evidence of long-term changes in weather patterns. These changing patterns may mean individual weather events are stronger, or more frequent, but individual weather events themselves do not constitute a change in climate.

Greenhouse gas emissions

Greenhouse gasses, also known as GHGs or heat-trapping gasses, form a protective barrier in the atmosphere that prevents heat from being reflected back into space. This process, known as the greenhouse effect, helps to make life possible, but as emissions increase, the effect becomes stronger and global temperatures begin to rise.

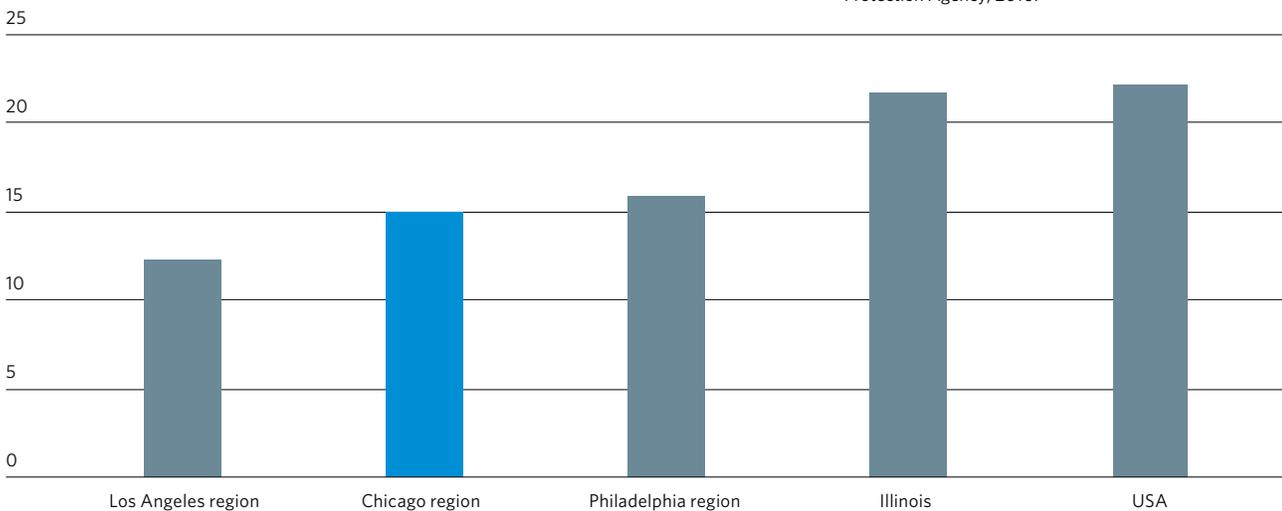
In 2010, the most recent year for which there is data, northeastern Illinois emitted 126.25 million metric tons of CO₂ equivalent. In total, this amounts to 15 metric tons of CO₂ equivalent per capita from buildings, transportation, industry, solid waste, wastewater, drinking water, and agriculture.

Buildings and transportation account for most of the region's emissions. In 2010, building energy, including heating, cooling, lighting, and general electricity, was responsible for nearly two-thirds of all GHG emissions in the region. On-road transportation, which includes public, private, and commercial motor vehicles, was the second-largest source of emissions.

Greenhouse gas emissions vary considerably across the region. In 2010, the City of Chicago emitted the fewest GHG emissions per capita, and Will County produced the most emissions per capita. The design of the built environment and its impact on housing density and travel behavior helps explain these differences.

Per capita greenhouse gas emissions, CMAP region and select other geographies

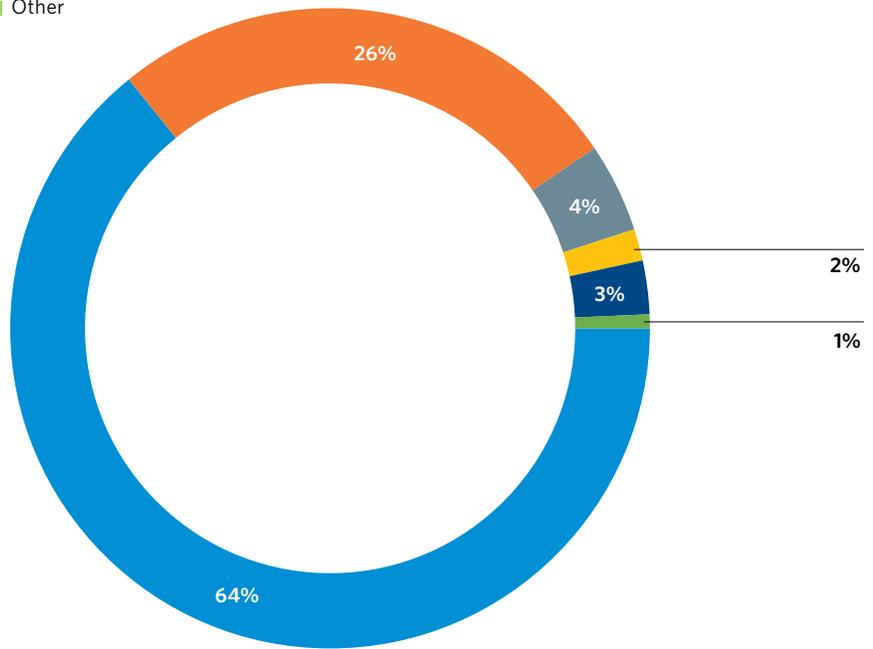
Sources: Chicago Metropolitan Agency for Planning, 2012; Delaware Valley Regional Planning Commission, 2007; Southern California Association of Governments, 2012; World Resources Institution, 2007; U.S. Environmental Protection Agency, 2010.



Emissions by sector, CMAP region, 2010

Source: Chicago Metropolitan Agency for Planning
2010 Regional Greenhouse Gas Emissions Inventory.

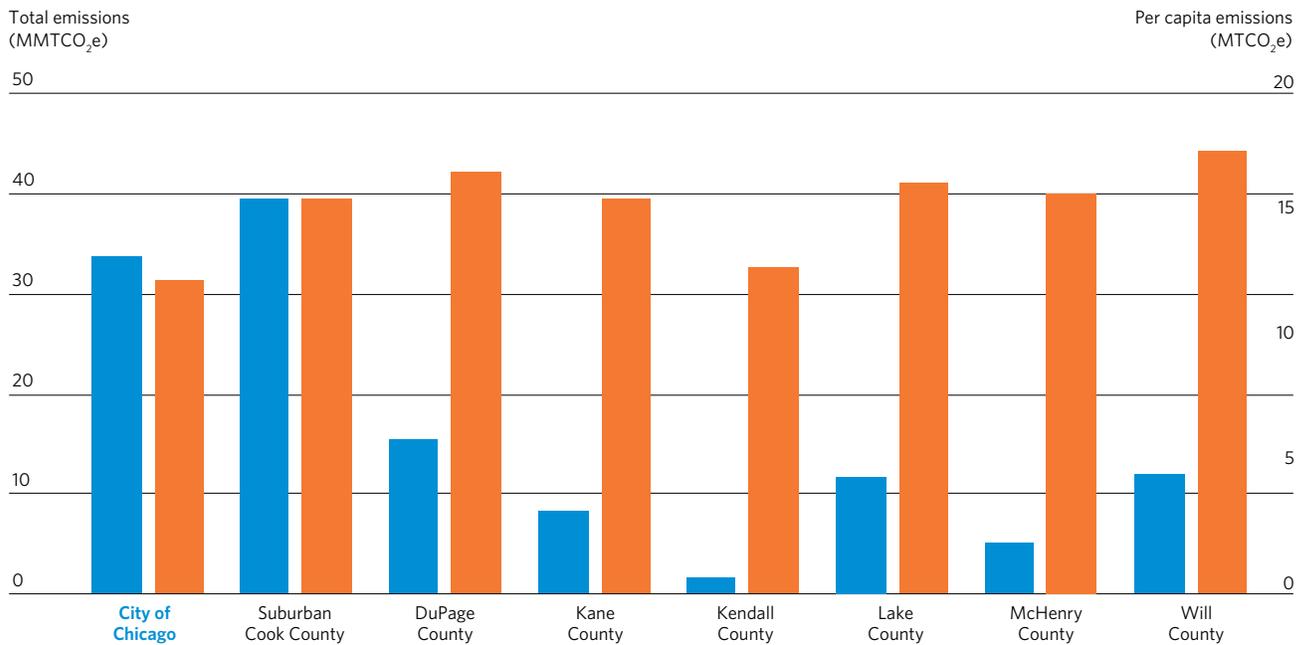
- Building energy
- On-road transportation
- Rail and off-road transportation
- Waste and wastewater
- Solid waste
- Other



Emissions by county and City of Chicago, 2010

Source: Chicago Metropolitan Agency for Planning
2010 Regional Greenhouse Gas Emissions Inventory.

- Per capita
- Total



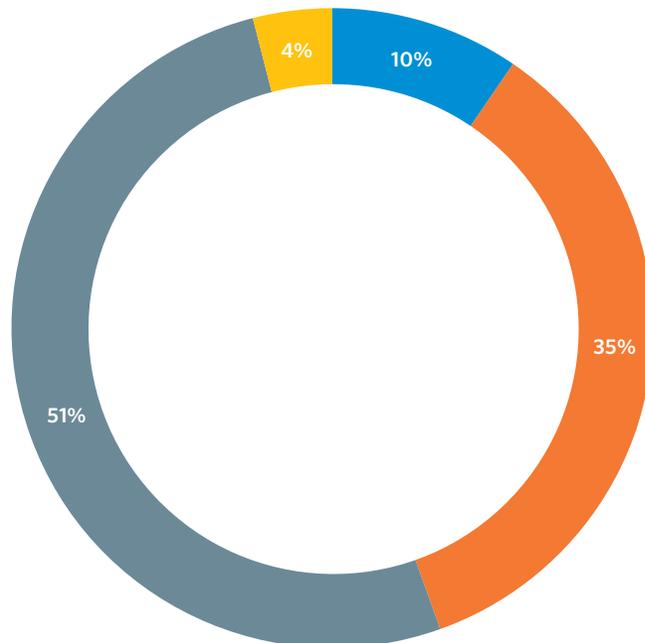
Energy portfolio

Illinois is a national leader in nuclear energy. Over half of all electricity generated in the state comes from nuclear sources. Solar energy currently accounts for less than one percent of all electricity generated in Illinois.

Net electricity generation by source, Illinois, July 2017

Source: U.S. Energy Information Administration, 2017.

- Nuclear
- Natural gas
- Coal
- Wind and solar



Historical climate

The Chicago area has a continental climate characterized by hot, humid summers and cold, dry winters. Precipitation is greatest during the summer, though major storms occur throughout the year. Weather patterns in the region are highly variable, with frequent, short-term fluctuations in temperatures, humidity, cloudiness, and wind direction.²

The Chicago region experiences several forms of extreme weather. Severe thunderstorms, some capable of producing strong winds, hail, and tornadoes, are common during the summer and spring.³ Heavy rains from these storms can lead to flooding along riverbanks and in areas with large amounts of impervious coverage and inadequate drainage systems. Extreme heat during the summer months can create potentially unsafe living conditions in areas with limited access to air conditioning, especially for the elderly and people living alone. A five-day heat wave in the summer of 1995 dramatically demonstrated this threat, as more than 700 Chicago residents died.

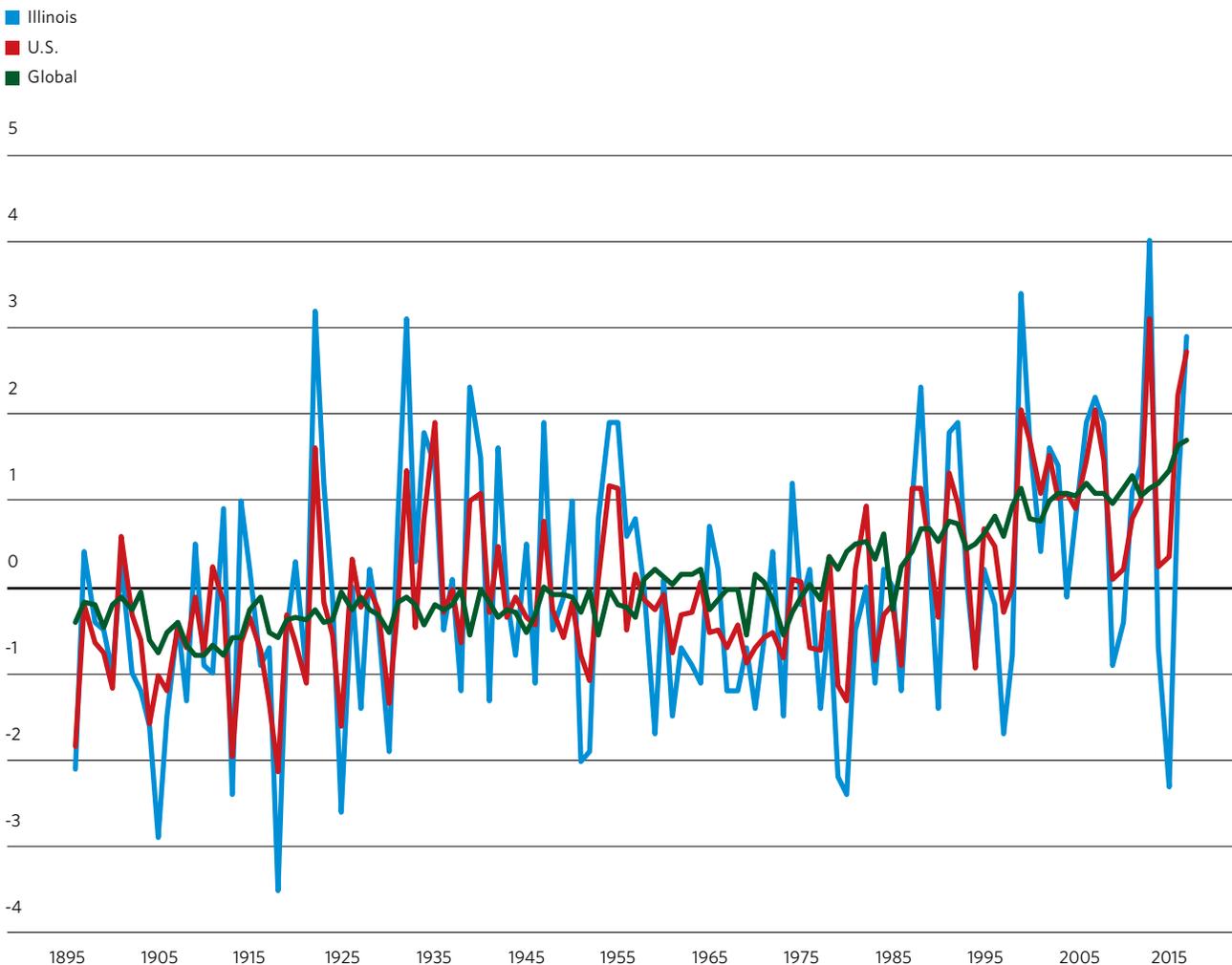
On average, the region receives 36.3 inches of snow each year between November and March.⁴ Heavy snowfall, especially in areas near Lake Michigan, can disrupt transportation systems and force school and business closures.⁵ Freezing rain occurs less frequently but can cause severe traffic disruptions and power outages. Extremely cold days—those below 0 degrees Fahrenheit—occur an average of three days per year.⁶

Observed change

Average annual temperatures in Illinois have increased by one degree Fahrenheit since 1900.⁷ During the same period, average annual temperatures in the U.S. rose by 1.3-1.9 degrees Fahrenheit, and global temperatures rose by 1.5 degrees Fahrenheit.⁸ Because temperature affects many weather processes—including precipitation and storm formation—even small changes can dramatically increase the destructive potential of natural disasters.

Average temperature anomalies, in degrees Fahrenheit, 1895-2015

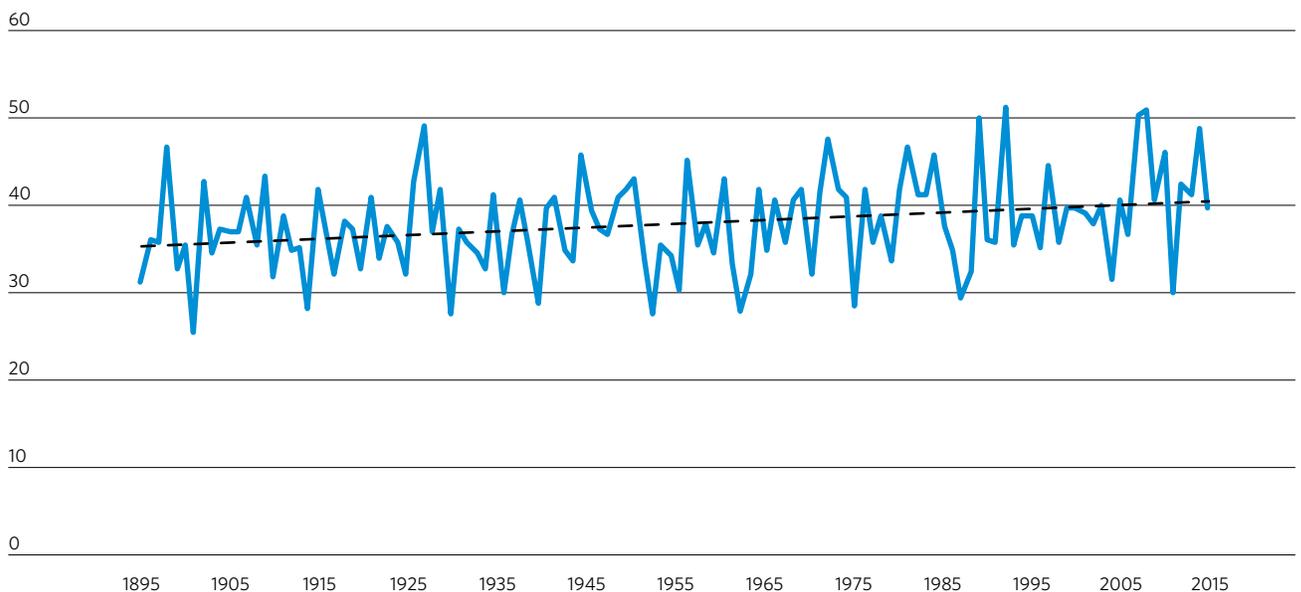
Source: National Centers for Environmental Information, "Climate at a Glance," National Oceanic and Atmospheric Administration, 2017.



On average, air can hold four percent more moisture for every degree Fahrenheit of temperature increase, which can lead to more frequent and more powerful storms. The region has already begun to see the effects of this increase. Between 1979 and 2009, extreme precipitation events increased 40 percent compared to the previous 30-year period.⁹

Average annual precipitation, in inches, Illinois, 1895-2015

Source: National Centers for Environmental Information, "Climate at a Glance," National Oceanic and Atmospheric Administration, 2017.



Projections

Climate scientists use models based on GHG emissions scenarios to create climate forecasts. Typically, these models include a “low-emissions scenario” that assumes significant reductions in GHG emissions, and a “high-emissions scenario” that assumes global emissions will continue to increase.

Like any forecast, climate projections are not precise. Rather, they are tools for analyzing high-level trends and making long-term planning decisions. Generally, these models suggest the region’s climate will become warmer and wetter, and the weather will become more variable.

Under a high-emissions scenario, average annual temperatures in northeastern Illinois could increase by six to 13 degrees Fahrenheit by the end of the century. Under a more optimistic, low-emissions scenario, average temperatures are expected to increase by three to nine degrees Fahrenheit.

The region is also likely to see increases in extreme heat. Historically, days above 100 degrees Fahrenheit have been extremely rare. By 2100, the region could reach these temperatures 23 days per year.

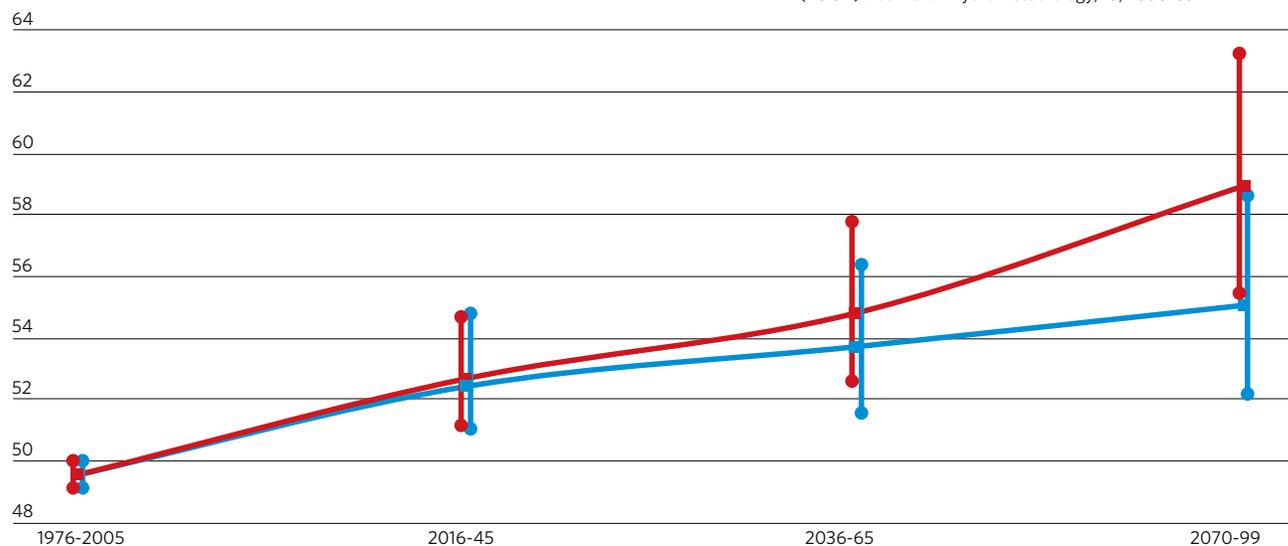
Recent climate models indicate that northeastern Illinois will see modest increases in annual precipitation, with significant seasonal and year-to-year variability. The winter and spring months will likely become even wetter, while the summer months are expected to become drier. Under a high-emissions scenario, mean model results suggest the region will see an increase in annual precipitation of four inches. Under a low-emissions scenario, an increase of two inches is projected.

Increases in large rain events—greater than one inch—will likely become more frequent during the coming years. By 2100, these events could occur four to six times per year, compared with three to four times annually from 1976-2006.

Climate models highlight that while reducing greenhouse gas emissions must be a component of a long-term climate strategy, reductions alone are not enough. The climate has already begun to change, and some level of adaptation will be necessary.

Range of projected daily average temperature, in degrees Fahrenheit, in northeastern Illinois

- High-emissions scenario mean
- Low-emissions scenario mean

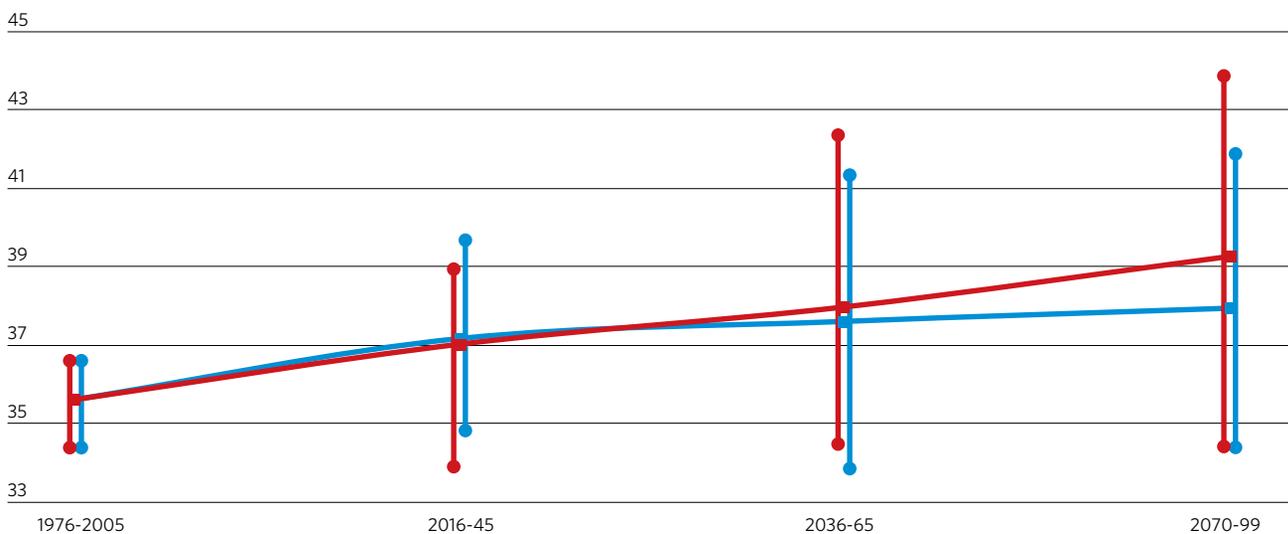


Note: Under a scenario that assumes emissions will continue to increase, regional temperatures are expected to increase by nine degrees Fahrenheit above historical levels. Under a lower emissions scenario, regional temperatures are expected to increase by five degrees above historical levels.

Source: D.W. Pierce, D. R. Cayan, and B. L. Thrasher, 2014: Statistical downscaling using Localized Constructed Analogs (LOCA). Journal of Hydrometeorology, 15, 2558-85.

Range of projected annual total precipitation, in inches, in northeastern Illinois

- High-emissions scenario mean
- Low-emissions scenario mean



Source: D.W. Pierce, D. R. Cayan, and B. L. Thrasher, 2014: Statistical downscaling using Localized Constructed Analogs (LOCA). Journal of Hydrometeorology, 15, 2558-85.

Global climate change

While northeastern Illinois will not directly experience the most severe effects of climate change—including sea level rise, hurricanes, and desertification—the region will feel the economic and demographic effects of these forces. Sea level rise and powerful hurricanes may cause more people to move to the region, while the cost of rebuilding and reinforcing coastal communities may reduce the amount of federal funding available for projects in Illinois. Supply chain interruptions for both food and consumer products could encourage more diversification of the region’s economy, but also increase costs for consumers.

Climate vulnerable populations

Climate change is a threat multiplier that intensifies existing environmental, social, and economic challenges.

As part of the region’s inclusive growth strategy, CMAP has identified low-income areas with large minority or limited English-speaking populations. These Economically Disconnected Areas, or EDAs, often have the greatest exposure to environmental hazards, and may have limited capacity to adapt to environmental and economic shocks. These demographic features, as well as other key indicators of climate vulnerability, including age, disability status, and housing tenure, should be used to plan for those most vulnerable to climate change at the local level.



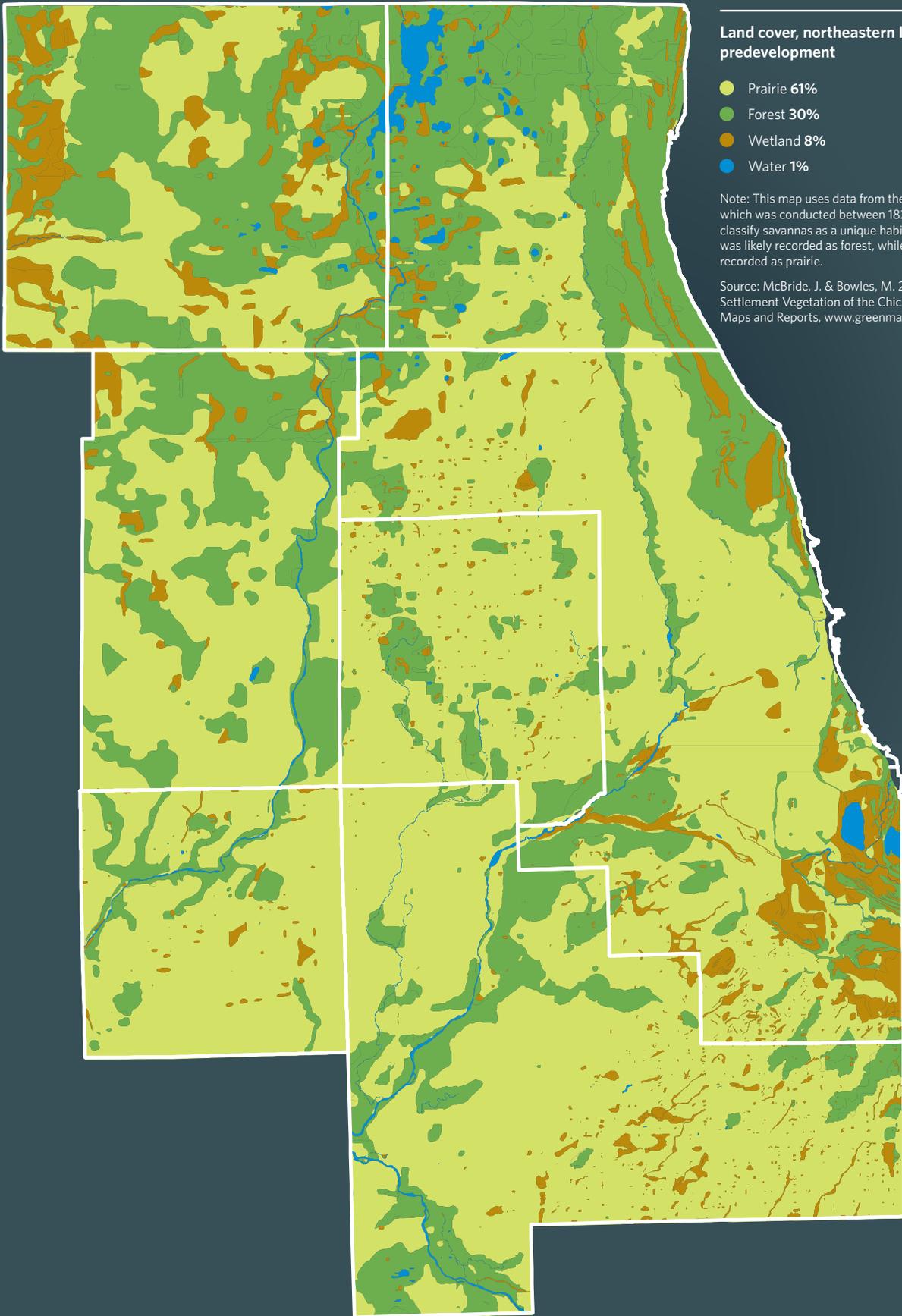


Development

The Chicago region's urban footprint has grown considerably during the last 100 years. While growth is essential to maintaining a strong regional economy, new development on the region's periphery has the potential to negatively affect farms and natural areas and unnecessarily increase the costs of infrastructure and public services. In particular, impervious surfaces—including buildings, roads, parking lots, and other surfaces that prevent rain from filtering into the ground—retain heat and increase stormwater runoff, reducing water quality and elevating flood risk.

Predevelopment land cover

Prior to large-scale development, the Chicago region was a mosaic of distinct ecosystems, with forests, prairies, savannas, and wetlands existing side by side. Tallgrass prairie and oak savanna covered much of the region, with pockets of hardwood forest along the eastern banks of rivers, lakes, and other firebreaks.¹⁰ Much of southern Cook and eastern Will counties was wetland, while the northern counties, including Lake and McHenry, were the most heavily forested areas.



Land cover, northeastern Illinois, predevelopment

- Prairie 61%
- Forest 30%
- Wetland 8%
- Water 1%

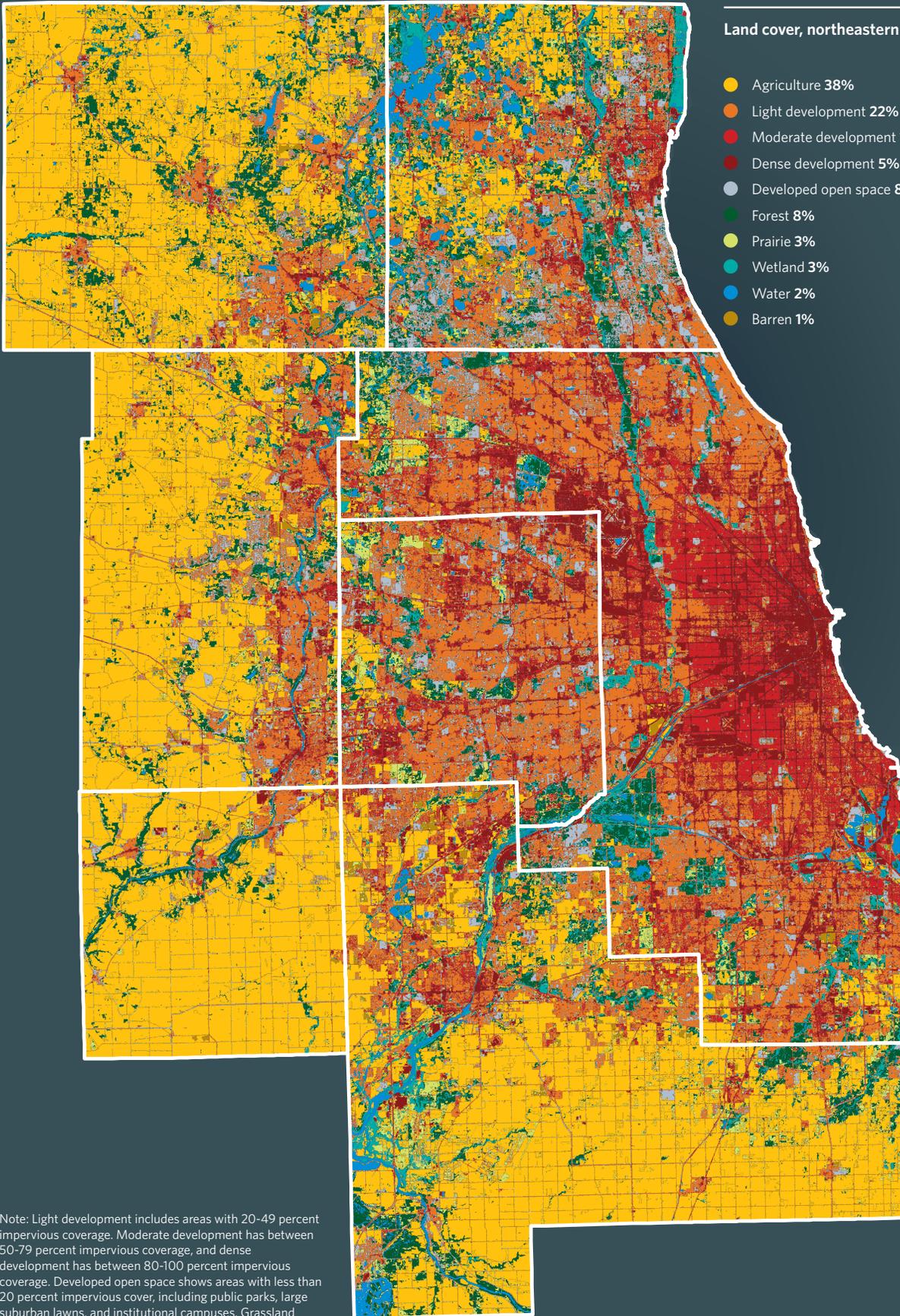
Note: This map uses data from the Public Lands Survey (PLS), which was conducted between 1821-40. The PLS did not classify savannas as a unique habitat type. Denser savanna was likely recorded as forest, while open savanna was likely recorded as prairie.

Source: McBride, J. & Bowles, M. 2007. Pre-European Settlement Vegetation of the Chicago Region. Interactive Maps and Reports, www.greenmapping.org/archive.php.

Land cover today

Today, most of the region has been developed for urban or agricultural use, though pockets of high-quality wetlands, prairies, savannas, and forests still exist, including many critically important oak ecosystems.¹¹

Land cover, northeastern Illinois, 2011



Note: Light development includes areas with 20-49 percent impervious coverage. Moderate development has between 50-79 percent impervious coverage, and dense development has between 80-100 percent impervious coverage. Developed open space shows areas with less than 20 percent impervious cover, including public parks, large suburban lawns, and institutional campuses. Grassland includes livestock pasture, open fields, tallgrass prairie, parkways, and other herbaceous areas.

Source: National Land Cover Database, 2011.

Recent development trends

Development has significantly affected agricultural and natural lands in recent years. From 2001-15, approximately 140,000 acres of agricultural and natural areas were developed, primarily in the collar counties. This growth represents 12 percent of the region's total land area—roughly equivalent to the total land area of the City of Chicago.

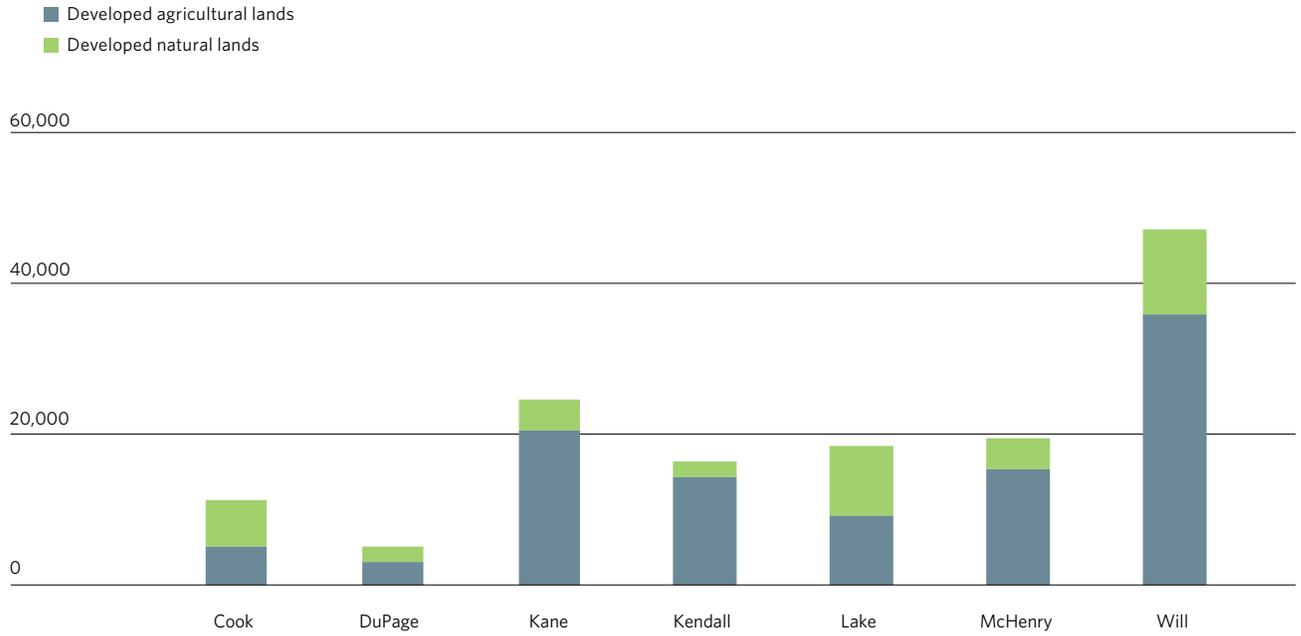
Will County saw the most development of natural and agricultural lands of any county in the region, adding more than 45,000 acres of residential, commercial, and industrial development.

Most newly developed land has been for residential use, even as the region's population growth has slowed.

From 2000-15, 37 percent of new residential development in the Chicago region occurred in areas with limited existing infrastructure, typically on the periphery of the region. CMAP's Infill and TOD snapshot further explores the implications of this development pattern.

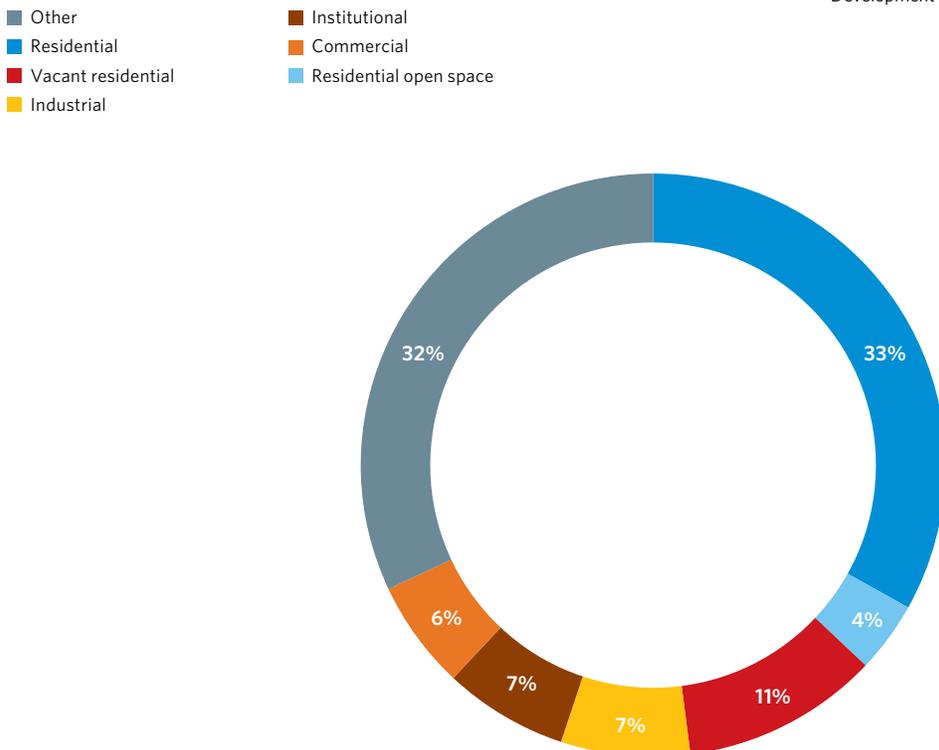
Land development, in acres, CMAP region, 2001-15

Source: 2001-11 National Land Cover Dataset and 2015 Northeastern Illinois Development Database.



Newly developed natural and agricultural areas by land use, CMAP region, 2001-15

Source: 2001-15 municipal boundaries, 2001-11 National Land Cover Dataset, and 2015 Northeastern Illinois Development Database.



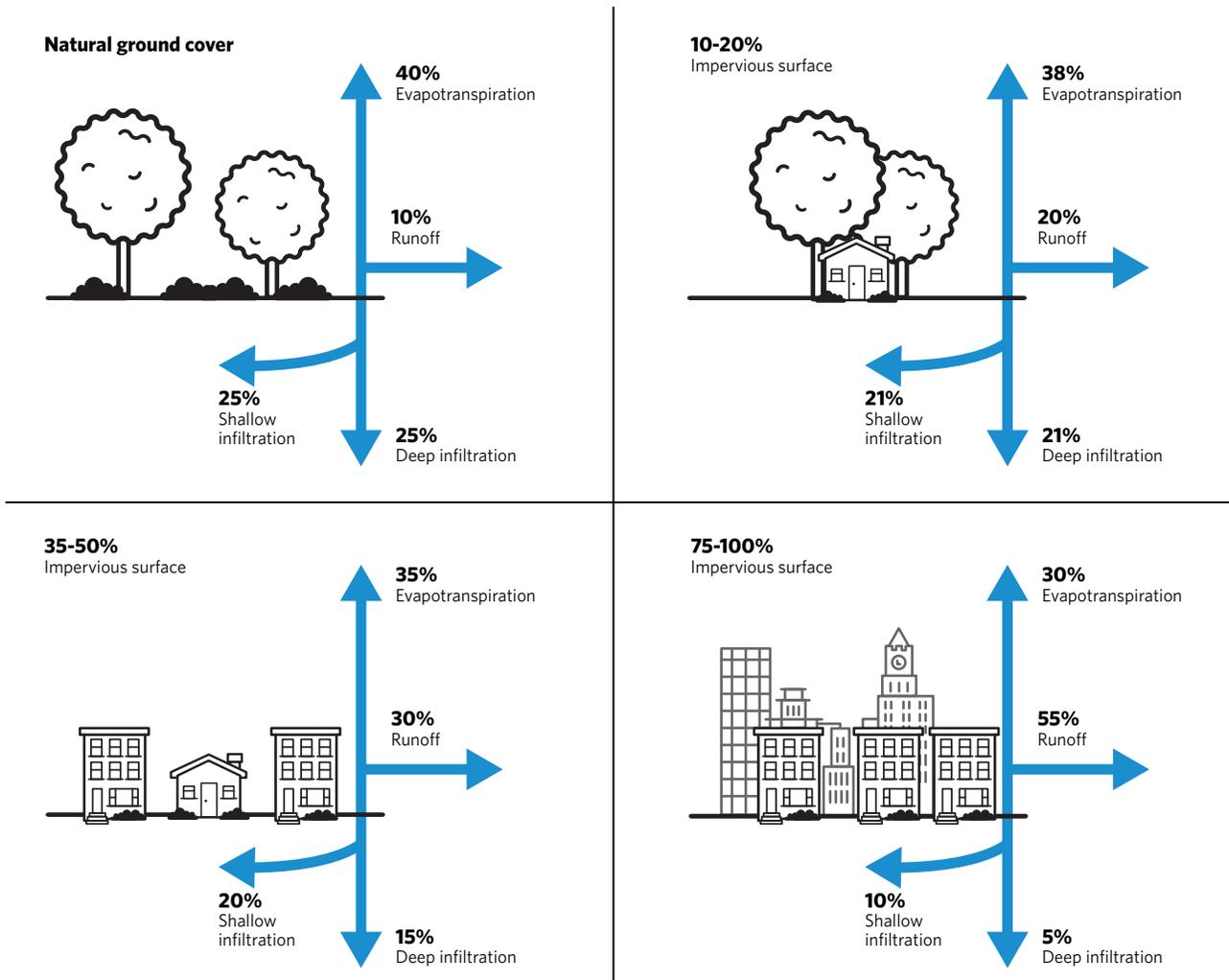
Imperviousness

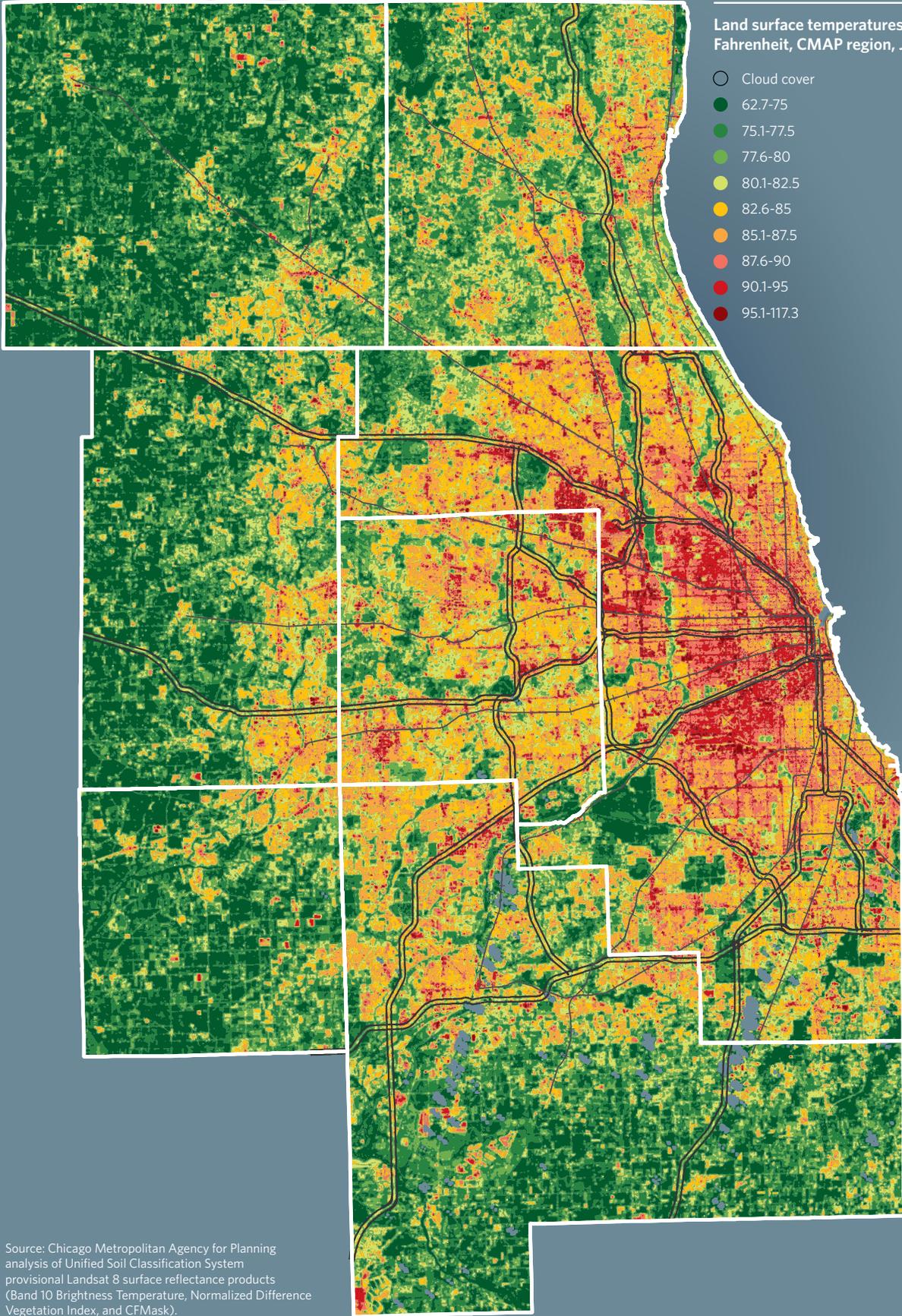
Impervious surfaces negatively affect water quality by preventing stormwater from infiltrating into the ground. Instead, water that falls on these surfaces washes away as stormwater runoff, picking up sediment, oils, and debris as it travels to waterways and sewers throughout the region.

Impervious surfaces also influence extreme heat through the urban heat island effect. During the day, these surfaces heat up in the sun and remain warm long into the night. CMAP analysis of land surface temperature found that areas with greater than 50 percent impervious coverage are, on average, five to six degrees Fahrenheit warmer than the regional average.¹² This difference can increase the local impacts of heat waves and drought, even affecting regional weather patterns.

Effect of imperviousness on stormwater

Data source: U.S. Environmental Protection Agency, Impervious Surfaces and the Hydrologic Balance of Watersheds, 1991.





Land surface temperatures, in degrees Fahrenheit, CMAP region, July 21, 2014

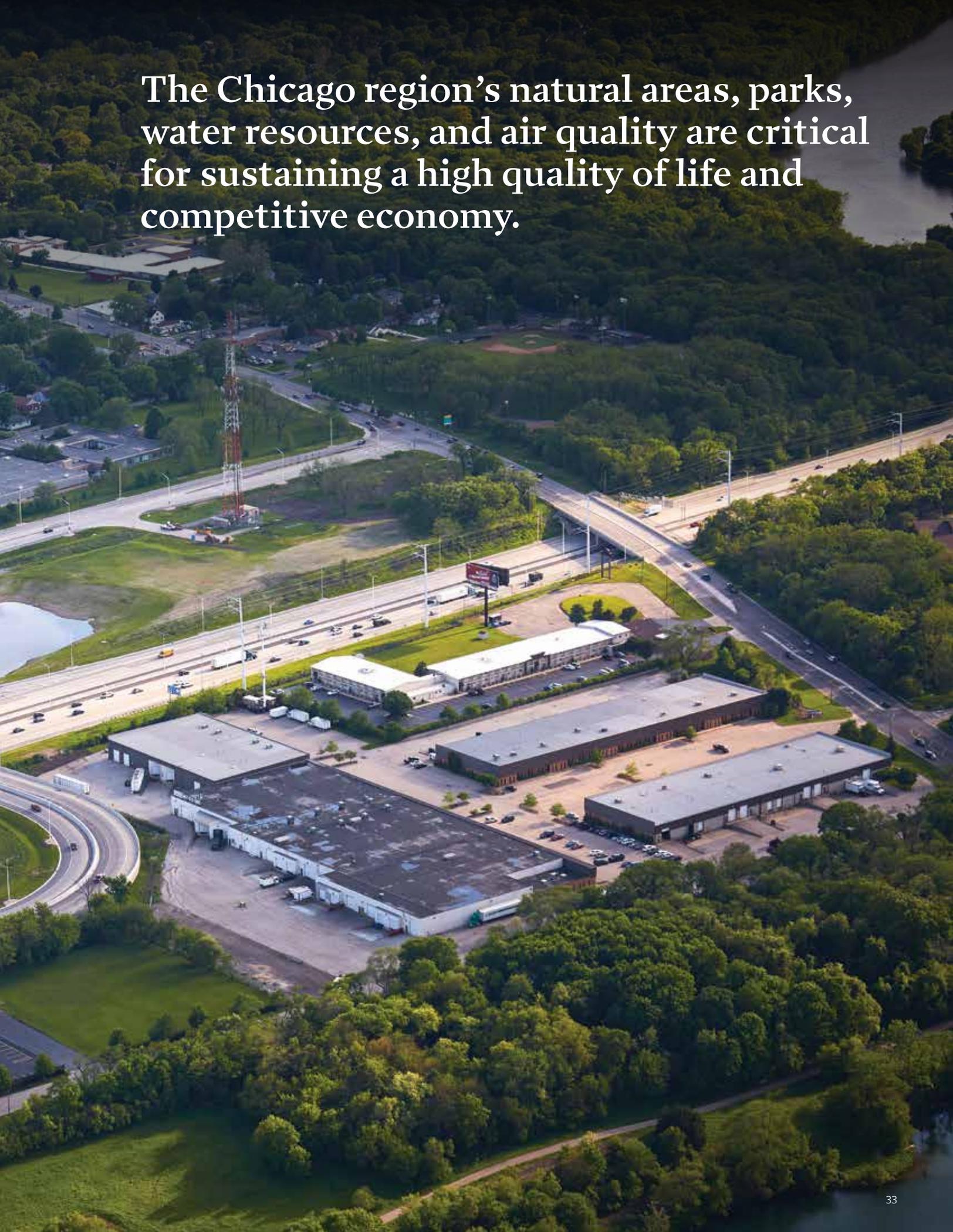
- Cloud cover
- 62.7-75
- 75.1-77.5
- 77.6-80
- 80.1-82.5
- 82.6-85
- 85.1-87.5
- 87.6-90
- 90.1-95
- 95.1-117.3

Source: Chicago Metropolitan Agency for Planning analysis of Unified Soil Classification System provisional Landsat 8 surface reflectance products (Band 10 Brightness Temperature, Normalized Difference Vegetation Index, and CFMask).

Current conditions and trends



The Chicago region's natural areas, parks, water resources, and air quality are critical for sustaining a high quality of life and competitive economy.





Habitat

Northeastern Illinois has an incredibly high level of biodiversity. Located in a transitional zone between hardwood forest and tallgrass prairie, the area supports a wide range of habitat types, including some of the rarest ecosystems in North America. Despite this rich legacy, natural areas in the Chicago region face a number of challenges, including climate change, development, invasive species, fragmentation, land management, and pollution.

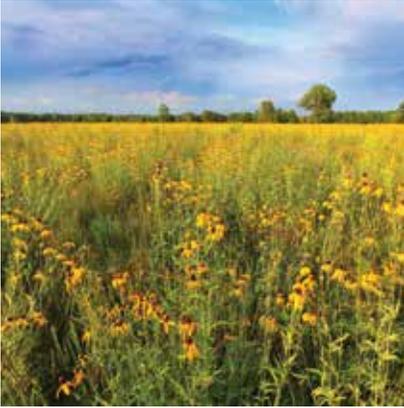
Habitat fragmentation

The Chicago region maintains many high-quality natural areas, but these preserves are often isolated from one another by agriculture, roads, and development. Many birds, fish, and land animals need large corridors of open space to survive. These corridors have become increasingly rare as the region has developed.

Community groups, landowners, and local governments have begun to implement creative solutions to this problem. For example, Commonwealth Edison has begun planting native prairie grasses and sedges—grass-like plants once common across the Chicago region—along its utility corridors, providing important connections between open space preserves. When designed properly, bicycle and pedestrian trails can serve a similar purpose.

Ecosystem types

The Chicago region is home to four general types of terrestrial ecosystems—prairies, oak savannas, forests, and wetlands—and two broad groups of aquatic natural areas—Lake Michigan, and inland lakes and streams. Each of these habitat types provides specific conditions that native plants and animals need to survive.



Prairies

Tallgrass prairie once dominated much of the Chicago region. Prairie ecosystems are home to a wide range of plant and animal species, including perennial grasses, such as big bluestem and switch grass, and large vertebrates, such as deer and bison. These areas are shaped by fire, and the native plants and animals are well adapted to regular burns.



Oak savannas

Oak savannas are the region's most characteristic ecosystem type. These ecosystems exist at the transition from hardwood forest to open prairie, which restricts their geographic range to just a few regions in North America. In oak savannas, prairie grasses and fire-resistant trees live side by side. Average canopy coverage varies between 10-50 percent, though local conditions may be higher or lower. Oak savannas are rich with biodiversity, and support more than 500 plant and animal species.¹³



Wetlands

The Chicago region is home to a variety of wetland ecosystems, including marshes, bogs, fens, seeps and springs, sedge meadows, and pannes. These ecosystems support a diverse array of mammals, amphibians, reptiles, birds, and other species, many of which cannot survive anywhere else. Wetlands also provide critical habitat for migratory birds, and help alleviate flooding by absorbing stormwater after heavy rains.



Forests

In northeastern Illinois, hardwood forests have traditionally grown in areas where fires are rare, primarily along the eastern banks of waterways and in areas with poor drainage. Oaks and hickories are the dominant species in most of the region's woodland communities, though specific soil types, moisture levels, and light availability may result in more or less species diversity.

As the region has developed, human interventions in natural ecosystems—including the suppression of wildfires and introduction of non-native species—have greatly increased the diversity of tree species in urban and natural areas alike. Today, northeastern Illinois has a greater variety of tree species than at any other point in its history, and many trees now grow in areas that have not historically supported forests. In urban areas, tree diversity helps protect the urban forest from diseases and insect infestation. In natural areas, increased species diversity is often a sign of wildfire suppression, and negatively affects natural habitats.



Inland lakes, rivers, and streams

Lakes, rivers, and streams support both terrestrial and aquatic ecosystems. Development along the region's waterways has reduced water quality of many rivers and lakes. Hydrologic modifications, such as dams and locks, have eliminated important fish and mussel habitats, and sometimes create a hard barrier for migration.



Lake Michigan

Lake Michigan is one of the Chicago region's most defining features, both geographically and ecologically. The lake supports a diverse range of birds, mammals, fish, and other aquatic life, in addition to numerous coastal habitats, including dunes, lagoons, and marshes.

The Great Lakes contain 21 percent of the world's surface freshwater.¹⁴ Lake Michigan contains 21.5 percent of the freshwater in the Great Lakes.¹⁵

Land preservation

Northeastern Illinois has a rich history of land preservation.

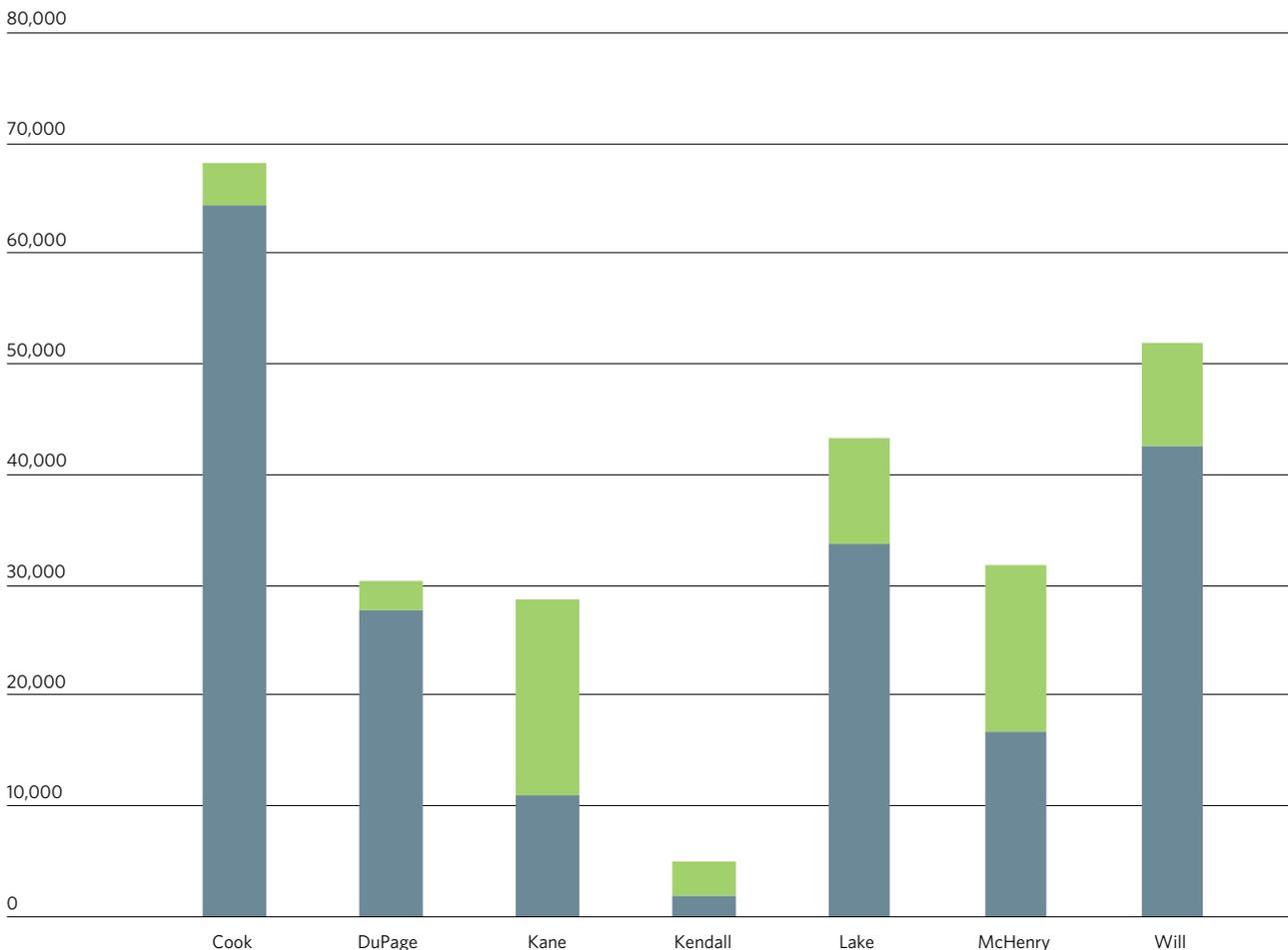
In total, the region is home to 260,000 acres of permanently preserved open space. This land is protected by a variety of stakeholders, including local, state, and federal agencies, community organizations, and private landowners.

Land conservation continues to be an important goal for the region. Since 2001, an additional 61,500 acres of land have been preserved.

Land conservation, in acres, CMAP region, prior to and since 2001

- Protected prior to 2001
- Protected since 2001

Source: Chicago Metropolitan Agency for Planning Land Use Inventory, Illinois Department of Natural Resources, County Forest Preserves or Conservation Districts, Kendall County Forest Preserve District Master Plan, and I-View: Prairie State Conservation Coalition's database of Illinois protected natural lands.



Cook County is the region’s leader in total acres preserved, though Kane and McHenry counties have made significant additions to their conservation networks over the last 15 years.

In northeastern Illinois, local municipalities and small, grassroots organizations have driven land preservation efforts. Nearly 80 percent of all funding for land preservation in the region comes from local sources.

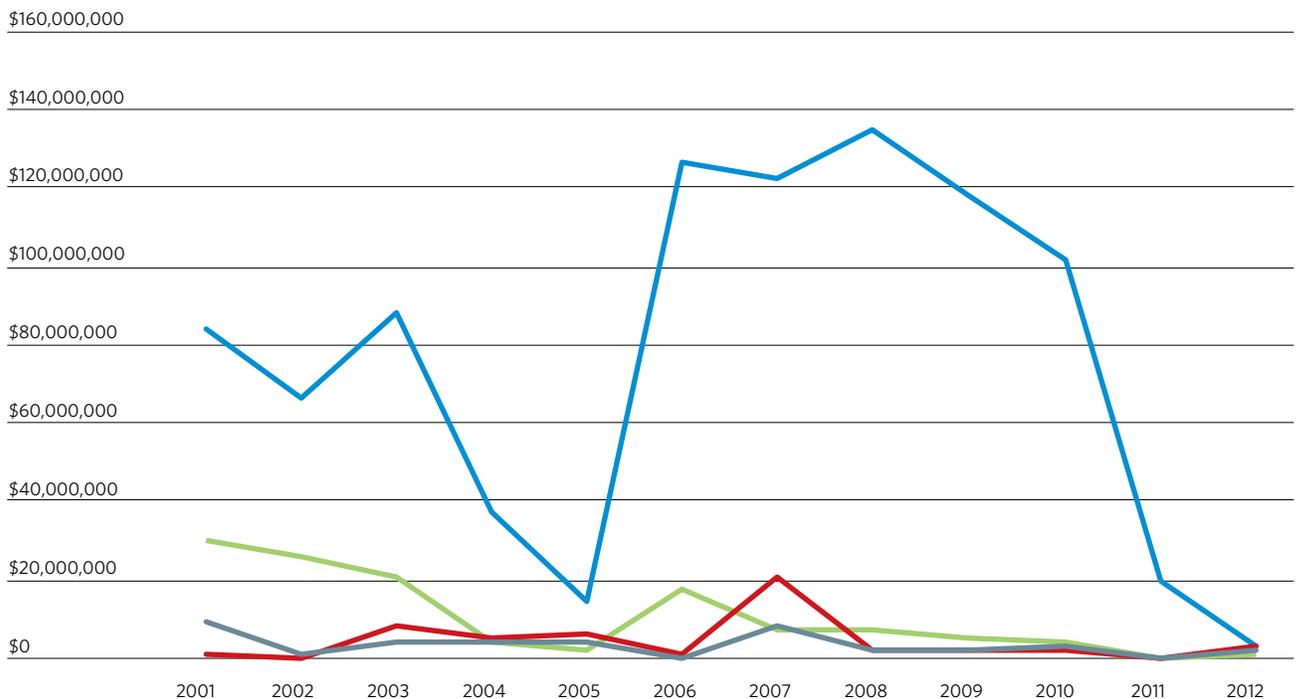
Funding for land preservation has declined since the 2008 recession, though the recent success of the Kane County Forest Preserve District’s \$50 million land acquisition and improvement referendum in April 2017 may signal a change in this trend.

Conservation funding by source, 2001-12

- Local funding
- State funding
- Federal funding
- Other

Note: Data from the Trust for Public Land’s Conservation Almanac, shown here, does not account for all municipally funded conservation projects.

Source: The Trust for Public Land, Conservation Almanac, 2016.



Threatened and endangered species

Northeastern Illinois has a high level of biological diversity, but development, fragmentation, and environmental degradation have created challenges for many of the plant and animal species that live here.

The Illinois Department of Natural Resources (IDNR) maintains a list of species that are threatened or endangered within the state. At the federal level, the U.S. Fish and Wildlife Service and the National Oceanic and Atmospheric Administration maintain a list of species threatened with global extinction, meaning they may disappear altogether.

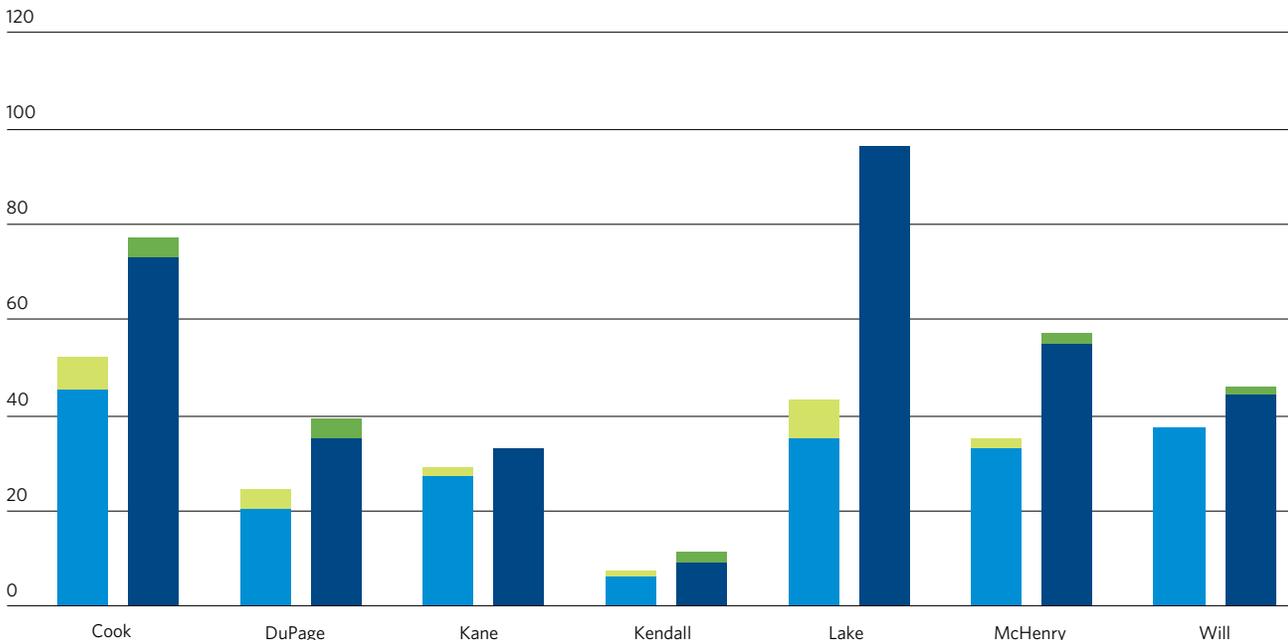
The Chicago region contains 70 animals and 166 plants on the IDNR list, including 14 species that are also listed federally.

Threatened and endangered species by county

Note: All species on the federal lists are also included on state lists.

Source: Chicago Metropolitan Agency for Planning analysis of Illinois Department of Natural Resources and U.S. Fish and Wildlife Service data.

- Illinois threatened
- Federally threatened
- Illinois endangered
- Federally endangered



Invasive species

The plants and animals of the Chicago region have developed a delicate balance over several thousand years. When new, unfamiliar species are introduced into natural areas, this balance can be disrupted, leading to severe ecological problems.

Landscaping, hiking and camping, and global trade all have the potential to introduce new species into the Chicago region. As the climate continues to change, warmer, wetter, and more variable weather may further expose the region to invasive species.

Since arriving in 2007, the emerald ash borer has decimated the region's ash populations, forcing local governments to spend millions of dollars removing and replacing damaged trees.

Asian carp is another invasive species that recently arrived in the region. The fish is currently confined to the Illinois River by an electric dispersal barrier located in Romeoville, which sends an electric current through a small portion of the Chicago Sanitary and Ship Canal. The barrier has so far prevented carp and other aquatic nuisance species from entering the Great Lakes Basin, but is not a permanent solution. Should Asian carp reach the Great Lakes, the region could experience significant ecological and economic harm.



Parks and recreation

The Chicago region enjoys a well-established and continually expanding network of parks, trails, and natural areas.

Access to parks

Parks provide tangible economic, societal, and health benefits. Ensuring adequate access to parkland is an important regional goal, measured at two distinct levels: access to four acres of parkland per 1,000 residents and access to 10 acres of parkland per 1,000 residents.

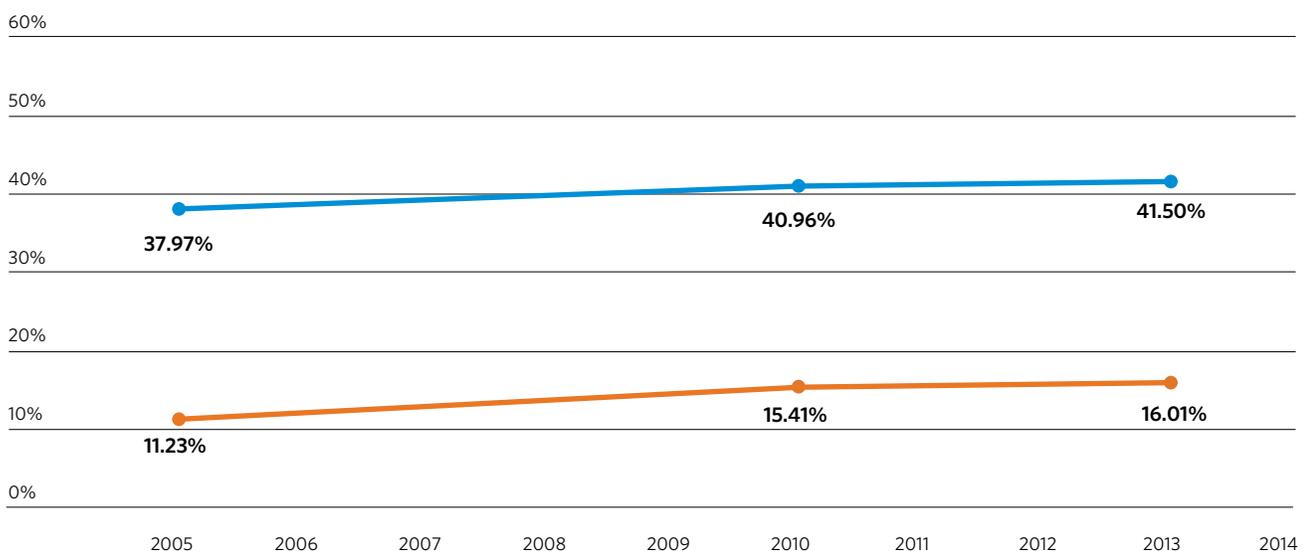
Since 2005, park access has improved by both measures.

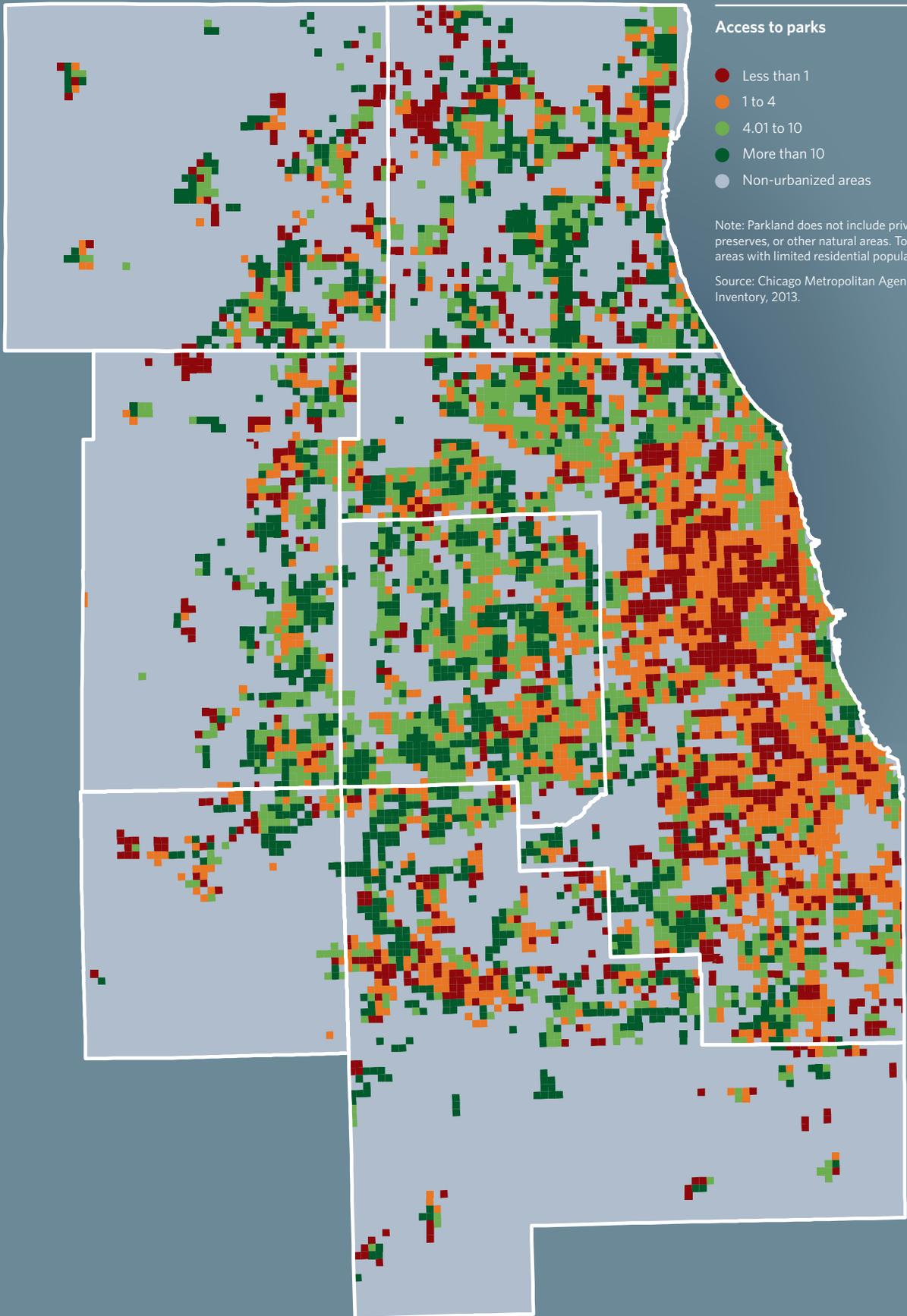
Park access varies considerably throughout the region. Dense and low-income communities, as well as newer communities on the region's periphery, tend to have the least access to parks. More affluent and suburban areas typically have greater park access.

Regional access to parks

Source: 2010 Census, Chicago Metropolitan Agency for Planning 2010 Land Use Inventory, and Chicago Park District.

- 4+ acres observed
- 10+ acres observed





Access to parks

- Less than 1
- 1 to 4
- 4.01 to 10
- More than 10
- Non-urbanized areas

Note: Parkland does not include private open space, forest preserves, or other natural areas. To ensure data accuracy, areas with limited residential population have been removed.

Source: Chicago Metropolitan Agency for Planning Land Use Inventory, 2013.

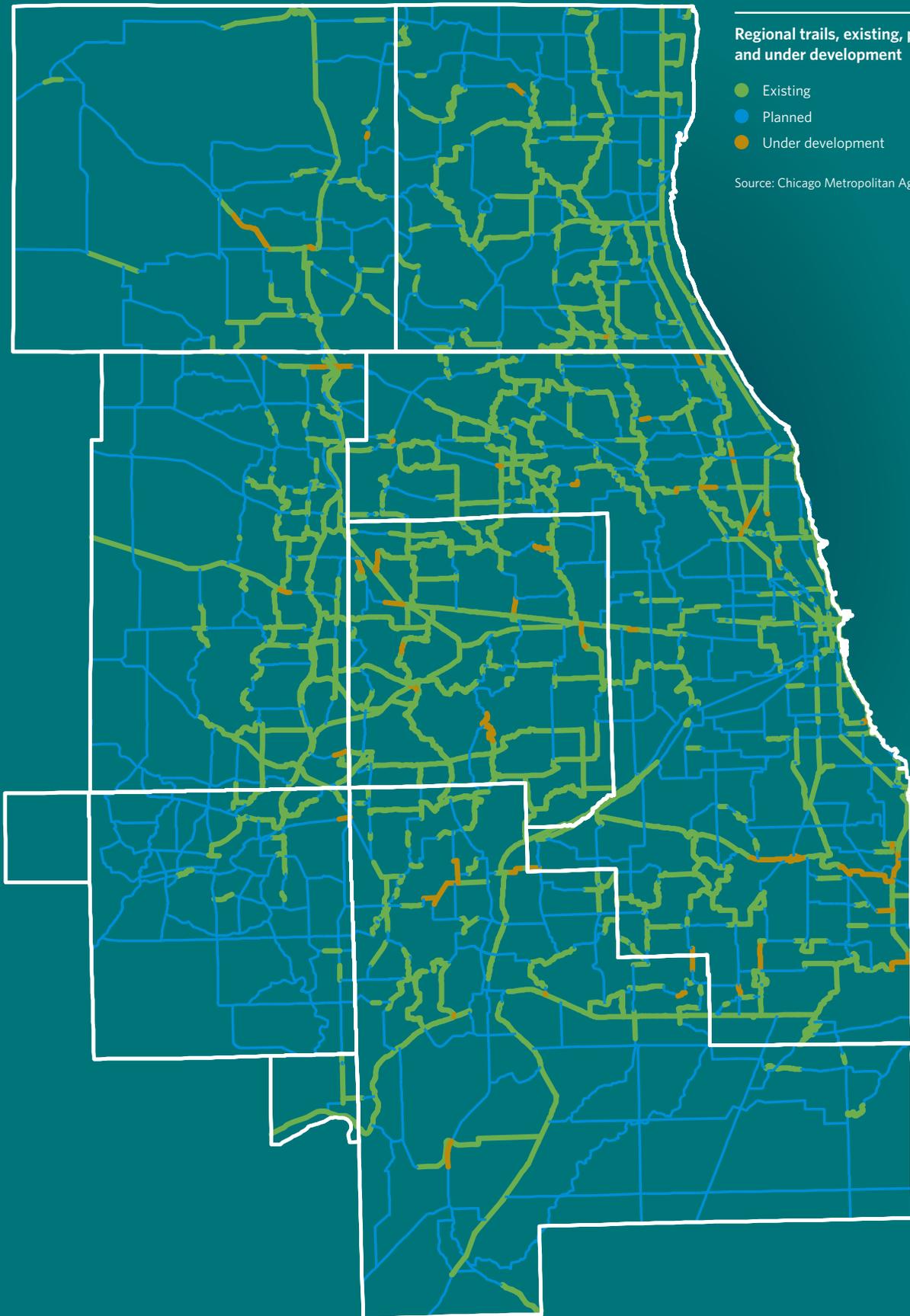
Regional trails

CMAP developed and is tracking a draft update to the Regional Greenways and Trails Plan in 2016, to build a comprehensive network of bicycle and pedestrian trails throughout the region and better connect residents to parks and open space. As of 2017, 41.4 percent of the system was completed.

Northeastern Illinois Regional Greenways and Trails Plan completion

Source: Chicago Metropolitan Agency for Planning, 2017.

Year	Total length of system (in miles)	Length of system complete (in miles)	Percent complete
1997	2,000	500	25.0%
2009	2,720	998	36.7%
2017	3,168	1,313	41.4%



Regional trails, existing, planned, and under development

- Existing
- Planned
- Under development

Source: Chicago Metropolitan Agency for Planning, 2017.

Access to rivers and lakes

Northeastern Illinois has a wealth of water resources, including Lake Michigan, inland lakes and streams, and a variety of wetlands. These spaces provide a wide range of benefits to residents, businesses, and visitors, but their value has not always been recognized.

In many parts of the region, transportation infrastructure, industry, and other uses block access to these spaces, reducing their benefits to communities and residents. In recent years, communities throughout the region have begun rediscovering their water assets through innovative new trails, mixed-use developments, and brownfield cleanups.

For example, for much of Chicago's history, the Chicago River was largely inaccessible due to industry and transportation infrastructure. Beginning in the 1990s with the reconstruction of Wacker Drive, the City began implementing a plan to reconnect downtown to its riverfront and bring new life to the Chicago River.

Today, the Riverwalk has become a popular destination for residents and tourists alike. The network of parks, walkways, and open space features a growing list of attractions, including cafés, restaurants, and live performances.



Photo by JK Willis via Flickr, www.flickr.com/photos/kycactus.

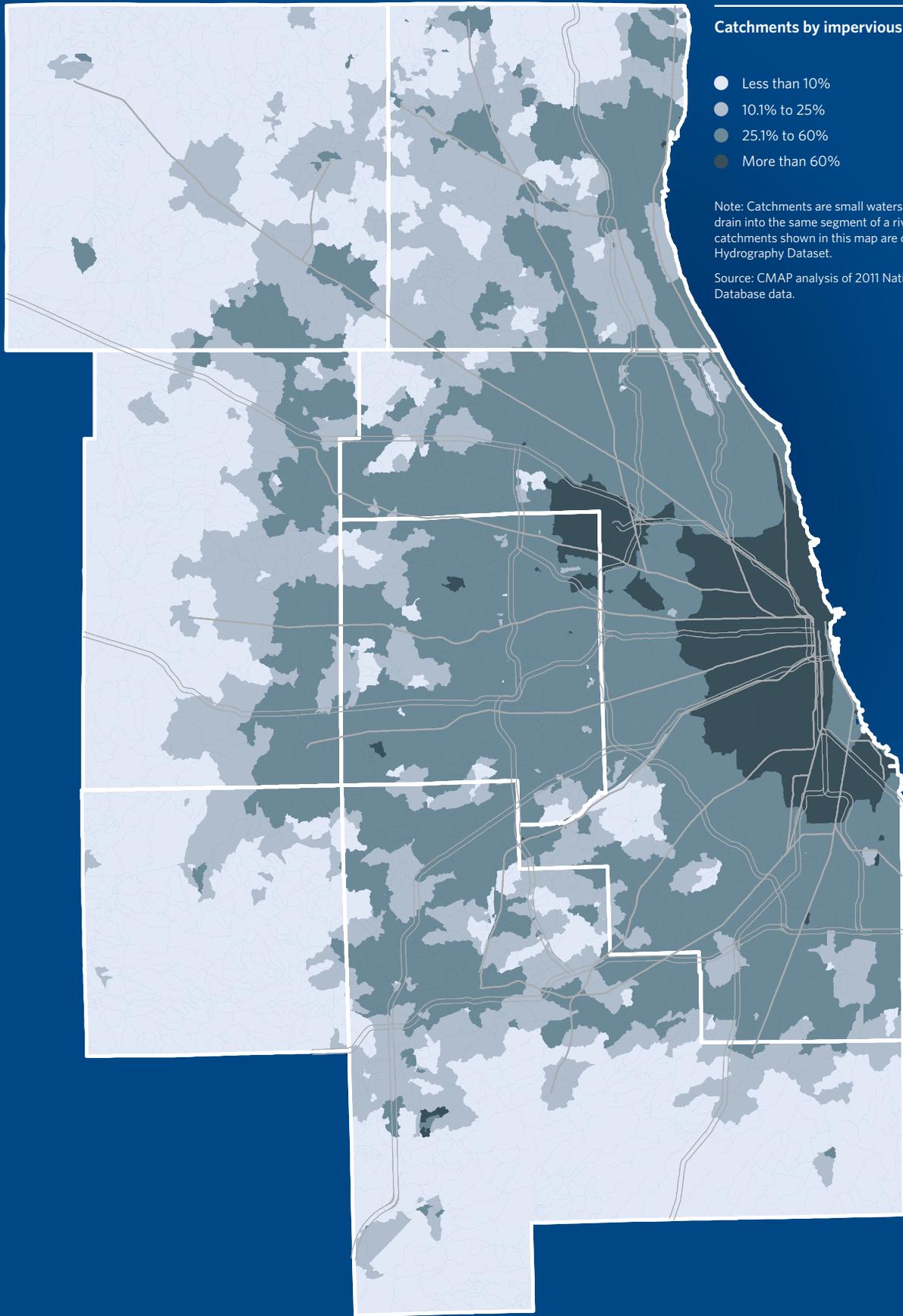
Water quality

Regional water quality has improved significantly over the last 50 years, but several important challenges remain.

Impervious surfaces

Impervious surfaces reduce water quality and increase flood risk by preventing stormwater from infiltrating into the ground. Rather, stormwater falling on impervious surfaces ponds in low-lying areas or is washed into waterways and sewers, bringing with it sediment and other contaminants. As imperviousness increases, so does runoff, resulting in more untreated water entering the region's rivers, streams, and lakes. In areas with high impervious coverage, stormwater runoff often accumulates in roadways, parking lots, basements, and other low-lying areas.

A waterway begins to experience ecological harm when 10 percent or more of its watershed has impervious coverage. Substantial harm begins at 25 percent, and when 60 percent or more of the watershed is impervious, complete restoration becomes very difficult.¹⁶



Catchments by imperviousness

- Less than 10%
- 10.1% to 25%
- 25.1% to 60%
- More than 60%

Note: Catchments are small watersheds—land areas that drain into the same segment of a river, stream, or lake. The catchments shown in this map are defined by the National Hydrography Dataset.

Source: CMAP analysis of 2011 National Land Cover Database data.

Combined Sewer Overflows

Combined sewer systems carry stormwater and untreated sewage in a single pipe. During periods of heavy rain, contents of these systems can overflow into local rivers and streams, creating a combined sewer overflow, or CSO. During heavy rain, untreated wastewater from CSOs combines with other runoff-related contaminants, including sediment, oils, and garbage, which negatively affect water quality. In 2016, the most recent year for which there is data, this occurred on 43 separate days within the Metropolitan Water Reclamation District of Greater Chicago (MWRD) service area, which includes more than 880 square miles of Cook County.¹⁷

MWRD operates the region's largest combined sewer system, though many suburban communities have similar systems. During particularly heavy rains, MWRD sometimes must open the locks separating the Chicago River from Lake Michigan to avoid flooding, releasing millions of gallons of untreated water into the lake.

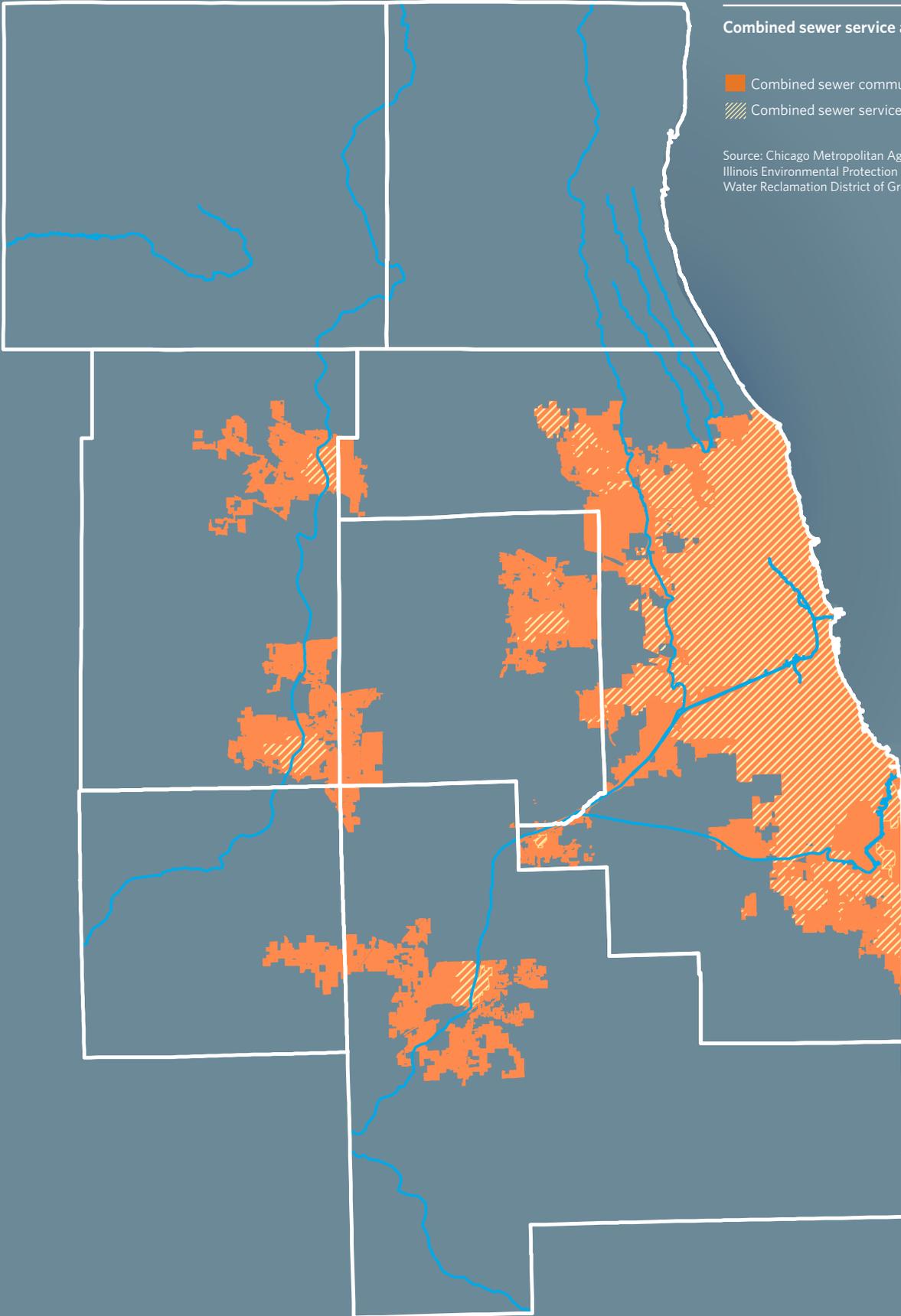
Emerging pollutants

Northeastern Illinois has made significant improvements in regional water quality, but several key challenges remain. Increasingly, pharmaceuticals (especially antibiotics and endocrine disrupters) and other contaminants not removed by traditional wastewater treatment processes are negatively affecting aquatic wildlife. Chloride pollution from road salt and nutrients from agriculture and wastewater treatment facilities have also emerged as priority pollutants to reduce.

Combined sewer service areas, CMAP region

- Combined sewer communities
- Combined sewer service areas

Source: Chicago Metropolitan Agency for Planning, 2018; Illinois Environmental Protection Agency, 2014; Metropolitan Water Reclamation District of Greater Chicago, 2016.



Water quality

Water quality is important for ecosystem health, drinking water, and recreation. To ensure that Illinois waterways continue to provide these services, the Clean Water Act requires the State of Illinois to establish water quality criteria for all surface waters within the state and monitor water quality to ensure that beneficial uses are supported.¹⁸ Generally, many of the region's waterbodies are not meeting all of their designated uses. For example, based on data from Illinois EPA's 2016 Integrated Water Quality Report,¹⁹ only 30 percent of stream miles designated for an aquatic life use are meeting their water quality criteria.

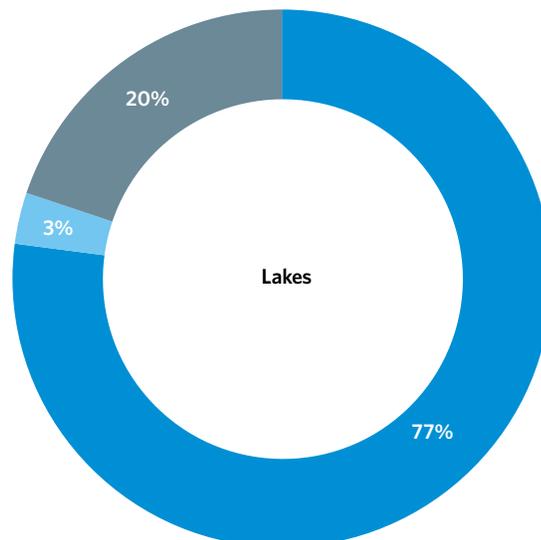
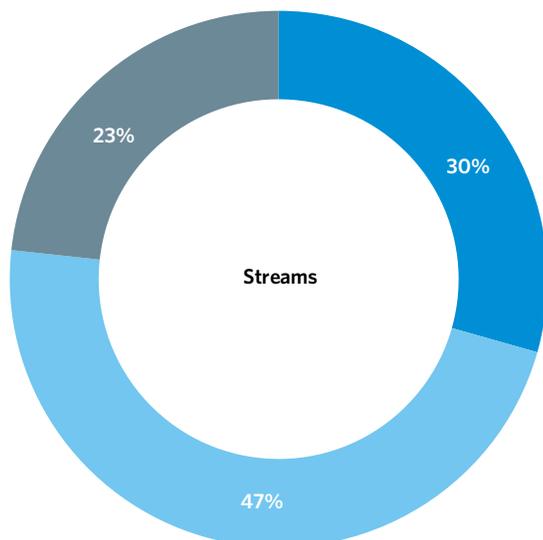
CMAQ estimates that fewer than 50 percent of the region's stream miles and lake acres have been assessed for water quality. Additionally, only large streams and rivers are included in Illinois EPA's assessment dataset and in IDNR's biological stream rating system. Smaller first- and second-order headwater streams are not included, though they are vitally important to downstream water quality. Many lakes and ponds also are not represented in the dataset due to a lack of public access.

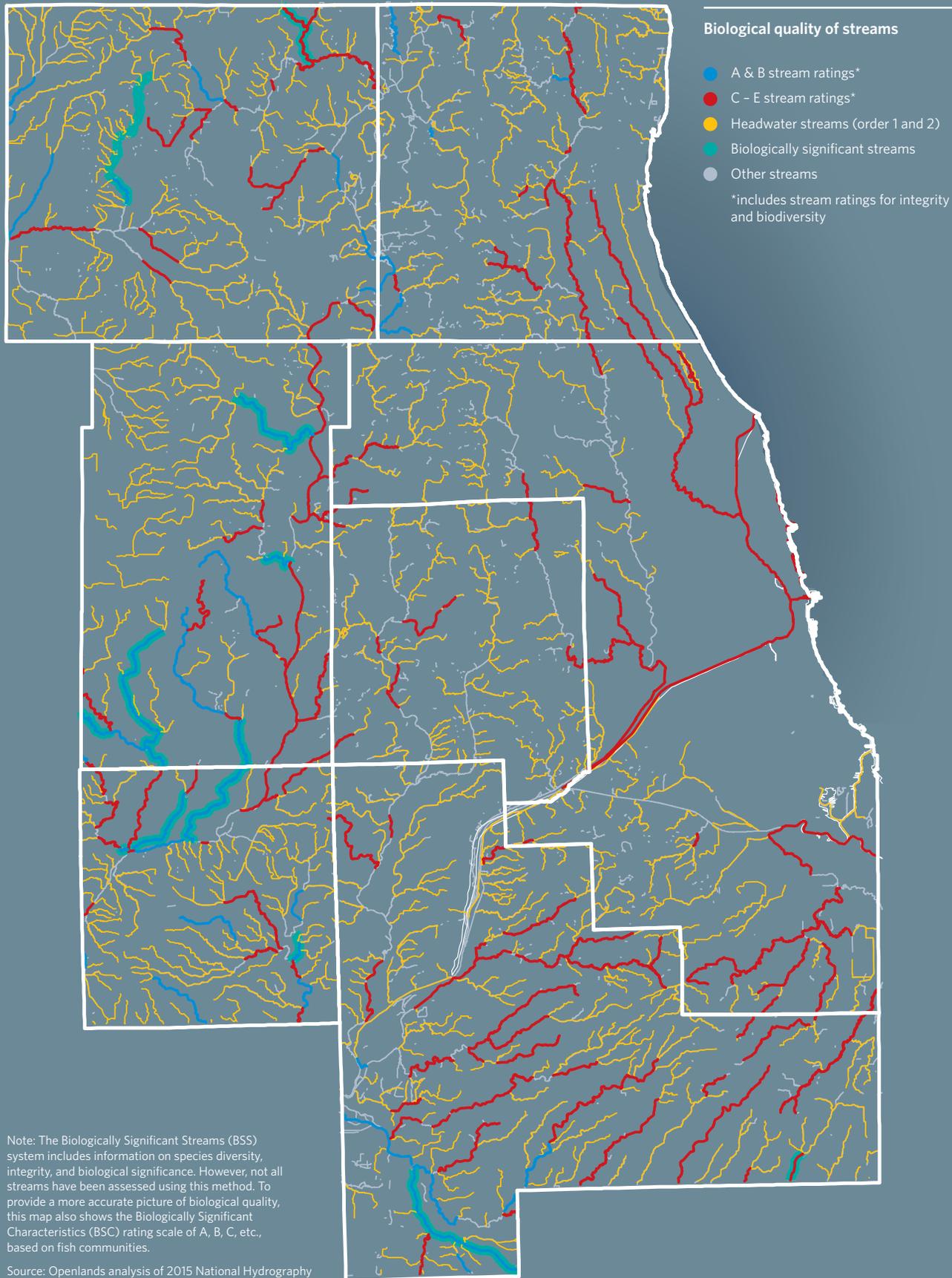
The State of Illinois is also responsible for monitoring the biological quality of the state's lakes and streams. Many smaller creeks and streams have not been assessed. Most of the aquatic habitats that have been assessed are in poor to moderate condition.

Attainment of aquatic life water quality standards, CMAP region

- Fully supporting
- Not supporting
- Not assessed

Source: Illinois Environmental Protection Agency, "Appendix B-2 Specific Assessment Information for Streams, 2016," and "Appendix B-3 Specific Assessment Information for Lakes, 2016;" Illinois Integrated Water Quality Report and Section 303(d) List - Vol I: Surface Water - 2016.





Note: The Biologically Significant Streams (BSS) system includes information on species diversity, integrity, and biological significance. However, not all streams have been assessed using this method. To provide a more accurate picture of biological quality, this map also shows the Biologically Significant Characteristics (BSC) rating scale of A, B, C, etc., based on fish communities.

Source: Openlands analysis of 2015 National Hydrography dataset, and Illinois Department of Natural Resources, 2008.

Riverine flooding

During periods of heavy rain, rivers and streams sometimes overflow their banks and inundate the surrounding area. This is known as riverine or over-bank flooding. Areas with a one percent or greater chance of experiencing a riverine flood during a given year are referred to as 100-year floodplain areas. Homes located within the 100-year floodplain have a one-in-four chance of flooding during the life of a 30-year mortgage. To offset this risk, structures in these areas are required to obtain flood insurance through the FEMA National Flood Insurance Program (NFIP) before they are eligible for a federally insured mortgage.

Floodplains are not static. Development, stormwater management projects, and changing precipitation patterns all affect when and where flooding occurs. Because floodplain maps use historical data and are costly to update, they are often out of date and do not accurately depict flood risk.



Urban flooding

Urban flooding occurs when precipitation overwhelms local drainage systems, which happens most frequently in developed areas with large amounts of impervious coverage. Basement flooding, sewer backups, and road ponding are all forms of urban flooding.

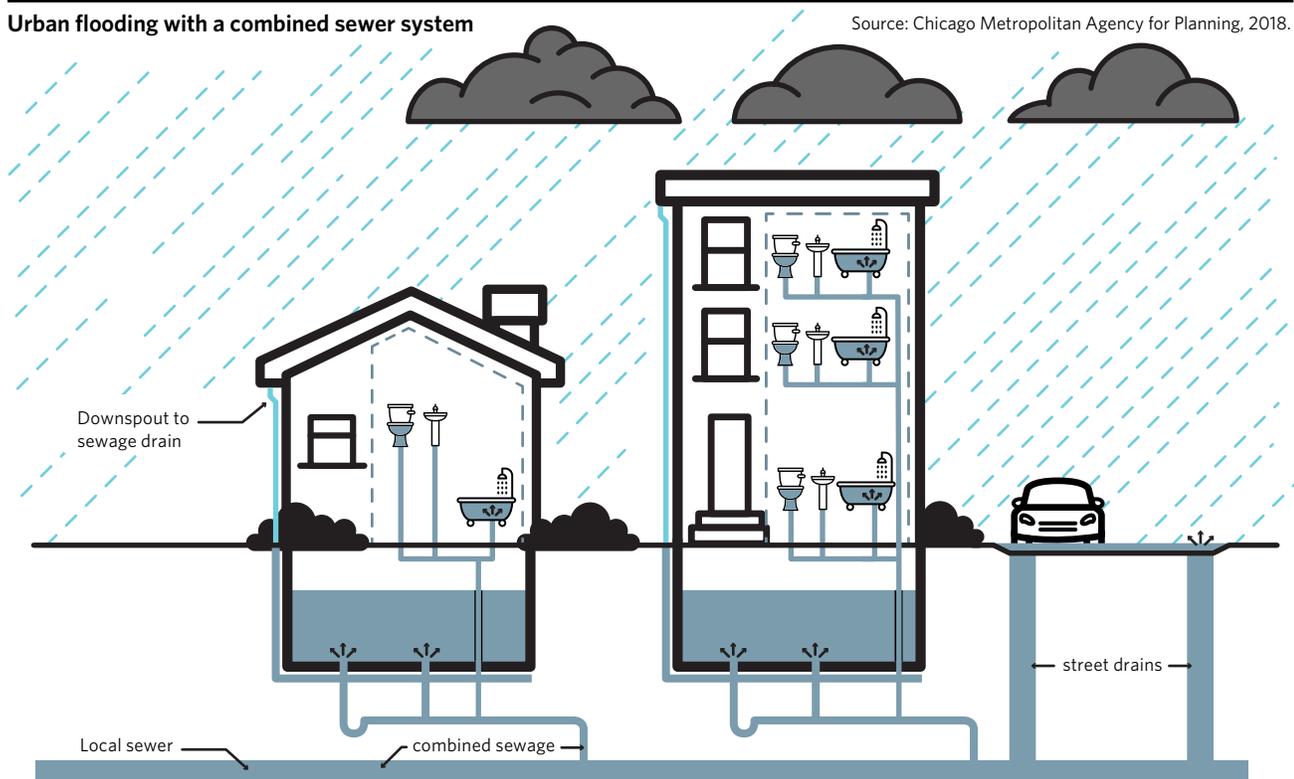
Because urban flooding often occurs outside of the floodplain, many of those affected by these floods do not receive coverage through the NFIP, and must pay for cleanup and recovery themselves. Even residents with insurance may not be fully covered, as standard homeowners and renters insurance policies have exceptions for flood-related damages.

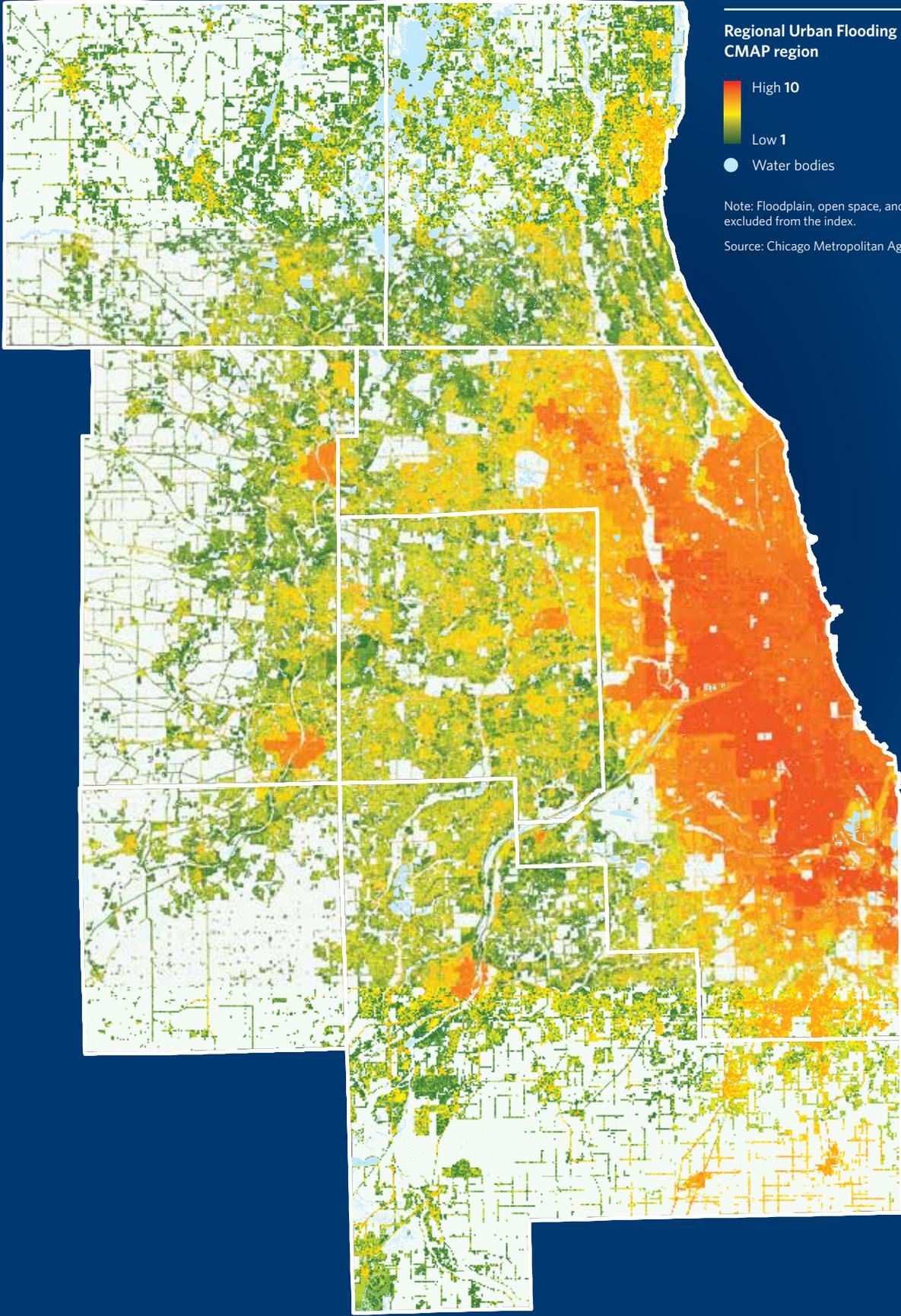
To understand where urban flooding is likely to occur, CMAP created a Regional Urban Flooding Susceptibility Index that uses topography, land cover, reported flood locations, and other information to identify areas that may have an elevated risk of urban flooding.

Generally, denser areas with older infrastructure have the highest susceptibility to urban flooding because they were not designed to accommodate today's storms.

Urban flooding with a combined sewer system

Source: Chicago Metropolitan Agency for Planning, 2018.





**Regional Urban Flooding Susceptibility Index,
CMAP region**

- High 10
- Low 1
- Water bodies

Note: Floodplain, open space, and agriculture are excluded from the index.

Source: Chicago Metropolitan Agency for Planning, 2017.

Flood damages

Statewide, urban and riverine flooding caused an estimated \$2.319 billion in damages between 2007-14.²⁰ More than three-quarters of these damages occurred in the Chicago region. However, these damages provide only a partial understanding of the cost and extent of flooding as many damages go unreported for a variety of reasons. For example, basement backups from small storm events may not be eligible for federal assistance, and property owners often pay for damages out of pocket due to a lack of private insurance.

Flooding and climate change

As the region's climate continues to change, northeastern Illinois will likely see significant increases in precipitation, especially during the winter and spring. The region is particularly vulnerable to flooding during these months due to frozen soils, which are less able to absorb water, and the seasonal dormancy of water-absorbing plants, such as street trees, shrubs, and prairie grasses.

Even as winter precipitation increases, the summer months are expected to become drier, with a large portion of the season's rain falling during just a few powerful storms.

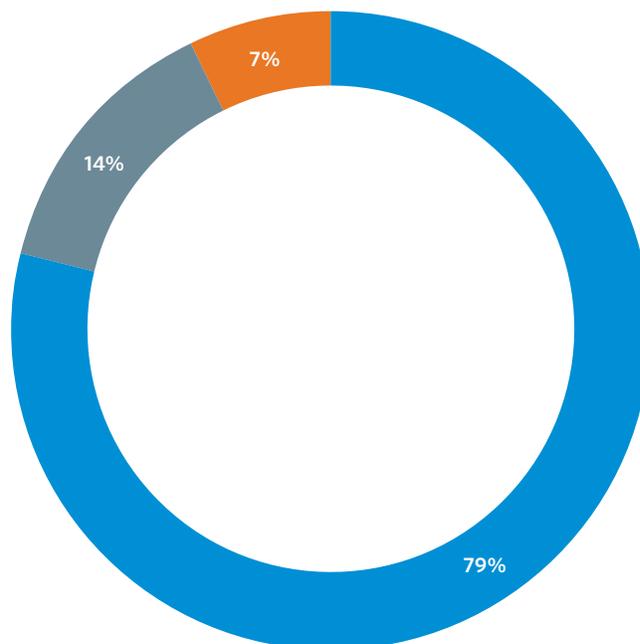
These trends suggest that reducing flooding damages will become an increasingly important priority for northeastern Illinois communities during the years to come.

Total public and private flood insurance and disaster relief payouts for flooding, by geography, 2007-14

- CMAP region **\$1.8 billion**
- Rest of Illinois **\$325 million**
- Statewide **\$162 million**

Note: "Chicago Metropolitan Agency for Planning region" does not include Kendall County. "Statewide" includes Public Assistance grants, which are not broken down by geography.

Source: Brad Winters, et al, "Report for the Urban Flooding Awareness Act," State of Illinois Department of Natural Resources, Office of Water Resources, June 2015, www.isws.illinois.edu/hilites/more.asp?id=ufaa&fr=hi.



Water supply

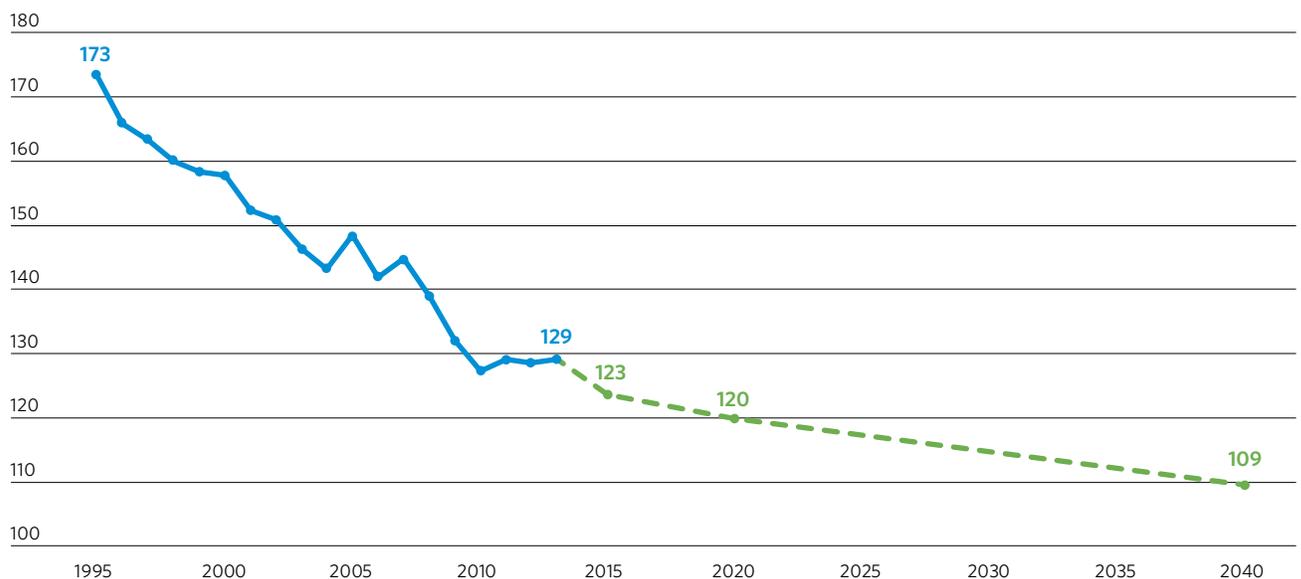
Chicago-area communities receive water from three sources: Lake Michigan, groundwater aquifers, and inland rivers (the Fox and Kankakee). Lake Michigan provides 81 percent of Chicago-area residents with their drinking water.

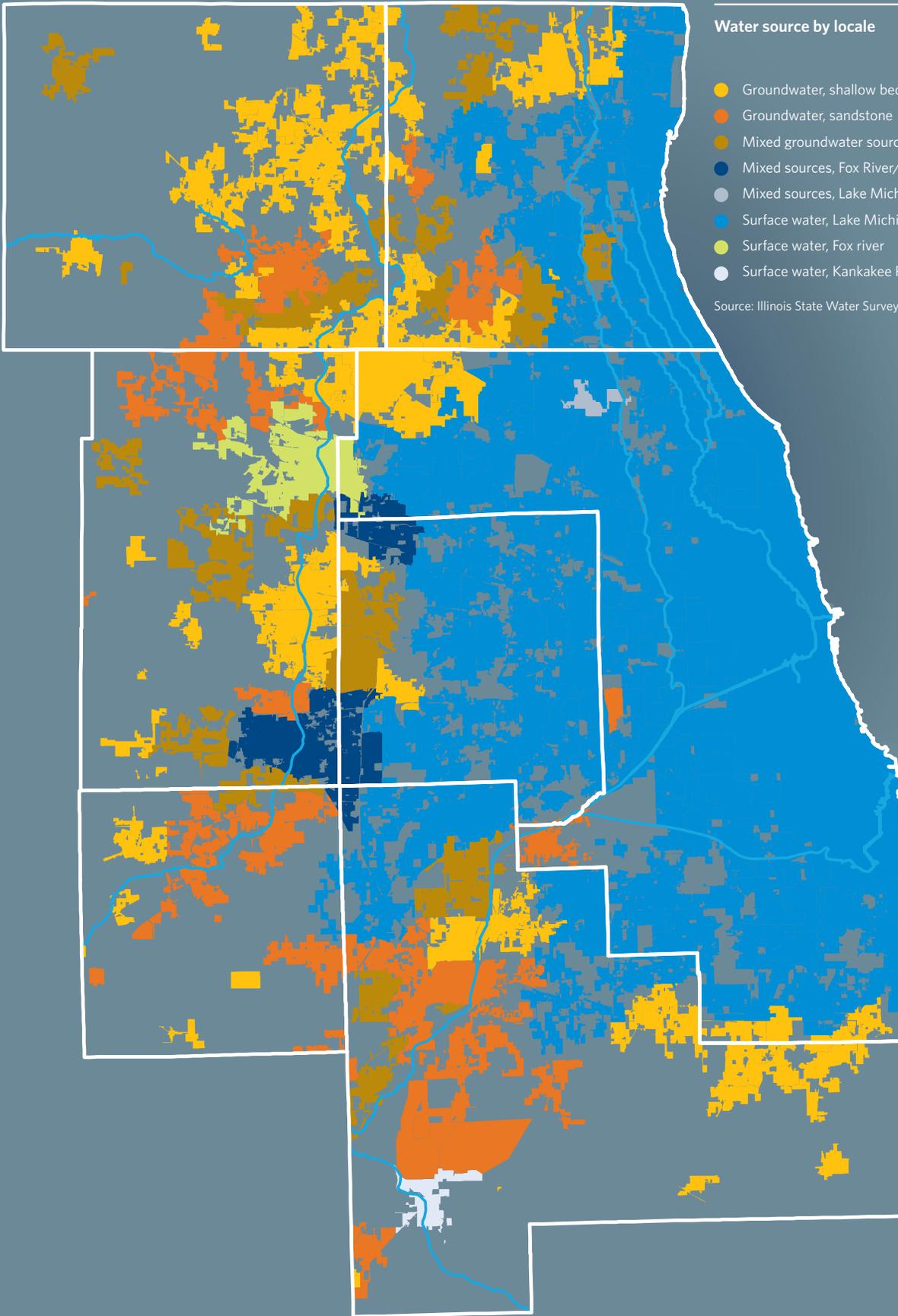
Per capita water consumption has declined in recent years—a long-term goal of GO TO 2040.

Per capita water consumption, in gallons per day, 1995-2013, and GO TO 2040 targets

- Recorded history
- GO TO 2040 targets

Source: Illinois Water Survey (1991-2012); Dziegielewski and Chowdhury, 2008 (Regional Water Demand Scenarios for Northeastern Illinois: 2005-50) for future years. U.S. Census Bureau and Chicago Metropolitan Agency for Planning socioeconomic forecast.





Water source by locale

- Groundwater, shallow bedrock/glacial
- Groundwater, sandstone
- Mixed groundwater sources, shallow/sandstone
- Mixed sources, Fox River/groundwater
- Mixed sources, Lake Michigan/groundwater
- Surface water, Lake Michigan
- Surface water, Fox river
- Surface water, Kankakee River

Source: Illinois State Water Survey, 2014

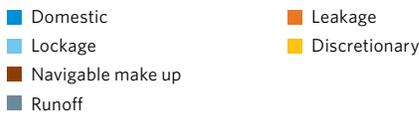
Lake Michigan allocation

Unlike other Great Lakes states, Illinois does not return treated water back to the Great Lakes Basin. Instead, this water is redirected to the Mississippi River System and Gulf of Mexico, via the Sanitary and Ship Canal, a human-made waterway intended to prevent waste from entering the lake and to connect Great Lakes shipping lanes to the Mississippi River. To protect water levels in the Great Lakes, the U.S. Supreme Court has set strict limits on the amount of water the region may divert from Lake Michigan, an amount known as the Lake Michigan Allocation.

The Lake Michigan Allocation accounts for direct water withdrawals, as well as stormwater runoff, river flow, and canal lockage that, if not for the Chicago Sanitary and Ship Canal, would have entered Lake Michigan. Water lost due to leaking pipes is also considered part of the allocation.

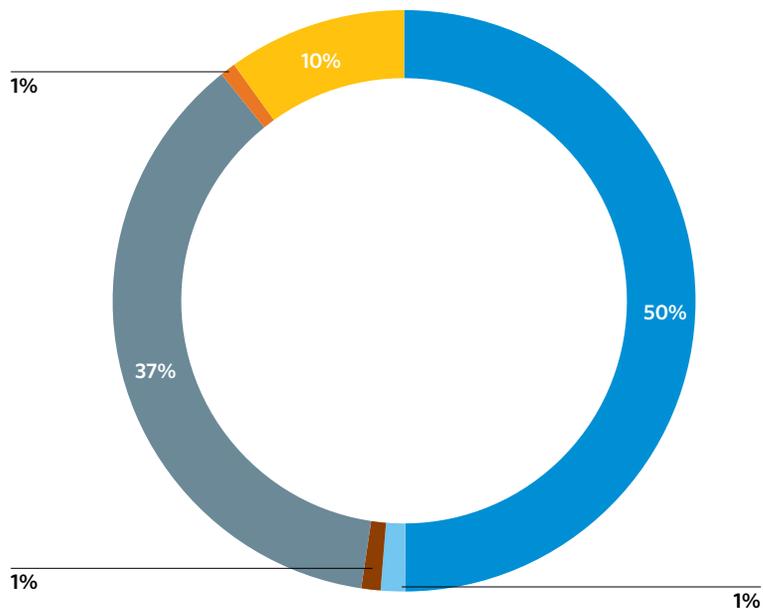
Due to this restriction, Lake Michigan has only limited capacity for additional users. The 2010 CMAP report Water 2050: Northeastern Illinois Regional Water Supply/Demand Plan estimates that an additional 50-75 million gallons per day may be available for new users through the year 2030, roughly equal to three percent of the total allocation. With limited growth potential, it is likely that the use of other water sources will become increasingly necessary for water supply, particularly in outlying parts of the region. However, these sources also have limitations to consider.

Breakdown of Lake Michigan Diversion, 2005-07, 2009-13



Note: All water diverted from Lake Michigan counts toward the region's allocation, including municipal withdrawals, river flow, stormwater runoff, and leaking pipes. When water is lost to runoff or leakage, less water is available for the region's residents and businesses.

Source: U.S. Army Corps of Engineers; Lake Michigan diversion accounting reports unavailable for water years 2008, 2014, and 2015.



Aquifer drawdown

The percentage of the region living in groundwater-reliant communities has increased in recent years.

Aquifers are large, underground water reserves used to provide drinking water to areas with limited access to surface water sources, such as rivers and lakes. Aquifer drawdown occurs when local groundwater withdrawals exceed the aquifer's ability to recharge, causing a measurable decrease in water levels. This problem is most severe for deep bedrock aquifers that recharge slowly. In the Chicago region, the St. Peter deep bedrock aquifer has seen significant drawdowns in the Joliet-Aurora area. By 2050, drawdown of the St. Peter aquifer will likely force many communities to switch to alternative water sources.

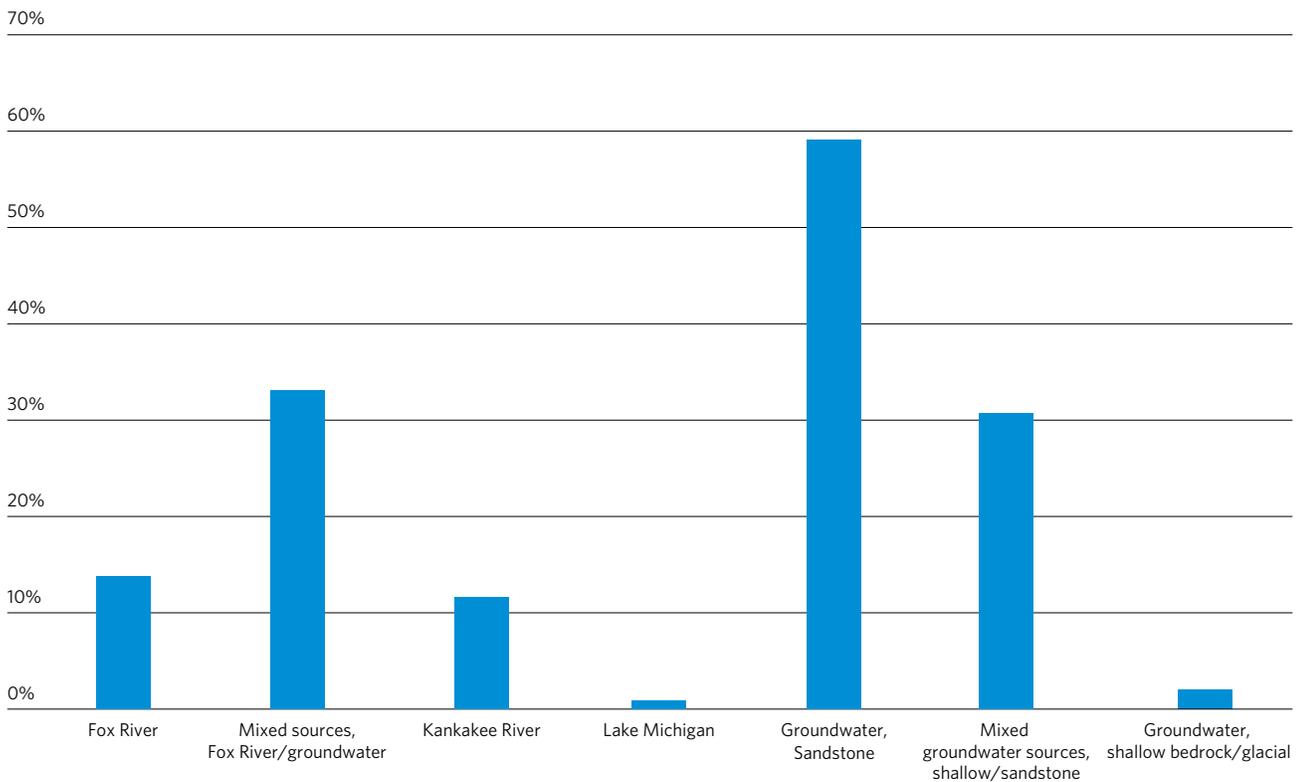
Inland surface water

Four communities in the Chicago region currently use water from the Fox and Kankakee rivers to meet their daily needs. These rivers have additional capacity for new users, and will likely become increasingly important water sources as groundwater supplies become less reliable.

Percent change in population by water source for incorporated areas, 2000-10

Note: Accounts for changes in water source (from groundwater to Lake Michigan) for the following communities: Bolingbrook, Ford Heights, Homer Glen, Mokena, New Lenox, Plainfield, Riverwoods, and South Chicago Heights.

Source: Chicago Metropolitan Agency for Planning analysis of Illinois State Water Survey data, and 2000 and 2010 U.S. Census.



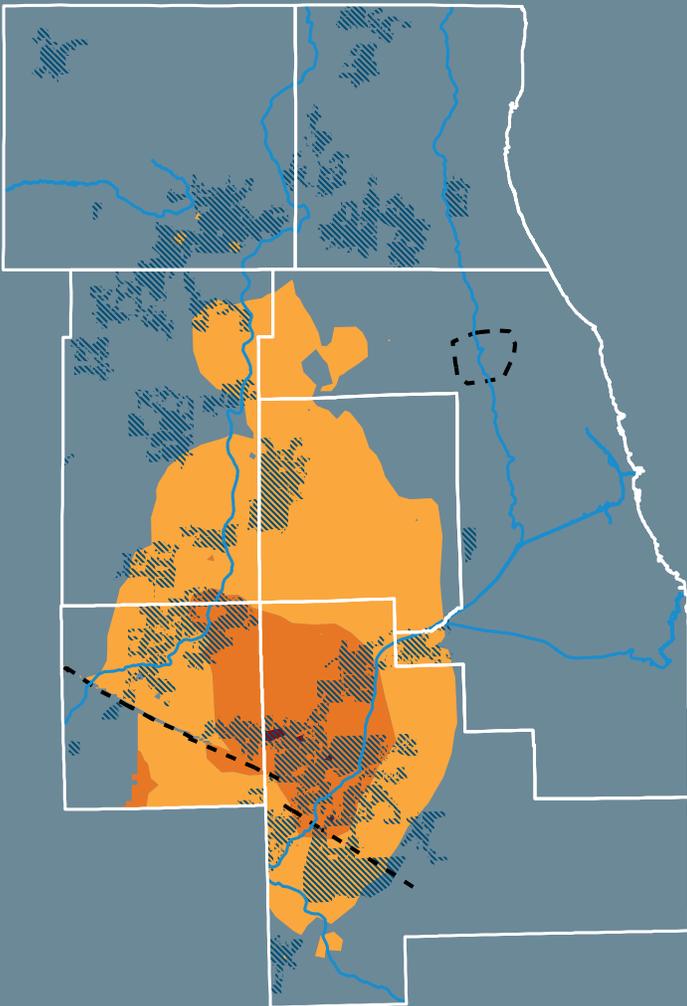
Observed and projected desaturation of the St. Peter aquifer, 2014 and 2050

- Complete desaturation
- Partial desaturation (non-pumping)
- Partial desaturation (pumping)
- Sandstone dependent community
- Bedrock fault
- River

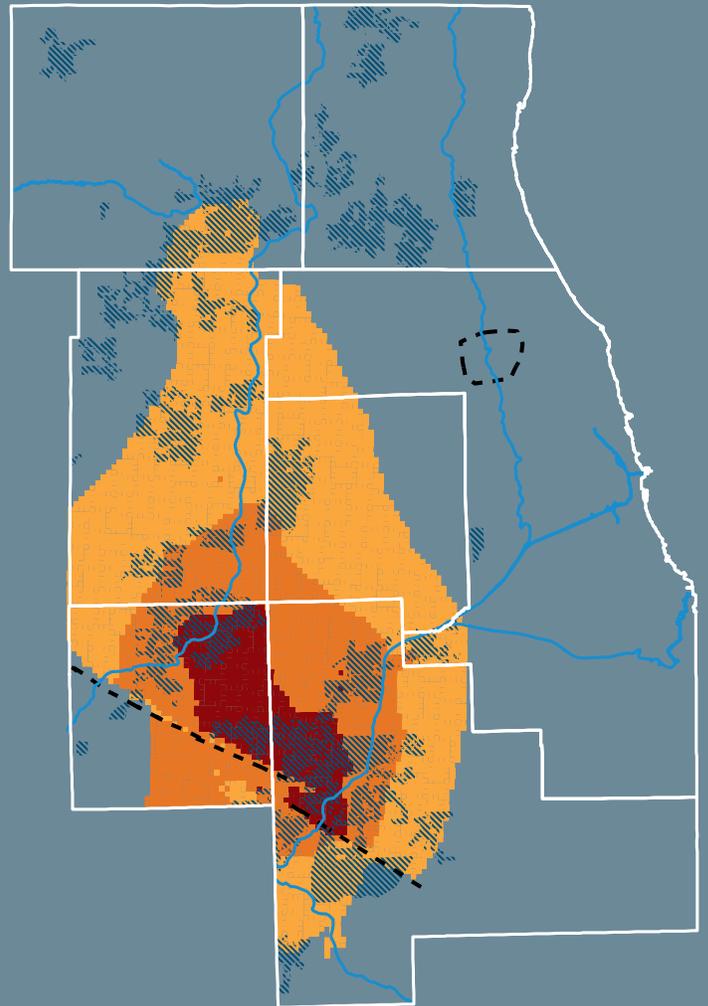
Note: "Pumping" refers to the condition of an aquifer immediately following a withdraw; "non-pumping" refers to the resting state of an aquifer. Areas experiencing non-pumping partial desaturation have a high risk of progressing to complete desaturation.

Source: Illinois State Water Survey, 2014.

2014



2050



Air quality

Businesses, homes, and transportation systems help drive the region's economy, but can also produce harmful air pollutants that reduce neighborhood vitality and pose significant health risks. Understanding the scope and scale of emissions in northeastern Illinois allows for better land use, transportation, and neighborhood planning—while also providing a baseline for future reduction targets.

Clean Air Act

The entire Chicago region, including portions of the Metropolitan Statistical Area reaching Indiana and Wisconsin, is in nonattainment of the Clean Air Act for ozone pollution. Ozone emissions come primarily from non-point pollution sources, such as private automobiles, commercial trucks, and heavy machinery. Exposure to ozone emissions has been linked to bronchitis, emphysema, and other asthma-like conditions. Exercise and ongoing exposure may increase the severity of these impacts, making children, athletes, and outdoor workers particularly vulnerable. Long-term exposure can affect lung development in small children, and may lead to asthma and other chronic conditions.²¹

Four communities bordering the Des Plaines River—Lockport, Lockport Township, Lemont Township, and DuPage Township—are in local nonattainment for sulfur dioxide, a pungent, colorless gas with severe health implications.

In Chicago, the Pilsen Nonattainment Area is in local nonattainment for airborne lead contamination, which has been linked to hypertension, kidney dysfunction, reproductive disorders, and developmental delays in children.²²

Unlike ozone, sulfur dioxide and lead come primarily from just a few localized sources.

Air quality improvements

Despite these ongoing challenges, air quality has improved significantly in recent years. At the state level, fine particulate matter decreased by 20 percent, one-hour sulfur dioxide by 65 percent, annual nitrogen by 32 percent, nine-hour carbon monoxide by 67 percent, and eight-hour ozone by six percent between 2006-15.²³

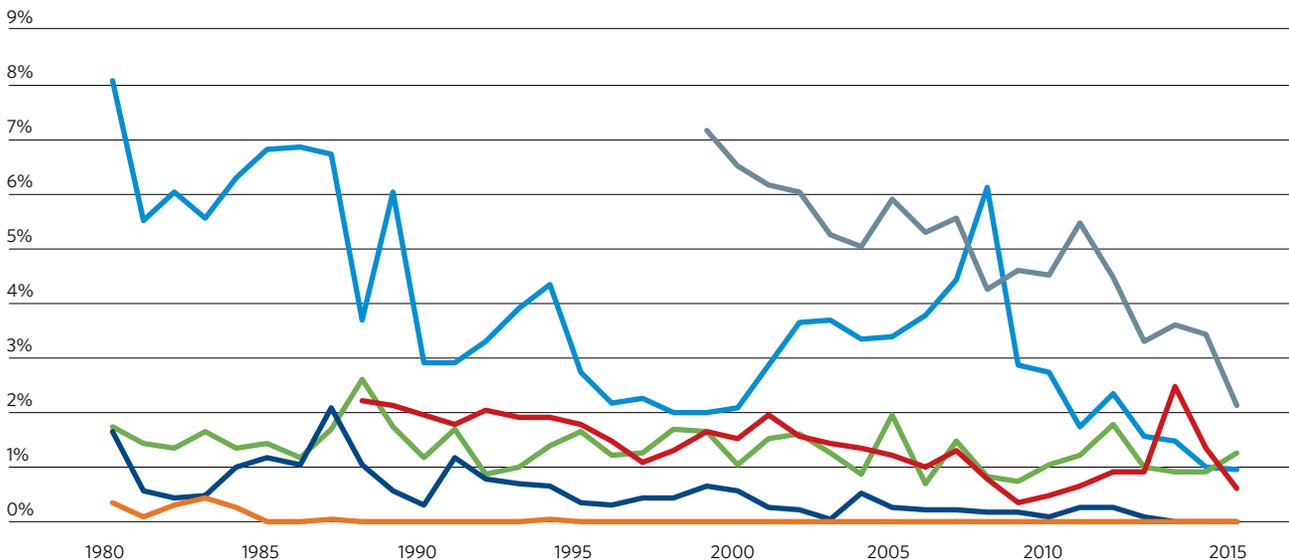
From 1980-2015, the percentage of days with potentially unhealthy air quality in the Chicago region, measured by the six criteria pollutants regulated by the Clean Air Act, decreased steadily. This trend highlights the gradual improvement of air quality in the region.

Percent of days with potentially unhealthy Air Quality Index (AQI) readings per year

- Nitrogen dioxide (NO₂)
- Fine particulate matter (PM2.5)
- Ozone
- Sulfur dioxide (SO₂)
- Coarse particulate matter (PM10)
- Carbon (CO)

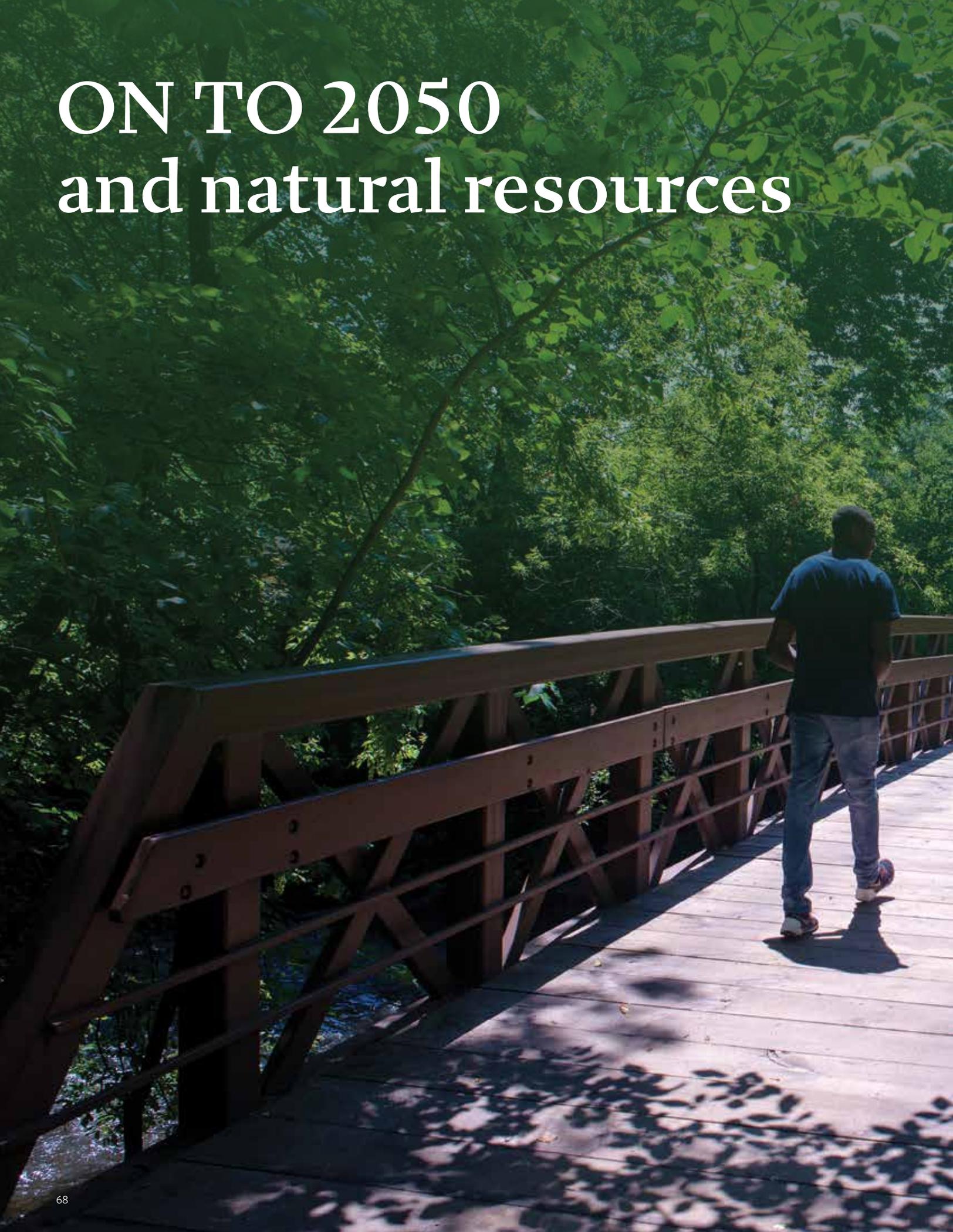
Note: Ozone, particulate matter, and nitrogen dioxide affect public health at lower concentrations than sulfur dioxide or carbon monoxide. To account for this difference, this chart shows AQI scores greater than 50 "moderate" for ozone, PM10, PM 2.5, and NO₂, and AQI scores greater than 100 "unhealthy for sensitive populations" for SO₂ and CO. AQI data is available for six counties in the CMAP region. Kendall County is not included in this dataset.

Source: Chicago Metropolitan Agency for Planning analysis of U.S. Environmental Protection Agency data.

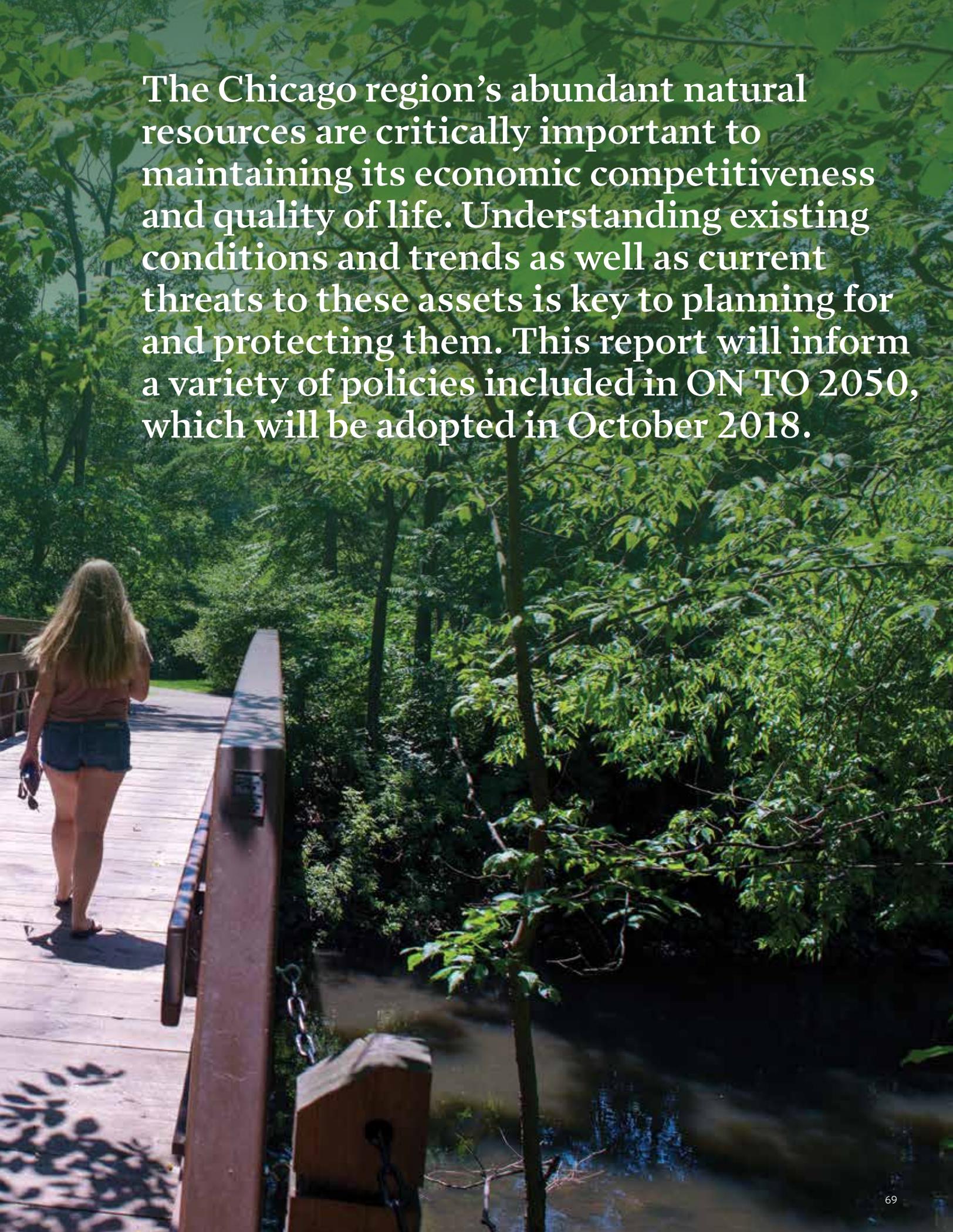


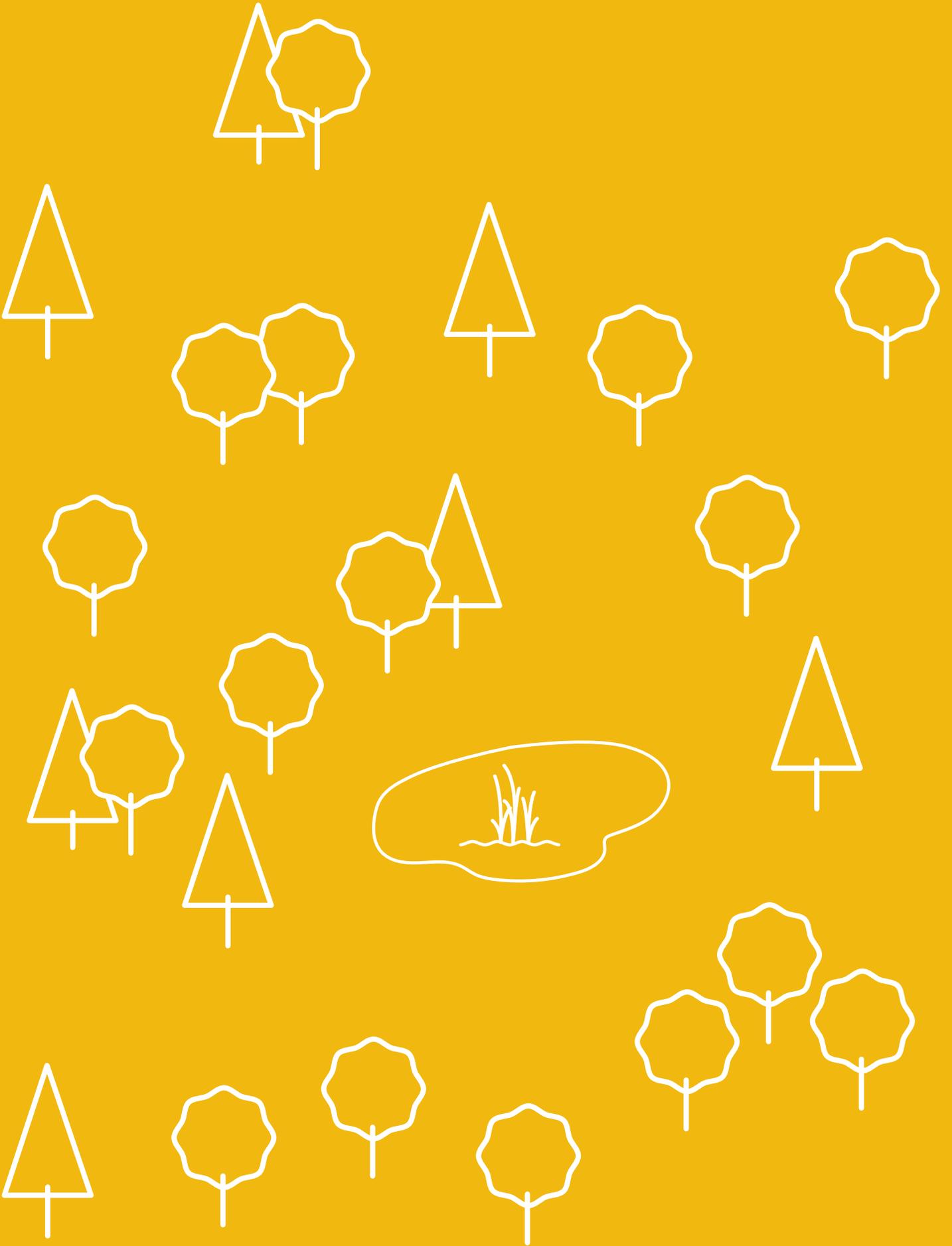


ON TO 2050 and natural resources



The Chicago region's abundant natural resources are critically important to maintaining its economic competitiveness and quality of life. Understanding existing conditions and trends as well as current threats to these assets is key to planning for and protecting them. This report will inform a variety of policies included in ON TO 2050, which will be adopted in October 2018.





Endnotes

- 1 "Green Infrastructure Vision 2.3: Ecosystem Service Valuation," CMAP, 2014, <https://datahub.cmap.illinois.gov/dataset/green-infrastructure-vision-2-3-ecosystem-valuation>.
- 2 Jim Angel, "Climate of Chicago—Description and Normals," State Climatologist Office for Illinois, www.isws.illinois.edu/atmos/statecli/general/chicago-climate-narrative.htm.
- 3 Jim Angel, "Climate of Illinois Chicago—Description and Normals," State Climatologist Office for Illinois.
- 4 "1981-2010 Monthly and Yearly Normals for Chicago and Rockford," National Weather Service, www.weather.gov/lot/ord_rfd_monthly_yearly_normals.
- 5 Jim Angel, "Climate of Illinois Chicago—Description and Normals," State Climatologist Office for Illinois.
- 6 "Chicago's Temperature Records," National Weather Service, www.weather.gov/lot/Chicago_Temperature_Records.
- 7 "State Climate Summaries: Illinois," National Oceanic and Atmospheric Administration (NOAA) National Centers for Environmental Information, <https://statesummaries.ncics.org/il>.
- 8 "Our Changing Climate," NOAA National Centers for Environmental Information, 2014, <http://nca2014.globalchange.gov/highlights/report-findings/our-changing-climate>.
- 9 P.Y. Groisman, R.W. Knight, & T.R. Karl, "Changes in intense precipitation over the central United States," 2012, *Journal of Hydrometeorology*, 13:47-66.
- 10 Prairie fires are often driven by winds. Due to northeastern Illinois' predominant wind patterns, wildfires have typically moved west to east across the landscape. Because fires cannot cross wide waterways, areas on the eastern banks of river and lakes were typically protected from fires, allowing fire-sensitive trees to thrive.
- 11 "Oak Ecosystems Recovery Plan," Chicago Wilderness, October, 2015, <https://www.dnr.illinois.gov/conservation/IWAP/Documents/Chicago%20Wilderness%20Oak%20Ecosystem%20Recovery%20Plan.pdf>.
- 12 "Climate Resilience," CMAP, 2016, cmap.is/2n6Zrr5.
- 13 Patrick M. O'Connell, "Restoration of Illinois' oak savannas tries to reach new heights," *Chicago Tribune*, May 30, 2017, cmap.is/2BnwYpC.
- 14 "Great Lakes Facts and Figures," U.S. Environmental Protection Agency (EPA), <https://www.epa.gov/greatlakes/great-lakes-facts-and-figures>.
- 15 "About Our Great Lakes: Lake by Lake Profiles," NOAA-Great Lakes Environmental Research Laboratory, <https://www.glerl.noaa.gov/education/ourlakes/lakes.html>.
- 16 Thomas R. Schueler, Lisa Fraley-McNeal, Karen Cappiella, "Is Impervious Cover Still Important? Review of Recent Research," 2009, *Journal of Hydrologic Engineering* 14, no. 4.
- 17 "Combined Sewer Overflows (CSO) Events," Metropolitan Water Reclamation District of Greater Chicago, cmap.is/2DfC5Wc.
- 18 Illinois EPA designates the states' waters for various uses including aquatic life, aesthetic quality, primary contact (e.g., swimming, water skiing), secondary contact (e.g., boating, fishing), food-processing water supply, and fish consumption.
- 19 "Illinois Integrated Water Quality Report and Section 303(d) List - Vol I: Surface Water - 2016," Illinois EPA, www.epa.illinois.gov/topics/water-quality/watershed-management/tmdls/303d-list/index.
- 20 Brad Winters, et al., "Report for the Urban Flooding Awareness Act," State of Illinois Department of Natural Resources, Office of Water Resources, June 2015, www.isws.illinois.edu/hilites/more.asp?id=ufoo&fr=hi.
- 21 "Picture of America: Outdoor Air Quality," Centers for Disease Control, https://www.cdc.gov/pictureofamerica/pdfs/Picture_of_America_Air_Quality_Final.pdf.
- 22 "Learn about Lead," U.S. EPA, <https://www.epa.gov/lead/learn-about-lead#effects>.
- 23 "Illinois Air Quality Report: 2015," Illinois EPA, 2015, cmap.is/2CKT0yM.

Selected data used in the development of this report can be found at <https://datahub.cmap.illinois.gov/group/on-to-2050-report-data>.

233 South Wacker Drive, Suite 800
Chicago, Illinois 60606
312-454-0400
ONTO2050@cmap.illinois.gov
www.cmap.illinois.gov

The Chicago Metropolitan Agency for Planning (CMAP) is our region's official comprehensive planning organization. The agency and its partners are developing ON TO 2050, a new comprehensive regional plan to help the seven counties and 284 communities of northeastern Illinois implement strategies that address transportation, housing, economic development, open space, the environment, and other quality-of-life issues. See www.cmap.illinois.gov for more information.

ON TO 2050 snapshot reports will offer data-driven summaries of regional trends and current conditions. These documents—as well as strategy papers—will define further research needs as the plan is being developed prior to adoption in October 2018.

