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The Role of Our Urban Forest in the Chicago Metropolitan Region's Future

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Introduction

Trees throughout the region constitute a valuable urban and community forest resource that contributes significantly to human health and quality of life. Beyond aesthetic value and social well-being, the urban forest provides essential ecosystem services to clean the air, protect and clean water, support biodiversity, shelter homes, and conserve energy. As we prepare for a region with 2.8 million new residents by 2040, the services provided by the urban forest will be invaluable. Growing a more robust, healthy urban forest will help achieve greater community livability and quality of life in the region.

Efforts needed to create and sustain a robust urban forest are interdependent with the efforts needed to address major land use and environmental issues being considered in *GO TO 2040*. The nature of new residential and commercial development shapes how much and what kind of space is available for growing trees, for example. Storm water management, air quality, and energy conservation strategies should consider the substantial role trees play. Public policy priorities can foster investment in the urban forest or detract from it.

The urban forest is not managed by one single entity that could plan and implement a comprehensive strategy to maximize its benefits. The ownership, composition, quality, and functional value of the urban forest vary greatly across the region and by ownership and land use types. A more cohesive regional approach is needed to knit together policies and priorities in order to improve the quality and extent of present and future urban forest capacity. Therefore, the urban forest must be seen as a vital component of planning at the local and regional levels.

This paper defines urban forestry, makes the case for the importance of the urban forest, and lays the groundwork for critical regional leadership in urban forestry. We also point out opportunities for enhanced management and use of the urban forest to better serve the entire region. These opportunities can be realized through interdisciplinary collaboration between development, transportation, environmental, and economic policies and programs.

I. Definition of Urban Forest and Urban Forestry

The urban and community forest is the forest that surrounds us in our daily lives. The trees and other plants that create a canopy over communities characterize the urban forest. We do not travel to visit the urban forest, but rather step out into it as we retrieve the morning paper under our own shade tree. Maybe the day starts with a walk along tree-lined streets to a train station, then a train ride dashing through a canopy of trees along the right-of-way, traversing public, private, and institutional lands sprinkled with trees. Downtown, the urban forest lives in landscaped plazas and sidewalk pits that soften harsh lines of the city streetscape and moderate temperatures and solar radiation. At day's end, we may refresh ourselves with a walk through a neighborhood park or nearby forest preserve. All of these trees—some planted,

some naturally occurring, some carefully cultivated, some unmanaged—contribute to the quality of life in the region. Viewed as a whole, this vast resource is the urban forest.

The urban landscape is most effectively viewed as an urban ecosystem, with each part relating to and affecting the whole. People and all the structures and institutions that support us are interdependent with the soil, water, plants, and animals that are part of the urban forest. Trees are the most prominent, recognizable feature of an urban forest, but trees alone do not define it. Natural forests and other plant communities are often not sustainable as small fragments interspersed with populated areas. In these situations, human activity disturbs natural processes, and these processes must be augmented by management practices. Similarly, landscapes planted in developed areas can be planned and managed to contribute to urban ecosystem health and sustainability.

Urban forestry is defined as the art, science, and technology of managing trees, forests, and natural systems in and around cities, suburbs, and towns for the health and well-being of all people.[1] This discipline naturally fits with planning processes that strive to improve the quality of life for the region. Local and regional planning strategies should be crafted that recognize urban forestry and aim to maximize its potential to contribute to regional well-being.

Urban forestry management borrows to some degree from traditional forestry. Some fundamental management practices, like tree planting and removal, mimic the dynamics of a natural forest life cycle. Mulching around the base of newly-planted trees mimics the ground conditions in a forest environment. Public works and transportation system management also influence urban forest management, as do some principles of natural resource management.

But why manage an urban forest? If nature takes care of trees in a naturally occurring forest, why do we have to take care of trees in our urban forest? The answer is that trees evolved in forests with companion organisms and conditions that are no longer present in the urban environment. Thus, arboricultural practices aim to replace some of the components of nature to help trees flourish among human neighbors. Some practices, like pruning to remove weak branches, are essential for trees and people to live harmoniously in the urban environment.

Urban forestry strategies are relevant to all landowners whose objective is to sustain a canopy of trees for the benefits they provide to *people*. Managing forest lands and natural areas for biodiversity objectives requires a different, but complementary strategy. For a fuller discussion of management practices, see Appendix A. They are representative of the urban forest stewardship management activities that enhance community livability.

[1] Planning the Urban Forest, Ecology, Economy and Community Development, American Planning Association, PAS Report # 555

II. Benefits

One of the first considerations in developing a strong and comprehensive urban forestry program is determining the desired outcomes from managing vegetation in cities.[2] Urban trees offer multiple benefits that contribute greatly to the quality of life and livability of communities. Through proper planning, design, and management, urban trees can mitigate many of the environmental impacts of urban development by moderating temperature, reducing building energy use and atmospheric carbon dioxide (CO_2), improving air quality, lowering rainfall runoff and flooding, and reducing noise levels. Not only are substantial environmental benefits attributed to trees, there are sophisticated tools and models that allow us to estimate those services and quantify their value. Economic benefits are well understood and substantiated through cost/benefit studies. (See Section VII. Opportunities: C. Cost Effectiveness)

Trees and associated forest resources can also significantly influence the social and economic environment of a city. They can define community identity, add beauty, encourage active living, directly improve human physical and mental health, and foster a more meaningful connection between people and the natural environment. The benefits associated with trees are highly variable within and among urban areas and are sometimes difficult to measure. Nevertheless, these benefits reflect the important contributions of trees and forests to the quality of life for urban dwellers.

The discussion below highlights how trees provide some of these important benefits.

A. Energy Conservation

Trees reduce energy needs for heating or cooling by shading buildings in the summer, thus reducing summer air temperatures, and by blocking winter winds. Strategically placing trees to maximize summer shading has been shown to be an effective energy conservation practice. In the Midwest, trees placed to shade the west wall can reduce annual energy consumption by up to 7%, though any shading on south walls can actually increase winter heating demands.[3] Trees planted to the south should be selected and pruned to allow the sun to reach south walls in midwinter. Evergreen trees can work as windbreaks to block winter winds when planted to the north, northwest, and west of the building.

Proper tree placement near buildings maximizes energy conservation. For example, average annual energy savings in cooling and heating a typical residence with an energy-efficient planting design in Madison, WI, were about 4% greater than a residence with no trees and 13%

[2] This section draws heavily on Nowak, D.J. and J.F. Dwyer 2007. Understanding the benefits and costs of urban ecosystems. In: Urban and Community Forestry in the Northeast 2nd Edition. ED. J.E. Kusar. Springer Publishers.

[3] McPherson, E.G 1994. Energy saving potential of trees in Chicago. Pp 83-94 In: McPherson, E.G., Nowak, D.J., and Rowntree, R.A. 1994 Chicago's urban forest ecosystem: Results from the Chicago urban forest climate project. Gen Tech Rep. 186. USDA Forest Service. Northeastern Forest Experiment Station. Radnor, PA.

greater than one with improperly placed trees [4]. Other studies have found that energy use in a house with trees can be 20% to 25% lower per year than that for the same house in an open area[5].

At the community level, a robust urban forest canopy can help mitigate the urban heat island effect by providing direct shade to cool structures and paved surfaces and by evaporative cooling that lowers ambient air temperatures. Together, these reduce energy demands for summer cooling. Utilities in many parts of the country have embraced the energy conservation features of community trees and support tree planting programs.

Case Study: Iowa Utility Tree Planting Partnership

Legislation enacted in Iowa in 1990 required utility companies to spend a portion of their revenues to promote more efficient energy use. Among the programs that resulted was a partnership between utilities and the not-for-profit Trees Forever to plant trees. The partners implemented projects to plant trees in energy efficient landscapes, replace trees conflicting with power lines, to plant trees for beautification, and more. Since its inception, the program has paired volunteers, resources, and communities to plant 1.1 million trees that conserved an estimated 14.6 million kilowatt-hours of energy—enough to power 1,460 homes for a year. *Source:* Alliance for Community Trees, www.actrees.org

B. Air Quality

Trees influence air quality in a number of ways that are overwhelmingly positive, but sometimes negative. These can be summarized in terms of the letters T-R-E-E, which stand for[6]:

T*emperature reduction and other microclimatic effects.* By lowering air temperatures, trees lower the emission of volatile organic compounds (VOCs) from both vegetation and human sources (for example, gasoline), thus reducing the potential for ozone formation.

R*emoval of air pollutants.* Trees remove pollution from the air by intercepting airborne particles on their leaves and branches, and absorbing gaseous pollutants into their leaves via stomata[7]. Once inside the leaf, gases diffuse into intercellular spaces and may be absorbed by water films to form acids or react with the inner surfaces of leaves. Some intercepted particles can be absorbed into the tree[8] [9], though most are temporarily retained on the plant surface. The particles may be re-suspended to the atmosphere, washed off by rain, or dropped to the ground with leaf and twig fall[10]. Sustaining widespread healthy forest cover through

[4] McPherson, E. G. 1987. Effects of vegetation on building energy performance. Ph.D diss., SUNY College of Environmental Science and Forestry, Syracuse, NY.
[5] Heisler, G. M. 1986. Energy savings with trees. J. Arboric. 12(5): 113-125.
[6] Nowak, D.J. 1995. Trees pollute? A "TREE" explains it all. In: Proceedings of the 7th National Urban Forestry Conference. American Forests. Washington, DC. pp. 28-30.
[7] Smith, W.H. 1980. Air Pollution and Forests, Springer-Verlag, New York.
[8] Ziegler, I. 1976. The effect of air-polluting gasses on plant metabolism. In: Environmental Quality and Safety, Volume 2. Academic Press, New York. pp. 182-208.
[9] Rolfe, G.L. 1974. Lead distribution in tree rings. For. Sci. 20(3): 283-286.
[10] Smith, W.H. 1980. Air Pollution and Forests. Springer-Verlag, New York.

comprehensive urban forestry programs can lower local short-term levels of air pollution by 5% or more.[11]

***E**mission of VOCs and tree maintenance emissions.* Trees also emit various VOCs that can contribute to the formation of ozone (O_3).

***E**nergy effects on buildings.* By reducing building energy requirements, trees reduce pollutant emissions from power plants, thereby improving air quality.

Case Study: TREE Benefits
An Assessment of Chicago's Urban Forest in 2009 Found:

Number of trees: 3,585,000
Pollution removal: 888 tons/year ($6.4 million/year)
Carbon storage: 716,000 tons ($14.8 million)
Carbon sequestration: 25,200 tons/year ($521,000/year)
Building energy savings: $360,000/year

Source: Nowak, David J., Hoehn, Robert E. III., Crane, Daniel E., Stevens, Jack R., Leblanc Fisher, Cherie. 2010. *Assessing Urban Forest Effects and Values*, US Forest Service Northern Research Station, Bulletin NRS-37, 2010

Increasing tree cover in urban areas will lead to greater pollution removal, as well as reduced air temperatures that can help improve urban air quality. Factors that affect pollution removal by trees include the amount of healthy leaf-surface area, concentrations of local pollutants, and local meteorology.

C. Urban Hydrology

By intercepting and retaining or slowing the flow of precipitation reaching the ground, urban forests can play an important role in urban hydrologic processes. They can reduce the rate and volume of storm water runoff, decrease flood damage, reduce storm water treatment costs, and enhance water quality. Estimates of runoff for an intense storm in Dayton, OH, showed that the existing trees reduced potential runoff by 7% and that a modest 7% increase in tree cover would reduce runoff by nearly 12%[12]. A study of the Gwynns Falls watershed in Baltimore indicated that heavily forested areas can reduce total runoff by as much as 26% and increase low-flow runoff by up to 13% compared with non-treed areas in existing land cover and land use conditions[13]. Further, tree cover over pervious surfaces (such as soil and turf) reduced total runoff by as much as 40%; while tree canopy cover over impervious surfaces (such as concrete and asphalt) had a limited effect on runoff. In reducing runoff, trees function like retention/detention structures. In many communities, reduced runoff due to rainfall interception also can reduce costs of treating storm water by decreasing the volume of water handled during periods of peak runoff[14].

[11] Nowak, D.J., Crane, Daniel E., Stevens, Jack C. 2006. Air pollution removal by urban trees and shrubs in the United States. Urban Forestry and Urban Greening 4 (2006):115-123.
[12] Saunders, R.A, 1986. Urban vegetation impacts on urban hydrology of Dayton, Ohio. Urban Ecol. 9:361-376.
[13] Neville, L.R. 1986. Urban watershed management: the role of vegetation. Ph. D. diss., SUNY College of Environmental Science and Forestry, Syracuse, NY.
[14] Saunders, R.A, 1986. Urban vegetation impacts on urban hydrology of Dayton, Ohio. Urban Ecol. 9:361-376.

D. Noise Reduction

Properly designed plantings of trees and shrubs can reduce noise levels significantly. Leaves and stems reduce transmitted sound primarily by scattering it, while the ground absorbs sound[15]. For optimum noise reduction, trees and shrubs should be planted close to the noise source rather than the receptor area[16]. Wide belts (30 meters) of tall dense trees combined with soft ground surfaces can reduce apparent loudness by 50% or more. Although noise reduction from plantings along roadsides in urbanized areas often is limited due to narrow roadside planting space (less than 10 feet in width), reductions in noise of 3 to 5 decibels can be achieved with narrow dense vegetation belts with one row of shrubs roadside and one row of trees behind.[17]

Vegetation also can mask sounds by generating its own noise as wind moves tree leaves or as birds sing in the tree canopy. These sounds may make individuals less aware of offensive noises because people are able to filter unwanted noise while concentrating on these more desirable sounds[18]. The perception of sounds by humans also is important. By visually blocking the sound source, vegetation can reduce individuals' perceptions of the amount of noise they actually hear[19]. The ultimate effectiveness of plants in moderating noise is determined by the sound itself, the planting configuration used, and the proximity of the sound source, receiver, and vegetation, as well as climatic conditions.

E. Urban Wildlife and Biodiversity

There are many benefits associated with urban vegetation that contribute to the long-term functioning of urban ecosystems and the well-being of urban residents. These include wildlife habitat and enhanced biodiversity[20]. Urban wildlife can serve as biological indicators of changes in the health of the environment. For example, the decline of certain bird populations has been traced to overuse of pesticides. Urban wildlife also can provide economic benefit to individuals and society[21]. For example, bird feeding supports a $170- to $517-million industry in the United States[22] [23].

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[15] Aylor, D.E. 1972. Noise reduction by vegetation and ground. J. Acoust. Soc. Am. 51(1): 197-205

[16] Cook, D.I. and Van Haverbeke, D.F. 1971. Trees and shrubs for noise abatement. Res Bull. 246. Nebraska Agricultural Experiment Station, Lincoln.

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[21] Ibid

[22] DeGraaf, R.M. and Payne, B.R. 1975, Economic values of nongame birds and some research needs. Trans. North Am. Wildl. and Natur. Resour. Conf. 40:281-287.

[23] Lyons, J.R. 1982. Nonconsumptive wildlife-associated recreation in the U.S.: Identifying the other constituency. Trans North Am. Wildl. and Nat. Resour. Conf. 47: 677-685.

Surveys have shown that most city dwellers enjoy and appreciate wildlife in their day-to-day lives[24]. Among the State of New York's metropolitan residents, 73% showed an interest in attracting wildlife to their backyard[25]. Feelings of personal satisfaction from helping wildlife were the most frequently reported reason for feeding wildlife in backyards[26].

Urbanization can sometimes lead to the creation and enhancement of animal and plant habitats, which, in turn, usually increases biodiversity. For example, tree species diversity and richness in Oakland, CA, increased from about 1.9 (Shannon-Weiner diversity index value) and 10 species in 1850 to an index value of 5.1 and more than 350 species in 1988[27]. However, the introduction of new plant species into urban areas can lead to problems for managers in maintaining native plant structure, as exotic plants can invade and displace native species in forest stands.

Urban forests can act as reservoirs for endangered species. For example, 20 threatened or endangered animal species and 130 plant species are listed for Cook County, the most populated county of the Chicago metropolitan area[28]. In addition, residents of urban areas are increasingly preserving, cultivating, and restoring rare and native species and ecosystems[29]. Because of increased environmental awareness and concerns about quality of life and sustainability of natural systems, ecological benefits of the urban forest are likely to increase over time[30].

F. Benefits to Individuals

Urban trees improve human health in a wide variety of ways, ranging from improved air quality to reduction of stress and inter-personal conflict. Urban trees provide beauty and are among the most important features contributing to the aesthetic quality of residential streets and community parks[31]. Perceptions of aesthetic quality and personal safety are related to factors

[24] Shaw, W.W., Magnum, W.R. and Lyons, J.R. 1985. Residential enjoyment of wildlife resources by Americans. Leisure Sci. 7:361-375.
[25] Brown, T. L. Dawson, C.P. and Miller, R.C. 1979. Interests and attitudes of metropolitan New York residents about wildlife. Trans. 44th North Am. Wildl. and Nat. Resour. Conf. 44:289-297.
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[29] Ibid.
[30] Dwyer, J.F., McPherson, E.G., Schroeder, H.W., and Rowntree, R.A. 1992. Assessing the benefits and costs of the urban forest. J. Arboric. 18(5): 227-234.
[31] Schroeder, H.W. 1989. Environment, behavior, and design research on urban forests. In: Advances in Environment, Behavior, and Design. (E.H. Zube and GL. Moore eds.) Plenum Press, New York pp. 87-107.

such as the number of trees per acre and viewing distance[32]. Urban trees and forests provide significant emotional and spiritual experiences that are important in people's lives and can foster a strong attachment to particular places and trees[33] [34] [35]. A wide range of individual benefits have been associated with volunteer tree planting and care and further exploration of these opportunities is warranted[36] [37]. Volunteers continue to play an increasingly important role in urban forestry efforts such as conducting tree inventories[38]. Chicago-area residents can receive training in tree planting and care and perform volunteer work for public trees through Openlands' TreeKeepers program[39].

Nearby nature, even when viewed from an office window, can provide substantial psychological benefits that affect job satisfaction and a person's well being[40]. Reduced stress and improved physical health for urban residents have been associated with the presence of urban trees and forests in a number of environments. Living in a green environment has been associated with a wide range of individual benefits, including improved learning and behavior by children in urban areas[41] [42] [43]. Experiences in urban parks have been shown to change moods and reduce stress[44], and to provide privacy refuges[45]. Hospital patients with window views of trees have

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[32] Schroeder, H.W. and Anderson, L.M. 1984. Perception of personal safety in urban recreation sites. J. Leisure Res. 16:178-191.

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Schroeder, H.W. 2002. Experiencing nature in special places. J. Forestry 100(5):8-14

Schroeder, H.W. 2004. Special places in the Lake Calumet Area. USDA Forest Service North Central Research Station General Technical Report 249. St. Paul MN. 23pp.

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[37] Sommer, R. 2003. Trees and human identity. In: Identity and the natural environment: The psychological significance of nature. (S. Clayton and S. Opotow, Eds.) MIT Press. Cambridge and London. pp. 179-204.

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[39] Openlands website, http://openlands.org/Community-Greening/Projects/urban-forestry.html, September 2010

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[42] Taylor, A.F., Kuo, F.E., and Sullivan, W.C. 2001. Views of nature and self discipline: Evidence from inner-city children. J. Env. Psych. 21: 49-63.

[43] Wells, N.M. 2000. At home with nature: Effects of "greening" on children's cognitive functioning. Env. and Behav. 32(5): 775-795.

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Kaplan, R., and Kaplan, S. 1989. The experience of nature: A psychological approach. Cambridge University Press, Cambridge, UK.

been shown to recover significantly faster and with fewer complications than comparable patients without such views[46]. In addition, tree shade reduces ultraviolet radiation and thus can help reduce health problems associated with increased sun exposure, such as cataracts and skin cancer[47].

As public concern about adult and childhood obesity grows, trees and forests are receiving increasing attention. They can serve as environments that encourage exercise, such as playing in well-landscaped parks or running along tree-lined streets and trails. The strenuous, physical work involved in caring for trees and landscapes can also be a way for volunteers to get exercise[48]. A comprehensive overview of the relationship between urban design and human health concluded, "There are strong public health arguments for the incorporation of greenery, natural light, and visual and physical access to open space in homes and other buildings"[49].

G. Benefits to Communities

Urban forests can make important contributions to the economic vitality and character of a city, neighborhood, or subdivision. It is no accident that many cities, towns, and subdivisions are named after trees. Oak Brook, Elmhurst, and Sycamore are just a few examples. Further, many cities strive to be a "Tree City USA." Often, trees and forests on public lands—and on private lands to some extent—are significant "common property" resources that contribute to the economic vitality of an entire area[50]. The substantial efforts that many communities undertake to develop and enforce local tree ordinances and manage their urban forest resources attest to the significant return that they expect from these investments.

A stronger sense of community and empowerment of inner city residents to improve neighborhood conditions can be attributed to involvement in urban forestry efforts[51]. Active involvement in tree-planting programs has been shown to enhance a community's sense of social identity, self-esteem, and territoriality; it teaches residents that they can work together to choose and control the condition of their environment. Planting programs also can project a

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visible sign of change and provide the impetus for other community renewal and action programs[52]. Several studies have shown that participation in tree planting programs influences individuals' perceptions of their community.[53] Conversely, a loss of trees within a community can have a significant psychological effect on residents[54]. A useful framework for considering social benefits of urban and community forestry projects has been developed and illustrated with community examples[55].

Urban trees and forests can help alleviate some of the hardships of inner city living, especially for low-income groups[56]. Extensive research in inner city areas of Chicago suggests that urban trees and forests contribute to stronger ties among neighbors, greater sense of safety and adjustment, more supervision of children in outdoor places, healthier patterns of children's play, more use of neighborhood common spaces, fewer incivilities, fewer property crimes, and fewer violent crimes[57].

While there is sometimes concern over the influence of trees and other vegetation in urban areas on the incidence of crime, research has provided management guidelines that can reduce the fear of crime in urban forest areas[58] [59].

Streetscape greening has been shown to positively affect customers' purchasing behavior, suggesting important benefits to commercial establishments and a basis for partnerships with

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[52] Ibid.

[53] Sommer, R., Learey, F., Summit, J., and Tirell, M. 1994. Social benefits of resident involvement in tree planting: Comparisons with developer-planted trees. J. Arboric. 20(6):323-328.
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Kou, F.E., and Sullivan, W.C. 2001. Aggression and violence in the inner city: Impacts of environment via mental fatigue. Env. and Behav. 33(4): 543-571.
Kuo, F.E, Bacaucia, M., and Sullivan, W.C. 1998. Transforming inner-city landscapes: Trees, sense of safety, and preference. Env. and Behav. 30(1): 28-59.
Sullivan, W.C, and Kuo, F.E. 1996. Do trees strengthen urban communities, reduce domestic violence? Arborist News 5(2): 33-34.

[58]Schroeder, H.W. and Anderson, L.M. 1984. Perception of personal safety in urban recreation sites. J. Leisure Res. 16:178-191.

[59] Michael, S.E., and Hull, R.B. 1995. Effects of vegetation on crime in urban parks. Arborist News. February p. 45.

the business community in urban forest planning and management[60]. However, improper landscaping of business areas can have a negative impact by blocking business signs or reducing the attractiveness of the area.

H. Real Estate Values

The sales value of real estate reflects the benefits that buyers attach to attributes of the property, including vegetation on and near the property. In addition, increased real estate values generated by trees also produce direct economic gains to local governments through property taxes.

A survey of sales of single-family homes in Athens, GA, indicated that landscaping with trees was associated with an increase in sales prices of 3.5% to 4.5%[61]. Builders have estimated that homes on wooded lots sell on average for 7% more than equivalent houses on un-wooded lots[62]. A recent study in Athens, GA, indicates that a 1% increase in relative tree cover is associated with an increase of $296 in residential value[63]. A study of small urban-wildland interface properties in the Lake Tahoe Basin indicates that forest density and health characteristics contributed between 5% and 20% to property values[64]. Shopping centers often landscape their surroundings to attract shoppers, thereby increasing the value of the business and shopping center[65].

Parks and greenways have been associated with increases in nearby residential property values[66]. Some of these increased values have been substantial, and it appears that parks with "open space character" add the most to nearby property values. Part of the contribution to the value of residential property is associated with the view from that property. One study suggests

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[60] Wolf, K. L. 2003. Public response to the urban forest in inner-city business districts. J. Arboric. 29(3): 117-126.
Wolf, K.L. 2004. Trees and business district preferences: A case study of Athens, Georgia US. J. Arboric. 30(6): 336-346.

[61] Anderson, L.M., and Cordell, H.K. 1988. Influence of trees on residential property values in Athens, Georgia (USA): A survey based on actual sales prices. Landscape and Urban Plann. 15: 153-164.

[62] Selia, A.F., and Anderson, L.M. 1982. Estimating costs of tree preservation on residential lots. J. Arboric.8: 182-185.
Selia, A.F. and Anderson, L.M. 1984. Estimating tree preservation costs on urban residential lots in metropolitan Atlanta. Georgia For. Res. Pap. No. 48.

[63] Sydor, T.; Bowker, J.M.; Newman, D.H. and Cordell, H.K. 2005. Valuing trees in a residential setting: Revisiting Athens, Clark County, Georgia. 15 pp.

[64] Thompson, R., Hanna, R., Noel, J., and Piirto, D. 1999. Valuation of tree aesthetics on small urban-interface properties. J. Arboric. 25(5): 225-234.

[65] Dwyer, J.F., McPherson, E.G., Schroeder, H.W., and Rowntree, R.A. 1992. Assessing the benefits and costs of the urban forest. J. Arboric. 18(5): 227-234.

[66] Correll, M, Lillydahl, J., and Single, L. 1978. The effects of greenbelts on residential property values: Some findings on the political economy of open space. Land Econ. 54: 207-217.
More, T.A., Stevens, T., and Allen, P.G. 1988. Valuation of urban parks. Landscape and Urban Plann. 15:139-152.
Crompton, J.L. 2004. The proximate principle: The impact of parks, open space and water features on residential property values and the property tax base. National Recreation and Park Association, Ashburn VA. 184 pp. plus appendix.

that a good view adds 8% to the value of a single-family house[67]. A premium of 5% to 12% in housing prices in the Netherlands was associated with an attractive landscape view from the property[68].

III. History

In the United States, trees and gardens were first recognized as important features of livable cities by the City Beautiful and Garden City movements in the late 19th and early 20th centuries. Though the City of Chicago was incorporated in 1837 with the motto, "Urbs in Horto" or "City in a Garden," Chicago in its early development had few green amenities. Following a period of rapid, haphazard growth and industrial development, green spaces grew to be seen as essential to public health and the image of civil society.

The *Plan of Chicago*, published in 1909, laid out networks of green boulevards, regional parks, and forest preserves. Soon after, the Chicago Tree Committee was formed; the first street tree ordinance was adopted; and the first City Forester was hired to oversee the preservation, cultivation, and planting of shade trees.[69]

The suburb of Riverside was platted in a park-like way, with "residences separated by patches of the untouched, original forest."[70] At about the same time, real estate developer William Robbins invested in 800 acres that is now Hinsdale, planting thousands of young shade trees before he sold the lots "so that when they matured they would transform barren Hinsdale into a grove and her streets into 'cool cathedral aisles.' " The trees attracted buyers, and his success started a tree planting trend among other developers.[71]

In the early 1900s, residential streets were planted with American elms. This fast-growing, resilient tree formed much-beloved cathedral-like canopies defining the character of communities like Evanston, Oak Park, Elmhurst, and Chicago. But starting in the 1950s a devastating exotic pest was introduced to the eastern seaboard and came west. Dutch elm disease spread rapidly up and down tree-lined residential streets, forever changing the ambiance of neighborhoods. As tragic as that was, the infestation gave birth to a new approach to managing community trees that was rooted in traditional forestry—urban forestry.

In the 1990s, the US Forest Service reframed urban and community forests as urban ecosystems and began quantifying the environmental services they provide.[72] As the concept

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[67] Rodriquez, M., and Sirmans, C.F. 1994 Quantifying the value of a view in single-family housing markets. Apprais. Journ. October 1994:600-603.

[68] Luttik, J., 2000. The value of trees, water and open space as reflected by house prices in the Netherlands. Lands. Urb. Plann. 48: 161-167.

[69] Prost, 1911

[70] Schick, L, Chicago and its Environs: A Handbook for the Traveler, 1891, p. 417

[71] Bakken, Timothy H., Hinsdale. Published in 1976 by the Hinsdale Doings

[72] An Ecosystem Approach to Urban And Community Forestry, A Resource Guide, Northeastern Area State and Private Forestry, US Forest Service, July 1993, Module 1

of green infrastructure has taken root, the urban forest has come to be seen as a holistic system of interconnected natural and cultivated landscapes that support trees, people, and biological diversity. This new approach values the environmental, social, and economic services of the urban forest and offers greater opportunities to enhance and reap these benefits for area residents. However, it also demands strong and creative leadership at the regional level and across organizations and disciplines.

IV. Landowners and Land Managers

To understand the urban and community forest as a whole, functioning (urban) ecosystem, each of the component parts needs to be understood as well. This section discusses the land managers overseeing the different components. Public, private, and not-for-profit groups are currently managing segments of the urban forest. However, an expansive regional perspective could best identify opportunities to enhance the urban forest. By looking at the urban forest in a more cohesive way, potential benefits could be maximized to improve the well-being of people living in the region.

The urban forest lies on small and large parcels of land and in diverse corridors, and is affected directly and indirectly by diverse policies with a broad range of objectives. At the smallest scale, individual trees are often highly valued and may be intensively cared for. At the largest scale, forested landscapes, together with grasslands, wetlands, and farmland, form the green infrastructure system and may be managed for biodiversity, recreation, or receive little or no management.

This diversity of ownership and management is both an asset and a liability. No one management strategy is best for park land managers and for utilities and for municipalities. Stewardship of the urban forest is not subject to constraints of any one kind of agency or property owner. Strong regional or sub-regional leadership is needed to knit together the numerous stakeholders and objectives into a vital, comprehensive approach

A. Residential Landowners

The urban forest begins at home. Indeed, the residential landscape is the first connection that most people have to the natural world. Their understanding of this most intimate of natural systems shapes their expectations of public and private land management. In the best situations, homeowners may choose to plant trees that bring seasonal color, attract birds, provide shade, or provide screening. Homeowners may also landscape for maximum energy conservation by strategically shading their homes and diverting wind. Professional arborists provide services to help homeowners nurture valued landscape trees, keep pests at bay and prune the crowns to maximize beauty and function. But in other instances, residents may object to mature trees or not plant trees at all, and valuable environmental services are lost to residents and the community.

B. Homeowner Associations

At the next scale, homeowner associations can be influential stewards of the urban environment. Definitive information is lacking on the number of homeowner associations in northeastern Illinois and the number of residents they represent, but they are known to be prevalent. As an example, the Naperville Area Homeowners Confederation alone represents more than 140 subdivisions and some 145,000 residents.

Homeowner, or community, associations control extensive landscapes with little expertise and objective professional guidance. Developers install landscapes in accord with subdivision codes and create pleasant, shared landscapes that are enjoyed for property-value enhancement, beauty, and recreation, while water resources primarily function for storm water management. Unfortunately, new subdivisions are often marked by fast-growing but poorly suited and poorly planted young trees that will be costly to maintain over their shortened lifespan.

These landscapes usually are not designed for long-term sustainability and ecosystem function. Because these landscapes utilize high-maintenance trees and other plants, homeowner associations and property management firms must maintain them intensively, using pesticides and fertilizers extensively. Sustainable landscape concepts are not widely practiced among developers and homeowner associations. Yet, these landscapes could be adapted and managed sustainably to contribute ecosystem services. To start, long-lived, pest-resistant trees could replace high-maintenance ones, and more could be planted strategically to conserve energy and intercept storm water. Vast areas of turf could be replaced with native and sustainable plantings and unnecessary fertilization could be eliminated to protect water quality.

C. Municipalities

Of the public land managers responsible for the urban forest, municipalities generally have the greatest capacity for management of community trees. Street trees, the trees that are planted and cultivated in the public right-of-way, are the most familiar components of the urban forest. Residents have grown to expect municipalities to plant and maintain trees in public parkways, and they generally support public investment in these trees.

The national Tree City USA program, sponsored by the Arbor Day Foundation in cooperation with the USDA Forest Service and the National Association of State Foresters, recognizes good municipal forestry programs. The criteria demand a governing authority for public trees, staff resources, community involvement, and a minimum expenditure of $2 per capita for trees. An advanced program, the Growth Award, recognizes deeper stewardship of community trees. In Illinois, nearly 200 communities currently hold the Tree City USA status. Statewide, these communities spend about $82 million, or $12 per capita on average, planting, and caring for community trees.[73]

[73] Illinois Department of Natural Resources, Urban and Community Forestry Program, Tree City USA Conference program, 2009

The road right-of-way, which includes the parkway, planting strip, and tree pits, is a demanding environment in which to grow trees. Streets and infrastructure limit growing space for roots. Additionally, reflected and retained heat from concrete and asphalt, road salt, and collisions with both lawnmowers and vehicles stress trees and shorten their lives. Many aesthetic and safety concerns, such as weak wooded trees that cause damage during storms, limit the types of trees that can be grown. Only a limited palette of trees can tolerate these demands, and this limited diversity leaves street tree populations vulnerable to disease and pests.

Progressive municipal forestry programs retain certified arborists to oversee tree planting, maintenance, and removal operations to protect public investment in trees and maximize the benefits communities derive from them. Some also aim to protect trees during development and other operations, and to assure that development plans accommodate trees over the long-term. Many city foresters inventory their street trees as a basis for management plans.

Older communities may have a highly valuable urban forest partly because they have retained mature trees that were present at the time of development. Other communities have planted trees long ago that are now mature. As mentioned above, unfortunately, new subdivisions are sometimes marked by fast-growing, poorly planted, costly to maintain young trees. Yet current residential construction practices consistent with municipal regulations often cause substantial physical damage to growing conditions for trees, thereby diminishing the prospect of growing a mature urban tree canopy.

Fundamental to urban and community forest stewardship are municipal ordinances that assign agencies responsible for community trees, set requirements for planting and removing trees on public property, and prevent tree-related public nuisances like the transmittable Dutch elm disease. Ordinances may also establish a citizen's tree board or commission to advise the municipality.

D. Park Districts

Where park management is separate from other municipal services, park districts are the stewards of public trees and landscapes that support recreation.[74] Natural resource management is often, but not always, secondary to the recreation mission of park districts, and their urban forestry programs reflect that priority. Yet, trees are essential and valued components of active and passive parks. Playgrounds and athletic facilities are more desirable and attractive when trees are incorporated into the design and maintained well.

Generally, a greater diversity of trees exists in parks than in street parkways, and these tend to live longer because of the more favorable growing conditions. However, in some high-use areas, such as picnic groves on Chicago's lake front where hot charcoal has burned the base of trees, park trees have shortened lives.

[74] Parks and Open Space Strategy paper www.goto2040.org/parks.aspx.

Professional arborist staff and systematic tree management are not particularly common among park districts. However, a few park districts, such as Downers Grove and St. Charles, do employ naturalists who restore and manage natural areas and educate residents.

E. Transportation Agencies

Trees and landscaping also enhance expressways and arterial streets, creating functional buffers and community gateways. Sustainable landscaping with trees, shrubs, and native and ornamental plants reduces roadside mowing requirements and can enhance driver and pedestrian safety by calming traffic and separating vehicles and pedestrians.[75] It also reclaims medians and right-of-ways as functioning green infrastructure that enhances storm water infiltration and cleanses the air. However, road salt and roadway contaminants directly kill trees or render the soil chemistry inhospitable, so that growing trees along transportation corridors is a formidable challenge.

Case Study: Chicago Gateway Green
Chicago Gateway Green, founded by Hyatt Hotel executive Don DePorter, Mayor Richard M. Daley, and the Illinois Department of Transportation, melds corporate and civic involvement to improve Chicago's quality of life by creating green ribbons through the city. Gateway Green's Expressway Partnership program is transforming the city's expressways into parkways. The newest Tree Partnership program is a large-scale tree planting initiative that will convert unused lands across Chicago into green spaces. In its more than 20-year history of greening and beautifying Chicago's gateways, expressways, and neighborhoods, Chicago Gateway Green has planted 77,000 shrubs and 3,000 trees. *Source:* www.gatewaygreen.org

Township and county highway departments, the Illinois State Toll Highway Authority and Illinois Department of Transportation (IDOT) may plant and maintain trees and other plants in highly visible environments while adhering to guidelines for the "clear zone" around the roadway to maintain safety. IDOT also awards federal transportation funds through the Illinois Transportation Enhancement Program (ITEP) for community-based projects that enhance the transportation infrastructure. Tree planting and management boosts the aesthetic and environmental dimensions of transportation corridors. In 2009 ITEP awarded approximately $13 million or 60% of available funds for streetscaping, tree planting, and maintenance projects.[76]

F. Institutional and Commercial Landowners

The urban forest that grows on private non-residential land varies from sylvan golf courses and campuses to sparse landscaping on industrial lands. Campuses often support large-stature specimen trees in community arboreta that are treasured and protected. At the other extreme, many landscaping ordinances require the planting of trees to buffer parking lots and strip malls,

[75] Dumbaugh, Eric, Safe Streets, Livable Streets, Journal of the American Planning Association, Vol. 71, No. 3, Summer 2005.
[76] www.dot.il.gov/opp/itep.html April 23, 2010

but these trees, which are coveted for shade during summer months, receive little or no care and have short, difficult lives. Too diverse to discuss in this paper, these lands are mentioned to present the full picture of the diverse landowners and land managers of the urban and community forest.

G. Utilities

While community trees are highly valuable and desirable, reliable utility services are essential. Conflicts arise when trees grow in utility rights-of-ways. Overhead power lines traverse many communities and share public easements with trees. Line clearance tree-trimming, which diverts tree growth away from overhead power lines, is unpopular among residents and city leaders. But without this type of pruning, branches can grow into power lines, or large, unstable limbs may break in storms and threaten reliable delivery of electricity. In some instances, a best practice for utility vegetation management programs is to collaborate with city foresters to replace tall trees with lower-growing, compatible trees.

Case Study: Lewis University Community Arboretum and Tree Committee
Lewis University is only the fourth university in Illinois to be named Tree Campus USA by the National Arbor Day Foundation for its dedication to campus forestry management and environmental stewardship. Lewis University is a veritable arboretum with more than 60 varieties of deciduous trees on its main campus in Romeoville. Lewis University met the required standards of tree care and community engagement to earn the award. *Source:* Lewis University press release, February 18, 2010

Transmission lines outside of residential areas afford utility companies opportunities for urban forest stewardship in large and contiguous rights-of-way. In one instance, Commonwealth Edison, Du Page County, and the Forest Preserve District of Du Page County collaborated to remove invasive plants and restore native prairie plants to a 3 mile stretch of right-of-way maintained as a recreational trail.[77] Utilities with underground transmission assets also maintain rights-of-way or set vegetation policies that affect the urban forest. Right-of-way maintenance for an underground petroleum pipeline that had been deferred for decades resulted in the removal of hundreds of trees in residential portions of Homer Glen in the summer of 2007. [78]

H. Forest Preserve and Conservation Districts

Forest preserves and conservation areas are designated and protected parcels of land that are valued as the support system that maintains natural communities, sustains clean air and water, supports wildlife habitat, and offers recreational and educational opportunities to connect people to nature. Restoration of degraded ecosystems has become an important objective for these regional land managers. Technical expertise, resources, and public support are strong for land preservation, restoration, and stewardship. Here, trees are appreciated as forests,

[77] DuPage County Environmental Commission Minutes, October 14, 2009
[78] Sheehan, Colleen, Southtown Star, July 5, 2007

woodlands, and savannas and understood to be important ecosystems within the greater urban area.

V. Inventories and Assessments

Inventories and assessments are fundamental to natural resource management, public works, and citizen involvement. Understanding an urban forest's structure, function, and value can promote management and policy decisions that will improve human health and environmental quality. Urban forest assessment tools, such as the *i-Tree* models developed by the US Forest Service, have achieved a level of sophistication that enables assessment to guide public policy.

A. Local Inventories

Street tree inventories at the local scale are generally developed by public works programs. These inventories aid integration with other public works functions like streets and sewers to avoid damage and coordinate work activities. Many are based on Geographic Information Systems (GIS). Inventories can also help communities estimate the value of their arboreal assets for legal and insurance purposes.[79] Valuation of trees also reminds policy-makers that trees are significant public investments. Ideally, these inventories also support the forest-level view of a community's trees. Knowing the species composition of the forest will help a community plan for pest infestations like the recent introduction of the invasive Emerald ash borer.

Case Study: Lombard

Total parkway tree population	18,369
Parkway ash population	2,956 (15.8%)
Current value of all parkway trees:	$38,636,700
Current value of all parkway ash:	$7,548,321 (20.65%)
Cost to remove ash trees over 10" dbh	$583,401
Cost to replace all parkway ash trees	$730,132

Source: Lombard City Forester, Steve Kremske, February 25, 2010

Forest preserve and conservation districts are more likely to undertake broad-based forest inventories of their entire forest and associated holdings that will identify tree density (stocking levels), species dominance, and the presence of understory plants that indicate forest health.

B. Regional Assessments

Regionally, inventories and assessments focus on the overall structure and function of the urban forest. Information such as the proportion of the region under tree canopy cover is an important metric that influences regional quality of life. Urban tree canopy is the amount of land sheltered by the crowns of trees and is a useful measure of the extent and potential function of the urban forest. Information about the health, nature, extent, and dynamics of the urban forest can guide supportive land use, transportation, economic, and environmental

[79] Guide for Plant Appraisal, 9th Edition, 2000

policies. For example, a regional tree canopy goal could be set to drive planting, preservation, and maintenance of urban trees in support of green infrastructure and climate change mitigation objectives.

The Morton Arboretum is collaborating with the US Forest Service to complete the 2010 Tree Census. This is the first comprehensive urban forest assessment of the seven-county Chicago metropolitan region. The 2010 assessment will provide a valuable guide for management of urban forest ecosystems across the region and support vigorous regional leadership efforts.[80] The regional assessment will also identify and measure the magnitude and value of ecosystem services provided by the existing canopy. This comprehensive valuation of air quality, storm water, energy conservation, and economic benefits is unprecedented for a large metropolitan region.

Current regional urban forest assessment models have evolved from the earliest ones developed in Chicago. In 1993, at the invitation of the City of Chicago, the US Forest Service undertook the Chicago Urban Forest Climate Project, a pilot regional urban forest assessment for Cook and DuPage counties. The study encompassed all land use types across the two counties. Detailed models were developed, such as those used to predict air quality and rainfall interception by measuring the leaf surface area of tree species. These models were then used to project the contribution of the region's trees to such ecosystem services as filtration of particulate pollution by leaf surfaces. This pilot became the basis for the US Forest Service Urban Forest Effects (UFORE) model that was recently renamed i-Tree Eco. UFORE studies have been undertaken by New York, Philadelphia, Milwaukee, Santiago, Chile, Beijing, China, and other global cities[81].

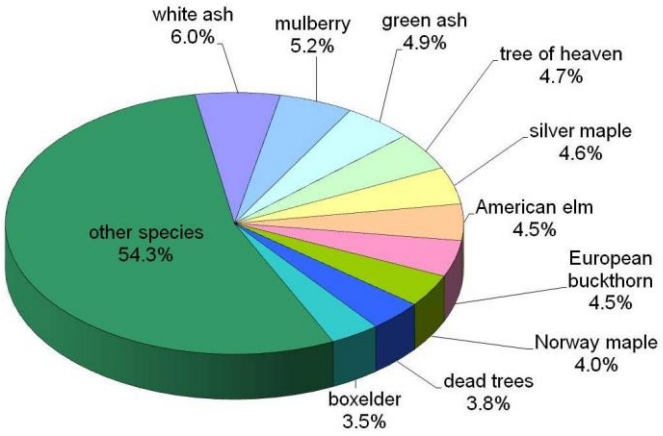
Case Study: Using Assessments to Fight EAB
The 1993 Chicago Urban Forest Climate Project determined that 20% of the region's street trees are ash—a figure that was instrumental in mobilizing planning and action to reduce the impact of the Emerald ash borer 10 years later. This destructive pest has destroyed an estimated 25 million ash trees in the Midwest. Knowing where and what proportion of the region's trees are ash guides leaders in making appropriate management responses and projecting future resource needs.

In support of Chicago's Climate Action Plan, the City of Chicago and the Chicago Park District, in cooperation with the US Forest Service, completed a UFORE assessment in 2009. Standardized field data about trees and land characteristics from 745 random sample plots across all land use types throughout Chicago were analyzed, along with hourly air pollution and meteorological data, to determine the structure and function of the city's urban forest. Knowing the species composition of the urban forest can enable strategic planning and management and is a foundation of ecosystem services calculations. The analysis of ground cover types can help target tree planting efforts and are fundamental to storm water and heat island analyses. See

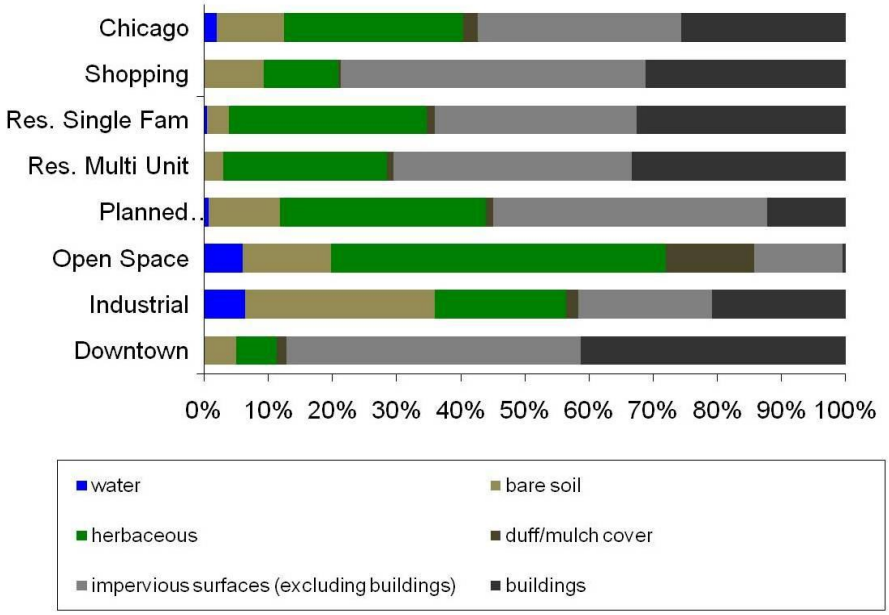
[80] www.mortonarb.org/tree-census.html
[81] US Forest Service, i-Tree website, www.itreetools.org

Section II. Benefits for a summary of ecosystem services results from the Chicago assessment. Some assessment results are summarized below.

Relative Abundance of Tree Species in Chicago 2009[82]



Urban Forest Ground Cover in Chicago 2009[83]



[82] Nowak, David J., Hoehn, Robert E. III., Crane, Daniel E., Stevens, Jack R., Leblanc Fisher, Cherie. 2010. Assessing Urban Forest Effects and Values, US Forest Service Northern Research Station, Bulletin NRS-37, 2010, www.itreetools.org/resources/reports/Chicago's%20Urban%20Forest.pdf

[83] ibid

VI. Regional Challenges—Sustaining Appropriate Tree Canopy Cover Over Time

The major challenge concerning the region's urban and community forest is to sustain an appropriate tree canopy cover over time. Barriers to meeting that challenge are two-fold: threats to the existing tree canopy and limitations on the establishment of future tree canopy.

A. Threats to the Existing Tree Canopy

Existing urban forest canopy is primarily lost through the impacts of landscape change and pests. Caring for and protecting existing trees is the most effective way to sustain an appropriate tree canopy cover over time. Large, mature trees provide up to 16.4 times more environmental and economic benefits over their lifetime than small trees, according to the Midwest Community Tree Guide.[84] Air and water quality benefits are a function of leaf surface area, and large trees have exponentially more leaf surface area than small trees. Large trees also provide the greatest boost to property values and contribute strongly to aesthetics, sense-of-place, and other user experiences. Mature trees are essentially irreplaceable, and it is essential to implement policies to protect them.

Comparison of Lifetime Tree Benefits Relative to Mature Size[85]

	Tree Values at Year 30	
Large Tree >40ft tall	Net benefits/year	$ 37
	Lifetime net benefits	$4,440
	Life expectancy	120 years
Medium Tree 25-40ft tall	Net benefits/year	$ 16
	Lifetime net benefits	$ 960
	Life expectancy	60 years
Small Tree <25ft tall	Net benefits/year	$ 9
	Lifetime net benefits	$ 270
	Life expectancy	30 years

1. Landscape Change and Canopy Loss

Development causes the loss of trees on individual sites and diminishes total urban forest canopy at the regional scale. Though development in wooded lots, especially for residential development, can be desirable, current methods used in site clearance and construction can damage or destroy existing trees and woodlands. A typical approach is to clear land of tree cover and install new, primarily ornamental landscaping upon completion of construction.

[84] McPherson, E.G; Simpson, J.; Peper, P,; et. al, Midwest Community Tree Guide, US Forest Service, 2006
[85] Ibid.

Urban forest integrity and ecosystem health is damaged with extensive earth moving operations, and the loss of mature trees diminishes the quality of life in the region.

Some communities define themselves by their large, mature trees. Loss of mature trees within established neighborhoods can be painful to residents. Communities that value a mature canopy of trees may choose to regulate potential damage or removal through tree preservation ordinances. There, individual public and privately-owned trees are perceived as important community assets and protected during site clearance and construction activities. Tree preservation becomes an especially important issue in teardown projects in mature neighborhoods.

Tree preservation ordinances can require certain preservation practices, like the establishment of protection zones around valuable trees to limit disturbance of soil and vital root systems. Careful monitoring for adherence to preservation standards is essential throughout the construction process, as trees such as oaks are sensitive to soil disturbances, and unintentional, irreversible damage can occur from misdirected equipment or contractors.

Successful tree preservation ordinances protect the most valuable trees on private property during site development. Often placed in the building section of municipal codes, tree protection requirements are usually triggered by building permit requests. Such ordinances allow tree preservation procedures to be integrated into overall site planning. Sometimes the placement of structures such as driveways or utilities can be altered to preserve trees. When trees cannot be preserved, developers are often assessed a penalty for removing trees or may be asked to replace a comparable number of trees. A few communities like Park Ridge have also established a tree planting fund that permits mitigation planting to occur elsewhere in the community[86].

Case Study: Public Tree Preservation Policy
A developer in Skokie complied with municipal code to protect a mature white oak on the parkway while redeveloping a residential site. A subcontractor, unaware of the tree preservation objective, cut a utility trench through the tree's critical root zone, rendering the tree unsafe and unable to survive. The tree had to be removed by the village. The contractor was held responsible for the full value of the public tree: $14,000. *Source:* Skokie Village Forester, Cathy Stevens, 2006

Tree preservation ordinances typically set minimum tree sizes for preservation, and sometimes call out valuable native tree species like oak and hickory for stricter protection measures. Most ordinances require a tree preservation plan to include an inventory and assessment of trees large enough to be considered for protection. Developers must describe and adhere to standard protection measures like protective fencing and avoiding grading around the important root zone. Communities such as Northbrook deploy dedicated tree preservation officers to regularly inspect sites.[87] Repeated violations can result in an expensive "stop work order" for developers.

[86] Village of Park Ridge municipal code, www.parkridge.us/assets/1/documents/art15.pdf , September, 2010
[87] Village of Northbrook, Tree Preservation Code, http://library.municode.com/index.aspx?clientId=11769&stateId=13&stateName=Illinois

The most aggressive ordinances may also require monitoring of tree health over a number of years. If trees die in that period, assurance bonds are withheld.[88]

In new residential projects, conservation development can offer viable options for preserving tree canopy on the neighborhood scale. Concentrating buildings and infrastructure on smaller lots allows for the preservation of wooded lands and other natural land cover. However, integration of landscape trees proximate to residential buildings for the purpose of energy conservation, screening, and noise reduction are more difficult in some conservation design models.

Tree preservation ordinances rarely succeed when large homes consume the majority of the lot with buildings and structures. Trees have a greater chance of surviving the site development process when the area roughly equivalent to the spread of the trees' crown remains undisturbed. On a mature oak tree, for example, this area may be 50 feet or more in diameter. Small set-backs and side yards—on the order of 10 or 20 feet—is likely to force the removal or death of valued large trees. Thus, when an area zoned for residential development contains significant stands of large mature trees, it may be appropriate to reconsider zoning classifications or to ensure development codes stipulate a minimum distance between trees and buildings.

Case Study: Messing with Mr. T's Trees
When television star Mr. T cleared his elegant, old estate in sylvan Lake Forest of hundreds of mature oak trees in 1987, his chainsaw was heard 'round the region and sparked a revolution.' This large scale tree removal in such a lushly canopied community was unexpected and unwelcomed. For the first time in the region, civic leaders chose to regulate tree removal on private property to protect the character and beauty of their community. This pioneering tree preservation ordinance has grown stricter over time and serves as the gold-standard municipal ordinance in the region. Many Chicago-area communities have studied the ordinance and built their own community policy on its foundation. *Source:* New York Times, May 29, 1987

Coordination of development policies and objectives to sustain a robust tree canopy is needed to help make communities livable, especially when local tree ordinances are lacking. Approximately 30 communities in northeastern Illinois have tree preservation ordinances in place. Passage of tree ordinances can be difficult to secure. They are often born in the tumultuous atmosphere of community conflict associated with teardowns. Mature trees that sheltered and screened modest homes may be removed when larger homes are built on these same lots. Local debate may consider the rights of individual property owners as paramount, and tree protection ordinances can struggle for acceptance. In the height of the teardown trend around 2006, more than 20 communities reported attempts to regulate tree removal on private property, yet very few succeeded.[89]

[88] Village of Homer Glen, Tree Preservation Code, www.homerglen.il.org/regulations/treepreservation
[89] Community Trees Program, The Morton Arboretum

2. Pests and Canopy Loss

Global trade and climate change have contributed to a rash of invasive pest introductions that pose serious threats to urban and community forests. Pests that may be kept in check in native ecosystems by the balance of nature go unchecked in foreign ecosystems, and the losses can be profound, as in the case of Dutch elm disease, a fungal disease spread by the invasive elm bark beetle. Gypsy moth, best known for its devastation of eastern forests, became problematic here in the 1970s, and today infestations are periodically heavy in Cook, Du Page, McHenry, and Lake Counties.[90] The insect eats foliage at a time in the growing season that is most damaging to tree health and can result in tree death.

Recent introductions of damaging invasive insects include Japanese beetles, well-known to gardeners, and bag worm, which is particularly damaging to popular evergreen trees and shrubs. Emerald ash borer, previously mentioned, was found in Illinois in 2006 and is currently the most potentially damaging of these pests. Forest inventories indicate that some 130 million ash trees in the state could be killed by this insidious invasive insect. Now found in 14 states and Canada, it has already destroyed tens of millions of ash trees.

Unless invasive pests are found and stopped at points of introduction, they will continue to be an imposing threat to the health of the urban ecosystem. The only possible long-term management response is to plant a diverse urban forest that offers the greatest opportunity for resistance, and therefore resilience, to new pest introductions.

Case Study: Chicago and the Asian Long-Horned Beetle

This large, menacing-looking, tree-feeding beetle was little known when it was found in Chicago and a few suburban locations. An unprecedented collaboration of state, federal, and municipal agencies quickly responded by extensively surveying to find all signs of infested trees, destroying all infested trees, and replacing them with new trees resistant to the beetle. After several years of intensive and expensive efforts, it appears that eradication efforts have succeeded locally (the only occurrence of such success known), and all state and federal quarantines and monitoring programs have ceased in the region. *Source:* Antipin, J.; Dilley, T., *Chicago vs,.the Asian longhorned beetle: A portrait of success*, US Forest Service 2004.

Most policies that govern the urban and community forest are local. Among the few state or regional policies that currently impact urban and community trees are ones that relate to the movement of invasive pests. The Emerald ash borer is an inconspicuous insect from China that can be unknowingly moved on infested firewood, logs, and nursery stock. The USDA Animal and Plant Health Inspection Service (APHIS) and the Illinois Department of Agriculture establish and enforce quarantines to reduce the spread of the pest. They also monitor for the presence of other pests.

[90] Illinois Department of Agriculture www.agr.state.il.us/environment/pest/gypsymoth

B. Challenges to the Establishment of New Trees

Urban and regional planning and development directly influence the quality, extent, and function of the future urban forest. Once structures and land use decisions are in place, the condition of the growing medium and quality of the growing space is difficult to change. It is important to consider the need for a sustainable urban forest canopy early in the planning and site design process. Current construction practices may inflict substantial physical damage to growing conditions for trees, and once landscapes are completed, non-sustainable, or even harmful, landscape maintenance practices can reduce or impede urban ecosystem health.

Besides the tree preservation ordinances discussed above, other ordinances that guide development, transportation, and the environment also influence the character and extent of future urban forests. Examples are subdivision and zoning codes, which may encourage healthy tree growth or unwittingly stifle the growth of robust urban forest landscapes. These codes will typically call for a certain number of trees to be installed per parking space or per foot of new roadway, and they will also detail some of the engineering requirements for tree pits, parking lot islands, and so forth. The objective of these codes is generally to provide visual screening of unattractive areas, to "soften" paved areas, and to provide amenities to residents and customers. Indeed, trees are a desirable component of plazas, streetscapes, and roadways. Yet, too often the design requirements in subdivision and zoning codes do not allow adequate space above ground for tree crowns to mature without conflicting with structures, nor adequate below-ground space for vital roots to develop to support tree growth. In new developments, the most limiting factors to growing a robust urban forest canopy are space and soil. As trees require rooting space to be at least as broad as their mature crowns, traditional restricted tree pits, parking lot islands, and medians cannot sustain trees over time. New plantings in such spaces rarely last more than a few years, imposing costs on property owners or local governments to replace them.

Case Study: Rooting Out Adequate Growing Space
In the parking lot of Cantera, a large commercial and entertainment development in Warrenville, development code called for the visually pleasing interruption of stretches of pavement with trees spaced out between rows of parking spaces. While the numerous small planting pits addressed the design intent, trees could not thrive in the tiny planting pits surrounded by pavement and they quickly died. An alternative approach would have been clustering trees in large planting areas with deep, quality soil and shared rooting space. In such a design, trees would have adequate growing conditions to reach a large, functional size .

1. Growing Space and Tree Establishment

Landscaping and streetscaping is most successful if it is designed from the outset as an important part of residential, commercial, and transportation developments. A viable urban forest will not thrive in urban landscapes unless it is planted and cared for. Attractive, functional, and successful tree-scape designs require thoughtful placement, adequate rooting and growing space, and appropriate selection and planting. Very narrow parkways also limit

the future growth of trees and drive up management expenses. Cars and mowers will likely damage these trees, shortening their lifespan.

There may be some difficulty in growing healthy, large shade trees in compact residential neighborhoods. Highly desirable landscape trees can span 40-80 feet in width and cannot reach their mature size in small yards. Unless development policies leave room for trees, the ecosystem services associated with large trees will be unavailable. On the other hand, compact residential developments have significant benefits, such as reduced infrastructure costs and the ability to support alternative modes of transportation, such as walking and transit. One way to permit the healthy growth of large trees in compact developments is to have shared landscapes that preserve growing space for large shade trees to thrive and reach their full size. Also, using more permeable surface for driveways, parking lots, and walkways will increase useable growing space, as tree roots can survive under such surfaces.

A cohesive, regional approach to urban forestry is essential to protect the health of the urban forest, sustain the tree canopy, and enhance the health and well-being of the region's residents. To take one example, trees may be added as landscape features along new local roadways, but without designing adequate growing space and supplying viable soil medium, roadway trees cannot survive. A more sustainable approach recognizes roadside trees as an essential component and designs roadways from the outset to preserve existing trees and support the vigorous growth of healthy trees over time. Land use policies that guide development, transportation, and the environment have profound impacts on the character and extent of future urban forests. Collaboration and communication among the landowners and land managers discussed above, as well as those who establish and enforce development regulations, would help mitigate potential damage to the urban forest by seeking constructive solutions to achieve multiple goals.

2. Soil and Tree Establishment

There has been much education aimed at farmers to help them value their soil as a precious resource that warrants stewardship and protection. Urban regions more commonly treat soil as merely the foundation for building, when it is, in fact, the foundation for all plant life and ultimately all human life. Its complex structure and chemistry was developed by natural processes over hundreds to thousands of years. Oak-hickory forests and oak savannas thrive on loose soils rich in organic matter. Construction practices harm the deep, fertile Illinois soil profile, permanently altering the ability of the land to support tree growth. Extensive grading during development may strip away precious topsoil; and heavy equipment may densely compact subsoil. Trees roots struggle to survive in such soil. Once structures and infrastructure are built, a few inches of topsoil bereft of critical soil structure is returned. The resulting shallow, disturbed soils and restricted growing space may prevent the development of a mature, native tree canopy.

Aggressive local and county regulations aim to protect water quality from runoff contamination during construction, yet no regulations protect our fragile soil resources. Significant changes in

development regulations and practices are needed to preserve soil and the future capacity of the land to grow a robust urban forest. The tolerance for elevation changes in our region's modest topography is pretty low. Other regions of the country successfully build over and around slopes and rises. Development policies should discourage radical grading and leveling to preserve soil structure. Where possible, a small construction envelope should be enforced to restrict heavy equipment access from damaging soil over the entire construction site. The need for grading and excavation to create storm water retention structures may be reduced if trees are maintained on the landscape to serve the storm water retention function.

VII. Opportunities

Urban and community forests achieve their best and highest use when abundant trees are mature, flourishing, and improving the lives of people. The lack of a connected, regional urban ecosystem management perspective means that the urban forests of northeastern Illinois are inadequately managed, and ecosystem services go unclaimed. However, the discussion can be reframed to lay the groundwork for cooperation and innovation that can capture these essential services. That discussion can capitalize on factors such as the following that will support these critical regional efforts.

A. People Love Trees

We can tap into humans' deep, innate connection to trees to gain support for regional environmental objectives. Trees are beloved ambassadors of the natural world.

Innumerous cultural and spiritual traditions value trees. Ubiquitous trees impact people at every socio-economic level throughout the region. While a few communities have a culture that is uncomfortable with trees growing around residences, most have a historic connection to trees. Seven communities in the region are named for oaks (Oak Park, Oak Lawn, Oak Brook, Green Oaks, etc,) and dozens are named for trees or stands of trees (Maple Park, Sycamore, Elmwood Park, Elmhurst, Downers Grove, etc.) Trees are a very common element in village seals and logos. Despite our prairie heritage, civic pride seems more arboreal in nature.

Civic leaders understand the value of trees. A 2002 study of Illinois mayors and managers found that 99% of respondents agreed that trees improve community appearance, and 90% also agreed that trees are important for maintaining a healthy community environment and quality of life.[91]

Mature trees are passionately valued by residents for the beauty and comfort they bring to neighborhoods. In a 2004 survey of 677 Kenilworth residents, 93% rated trees as the most important attribute in defining the existing character of the community. Further, 86% also stated that the loss of mature trees was "very negatively" impacting Kenilworth, greater than

[91] Green, Thomas; Howe, Timothy; Schroeder, Herbert, Illinois small community tree programs: attitudes, status, and needs. Final Report of the Illinois small community tree program survey May 1998. www.na.fa.fed.us/spfo/pubs/uf/il_tree survey/r2.htm

any other factor.[92] Similarly, in a 2004 survey Downers Grove residents placed "greenspace/trees" as the top choice of desirable aspects of their neighborhood that they felt should be preserved and enhanced.[93]

Ultimately, trees can bridge a connection from home to the natural world. People who never visit forest preserves and don't understand biodiversity can enjoy the change of seasons reflected in landscape trees. Cultivating appreciation for neighborhood trees and their rich gifts can help foster an understanding of more complex environmental concepts like green infrastructure. Trees are almost universally accepted in the landscape, while some communities are still striving for aesthetic acceptance of natural landscaping and bioswales.

B. Strong Civic Involvement

Community forestry programs seem to thrive with an exceptional level of civic involvement. Relative to other civic and environmental issues, statutory and ad hoc citizen commissions that guide community forestry programs are fairly common. An estimated 20 communities in the region have a designated citizen tree commission or tree board[94] and another 15 or more have environmental commissions[95]. These groups advise municipal tree programs, offer technical expertise, and oversee special events such as Arbor Day and Earth Day celebrations[96].

The Arbor Day tradition, now a well-recognized state and national holiday, also engages the community and children in stewardship of the urban forest. In 2007 a survey found that 70 northeastern Illinois communities celebrated Arbor Day or Earth Day. In total, 148 schools and nearly 20,000 children planted some 15,000 trees and seedlings.

Additionally, community controversies involving tree removal sometimes spark the formation of civic groups that persist and champion urban trees. "Save the Timber" is a non-profit citizen advocacy group that formed in 2004 when the historic Timber Trails golf course in Western Springs was sold for private development and the mature oak trees were threatened. The group collaborated with Openlands, a regional land conservation organization, to propose an alternative conservation design to protect more trees and preserve open space. They remain active in 2010.[97] In the Beverly neighborhood in Chicago, tree removal in the historic district sparked the formation of "Keeping Beverly Green," which has been advocating before the Chicago City Council and city agencies for tree protection policies.[98]

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[92] Village of Kenilworth Resident Survey, 2004
[93] Village of Downers Grove, Community Dialogue Summary, 2004
[94] Community Trees Program, The Morton Arboretum, 2009
[95] Metropolitan Mayors Caucus Survey, 2007
[96] Morton Arboretum Community Trees Program Survey, 2007
[97] Interview with Ellen Raymond, Save the Timber Founder, February 27, 2010
[98] Interview with Kathleen Tobin, Keeping Beverly Green Founder, November 3, 2009

C. Cost Effectiveness

When trees are viewed simply as an amenity, stressed local budgets may not appear to have the capacity to support tree planting and maintenance, but when social, economic, and environmental services provided by trees are considered, urban forestry becomes a good public investment. The US Forest Service conducted a cost/benefit analysis of urban forests specific to the Midwest. [99] It considered the following costs and benefits related to community trees:

Benefits	Costs
Electricity Savings	Tree & Planting
Natural Gas Savings	Pruning
CO_2 Reduction	Remove and Dispose
Ozone Avoidance	Infrastructure Repair
NO_2 & SO_2 Reduction	Irrigation
PM_{10} Removal	Clean-up
Rainfall Interception	Liability & Legal
Other Benefits	Administration

Street or Park Tree 20 years after planting			
Annual Benefits			
	Small	Medium	Large
	Crabapple	Red Oak	Hackberry
Environmental Benefits	22.00	38.09	77.19
Other Benefits	4.80	14.44	24.85
Total Benefits	**26.80**	**52.52**	**95.93**
Costs	**26.66**	**33.01**	**35.87**
Net Benefits	$0.14	$19.52	$60.05
Benefit/ Cost	**1**	**1.59**	**2.67**

The study compared three sizes of trees and used Glen Ellyn as the Illinois reference city. It assumes a 40% mortality rate. Large public shade trees return $2.67 in measurable ecosystem services for every dollar invested. The least functional tree of the study was a small stature ornamental tree in a public landscape—which broke even over the 20 year period with a 1:1 cost/benefit ratio. The most valuable tree, a large residential tree assumed to be shading a west wall and therefore providing optimal energy conservation benefits, returned $6.75 in services for every dollar invested. Lower maintenance costs, greater longevity, and energy conservation services are credited for the high return of residential trees compared to public trees.

[99] US Forest Service, Midwest Community Tree Guide, Benefits, Costs and Strategic Planning, McPherson, Greg, et. al, PSW-GTR-199, 2006

Overall, the urban and community forest is a dynamic ecosystem that provides essential measurable environmental, social, and economic services to enhance the quality of life in communities. Trees are capital assets that grow more valuable over time and stand out as responsible public investments.

D. Expanding Functional Green Infrastructure

The urban forest is the thread that weaves green infrastructure into the psyche of the urban resident and the agenda of the local unit of government. The green infrastructure movement in Illinois would benefit by explicitly including the urban forest. The Green Infrastructure Vision states "the nearly 360,000 acres of natural areas that make up Chicago's Wilderness comprise our 'green infrastructure.' It includes large complexes of remnant woodlands, savannas, prairies, wetlands, lakes, stream corridors, and other natural communities that support biodiversity and provide habitat for diverse communities of native flora and fauna at the regional scale." [100]

However, the national Conservation Fund sees the green infrastructure network more broadly, including working landscapes and other open spaces that conserve ecosystem values and functions and provide associated benefits to human populations.[101] Further, the American Planning Association predicts that "Connecting the trees, parks, and other urban green infrastructure at site and neighborhood scales to the surrounding waterways and other regional green infrastructure networks may well become the next great frontier in planning and government services." [102]

One promising solution is to use trees in addition to rain gardens, bioswales, and other green infrastructure tools that manage storm water. Since trees add a vertical layer of green to built environments, the environmental function of urban land is enhanced without compromising its original use. For example, a large tree stretching up and over a residential yard adds significant leaf surface area above roofs, driveways, and turf to intercept rainfall. And, within a parking lot, a bioswale can intercept rainfall and filter storm water within the allocated planting strip. If properly designed, the same planting strip could also support trees that catch rainfall, speed infiltration and uptake water with their roots, create shade, and reduce ambient air temperatures in hot summer weather. Trees have the added advantages that they do not limit access and landscape use and require less expertise to install and manage than rain gardens, for example.

Implementing sustainable landscape practices on existing urban landscapes could collectively enhance their function and create a healthier urban forest ecosystem. Whereas conservation

[100] Chicago Wilderness website www.chicagowilderness.org

[101] Benedict, Mark; McMahon, Edward, Green Infrastructure, Linking Landscapes and Communities, 2006, p. 3

[102] Planning the Urban Forest, Ecology, Economy and Community Development, American Planning Association, PAS Report # 555, 2009

design principles allow new developments to preserve and restore ecosystem function, urban forestry can reclaim these valuable benefits from vast, established landscapes.

In the region, green infrastructure is presently seen to have primarily a storm water function. The Illinois Legislature enacted Public Act 96-26, the Green Infrastructure for Clean Water Act, requiring the Illinois EPA to assess and evaluate the use of green infrastructure to help manage storm water in Illinois. Again, the national dialogue has a broader view that includes ecological, social, and economic functions and benefits, beyond those already mentioned:

- Cleaner air
- Increased recreational and transportation opportunities
- Improved health
- Better connection to nature and sense of place[103]

The role of urban forests in improving air quality, enhancing public health, cultivating relationships with nature and creating a sense of place is well researched and documented. The region stands a better chance of capturing all of the ecosystem services possible with a comprehensive green infrastructure vision that considers the urban forest.

E. Expertise and Institutional Support

Northeastern Illinois is well known for sound management of urban trees and forests, ranging from street trees at the municipal level to extensive parks and forest preserves. These efforts are supported by a number of organizations with national and international reputations such as the Morton Arboretum, Chicago Botanic Garden, Field Museum of Natural History, Openlands, and a number of high-quality universities. These organizations have a tradition of working together to deal with critical regional problems such as pests and restoration of forests and other landscapes.

F. Regional Indicator

A key finding of the urban forest assessment, the 2010 Tree Census, will be urban tree canopy. The Regional Indicators Project (MetroPulse), an important CMAP endeavor, could use the urban tree canopy as a solid indicator of environmental quality within urban environments. Since urban forests encompass communities, urban tree canopy is a potential indicator that is directly related to livable communities. This metric has been used by the Boston Indicators Project and as an indicator in Minneapolis, Portland, San Francisco, and St. Louis.

G. 2010 Tree Census

[103] Green Infrastructure, Conservation Foundation website www.greeninfrastructure.net

The 2010 Tree Census being completed by the Morton Arboretum in cooperation with the US Forest Service will for the first time provide a sound basis for decision making concerning the region's urban and community forests. The project has focused significant attention on the region's forests and promises to enlarge public and private interest in expanding, enhancing, and sustaining the urban forest.

VII. Strategies for Regional Leadership

A new, collaborative regional approach to urban and community forestry is essential for preparing for 2.8 million new residents by 2040. National leadership and technical support from the US Forest Service is strong, and local investment and management are growing. Long in the domain of natural resource and public works agencies, urban forestry needs to become integrated with other important regional considerations by the civic leaders implementing long-term regional plans. Strong regional or sub-regional leadership is needed to knit together the numerous stakeholders and objectives into a vital, comprehensive approach to optimally manage the region's urban forest to enhance and sustain quality of life. Recognition of the value of the urban forest and a long-term regional perspective that acknowledges the interrelationships of land use, transportation, economic, and environmental policies will go far in cultivating an urban conservation ethic that protects, grows, and sustains the urban and community forest. Once these connections are made, the potential of a highly comprehensive view of green infrastructure will be a powerful force in achieving an improved quality of life for the region.

Case Study: Boston Indicators Project

Indicator: Tree Cover and number of trees and bulbs/flowers planted.

Why is this important?

The liveliness and safety of Boston's streets depends on how well the built environment, street life and open spaces are integrated. Trees, especially in dense neighborhoods, give people a sense of place, comfort and beauty.

How are we doing?

In 2007 the City of Boston and its partners in the Boston Urban Forest Coalition launched the Grow Boston Greener Campaign to plant 100,000 new trees by 2020, which would increase tree canopy cover from 29% to 35% by 2030. Initial goals have been met with 1,000 trees planted in 2007 and 3,000 in 2008 with a primary focus on communities with low canopy cover.

As of 2008, about half of Boston's neighborhoods have at least a 30% tree cover; however, the neighborhoods of East Boston and South Boston along with the Central City—which include Chinatown—have less than a 10% tree cover.

Source: Boston Indicators Project

Such a perspective is endorsed by the American Planning Association's recent definition of urban and community forestry as, "a planned and programmatic approach to the development and maintenance of the urban forest, including all elements of green infrastructure within the community, in an effort to optimize the resulting benefits in social,

environmental, public health, economic, and aesthetic terms, especially when resulting from a community visioning and goal setting process."[104]

The first step in developing a regional approach to urban forestry is the recognition of the value of the urban forest and the important services that it provides. Current research documenting the social, economic, and environmental values of the urban forest strongly supports this view. Through dialogue with civic leadership, the compelling case for community trees and forests as a vital component of the regional quality of life can be made.

A vital second step is an accurate and regional assessment of the urban forest. The Morton Arboretum and US Forest Service's 2010 Tree Census will provide baseline information about the structure, function and value of the region's urban forest that is essential to future goal setting and developing indicators of progress.

The results of the 2010 Tree Census provide an excellent catalyst for discussions by a regional leadership forum. These might include the following:

- Tree canopy across the region—variations by area, ownership, and land use; and needs for the future
- Opportunities for tree planting to increase the tree canopy throughout the region
- Diversity of the region's urban forest by species and age
- Extent of invasive species and the problems that they pose
- Species at risk to known and possibly emerging pests
- Benefits generated by the urban forest and opportunities for enhancing those benefits as part of regional environmental strategies for:
    - -pollution removal
    - -carbon storage
    - -building energy reduction
    - -storm water management
    - -mitigation of the urban heat island
    - -improved regulations for tree preservation and subdivision development

Further research is needed to guide innovative policy solutions that both protect existing urban forest resources and support the growth of a sustainable urban forest. Successful local tree protection ordinances and programs need to be modeled and analyzed to further support the adoption of such policies in new communities. Pioneering policies that could guide development to protect vital soil and growing space for the future urban forest have yet to be conceived. Communities could adopt conservation design concepts more broadly that are inclusive of landscape tree protection and cultivation. Similarly, updates to zoning and subdivision codes may be needed to support sustainable urban forestry—such as requirements

[104] American Planning Association

for parking lot designs that provide for the long term growth of trees—and this may require technical assistance to local governments.

Finally, community comprehensive plans should consider urban forestry and the significant role it has in achieving livable communities. Whereas policies such as conservation design improve the ecosystem function of new developments, adequate urban forest management optimizes the ecosystem services of existing landscapes—these are resources we already have. By modestly investing in our urban forest to sustain large, long-living, healthy trees, we can earn back valuable benefits for people in the region. CMAP and its partners should provide guidance and assistance to communities who value a robust urban forest and demand the vital services it provides to people.

APPENDIX A

Urban Forest Management

I. Management Plans and Specifications

Comprehensive urban forest management plans are not yet common among land managing organizations, but municipalities again lead in this area. Municipal forestry management plans and specifications focus on essential practices needed to maintain an enduring tree canopy that provides maximum benefits to the community as a whole, while minimizing possible liabilities. These plans provide goals for the community forest, set specifications for planting and maintenance tasks, and establish priorities, mostly geared towards street trees. In addition, some of these management strategies intersect with other issues, such as public safety, environmental health, and transportation.

II. Planting

Vital to a sustained urban forest canopy, planting is the most visible and rewarding of all management activities. With few exceptions, trees are planted into the landscape as substantial, commercially produced nursery stock. Nurseries in Kane, Kendall, Will, McHenry and other partly agricultural counties supply the region with cultivated trees and woody plants grown from small, mostly cloned plants produced in the fertile Pacific Northwest region.

There is much interest in and a growing market for native trees grown from local seed for genetic and biodiversity objectives. In fact, many strategies promote exclusive use of natural landscaping and native plants. However, use of native and introduced trees is generally an appropriate solution to the challenging growing conditions and constraints in an urban environment.

Horticultural breeding allows us to grow a greater diversity of trees and enjoy more ecosystem services. Much breeding work goes into producing plants, called cultivars, which are better suited to urban growing environments, perform better in the landscape, or offer more attractive features such as showy fall color than their naturally occurring counterparts. In addition, trees bred for longer flowering or smaller stature appeal to consumers and inspire them to plant more trees. Finally, native trees such as ash trees and American elms are vulnerable to exotic pests and diseases. Disease-resistant elms, which have taken 30 years to breed, are appropriate and ecologically benign.

Even native trees, like honey-locust trees, have been bred to eliminate naturally occurring menacing thorns and produce stronger and better shaped crowns. They are now widely planted in the landscape primarily as these improved ‘cultivars.’

Tree planting is more complicated than commonly believed. Techniques must mimic nature to assure transplant success. Nursery production processes that place young root systems too deep in the soil have recently been linked to slow, but widespread underperformance and likely failure of landscape trees. One to three years of care in the form of frequent monitoring, watering and mulching is essential to the successful establishment of newly planted trees. It is difficult for some agencies to attend to appropriate after-care, and young trees die soon after planting. Better planting contracts require multiple years of monitoring and watering to protect the investment in tree planting.

Case Study: Suburban Tree Consortium
The Suburban Tree Consortium was created in 1985 by a group of municipalities wishing to improve the quality and selection of parkway trees in the Chicago area. The ubiquitous low bid process yielded inferior trees with high mortality rates and it prohibited continuity and consistency in the tree supply. The communities successfully lobbied, with the help of the West Central Municipal Conference, to change state statutes to extend the length of time municipalities could enter into contractual relationships with area nurseries. S*ource*: West Central Municipal Conference (www.westcook.org)

III. Pruning

Pruning is an important maintenance practice for trees in the urban landscape. In nature, dead or weak limbs fall to the forest floor and eventually decompose. This is not acceptable for trees growing in human-dominated landscapes. Dead or dying branches or branches that could break are cut out by trained arborists. Structural pruning helps trees build strong branching architecture that can extend tree life. Pruning may also be done to fit trees into restricted urban spaces by directing growth away from streets, structures and utility lines. Quality pruning that retains and enhances the natural shape and character of a tree goes unnoticed by the untrained eye. Utility pruning, on the other hand, appears harsh and unnatural to the public, though it is also governed by American National Standards Institute (ANSI) standards and is done by qualified arborists.

IV. Pests

Established trends in nursery production, landscape design, and construction have led to the overuse of inexpensive, fast-growing, high maintenance plants that require pesticide applications to control serious or annoying pests. For example, crabapples are adaptable in difficult growing environments; small and compatible with urban infrastructure; and offer spring flowers and fall and winter ornamental features that make them popular and common. The horticultural industry has bred about 400 different cultivars. A few are superior and flourish with minimal care, but many commonly used crabapples are susceptible to diseases and insect pests and require chemical pest control. By selecting the superior cultivars, the beauty and function of these ornamental trees can be enjoyed without excessive pesticide use.

While the selection and planting of optimal, targeted tree species is the ultimate, long-term solution, Integrated Pest Management is currently the best practice for managing losses and

inconvenience from insect and diseases pests. Professional horticulturists and arborists regularly monitor plant health. When pest problems are detected, the severity and consequences are evaluated to determine if control is necessary. Environmentally benign control measures, like hand-picking Japanese beetles and destroying them in soapy water, are used before pesticides are applied.

V. Removal

The higher the human use of the land, the more proactive the removal of dead, dying or structurally failing trees must be. Trees are removed to prevent their unplanned collapse; to preserve landscape aesthetics, and to prevent the spread of pests or diseases. Trees are also removed for construction and to eliminate conflicts with infrastructure. Urban and community trees can be killed by insect pests, diseases, physical injury, conflicting maintenance operations – like salting roadways, and other causes. Most often, land managers remove trees that are in a severe state of decline before death occurs.

Effective urban forest management calls for evaluation and mitigation of hazardous trees to minimize potential damage to persons or property. Arborists are trained to evaluate trees and their potential longevity in the landscape. Evaluation factors are based on the species of tree; its form, branching and rooting habits; its vulnerability to internal decay; and the history and current use of the landscape. For example, silver maple trees, known to have weak wood and branching habit, would be more likely removed than other species if there is evidence of structural weakness and the tree is adjacent to a playground. Municipal ordinances and specifications often prohibit the planting of structurally weak trees such as cottonwoods, silver maples and box elder trees on public right-of-ways.

VI. Wood Utilization

Woody debris from pruning and removal operations is prohibited from landfills in Illinois. Branches and small debris are processed into wood chips and useful as landscape mulch. There is growing capacity to utilize this material for biomass fuel. Robbins Community Power plans to open a 50,000 mega watt power plant fueled by wood chips from landscape operations and construction debris in 2010. However, certain large trees might also contain sufficient high-quality wood that could be milled into useable lumber. The green building trend also presents opportunities to produce useable lumber from felled urban trees. This supply of urban timber, though small and diffuse, meets green principles for reclaimed and locally sourced material. The US Forest Service estimates that reclaimed urban wood waste could equal 3.8 billion board feet or nearly 30% of annual hardwood consumption in the United States.[105] The Illinois Emerald Ash Borer Wood Utilization Team is building on increased opportunities resulting from loss of ash trees to create networks, markets and build capacity to help reclaim usable lumber from trees.[106]

[105] US Forest Service, Utilizing Municipal Trees: Ideas From Across the Country, NA-TP-06-01, October 2001 p. 1
[106] Illinois Emerald Ash Borer Wood Utilization Team website, http://illinoisurbanwood.org