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ANALYSIS OF THE MASTER PLANS OF SEVENTEEN MIDWESTERN CITIES:

Are trees part of the plan?

By

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CHAPTER 1

INTRODUCTION

In the United States, urban areas cover 3.5% of the land area of the lower 48 states, are home to 75% of the population and contain 3.8 billion trees. They are defined by the U.S. Census (2002) as "...consisting of a central place(s) and adjacent population with a general population density of 1000 people per square mile of land area that together have a minimum residential population of at least 50,000 people." The broader category of metropolitan areas are defined by the U.S. Census (2002) as "...a county, or group of counties that contains a large population nucleus as its core; can include adjacent counties that have a high degree of economic and social integration with the core." Metropolitan areas cover 24.5% of the total land area of the lower 48 states, contain 80% of the total population and 74.5 billion trees (Dwyer, Nowak, Noble and Sissini 2000). These areas are home to the nation's urban and community forest resource which is made up of all the trees, both public and private, in and around cities and suburbs (Moll 1988).

The urban and community forest is an important component of the urban environment. It provides numerous benefits to the residents and communities that inhabit it. Trees remove pollutants from the air, help ameliorate summer temperatures, reduce storm water runoff, and provide social and psychological benefits. They are also one of the only components of the urban environment that actually increases in value each year. Despite these facts, a 1986 study found that 80-85% of U.S. cities did have a plan in place to manage their urban forest resource (Kielbaso 1990). Another study of 20 U.S. cities, found that despite an all time high in support for urban forestry programs by citizens and businesses, city urban forestry programs to plant and maintain trees are in decline. Budgets for maintenance had been cut in 70% of the cities

surveyed, street tree planting declined by 14% and 45% of the cities surveyed did not have a regular maintenance program (Skiera and Moll 1992).

Why are trees being overlooked in the urban environment when they are an important part of a city's infrastructure? The infrastructure of a city can be split into two distinct categories, gray infrastructure and green infrastructure. Gray infrastructure is the hardscape of the city which includes streets, sidewalks, sewers, and utilities. Green infrastructure, according to the American Planning Association is:

"...our nation's natural life support system, an interconnected network of natural areas, conservation lands and working landscapes that support native species, maintain natural ecological process, sustain air and water resources, and contribute to the health and quality of life for America's communities," (Benedict 2000 p.1).

U.S. cities actively plan, manage and invest in their gray infrastructure resources (McMahon 2000). In contrast, green infrastructure has not been managed or financially supported by most cities. This has led to land fragmentation and planning that has been "...reactive, site-specific, narrowly focused, and/ or not well integrated with other efforts," (Benedict 2000 p.2). The urban forest is a part of the green infrastructure and like other components, it has not been planned for, it just happened (Strom 2000). "If urban forest resources are to be enhanced, sustained and integrated into the planning and development process...then green infrastructure needs to be elevated to the same level of importance as 'gray infrastructure'," (Strom 2000, p. 78).

The end product of a city's planning and development process is the creation of a comprehensive master plan (master plan). A master plan is a planning document that guides future community growth, development and change. It provides a snapshot of how the community will look in the future based on the needs and priorities identified by the city. It also provides implementation steps necessary to meet the city's future goals and objectives

(Elmendorf 2000). The planning and maintenance of gray infrastructure is an integral component of the master plan. It is woven throughout the master plan in sections on housing, industry, commercial, transportation and community facilities. Are trees and the urban and community forest, a component of the green infrastructure of a city, a part of the master plan? The purpose of this paper is to identify if trees and the urban and community forest resource of a city have been incorporated into its comprehensive master plan (master plan).

CHAPTER 2

BACKGROUND

This chapter discusses the historical uses of trees in cities, their benefits and costs, the history of urban planning, benefits of planning and the components of a comprehensive plan. It provides a framework for understanding the link between trees and urban planning and demonstrates the integral role that trees play in the urban environment.

2.1 Trees in Cities

Ancient and European Influences

Trees have been used to enhance and beautify the urban environment since ancient times. Early civilizations prized trees for their beauty, and planted them in formal gardens and around temples (Lawrence 1997). The Hanging Gardens of Babylon created during the 6th century BC is one of the best known examples of this type of planting (Koch 2000). Although trees were found in cities during antiquity, most trees were planted on private property and were rarely found along streets. It was not until later in history that they began to appear on public property and line boulevards.

There are eight European urban design elements that have been identified as important in the evolution and development of the 19th century tree lined boulevard (Lawrence 1988). These elements varied from city to city and included the renaissance garden allée, exterior avenues, wall promenade, waterside promenade, malls and cours, place promenade, baroque boulevard and interior avenues.

The first use of trees as a landscape element was the garden allée, which originated in Italy during the Renaissance period. Allée's were pathways within a formal garden that were lined with trees and enclosed by a wall (Lawrence 1997, Koch 2000). In the 16th century the

French adopted the Italian allée. The French allées became independent forms in the landscape design and were occasionally extended outside the garden walls (Lawrence 1988). Tree use in urban areas and their role as public amenities was largely influenced by the garden allée (Lawrence 1988).

Garden allées that were extended outside the walls of formal gardens in France became known as exterior avenues. These tree lined streets were scattered throughout rural areas and became entryways into larger cities (Lawrence 1988, Koch 2000). Many of the exterior avenues eventually became a part of the city, as city walls were dismantled and the city was extended into the country (Koch 2000).

Throughout the Middle Ages, tree planting was primarily done along walls that surrounded the city and on sites where old walls once existed. During the 16th century, the method used to erect city walls changed and so did the method of planting trees. The new walls were created by placing ramparts, earthworks and ditches in between masonry walls. This eliminated the use of single masonry walls and created a new public space for tree planting, the wall promenade. Trees were planted in rows along the top of the redesigned walls, creating a new use for the garden allée (Lawrence 1988).

The waterside promenade, the planting of trees along canals and waterways, was created during the same time period as the wall promenade. It was first used in the "Plan of the Three Canals" (Lawrence 1988), developed in Amsterdam in 1615. The Plan recommended the construction of houses, and the planting of elm trees along the canals. This plan was one of the first to bring trees into the central city and incorporate the elements of buildings, trees and traffic (Koch 2000). Other cities in the Netherlands used the "Plan of the Three Canals" as a model for incorporating trees into their cities. However, this design was not adopted by other European cities for nearly a century (Lawrence 1995, Koch 2000).

Malls and cours, the fifth design element, were created in many European cities in the early seventeenth century following the popularity of two recreational pastimes, pall mall and carriage riding (Lawrence 1995). Pall mall was a game similar to croquet where a ball was hit with a mallet along a stretch of lawn. The playing ground, malls, were large areas of lawn lined with trees. These areas were usually created in private gardens, but in some cases malls were laid out in public open space near cities (Lawrence 1988). Cours were created for the upscale population to take recreational carriage rides. They were surrounded by walls and the carriage paths were lined with tree (Lawrence 1988). Typically these areas were for private use only, but on some occasions the cours were open to anyone who had a carriage (Koch 2000). Both of these pastimes soon lost their appeal and the malls and cours were transformed into other uses like walking promenades, vehicle promenades and in later years, city streets (Koch 2000, Lawrence 1988).

Another antecedent of the boulevard was the place promenade (place) or square. During the seventeenth century, Italians created the place, the area where several important streets met (Koch 2000). The Italian place did not contain vegetation; however, when adopted by the French, street trees were incorporated into the design (Koch 2000). The place was used in many European countries; however, their use varied by region. While the British designed their places as private parks, the French, Spanish and Germans used them in conjunction with vehicular traffic and as public open spaces (Koch 2000). These places resembled boulevards in their use of trees to line streets (Lawrence 1988, Koch 2000).

The urban design form that most influenced the 19th century tree lined boulevard was the baroque boulevard (Lawrence 1988). It was created during the 16th century, when the walls surrounding Paris were removed by order of Louis XIV. The sites where the walls once

stood became raised promenades planted with rows of trees and open to pedestrians and light carriage traffic (Lawrence 1988).

The final European design element that influenced the creation and development of the tree-lined street was the interior street. Interior streets or those that were in the city center were devoid of trees through much of the sixteenth century. As cities began to expand and new towns were created in the seventeenth century, trees began to line avenues for short distances (Lawrence 1988). Street tree planting for long distances did not begin until Louis XIV changed Versailles from a country chateau into the residential center and lined the radial streets with trees. "By the middle of the eighteenth century, French urban designers were using internal tree-lined avenues as principal features of urban expansion in other residential cities," (Lawrence 1988, p. 368). Although this was an important step toward the boulevard, tree planting along interior streets was often formal and many of these areas resembled place promenades (Lawrence 1988).

Each of these eight urban design elements helped to influence the creation of the tree lined boulevard. The 19th century boulevard was wider and contained better pavement, drainage, and lighting than its predecessors. The British enhanced them by adding sidewalks, house numbers and storm drains. While the British did not include trees in their new street designs, the French did and used sidewalks as a way to protect pedestrians and trees. Lawrence said this about the creation of boulevards:

> "The new boulevard form facilitated transportation, police access, waste disposal,
> drainage and air circulation, in addition to being enormous public works projects. They
> also made trees essential and prominent in the urban landscape. They combined
> various prior usages as repetitive visual elements that gave dimension to vistas and
> distant perspectives, as graceful ornaments complementing the often mediocre design of

structures along the boulevards, as shady promenades for pedestrians, and as purifiers of the polluted urban air (p. 372)."

American Cities

Early colonial American cities looked to Europe for urban design ideas; however, many of them adopted tree planting styles that differed greatly from European styles. American colonial cities preferred planting trees in a less formal, uniform and planned manner than that of European cities. Homeowners and businesses planted trees in their front yards for aesthetics and to provide shade. Reflecting the individuality of the United States, they chose a variety of tree species and spaced them irregularly in their front yards. Peter Kalm, a Swedish botanist visiting the United States in 1748, noted the presence of a variety of trees including London planetree and Black locust that lined New York City streets (Lawrence 1995).

While most colonial cities did not plan for trees, in 1682 William Penn created a design for Philadelphia which included open space areas designated for tree planting (Pitt 1979, Miller 1989). Although included in his plan, trees were largely absent from Philadelphia streets and yards. During most of the 18th century, insurance companies would not insure homes with trees planted near them, discouraging residents and businesses from planting them (Grey and Denke 1978). In the 1780's, these insurance regulations changed and trees began to appear regularly along streets and in yards (Miller 1989).

During the 1800's, local and state governments passed legislation and local ordinances that reflected the importance they placed on trees, tree planting and tree preservation. The territory of Michigan passed the first act regarding tree planting in 1807. The act required that trees be planted along Detroit's boulevards and in groves throughout the city. When looking for a capital city, Mississippi stressed the importance of planting areas with native trees and vegetation (Pitt 1979, Miller 1989). During the industrial revolution, governments created

vegetation ordinances requiring tree planting and maintenance along roads and parks (Miller 1988).

As America grew, and developed, tree planting efforts changed. During the nineteenth century industrialization left American cities dirty and crowded. In response to this, and influenced by the romantic movement in England, Americans began focusing their attention on city beautification efforts. These efforts included planting trees along streets and creation of city parks and civic centers. The efforts of this movement were so popular that they extended themselves past the city limits and into newly created suburban communities. This began the civic movement of planting trees along streets; and by the end of the nineteenth century many cities were beginning to recognize the need to formalize their street tree plantings (Lawrence 1995).

2.2 History of Urban and Community Forestry

As long as trees have been intentionally used in urban environments there have been people managing and taking care of them. Proof of such tree and urban vegetation managers can be seen in the caretakers of the gardens of Babylon and Assyria in 200 B.C. A book written in 302 B.C. on plants included a section on tree care and described how to prevent decay after a tree had been wounded (Koch 2000).

Books and experiments on tree care continued to be written between the 16th and 19th century. Although the importance of tree care was touted in the literature, it was not until the introduction of exotic insect pests, like gypsy moth, brown tail moth and elm leaf beetle, into the New England landscape during the late 19th century that American cities began to focus on street tree care and protection (Koch 2000).

Urban and community forestry developed rapidly in the United States during the early 20th century. Early pioneers of urban and community forestry included John Davey, who started a tree care company that still bears his name today and W. Solotaroff who published a defining work on urban tree care, *Shade-trees in Cities and Towns* (Koch 2000). In 1924, the first national conference addressing urban tree care issues, the National Shade Tree Conference, was held; it was the first conference to bring together tree care professionals and average citizens (Koch 2000).

The early twentieth century also saw the development of city forestry programs in many large and medium sized cities. These programs not only focused on the planting of trees but also their maintenance and management (Miller 1989). Many smaller communities focused their efforts on planting and only began managing their trees when a disease (i.e. phloem necrosis, Dutch elm disease and chestnut blight) affected trees in their community (Miller 1989).

While the management of urban trees continued throughout American cities during the 20th century, there was no definitive term to describe the practice. The term urban forestry was first used in 1965 at the University of Toronto (Jorgensen 1970). A graduate student was in need of a title for a research project that had evaluated the success/failures of municipal tree planting programs in a community outside of Toronto (Johnston 1996). The term was not widely accepted by Canadians but readily adopted by Americans, who needed a term to describe the management of urban trees (Johnston 1996). The term was officially recognized by the U.S. government in 1968, when a report by the Citizens Advisory Committee on Recreation and Natural Beauty recommended that the Forest Service create an urban and community forestry program. The program was funded in 1972, with an amendment of the 1950 Cooperative Forest Management Act (Johnston 1996). The Cooperative Forest

Management Act of 1978, continued to provide support for urban and community forestry programs throughout the United States.

In 1990 President George Bush created the America the Beautiful campaign and increased the federal funding for urban and community forestry programs by ten fold (Johnston 1996). The 1990 Farm Bill established the National Urban and Community Forestry Advisory Council to help provide guidance and promote urban and community forestry to the Secretary of Agriculture (Johnston 1996). Despite the increased efforts of the federal government, the state of the nation's urban forests has been declining over the past 15 years (Johnston 1996).   A study completed by the American Forestry Association in 1987 found that street trees in twenty American cities were in serious decline (Johnston 1996). Surveys by Kielbaso in 1980 (Kielbaso, Haston, Pawl 1982) and 1986 (Kielbaso 1988) and a follow-up survey completed by Davey Tree and the International Society of Arboriculture in 1994 (Davey 1994) showed declines in the amount of money allocated by cities to urban forestry programs and an increasing dependence on outside funding. Another national study conducted by Kielbaso and Cotrone (1989), found that 76 percent of cities surveyed did not have an urban forester or tree manager on staff. Cities that had urban foresters on staff had urban forestry management plans over 50% of the time. Only 17% of the cities that did not have an urban forester on staff had an urban forestry management plan (Johnston 1996). "Despite the best efforts of the urban forestry movement, the condition of many forests in towns and cities throughout the United States is deteriorating," (Johnston 1996, p. 275).

2.3 Benefits of Trees

The deterioration of the urban forest can have a serious impact on the urban environment and affect the quality of life of urban residents. This section describes both the benefits that trees provide in the urban environment and the adverse affects associated with the deterioration of this resource.

Environmental Benefits

Global Climate Change: Air Temperature, Air Quality and the Greenhouse Effect

Over the last century, scientists have estimated that the earth's surface temperature has increased by 1^0 F and it is estimated that the temperature will increase by 3.5^0 F by the year 2100 (Abdollahi, Ning & Appeaning 2000). If this estimate holds true, it will be the fastest temperature change the planet has seen in 10,000 years (Abdollahi et. al 2000). The increase in surface temperature over the last century and the prediction for higher temperatures in the future has been directly attributed to humans and the increase in greenhouse gases in the atmosphere (McPherson 2000).

Greenhouse gases include carbon dioxide, methane, chlorofluorocarbons, nitrous oxide, and ozone. These gases help to sustain life on earth by trapping heat from the sun which in turn warms the surface of the planet. Although these gases are a vital component to human life on earth, increased levels of greenhouse gases due to human activity are beginning to have detrimental effects on the environment (McPherson 2000). From 1990-1996 carbon emissions in the United States, increased from 5 to 5.5 billion tonnes, these emissions are largely from fossil fuel combustion and deforestation (Nowak 2000). Adverse effects associated with the increase in greenhouse gases include an increase in atmospheric air temperature, rise in sea levels, melting of mountain glaciers, disruption of the water cycle (i.e. increased droughts and

floods, water quality problems, etc.), change in vegetation types and effects on agricultural crop yields (Abdollahi et. al 2000).

As air temperature on the surface of the earth increases, so does the temperature in the city center. Over the past 50 years, downtown areas have experienced a 1^0 F increase in air temperature for each decade (McPherson & Rowntree 1993). Daily summer air temperatures in urban centers can be between 2 and 8^0 F hotter than the surrounding rural communities (Akbari, Davis, Huang, Liu and Taha 1992). This occurrence is commonly referred to as the "urban heat island," and can result in an increase in electricity demand, poor air quality and human discomfort (Souch & Souch 1993).

The structure of the city contributes to the urban heat island by affecting the air temperature of the surrounding environment. Areas with tall buildings and impervious surfaces (i.e. sidewalks, roofs, roads) absorb and reflect heat thereby increasing the air temperature of the surrounding environment. In contrast, areas with vegetation and grass, less impervious surfaces and shorter buildings, such as a subdivision have lower air temperatures because they reflect and absorb less heat. Air temperature differences of up to 9^0 F have been documented between a downtown area and a vegetated subdivision (McPherson & Rowntree 1993).

Trees can help ameliorate many of the negative effects associated with the increase in air temperature and greenhouse gases in urban areas. Tree canopies absorb or reflect incoming solar radiation, reducing the amount of radiation that can be radiated by buildings and other impervious surfaces (Souch & Souch 1993). A tree can reduce the amount of incoming solar energy in their shade by more than 90% (Heisler, Grant, Grimmond and Souch 1995). Air temperatures below mature canopies in Sacramento, California were found to be 3- 6^0 F cooler than areas with no trees; and Miami reported an average reduction of 6.4^0 (Souch & Souch 1993).

In addition to cooling the surrounding environment through shading, trees also cool the air through evapotranspiration. Solar radiation that is not reflected by the tree canopy is absorbed by the leaves and leads to the evaporation and transpiration of water, which aids in cooling the leaf surface (Nowak & Dwyer 2000). Evapotranspiration requires a large amount of energy, about 580 calories (Heisler et.al 1995), when enough energy is not available from the sun in the afternoon and evening, the tree takes energy (heat) from the surrounding atmosphere which leads to atmospheric cooling around the tree (Souch & Souch 1993).

They also serve an important function in removing atmospheric chemicals and pollutants, such as ozone and sulfur dioxide, from the environment. They do this by either intercepting airborne particulates or absorbing gases into the plant tissues through the leaf stomata (Lawson 1996). A study found that streets lined with trees could intercept as much as 7000 air borne dust particles per liter of air (Huang, Ritschard, Sampson, Taha 1993). Unlike gases, intercepted particulates are not absorbed into the plant and removed from the atmosphere. Rather trees serve as a temporary holding area for these particulates because they are kept on the surface of the plant and are easily washed off or redeposited into the atmosphere (Nowak and Dwyer 2000). Computer simulations have shown that the average amount of pollution removed by New York City trees in 1994 was 13.7 grams per square meter of tree canopy (Nowak and Dwyer 2000).

Trees also reduce the amount of carbon dioxide in the atmosphere. Urban forests accomplish this in two ways: (1) through the direct sequestering of carbon dioxide from the atmosphere while a tree is actively growing and (2) by planting trees around buildings and other structures. Carbon sequestering is the direct absorption of carbon dioxide into the plant tissue of the tree. The amount of carbon dioxide a tree can sequester is dependent upon its age and health. A young, healthy tree sequesters more carbon than an old growth forest that

releases as much carbon dioxide as it absorbs (McPherson 2000). Forests in rural areas sequester twice as much carbon dioxide as urban areas because of the higher tree density per area. However, individual urban trees sequester more carbon dioxide than rural trees because they grow faster (McPherson 2000). Planting trees in and around buildings also reduces the amount of carbon dioxide in the atmosphere. When trees are properly placed around a building the demand for heating and cooling is reduced, decreasing the carbon dioxide emissions produced by local power plants (McPherson 2000). Huang et. al found that "...the annual amount of carbon saved per tree in cooling energy savings (88 pounds saved per tree per year) is five to ten times greater than the amount of carbon sequestered on a per tree basis," (1992, p. 36).

Although trees absorb atmospheric carbon dioxide they also release it during respiration, fall leaf drop, senescence and decomposition. The amount of carbon dioxide absorbed plus the carbon dioxide emissions avoided minus the amount of carbon dioxide released equals the net carbon dioxide benefit (McPherson 2000). Statistics regarding the net carbon dioxide benefit urban trees produce may seem low. However, in order to understand their true impact they must be seen in context to the amount of urban tree cover in the city. For example, the 5.5% (Dwyer et al. 2001) of urban tree cover in Sacramento, California sequesters 1.8 % of the carbon dioxide that residents produce (McPherson 2000). The net carbon dioxide benefit trees produce will only increase as urban tree cover increases.

Trees and Energy Conservation

In 1990, Americans spent $98.1 billion and consumed 7% of the total energy produced, heating and cooling their homes (McPherson & Rowntree 1993). The burning of fossil fuels to produce electricity releases about one half pound of carbon dioxide for every kilowatt hour of

electricity produced. An average city of 100,000 consumes approximately 100 billion kilowatt hours of electricity per year (Akbari 1992).

Trees can play a vital role in energy conservation and the reduction of carbon dioxide in the atmosphere. One tall urban tree has been shown to provide as much cooling as five window air conditioners powered for 20 hours per day (Mao, Gao and Sun 1993). In northern climates, placing trees on the north and west side of a building can reduce winter winds and heating costs. While planting deciduous trees on the south side of a building provides shade in the summer and sunlight in the winter. When trees are properly planted they can reduce energy consumption in a home by 20-25% when compared with a home in the open with no trees (Nowak & Dwyer).

A study of 113 homes in College Station, Texas found that shade was the most significant variable in reducing the amount of energy used (Rudie and Dewers 1984). In Florida trees planted next to residential buildings reduced summer energy demands by 3 kilowatts in the morning and 5 kilowatts during the afternoon (Huang et. al 1992). A study in Ann Arbor of neighborhoods with high, medium and low densities of vegetation found that proper placement of vegetation could yield substantial energy savings (Laverne and Lewis 1996).

While trees can provide many energy conservation benefits, they can also increase energy consumption if they are not properly placed and planted. This includes trees that block winter sunlight, do not shield buildings from winter winds or do not shade buildings in the summer. Three homes in Madison, Wisconsin were compared for energy consumption and use, a home with an energy efficient planting design, a home without trees and a home with trees that blocked winter sunlight and provided little shade in the summer. The home with trees that blocked winter sunlight and provided little summer shade had higher energy bills than the home

without trees (Dwyer et. al 1992). Proper placement of trees for energy conservation not only saves homeowners and businesses money but it also reduces the amount of atmospheric carbon dioxide released by power plants.

Urban Forestry and Urban Hydrology

As cities and communities have grown, the amount of impervious and impenetrable surfaces, like roads, parking lots, roof tops, patios and compacted soils have increased (Arnold & Gibbons 1996). As areas are paved over, the natural hydrologic processes that used to occur change and instead of water slowly percolating into the soil, the water rushes off streets, driveways, parking lots and rooftops into storm sewers and detention basins. Many of these sewers were not created to handle large volumes of fast moving water, which has led to increases in flooding and a decrease in water quality due to non-point source pollution (Arnold & Gibbons 1996, Beattie, Kollin & Moll 2000). Today, urban forests are being used to help intercept, retain and slow precipitation reaching the ground. Helping to reduce flooding, decrease costs of storm water treatment and increase water quality by reducing the amount of water that runs across impervious surfaces, gathers pollutants and flows into water bodies (Beattie, Kollin & Moll 2000).

In Dayton, Ohio their tree cover reduced runoff by 7% and a small increase in tree cover could reduce the runoff by nearly 12% (Dwyer et. al 1992). As an increase in tree cover can reduce runoff, a decrease can cause water to be warmer in the summer and cooler in the winter which has negative effects on water quality (Arnold & Gibbons 1996). By expanding urban tree cover and reducing impervious surfaces natural hydrologic processes can be brought back to the urban environment. Studies have shown that sinking planter beds in parking lots instead of raising them provides an on-site storm water runoff and treatment area (Arnold &

Gibbons 1996). Designs that use trees to minimize storm water runoff not only reduce storm water flows and non-point source pollution but they also save communities money. If all of the trees were removed in Garland, Texas it is estimated that the city would have an additional 19 million cubic feet of storm water and it would cost them $38 million to manage it (Bettie, Kollin & Moll 2000).

Urban Forests as an Ecosystem

An often forgotten benefit of the urban forest is its role as an ecosystem. Trees provide a necessary habitat for urban animals like squirrels and birds. These animals use urban trees for food, shelter and cover which are vital for their survival. Many urbanites appreciate the urban wildlife that they encounter during their daily lives (Dwyer et. al 1992). Without trees, wildlife could not survive in a city environment and urban dwellers could lose their only contact with wildlife in their daily lives.

Summary of Environmental Benefits of Trees

At the present stocking levels of trees in cities, urban forests have demonstrated the positive impact they have on air quality, air temperature, greenhouse gases, energy conservation, urban hydrology and wildlife enhancement. Many of these benefits would have a far greater impact if the urban forest resource in cities was larger. Planting 100 million trees would increase carbon dioxide emissions avoided by 22 million tonnes annually after 10 years (McPherson 2000). There have been many estimates on the number of tree planting opportunities in urban areas in the United States. They range from 160 million (Lawson 1996) to 225 million (McPherson 2000). Whatever the correct estimate, it is clear that the urban

forests in the United States are far from being fully stocked with trees and their benefits will only increase as the urban and community forest increases.

Psychological and Social Benefits

Psychological Benefits of Trees

Trees not only provide environmental benefits but they also provide psychological benefits to urban dwellers. People living and working in urban environments are constantly overstimulated and forced to pay attention to many aspects of their environment, which can lead to stress. Trees are an element of the landscape that are easy to pay attention to and allow the brain to rest and refresh itself (Shroeder & Lewis 1991). Dwyer, Schroeder and Gobster believe that, "The psychological ties between people and trees defy easy quantification, yet few would deny their existence or their profound implications for urban forest management," (1991, p. 276). To better understand these benefits, many researchers have studied the psychological benefits that humans gain from trees.

Studies by Kaplan and Kaplan (Schroeder and Lewis 1991) and Orchard (Starkey 1979) identified trees as a necessary component of the urban landscape because of the positive effect they have on mental health. Orchard, wrote that to maintain a healthy mental state, humans require trees in their everyday environment. He argued that people have lived with trees in their daily lives for thousands of years and that this long history has created a background frame of reference (Starkey 1979). They have become a necessary psychological and physical factor in people's lives (Starkey 1979).

In 1992, Hull conducted a study of visitors to an urban park to assess the relationship between visits to urban parks and changes in mood. Park visitors were asked their mood upon arrival, thirty minutes after arrival and at departure. He found that visitor's moods changed

positively after being in the park for thirty minutes, this was especially true for people engaged in active recreation. The results suggest that even a short period of time in an urban park appeared to produce positive moods among visitors.

The psychological attraction that people have to trees is another element that has been explored by researchers. Experiments at Morton Arboretum, in 1991, explored the strong attraction between people and trees (Dwyer et. al 1991). The researchers asked individuals to describe experiences they had when they felt a strong connection to the environment and to explain their feelings. They discovered that people had very strong emotional ties to the forest and that these connections helped them deal with difficult times in their lives. Several "themes" were identified that helped to provide insight into this attraction: sensory, symbolic, and human roots in the forest (Dwyer et. al 1991).

Sensory benefits are those that are associated with the five senses, sight, smell, taste, hearing and touch. Sensory benefits of trees have been shown to promote relaxation and serenity in people. A study by Ulrich measured the health effects of people who viewed scenes of urban areas with vegetation and urban areas without vegetation. Participants who looked at scenes with urban vegetation had better health signs including lower blood pressure, lower heart rate and more relaxed brain wave patterns when compared with those who viewed scenes without vegetation (Dwyer et. al 1991).

People have also attached many symbolic meanings to trees in their everyday lives and in religion. People describe their family in terms of their family tree; they plant trees as living memories of a loved one; and they attach symbolic meaning to trees growing in special locations (a tree growing next to their grandfathers house is "grandpa's tree") (Dwyer et. al 1991). Trees as symbols are also evident in religion, as in the Tree of Life and Tree of Knowledge in the Bible.

The third theme used to provide insight into humans' attachment to trees is the idea that humans have roots in the forest. Some researchers have described humans' psychological attraction to trees as a primal instinct that reminds them of their "home" on the African savannah, the place where they evolved. These researchers also contend that humans have evolved to prefer a particular forest type, preferring forested areas with an open understory and an overhead canopy which resembles the African savannah (Dwyer et. al 1991). Other researchers believe that trees in the urban environment provide residents with a connection to the past and allow them to escape the everyday stresses of the urban environment (Dwyer et. al 1991).

Trees restorative effects not only help to mend the human psyche but have also been proven to have a positive impact on human health. Ulrich investigated the recovery rates of surgery patients in a hospital in relation to the view they had from their window. The patients had undergone similar surgeries and were receiving similar post surgery care. Ulrich found that patients who had views from their windows of trees, required fewer painkillers, had fewer complications and left the hospital sooner (10% shorter stays) than patients who looked out at a brick wall (Hull & Ulrich 1997) A study of dental patients who feared dental treatment found that their heart rate and stress levels were lower when a mural depicting trees was hung in the waiting room (Hull & Ulrich 1997). Pre-surgery patients shown pictures of serene environments, such as trees, water and other natural features, had blood pressure levels 10-15 points lower than patients in a control group that viewed no pictures (Hull & Ulrich 1997). A study by Moore found that prison inmates who had a view of farmland visited the prison doctor less often than those prisoners who had a view of the interior of the prison (Harris 1992, p.12).

In addition to the positive effects on the human psyche and human health, the urban forest also provides aesthetic benefits to city residents. "Research on the aesthetic quality of

residential streets in the Midwest has shown that street trees are the single strongest positive influence on the perceived quality of the view along the street," (Shroeder, and Ruffolo 1996).

In recent years many researchers have worked to uncover the mystery of human's psychological and emotional attachment to trees. The research highlighted above provides some insight into to why people have developed such strong ties to trees and why trees are an important component in the urban ecosystem. Trees provide restorative effects to the human psyche which not only reduces stress levels but also provides positive health effects on the body.

Social Benefits of Trees

Closely tied to the psychological benefits are the social benefits that urban residents gain from trees. In *The Power of Place*, Gallagher explained that people take cues from their surroundings and modify their behavior accordingly (Maguire, Foote & Vespe 1997). She described how teenagers in New York City would walk down Amsterdam Street with the volume on their radios on the loudest setting but when they crossed Broadway and entered a well-maintained neighborhood they would turn down their radios. This observation helps to build credence to the argument that a person's behavior toward a place is influenced by its appearance (Maguire et. al 1997). Maguire et. al (1997) argued that pleasant surroundings make people feel more secure and content, which is why people go to such great lengths to beautify their homes and landscapes. The opposite is true for unpleasant and ugly places where people feel a lack of connection and do not feel a responsibility to the area.

An example that helps to illustrate this idea are the U.S. urban riots of the late 1960's. Residents of the cities involved in the riots did not feel a connection to their environment because they felt the areas were ugly and unpleasant. In 1968, following the urban riots, the

U.S. Riot Commission released a study that showed that "...the demand for more parks accompanied almost every outbreak of racial violence in metropolitan areas in the late 1960's," (Driver and Rosenthal 1978, p.99).

In another study, Sullivan and Kuo (1996) found that residents living in public housing in Chicago had stronger ties to their neighbors if they lived in buildings with trees than those residents who did not have trees near their buildings. The study also found that less domestic violence and more constructive ways of solving conflict were present in buildings that had trees versus buildings without trees. They explained this difference may have been present because residents in buildings with trees have stronger ties to their neighbors and can call on them for support in times of need. People with strong neighborhood ties have been shown to be healthier, less likely to abuse or neglect their children and less likely to use social services in times of need (Sullivan & Kuo 1996). This study does not definitively prove that trees help to increase neighborhood ties in public housing; however, it does provide evidence that there is some connection between trees and neighborhood behavior.

Trees have also been shown to have an affect on the social interaction of children. The presence of trees increased play time among children living in public housing in Chicago (Taylor, Wiley, Kuo & Sullivan 2001). Play is an important developmental activity for children, it provides them an arena to "...learn and practice skills for survival and success in life," (Taylor et, al 2001, p.1). The researchers observed children playing in two areas of a Chicago public housing complex, an area with few to no trees and vegetation and an area with a high level of trees and vegetation. They found that nearly twice as many children played in the areas with trees and vegetation compared the area with few or no trees. The presence of trees in the landscape appeared to help promote healthy development of children in the public housing complex.

Along with passive benefits that people gain from trees, there are also "active" benefits people receive. These active benefits are associated with city residents actively engaged in planting street trees. McBride and Beatty wrote that by involving neighborhood residents in tree planting efforts, a sense of ownership is promoted, residents take pride in the street trees they planted which reduces tree mortality (Sommer, Learey, Summit and Tirrell 1994). Sommer et. al (1994) found that residents were more satisfied with the street trees planted if they were involved in the tree planting effort than those residents who were not involved.

Although much more research needs to be completed in the area of the social benefits of trees, the research of Sullivan and Kuo (1996) and other researchers provides important preliminary information on the important social and psychological role trees play in the city. "...urban forests are not mere amenities- they are a basic part of the infrastructure of any city, as necessary as streets, sewers and electricity (Sullivan & Kuo 1996, p. 2).

Economic Benefits of the Urban Forest

While trees provide environmental, social and psychological benefits, the economic benefits they produce are the most tangible. These benefits can be seen in obvious ways such as in the reduction of heating and cooling costs due to proper placement of trees around a home or building. There are also less obvious ways that the urban forest influences economics including increasing real estate/property values, influencing local economic development, recreation and physical/mental health.

Wooded home lots have been shown to sell for an average of seven percent more than an equivalent non-wooded lot (Dwyer 1991). Studies completed during the 1970's found that trees increased the market value of both developed residential lots and undeveloped land. It increased the market value of the residential lots by 12% and the undeveloped land by up to

27% (Driver and Rosenthal 1978). In a 1994 Bank of America study, 84% of real estate agents surveyed believed that homes with trees could be 20% more salable in terms of property value and curb appeal than comparable home with no trees (Petit, Bassert and Kolin 1995).

Homebuyers are not only willing to pay more for a wooded lot but also for homes that are landscaped with trees and near parks, open space and greenways. An Atlanta study found a home with trees increased the sales price by 3.4 – 4.5% (Nowak & Dwyer 2000). Locating near an open space park with low recreation usage also increased the selling price of homes by $1130 in an Ohio community (Dwyer 1991). Research in Boulder, Colorado found that distance from a greenbelt affected the selling price of a home. For every foot away from the greenbelt, the price of the home dropped by $4.20 (Driver and Rosenthal 1978). A survey of homeowners on how builders can help the environment, 89% said builders should leave as many trees as possible, and 77% said builders should add more trees to developments (Petit et. al 1995). In Mandeville, Louisiana, 72.1% of woman and 66.3% of men were willing to pay additional fees to preserve and protect trees during development in their community (Lorenzo, Catalino, Qi and Guidry 2000).

Although studies have proven that trees add value to residential real estate, many subdivisions built in the last decade have been barren landscapes with 4000 square foot homes, but no trees. The owners of these new homes are willing to spend a considerable amount of money to have large trees put into their landscapes (Hair 1999). They want large trees because they give an instant effect to the landscape and are consistent with the scale of the home. The demand for large trees by homeowners has been so great that many nurseries are in short supply (Hair 1999). The willingness of residents to pay for the protection/preservation of trees during development and to put large trees into their landscapes gives credence to the

argument that when developing land for residential communities, developers and planners should work to preserve existing trees and avoid leveling the entire site.

Increasing real estate and property values also provides economic returns for a community in terms of increased property taxes. If a homeowner was paying $500 per year in property taxes, an increase in property value of 5% due to trees would add $25 to their property taxes for the year. If this estimate is extrapolated to all 62 million single family homes in the United States it would equal $1.5 billion (Dwyer 1991).

The influence of trees on local economic development is less easy to quantify, but can be seen by driving through a community. Many communities in the United States have been designated a Tree City USA (TC USA), a program sponsored by the National Arbor Day Foundation that rewards communities that practice good stewardship towards their urban forest resource. TC USA communities proudly display their TC USA status by placing plaques at the entrances to their communities and flying the TC USA flag at city hall. Trees have also influenced the naming of subdivisions (i.e. Whispering Pines) and streets in neighborhoods (Dwyer, McPherson, Schroeder and Rowntree 1992). In the last 10 years tree planting has become a major downtown improvement project in Atlanta which has helped to increase its appeal to outside organizations looking for convention sites (Dwyer et. al 1992). In Stittsville, Ontario, redevelopment of its main street which included extensive tree planting, attracted over 20 new businesses to relocate there (Haller 1996).

Outdoor recreation activities such as hiking, biking and running have become popular pastimes in the United States over the past decade. Outdoor enthusiasts continually look to their local urban parks to recreate. Bike trails along river corridors in metropolitan Chicago support up to 5000 bicycles per day (Dwyer et. al 1992). Dwyer (1991) found that urban park users preferred wooded parks with some mowed grass over open parks with mowed grass and

few trees and they would be willing to pay an average of $1.61 more per visit for them. By placing these parks in urban areas, residents would not have to travel far to use a park which would save money on travel, fuel and reduce pollution (Dwyer et. al 1992).

As mentioned in the Psychological Benefits section, trees provide many psychological and health benefits. The Ulrich study of surgery patients that found that those who had views of trees recovered faster, had less complications and needed fewer pain killers (Hull & Ulrich 1991), has definite economic impacts on the health care system. In an era when health care costs are constantly rising, finding ways to minimize these costs will not only benefit individuals but also society as a whole. The psychological benefits that trees provide may also be able to help reduce work place stress and absenteeism (Dwyer 1991).

2.4 Costs of the Urban and Community Forest

As important as the benefits of the urban and community forest are, it is also necessary to recognize the costs associated with it. As with the benefits, the costs can be environmental, economic, physical and psychological. Environmental costs can occur when trees are improperly placed around buildings causing an increase in demand for energy. Improperly placed trees block sunlight from buildings in the winter and do not provide shade in the summer. This increases the demand for heating and cooling, which leads to an increase the carbon dioxide emissions produced by local power plants.

There are several economic costs associated with managing the urban and community forest. The largest cost is associated with the planting and initial maintenance of trees (McPherson 1994). A study in Chicago found that the costs associated with tree planting ranged from $109 per tree to $341 per tree. This difference was based on who planted the tree and follow-up maintenance. The trees that cost $109 were planted at a public housing

facility and were planted and maintained by volunteers, which reduced the cost of planting. The trees that cost $341 to plant, were planted in a park by city workers, and included irrigation after planting (McPherson 1994). Other costs associated with the managing of the urban and community forest include pruning and removal. McPherson (1994) found that the cost to prune street trees was $12 per tree and the cost of removal was $16-22 per tree.

Damage to the urban infrastructure is another cost associated with trees. Tree roots can damage sidewalks, driveways, curbs, gutters, foundations and utility lines. In addition to the costs of repairing the infrastructure, there are costs associated with litigation, if people are injured due to the damage. Each year, California spends $70.7 million dollars to repair damaged infrastructure and to settle legal cases; this equals $2.19 per capita and $11.22 per tree. Sixty-one percent of the cost goes to the direct repair of the urban infrastructure, while 14% is paid out in legal claims (McPherson and Peper 2000). Trees caused damage to the urban infrastructure for several reasons: size of planting area, tree species selection, shallow soil, tree size and the restricted macropores in the soil (McPherson and Peper 2000).

While environmental and economic costs have been well documented, the physical and psychological costs of trees have not. Physical costs are associated with human health and include increased allergies due to pollen in the air (Hull and Ulrich 1991). Many communities have selected male tree species that do not produce fruit in order to reduce the "mess" caused by flowers that female trees produce. However, selecting male tree species increases the amount of pollen in the air, which can lead to allergic reactions and increased respiratory illnesses (Hull and Ulrich 1991).

Psychological costs are much more difficult to quantify than the other costs. Trees in the urban environment create shade that can disrupt many activities like gardening or they can be obstacles to active sports like soccer or baseball. Trees and other vegetation can also create

feelings of fear and anxiety in city residents, because they provide a place for attackers and criminals to hide (Schroeder and Lewis 1991). Other psychological costs include stress caused by the thought that a tree may damage personal property, the annoyance of having to "clean up" twigs, leaves and flowers a tree produces and emotional distress caused by having to remove a tree that has personal meaning (Schroeder and Lewis 1991).

It is important to consider both the costs and benefits when creating and managing a city's urban forest resource. McPherson (1994) found the benefit-cost ratio of managing the urban and community forest in Chicago was 2.83; meaning that the projected benefits gained were nearly three times the value of the projected costs. To effectively plan, urban foresters and planners need to properly value the urban forest benefit and understand the planning and management needed to achieve this benefit (Dwyer et. al 1992). The urban forest resource provides much promise as urban areas continue to look for cost effective ways to enhance and improve urban design.

2.5 History of Urban Planning in the United States

Urban Planning 1800-1910

The 19th and 20th centuries in the United States were times of prosperity, ingenuity, development and rapid population growth. Cities were laid out in a grid iron pattern by real estate developers, engineers, surveyors and government officials (Krueckeberg 1983). The grid iron pattern created functional blocks and lots that could easily be sold, which is why this method of urban design was so readily used in 19th and 20th century America.

As technology improved, the health and safety of cities began to improve and planning began to take hold. Two events helped to bring planning into the city, the sewage system and the first sanitary survey (Krueckeberg 1983). The invention of the sewage system in the mid

1800's provided a sanitary and safe way to dispose of human waste. The new sewage system was connected to the water delivery system to create an interdependent city service. The sanitary survey was done in response to a yellow fever epidemic that was sweeping cities. This survey was considered one of the first planning efforts because it mapped and recorded sanitary conditions throughout the city in order to help develop a plan to combat the disease (Krueckeberg 1983). Sanitarians were interested in providing clean, healthy environments and believed that the crowded cities of the late 1800's were contributing to the poor health of their residents. They advocated open, dry areas with many trees and parks for residents to get fresh air and to exercise (Peterson 1983).

These antecedents of urban planning helped to develop a view that cities were not just made up of independent elements; rather they were interdependent elements working together. This view was not shared by many urban decision makers. However, one person who believed in the interdependence of the city was Frederick Law Olmsted. Olmsted, who is most famous for his designs of Central Park in New York City and Riverside, Illinois, is widely believed to be the most influential person in early American planning (Fishman 2000). Olmsted believed that cities should be open to nature for the mental and physical betterment of city residents (Peterson 1983). He advocated parks where people of all socioeconomic backgrounds could relax and designed tree lined boulevards into neighborhoods to help create a healthy environment.

Olmsted's work of bringing nature into the city strongly influenced the City Beautiful movement. City Beautiful was a middle and upper class national movement started in the late 1890's that attempted to bring both beauty and function into the city. Advocates of City Beautiful believed that by changing ugly cities into beautiful ones they could control and

enhance the economic and physical growth of the urban environment. They thought that all ills of the city could be solved through beautification.

The City Beautiful movement focused on four main areas: (1) municipal art, (2) civic improvement, (3) outdoor art (beautifying the landscape), and (4) reviving classical architecture. Projects ranged from physical restoration of city buildings to the careful selection and maintenance of street trees (Wilson 1989). The expertise of professionals was valued in the movement and often brought together an interdisciplinary team to work on a project. Professions involved in the movement included landscape architects, planners, engineers, parks superintendents, public works directors, artists, and reformers. Efficiency was an important component of the City Beautiful movement and advocates valued professionals because they were knowledgeable and efficient (Wilson 1989).

In the early years of the movement, much of the focus was on beautifying the city through municipal art. This included promoting the use of art for public display, planting trees, advocating color in urban design and protesting against billboards and air pollution (Krueckeberg 1983). In the early 1900's, City Beautiful began to switch its focus from piecemeal urban projects to creating comprehensive master plans for cities. Supporters of the movement began advocating the use of long range goals to help guide civic improvement, and promote efficiency by avoiding duplication and waste (Peterson 1983). The idea of creating a comprehensive document that would guide city improvements was new to the field of planning and helped secure the City Beautiful movements place in its history.

In 1902, the first, complete comprehensive master plan was unveiled in Washington DC. The McMillan Plan (named after Senator James McMillan who chaired the committee) was the first to unite buildings, parks and boulevards and to set out a comprehensive plan for the future

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design and development of the city. The McMillan Plan, like many plans created during the City Beautiful movement, included nature in the design of the city.

Since the early 1900's the City Beautiful movement had been criticized for many of its ideas and projects. Many critics found faults in the projects undertaken during the movement, criticizing their exorbitant costs, superficial focus on urban decoration, piecemeal projects scattered throughout the city and for not helping to control growth (Wilson 1989). By 1910, the faults with the movement caused its popularity to wane and new, young planners to abandon the City Beautiful ideology for a more practical and realistic approach to planning.

Despite these criticisms the City Beautiful movement has influenced modern American urban planning. Their most noticeable legacy is the comprehensive master plan. However, other aspects of modern urban planning also reflect their influence, including subdivision regulation, zoning codes, sidewalks and buried utilities (Peterson 1983).

Urban Planning 1910-Present

Following the City Beautiful movement, planning took on a more practical and realistic approach. Planners were less concerned with the ornate beautification of the city environment and more concerned with creating an urban infrastructure that could support the millions of people living in cities. In the late 19th and early 20th century, industrialization led to an increase in urban populations and a shortage in housing. Since the City Beautiful Movement had not addressed issues of urban housing, it was the primary focus of planning from 1910-1930.

Planners wanted to address the issues of overcrowding and appalling housing conditions caused by industrialization. One of the ways that they attempted to do this was through zoning regulations that kept industrial buildings out of residential areas. In 1913, planners successfully

petitioned the state legislatures of New York, Minnesota, Wisconsin and Illinois to create enabling legislation that banned industry from residential areas.

Planners from 1910-1930, developed comprehensive master plans for cities that covered both publicly and privately owned land within the city. These plans were different from those created during the City Beautiful movement in that they not only addressed the design and development of the city but also its growth. The plans also incorporated the new zoning regulations that had been passed.

In 1928 the Federal government passed the first planning legislation, the Standard City Planning Enabling Act. The legislation helped to shape state planning legislation. However, it also led to confusion among planners and government officials about the difference between zoning regulations and comprehensive master plans. The confusion led many cities to develop zoning plans without first developing a comprehensive master plan. A comprehensive master plan is intended to serve as a foundation for zoning (Kaiser & Godschalk 1995).

Planners during the early half of the 20th century were independent contractors who created comprehensive master plans for non-governmental planning commissions within a city. The separation of city planning from city government was formulated during the Progressive Reform movement when there was a distrust of politics. However, the Federal Government perpetuated this separation in the Standard City Planning Enabling Act of 1928 by purposefully separating the planning commission from politics. It was intended that the plan created by the planning commission would serve as the advisor to the city council and city departments not the commission itself (Kaiser & Godschalk 1995).

Planning took on a new role with the crash of the stock market in 1929 and the depression that followed. The New Deal, which combined ideas and experiences from previous presidents including Teddy Roosevelt and Herbert Hoover, was designed to help America get

out of the depression. One of the major components of the New Deal was planning. In 1933, the National Resources Planning Board (NRPB) was formed to coordinate work of the Public Works Administration created under the New Deal (National Industrial Recovery Act of 1933).

There were 8 major planning programs between 1933 and 1940 intended to get the country out of the depression. Each of the programs employed professional planners who utilized economic, social and spatial planning. The programs were temporary work relief, major public works and agriculture projects, industry, housing, resettlement and regional and national planning.

The NRPB served from 1933-1943, and although it never created any national plans some of its efforts are evident in planning today. The commission was successful in planning and construction of public works, coordinating federal planning activities, promoting regional planning commissions and conducting national research on a variety of issues including land use, industry, population and housing (Brinkley 2000, Hancock 1988).

Planning became a national issue following World War II for several reasons (Kaiser and Godschalk 1995). First, cities were experiencing a post war population surge, urban areas were expanding, urban blight was a serious problem and urban infrastructure projects that had been postponed due to the depression and the war were in need of investment. Second, cities began to create urban planning departments, taking over the role that non-governmental planning commissions once served. This switch in responsibility created enormous interest in planning among city officials. Third, was the passage of the federal Housing Act of 1954. Section 701 of the act mandated that communities develop a long range comprehensive plan in order to be eligible for federal grants for urban renewal and other programs. The act was important in that it also provided money to communities to create their comprehensive master plan which led to an unprecedented amount of urban planning in the 1950's and 1960's.

The mandate the federal government placed on cities to develop comprehensive master plans to be eligible for federal funding set a precedent in city planning. Urban planners had long understood the importance of planning for the future of the city and now had backing and funding from the federal government to help convince city officials. Planning developed rapidly from 1950-1980 as communities were confronted with new and unique issues. As communities addressed these issues, their plans adapted to reflect their changing priorities and needs. Planning in the 1950's and 1960's focused on urban renewal, housing issues and poverty assistance and were reflected in sections on blight, neighborhood development, citizen participation and transportation being added to comprehensive plans. The 1970's and 1980's planning issues focused on managing urban growth, protecting the quality of natural resources (water, air and land), concerns with waste management practices, historic preservation and community development. These concerns led to new sections in comprehensive plans on growth management, economic development, environmental protection, historic preservation, affordable housing and community development (Kaiser, Godschalk and Chapin 1995).

The issues that affected the United States in the 1970's and 1980's have helped to shape planning in the United States today. Planners today have increasingly focused their attention on controlling urban sprawl and development to promote move livable communities. To address these planning issues they have combined planning practices of the past to create their comprehensive master plans (Kaiser & Godschalk 1995). Planning will continue to shift focus and change as important new planning issues are brought to the forefront of society.

2.6 The Comprehensive Master Plan

Planning has been defined by the American Planning Association "...as a comprehensive, coordinated and continuing process, the purpose of which is to help public and private decision makers arrive at decisions that promote the common good society," (Elmendorf 2000, p.65). A comprehensive master plan is a planning document that guides future community growth, development and change. Based on the needs and priorities identified by the city, the plan provides a snapshot of how the community will look in the future and identifies the steps that need to be taken in order to meet the cities future goals and objectives (Elmendorf 2000).

Development of a comprehensive master plan is a process that involves several steps - (1) creation of a vision that will guide the community, (2) gathering, analyzing and organizing community information and data, (3) identifying and evaluating community alternatives, (4) coordinating development activities, (5) reviewing and changing proposed land use development,(6) disseminating information,(7) involving the public and (8) updating and formulating community ordinances (Elmendorf 2000, Gordon 1993, Kaiser, Godschalk & Chapman 1995). The end product of the planning process is a document that proactively plans for future development and change by providing a course of action that will help the community avoid future costs.

Benefits of Planning and Costs of Not Planning

Development of a comprehensive master plan provides a community with many benefits according to Gordon (1993). First, the community can better anticipate future needs and problems. By gathering, analyzing and organizing community information and data, the community can foresee potential opportunities and problems and account for them in

development. Second, the process provides a tool to evaluate community strengths and weaknesses and identify where they want to go and how to get there. Third, by involving the public and stakeholders, community officials can build consensus on future goals and visions of the community. Community consensus will avoid opposition to the plan and allow for its adoption and implementation. Fourth, the process facilitates the allocation of scarce resources. By carefully reviewing community information and evaluating community alternatives, government officials use past, present and future trends to allocate scare community resources. Fifth, the planning process and resulting plan provide benchmarks for the community. These benchmarks allow the community to evaluate the successes and failures of the plan and the planning process.

There are also costs associated with communities that do not develop a plan for their future development and growth. By not participating in the planning process potential opportunities and threats within the community can go undetected and lead to insurmountable problems (Gordon 1983). These problems can cause unforeseen municipal expenditures, a decrease in both public and private property values and a lack of private investment in the community (Elmendorf 2000).

Components of a Comprehensive Master Plan

The comprehensive plan that results from the planning process is a document that contains maps, outlines the visions, goals, policies, and implementation that guides the future growth and development of the community. It contains five main parts (1) community background,(2) resource inventory, (3)the community's visions, goals and objectives, (4) plan elements and (5) plan implementation (Arendt 1999).

Community history, demographics, transportation, community services and other characteristics make up the background section of the plan and are collected early in the planning process. The resource inventory identifies and describes all of the resources available within the community, including cultural, social, natural, economic and physical. The resource inventory section usually includes a map that highlights the location of important community resources. The community's visions, goals and objectives are based in part on the information collected during the background and resource inventory (Elmendorf 2000). The vision describes the future of the community and the goals and objectives help to achieve the vision.

The plan elements section are the components of the master plan that help to achieve the vision, they include land use, transportation, community facilities and utilities and conservation. The land use plan highlights current and future land use patterns and the relation of different land use types (i.e. industrial, residential, agriculture, etc.) to each other. The transportation plan focuses not only on vehicular traffic but also pedestrian walkways and bike paths. Transportation plans are important to the growth of a community because they help to influence development patterns (Elmendorf 2000). The community facilities and utilities section directs those elements that serve the community including schools, hospitals, libraries, electricity, and sewage treatment plants. The conservation element of the plan helps to incorporate the natural environment into the comprehensive plan by addressing issues of acquisition, conservation and preservation of the natural environment. "If the natural environment is not considered in the comprehensive plan, it may not be adequately or correctly addressing in zoning and subdivision, or other ordinances used to implement policies expressed within the plan, (Elmendorf 2000, p. 67). The plan implementation section is the most critical of the comprehensive master plan because it describes how the policies in the plan will be executed and financed (Arendt 1989).

The comprehensive master plan has evolved significantly since its inception in the early 20th century. Plans adopted during the City Beautiful movement were extravagant and expensive and provided no guidance on how the plan would be financed. Plans today are fiscally responsible and now direct the community on how plan implementation will be financed. Issues and problems addressed in the master plan have also changed as communities confront new challenges. The flexibility and adaptability of comprehensive master plans to meet changing community needs and priorities explains why its development continues to be an important part of city planning departments across the United States.

2.7 Summary

Trees have been used in the urban environment since antiquity. Ancient civilizations used them to beautify areas and provide food. Today, in addition to the benefits that ancient civilizations received, we know that trees also provide numerous environmental, economic, psychological and social benefits. They improve air quality, modify air temperature, increase energy efficiency, reduce storm water runoff, increase property values, influence local economic development, improve wildlife habitat, influence recreation, have a positive effect on mental health, improve social interactions and make the urban environment a more pleasant, safe, comfortable, and healthy environment in which to live, play and work.

Although trees and the urban and community forest provide numerous benefits to the urban environment there are also costs associated with them. As with the benefits the costs can be environmental, economic, physical or psychological. Environmental and economic costs include increases in power plant emissions of carbon dioxide due to improperly placed trees, planting and maintenance (i.e. pruning, watering, removal, administration), repair of the urban infrastructure, and litigation. Physical costs or health costs are associated with an increase in pollen that leads to more allergic reactions and respiratory illnesses. Feelings of fear that trees

give criminals a place to hide, anxiety caused by the thought a tree may cause damage to people or personal property, annoyance of having to "clean up" sticks, flowers, fruit and leaves, and personal conflict associated with having to remove a tree that has personal meaning are some of the psychological costs associated with trees and the urban forest.

While these costs exist, many of them can be reduced or avoided through proper planning and management, which can also help to maximize the benefits of the urban and community forest. "Planning is collective action for the common good, but particularly action that concentrates on building and shaping the shared physical infrastructure for present needs and future growth," (Fishman 2000 p. 2). Planning helps a city evaluate potential opportunities and threats in their community, so they can be addressed before they are missed or cause a problem.

Planning flourished in American cities in the late 19th century and 20th century. It evolved from the City Beautiful movement of the late 19th and early 20th century, which advocated beautifying the urban landscape and creating long range comprehensive master plans that would guide future improvements. To a more practical and realistic approach, used during most of the 20th century that focused on incorporating housing issues, urban renewal, poverty assistance, neighborhood development, transportation, waste management, historic preservation and natural resource management into their master plans. Today, planning is still practical and realistic, but it now incorporates urban sprawl, development and creating more livable communities into its master plan, while still addressing the earlier planning issues.

In the past, planning of the urban environment has primarily focused on the city's gray infrastructure (streets, sidewalks, sewers and lighting) (McMahon 2000), while overlooking the city's green infrastructure resource (urban forest, parks, open space, etc.). In 1985, Stirrat (1985), an urban planner said,

"Trees have long been regarded as an intrinsic part of town planning but only from a visual point of view. The biology of trees has not really been understood, and therefore the planning need for long-term site and area tree management has not been promoted," (p.204).

The objectives of this paper are: (1) to identify if trees and the urban and community forest resource of a city have been incorporated into its comprehensive master plan; and (2) to provide insight into how cities are planning their urban and community forestry resource to identify if they are maximizing the benefits that trees provide.

When trees are not incorporated into the plan, the urban forest is deemed not a priority within the city and tree care suffers financially. City officials and residents mistakenly believe that trees can take care of themselves and allocate tree care dollars to other city services. In 1990, tree care was .49% of the total city budget (Kielbaso 1990). By not planning, not only are cities not maximizing the benefits they receive from trees and the urban forest but they are also allowing them to become a threat to the community because they can lead to unforeseen costs. These costs can be associated with the removal of trees due to an insect or disease infestation and the subsequent replanting; legal cases caused by limbs or trees injuring people or damaging property; or decreases in property value or disinvestment in the city due to a loss in tree cover. This study provides insight into how cities are planning their urban and community forest resource to help understand the role that trees play in today's cities. The urban and community forest has seen a steady decline in the United States over the past 20 years due to disinvestment and it generally being overlooked by city officials and planners. The purpose of this study is to identify if city officials and planners have begun to understand the importance of the urban and community forest by incorporating it in their comprehensive master plans. This knowledge can help reverse the trend of a declining urban and community forest and help to maximize the benefits it provides to urban residents

CHAPTER 3

METHODS

This study examined whether trees and the urban and community forest resource have been incorporated into recent (completed after 1990) city master plans to answer the question, are trees and the urban and community forest part of the plan? The study examined the comprehensive master plans of seventeen Midwestern cities. Cities in the Midwest were chosen because the states are similar economically. The seventeen cities are in states that are covered by the Northeast area of the United States Forest Service geographical areas. The cities were in the following states: Illinois, Indiana, Iowa, Michigan, Minnesota, Missouri, Ohio and Wisconsin.

Initially, the seventeen cities were randomly chosen from the 2000 United States Census list of incorporated cities with populations of 100,000 or more. Cities of 100,000 or more were identified for each state and their names were written on a piece of paper. To randomly select the cities, all the cities for a particular state were placed in a bag and one was chosen. Two cities were randomly chosen for each state, except Wisconsin where three cities were inadvertently chosen. Each city was contacted with a request for a copy of their most recent comprehensive master plan. Several of the cities selected during the first random selection process did not have comprehensive master plans, completed after 1990, and had to be replaced. The year 1990 was chosen because comprehensive master plans design the city for between 10 and 30 years into the future. To select replacement cities for those that did not meet the criteria, cities were again selected randomly, following the above process. If the city had a comprehensive master plan completed after 1990 it was selected; if it did not, another city was randomly chosen. In Indiana and Michigan, there was only one city with a population

of 100,000 or more that had a plan completed after 1990. In Wisconsin, there were no cities with a population of 100,000 or more that had plans completed after 1990. In these states a list of cities with populations of 50,000 or more was created for each state and the cities were selected based on the selection process described earlier. Indiana had no cities with a population of 50,000 or more that had a recent comprehensive plan. In this case, a list of cities with populations between 25,000 and 50,000 was compiled and the city was randomly chosen from that list based on the selection process. The cities selected, their populations and year that their comprehensive plan was adopted can be seen below in Table 1.

Table 1: Populations and year comprehensive master plans were adopted for the seventeen Midwestern Cities studied (2002).

CITY	POPULATION	YEAR PLAN ADOPTED
Naperville, IL	128,358	1994, 1996, 1998 (city divided into three sectors- each with their own master plan)
Peoria, IL	112, 936	1992
Carmel/Clay IN	37,733	1996
Indianapolis, IN (Marion County)	791,926	1991
Cedar Rapids, IA	120,758	1999
Des Moines, IA	198,682	1995
Detroit, MI	951,270	1994
Westland, MI	88,602	1996
Minneapolis, MN	382,618	2000
St. Paul, MN	287,151	1999
Kansas City, MO	441,545	1997
Springfield, MO	151,580	1996
Cleveland, OH	478,430	1991
Toledo, OH	313,619	2000
Appleton, WI	70,087	1996
Kenosha, WI	90,352	1995
West Allis, WI	61,254	1990

After the plans were selected, each of the master plans was carefully studied based on ix variables identified by the researcher. There were two types of variables used, those that

were predetermined prior to analysis and those that were added during analysis. Predetermined variables were chosen based on several factors: the researcher's perception of the role that trees play in cities (i.e. planted along streets) based on the literature, components of a city's urban forestry program (i.e. tree planting, maintenance), the role of trees in urban growth and development and the concepts of open space and greenspace and their connection with the urban infrastructure. The predetermined variables used were: ordinances, trees in public spaces, transportation and open space/greenspace. Variables were added during analysis when they were mentioned in at least two master plans or referenced trees in a way that had not been addressed in the predetermined units. Variables added after analysis began were: landscaping in public spaces and development. The term landscaping was added after analysis began because it was used so frequently within the master plans. Since the term landscaping was not defined in any of the master plans a definition was created, based on the definition of landscaping in Webster's New World Dictionary. The definition of landscaping used for the purpose of this study was the planting of vegetation in public spaces. Development was another unit of analysis that was added after analysis of the plans began. At first, the references were sorted into other units; however, the concept of development was so strong in these references that a new unit of analysis was created.

The defined variables were subdivided into units of analysis that helped to identify how the variable was referenced within the master plan. As with the variables, units of analysis were both predetermined before analysis and added on after analysis began. Both were selected using the same criteria as the variables. Units of analysis were further subdivided to provide more detail on how the unit was referenced. For example, the unit of analysis "reference to planting on public property" included subunits such as "planting and preservation" and "planting and replacement." A list of variables, units of analysis and subunits of analysis are

included in Appendix A; variables and units with an asterisk by them were added after analysis

began.

CHAPTER 4

RESULTS AND DISCUSSION

This chapter presents the results of the master plan analysis of the seventeen

Midwestern cities and provides interpretation and discussion. For further detailed information

on the results please see Appendices B and C. Appendix B provides the number of references

to each unit of analysis by city and Appendix C provides detailed references for each of the

cities studied.

4.1 Overall Results

All seventeen of the master plans studied referenced trees at least once in their

comprehensive master plan. In four cities, tree references covered only one variable. For

instance in Kenosha, WI trees were referenced four times in the master plan. All four of the

references were addressing the need for a tree planting ordinance. In West Allis, WI the only

reference to trees was a drawing of a plan that included trees; there were no references to

trees within the text.

In all, there were 126 references to trees within the master plans of the seventeen

cities. Total references to trees per plan ranged from 1 to 20. Figure 1 provides the

percentage of references for each of the variables studied.

Figure 1: Percentage of References to Trees for each Variable
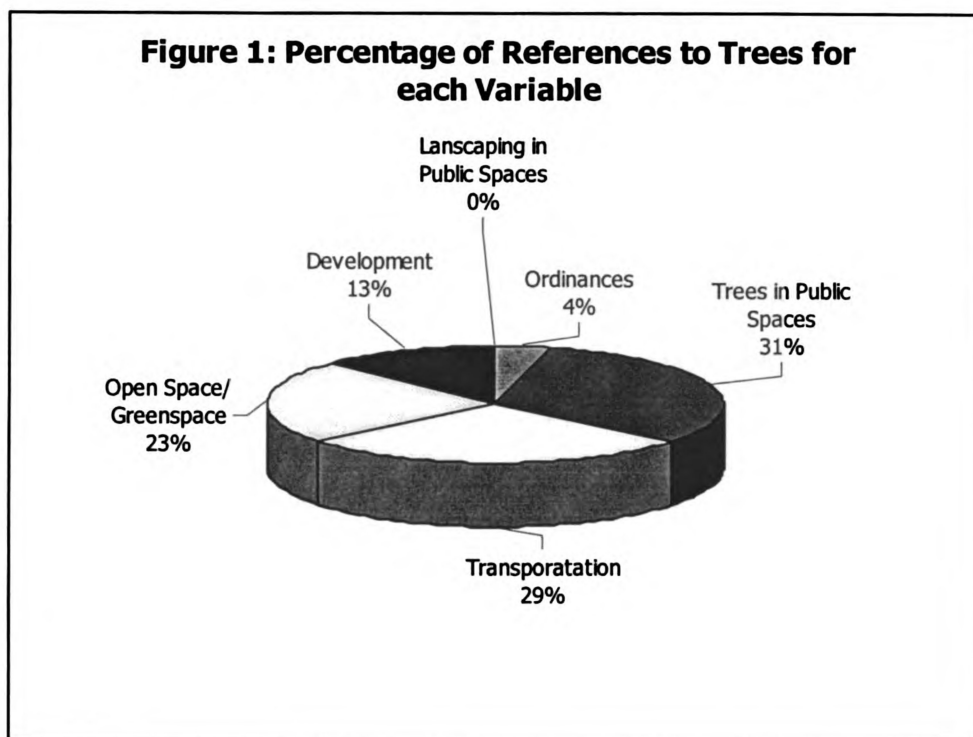
The results that follow provide a more detailed look at how the cities specifically referenced trees in their plans. Appendices B and C provide further detailed information for each of the cities.

4.2   Ordinances

Ordinances are one tool that communities can use to help create a sustainable and healthy urban and community forest resource. Tree ordinances can be used to protect/preserve existing trees, require the planting of trees, describe who is responsible for the maintenance of public and privately owned trees, decide what constitutes a hazardous tree on public/private property and even help to resolve conflicts between landowners and their trees (International Society of Arboriculture 2002).

Between 1890 and 1970 there were a number of legal cases where trees or tree limbs fell and injured or killed a person or damaged property. During this time, governmental

agencies in the United States could not be sued because of governmental and sovereign immunity. There was one exception to this law, when a dangerous condition existed (Evans 1981). The plaintiff's in these cases had the burden of proof; it was their responsibility to prove that the tree was dangerous prior to the accident. Today, resulting from Supreme Court rulings, governmental agencies no longer have immunity from prosecution and can be sued whether or not the tree was dangerous prior to the event. The plaintiff now has to prove that the governmental agency was negligent (Evans 1981).

Trees provide many benefits to a community; however, without proper planning, management and investment they can also be a liability. Table 2 provides the results of the number of cities that referenced ordinances in their master plans.

Table 2: References to ordinances in the master plans of seventeen Midwestern cities (2002)

	# of Cities	% of Cities	Total # of Times Referenced
Tree Planting Ordinance	1	5.9%	4
Tree Removal Ordinance	0	0.0%	0
Tree Preservation Ordinance	1	5.9%	1
Landscaping Ordinance	3	17.6%	4
Zoning and Beautification	2	11.8%	2

Of the seventeen master plans examined six cities (35.3%) made reference to a landscape ordinance. Minneapolis, MN was the only city that recommended a tree preservation and replacement ordinance. The five other cities referenced ordinances in terms of development, landscaping, beautification and screening. References in this variable ranged from Minneapolis, MN recommending the adoption of a tree preservation and replacement ordinance

for public and private development; to Des Moines, IA recommending the enforcement of ordinances that promoted beauty and safety. None of the seventeen communities studied, mentioned removal ordinances in their master plans. Removal ordinances can help cities avoid paying damages in legal cases. By having such an ordinance and adhering to it, removing trees that pose a risk to human life and property, cities can demonstrate that they are doing everything possible to remove hazards from the community.

A study completed by Perry in 1978, requested tree ordinances from sixty U.S. cities. Fifty-one cities provided ordinances, and most of them (forty-eight) pertained to the protection of trees on public lands (Miller 1978). While in the Perry study, 85% of the cities provided tree ordinances, in this study 11.8%, or two cities, referenced tree ordinances in their plan. One city referenced tree preservation ordinances while the other city referenced the creation of a tree planting ordinance. While the studies are clearly different in terms of the documents that were examined, the comprehensive master plan, reviewed in this study, is the impetus behind the development of city ordinances. The master plan guides the city's future growth, development and change; and ordinances are used to affect the actions of residents, city officials and developers to help achieve the goals of the master plan. The small number of tree ordinances referenced could be explained in two ways: (1) the community has tree ordinances in place but did not incorporate them in the master plan or (2) the city does not fully understand the benefits of trees in their community and does not yet see a need for a tree ordinance.

As mentioned earlier, tree removal ordinances were not referenced in any of the master plans studied; however, the absence of such an ordinance may not be limited to just these cities. In creating a tree ordinance, most cities address the need for removals in sections on overall tree maintenance (Johnson, Baker and Johnson 1990) and do not treat them separately.

Incorporating removals into the overall tree ordinance is adequate only if they fully address the hazardous nature of trees and have a plan in place on how to properly handle trees that pose a risk to human life and property. If the broad tree ordinance does not properly address these issues it may be prudent for the city to consider creating a removal ordinance.

If the community has not created a tree ordinance because they fail to fully understand the benefits of the urban forest or do not see the need for a tree ordinance, they are missing an important opportunity. Ordinances can affect the actions of residents and developers, and cities can use them to create or enhance their urban forestry program. Creation of a preservation and planting ordinance can require developers to preserve as many existing trees in a development and to plant trees in public spaces when the development is complete. Requiring homeowners who request tree planting in the public right-of-way to maintain the trees for three to five years can reduce both mortality and maintenance expenses. By developing tree ordinances that include both planting and preservation, cities can begin to create an urban forestry program and help reduce costs of planting and maintenance.

4.3 Trees in Public Spaces/Landscaping in Public Spaces

The urban forest resource is changing due to changes in land use patterns. Dwyer et. al (2000) described what happens as areas are developed:

> "As an urban area becomes more intensely developed, the amount
> of available growing space decreases, residential lot size is reduced,
> the amount of impervious ground cover increases, and tree canopy
> cover decreases," (p. 53).

Development and sprawl can lead to a decrease in tree cover, if an effort is not made by cities during development and expansion to plan for and plant trees. The environmental, economic,

social and psychological benefits urban residents receive from trees are reduced as trees die or are removed and not replaced.

The results in this section examined whether cities are planning for the planting and maintenance of the urban and community forestry resource. The variable "Trees in Public Spaces" referred to the planting of trees on property owned by the city. Public spaces included, but were not limited to, areas within the city owned right-of-way, parks, and around city-owned buildings. References to "Landscaping in Public Spaces" pertained to whether cities mentioned landscaping on public lands. This variable was included in the analysis of the master plans because of the frequency in which it appeared in all of the master plans. Since it was not defined in any of the plans, a definition was created based on Webster's New World Dictionary. The definition used for the plan analysis was, the planting of vegetation in public spaces. The broad nature of the definition reflects the way in which the term was referenced in the plans. The results for this variable are displayed in Table 3.

Table 3: References to Trees in Public Spaces in the master plans of seventeen Midwestern cities (2002)

	# of Cities	% of Cities	Total # of Times Referenced
Tree Planting Plans			
Maps	1	5.9%	6
Plans	4	23.5%	5
Reference to Planting on Public Property			
Planting & Preservation	1	5.9%	1
Planting & Replacement	2	11.8%	2
Tree Planting	4	23.5%	4
Design Standards	1	5.9%	1
Planting (general)	1	5.9%	1
Background	3	17.6%	4
General			
Trees in Neighborhoods	1	5.9%	1
Arboretum	1	5.9%	1
Forestlands/Woodlands/ Forested Corridors/Forest Preserves	2	11.8%	9
Vegetation	1	5.9%	2
City Infrastructure	1	5.9%	1
Air Quality	1	5.9%	2
Maintenance of Trees	2	11.8%	4
Landscaping in Public Spaces	9	52.9%	22

"Trees in Public Spaces" were mentioned in 13, or 81.3% of the master plans studied. The references in this section ranged from "Tree Planting" referred to by five cities to "Trees in Neighborhoods" that was referenced by one city. Although trees in this variable were mentioned by 13 of the cities, the total number of references in these master plans was 44. Total references to trees this variable ranged from 1 to 11 per plan. Nine of the seventeen cities or 52.9% of the communities referred to "Landscaping in Public Spaces." Landscaping is a general term that can include tree planting. Since it was used in a general manner, it was treated separately from the "Trees in Public Spaces". Typical references in this category

included the use of landscaping to identify an area and the use of landscaping to buffer/screen

areas. None of the city plans mentioned maintenance of landscaping in public spaces. While

landscaping can include trees, a distinction needs to be made between landscaping with trees

on public property and planning and planting trees in a comprehensive urban and community

forestry program. Landscaping is usually done to meet a specific need in the community (ex.

beautify the new library), and is typically installed by an outside contractor to provide an instant

effect with little or no maintenance. Planting of trees for a comprehensive urban and

community forestry program means planning, planting and maintaining them for the future

benefits they will provide the community.

For the subunit of analysis of "Tree Planting Plans," trees were considered referenced if

there were drawings or maps that included trees even if there was no direct mention to trees

within the body of the text. For one city, Appleton, Wisconsin, a set of proposed plans that

included trees in the design was the only reference to trees in their entire plan; there was no

direct mention of trees in the text of their plan.

"Tree planting" was referred to by the most number of cities in this variable. Examples

of references to this subunit of analysis included:

- St. Paul, MN – planted more than 25,000 trees along the Mississippi River to create a
  river corridor and return the area to its original landscape.

- Springfield, MO – recommended the planting of a public orchard.

- Detroit, MI – recommended the "...use of more evergreen trees and shrubs that
  have interesting wintertime color and shape."

References that were sorted into the "Background" subunit of analysis described existing

conditions within the city or desired community characteristics. Examples of references within

the master plans were:

- Springfield, MO residents desired parks that had an "abundance of trees...", community members believed that "additional parks, greenways, trails and preserved open space and trees were desired as a necessary component of the community's future development pattern."

- Detroit, MI's plan stated that, "shade trees are the single most important element that enhances the character and amenity of residential neighborhoods."

The "General" unit of analysis was used for specific references to trees that did not fit into other units or subunits of analysis in this variable. "Forestland/Woodlands" was referenced by two of the seventeen cities a total of nine times. References in this category included:

- Springfield, MO – recommended that the "...city as a park..." could protect forest lands. The plan also recommended that forested corridors, forests and woodlands would make good setting for greenways.

- Naperville, IL - identified several areas that were already part of their forest preserve system.

One of the most intriguing finding in this variable was the number of cities that mentioned "Maintenance of Trees" in their master plan. Detroit, Michigan and Toledo, Ohio were the only two plans out of the seventeen that referred to the maintenance of trees. Detroit recommended that the city encourage residents to maintain newly planted trees, while Toldeo recommended that they improve their tree trimming services throughout the city.

In a study of Michigan's urban forests, the researchers found that 49.15% of urban trees were in the fair to poor condition category (Kielbaso and Wildenthal 1994). They also found that a majority of the trees in 24" + diameter class were in the poor condition class. Maintenance is an important component of an urban forestry program. It not only aids the city in litigation by demonstrating that they do not neglect their publicly owned trees but it also helps maintain the trees health and long-term survival.

While most of the cities studied, 13, referenced "Trees in Public Spaces", the results in this section demonstrate that the planting and maintenance of the urban and community forest

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resource has not been fully addressed in the cities studied. City officials are not only failing to maximize the benefits of the urban and community forest but they may be inadvertently causing their trees to become a threat to the community.

4.4 Transportation

Transportation corridors are the life of a city. They are intended to move people smoothly around the city with limited disruption in movement. In the past, city streets were lined with American Elms that arched gracefully over the road forming a continuous canopy. In the 1960's and 1970's Dutch Elm disease killed most of the American elm trees that lined city streets, leaving many open spots in the canopy and along the street. Today, although, the elms have disappeared, many cities continue to plant trees along their transportation corridors. This is where most of the trees owned by the city are located, in the public right-of-way, usually found in the area between the sidewalk and the curb. Table 4 displays the results of references to both trees planted along transportation corridors and the more general analysis unit, landscaping along transportation corridors.

Table 4: References to Transportation in the master plans of seventeen Midwestern cities (2002)

	# of Cities	% of Cities	Total # of Times Referenced
Trees Planted Along Streets/Transportation Corridors			
Trees Planted/Planting	9	52.9%	22
Screen/Buffer	1	5.9%	4
Drawings/Plans	0	0.0%	0
Trees Creating an Identity for an Area	5	29.4%	5
Benefits of Trees	1	5.9%	1
Background	4	23.5%	4
Landscaping Along Streets/Transportation Corridors			
Improve/Provide Landscaping	8	47.1%	27
Buffer/Screen	4	23.5%	11
Landscape Parking Lots	1	5.9%	2
Landscaping & Development	1	5.9%	2
Landscaping creates an Identity for an Area	2	11.8%	2
Landscape Entrances into City	2	11.8%	6
Landscape Design Standards	3	17.6%	4
Landscaping & Streetscapes	1	5.9%	1
Landscaping & Traffic	2	11.8%	2
Landscaping & Sidewalks	1	5.9%	1
Landscaping & Pedestrians	2	11.8%	4
Benefits of Landscaping	1	5.9%	1
Background/Characteristics	2	11.8%	21
General- Beautification			
Streetscapes	8	47.1%	33
Greenway	9	52.9%	250 +
Irrigated Medians	1	5.9%	3
Planted Medians	1	5.9%	1
Buffer	1	5.9%	1
Planting (General)	1	5.9%	1
Boulevards/Parkways	5	29.4%	57
Open Space & Transportation	1	5.9%	3

"Landscaping" was included in this section along with tree planting, but each was treated as a separate subunit of analysis. Of all of the units of analysis, "Greenways" was referenced the most, more than 250 times by nine cities. A greenway is a natural corridor

along a river that provides for ecological, recreational and cultural/historical uses (The New England Greenway Vision Plan). The large number of references to greenways may be due to the shift in planning that has occurred because of the fragmentation of the green infrastructure (Benedict 2000). The cities studied appeared eager to connect the fragments of open space throughout the city and return the river corridor to its natural state, creating an interconnected greenway. References to "Greenways" were similar throughout the master plans, common references included:

- Appleton, WI – recommended the creation and enhancement of the greenways within the city

- Kansas City, MO – recommended the creation and enhancement of the greenway system; creation of a regional greenway system; integration water quality into greenway; and preservation of greenways.

"Trees Planted/Planting Along Transportation Corridors" was referenced by 52.9% or nine of the cities studied. The references in all of the units and subunits of analysis pertained to the use of trees to beautify the transportation corridor, buffer/screen incompatible land uses and to create a gateway along transportation corridors into the community. Beautification was a strong element in the Transportation variable. In studying this section of the plans, it appeared that cities wanted to use landscaping and trees to create the best image possible for people driving through their community. The city officials may believe that this could lead to new people and businesses moving into their community, increasing their tax base.

References to streetscapes, and boulevards and parkways were mentioned in several of the master plans. Neither units of analysis were defined in any of the plans but references typically focused on the beautification of the street environment by using one or the other. Although not mentioned specifically, tree planting is one method the city could have used to

create a streetscape or boulevard/parkway. Examples of how the cities referenced

boulevards/parkways were:

- Kansas City, MO - recommended the expansion, creation and enhancement of boulevards within the city.

- Kenosha, WI - recommended that neighborhoods be bounded by "...park, parkway and institutional area..."

- Naperville, IL- defined a right of way as 66 feet to accommodate utilities, sidewalks and parkways.

In this section over half of the cities, 52.9%, referenced the subunit of analysis "Trees Planted/Planting" along transportation corridors. The results point to an understanding that the cities studied had about the value of planting trees along their transportation corridor. Most of the references focused on using them to beautify and create an identity for an area. If city officials understand the other benefits of trees, it may help to facilitate more tree planting along transportation corridors. A study of Michigan's urban forest resource found that on average there are 50.9% available planting sites along city streets (Kielbaso and Wildenthal 1994). By planting even half of these sites, cities can increase the benefits they receive from trees and help increase the quality of life for its residents.

4.5 OPEN SPACE/GREENSPACE

Over the past decade the terms open space and greenspace have become widely used in cities across the United States. Community leaders and citizens alike have begun to understand the importance of preserving undeveloped land for the betterment of the community. This is best evidenced by the number of web sites devoted to the topic of open space on the internet. These sites are hosted by municipalities, non-profits and citizen action groups. This variable examined how open space and green space were being planned for in

the seventeen cities, if trees were referenced as part of open space/greenspace and if and how the terms were defined.

Although the terms open space and greenspace were combined as a variable they were analyzed individually in the plans. This was done to identify if communities referenced the terms differently or if the types of references were similar. Table 5 displays the results of this variable.

Table 5: References to Open Space/Greenspace in the master plans of seventeen Midwestern cities (2002)

	# of Cities	% of Cities	Total # of Times Referenced
Open Space			
Preservation/Protection	12	70.6%	32
Creation/Development	8	47.1%	38
Buffer	3	17.6%	8
Planning	3	17.6%	4
Definition	6	35.3%	8
Open Space & Development	5	29.4%	12
Link	2	11.8%	7
Part of Community Infrastructure	1	5.9%	1
Improve	2	11.8%	5
Providing Adequate Open Space	2	11.8%	3
Benefits of Open Space	1	5.9%	1
Background	13	76.7%	71
Greenspace	1	5.9%	1
Creation	1	5.9%	1
Improve	1	5.9%	1
Link	1	5.9%	1
Planting	1	5.9%	1
Buffer	1	5.9%	1
Preservation	1	5.9%	1
Development & Green Space	2	11.8%	2
Background	2	11.8%	4
Provide Adequate Greenspace	1	5.9%	1
Other			
Greenbelt	1	5.9%	1
Landscaping	6	35.3%	15
Woodlands	5	29.4%	28
Urban Gardens	1	5.9%	1
Natural Resources	1	5.9%	1
Natural Areas	1	5.9%	1
Arboretum	1	5.9%	1
Community Gardens	2	11.8%	2
Vegetation	1	5.9%	2
Urban Ecology	1	5.9%	1

The variable "Open Space/Greenspace" was referenced by all of the cities studied. All 17 of the cities referenced the unit of analysis "Open Space" in their master plan; while 5 cities referenced the unit of analysis "Greenspace." The total number of references to "Open Space/Greenspace" ranged from 1 to 36 per plan. On average, there were twice as many references to "Open Space/Greenspace" than to trees in all the other variables combined.

As seen in Table 5, the units of analysis of "Open Space" and "Greenspace" were referenced in similar ways to each other. References ranged from preservation/protection to providing adequate greenspace or open space in the city. No difference or similarities in the terms, aside from their references, could be gleaned from the plans. This was because, while six of the cities provided definitions for "Open Space" none of them provided one for "Greenspace."

Definitions for "Open Space" varied widely among the six cities. They ranged from places for active recreation to areas set aside for retention/detention purposes (i.e. a temporary storage area for storm water). The definitions of open space were:

- Naperville, IL - defined open spaces as "...land reserved within developed areas generally for detention/retention purposes with no active recreational uses provided

- Peoria, IL- defined open space as "parks...[with] developed and undeveloped open space for passive and active recreation."

- Detroit, MI – open space definition "included large open areas with use not specified but usually available for the general public."

- Westland, MI – parks and open space definition, "this classification included parcels either improved or unimproved that are used for public and private non-intensive recreational activities, including parks, natural areas, golf courses and private outdoor recreational facilities

- Springfield, MO – defined open space as "...land not used for development or formal parks that is to remain available for public enjoyment."

- Cleveland, OH it was defined as "parks, playgrounds, recreation centers, stadiums and land reserved for outdoor open space."

The broad use of the term open space in these plans is consistent with definitions found in planning texts.

> "...open space refers to lands intended to conserve and protect valuable natural features and processes...[it] is sometimes also the location of natural [events], such as floods, earthquakes, hurricanes...Open space might also include scenic, geological, ecological or historical features that have cultural value. That is, open space contributes to both social use values as well as environmental values," (Kaiser et. al 1995 p. 295).

Although each city provided a different definition, there is a common thread through each of them, that the land is open and undeveloped among developed lands within the city.

Cities in this section primarily mentioned open space in one of three ways, either in terms of its preservation/protection, creation or background information. Preservation/protection was referenced by 12 of the cities studied. References focused on the preservation and protection of open space areas during development and growth in the city. The creation of open space was mentioned in 8 of the seventeen cities, common references included the creation and enhancement of open spaces. Background issues were referred to by the most cities studied, 13, the most number of times 71. Typical references in the background section described existing open space conditions in the city.

In this variable trees were only mentioned in relation to woodlands within the city. As with the other variables and units/subunits of analysis, references to woodlands in the "Open Space" variable either described existing conditions or encouraged the preservation and protection of woodlands during development and growth.

In examining the results of the seventeen plans it seems clear that open space/greenspace are an important component of future land use. Since the master plan guides future growth, development and change, the cities are using them to protect, preserve and create open space and greenspace, to help create a more livable city for their residents. The Cedar Rapids, IA plan provides a good example of the high value that the cities studied

have placed on open space, "A network of public open spaces and facilities provide gathering places where ideas and experiences are freely shared to continually enhance the lives of residents."

4.6 Development

This variable included references that focused on the development of the urban environment. Development included both new construction and repairs to existing structures and infrastructure on both public and private property. Several of the units of analysis in this variable have been used in other variables throughout this study. They have been separated from the other variables because they specifically address development. The results for this variable are displayed in Table 6.

Table 6: References to Development in the master plans of seventeen Midwestern cities studied (2002)

	# of Cities	% of Cities	# of Times Referenced
Tree Planting/Preservation	7	41.2%	15
Landscaping	11	64.7%	40
Site Plan Review	1	5.9%	4
Special Use Permit (includes landscape provisions)	1	5.9%	1
Vegetation	1	5.9%	3
Deforestation	1	5.9%	1
Buffer/Screening	1	5.9%	1
Landscape Manual	1	5.9%	1
General Development- includes natural resources/landscaping	1	5.9%	2

While the concept of development can be seen throughout the master plans of the seventeen cities, the references in this category had a strong development theme and therefore were placed in a separate variable. The unit of analysis "Landscaping" was referenced by the most cities, 11, and the most number of times, 41. As in other sections, landscaping was not defined, and the definition created for this analysis was used. Typical references to landscaping included:

- Cleveland, OH - required the use of landscaping in development to buffer different land uses.

- Des Moines, IA – recommended that the city "Assure that new structures and landscaping are compatible with surrounding areas."

- Detroit, MI's that recommended that "Landscaping be included as an integral element of both public and private development."

Tree planting and preservation in the context of development was referenced by 7 of the cities. The references mentioned the planting of trees in new developments and their use as a buffer to screen new development with other land uses. Examples of common references included:

- Carmel/Clay, IN – recommended that development be clustered to protect significant stands of trees.

- Naperville, IL- advocated the protection trees during development and the use trees to buffer development.

- Westland, MI – called for the creation of a list of recommended trees for developers to use and encouraged the use of trees to buffer development and incompatible land uses.

The focus on protection and preservation of natural resources in development was a common theme in this section. It points to the understanding that most of these cities, 12 of the 17, had about the unique natural resources of their city, the need to protect them from development and the importance of landscaping and planting trees following development. The

results of this section once again point to the importance of creating tree ordinances. If the cities studied developed tree ordinances, they can incorporate their interests in preserving, protecting and enhancing landscape features during development into their ordinances and mandate that developers protect, preserve and plant trees during and after development. This would not only help enhance their urban forest resource but would also increase property values and reduce urban forestry planting costs.

4.7 Summary

This study examined whether trees and the urban and community forestry resource were a part of the comprehensive master plans of seventeen Midwestern cities. There were a total of 126 references to trees in the all of the master plans, and references were found in each of the variables studied. References ranged from tree protection/preservation during development to their planting along transportation corridors. While the references to trees were found in all of the variables, most of the variables focused on planting trees to beautify the area and preserving them during development. These are both important components in planning the urban and community forest; however, the maintenance of trees was absent in 15 of the plans studied.

The results prove that while trees were mentioned in the master plans, they are far from being fully incorporated. Two results illustrate this point: (1) there were 126 total references to trees in all seventeen plans, which is equal to an average of 7.4 references per plan; and (2) 15 of 17 plans did not mention maintenance of trees in any section of their master plan. For trees to be fully incorporated into the master plans they must interwoven into all sections of the master plan from housing to transportation and include the maintenance of trees and the urban forest resource.

CHAPTER 5

CONCLUSION AND RECOMMENDATION

This study examined the comprehensive master plans of seventeen Midwestern cities to identify if trees and the urban and community forest resource are part of the plan. The results of this research suggest that trees have not been fully incorporated into the master plan. All the cities studied referenced trees in their plan; however, the references primarily focused on the planting of trees and failed to address their maintenance, except in the cases of Toledo and Detroit.

The results of this study support the idea that Stirrat proposed in 1985, that

> "trees have long been regarded as an intrinsic part of town
> planning but only from a visual point of view. The biology of
> the tree has not really been understood, and therefore the planning
> need for long-term site and tree management has not been promoted," (p.204).

By not fully incorporating trees into the plan, cities are failing to gain the maximum benefit of their urban and community forest resource, and possibly causing this resource to be a threat to the community.

The findings of this study also provide insight into the role that trees play in today's city. Trees continue to be valued for their aesthetic qualities and ability to screen visually unappealing components of the city. Their benefits were addressed in two cities, Peoria, IL, which described several environmental and aesthetic benefits of street trees and Detroit, MI that highlighted trees ability to improve air quality. Overall, trees continue to be in the periphery of the urban environment, they are acknowledged by residents, city officials and planners; however, their use and benefits are yet to be maximized.

While the results of this analysis have demonstrated that trees have not planned and managed for within the city's master plan, it does not necessarily mean that trees are being

overlooked. Many cities have forestry departments that plant and care for the city's trees; however, by not fully incorporating trees into the master plan, they are not a city priority and financing of the forestry department may be in jeopardy during hard economic times. Additional research on this subject could examine how many of the seventeen cities studied have city forestry departments and what their role is in the planning and maintenance of trees. This could provide a better idea of the importance each city places on its urban and community forestry resource.

How can trees and the urban and community forest resource be incorporated into a city's comprehensive master plan? City planners, government officials and urban residents need to be educated on the need for planning the urban and community forest, the resulting benefits and the costs (Morgan and Johnson 1993). Building awareness about the integral role that trees play in the urban environment and the benefits of planning it can help leverage support for incorporating it into the comprehensive master plan.

Once trees and the urban and community forest have been incorporated into the master plan, cities need to create a tree management program. The comprehensive master plan only provides a vision of how the community will look in the future, the tree management program is the method by which to achieve the goals set forth in the plan. To begin, the city needs to create tree preservation, removal and planting ordinances. These ordinances will provide information on who is responsible for the trees, how the ordinances will be enforced, what trees should be preserved or removed, when planting is required and what species of trees should be planted. The next step is to create a tree board or city department that will oversee the trees within the community based on the tree ordinance created. They will be responsible for the planting, maintenance and care of all city owned trees.

Determining how the program will be funded is the next step. Careful scrutiny of the city's finances and available state and federal funds should be examined. Alternative tree care options should also be evaluated. Creating a volunteer program to maintain trees and conduct street tree inventories or requiring homeowners to maintain a newly planted street tree in front of their home can help reduce costs of the program. The next step is to identify the public urban forest resource in the community by conducting a street tree inventory. The inventory will determine tree species, age, size, condition and planting and maintenance needs in the city. Following completion of the street tree inventory a maintenance and planting program should be developed. This program should detail the pruning cycle (ex: pruning the sugar maple on Fowler St. every six years), planting priorities and steps for handling emergencies. The final step is reevaluation of the program every few years to ensure that the needs and priorities of the community continue to be met.

The findings of this study suggest that work still needs to be done to elevate the urban and community forest to the level of gray infrastructure in planning. However, it is a positive sign that all seventeen cities referenced trees at least once in their master plan. Planning has become an important issue in cities and its focus has switched to controlling growth and development and creating a more livable city environment for its residents and visitors. Trees are an important part of creating a more livable environment, and the time is right for it to be incorporated into the comprehensive master plans. Educating city officials, planners and urban residents is the key to increasing awareness of the urban and community forest and incorporating it into the comprehensive master plan. An education program is difficult to execute; however, there are many resources at the state, local and national level that can be utilized. To begin, a statewide committee should be developed with members from the urban and community forestry field, the private tree care sector, government agencies, planning

officials and citizens. This committee would be similar to state's urban and community forestry council, and could even be a subcommittee of the council. The committee would decide how best to reach local decision-makers and citizens with information about the urban and community forest resource and which messages would be most pertinent for each group. Local conservation districts, state natural resource agencies, tree related non-profit organizations and tree related trade groups and associations could help disseminate information and be speakers at forums and meetings. Using the media would be another important step in educating decision-makers and citizens. Providing media outlets with press releases and opportunities to see urban and community forestry issues (i.e. emerald ash borer, Asian long horned beetle) will help bring the importance of urban trees to the forefront. Creation of an education program may take years to develop and implement. Although, it may be a slow process, the end result could be a community that understands the benefits of its urban and community forestry resource and wants to keep it healthy. "To grow successfully, the urban forest must be designed as an integral part of the urban whole...," (Urban and Sievert 1989, p. 101).

APPENDICES

Ordinances	Transportation	Greenspace/Open Space	Development*
Tree Planting Ordinance	Trees Planted Along Streets/Transporation Corridors	Open Space	Tree Planting/Preservation*
Tree Removal Ordinance	Trees Planted/Planting	Preservation/Protection	Landscaping*
Tree Preservation Ordinance	Screen/Buffer	Creation/Development	Site Plan Review*
Landcaping Ordinance*	Drawings/Plans	Buffer	Special Use Permit (includes landscape provisions)*
Other (Zoning, Beautification, etc.)*	Trees Creating an Identity for an Area	Planning	Vegetation*
	Benefits of Trees	Definition	Deforestation*
Trees in Public Space	Background	Open Space & Development	Buffer/Screening*
Tree Planting Plans	Landscaping Along Streets/Transporation Corridors	Link	Landscape Manual*
Maps**	Improve/Provide Landscaping	Part of Community Infrastructure	resources/landscaping)*
Plans	Buffer/Screen	Improve	
Reference to Planting on Public Property	Landscape Parking Lots	Providing Adequate Open Space	
Planting & Preservation	Landscaping & Development	Benefits of Open Space	
Planting & Replacement	Landscaping creates an Identity for an Area	Background	
Tree Planting	Landscape Entrances into City	Greenspace	
Design Standards	Landscape Design Standards	Creation	
Planting (general)	Landscaping & Streetscapes	Improve	
Background	Landscaping & Traffic	Link	
General	Landscaping & Sidewalks	Planting	
Trees in Neighborhoods*	Landscaping & Pedestrians	Buffer	
Arboretum*	Benefits of Landscaping	Preservation	
Forestlands/Woodlands/ Forested Corridors/Forest Preserves*	Background/Characteristics	Development & Green Space	
Vegetation*	General- Beautification	Background	
City Infrastructure*	Streetscapes*	Provide Adequate Greenspace	
Air Quality*	Greenway*	Other	
Maintenance of Trees*	Irrigated Medians*	Greenbelt*	
	Planted Medians*	Landscaping*	
Landscaping in Public Spaces*	Buffer*	Woodlands*	
	Planting (General)*	Urban Gardens*	
	Boulevards/Parkways*	Natural Resources*	
	Open Space & Transporation*	Natural Areas*	
		Arboretum*	
		Community Gardens*	
		Vegetation*	
		Urban Ecology*	

*Analysis units added during analysis

**All items in italics are subunits of analysis

	Cedar Rapids, I	Des Moines, IA	Carmel/Clay, IN	Marion County,	Naperville, IL	Peoria, IL	Detroit, MI	Westland, MI	Minneapolis, MN	St. Paul, MN	Kansas City, MO	Springfield, MO	Cleveland, OH	Toledo, OH	Appleton, WI	Kenosha, WI	West Allis, WI
Ordinances																	
Tree Planting Ordinance																x (4)	
Tree Removal Ordinance																	
Tree Preservation Ordinance									x (1)								
Landcaping Ordinance						x (1)							x (1)		x (2)		
Zoning & Beautification Ordinances		x (1)				x (1)											
Trees in Public Space																	
Tree Planting Plans																	
Maps																x (6)	
Plans								x (2)			x (1)				x (1)		x (1)
Reference to Planting on Public Property																	
Planting & Preservation						x (1)	x (1)		x (1)								
Planting & Replacement							x (1)		x (1)								
Tree Planting									x (1)			x (1)					
Design Standards									x (1)								
Planting (general)							x (1)										x (1)
Background										x (1)		x (2)					
Other (General)																	
Trees in Neighborhoods		x (1)															
Arboretum								x (1)									
Forestlands/Woodlands/ Forested Corridors/Forest Preserves					x (3)							x (6)					
Vegetation							x (2)					x (2)					
City Infrastructure							x (1)				x (1)						
Air Quality																	
Maintenance of Trees							x (1)							x (3)			
Landscaping in Public Spaces					x (1)		x (7)	x (2)	x (2)	x (1)	x (6)			x(1)	x (1)		x (1)

Transportation

	Cedar Rapids, IA	Des Moines, IA	Carmel/Clay, IN	Marion County, IN	Naperville, IL	Peoria, IL	Detroit, MI	Westland, MI	Minneapolis, MN	St. Paul, MN	Kansas City, MO	Springfield, MO	Cleveland, OH	Toledo, OH	Appleton, WI	Kenosha, WI	West Allis, WI
Trees Planted Along Streets/Transporation Corridors																	
Trees Planted/Planting						x (3)	x (6)		x (2)	x (1)	x (1)	x (1)	x (1)	x (3)	x (4)		
Screen/Buffer															x (4)		
Drawings/Plans																	
Trees Creating an Identity for an Area							x (1)	x (1)							x (3)		
Benefits of Trees						x (1)											
Background									x (1)			x (1)	x (1)		x (1)		
Landscaping Along Streets/Transporation Corridors																	
Improve/Provide Landscaping					x (2)		x (4)		x (1)	x (1)	x (4)			x (1)	x (13)		x (1)
Buffer/Screen							x (3)		x (1)				x (3)		x (4)		
Landscape Parking Lots															x (2)		
Landscaping & Development															x (2)		
Landscaping creates an Identity for an Area	x (1)											x (1)					
Landscape Entrances into City	x (1)						x (5)										
Landscape Design Standards							x (1)				x (1)				x (2)		
Landscaping & Streetscapes							x (1)										
Landscaping & Traffic							x (1)				x (1)			x (1)			
Landscaping & Sidewalks											x (1)						
Landscaping & Pedestrians							x (3)				x (1)						
Benefits of Landscaping									x (1)								
Background/Characteristics									x (1)						x (20)		
Other (General- Beautification)																	
Streetscapes	x (3)	x (1)				x (1)	x (5)		x (2)		x (11)	x (200+)	x (1)	x (2)	x (10)		
Greenway					x (1)				x (7)	x (1)	x (16)	x (4)		x (11)	x (6)		
Irrigated Medians														x (3)			
Planted Medians					x (1)				x (1)								
Buffer																	
Planting											x (1)						
Boulevards/Parkways			x (3)		x (1)					x (1)	x (50)					x (2)	
Open Space & Transporation			x (3)														

(#) = number of times referenced

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Greenspace/Open Space

	West Allis, WI	Kenosha, WI	Appleton, WI	Toledo, OH	Cleveland, OH	Springfield, MO	Kansas City, MO	St. Paul, MN	Minneapolis, MN	Westland, MI	Detroit, MI	Peoria, IL	Naperville, IL	Marion County, IN	Carmel/Clay, IN	Des Moines, IA	Cedar Rapids, IA
Open Space																	
Preservation/Protection	x (1)	x (3)	x (4)						x (2)	x (4)	x (1)	x (4)	x (5)	x (1)	x (2)	x (1)	x (4)
Creation/Development				x (2)			x (5)	x (1)	x (3)	x (1)	x (12)	x (3)	x (11)				
Buffer											x (2)				x (5)		
Planning				x (1)			x (1)			x (1)							x (2)
Definition					x (1)	x (1)				x (1)	x (1)	x (1)	x (3)		x (3)		
Open Space & Development			x (3)							x (1)	x (1)		x (1)	x (4)			
Link							x (3)						x (4)				
Part of Community Infrastructure																	
Improve							x (1)		x (3)		x (2)						
Providing Adequate Open Space									x (1)				x (2)				
Benefits of Open Space												x (1)					
Background		x (16)	x (2)	x (1)	x (1)	x (20)	x (3)		x (8)	x (2)		x (3)	x (10)		x (1)	x (1)	x (3)
Greenspace																	
Creation				x (1)			x (1)										
Improve							x (1)										
Link									x (1)								
Planting									x (1)								
Buffer											x (1)						
Preservation							x (1)										
Development & Green Space	x (1)						x (1)										
Background							x (2)		x (2)								
Provide Adequate Greenspace	x (1)																
Other																	
Greenbelt	x (1)														x (1)		
Landscaping					x (1)	x (4)		x (1)			x (4)	x (4)					x (4)
Woodlands		x (10)					x (4)							x (5)	x (5)		
Urban Gardens					x (1)										x (1)		
Natural Resources		x (1)															
Natural Areas																	
Arboretum			x (1)														
Community Gardens						x (1)			x (1)								
Vegetation																	
Urban Ecology								x (1)									

(#) = number of times referenced

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Development	Cedar Rapids,	Des Moines, IA	Carmel/Clay, IN	Marion County,	Naperville, IL	Peoria, IL	Detroit, MI	Westland, MI	Minneapolis, MN	St. Paul, MN	Kansas City, MO	Springfield, MO	Cleveland, OH	Toledo, OH	Appleton, WI	Kenosha, WI	West Allis, WI
Tree Planting/Preservation		x (1)	x (1)	x (1)	x (5)	x (2)	x (1)	x (4)							x (1)		
Landscaping		x (1)	x (7)	x (2)	x (6)		x (5)	x (8)	x (2)		x (2)		x (5)	x (1)	x (1)		
Site Plan Review															x (4)		
Special Use Permit (includes landscape provisions)															x (1)		
Vegetation							x (3)										
Deforestation											x (1)						
Buffer/Screening									x (1)								
Landscape Manual														x (1)			
Other (General Development- includes natural resources/landscaping)				x (2)													

(#) = number of times referenced

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APPENDIX C
Examples of References for Each Variable, Unit and Subunit of Analysis

Ordinances

Planting, Removal, Preservation and Landscaping Ordinances

- Kenosha, WI - mandated that street tree planted occur in new developments.

- Minneapolis, MN - recommended the adoption of a tree preservation and replacement ordinance for public/private development.

- Appleton, WI - emphasized the need for landscaping in parking lots and in any development or redevelopment projects along major roads.

- Cleveland, OH - created a landscape ordinance in 1990.

- Peoria, IL- mandated that non-residential parking lots and yards are well-landscaped.

Zoning and Beautification Ordinances

- Peoria, IL - recommended the city study the effectiveness of screening that is required in the zoning ordinance.

- Des Moines, IA - recommended enforcing ordinances that promoted beautification and safety.

Trees in Public Space

Tree Planting Plans

- Kenosha, WI- provided six maps of existing and planned conditions, land use plans and revitalization strategies that included trees and tree planting in public spaces.

- Westland, MI- included site development guideline plans that included trees.

- West Allis, WI- included a drawing of a street improvement plan that included the planting of street trees.

- Kansas City, MO - recommended creating a reforestation plan along the Big Blue River.

- Appleton, WI - proposed plans included drawing of trees in public spaces.

Reference to Planting on Public Property

Tree planting
- Minneapolis, MN - required the creation of sidewalks that accommodate a variety of needs including trees.

- Springfield, MO - recommended the planting of a public orchard.

- Detroit, MI - recommended the "...use of more evergreen trees and shrubs that have interesting wintertime color and shape."

- Peoria, IL - mandated that the city must provide street trees. "Street trees are needed in densely developed areas like these to reduce noise, cleanse the air, reduce glare, absorb heat, provide shade, add human scale and improve neighborhood character."

Planting and Replacement of Trees
- Detroit, MI - recommended the immediate replacement of trees lost from disease. They also recommended that homeowners be encouraged to maintain these trees regularly

- Minneapolis, MN - recommended the planting and replacement of trees on public property.

Background
References in this category described existing conditions within the city or desired community characteristics.
- Springfield, MO - residents desired parks that had an "...abundance of trees...." Community members believed that "Additional parks, greenways, trails and preserved open space and trees were desired as a necessary component of the community's future development pattern."

- St. Paul, MN - planted more than 25,000 trees along the Mississippi River to create a corridor and return the area to its original landscape.

- Detroit, MI - "Shade trees are the single most important element that enhances the character and amenity of residential neighborhoods."

Planting and Preservation, Design Standard, Planting (General)
- Minneapolis, MN - created a goal to "...encourage the planting and preservation of trees and other vegetation." Recommended the use of "...design standards...for public/private development with supporting street furniture (including street trees)..."

- West Allis, WI - recommended the "...creation of a 'planting' parkway of 10 to 20' between the back of the curb and parking lot or storage areas."

General

Trees in Neighborhoods
- Des Moines, IA - described existing older residential areas that contain mature trees.

Arboretum
- Westland, MI - recommended the creation of a city arboretum.

Forestlands/Wodlands/Forested Corridors/Forest Preserves
- Springfield, MO - recommended that the "...city as a park..." could protect forest lands. Recommended that forested corridors, forests and woodlands would make good setting for greenways.

- Naperville, IL - identified several areas that are already part of their forest preserve system.

Vegetation
- Springfield, MO - described the character of its public open space as having a "...variety of vegetation." They also recommended the use of native or natural vegetation in landscaping.

City Infrastructure
- Kansas City, MO - recommended that the city "Require 1% of the city infrastructure projects go toward design enhancement and beautification of public projects."

Air Quality
- Detroit, MI - recommended the use of trees to reduce air pollution.

Maintenance of Trees
- Detroit, MI - recommended that "When trees are lost from disease, replacing them immediately and then encouraging homeowners to maintain them regularly.

- Toledo, OH - recommended that the city improve its neighborhood services including tree trimming.

Landscaping in Public Spaces

Landscaping in Public Spaces
- Toledo, OH - recommended the use of "attractive landscaping" to serve as a gateway into the downtown area.

- Naperville, IL - recommended the use of extensive landscaping "to promote a sense of identity to the area."

- Minneapolis, MN - promoted the maintenance and cleaning of all landscaped areas in the public right-of-way. Recommended the use of landscaping to promote safety and security in parks.

- St. Paul, MN - recommended the use of landscaping to give an area a "sense of place."

- Westland, MI - recommended the use of landscaping to buffer incompatible public and private lands uses. Recommended that signs and landscaping be updated throughout city.

- West Allis, WI - recommended that parking lots be landscaped to provide a buffer between public areas and private residential areas.

- Kansas City, MO- recommended that parking lots be landscaped to provide a buffer between public areas and private residential areas. Recommended the use of landscaping to identify the entertainment areas of the city.

- Detroit, MI - recommended the creation of a "fun area" that could be identified through landscaping. Encouraged residents to maintain landscaping on both private and public property. Recommended parking areas be landscaped.

- Appleton, WI - provided background on housing and landscaping in the city.

Transportation

Most examples in this section are presented differently than the other sections because the subunits of analysis used accurately described how the cities referenced them. No examples are provided for those subunits of analysis that were only referenced by one city, except in cases where elaboration was required (see General-Beautification unit below).

Trees Planted Along Streets/Transportation Corridors

Trees Planted/Planting

The cities below all referenced trees planted/planting along transportation corridors. References in this section were general recommendations for planting street trees.

Appleton, WI	Kansas City, MO	Springfield, MO
Cleveland, OH	Minneapolis, MN	St. Paul, MN
Detroit, MI	Peoria, IL	Toledo, OH

Trees Creating an Identity for an Area

The cities below all recommended the use of trees to help create an identity or sense of place for a particular area.

Detroit, MI	Westland, MI	Appleton, WI

Background

The cities below described previous boulevards and city streets that were lined with large, canopy shade trees.

Minneapolis, MN	Cleveland, OH
Springfield, MO	Appleton, WI

Landscaping Along Streets/Transportation Corridors

Improve/Provide Landscaping

The cities below referenced this unit of analysis in one of several ways: improving the appearance of a transportation corridor using landscaping and providing landscaping around parking lots and along streets.

Naperville, IL	St. Paul, MN	Appleton, WI
Detroit, MI	Kansas City, MO	West Allis, WI
Minneapolis, MN	Toledo, OH	

Buffer Screen

The subunit was typically recommended for areas where there were conflicting land uses (i.e. residential area next to or near an industrial area). Cities that mentioned the use of landscaping for a buffer/screen are:

Detroit, MI	Cleveland, OH
Minneapolis, MN	Appleton, WI

Use of Landscape Design Standards

Design standards were recommended to aid developers in creating a landscape design theme that was common to the area.

Detroit, MI	Appleton, WI	Kansas City, MO

Landscaping to Create an Identity
- Cedar Rapids, IA - believed that "The community's appearance is determined by a combination of streetscape, landscaping, public art and development design.

- Springfield, MO - recommended to "Define civic parks by providing signage, landscaping and streetscapes that signify a destination or arrival at a unique place."

Landscaping the Entrances into the City
- Cedar Rapids, IA - recommended the use of more stringent landscaped standards along community entry corridors.

- Detroit, MI - recommended that "gateways" into the city be well-landscaped.

Landscaping and Traffic
- Detroit, MI - recommended the use of landscaping to reduce traffic in certain areas.

- Toledo, OH - referred to landscaping along streets as an essential element of an urban village.

Landscaping and Pedestrians
- Detroit, MI - recommended providing landscaping to provide a better pedestrian environment.

- Kansas City, MO - recommended landscaping in the pedestrian environment.

Background/Characteristics
This subunit of analysis included those references that described existing conditions within the city, desired community characteristics or development conditions.

- Minneapolis, MN believes that auto oriented travel "...discourages pedestrian scale design, landscaping and facade treatment contributing to patterns of strip mall development..."

- Appleton, WI referred to landscaping when describing existing conditions along roadways within the city.

General- Beautification

Streetscape
Streetscapes were not defined within any of the master plans of the cities studied. However, references typically focused on the beautification of the street environment. References to streetscape included the recommendation for the creation and improvement of streetscapes; the use of streetscapes to affect traffic patterns; the use of lights, furniture, and landscaping in the streetscape design; and the creation of streetscape plans to guide future improvements.

Appleton, WI	Detroit, MI	Toledo, OH
Cedar Rapids, IA	Minneapolis, MN	Kansas City, MO
Cleveland, OH	Springfield, MO	

Greenway

- Appleton, WI - recommended the creation and enhancement of greenways within the city.

- Kansas City, MO - recommended the creation and enhancement of the greenway system; creation of a regional greenway system; integration of water quality into greenway; and preservation of greenways.

- Minneapolis, MN - recommended the creation of greenways throughout city and highlighted the importance of greenways.

- Naperville, IL - provided background into a greenway that exists within county.

- Peoria, IL - recommended developing a greenway.

- Springfield, MO - identified the need for a greenway throughout city. Defined a greenway as "...a corridor of lands that is protected or managed in some manner and generally follows a natural stream or drainage way." Devotes an entire section to greenways that highlights background, recommendations and strategies.

- St. Paul, MN - recommended the restoration of existing greenways within the city.

- Toledo, OH - recommended the creation, expansion and linking of greenways.

Irrigated Medians

- Toledo, OH - recommended that by 2020 all boulevards will be irrigated.

Planted Median

- Naperville, IL - recommended the creation of a four lane road with a planted median

Boulevards and Parkways

- Carmel/Clay, IN - recommended that development occurs at intersections of at least one major parkway.

- Kansas City, MO - recommended the expansion, creation and enhancement of boulevards within the city.

- Kenosha, WI - recommended that neighborhoods should be bounded by "...park, parkway and institutional area..."

- Naperville, IL - defined a right of way as 66 feet to accommodate utilities, sidewalks and parkways.

- St. Paul, MN - recommended the enhancement of the parkway system.

Open Space/Greenspace

As in the Transportation section, many of the examples in this section are presented differently than the other sections because the subunits of analysis used accurately described how the cities referenced them.

Preservation and Protection of Open Space

The preservation of open space during development was the common way open space was mentioned in this category. Cities that promoted open space preservation were:

Cedar Rapids, IA	Naperville, IL	Minneapolis, MN
Des Moines, IA	Peoria, IL	Appleton, WI
Carmel/Clay, IN	Detroit, MI	Kenosha, WI
Marion County, IN	Westland, MI	West Allis, WI

Creation/Development of Open Space

The creation/development of open space was recommended by:

Naperville, IL	Westland, MI	Kansas City, MO
Peoria, IL	Minneapolis, MN	Toledo, OH
Detroit, MI	St. Paul, MN	

Common references included:
- Cedar Rapids, IA - recommended the establishment of new open spaces.

- Detroit, MI - recommended creation/enhancement of open space throughout the city.

- Kansas City, MO - Goal: "Development preserves or creates open space, respects existing topography and minimizes the impact of development on the natural environment."

- Minneapolis, MN - transformed brownfields into open space.

Buffer
The use of open space as a buffer was in the master plans of:

Carmel/Clay, IN   Detroit, MI   Toledo, OH

Open Space & Planning

References in this category addressed the need of planning for open space within the

city. It was addressed in the following cities master plans:

Cedar Rapids, IA   Westland, MI   Kansas City, MO

Definition of Open Space
- Naperville, IL - defined open spaces as "...land reserved within developed areas generally for detention/retention purposes with no active recreational uses provided.

- Peoria, IL - defined open space as "parks...[with] developed and undeveloped open space for passive and active recreation."

- Detroit, MI - open space definition "Included large open areas with use not specified but usually available for the general public.

- Westland, MI- parks and open space definition "This classification includes parcels either improved or unimproved that are used for public and private non-intensive recreational activities, including parks, natural areas, golf courses and private outdoor recreational facilities.

- Springfield, MO - defined open space as "...land not used for development or formal parks that is to remain available for public enjoyment."

- Cleveland, OH - defined recreation and open space as "parks, playgrounds, recreation centers, stadiums and land reserved for outdoor open space."

Open Space & Development
- Carmel/Clay, IN - recommended making developers fund open space.

- Detroit, MI - recommended policy to restrict billboards near parks and open space.

- Marion County, IN - encouraged in-fill development "...with full consideration of environment/open space impact on the surrounding area."

- Naperville, IL - required that subdivisions over 50 acres had to have an open space area.

- Appleton, WI - recommended the creation of parks and open space along roads of new developments.

Link
Naperville, IL and Kansas City, MO recommended the city try to link existing and newly created open spaces to form an open space corridor.

Part of Community Infrastructure
Kansas City, MO recommended that open space be considered as part of the community infrastructure.

Improve Open Space
Detroit, MI and Minneapolis, MN encouraged the improvement of existing open spaces in their cities.

Provide Adequate Open Space
Naperville, IL and Minneapolis, MN wanted their cities to ensure that there was adequate open space in existing areas and new developments.

Benefits of Open Space
Peoria, IL - highlighted the benefits of open space

Background
The following cities made background references to open space:

Cedar Rapids, IA		Cleveland, OH
	Westland, MI	
Des Moines, IA		Toledo, OH
	Minneapolis, MN	
Carmel/Clay, IN		Appleton, WI
	Kansas City, MO	
Naperville, IL		Kenosha, WI
	Springfield, MO	
Peoria, IL		

Typical references in the background category included:
- Cedar Rapids, IA- "A network of public open spaces and facilities provide gathering places where ideas and experiences are freely shared to continually enhance the lives of residents."

- All cities described existing open space conditions in their city.

- Minneapolis, MN- Began planning parklands according to open space specifications in the 1950's.

Greenspace

Greenspace was mentioned in the master plans of fewer cities than open space. Greenspace was mentioned in the master plans of Detroit, MI; Minneapolis, MN; Kansas City, MO; Toledo, OH; and West Allis, WI. References fell into the following categories: creation, improve, link, planting, buffer, preservation, development and greenspace, background and provide adequate greenspace. The references were similar to the ones highlighted in the open space section above.

Other

Greenbelt
- West Allis, WI- recommended the creation along the northern boundary of the city.

Landscaping
- Carmel/Clay, IN - described an area in the township that was "...the most expansive undeveloped landscape in the township."

- Cleveland, OH - set a goal to use vacant lands for gardening and landscaping activities.

- Detroit, MI - recommended the use of landscaping to improve areas near the river, in parks and in between conflicting land uses.

- Peoria, IL - recommended the use of landscaping along its riverfront.

- Springfield, MO - recommended the creation of "...design and landscape standards for the entire park system."

- St. Paul, MN - recommended using natural landscaping to reconnect neighborhoods to the Mississippi River.

Woodlands
- Carmel/Clay, IN - highlighted where existing woodlands exist in the county and townships, mainly along the river.

- Cedar Rapids, IA - encouraged the preservation of woodlands and also notes that the master plan does not provide significant woodland protection.

- Kansas City, MO - used woodlands as natural corridors.

- Kenosha, WI - highlighted the benefits of woodlands, current woodland resource and recommended the preservation of woodlands.

- Marion County, IN - encouraged the protection of woodlands.

Urban Gardens
- Cleveland, OH - described a residential area as having urban gardens

Natural Resources
- Carmel/Clay, IN - recommended adopting development standards to protect natural resources.

Natural Areas
- Kenosha, WI - Natural areas were delineated on a map in the master plan.

Arboretum
- Appleton, WI- public library contained an arboretum

Community Gardens
- Minneapolis, MN and Springfield, MO both described the need to create a community garden.

Vegetation
- Naperville, IL - recommended that unique vegetation be protected.

Urban Ecology
- St. Paul, MN - encouraged the city to, "Restore and establish the unique urban ecology."

Development

Tree Planting/Preservation
- Appleton, WI - "The City and AA1 [a developer] should discuss design standards such as strong canopy tree landscaping in the right-of-way.

- Carmel/Clay, IN- cluster development to protect significant stands of trees.

- Naperville, IL recommends the protection of trees during development and the use of trees to buffer development.

- Westland, MI recommended that the city create of list of recommended trees for developers and to use trees to buffer development and incompatible land uses.

Landscaping

- Appleton, WI - encouraged the use of vegetation to block non-conforming land uses.

- Carmel/Clay, IN - "Required the preservation of unique landscapes in the platting process." They also encouraged the use of landscaping to buffer different land uses.

- Cleveland, OH - required the use of landscaping in development to buffer different land uses.

- Des Moines, IA - recommended that the city "Assure that new structures and landscaping are compatible with surrounding areas."

- Detroit, MI - recommended that "Landscaping be included as an integral element of both public and private development."

- Kansas City, MO - recommended that "Require landscaping and/or screening plans to be prepared for all new development visible from interstate..."

- Marion County, IN - recommended the city "Encourage...adequate landscaping... to buffer nonresidential development."

- Minneapolis, MN - required the landscaping of newly developed parking lots.

- Naperville, IL - recommended the city "Continue to implement high quality development standards, with sufficient fully landscaped parking facilities."

- Toledo, OH - one of the evaluation criteria for the master plan was that, "There will be no unlandscaped vacant lot."

- Westland, MI - required "New and expanding industrial land uses must upgrade landscaping and signs." Recommended that a new subdivision have a landscaped median.

Site Plan Review

- Appleton, WI - recommended that the city enact a site plan review process that would be used to evaluate landscaping, lighting, traffic flow, etc.

Special Use Permit
- Appleton, WI - recommended that landscaping be incorporated into conditions to receive a special use permit.

Vegetation
- Detroit, MI - recommended the use of vegetation around buildings to help with climate control and as a buffer between existing land uses.

Deforestation
- Kansas City, MO - encouraged the "prohibition of deforestation within the floodplain and other environmentally sensitive areas."

Buffer/Screening
- Minneapolis, MN - recommended buffer and screening between new development and existing residential areas.

Landscape Manual
- Toledo, OH recommended the creation of a landscape manual for developers.

General Development
- Marion County, IN recommended that urban development not be permitted on environmentally sensitive lands.

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