



TREES IN THE CAPITOL CITY ... CONNECTING THE DOTS
Urban Forest Master Plan for the City of Des Moines 2020



PLANTING

MAINTENANCE

EDUCATION

This color print publication is produced by the City of Des Moines. It is a summary document found online at DSM.city/forestplan. A complete version of the master plan content may be accessed, chapter by chapter, at DSM.city/forestplanchapters. Thank you to the many contributors who provided research and content.

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The City of Des Moines recognizes the value of having tree cover throughout the City and views our natural environment as a community asset. We actively promote the growth of our urban forest by providing residents our Tiny Tree and Street Tree programs, both dedicated to planting more trees in the City. Having a strong urban tree canopy is essential to lowering the urban heat island effect, sequestering carbon out of the atmosphere, and releasing oxygen into the atmosphere

while increasing property values and helping to manage stormwater. Building our tree canopy not only requires a commitment to planting and maintaining our trees, but also educating the public on the benefits of trees. As a former member of the National Urban and Community Forestry Advisory Council, I have seen how communities across the nation have benefited from investing in their urban tree canopy, which is exactly the kind of work we have been doing, and will continue to do, in Des Moines. I am proud of the Urban Forest Master Plan and how the City of Des Moines continues to prioritize our urban tree canopy, and I encourage everyone to get out and plant more trees!

**T. M. Franklin Cownie, Mayor
City of Des Moines**



The mission of the Iowa Department of Natural Resources is “To conserve and enhance our natural resources in cooperation with individuals and organizations to improve the quality of life in Iowa and ensure a legacy for future generations.” Urban and community forests are key to this mission by providing healthy forests and livable communities. The state has a goal of enhancing and expanding Iowa’s urban tree canopy by 3% to provide people with the resulting social, economic and environmental

benefits right where they live. To accomplish this goal and connect the dots across Iowa and within our community centers we need collaboration and partnership. This Urban Forest Master Plan represents a great example of a city with a strong vision, private landowners, volunteers, and organizations all coming together to care for the trees in their city. I want to thank and congratulate the City of Des Moines and all that have contributed to this plan for connecting the dots between trees and people and improving the quality of life for Iowans and future generations.

**Emma Hanigan,
Urban Forestry Coordinator
Iowa Department of
Natural Resources, Forestry**



THE URBAN FOREST MASTER PLAN CONNECTING THE DOTS

The recurring theme of this Urban Forest Master Plan (UFMP) is ‘CONNECTING THE DOTS’. People don’t make a conscious daily connection with trees. However, trees in the ‘urban setting’ need the help of humans to thrive. Thus there is a critical need to connect residents with trees. The UFMP theme of ‘Connecting the Dots’ attempts to educate and inspire toward a stronger connection. Residents reading the Des Moines UFMP will be challenged to consider how important trees are to daily life, and to the vibrancy of the city. Each chapter uses local or regional data to ensure that all the information is relevant to Des Moines.

What Do We Have?

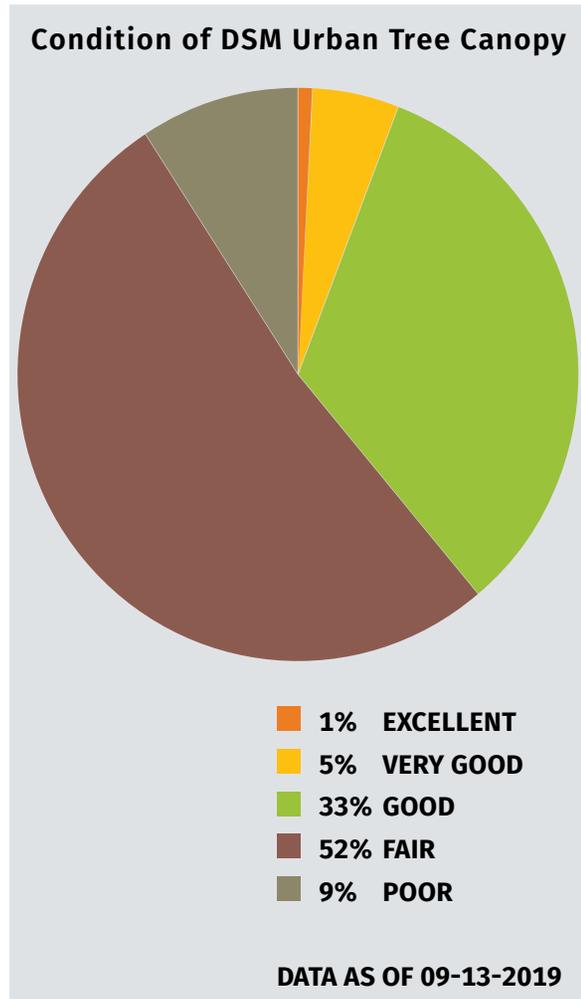
A Citywide tree inventory was conducted between 2015 and 2017. It captured data on 49,000 street trees and park trees in mowed and people-use areas of all parks and cemeteries. Overall, there are 196 species on public property. The graph at right shows that the present condition of 91% of the urban forest is in fair to excellent condition. This is a great starting point.

In 2014 Des Moines had a 29% canopy cover. The total ecological and economic benefits of these trees is over \$5 million annually.

What Do We Want?

Two items are required for the future success of the urban tree canopy. First, 3800 new trees per year must be planted to meet the Iowa DNR target of 3% canopy increase by the year 2045. Currently the City is able to plant 500-700 new trees from an annual budget of \$200,000. Second, a cyclical pruning program is required to guarantee maximum health and longevity of existing trees. Such a two-person crew with equipment is being added in 2020, and two more such crews must be added shortly to thereafter effectively prune all City trees on a 5-7 year cycle. The City will also strive to meet locally the following 11 national recommendations from Vibrant Cities Lab (vibrantcitieslab.com):

1. Create an education and awareness campaign
2. Foster urban forestry and natural resources stewardship and volunteerism





Large stately pine trees at Water Works Park

- | | |
|--|---|
| <ul style="list-style-type: none"> 3. Create sustainable jobs in urban forestry and green infrastructure 4. Cultivate partnerships between public and private sectors 5. Develop new public administration models for urban ecosystems 6. Create comprehensive, multi-jurisdictional Urban Regional Natural Resource Plans 7. Integrate federal agencies' green | <ul style="list-style-type: none"> infrastructure goals 8. Establish energy efficiency programs that emphasize the use of trees 9. Ensure equal access to urban forestry and green infrastructure resources 10. Support collaborative urban ecosystem-focused research 11. Encourage open access to and use of social assessment tools |
|--|---|

How Do We Get What We Want?

The priority of planting 3800 trees annually until the year 2045 will require a planting budget increase up to \$1 million per year. This can be achieved by quadrupling the current annual City Tree Replacement Fund, plus adding outside funds through the fundraising efforts of the nonprofit partner, Trees Forever. The priority of creating a cyclical pruning program to protect existing trees will be met by adding personnel. Three two-person pruning crews must be hired with trucks and equipment to bring the City's urban forest into a healthy, structurally-sound equilibrium. The first such crew will start in summer 2020.

The reader now knows what we have, what we want, and how we propose to get it. This 2-page outline represents a chapter that is 12 pages long. In fact all of the chapters in this publication are a synopsis of more detailed chapters the reader will find online at DSM.city/forestplanchapters. The excellent content of each chapter following this introductory chapter will make the case for improving our lives by building and maintaining a first-class urban tree canopy. It is our hope that as you read and study these chapters, you too will understand and appreciate the important role that trees must play in our city.

'May the forest be with you!'

STORMWATER AND TREES

Increases in stormwater negatively impact the capacity of our sewage treatment systems, especially in cities that have combined stormwater and sanitary sewers. Des Moines is one such community that has some combined sewers. Trees could be part of the solution that cities like Des Moines need. One of the major environmental benefits of trees is managing rainwater in advance of potential erosion. A tree can intercept and slow the pace of rainwater before it becomes ‘runoff’. This includes stormwater from either a snow melt or rainwater that flows over the ground surface without being absorbed into the soil or captured by the canopy of a tree.

Historically, stormwater runoff only occurred during large storm events when the rate of rainfall or snowmelt was greater than the rate at which water could be absorbed into the soil. With ever-increasing development and urbanization, the area of impervious surface in the US is approximately 40,005 sq. mi. with an additional 316 sq. mi. being added each year (Xian et al., 2011). According to the GIS Division of the City of Des Moines, the City has approximately 58,000 acres, and

approximately 14,000 of those are impervious surfaces. This equates to 24% of surface area in Des Moines that does not allow infiltration of water. Trees can make a difference to the soil compared to soils that are disturbed by impervious surfaces such as traditional sidewalks, streets and parking lots (Example in upper half of Figure 1).

In 2015-2017, the City of Des Moines and a local nonprofit, Tree Des Moines, contracted to have all the right-of-way and park trees inventoried by Davey Resource Group. Des Moines TreeKeeper8 (TK8) tree inventory data was compared to local hourly air pollution and meteorological data to quantify forest structure, environmental effects, and value to communities. The TK8 inventory data for six neighborhoods was transferred into i-Tree Eco to assess how much the trees were reducing the amount of stormwater runoff.

Figure 2 on page 7 shows the amount of water intercepted annually in each of 6 neighborhoods, measured as gallons per year. Numbers within the colored neighborhood bars represent the number of trees in that neighborhood. What needs to be understood however, is that even though the

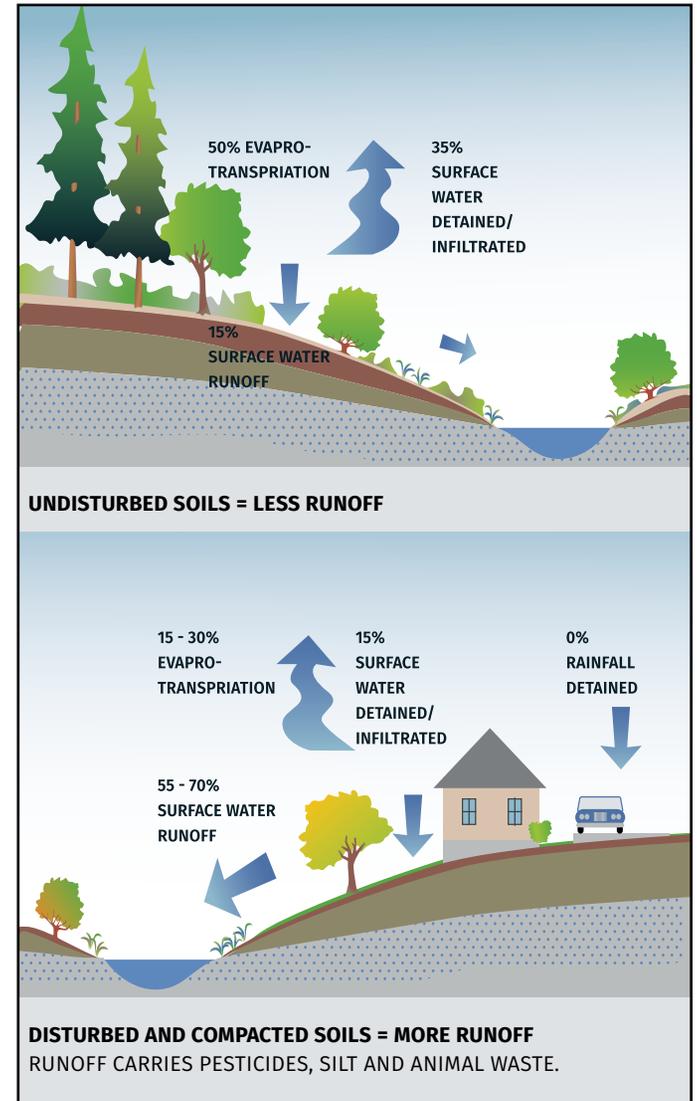


Figure 1

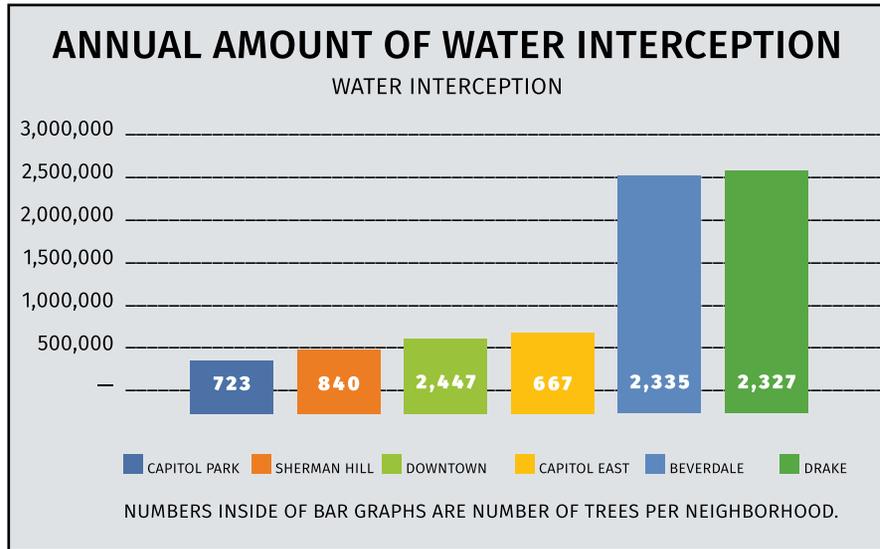


Figure 2

number of downtown trees (2,447) is more than that of Beverdale (2,335), the large amount of water intercepted in Beverdale is due to the mature size of the trees and the species of trees in that neighborhood.

How does the City of Des Moines connect the dots on the issue of stormwater runoff? The following recommendations are aimed at solving these issues and making the community safer and a more pleasant place to live and work.

RECOMMENDATIONS

- Plant more trees in general
More trees = less runoff
- Plant trees that become larger when mature
- Plant more trees over hard surfaces like streets and sidewalks
- Plant trees in and adjacent to parking lots
- Plant more trees in riparian areas to intercept more land flow of rain and snow melt before it reaches a water body
- Use modern technologies when planting, such as: trees in swales, trees in retention



Upland stream feeds Greenwood Park pond

- areas, planting trees as a phytoremediation technique on polluted soil, use of suspended pavement and structural cells to allow for more tree root growth, tree pits that receive stormwater, and use of permeable pavements around trees
- Plant 3-5 times the number of trees the City will lose to emerald ash borer
- Increase tree maintenance; older larger trees intercept more water
- Plant native tree species to better withstand fluctuating weather patterns

CLIMATE CHANGE AND TREES

State climatologists have studied weather patterns extensively. They generally agree that three measures of Des Moines' weather in the future will include: 1) some increase in temperature, mostly during the winter, but also with higher overnight low temperatures; 2) potential of a longer growing season; and 3) an increase in heavy rainfall events.

The first measure is an increase in Des Moines' temperature. Present and future models of the Cold Hardiness Zone map (CHZ) reveal important data. The Zone Map (Figure 1a), informs gardeners and growers which plants will likely survive in a location, based upon annual minimum temperatures averaged over a climatological period. Iowa at present resides in zones 5a and 5b. However, the effects of global warming suggest that in the next 50 years Iowa will reside in zones 6a and 6b (Figure 1b).

The potential change in CHZ noted above finds support in local annual average temperature data from the Des Moines Airport location. Figure 2 on page 9 shows the annual average temperature in Des Moines increased from 49

degrees Fahrenheit in 1951, to 52 degrees in 2017, a shift of 3 degrees over 67 years.

The second measure of climate change is a longer growing season. We can look at the increase of frost-free days in Des Moines over the same 67 years. In 1951, there were 158 frost free days at the Des Moines airport. This number steadily rose to 186 frost free days in 2017. This 18% increase will lead to a longer growing season for trees. This seems desirable, but it may also cause harm. Frost free warmer winter days are often followed by frost days. A phenomenon commonly seen in Des Moines trees responding to warming temperatures occurs when many just-opened magnolia or crabapple blossoms freeze and then turn an ugly brown. This complicates tree survival if a tree starts to develop flower or leaf buds that in turn get frozen. Such injury hinders growth for that year, and successive years of this pattern might also kill the tree. Additionally, tree pollen seasons becoming longer represents a possible negative side effect for allergy sufferers. Another slight downside to a longer growing season is that these faster growing trees also complete their life

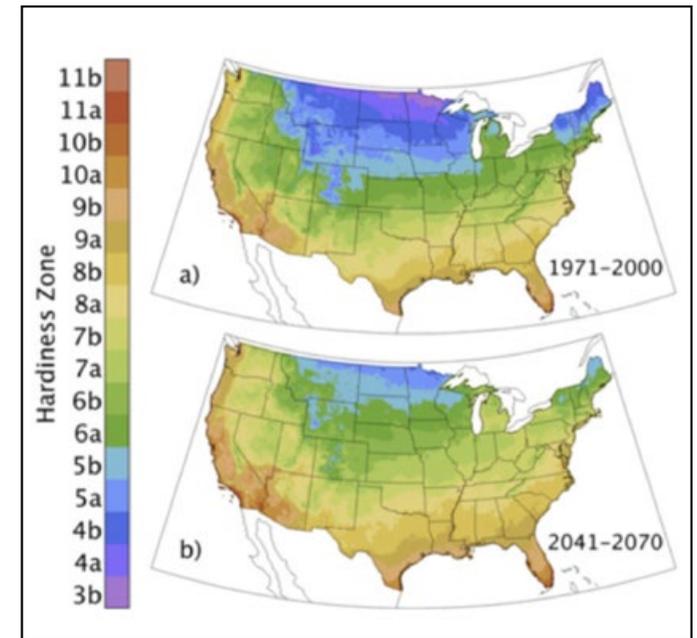


Figure 1 a. Cold Hardiness Zone map Iowa at present resides in zones 5a and 5b.

Figure 1 b. In the next 50 years Iowa will reside in zones 6a and 6b

cycle sooner. This means we may have to replace a tree that normally has an 80-year life span at the tender age of 76 or thereabouts. A situation we will happily manage while enjoying enhanced benefits of trees in longer summers. Overall, we hope the longer growing season will provide us with increased positive environmental benefits for an extended period of time each year.

The third measure of climate change is an increase in heavy rainfall events. Dr. Eugene S. Takle, CF Curtiss Professor (retired) in Agriculture and Life Science at ISU, reported that we now receive an increased number of heavy rainfall events. According to the 1893-1953 decadal records, Des Moines had four years with eight or more days when rain exceeded 1.25". This number increased to 11 such years in the 50 year period of 1963-2013, as the average number of those heavier rainfall events increased. The measure of 1.25" of rain is important because Iowa's soils can, on average, only absorb 1.25" of rain per day. Adding vegetation, including trees, drastically reduces the initiation of erosion. (<https://www.iowapolicyproject.org/2012Research/120521-climate-water.html>)

Trees alone, and trees combined with other green infrastructure elements, can greatly decrease some of the negative effects of increasing rainfall. For instance a single 18" trunk diameter swamp white oak absorbs or redirects enough stormwater to net \$52.69 in annual benefit to a location in the 50321 Zip Code. (treebenefits.com/calculator)

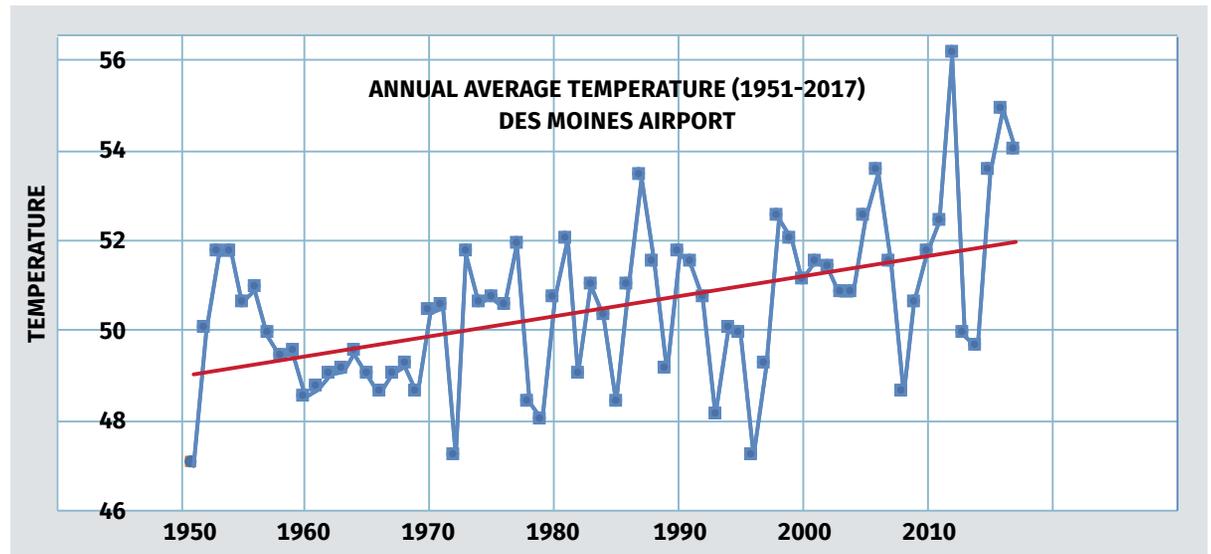


Figure 2. (mesonet.agron.iastate.edu)

RECOMMENDATIONS

- It is essential to sustain existing tree cover. The City of Des Moines needs to invest in a cyclical pruning program to prolong the life of all public trees; older larger trees intercept more rainwater
- Increase tree planting in response to heavier rain events, to lessen stormwater runoff and erosion
- Adjust our tree species selection to accommodate warmer temperatures
- Select species that will survive destructive early spring cold snaps
- Anticipate longer pollen seasons and advise residents how to cope
- Anticipate shorter tree life spans in longer growing seasons

TREES AS GREEN INFRASTRUCTURE

Des Moines has had significant population growth. Combined effects of urbanization and climate change are major concerns regarding urban development and intensification of storm events in the city. Impervious surfaces added by urban development contribute to increased volume of water flowing overland toward centralized stormwater collection systems. Excessive runoff volume may cause different issues including flooding and sewer system malfunction, as well as surface and subsurface water impairment. Traditionally, increased gray infrastructure construction has been considered as a solution. The traditional gray infrastructure systems approach is expensive and not sufficiently effective.

Green infrastructure is a practice used more and more frequently to address issues of land conservation and stormwater management. Green infrastructure uses soil properties and vegetation to improve watershed detention capacity .

Trees are obvious candidates to help decrease water losses from the urban hydrologic cycle (see THE WATER CYCLE on page 11) since they are able to provide dense vegetation canopy in a small

footprint. Trees serve as green infrastructure by routing rainfall to various components of the hydrologic cycle. Trees work like sponges as they absorb and keep water on site. Consequently, they function to reduce the amount of runoff, pollutants, and sedimentation going into creeks. Extensive tree canopies and their massive subsurface root systems are capable of capturing a significant volume of otherwise excess stormwater.

Current Assessment of Green Infrastructure Practices in Des Moines

Currently the City of Des Moines provides a rebate to property owners who install stormwater best management practices. Also, the City conducts a Street Tree Planting Program through the nonprofit Trees Forever and offers free small trees to property owners through the Tiny Trees program each spring. Trees planted in these initiatives provide an effective alternate means to prevent water losses from the urban hydrologic cycle.

The City does not currently have a green infrastructure master plan; however, it has started incorporating more green infrastructure practices



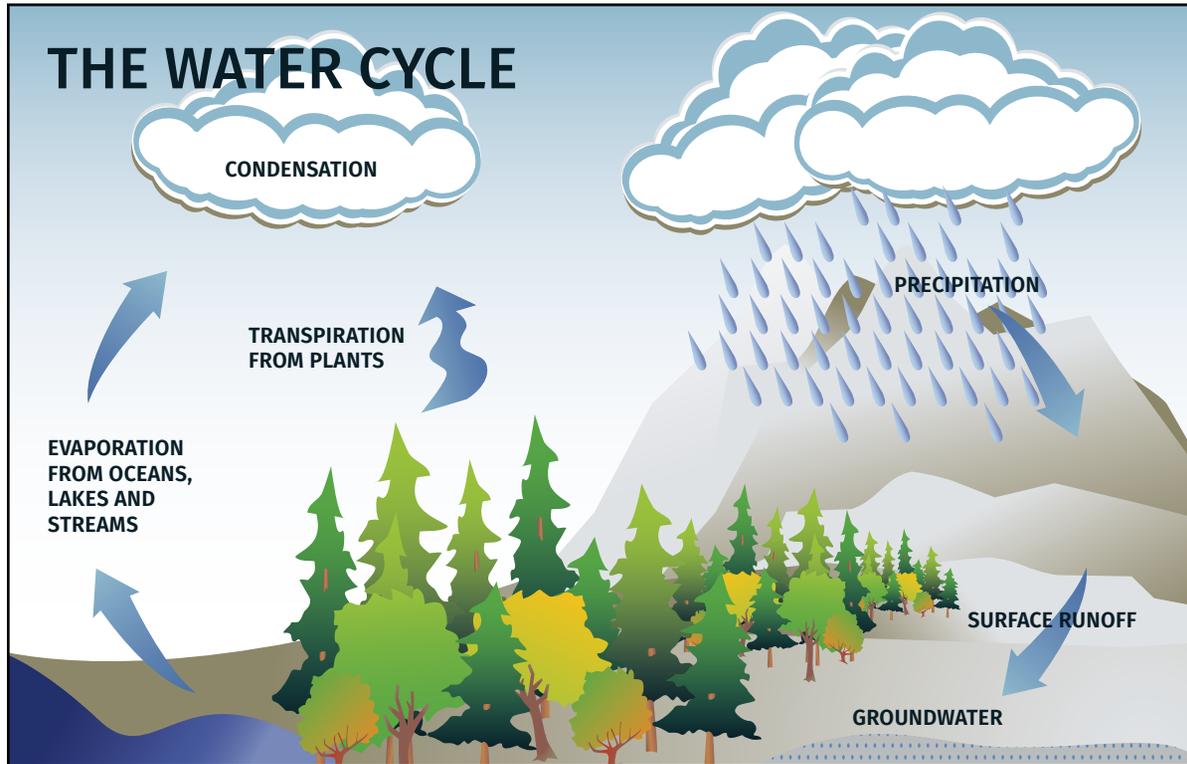
Green space open to the sky in a downtown parking lot

into its projects such as the following:

- Rainwater harvesting
- Rain gardens
- Permeable pavement
- Stormwater planters
- Tree trenches
- Infiltration trenches
- Placing trees over impervious surfaces
- Soil quality restoration

Summary

Trees have the ability to improve water quality by filtering pollutants, reducing impervious area and promoting infiltration to the groundwater table. Engineers and planners will need to



will likely be an effective way to coordinate green infrastructure management.

RECOMMENDATIONS

- Develop tree canopy goals by watershed; determine benchmarks and ensure adequate funding for achievement of tree canopy coverage goals
- Develop and execute a strategy to plant trees in the areas most in need of stormwater runoff control
- Look for opportunities to incorporate trees into new and existing green stormwater infrastructure projects
- Create and adopt new programs and processes to better integrate Des Moines trees with stormwater management
- Preserve large existing trees when possible to maximize rainwater retention and diversion
- Employ suspended pavement systems to increase soil volumes and promote large root zones
- Adopt a stream buffer ordinance
- Develop growth goals that reduce the impervious area of parking lots
- Develop a cross-department repository of green stormwater infrastructure projects and practices

consider all aspects of tree biology in order to successfully incorporate trees. Successful plans of green infrastructure development in urban settings like the City of Des Moines must include clear goals, an assessment of the assets, barriers, and existing opportunities along with a comprehensive look at the implementation plans, funding opportunities, a way to monitor and measure progress toward achieving the

community’s goals, and a strategy for long-term operations and maintenance. Currently, the lack of information and connection across organizations and disciplines is identified as a crucial issue which challenges forward progress. A hybrid approach that taps into the history of the topic, existing conditions in Des Moines, and future development opportunities, in addition to the technical aspects of the issue,

RIPARIAN ZONES AND TREES

Waterways in metropolitan areas demand protection from contaminants in order to ensure clean water for the community. Using riparian buffers, City land managers can improve the infiltration and filtration rates in high runoff zones. By planting and maintaining native species of trees and ground plants, these areas can be improved environmentally and cosmetically.

A riparian zone or riparian area is the interface between land and a river or stream. The word riparian is derived from Latin *ripa*, meaning river bank. Grasses, grass-like forbs (herbaceous flowering plants other than a grass), shrubs, trees or other vegetation growing along streams control or act as a buffer for erosion and help filter and keep water clean. By implementing an effective buffer system through riparian planting, a small amount of land can play a large role in a city's health.

The recommended riparian buffer zone is a two-part system with a streamside zone and an outer zone (Figure 1 on page 13). Each of these two zones serve different functions and they

also allow for different land use opportunities. Understanding both zones of the buffer can help land managers ensure that they are making the best use of sites. The ideal width of the proposed buffer system would be 50 feet. However, in an urban environment, where there is not always sufficient space, this can be tailored to suit the needs. In situations where space is limited, it is recommended that streambank stabilization and filtration functions be prioritized.

The streamside zone of the riparian buffer mainly serves the purpose of stabilization and as a filter for any surface water entering the waterway, keeping toxins and soil particles out of the water. Some of the permitted uses of this zone are footpaths, flood control structures, and utility right-of-ways. Important restrictions of this zone are zero or limited pesticide and fertilizer use, removal of any vegetation, livestock use or motorized vehicle travel.

The outer zone of the riparian buffer is mainly designed for flood control and animal habitat, but it also provides water filtration, intercepting most of the soil particles

that otherwise would run off surrounding landscapes during rain events. Variation in species composition makes for good habitat opportunities for small mammals, birds, and many other wildlife species. This outer zone is also able to accommodate more management activities. Established walkways or bike paths, stormwater management facilities, and large tree removal are all permitted activities. Again, pesticide and fertilizer use, construction of permanent structures, and livestock grazing are all restricted activities in the buffer area.

Knowing the length of the stream provides information for how big the project would be to buffer all of the streams inside the city. City land managers can design their own buffer system. For Des Moines, some recommended tree species are river birch, sycamore, swamp white oak, hackberry, silver maple, and willows. These species are fast growing and generally used in moist sites. Iowa native grass species, switch grass, big bluestem, and Indian grass are recommended due to their efficiency of filtering out sediment, nutrients and pesticides.

Sometimes the actual riparian edge, the slopes or stream banks, require maintenance or reconstruction. Fourmile Creek meanders 11.14 miles through Des Moines. The creek has been

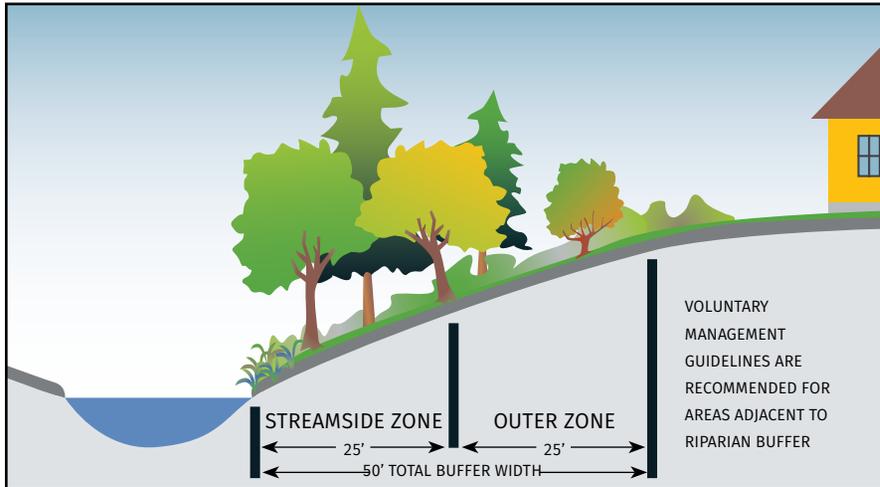


Figure 1. A model of a riparian zone.

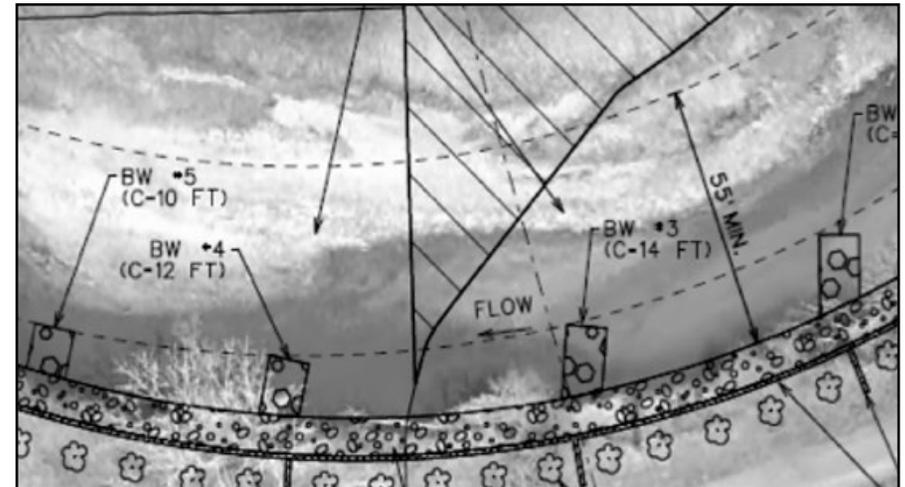


Figure 3. Plans for the five Bendway Weirs



Figure 2. Aerial view of Fourmile Creek

the subject of intense seasonal flooding over the years. Figure 2 shows a ‘hardening’ of the sloped bank on a bend of Fourmile Creek. Erosion was deteriorating the banks and the trail was under threat of flooding. The right side was hardened with rip rap stone and Bendway Weirs were installed, both for the purpose of stopping erosion. The five Bendway Weirs (designated BW) on the right bank are detailed in Figure 3. These rock outcroppings serve to slow the momentum of flood waters, and save the bank from erosion. Tree stakes were inserted into the creek bank and shrubs were planted on top, to form an effective vegetative streamside riparian zone.

RECOMMENDATIONS

- Survey and assess the condition of all riparian zones in the city
- Create the two-tier riparian buffer in as many places as possible
- Select water loving trees and plant diverse species along riparian zones
- Restrict vegetation removal, construction of permanent structures, livestock grazing, and chemical use in the streamside portion of riparian buffer
- Provide trails, water access, and public education along the outer zone of riparian buffers

STREET TREES

Urban trees impact the safety and comfort we feel within the transportation system. This chapter will explore these two unique aspects of trees as they relate to transportation: safety and comfort. Roughly 90 people die each day from motor vehicle crashes in the United States and more than 3 million people are injured. From 2008 to 2018, there were more than 55,000 automobile accidents in Des Moines; 117 fatal and more than 6,000 with major or minor injuries (Iowa DOT, 2018).

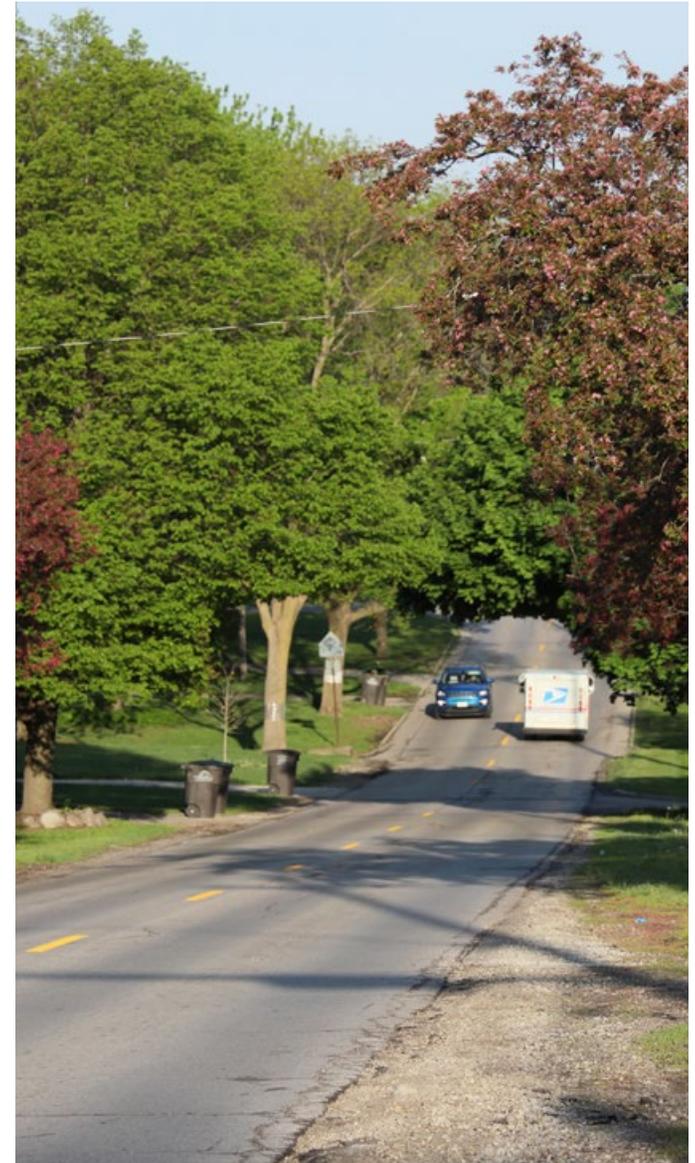
Safety

To combat these statistics, governments have implemented programs but they don't always solve the problem. Trees can help. Unlike other methods (roundabouts, speed bumps, etc.), sometimes viewed as nuisance to drivers, trees are typically desired by nearly all demographics. Speed has been a factor in one-third of traffic fatalities. Trees can help create safer streets by affecting the perception of lane width, which lowers average speed and lessens crash rates. The restful nature of trees can calm emotions and help reduce road rage.

Des Moines has been encouraging development of streetscapes for transportation beyond automobiles through its Complete Streets policy. The National Complete Streets Coalition named it the second-best Complete Streets Policy in the nation in 2018. Complete Streets are designed to allow safe and accessible transportation. The Iowa Economic Development Authority has gone further through their Green Streets program which adds ecosystem services provided by landscaping, including street trees. This incorporates all three pillars of sustainability – environment, economics, and equity. On the next page is a diagram of the typical green street concept. There are appropriately sited street trees and other green infrastructure pieces, as well as space for cars in motion, parked cars, transit and bike lanes, and wide sidewalks.

Comfort

Physical inactivity poses the greatest health risk to Americans. This affects both physical and mental health. If a person were to feel comfortable on the street they may opt to walk, bike, or take



This section of McKinley Ave. has no curbs for stormwater control

public transportation which has great implications on their health. Street trees can help provide a level of comfort that encourages use of alternate forms of transportation.

Comfort on a street comes in two forms: security and shelter. Feeling secure on the sidewalk or at a bus stop is crucial. Street trees can increase a person’s sense of security by acting as a screen between high speed traffic and the sidewalk. More people outside cars walking, looking out for one another makes the area safer. In addition to security, shelter is a necessary comfort component of a streetscape. Some Iowa months are hot and humid, others are cold and filled with whipping winds. In all seasons, street trees can provide needed shelter.

Almost all transit stops within the City of Des Moines are devoid of shade. Also, trees beside or at the rear of buildings provide limited shade at the street. This leaves a large gap in comfort for those moving around outside a car, and less likelihood of using an alternative mode of transportation.

Summary

Trees within the transportation framework are benefit multipliers. Conventionally, they mitigate heat island effect, improve air quality, increase home values, and manage stormwater.

Unconventionally, they can calm traffic and commuters, provide shelter from the elements, increase eyes on the street, encourage physical activity, and overall make a community a more welcoming place to travel to and stay.

RECOMMENDATIONS

- Further utilize green streets methods provided by the Iowa Economic Development Authority wherever possible to enhance Complete Streets Policy
- Conduct in-depth study of tree-lined

streets across the metro and compare them to the Complete Streets Policy and to current conditions in Des Moines to understand the benefits and challenges of street trees in the right-of-way

- Strategically plant street trees in high foot traffic or transit areas to create safe spaces for alternative transportation to enhance shelter from climate elements
- Consider working with the Des Moines Area Regional Transit Authority (DART) to utilize trees to create shade and wind breaks



WILDLIFE AND TREES

Wildlife is under threat in urban areas due to development, transportation, and human intrusions or disturbances. Urban forests provide refuge and connectivity to other urban landscapes. It is becoming more and more common to design urban spaces with natural features. Trees, shrubs, flowers, even animals, bring the idea of a closeness with nature, even in the middle of an urban area (Keniger et al. 2013). Promoting natural settings in urban areas will continue to be an important part of developing cities. Urban greenery adds benefits to physical health, cognitive performance, and psychological well-being (Keniger et al., 2013).

Urban forests are incredibly important to wildlife because our country is becoming increasingly urbanized. Urban populations grew 12.1% from 2000 to 2010 (U.S. Forest Service, 2018). Urban forests are the collection of private and public trees we see on our streets, in our yards and inside parks. These trees provide benefits to both people and wildlife. Not only do they help filter air and water, control stormwater, and conserve energy, they provide animal habitat (U.S. Forest Service, 2018). Urban forests can



Wildlife needs trees for resting and nesting

help support wildlife connectivity with ecological landscapes that serve as a refuge for species that are impacted by urbanization (U.S. Forest Service, 2018).

Urban areas present several threats to terrestrial and aquatic wildlife. It's important to

consider these threats and try to mitigate them, if possible. These threats usually come from urban development, movement of people through urban areas via transportation, and other human disturbances (Table 1 on page 17).

Table 1

THREATS TO TERRESTRIAL WILDLIFE						
■ LOW ■ MEDIUM ■ HIGH ■ VERY HIGH						
THREATS	AMPHIBIAN	BIRD	BUTTERFLY	LAND SNAIL	MAMMAL	REPTILE
RESIDENTIAL AND COMMERCIAL DEVELOPMENT	HIGH	HIGH	MEDIUM	MEDIUM	MEDIUM	HIGH
TRANSPORTATION AND SERVICE CORRIDORS	HIGH	VERY HIGH	MEDIUM	MEDIUM	HIGH	VERY HIGH
HUMAN INTRUSIONS AND DISTURBANCES	VERY HIGH	HIGH	MEDIUM	LOW	HIGH	VERY HIGH

Table 2

STATUS OF WILDLIFE SPECIES OF CONCERN IN POLK COUNTY					
	MAMMAL	BIRD	REPTILE	FISH	MUSSELS
SPECIAL CONCERN	SOUTHERN FLYING SQUIRREL	BALD EAGLE	BULLSNAKE SMOOTH GREEN SNAKE		
THREATENED	NORTHERN LONG EARED BAT	HEMSLOW'S SPARROW LONG EARED OWL	BLANDING TURTLE ORNATE BOX TURTLE SLENDER GRASS LIZARD	BLACKNOSE SHINER GRASS PICKEREL WESTERN SAND DARTER	CREEPER
ENDANGERED	PLAINS POCKET MOUSE SPOTTED SKUNK	BARN OWL KINGS RAIL NORTHERN HARRIER RED SHOULDERED HAWK			PISTOLGRIP

The Des Moines area data was examined for common wildlife found within the city, and needs were determined. Those needs were used to establish management goals for the land available to the City. These goals consist of planting native species and minimizing habitat fragmentation (process during which a large expanse of habitat is transformed into a number of patches of a smaller total area, isolated from each other by a matrix of habitats unlike the original). Threats to terrestrial wildlife can have more of an impact on certain types of species. There are two main categories of fauna: specialists and generalists (Bowles, 1998). Specialists are more impacted than generalists to threats to their community because they have a narrow range of food sources, and a narrow

range of climates in which they can live. They also have more predators. Their set of ideal survival environments are minimal and can easily be encroached on by humans. Specialists are usually those species that are most endangered (Table 2).

By using good management practices on City-owned land and promoting education and outreach to teach those practices to the public, Des Moines can incorporate natural environments into their urban areas that will benefit both people and wildlife. A better understanding of the world around us will allow the residents of Des Moines to promote good natural environments and continue to improve the ecological community in their areas.

RECOMMENDATIONS

- Identify threats to plants and wildlife and mitigate their impact
- Plant more native trees and shrubs because they are better adapted for survival in Des Moines
- Measure species diversity and abundance
- Strive for a diverse species, multi-age urban canopy with many different successional stages
- Cooperate with neighbors to foster implementation of local corridors between habitat
- Provide educational media and programming to foster an appreciation of wildlife in the urban forest

BEE POLLINATORS AND TREES

When people think of pollinators, they visualize bees buzzing from flower to flower collecting pollen to make their delicious honey that we enjoy in our iced tea. Most don't think about our reliance on them not only for 30% of our major food crops, but also as a base of biodiversity in ecosystems. Major pollinators are bees, but butterflies, hummingbirds, and other insects also play a huge role in this important task. All of these essential species are at risk. Colony collapse disorder (CCD) is affecting bees, which many researchers have identified as a major risk to bee populations and thus human health. Many factors have been identified as possible reasons behind CCD, including increased pesticide use, a lack of connectivity in urban areas, and the use of plant species which do not provide adequate resources to bees (Schacker, M., 2008. Brown, M., et al., 2010. Cameron, S A., et al., 2011). Even though CCD is said to affect bees, it also has negative effects on the other pollinators because of the deep interconnectedness of natural ecosystems and the ecosystem services they provide.

Des Moines can help combat this issue by

managing the urban forest with pollinators in mind. According to the Food and Agriculture Organization (FAO) of the United Nations (UN) global population is expected to keep increasing until there are 30% more people in the world by 2050. Worldwide trends show urban areas growing the most during this time of population expansion, a phenomenon commonly called "urban sprawl". Urban sprawl can be expected in Des Moines. With this in mind, a healthy amount of City space should be used as hubs for bee conservation if we expect to continue to enjoy our current lifestyles.

Currently, Des Moines is in rather good standing as far as providing pollinator habitat. Corridors are extremely important because they allow bees to travel between resources. Employing data from the City's tree inventory (TreeKeeper8), a variety of locations were evaluated across Des Moines. Several neighborhoods provide cohesive connectivity throughout the city. Looking at the top five tree species in each of these neighborhoods, there is at least one beneficial tree abundant in all of them. This shows that bees

in Des Moines have access to nesting or foraging resources without having to fly across the city.

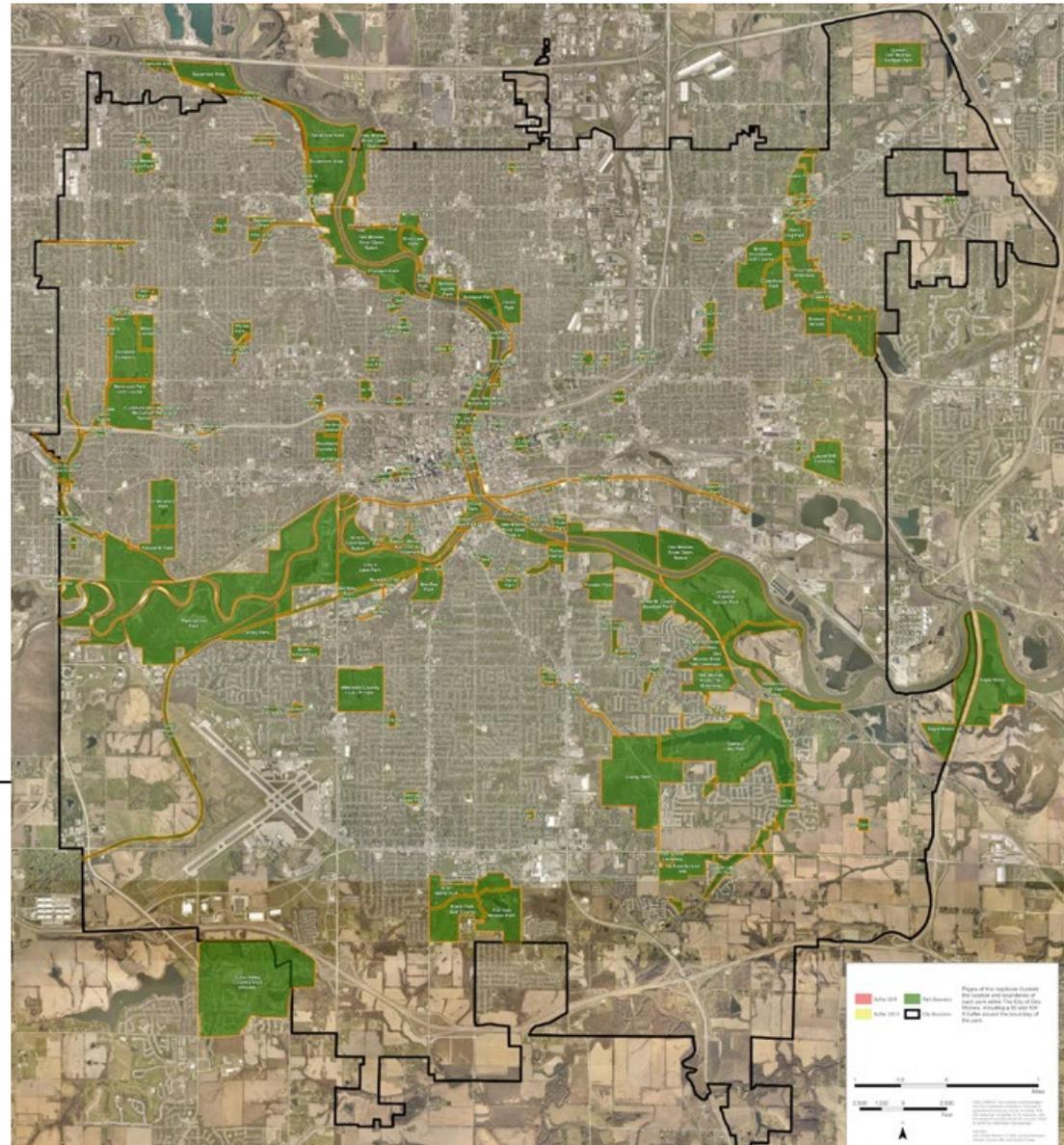
Another important factor affecting the availability of food and nesting resources is 'fringe' area which is often oriented in a linear fashion. These linear landscapes provide not only nesting resources, but also a connectivity between those resources. Fringe area is abundant in Des Moines, comprising about 627 acres. This represents 1% of 58,000 total land acres in Des Moines. Figure 1 on page 19 highlights all of the linear fringe around parks and along waterways. This map does not include residential fence lines or fringe along roads, but still shows the abundance of these landscapes across Des Moines. With this abundance of desirable tree species and linear fringe, Des Moines has a solid base for pollinator conservation.

RECOMMENDATIONS

- Educate city residents to use native plants on private property
- Develop pollinator habitat and food sources along riparian areas
- Plant native species of trees and shrubs along streets and in public natural areas, such as parks or other urban greenspaces, adding 'corridor' to provide passage between nesting and food sites

- Plant with species diversity in mind. According to the Iowa DNR, this diversity includes a height disparity between the plants used in the landscape. Canopy trees that can be good for pollinators in Iowa are species of oak, maple, and hackberry. Some mid-story trees for pollinators are serviceberry, cherry, crabapple, magnolia, and redbud
- Encourage best management practices for home gardening, to include leaving space between rows for bee nests
- Incorporate pollinator-friendly plants into fringe areas to maximize pollinator benefits
- Consider when it is safe to keep stags (dead but not yet fallen trees). Stags are nature's coincidental remedy for bees needing to rest and hibernate

Figure 1



LEGEND

 DES MOINES PARK BUFFERS

 DES MOINES PARKS

DATA FROM CITY OF DES MOINES GIS DATA

RESILIENCY AND TREES

Urban forest resilience is the capacity of a system to endure stress and still be able to perform and also the capacity to recover after a catastrophe. The tree canopy in Des Moines will gain resilience if the City is vigilant in making correct species choices and planting to match or exceed tree losses.

Climate Change Patterns

An upsurge in extreme weather events will likely increase the frequency of flooding, heat waves, and drought. It is important to clarify the degree of resiliency of Des Moines' urban forest. This task must assume high priority as the DNR reports a decrease of average annual tree growth, and an increase in average annual tree mortality. We should consider where a species currently lives and map the geographic shift of that environment under climate change. We should also consider insects, pathogens, or invasive species that might invade that area. This chapter provides an assessment of the vulnerability of select tree species within the Des Moines urban forest based upon particular pests and pathogens of concern in light of climate change.

Changing Species as Climate Changes

The two most determinant factors concerning which type of biome will manifest in a given area are temperature and rainfall. Particular to the subject of forest resilience, is the presence and severity of pests and pathogens. This resiliency chapter describes the risk of the Asian longhorned beetle, the pine shoot beetle, bur oak blight, anthracnose, and white pine blister rust, while assessing how these factors may be exacerbated by the projected climate change. It is essential to parallel the potential influence of the stressing agents alongside the climate shifts themselves. The City's TreeKeeper8 tree inventory provided tree species and quantity information to measure the degree to which the urban tree canopy would be altered if they were no longer present. The decision table is provided as Table 1 on page 21.

The species of greatest concern in the Des Moines forest include hackberry, bur oak, black and sugar maple, silver maple and eastern white pine. The top three Des Moines neighborhoods containing the greatest concentration of problem species are Union Park, Waveland Park and



Resiliency results from species diversity

Woods, and Downtown Des Moines. It is a priority that community support be drawn toward these issues. Forest management plans can be comprehensive, but often lack funding.

Summary

Climate change is going to cause some of our present native tree species to disappear. The City is losing ash trees to emerald ash borer. Other native species are threatened due to climate change. These include maples, pines, hackberry and bur oak.

RECOMMENDATIONS

- Increase new tree planting to anticipate future tree losses to climate change
- Ensure diverse species are planted. Avoid planting the most vulnerable species such as maple and pine, and reduce plantings of hackberry and bur oak
- Plant ‘all’ species while ensuring that the mix includes hybrid elm, bald cypress, black gum, sycamore, pecan, Persian ironwood, and oak in the white oak family (white, bur, swamp white). Additionally, beech and magnolia trees may benefit from climate change
- Develop a cyclical pruning program to foster good health and structure on existing trees
- Actively manage insects and disease. Preventing losses in the current tree canopy will help to mitigate the future loss of trees to climate change
- Stimulate community support for trees. Increased planting by private property owners can offset future losses. Also, increased education and vigilance may help to deter losses to insects or disease

NUMBER OF TREES IN DES MOINES	STRESSOR	BUR OAK BLIGHT	ANTHRACNOSE	WINTER DESICCATION	WHITE PINE BLISTER RUST	PINE SHOOT BEETLE	ASIAN LONGHORNED BEETLE
	HOSTS						
1415	BUR OAK	YES	YES	NO	NO	NO	NO
3000	HACKBERRY	NO	YES	NO	NO	NO	YES
900	EASTERN WHITE PINE	NO	NO	YES	YES	YES	NO
336	AMERICAN ELM	NO	NO	NO	NO	NO	YES
336	NORTHERN RED OAK	NO	YES	NO	NO	NO	NO
726	WHITE OAK	NO	YES	NO	NO	NO	NO
1103	AMERICAN SYCAMORE	NO	YES	NO	NO	NO	NO
2086	BLACK & SUGAR MAPLE	NO	YES	NO	NO	NO	YES
1189	RED MAPLE	NO	YES	NO	NO	NO	YES
1125	SILVER MAPLE	NO	YES	YES	NO	NO	YES
206	RIVER BIRCH	NO	NO	YES	NO	NO	YES

Table 1. Decision table, considering the number of vulnerable hosts and overlapping stressors

BIG TREES IN THE CITY

‘Old’ refers to trees that are anywhere from 150 years to many centuries old. Age more than size, makes these big trees vital to the forests they call home. Big, old trees are not simply enlarged versions of young trees. Big old trees have a significant impact on the health of ecosystems. An ecosystem is all of the plants, insects, and wildlife (all of the living things) that interact with all of the physical non-living things (soil, water, air, sunlight) that together create the environment that produces the ecosystem services on which we as humans are totally dependent. Trees are significant components of wildlife change. They link urban areas and the wilderness, allowing species to move between the two. Trees influence the growing conditions around them – from improving soil and raising soil moisture content, to offering shade and protection.

In urban areas trees are one of the most aesthetically appealing ways to absorb unwanted particulates to enhance a community’s respiratory health, and contribute to a city’s clean air requirements. Trees remove pollutants by absorbing them through the pores in the leaf

surface. Particulates are trapped and filtered by leaves, stems and twigs, and washed to the ground by rainfall keeping the particulates out of the air. Figure 1 at right shows that in general, air quality in Polk County is good. Trees help greatly in reducing the potential effects of poor air quality.

Big trees are also essential to the city to help mitigate heat buildup. Much of the greenhouse effect is caused by carbon dioxide. Trees remove carbon and store it while releasing oxygen. Large-stature trees bring energy savings as natural air conditioners offering up to \$250 of energy saving per year.

A healthy forest is an essential element of the health of residents. Access to trees and green spaces promotes physical activity and impacts moods and emotions. Urban vegetation slows heartbeats, lowers blood pressure, and relaxes brain wave patterns.

The bigger the trees the more effect they have on stormwater management. Trees and forests capture and store rainfall in the canopy. Tree roots and leaf litter promote the infiltration of rainwater into the soil which helps replenish our

NAAQS CRITERIA AIR POLLUTANTS		POLK COUNTY MEASURES 2017	
OZONE (PPM)	0.07	0.059	UNDER CRITERIA, TRENDING DOWN
PM2.5 (MG/M3)	12	7.4	UNDER CRITERIA, TRENDING DOWN
SULFUR DIOXIDE (PPB)	75	1	UNDER CRITERIA, TRENDING DOWN
NITROGEN DIOXIDE (PPB)	100	36	UNDER CRITERIA, TRENDING DOWN
CARBON MONOXIDE (PPM)	9	1	UNDER CRITERIA, STABLE

Figure 1. Polk County exceeds standards

groundwater supply. Trees and forests take up pollutants from soils and water and transform them into less harmful substances. Big trees provide exponentially greater benefits due to width and depth of canopy and the deep root system. Big trees are crucial to many aspects of life and should be protected.

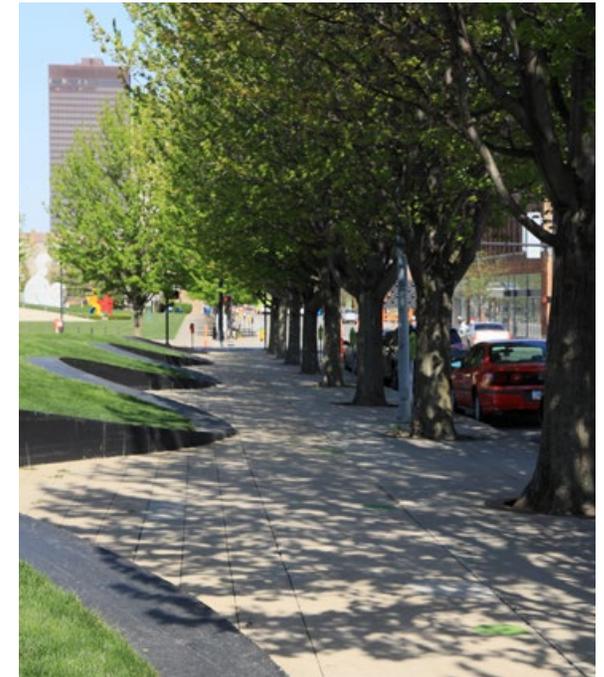
Summary

Bigger trees mean bigger benefits, including stormwater management, CO2 reduction,

Participants at the 2012 Des Moines Community Forest Workshop assigned dollar values to the annual eco-benefits of trees in Des Moines



Large trees downtown redirect rainwater



cooling, and noise reduction. As trees get larger, their benefits become more noticeable. Large trees help reduce the severity of a flood or storm event. They also help catch pollutants before they cause damage to the ecosystem. Trees have an impact in reducing atmospheric carbon dioxide by sequestering CO₂ in their roots, trunks, stems and leaves while they are growing and in wood products after they are harvested. Trees can reduce heating and air conditioning demands, reducing emissions associated with electricity

production. Trees can be used as a sound and wind barrier in order to reduce unwanted noise. A lot of positive benefits are associated with these large “beacons of hope”, so we must ensure that we encourage the growth of these large trees and manage them to lengthen their service lifetime and prolong the many benefits that they provide.

RECOMMENDATIONS

- Invest in maintenance of existing trees to promote longevity and good health

(the City has begun to add crews and equipment to restore a cyclical pruning program lost to budget cuts during previous decades)

- Plan proactive treatment for known diseases and insects to prolong the life of trees
- Educate residents on the need to prolong the life of private trees through timely professional maintenance
- Celebrate older ‘big’ trees

INSECTS, DISEASE AND INVASIVE PLANTS

Forest health is a description of the overall condition and vigor of trees in the urban forest. Many factors affect forest health including weather, animal depredation, and human activities. All forest health issues fall into two categories: native and non-native. In general, native insects and pathogens help recycle trees as a natural part of the lifecycle. Non-native insects, diseases, and plants on the other hand can devastate whole tree species, because local trees have no natural defenses against foreign invaders.

Non-Native Pests and Diseases in Iowa

Gypsy Moth Found: Eastern Iowa counties, 2018. Hosts: Hardwoods (96% of Des Moines street and park trees). Management Solution: Promote the growth of healthy trees, species diversity, monitoring, mating disruption or chemical control.

White Pine Blister Rust Found outside of Polk County. Host: white pine (2% of Des Moines street and park trees). Management Solution: removal of alternate hosts, removal of branches with cankers and fungicide.

Pine Shoot Beetle Found: Dubuque and

Scott Counties. Host: all pines (3% of Des Moines street and park trees). Management Solution: sanitation, insecticide.

Emerald Ash Borer Found: Polk County, 2017. Host: All Ash species (10% of Des Moines street and park trees). Management Solution: Increase diversity, preserving genetics of those not affected, treatment or removal of ash.

Emerging Non-Native Pests and Diseases inside and outside of Iowa

Asian Long-horned Beetle Host: Maple, horsechestnut/buckeye, willow, elm, birch, and sycamore (25% of Des Moines street and park trees). Management Solution: Species diversity, tree removal in known areas.

Oak Wilt Found: Statewide including Polk and Warren Counties. Host: all oak (13% of Des Moines street and park trees). Management Solution: prune oaks in winter only, paint cuts when branches must be pruned outside of winter dormant season, tree removal, root trenching and fungicide treatment.

Sudden Oak Death Found: Potentially shipped to Iowa on nursery plants from out of state

but not yet found. Host: All oaks (13% of Des Moines street and park trees). Management Solution: preventing spread and monitoring.

Thousand Cankers Disease Host: Walnut (2% of Des Moines street and park trees). Management Solution: maintaining healthy trees and monitoring.

Native Pests and Diseases in Iowa

Armillaria Root Disease Found: Polk and Warren Counties. Host: Hardwoods and Conifers (100% of Des Moines street and park trees). Management Solution: maintaining healthy trees.

Bur Oak Blight Found: in Polk and Warren Counties. Host: Bur oak and Swamp White Oak (8% of Des Moines street and park trees). Management Solution: tree species diversity and fungicide treatment.

Forest Tent Caterpillar Found: Allamakee, Winneshiek, Howard, Chickasaw, Fayette, Clayton, and Delaware Counties. Host: Hardwoods (96% of Des Moines street and park trees). Management Solution: egg mass removal, larvae removal, tree bands and insecticide.

Heterobasidion root disease Found: Lucas and Van Buren Counties. Host: Conifers (4% of Des Moines street and park trees).



8,000 public ash trees and 10,000 private ash trees will be lost to the emerald ash borer insect over the next decade. This ash tree was posted for removal in 2020 in the Southwestern Hills Neighborhood

Management Solution: reduce wounding, change thinning practices and species diversity

aggressively out-compete native forest species and threaten long-term forest sustainability and biodiversity.

Invasive Plants

Invasive species are non-native and are likely to cause economic or environmental harm. They

Wildlife Depredation

Wildlife browsing can negatively impact

individual trees and the species composition of our community forests. Wildlife can also impact vegetation by moving parasites and invasive plant seeds.

SUMMARY

- Proper management to protect our forests against pests may include various methods to prevent, eradicate, manage or restore impacted sites
- Practices could include maintaining species diversity, monitoring, slowing spread, treatment, mechanical removal and/or chemical treatment of invasive trees and plants, and reforestation
- Des Moines trees have been inventoried and the number of each species at risk has been charted

RECOMMENDATIONS

- Ramp up planting efforts to replace ash lost to emerald ash borer and to hedge against future losses
- Plant for diversity so the City has many species to defend against future losses
- Continue to proactively remove ash trees so there are no standing dead trees endangering residents





2020 SUSTAINABILITY REPORT CARD

What does it mean for the City to have a sustainable urban tree canopy? Des Moines, like many organizations, employs the definition of sustainability developed by the Brundtland Commission, 1987, as follows: “Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs”. Accepting this as our basic understanding of

sustainability, then, attention must be paid to the balance needed between ecological integrity, economic sustainability, and social vitality. Together these are often referred to as the three-legged stool of sustainability. One at the expense of the other will result in a failed sustainability model. There will be diversity of tree species suited to their site conditions and resistant to insects and disease (ecological); tree maintenance levels

are low (economical); and residents are happy with their trees (social). With this in mind, the following 2020 Sustainability Report Card has been developed to show how Des Moines measures up. This low-medium-high scorecard was largely developed by James Clark’s Model of Urban Forest Sustainability, by Andy Kenney’s Criteria and Indicators for Strategic Urban Forest Planning and Management (2011), and by Davey Resource Group (the company that performed the citywide tree inventory in 2017).

INDICATORS OF A SUSTAINABLE URBAN FOREST IN DES MOINES	OVERALL OBJECTIVE OR INDUSTRY STANDARD	PERFORMANCE LEVELS AND CRITERIA			DES MOINES 08/01/2020
		LOW	MODERATE	GOOD	
URBAN TREE CANOPY	Achieve the desired tree canopy cover according to goals set for the entire City and neighborhoods. Alternatively, achieve 75% of the total canopy possible for the entire City and in each neighborhood.	Canopy is decreasing and/or no canopy goals have been set.	Canopy is not dropping, but not on a trajectory to achieve the DNR-established goal of 3% canopy increase by 2045.	Canopy goal is achieved, or well on the way to achievement.	Des Moines canopy cover is 29%. Meeting the current DNR canopy increase goal of 3% will require quintupling the planting budget.
LOCATION OF CANOPY (EQUITABLE DISTRIBUTION)	Achieve low variation between tree canopy and equity factors citywide by neighborhood. Ensure that the benefits of tree canopy are available to all, especially for those most affected by these benefits.	Tree planting and public outreach and education is not determined by tree canopy cover or benefits.	Tree planting and public outreach and education is focused on neighborhoods with low tree canopy	Tree planting and public outreach and education is focused in neighborhoods with low tree canopy and a high need for tree benefits.	The City is committed to planting in underserved areas needing a high degree of tree benefits until equity is reached.
AGE OF TREES (SIZE AND AGE DISTRIBUTION)	Establish a diverse-aged population of public trees across the entire city and for each neighborhood. Ideal standard: • 0-8” DBH: 40% • 9-17” DBH: 30% • 18-24” DBH: 20% • over 24” DBH: 10%	Age distribution is not proportionately distributed across size classes at the city level.	Age distribution is evenly distributed at city level, though unevenly distributed at the neighborhood level.	Age distribution is generally aligned with the ideal standard diameter classes at the neighborhood level.	Generally aligned with ideal age distribution: 37% 0-8”; 28% 9-17”; 15% 18-24”; 20% 24”+.

INDICATORS	OVERALL OBJECTIVE OR INDUSTRY STANDARD	PERFORMANCE LEVELS AND CRITERIA			DES MOINES 08/01/2020
		LOW	MODERATE	GOOD	
CONDITION OF PUBLICLY OWNED NATURAL AREAS (TREES MANAGED EXTENSIVELY)	Possess a detailed understanding of the ecological structure and function of all publicly-owned natural areas (such as woodlands, ravines, stream corridors, etc.), As well as usage patterns.	No current information is available on tree condition or risk.	Publicly-owned natural areas are identified in a sample-based "natural areas survey" or similar data.	Information from a current, GIS-based, 100% complete natural areas survey is utilized to document ecological structure and function, as well as usage patterns.	Possess GLO survey (1930's) plus a natural resources inventory (2012), plus a sample DNR stewardship plan upon which plans and activities are based. Able to account for crop trees, burns, snags and dens.
TREES ON PRIVATE PROPERTY	Possess a solid understanding of the extent, location and general condition of trees on private lands	No data are available on private trees.	Current tree canopy assessment reflects basic information (location) of both public and private canopy combined.	Detailed information available on private trees. Ex. Bottom-up sample-based assessment of trees.	The City knows where there are pockets of oak. The City took sampling data on private ash ownership.
DIVERSITY	Establish a genetically diverse population of publicly-owned trees across the entire city and for each neighborhood. Tree populations should be comprised of no more than 30% of any family, 20% of any genus, or 10% of any species.	Fewer than five species dominate the entire tree population citywide	No species represents more than 20% of the entire tree population citywide.	No species represents more than 10% of the entire tree population citywide.	2 Species over 10%. Maple 17%; Oak 13%
SUITABILITY	Establish a tree population suited to the urban environment and adapted to the overall region. Suitable species are gauged by exposure to imminent threats, considering the "right tree for the right place" concept and invasive species.	Less than 50% of trees are considered suitable for the site.	50% To 75% of trees are considered suitable for the site.	More than 75% of trees are considered suitable for the site.	Right Tree, Right Place is the standard used. More than 75% of trees are suitable for their site.
NEIGHBORHOOD ACTION	Residents understand, cooperate, and participate in urban forest management at the neighborhood level. Urban forestry is a neighborhood-scale issue.	Little or no resident involvement or neighborhood action.	Some active groups are engaged in advancing urban forestry activity, but with no unified set of goals or priorities.	The majority of all neighborhoods are organized, connected, and working towards a unified set of goals and priorities.	Some neighborhoods have trees included in their official neighborhood plans. Each has unique goals but all steer toward a common goal.

INDICATORS	OVERALL OBJECTIVE OR INDUSTRY STANDARD	PERFORMANCE LEVELS AND CRITERIA			DES MOINES 08/01/2020
		LOW	MODERATE	GOOD	
LARGE PRIVATE & INSTITUTIONAL LANDHOLDER INVOLVEMENT	Large, private, and institutional landholders embrace citywide goals and objectives through targeted resource management plans.	Large private landholders are unaware of issues and potential influence in the urban forest. No large private land management plans are currently in place.	Aware of issues and potential influence in the urban forest. No large private land management plans are currently in place. Education materials and advice is available to large private landholders. Few large private landholders or institutions have management plans in place.	Clear and concise goals are established for large private landholders through direct education and assistance programs. Key landholders and institutions have management plans in place.	Key landowners have or are making tree canopy plans. Drake University is a Tree Campus USA.
GREEN INDUSTRY INVOLVEMENT	The green industry works together to advance citywide urban forest goals and objectives. The City and its partners capitalize on local green industry expertise and innovation.	Little or no involvement from green industry leaders to advance local urban forest goals.	Some partnerships are in place to advance local urban forest goals, but more often for the short-term.	Long-term committed partnerships are working to advance local urban forest goals.	Typically, it is contract work that brings the City and green industry together for the short-term.
CITY DEPARTMENTS AND AGENCIES	All City departments and agencies cooperate to advance citywide urban forest goals and objectives.	Conflicting goals and/or actions among City departments and agencies.	Informal teams among departments and agencies are communicating and implementing common goals on a project-specific basis.	Common goals and collaboration occur across all departments and agencies. City policy and actions are implemented by formal interdepartmental and interagency working teams on all City projects.	Public Works Forestry works with Engineering, Community Development, and Parks and Recreation to align urban tree canopy goals of tree protection and increased planting. Committed to alignment with the tomorrow plan.
FUNDER ENGAGEMENT	Local funders are engaged and invested in urban forest initiatives. Funding is adequate to implement citywide urban forest management plan.	Little or no funders are engaged in urban forest initiatives.	Funders are engaged in urban forest initiatives at minimal levels for short-term projects.	Multiple funders are fully engaged and active in urban forest initiatives for short-term projects and long-term goals.	Tree Des Moines raised money to complete the tree inventory. Trees Forever is a long-term partner engaged in promotion, planting, and fundraising.
UTILITY ENGAGEMENT	All utilities are aware of and vested in the urban forest and cooperate to advance citywide urban forest goals and objectives.	Utilities and City agencies act independently of urban forest efforts. No coordination exists.	Utilities and City agencies have engaged in dialogues about urban forestry efforts with respect to capital improvement and infrastructure projects.	Utilities, City agencies, and other stakeholders integrate and collaborate on all urban forestry efforts, including planning, site work, and outreach/education.	MidAmerican Energy, Des Moines Water Works, and cellular/cable providers collaborate on planning and site work. MidAmerican Energy and Des Moines Water Works represent City messaging to their clients.

INDICATORS	OVERALL OBJECTIVE OR INDUSTRY STANDARD	PERFORMANCE LEVELS AND CRITERIA			DES MOINES 08/01/2020
		LOW	MODERATE	GOOD	
DEVELOPER ENGAGEMENT	The development community is aware of and vested in the urban forest and cooperates to advance citywide urban forest goals and objectives.	Little or no cooperation from developers in (or awareness of) municipality-wide urban forest goals and objectives.	Some cooperation from developers and general awareness and acceptance of municipality-wide goals and objectives.	Specific collaborative arrangements across developer community in support of municipality-wide goals and objectives.	Whether by effect of ordinance or by developer initiative, the developer community accomplishes the tree protection and tree planting goals of the City.
PUBLIC AWARENESS	The general public understands the benefits of trees and advocates for the role and importance of the urban forest.	Trees are generally seen as a nuisance, and thus, a drain on City budgets and personal paychecks.	Trees are generally recognized as important and beneficial.	Trees are seen as valuable infrastructure and vital to the community's well-being. The urban forest is recognized for the unique environmental, economic, and social services it provides to the community.	The benefits of trees are expressed routinely and the public has embraced both the need for, and the desire to have, a healthy urban tree canopy.
REGIONAL COLLABORATION	Neighboring communities and regional groups are actively cooperating and interacting to advance the region's stake in the City's urban forest.	Little or no interaction between neighboring communities and regional groups.	Neighboring communities and regional groups share similar goals and policy vehicles related to trees and the urban forest.	Communities and regional groups share similar goals and policy vehicles related to trees and the urban forest. Regional urban forest planning, coordination, and management is widespread.	The Tomorrow Plan and the Capital Crossroads documents promote shared urban tree canopy goals. Metro municipal forestry leaders meet regularly to discuss and plan urban forest strategies.
TREE INVENTORY	Comprehensive, GIS-based, current inventory of all intensively-managed public trees to guide management, with mechanisms in place to keep data current and available for use. Data allow for analysis of age distribution, condition, risk, diversity, and suitability.	No inventory or out-of-date inventory of publicly-owned trees.	Partial or sample-based inventory of publicly-owned trees, inconsistently updated.	Complete, GIS-based inventory of publicly-owned trees, updated on a regular, systematic basis.	Completed in 2017 by Davey Resource Group. Management actions are updated daily. Plans to update entire inventory 1/5th at a time on 5-year cycle.
CANOPY ASSESSMENT	Accurate, high-resolution, and recent assessment of existing and potential citywide tree canopy cover that is regularly updated and available for use across various departments, agencies, and/ or disciplines.	No tree canopy assessment.	Sample-based canopy cover assessment, or dated (over 10 years old) high-resolution canopy assessment.	High-resolution tree canopy assessment using aerial photographs or satellite imagery.	Urban tree canopy (UTC) assessment completed in 2009 and updated in 2014 (US Forest Service and University of Vermont)

INDICATORS	OVERALL OBJECTIVE OR INDUSTRY STANDARD	PERFORMANCE LEVELS AND CRITERIA			DES MOINES 08/01/2020
		LOW	MODERATE	GOOD	
MANAGEMENT PLAN	Existence and buy-in of a comprehensive urban forest management plan to achieve citywide goals. Re-evaluation is conducted every 5 to 10 years.	No urban forest management plan exists.	A plan for the publicly-owned forest resource exists but is limited in scope, acceptance, and implementation.	A comprehensive plan for the publicly owned forest resource exists and is accepted and implemented.	Urban Forest Master Plan completed in 2020, including a management plan with benchmarks for accomplishment.
RISK MANAGEMENT PROGRAM	All publicly-owned trees are managed for maximum public safety by way of maintaining a citywide inventory, conducting proactive annual inspections, and eliminating hazards within a set timeframe based on risk level. Risk management program is outlined in the management plan.	Request-based, reactive system. The condition of publicly-owned trees is unknown.	There is some degree of risk abatement for publicly-owned trees, but risk is still managed on a request-based reactive system.	There is a complete tree inventory with risk assessment data and a risk abatement program in effect. Hazards are eliminated within a set time period depending on the level of risk.	The TK8 inventory includes a risk assessment. Forestry Division works proactively to eliminate or mitigate hazards.
MAINTENANCE PROGRAM OF PUBLICLY-OWNED TREES (TREES MANAGED INTENSIVELY)	All intensively-managed, publicly-owned trees are well maintained for optimal health and condition in order to extend longevity and maximize benefits. A reasonable cyclical pruning program is in place, generally targeting 5-7 year cycles. The maintenance program is outlined in the management plan.	Request-based, reactive system. Little-to-no systematic pruning program is in place for publicly-owned trees.	All publicly-owned trees are systematically maintained, but pruning cycle is inadequate.	All publicly-owned trees are proactively and systematically maintained and adequately pruned on a cyclical basis.	Hiring first of three two-person pruning crews in 2020 to initiate a 7-year cyclical pruning rotation.
TREE PROTECTION POLICY	Comprehensive and regularly updated tree protection ordinance with enforcement ability is based on community goals. The benefits derived from trees on public and private property are ensured by the enforcement of existing policies.	No tree protection policy.	Policies are in place to protect trees, but the policies are not well-enforced or ineffective.	Protection policies ensure the safety of trees on public and private land. The policies are enforced and supported by significant deterrents and shared ownership of City goals.	City Forester and Engineering Department co-designed robust tree protection standards. Enforced.
CITY STAFFING AND EQUIPMENT	Adequate staff and access to the equipment and vehicles needed to implement the management plan. A high-level urban forester or planning professional, strong operations staff, and solid ISA Certified Arborist technicians.	Insufficient staffing levels, insufficiently-trained staff, and/ or inadequate equipment and vehicle availability	ISA Certified Arborists and professional urban foresters on staff have some professional development but are lacking adequate staff levels or adequate equipment.	Multi-disciplinary team within the urban forestry unit, including an urban forest professional, operations manager, and Arborist technicians. Vehicles and equipment are sufficient to complete required work.	The City Forester, Urban Forestry Project Manager, and Forestry Section Chief are all ISA Certified and Tree Risk Assessment Qualified (TRAQ). 8 of 11 Arborists are ISA-Certified. The hiring standard for Arborists is they must have ISA certification. All vehicles will be current within two years.

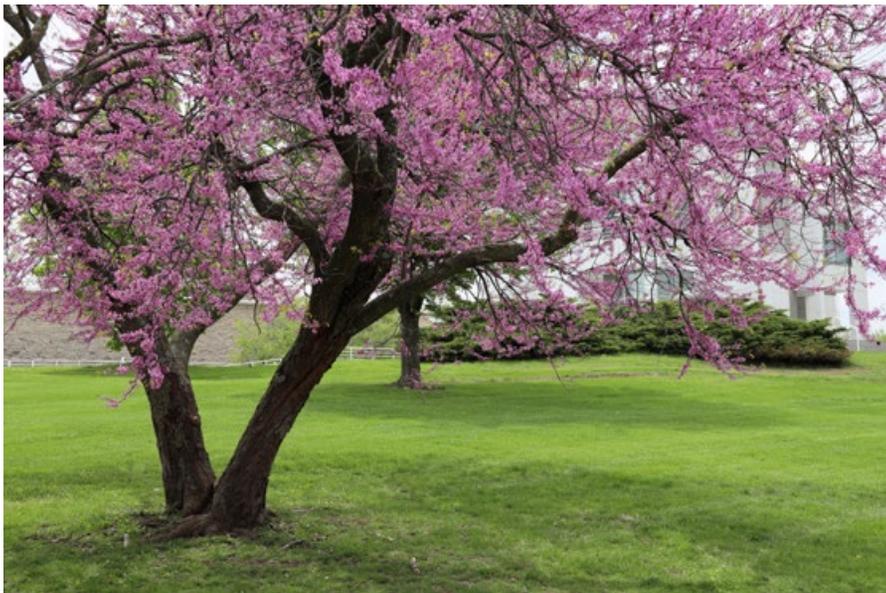
INDICATORS	OVERALL OBJECTIVE OR INDUSTRY STANDARD	PERFORMANCE LEVELS AND CRITERIA			DES MOINES 08/01/2020
		LOW	MODERATE	GOOD	
FUNDING	Appropriate funding in place to fully implement both proactive and reactive needs based on a comprehensive Urban Forest Management Plan.	Funding comes from the public sector only and covers only reactive work.	Funding levels (public and private) generally cover mostly reactive work. Low levels of risk management and planting in place.	Dynamic, active funding from engaged private partners and adequate public funding are used to proactively manage and expand the urban forest.	Adequate funding in place for perpetual maintenance as well as hazard mitigation. Seek to boost planting by budget increase and nonprofit fundraising.
DISASTER PREPAREDNESS & RESPONSE	A disaster management plan is in place related to the City's urban forest. The plan includes staff roles, contracts, response priorities, debris management, and a crisis communication plan. Staff are regularly trained and/or updated.	No disaster response plan is in place.	A disaster plan is in place, but pieces are missing and/or staff are not regularly trained or updated.	A robust disaster management plan is in place, regularly updated and staff is fully trained on roles and processes.	Forestry Division has a local disaster management plan. They will also adhere to the County disaster plan as needed for wide-scale events.
COMMUNICATION	Effective avenues of two-way communication exist between the City departments and between the City and its residents. Messaging is consistent and coordinated, when feasible	No avenues are in place. City departments and public determine on an ad-hoc basis the best messages and avenues to communicate.	Avenues are in place but used sporadically and without coordination or only on a one-way basis.	Avenues are in place for two-way communication, are well-used with targeted, coordinated messages.	Communications are excellent. Public Works has dedicated expertise from the Communications Office to design and launch media, as well as effectively respond to major issues. Tiny Trees (DSM.city/tinytrees) is an example.

The City of Des Moines Enjoys a Sustainable Urban Forest

This 6-page Sustainability Report Card combines two critical elements: 1) The computerized tree inventory. The data indicates fully 91% of the public trees are in Fair to Excellent Condition. This reported tree condition comes as a pleasant surprise. Prior to the inventorying of key tree health data, there was no way to accurately assess the condition of the tree canopy. Now we know, and the news is positive. 2) The excellent performance record of the Public Works Forestry Division. This group of trained individuals

manages a high-efficiency tree maintenance operation year-round, including their strong reactive efforts to mitigate damage during and after major wind storms. Combined, these two elements conclude that the current tree canopy is being managed in a sustainable way. This linkage of environmental, economic and social factors complete the sustainability picture. Two missing elements required to advance the program are more trees and a cyclical pruning program. First, to meet the 3% tree canopy increase goal, the City needs to plant 3800 new trees per year. Currently 500-700 are planted annually. The planting budget

needs to increase to \$1 million annually to meet the 3% goal. The City must quadruple funds in the City Tree Replacement Fund to \$800,000, and look to the nonprofit Trees Forever to contribute \$200,000 through outside fundraising. Second, the City has not had a cyclical pruning program for a few decades, primarily due to staff cutbacks. It is estimated that three additional two-person crews with necessary trucks and equipment will be able to achieve this goal. The first such two-person crew will be hired in 2020.





LARGE LANDOWNERS

Working cooperatively with the largest landowners in Des Moines, the City can make big strides in implementing the UFMP with effective outreach to just a few stakeholders. Total acreage, percent cover estimates, and overall canopy cover estimates per land parcel were gathered. This knowledge will allow City officials to have a better understanding of how to encourage expansion of tree canopy cover. The purpose of the study was to encourage alignment with the Iowa Department of Natural Resource mandate to add 3% to the urban forest canopy by 2045.

About the City

The City of Des Moines spans 58,000 acres with 57,000 acres of land and the rest, water. Tree canopy covers 17,000 acres (29% tree canopy). The percent contribution to this canopy made by large landowners (Figure 1.) was established within each of their property lines.

Des Moines Water Works

Des Moines Water Works (DMWW) provides water and maintains water distribution lines. It offers resources about

pollution prevention, water conservation, and emergency preparedness. Water Works Park is 1,600 acres with a tree cover of 961 acres. They did not share their current management plan with the authors, so follow-up is necessary. DMWW is the largest non-City landowner within the footprint of Des Moines.

Grandview University

Grandview University is privately-owned and sits on 100 acres of land with a tree cover of 10.8 acres. Grandview does not have any public plans detailing their forest management or efforts to mitigate their environmental impact.

Des Moines Area Community College

The Des Moines Area Community College (DMACC) has plans for inclusion of green infrastructure. Campuses do not have much green space as they are surrounded by buildings. The total land area of Urban Campus and Mercy Center is around 58 acres with a tree cover of 5.7 acres. A team of arborists and maintenance personnel

TREE COVER PERCENTAGE			
LANDOWNER	TOTAL ACREAGE	% TREE COVER	CANOPY
DMACC URBAN	58 AC	9.9%	5.7 AC
DRAKE UNIVERSITY	307 AC	21.3%	65 AC
GRANDVIEW UNIVERSITY	100 AC	10.8%	10.8 AC
DM PUBLIC SCHOOLS	329 AC	14%	46 AC
WRA	268 AC	7%	18.8 AC
DMWW	1601 AC	60%	960.6 AC

Figure 1. Large landowner tree cover

care for their grounds but they did not provide any forest master plan.

Wastewater Reclamation Authority

The Des Moines Metropolitan Wastewater Reclamation Authority (WRA) plans to reduce electrical and natural gas usage, increase biogas production and use, and increase on-site electrical generation. The WRA covers 268 acres with a tree cover of 18.8 acres. They have many structures thus expansion of forested areas is unlikely. The WRA did not share a plan but they do have



This sculpture, 'River Constellation', at Des Moines Water Works Park has majestic cottonwoods and pines as a backdrop

tree loss mitigation strategies throughout their multi-city network.

Drake University

Drake University is a private university with a goal of reaching carbon neutrality by 2050. Drake has a land area of 307 acres with a tree cover of 65 acres. Drake is a Tree Campus USA as recognized by the National Arbor Day Foundation.

Des Moines Public Schools

The Des Moines Public School District consists of sixty schools. Fifty-seven have Energy Star designation. The total land area is 329 acres, with a tree cover of 46 acres. They do not have a forest management plan but they do hire qualified Arborists to care for trees.

Summary

Information about large landowners was gathered to promote and coordinate tree management and urban forest plans. Cross-boundary management requires voluntary participation. Large landowners hold the responsibility of utilizing their lands wisely. Participation should establish a cohesive plan for the future. By responding to cooperative and sustainable initiatives, organizations are better equipped to respond to climate change.

RECOMMENDATIONS

- Continue dialogue with, and provide education to, large landowners inside City limits
- Together establish benchmarks for each entity to help Des Moines increase tree canopy by 3%
- Connect TreeKeeper Volunteers with planting projects for each landowner partner
- Provide public education on the benefits of increasing canopy on large tracts of land

REGIONAL COOPERATION

Cooperation on urban forest goals in the Des Moines metro area is important. A Community Forest Workshop in 2012 was a catalyst for encouraging regional cooperation. In 2018 metro urban forest managers began meeting to discover elements common to all and learn what was unique about forest work in each community. This ongoing initiative plans to make cooperation regarding the urban tree canopy an accepted practice across the entire DM metro area.

Cooperation in the Metro Area

The Tomorrow Plan, a blueprint for the sustainable development of the Greater Des Moines region over the next 40 years, includes the 17 communities represented on the next page.

If efforts to improve urban forestry services can be coordinated among all these partners, the results will be formidable. Together their efforts will help to meet The Tomorrow Plan’s following cooperative strategy: “Ever mindful of future generations, our mission is to cooperate across political boundaries to achieve social, economic and environmental resilience in Greater Des Moines.”

Benefits of a Cooperative Approach

A cooperative approach makes sense concerning the urban tree canopy for multiple reasons. More can be accomplished by the effort of a committed group of partners than by individual entities working alone. Each partner brings varied attributes, ideas, concerns and issues to the interaction, providing opportunities to learn from each other. Cooperation will also undoubtedly result in savings of valuable resources.

Current Urban Forestry Cooperation

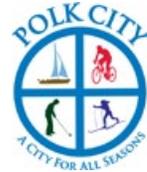
In June 2019, a survey about Metro Urban Forestry Cooperation was emailed to City personnel responsible for forests in the 17 metro communities, as well as to Polk County, Trees Forever, MidAmerican Energy, and the Iowa DNR. The purpose of the survey was to gauge the amount of current interest across the metro communities for cooperation around forest issues. Twelve potential areas of cooperation were listed in the survey and respondents provided their degree of interest on a five-point scale from Strongly Agree to Strongly Disagree (Figure 1).

TOPIC	STRONGLY AGREE OR AGREE
1. SINGLE THOUGHT AND NARRATIVE FOR TREES IN METRO	90%
2. TREE INVENTORIES	80%
3. WILDLIFE AND POLLINATOR CORRIDORS	100%
4. STORMWATER CONTROL	100%
5. RIPARIAN AREAS	100%
6. INVASIVE SPECIES CONTROL	100%
7. UTILITY CONTRACTORS	100%
8. BULK BIDDING/PURCHASING	70%
9. CANOPY COVER GOAL	90%
10. URBAN WOOD UTILIZATION	70%
11. TRAINING, WORKSHOPS, CERTIFICATION	100%
12. DISASTER RECOVERY	90%

Figure 1. Regional Opinion

Animals, fish and birds do not stop at municipal borders. Neither do creeks and rivers. Riparian areas dissect communities. If communities can agree on the best use of trees to assist in achieving common goals all these areas of interest may benefit. Multi-community efforts will also more effectively control invasives and deal with insects and disease more efficiently. Economic benefits might include sharing tree inventory software, inventory gathering

THE SEVENTEEN CITIES IN THE TOMORROW PLAN



services, and bulk bidding and purchasing of trees for planting and tools for maintenance.

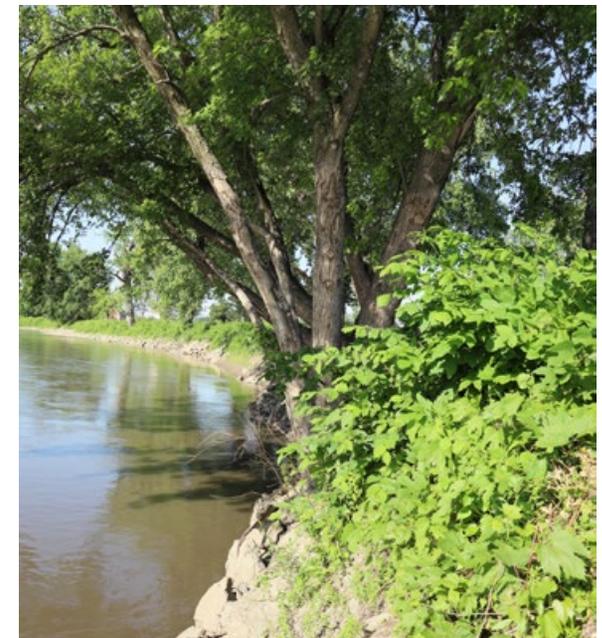
SUMMARY

- The 2012 Community Forest Workshop showed there is interest in cooperating on urban forest initiatives
- That willingness to cooperate has found expression recently through a quarterly meeting of metro urban forest managers
- Each cooperating community has its own demographics and unique challenges
- There also exist many similarities, and it is upon these that early cooperative efforts may take root and flourish
- There are many positive economic and

environmental reasons to engage in cooperative urban forest planning and management

RECOMMENDATIONS

- Pursue regional cooperation within the 17-community metro area
- Begin with initiatives most likely to result in successful outcomes
- Build on early successes to propel a robust cooperative effort
- Continue to rely on the nonprofit Trees Forever to be the neutral convener and catalyst for regional cooperation
- Develop and implement strategies to keep the cooperative initiative alive



Riparian borders between municipalities invite collaboration

URBAN WOOD UTILIZATION IN THE CITY

The City of Des Moines generates a lot of wood waste. This chapter will describe how tree removal in Des Moines generates wood waste, what disposal methods are currently used, and how implementing a modern urban wood utilization program can save money while helping the environment. Such a program will find new outlets to repurpose trees. Some of these trees have grown for decades or even centuries while enhancing the environment so they should be treated as a precious commodity. By diverting suitable tree parts to usable wood products, the City can become an example of sustainability and support local businesses while reducing the carbon footprint.

Demonstrating responsibility with a public natural resource like removed trees will build community support. A wood utilization program is focused on cost reduction and diversion of waste into something more environmentally conscientious.

Current Situation

Each year the City removes about 700 trees. The tree debris site makes use of a free wood chipping

service provided by Vermeer Corporation. This reduces trees into more manageable pieces. A significant volume of wood chips is produced which is not being creatively recycled. Currently wood chips are given to animal bedding companies or to a vendor in the mulch market. Putting all the trees into one pile and grinding everything into mulch is simple yet not sustainable since decaying mulch releases carbon back into the atmosphere. If the wood is turned into another wood product, the carbon remains locked up which will meet sustainability initiatives and reduce the demand for trees from rural forests.

Moving Forward

When discussing salvage options, knowledge of desirable material is helpful. Incorporating record-keeping can allow for better knowledge of trees that are cut down, the size, quality, and who may be interested in specific tree species. Options for urban tree utilization include the following: compost, mulch, firewood, saw logs, wood products and crafts. Most tree parts are suited for compost, mulch or firewood. A comprehensive

wood utilization program finds the highest use for all parts.

Turning some woody debris into compost is an option. Mulch is another option. Communication with other departments about availability is important, so it can save them from purchasing this material.

Firewood is another common product. The City could create a program that provides this firewood to individuals in need and a local nonprofit may be an option for providing volunteer labor to process firewood.

Ten to twenty percent of trees removed each year have logs of sufficient size and quality to be utilized for permanent wood products. By keeping the carbon sequestered in wood products, emissions are not increased. Using municipal urban wood helps local businesses, generating growth to the local economy. This also demonstrates responsible use of a public resource by a progressive city.

Potential Outlets

Loggers. Urban trees are often less desirable for loggers because they are costlier to remove and mill. If enough logs are available, loggers might remove the largest source of wood materials normally going to the tree dump.



Logs like this don't need to be wasted

Existing wood businesses. A few businesses already use urban wood. By creating a list of who to contact when specific sizes or species of trees are felled, businesses have the opportunity of using the trees for making their products.

RECOMMENDATIONS

- Change the name of the tree dump to something more environmentally friendly to help change attitudes and perceptions about tree removal



Turning waste material into furniture and other long-lasting products keeps carbon out of the atmosphere

- Educate City workers and the community about trees as a natural resource and how they can best be utilized after they are cut down and removed
- Use new wood reuse programs to move the City toward sustainability and environmental stewardship
- Learn from other municipalities across the country how their urban wood utilization programs came into existence and how they keep them going
- Plan for as many wood reuse options as possible to be flexible in choosing highest use based upon availability of stock or lack of space

VOLUNTEERISM, NONPROFITS AND TREES

A mix of people and organizations is needed to ensure a healthy future for our urban forest. It is important that programs are expanded to include support from nonprofit partners and volunteers. In this manner, the City can meet ambitious tree planting goals.

Trees Forever and Tree Des Moines are two nonprofits that partner with the City. Nonprofits have more latitude to apply for grants, raise private dollars, bring together community partners, and manage volunteers. Tree Des Moines helped the City complete its tree inventory. In addition, the City of Des Moines has worked closely with the nonprofit Trees Forever for nearly 30 years and now contracts with them to manage new tree plantings.

TreeKeepers

Since 2012, the City has partnered with Trees Forever to co-host the TreeKeepers program where volunteers are educated and empowered to care for trees and urban woodlands. Why TreeKeepers? Our urban forest is a valuable resource. A mature tree can provide \$3,790 in environmental and

economic value over its lifetime, a 250% return on investment. However, the urban environment is stressed because of poor soil conditions, too little space to grow, pollution, road salts, drought, over watering, improper pruning, insect damage, and more. Trees and native plants are being displaced by invasive species. There is simply not enough time or person-power for City employees to provide maintenance and to continue planting new trees, thus a community of caring tree stewards named TreeKeepers was implemented.

How Does The TreeKeepers Program Work?

TreeKeepers classes provide training in the areas of tree planting, young tree maintenance, invasive species removal, and urban forest advocacy. Volunteers who complete the program are certified TreeKeepers. Residents become the caretakers of their community's trees and woodlands which will result in a more sustainable Des Moines.

TreeKeeper Volunteer and Program Accomplishments as of 2019 include: 210



Planting on College Avenue spring 2020

TreeKeepers trained; 20 Fruit TreeKeepers trained; 20 UPCYCLE Stewards (woodland caretakers) trained; over 1,000 trees planted; and over 1000 young trees maintained.

Growing Futures

A new way Trees Forever is planting and caring for trees is through its Growing Futures program which employs teams of teens. These teen employees also participate in weekly professional development aimed at teaching vocational and leadership skills. This program seeks to improve



Trees Forever employees planting trees in 2020

quality of life by helping develop a robust urban forest. Community connections are built by engaging teens of a variety of backgrounds and focusing their work in communities that lack tree cover. Participants earn a Job Skills Certificate and gain valuable work experience.

When the City works with local nonprofits, more gets done. Thanks to Tree Des Moines, the City of Des Moines has a living, evolving tree inventory. Thanks to Trees Forever, the City has an active, engaged, and empowered group of local TreeKeeper volunteers. Through the Trees Forever

Growing Futures program more trees are planted and cared for. Volunteers, nonprofits and trees. Together they connect the dots to a healthier, greener Des Moines!

Inviting the residents of Des Moines to participate is key to ensuring we have a healthy urban forest. There are a few ways for residents to get involved with planting and caring for trees today.

RECOMMENDATIONS

- Plan now to attend the next TreeKeeper volunteer training program held every April
- Ask to be part of the UPCYCLE Stewards invasive species volunteer program to remove invasive species from our urban woodlands
- Sign-up with the City or a local tree-focused nonprofit like Trees Forever to volunteer for tree planting events across the city
- Tell a young person in your life about the opportunity to work with Growing Futures
- If digging a tree planting hole is not for you, volunteer instead with a local tree-focused nonprofit to use your creative talents

RECOMMENDED SPECIES

Selection of tree species is essential and has taken on new urgency considering climate changes. An upsurge in extreme climatic events prompts extra consideration in the selection of trees. The intent of this chapter is to outline the City of Des Moines protocol for proper tree selection, and to introduce the current Recommended Species List.

Utilities: The City chooses to employ the Right Tree, Right Place standard used nationally. Only shorter trees that mature under 25’ tall are planted under overhead wires. This means that ornamental trees like serviceberry, redbud and other trees that mature under 25’ tall are planted in these locations. Where there are no overhead wires the City always plants larger shade trees.

Infrastructure Conflicts: Infrastructure conflicts include traffic sight obstruction, competition with overhead wires, proximity to signs, lights, water connections and fire hydrants, and competition for space with curbs, sidewalks and other infrastructure. Des Moines commits to a multi-faceted response to demands so the tree will have the best chance at surviving and thriving.

Main Planting Areas: Trees in Des Moines are planted in three areas: streets, parks, and on private property. The City plants and maintains street and park trees. Residents are encouraged to plant trees on their private property. Completion of a site analysis that considers climate, site micro-climate, soil factors, and above- and below-ground limitations is critical. The cost of skipping site analysis can be counted by dead or poorly performing trees.

Tree Characteristics: A site analysis is followed by an understanding of tree characteristics. Consideration should be given to the following: diversity, invasiveness, hardiness, disease and pest resistance, mature size and form, aesthetics, longevity, whether native or non-native, and litter. The Recommended Species List has selected trees that will thrive in a wide range of conditions.

Selecting Trees for the Future: Since trees will be affected by changing climate, species adaptation should be considered. An increase of warm periods in winters prompts the tree to come out of dormancy, and damage

POSSIBLE BENEFITS		
WINNERS: THESE SPECIES WILL INCREASE 20% OR MORE BY THE YEAR 2100	LOSERS: THESE SPECIES WILL DECREASE 20% OR MORE BY THE YEAR 2100	
AMERICAN HORNBEAM	BLACK CHERRY	SUPPORTS POLLINATORS
BLACK HICKORY	BUTTERNUT	WILDLIFE FOOD SOURCE
BLACKJACK OAK	EASTERN WHITE PINE	BUFFER AND LANDSCAPE
BUR OAK	OHIO BUCKEYE	MEDICINAL INGREDIENTS
EASTERN REDBUD	SHAGBARK HICKORY	ROOSTING FOR INDIANA BAT
POST OAK	SHINGLE OAK	SUPPORTS POLLINATORS
RED MULBERRY	WHITE OAK	ALTERNATE FOR RED OAK DUE TO OAK WILT DISEASE
SOUTHERN RED OAK		
SUGARBERRY		SUPPORTS POLLINATORS
SWEETGUM		

Figure 1. Future Winners and Losers

is incurred when freezing temperatures return. Consideration of this winter thawing phenomenon, plus the increasing possibility of extended summer heat, has prompted the Chicago Botanical Garden to issue a climate change projection whereby the region is no longer able to grow previously reliable conifers.

Green over gray, saves the day



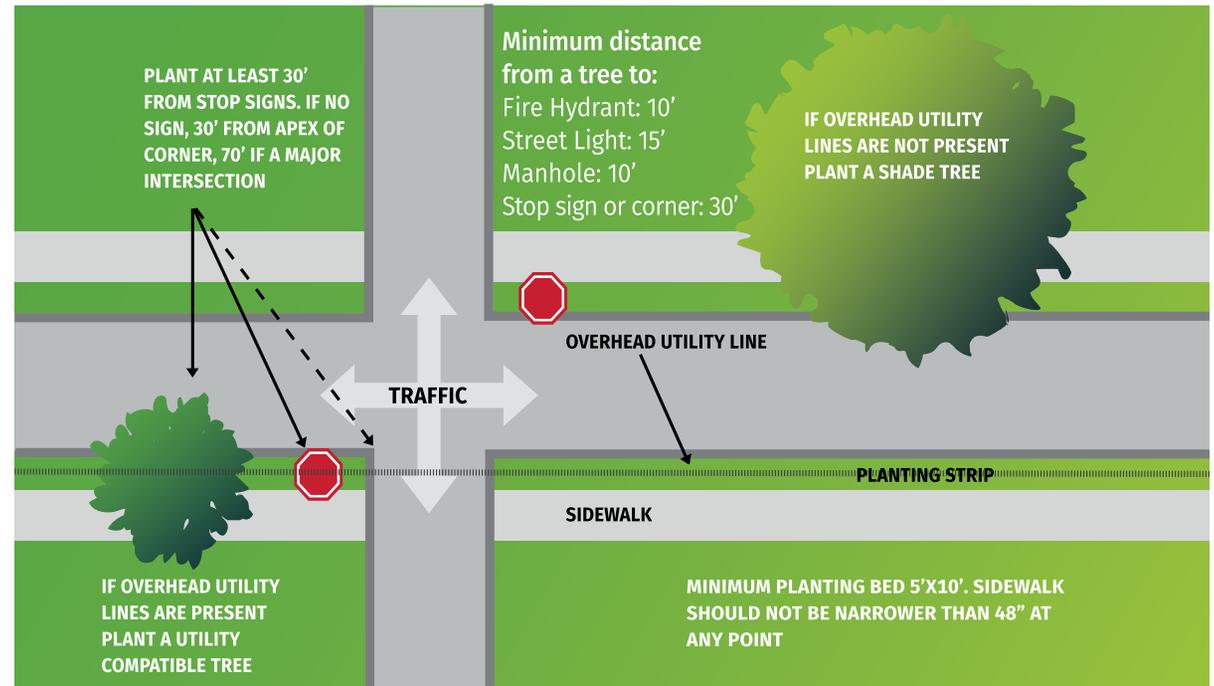
Winners and Losers in Tomorrow's Urban Tree Canopy: The Northern Institute of Applied Climate Science has created climate change projections for individual species. Some of the data from the Illinois projection was used to create the winners and losers chart (Figure 1 on page 44).

Recommended Species List for Des Moines: The Recommended Species List uses only about 50 of those species that are acceptable AND are commonly available. An online version will provide the most up-to-date information. The list may be accessed at DSM.city/recommendedspecies.

Summary

Finding Trees on My Street: Residents may search for trees in front of an address, or

Site considerations when planting trees



by species or size, by viewing the City's online inventory. Visit desmoinesia.treekeepersoftware.com to find out about the urban tree canopy in Des Moines.

RECOMMENDATIONS

- Perform an analysis at tree planting locations to assess opportunities and limitations of site
- Select commonly available tree species appropriate to the site
- Avoid planting invasive species

- Use changing climate data to make proper planting choices
- Water the tree twice weekly during each growing season for the first two years to properly establish the root system

TREE MANAGEMENT PLAN

The goal of the UFMP is to develop a list of recommendations for the City, including plans for tree management. Through the use of diversity in species, and ensuring proper tree structure by regular tree maintenance, the City can better improve and expand the urban forest.

Management Plan: Routine Maintenance Tasks

Planting of new trees should match the attrition rate of 700 trees per year with extra trees planted as leeway for planting losses, reaching up to 3,800 new trees annually to meet the DNR 3% canopy increase goal by 2045.

Proper pruning and training will ensure that trees mature into forest assets. Trees up to 10 inches of trunk girth benefit from a 3-5 year prune cycle. For mature trees a 7-10 year pruning cycle is appropriate. The 700 trees removed annually leave stumps which need removal. Grinding stumps to 12" underground stops re-sprouting and allows new plantings.

Communicating the benefits of trees and informing residents about tree management will

help get more people involved in increasing the tree canopy.

Tree advocates provide assistance in the care of trees. Des Moines enjoys such advocacy by two nonprofits, Trees Forever and Tree Des Moines. The City also

helps train TreeKeeper Volunteers to learn tree identification, planting and maintenance.

Goals for the next 5 to 15 years include a cyclical pruning and young tree training plan. Capacity must be measured to understand how many City crews are needed.

Charting a Course for Effective Management of the Tree Canopy

Planting should prioritize neighborhoods that have low canopy cover or an aging or vulnerable tree inventory. Neighborhoods most in need are Douglas Acres, Capital East, and Fairgrounds. Neighborhoods with the oldest forest



Volunteers are a key element of the UFMP

population include McKinley School/Columbus Park, Mondamin Presidential, and Capitol East. Diversity is important. No one species should exceed 5%, no one genus exceed 10% and no one family exceed 20%.

The Forestry Division will develop a cyclical pruning schedule employing three dedicated two-person pruning crews beginning with the first crew in 2020 and adding one each year. A 3-5 year pruning/training cycle for young trees up to 10 inches diameter at breast height and a 7-year pruning cycle for mature trees is a good balance. One four-person crew can complete three tree and/or stump removals per day. Citywide 38,536

PARTIAL SELECTION OF WARD GENUS DIVERSITY	WARD				NEIGHBORHOOD	GENUS	% OF TOTAL POPULATION
	1	2	3	4			
MAPLE (ACER)	15%	17%	20%	16%	CARPENTER	QUERCUS	5.51%
OAK (QUERCUS)	13%	14%	23%	12%	(AND DRAKE)	ACER	17.32%
APPLE/CRABAPPLE (MALUS)	12%	14%	13%	9%		MALUS	33.07%
HACKBERRY (CELTIS)	6%	7%	8%	8%		CELTIS	5.51%
BASSWOOD/LINDEN (TILIA)	4%	6%	6%	5%		TILIA	1.57%
GREEN/WHITE ASH (FRAXINUS)	6%	6%	8%	14%		FRAXINUS	3.15%
HONEYLOCUST (GLENDITSIA)	5%	3%	9%	6%		GLENDITSIA	7.87%

Figure 1. Species Diversity by Ward

trees identified for cyclical pruning will take 963 working days to complete at 10 trees/day/crew.

Summary

Every effort must be made to effectively manage the tree canopy. The Iowa DNR set a goal of increasing the City’s tree canopy cover 3% by 2045. This chapter lays out a maintenance plan for tree pruning and removal crews. An inventory of the City’s trees and sites showed the type of work needed in each neighborhood. When implemented this management plan will result in satisfaction of the following recommendations.

RECOMMENDATIONS

- Increase the number of healthy, balanced trees by performing effective pruning on a cycle that ensures every tree will

be maintained in a timely manner. The best balance between cost and benefit depends on age and size. Des Moines trees average 12 to 15 inches in trunk diameter at breast height (DBH) with considerable variation between neighborhoods. A 3-5 year pruning/training cycle for young trees up to 10 inches DBH and a 7-year pruning cycle for mature trees is a good balance

- Ensure that current work cycles are not abandoned. It is essential that current staff continue to respond to resident requests for items such as prompt removal of broken or dead branches and high-risk hazard trees
- Ensure timely removal of dead, dying, or structurally unsound trees and stumps. High priority removals first, with lower priority removals performed timely and equitably

CYCLICAL PRUNING SUMMARY: 1 TEAM PER WARD, 5 HOURS/DAY, 10 TREES/DAY, 3.5 7 YEAR CYCLES			
WARD	TOTAL DAYS	<-10 DBH	>10 DBH
1	220	30	189
2	189	32	157
3	215	57	158
4	205	39	165

Figure 2. Pruning Timeline by Ward

- Increase planting to 3800 trees per year to accommodate the normal attrition rate of 700 trees annually plus meet the 3% canopy increase goal
- Provide public outreach to educate residents about the maintenance plan, and to encourage good tree care and planting habits on private property



Sturdy oak: always a good species selection

PUBLIC OPINION

In May 2019, the City of Des Moines sent a survey to 1,200 Des Moines residents as part of the Urban Forest Master Plan initiative. Residents were asked questions regarding tree benefits, tree issues, City services, and interest in involvement. Findings encompass the opinions of the 430 residents who responded.

Potential Benefits of Urban Trees and Forests

The first questions asked how the canopy affects neighborhoods. An impressive 99% find importance in making the city look nice, creating intimacy within the neighborhoods, making the city feel welcoming, and for the psychological benefits.

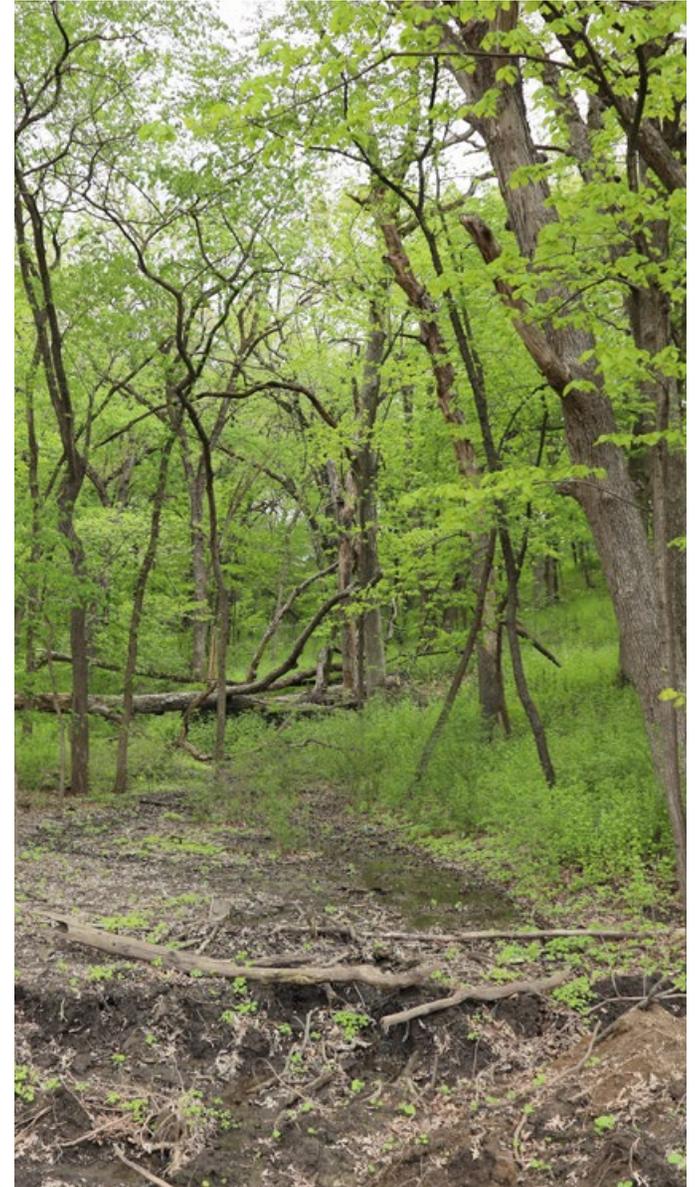
Potential Issues Associated with Urban Trees and Forests

Many residents want to see more shade while other residents say some neighborhoods have too much, making gardening difficult. More planning is needed around utilities as pruning sometimes makes trees unsightly. This can be prevented by using the Right Tree, Right Place protocol. There were concerns of damage caused

by limbs falling. One respondent suggested that there may be an age imbalance in trees throughout the city. In areas with older trees extra debris is created that sometimes blocks stormwater inlets. Unfortunately, 90% see the impacts on trees damaged by pests like the emerald ash borer and diseases like oak wilt and bur oak blight. Messy trees are an issue for 69%. Some suggest expanding planting of edible fruit and nut-bearing trees. Problems seeing road signs when driving or walking was a problem for 95%. The most concerning issue is the lack of assistance with affordable maintenance on private property.

City Tree Services

This portion asked residents to identify community and environmental goals and how the canopy is related. More geographical balance is needed since neighborhoods with newer housing projects seem to receive more new trees. In older neighborhoods, fewer new trees result in a dilapidated appearance. At least 65% of residents find importance in the canopy's role in improving air and water quality. Protecting riverbanks and soils from erosion is important to more than 90%.



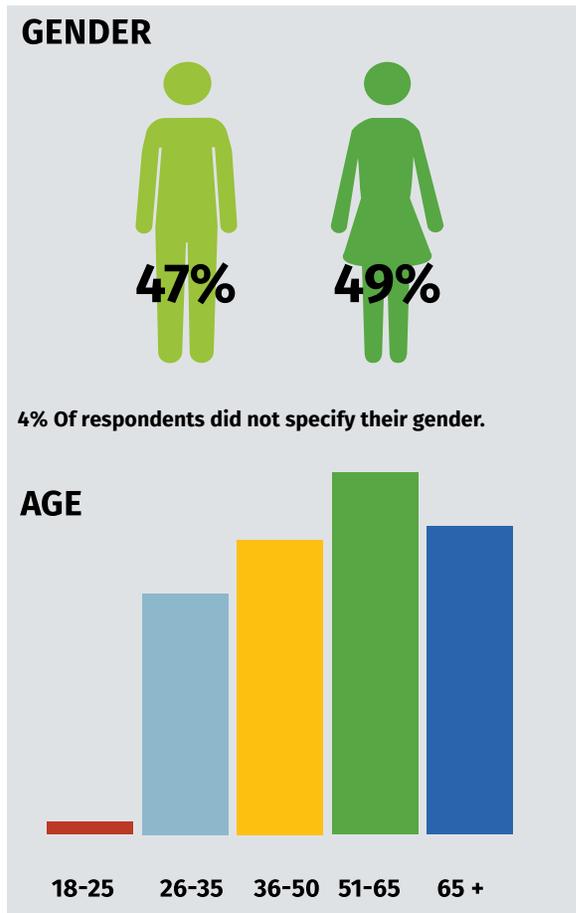


Figure 1. Gender and age of survey respondents

Action and Involvement

Residents desire to participate in environmental events. Most take care of their trees but lack the time additional community involvement might require. Strengthening

partnerships with businesses and reaching out to volunteer groups could support the drive for a more balanced urban canopy. Of individuals who responded 65% say they would volunteer for planting or caring for trees. With enough interest Des Moines Area Community College might offer a class. While only 28% of residents would be willing to serve on a committee to spearhead a planting campaign, this is enough to get the job moving.

Demographics

The Beaverdale Neighborhood led the way with 46 responses (15%), with Merle Hay residents sending in 21 responses (6.7%). The average for other neighborhoods was about 5 responses. Many of the responses were from those nearing retirement age. These people are likely to have the initiative to take part in City improvement projects.

Summary

Based on the public opinion survey, it appears that residents voiced overwhelming approval of the presence and benefits of trees and want to be involved in improvements. Urban trees will continue to prosper as neighborhood initiatives are set in motion. For this Urban Forest Master Plan to gain the momentum it needs, there must be more awareness throughout the neighborhoods.

Each neighborhood might form a committee to stimulate the community to be more active in this project. The more volunteer efforts there are, the more connections will be made between the people and where they live, establishing a stronger sense of pride in their community.

RECOMMENDATIONS

- Initiate contact with all neighborhoods to discuss their priorities for tree canopy
- Assist neighborhoods in the development of tree canopy goals as part of their neighborhood plan
- Seek creative solutions to the needs of seniors and residents with disabilities who may need help with tree maintenance and litter disposal
- Make a conscious effort to distribute tree planting and tree maintenance equitably across the city, attending to the tree needs of every population demographic
- Invest in strategies to combat major outbreaks of insects and disease
- Continue to follow the Right Tree, Right Place protocol for planting trees under overhead utilities
- Invest in additional street sweeping every autumn in areas with high leaf litter

ENVIRONMENTAL EQUITY AND TREES

Ensuring environmental equity requires a systematic approach. Most often in under-resourced communities, there is a lack of access to resources and meaningful opportunities for residents to discuss their opinions regarding how their natural resources are being managed. This leads to these neighborhoods suffering environmental inequities that results in an overall lower quality of life (Heynen 2003). Planting and maintaining public trees is an example of providing access to natural resources.

Environmental equity, according to the EPA is defined as, “The fair treatment and meaningful involvement of all people regardless of race, color, sex, national origin, or income with respect to the development, implementation and enforcement of environmental laws, regulations, and policies” (U.S. Environmental Protection Agency 2012). Most typically, environmental equity refers to environmental burdens, risks, or hazards being disproportionately placed in under-resourced neighborhoods. The placement of urban trees in communities increases access to natural resources, thus enabling City

managers and planners to take steps towards being environmentally just. There tends to be little focus on where trees are planted and for whom. Usually the focus is just getting trees in the ground to increase canopy cover. This thinking leaves out the importance of spatial distribution and species diversity in under-resourced communities (Heynen 2003). Since the urban tree canopy cannot be sustained only by public trees, it is vital to get private homeowners involved in tree planting initiatives if the overall goal is to increase urban tree canopy cover. In this regard, the City of Des Moines has a tree giveaway program (Tiny Trees) that provides trees to families or individuals who want to plant trees on their property. This is a great opportunity to increase canopy cover. However, the City needs to be sure trees are being equally distributed throughout socioeconomic classes.

Tree canopy cover was assessed in nine Des Moines neighborhoods that were selected using city-data.com, to see if there is a correlation between the quantity of canopy cover and income (Figure 1 on page 51). There appears to

Spring planting 2019



be a relationship between high income and high canopy cover. This is somewhat misleading since the canopy cover was based off both private and public trees (streets and parks). This relationship does not necessarily show that Des Moines has purposely created an environmental imbalance. The relationship could be because heavily wooded areas increase property value and cost more to maintain, leaving high income families and individuals to take up residence in these areas. Low income neighborhoods on the other hand tend to have more fragmented stands of trees.

It is usually not until you have a larger stand of trees that you start maximizing benefits, making the distribution of ecosystem services unequal, leading to environmental inequity (Heynen 2003).

RECOMMENDATIONS

- Increase tree planting in low and middle-income areas of the city
- Increase tree maintenance in these neighborhoods to keep trees longer into mature age, thus reaping greater benefits
- Provide education about how additional trees in these neighborhoods will lead to lower energy bills, slower/safer traffic with more pedestrian safety, increased home values, lower rates of childhood asthma, and cleaner air
- Engage more people from under-resourced communities with the Tiny Trees Giveaway program (DSM.city/tinytrees), where the City provides up to five small tree saplings, allowing property owners to plant them on their property
- Consider planting diverse, high quality species in under-resourced neighborhoods. This will maximize ecosystem services and benefits in these neighborhoods

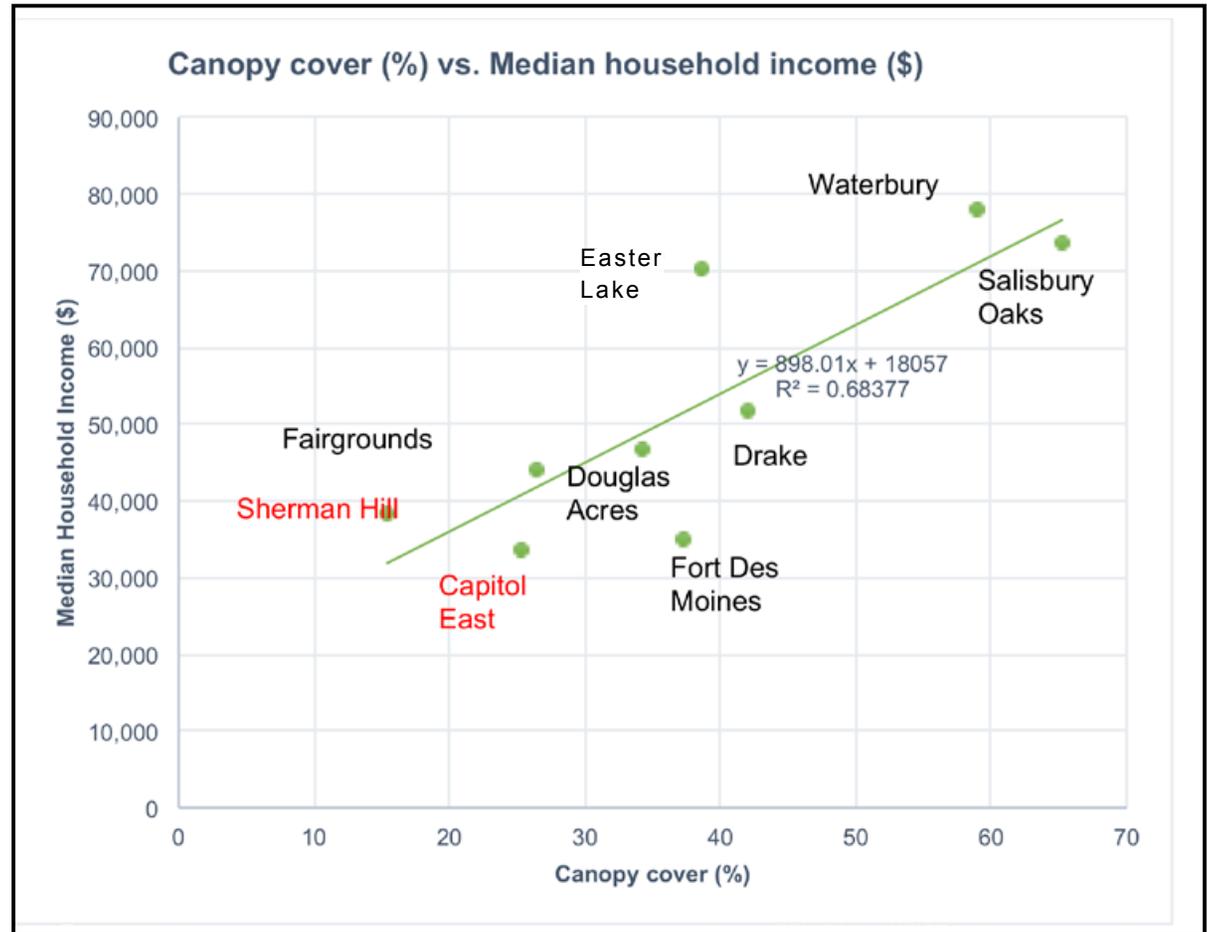


Figure 1. Canopy cover (%) versus median household income. This chart depicts a relationship, as median household income goes up, so does canopy cover. Sherman Hill and Capitol East are highlighted in red to show that they are the lowest income and least white neighborhoods.

URBAN HEAT ISLAND AND TREES

The mantra in the Des Moines Forestry Division is ‘Green over green keeps us clean; Green over gray saves the day!’ There’s nothing wrong with planting trees in parks (green over green). It’s a good thing, but with less of an environmental impact. Conversely, trees shading impervious surface (green over gray) will reduce Urban Heat Island effect, intercept rain runoff, protect and prolong the life of asphalt surfaces, provide shade for pedestrians and autos alike, reduce lingering gas fumes, safely separate cars and pedestrians, provide natural speed control for autos, and increase property values and quality of life in the neighborhood.

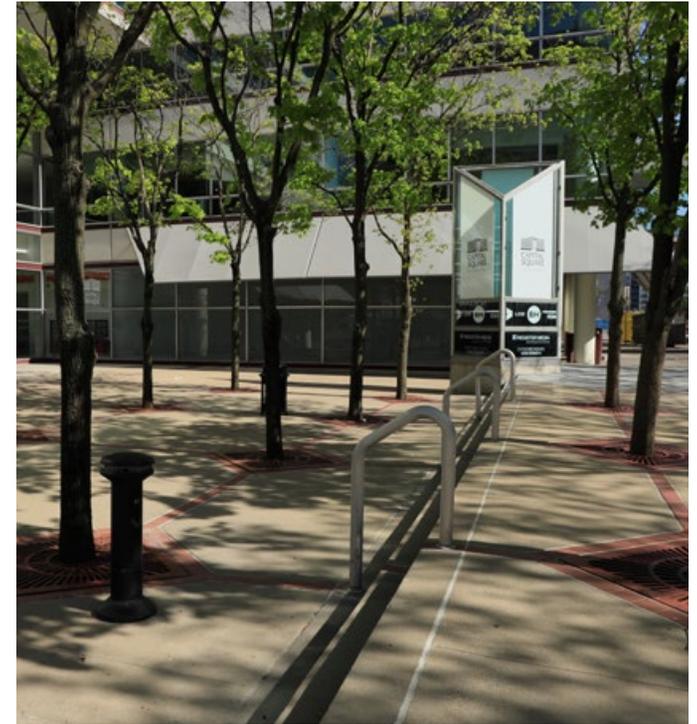
Urban Heat Island (UHI) describes urbanized areas, taken over by concrete infrastructure, that are typically hotter than nearby rural areas. The annual mean air temperature of a city with 1 million people or more can be 1.8 to 5.4°F warmer in the daytime than its surroundings. In the evening, the difference can be as high as 22°F. (epa.gov/heat-islands).

The heat island can cause many negative effects in an urban setting just like Des Moines.

Many developed areas have few green spaces including trees and other native plants. This can create a ‘concrete jungle’, with attendant health, environmental, and fiscal issues.

Urban Heat Island increases overall electricity demand, when offices and homes are operating cooling systems, lights, and appliances. This in turn leads to an increase in fossil fuel use at power plants, resulting in greenhouse gas emissions and increased air pollutants. The increase in daytime temperatures brought on by climate change, and higher air pollution levels, can affect human and animal health. High pavement and rooftop surface temperatures can also heat stormwater. This heated stormwater generally becomes runoff, which drains into storm sewers and raises water temperatures as it is released into streams, rivers, ponds, and lakes. Rapid temperature changes in aquatic ecosystems resulting from warm stormwater runoff can be particularly stressful, even fatal to aquatic life.

A useful tool for battling UHI is proper management of existing trees. The larger the tree, the more shade and cooling it provides. A side

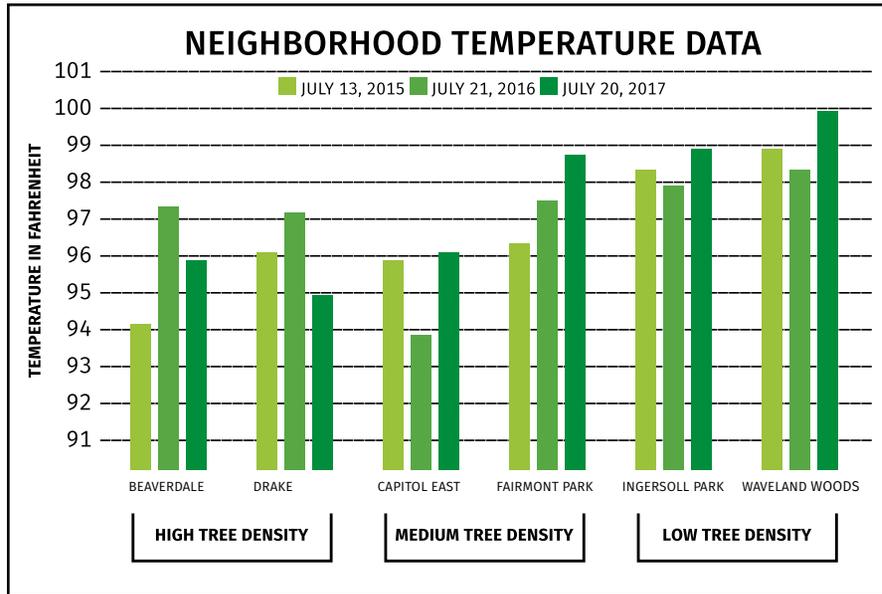


Trees at Capitol Square cool the patio for sitting

benefit is that as trees grow, they remove carbon from the atmosphere and store, or sequester, it. The net rate of carbon sequestered by urban trees in Des Moines is 12 million pounds annually, according to iTree Eco info (desmoinesia.treekeepersoftware.com).

For this chapter, six Des Moines neighborhoods were selected and divided into three categories dependent on their tree density.

Figure 1. Tree Density vs. Temperature



Pedestrians welcome tree shade along Court Ave. at the Farmers Market



High density tree population neighborhoods (Beaverdale & Drake) can be found on the left side of the Neighborhood Temperature Data chart. Medium density tree population neighborhoods (Capitol East and Fairmont Park) can be found on the middle of the chart. The low density tree population neighborhoods (Ingersoll Park & Waveland Woods) can be found on the right side of the chart. The neighborhoods with high tree populations were found to have been cooler than the neighborhoods with fewer trees. Based off of these findings it appears that the existence of trees does indeed help alleviate the effects of UHI.

RECOMMENDATIONS

- Develop a cyclical pruning program to improve the health and structure of existing street trees to maximize reduction in UHI
- Plant trees strategically along streets and sidewalks
- Plant trees in and around parking lots to reduce UHI
- Create ways to get trees into the hands of property owners. Well-placed trees in yards can also reduce the overall UHI effect
- Plant trees next to buildings. Educate

- residents on the benefits of planting summer shade to shelter west and east-facing walls, to block morning and afternoon sun at its lowest angle
- Plant trees near air conditioning units. Educate residents to plant near A/C units so they receive shade and enhanced A/C efficiency

TREES AND ENERGY CONSUMPTION

In urban settings, residential cooling and heating is affected by the surrounding tree placement relative to the building. A tree's proximate placement to a building affects direct sunlight hitting the building and therefore the radiation intensity. Studies have shown that tree morphology, such as tree size, canopy size and shape, leaf area, and leaf density all affect building energy cooling (Passe et al, 2018).

Use of Trees in Urban Communities

While winters are cold and frequently reach below freezing with added wind chill, summers can be humid and exhausting in Des Moines. Since Des Moines has many older homes and some residents living below the poverty level it is important to find cost effective ways to reduce heating and cooling costs. With just a little planning, proper tree placement can help Des Moines residents save energy. It is estimated that properly placing trees can provide a household up to \$250 a year in energy savings. Currently Des Moines enjoys 29% tree canopy which refers to the layer of tree leaves, branches and stems that cover

the ground when viewed from above. The City of Des Moines Public Works Forestry Division's goal is to increase Des Moines overall tree canopy by 3% in the next 25 years.

Local Study Information

Recently a model has become available to 3-D model tree canopy along with thermal-physical building location data. Hashemi, Marmur, Passe and Thompson (2018) conducted their study in Des Moines' Capitol East neighborhood, using a sample of 1,142 trees and 340 buildings. Tree

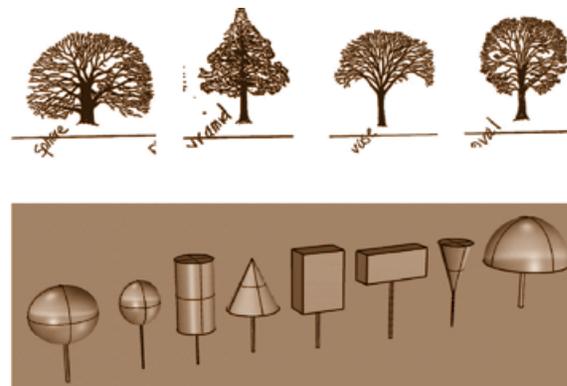
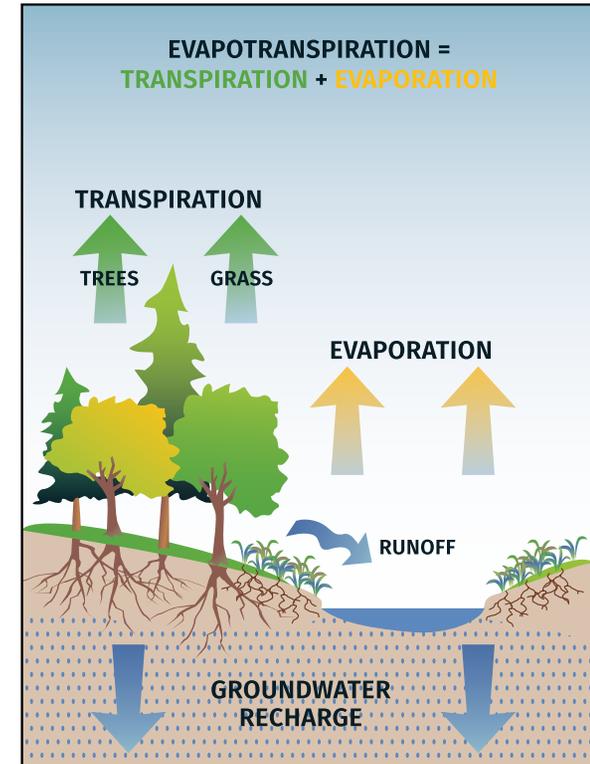


Figure 1. A 3-D modeling process was created to compute how tree canopy impacts building energy



inventory collected by ISU students and Des Moines Forestry staff consisted of eight canopy shapes (spheres, ellipsoids, cylinders, cones, horizontal rectangular cuboids, vertical rectangular cuboids, umbrella shapes, and paraboloids). These shapes are seen in Figure 1. Tree trunk diameter and height were also recorded.

The modeling process created a 3-D model computing how tree canopy impacts building

energy consumption. The modeling technique results indicated three major findings: trees were responsible for cooling energy savings of 1-20% on the buildings in the study area from May to September; 40 of the buildings had cooling energy savings of more than 5% due to trees; there was also substantial reduction in cooling demand due to well-placed trees, especially when they were on the south side of the building.

Need for Evapotranspirational Research

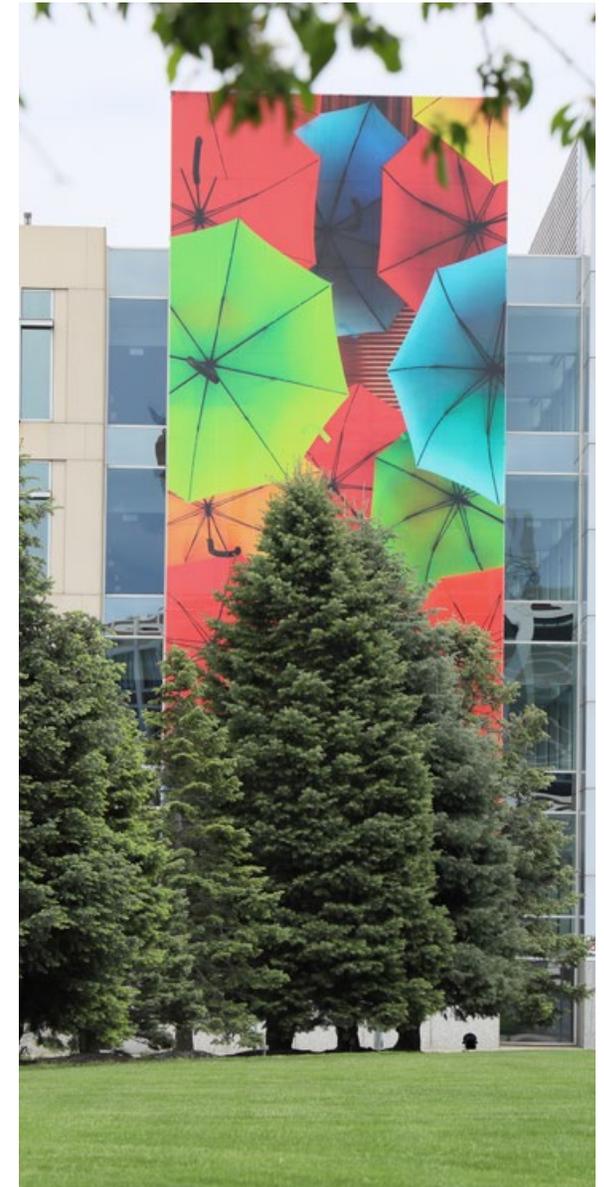
Evapotranspiration is the process in which water evaporates from a liquid state to a vapor state and cools the air. Placing trees near buildings increases evapotranspiration but the research in this field has only recently been progressing because of the development of building-microclimate energy modeling. Passe, Thompson, Gao, Marmur and Ganapathysubramanian (2019) used the same data from the energy consumption study conducted in Capitol East Neighborhood of Des Moines and over-layered a model to identify how evapotranspiration affected the same area. Using a combination of tree morphology evapotranspirational cooling rates, and building location, the study tested how trees affect building energy.

Summary

All Des Moines residents can use the results of local studies conducted in the Capitol East neighborhood to save building energy on their own properties. Combining and using all this information, a well-informed resident can choose the best locations on their own property for trees.

RECOMMENDATIONS

- Increase plantings of street trees to reduce heat from the street side of a home
- Educate residents to plant trees to reduce home and business energy bills
- Plant trees on the south side of buildings to reduce cooling costs
- Plant trees on the west and northwest of homes to provide mid to late-afternoon shade
- Shade east and west windows with trees, but prune lower branches to increase view
- Plant shade trees over patios, driveways and air conditioners
- Plant windbreak trees on the west, north-west and north to block cold winter winds



SOCIETAL EFFECTS OF TREES

Trees have benefits other than aesthetic value. These include physical and emotional well-being, reduced neighborhood violence, improved economy, increased land value, and food security. Focusing on the social benefits of urban trees provides us with further insight into all of these subjects.

Physical/Emotional Health

Studies have examined the effect of greenery on a person's levels of anxiety and depression (Ulrich, 1986). One way to environmentally change nursing homes or mental health facilities would be to provide both indoor and outdoor greenery. Also, increasing the number of trees around the facilities might help with noise and air pollution (Nowak, Stevens, 2006). National studies suggest that people living in polluted urban areas are far less likely to be admitted to the hospital with asthma when there are lots of trees in their neighborhood (Nowak and Stevens, 2006).

Reduced Neighborhood Violence

In Des Moines, police reports were analyzed to count violent crimes (arson, assault, homicide,

robbery, and weapons) in specific neighborhoods and compared these data with existing data on the canopy cover of each neighborhood (Hampton, 2018, UFMP Environmental Equity chapter). Based on the data, there appears to be a trend though it is very weak, 'that neighborhoods with less trees have more crime'. In Des Moines, ensuring equitable distribution of trees to all parts of the city will provide a potential buffer against any possible connection between the number of trees and the amount of crime.

Economic Revitalization & Food Security

Urban trees provide several socioeconomic benefits. Some of the direct benefits that trees offer are aesthetics, recreation, and fruit production, all creating large scale positive impacts on local urban economies. Fruiting trees provide an alternative food source for food-insecure families. In 2016, Des Moines reported that 32% of households have low food security. Trees can help to empower struggling households by both connecting them directly to a source of food and in learning the process of food

production. Vacant lots could be obtained by the City and transformed into edible landscapes with trees that produce fruit and vegetable gardens. In addition, the vacant lot can become a hub for service events, habitat for wildlife, and an aesthetically pleasing amenity for the public.



Families enjoy the Farmer's Market on 4th Ave.



The Better Homes & Gardens Test Garden in Des Moines, 2020

Increased Land Value

Ornamental plants and trees will almost always increase land value. In 2012, a study completed in Ames, Iowa revealed that urban residents place value on conservation features that include trees and are typically willing to pay an additional amount for them to be present

in their neighborhoods (Bowman et. al, 2012). Studies also show that consumers are willing to spend more time and money in places that are beautified with trees. Des Moines area retailers might consider converting some of the area they have to outdoor and indoor green space as a part of their business profit model.

RECOMMENDATIONS

- Provide community education to health care providers and residents concerning the physical and mental health benefits of trees
- Notify hospitals of the national Tree Campus Healthcare program and assist them in working toward recognition and achievement through this initiative
- Notify the Des Moines School Board of the national Tree Campus K-12 program and assist them in working toward recognition and achievement through this initiative
- Notify local universities of the national Tree Campus USA program and assist them in working toward recognition and achievement through this initiative
- Provide education to local builders and realtors on the economic benefits of trees on and adjacent to residential properties
- Provide education to retailers and businesses concerning the economic benefits of trees on and adjacent to commercial properties
- Provide education to neighborhoods and the Des Moines Police Department about the possible reduction in local crime when trees are planted and maintained

HISTORY OF TREES IN DES MOINES

Trees are always present, but attitudes toward them change with circumstances and people. Studying the history of trees in Des Moines provides a glimpse into the attitudes towards trees by the residents of the city at various points in time.

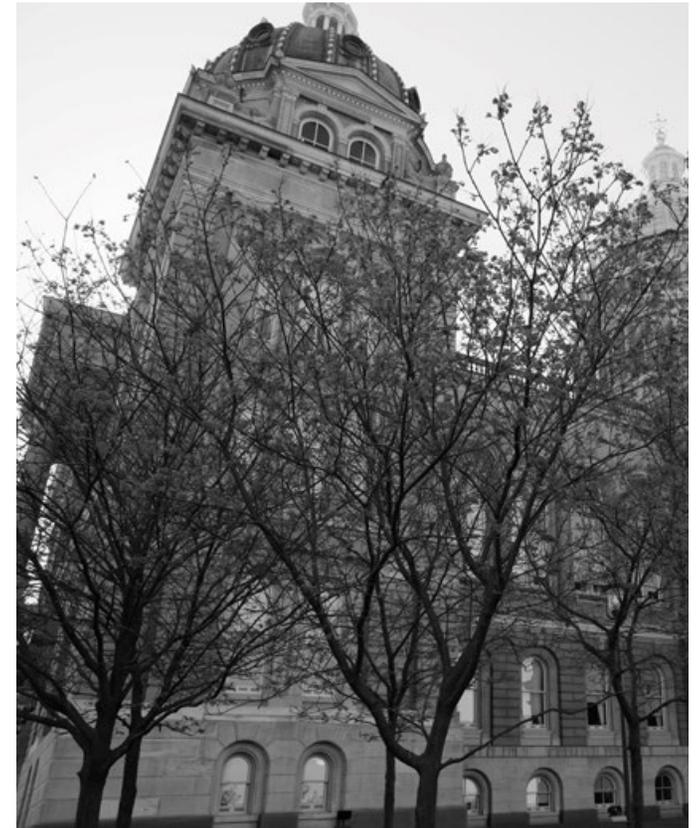
Awareness is Goal of Studying History

These two pages are merely an introduction. The full history of trees chapter may be found online at DSM.city/forestplanchapters wherein is found 75 pages of tree history. A progressive timeline of dates and events is naturally expected, and the reader will have plenty of these to enjoy and contemplate. The author also hopes that the reader will reap the intangible benefit of awareness. It is important to be more aware of the 'presence and possibility' that trees bring to the city. While most of the trees in forest areas of the city occur naturally through regeneration, all other City trees were intentionally planted. Who planted them and why? What was happening in our nation and in our world when a tree was planted? For instance, when a medium-size 20" trunk diameter bur oak tree was planted 100 years ago (1920), the League of

Nations was formed and women gained the right to vote. Tree history is also currently being made in 2020. The writing of this chapter on the history of trees took place during a 'work from home' period during the COVID-19 coronavirus pandemic of 2020. Locally, the COVID-19 outbreak prompted cancellation of the City's spring Tiny Trees giveaway and delayed new tree planting efforts by Trees Forever and its legion of volunteers. The coronavirus impacted tree history!

Highlights of Tree History in Des Moines

- 1843** From settlement days trees were a natural part of the landscape.
- 1959** Deadly Dutch Elm Disease Arrives; Blight Found on a Tree in Beaverdale.
- 1967** The City spent more than \$1.6 million removing 21,487 diseased elms from City property.
- 1968** In the 1960's the Chancellor Elm at Drake University contracted the Dutch Elm Disease. Finally, it was cut down in 1968 or 1969
- 1978** Des Moines boasted 230,000 American elm trees before Dutch elm



disease. Now it has 1,700. The same fate could be in store for the City's 59,000 oak trees dying of oak wilt and other diseases.

- 2009** On September 14, 2009, Council approved the Tree Preservation Principles.
- 2012** The City of Des Moines and Trees Forever started TreeKeepers to train volunteers.



Trees add ambiance to the Sylvan Amphitheater at Greenwood Park

2015 The nonprofit Tree Des Moines inventoried all the trees in Des Moines.

2016 Emerald ash borer confirmed in City.

2019 A ‘Des Moines Register Rose’ to residents who are taking advantage of the City’s Tiny Trees program (DSM.city/tinytrees).

2020 Proclaimed ‘2020 The Year of the Tree in Des Moines.’

2020 The nation and world is impacted by the COVID-19 pandemic. Tiny Trees was canceled and spring planting delayed.

Lessons Learned from Study on the History of Trees in Des Moines

- Early inhabitants of Des Moines inherited trees as part of the natural areas along river banks.

- Transportation and development needs drove the early consideration of trees in the city.
- Riverview Park was a ‘really big deal’ and trees made the environs so much more enjoyable.
- Downtown trees were almost non-existent during most previous development booms.
- Street construction and maintenance were responsible for a lot of tree losses, not unlike today.
- Development of the MacVicar Freeway resulted in a major loss of trees.
- The new computerized tree inventory will help to effectively manage the urban tree canopy.
- The creation of a City Tree Replacement Fund provides for more tree planting.
- Diversify! More tree species = a healthier urban tree canopy.
- Tiny Trees to the rescue. Residents have latched on to this BIG idea!
- Partnering with nonprofits is a winning idea.
- A pandemic like COVID-19 can dramatically alter tree programs.
- Residents have the privilege and responsibility to begin their own history of trees.



**ACTIVE INSECT,
DISEASE AND
INVASIVE
SPECIES
MANAGEMENT**

TREE CANOPY IN 2045 IS 98% 'FAIR TO EXCELLENT' CONDITION

**BIG TREES PRESERVED
AND CELEBRATED**

**NEIGHBORHOODS
AND LARGE
LANDOWNERS
PARTICIPATE IN
REACHING THE
CANOPY GOAL**

**SPECIES
DIVERSITY**

PLANT 3800 TREES ANNUALLY

(2021) INCREASED BUDGET

**TREES ROUTINELY
USED IN GREEN
INFRASTRUCTURE**

**HEALTHY
RIPARIAN
ZONES**

**ARBORIST
APPRENTICESHIPS**

32% TREE CANOPY COVER (2045)

CYCLICAL PRUNING

**URBAN WOOD
REPURPOSED**

**REDUCTION
IN URBAN
HEAT ISLAND**

**EQUITABLE
CITYWIDE
DISTRIBUTION
OF TREES AND
TREE SERVICES**

**SUSTAINABLE
URBAN FOREST
PROGRAM**

**PUBLIC
EDUCATION**

BLUEPRINT FOR SUCCESS

Acting on all of the Urban Forest Master Plan recommendations found on the following pages will ensure that the 32% tree canopy cover goal is met. It will make the adopted **Urban Tree Canopy**

Vision Statement a reality. “The City of Des Moines will be a community identified with and shaded by a ‘living tree canopy.’ The urban tree canopy will be recognized as a vital, functioning part of the City’s infrastructure and will be included in the vision for all future development. Members of the entire Des Moines community will experience a healthier well-being from the urban tree canopy through reduced energy costs, reduced pollution and softened city noise. The urban tree canopy cover will be extensive and reduce the heat island effect within the city. Des Moines residents will view the urban tree canopy as an important part of the city’s character and as an indicator of the city’s health and livability. Relying on the Urban Forest Master Plan (UFMP), the City of Des Moines will actively encourage participation in tree planting and stewardship, preservation and protection of existing trees, promote public safety and tree health, implement

cost effective planting and maintenance of trees, increase public awareness of the value of our community trees, assist metro partners to develop employment opportunities maintaining

the urban tree canopy, and maximize the social, economic, and environmental benefits of the community tree canopy for current residents and future generations.”



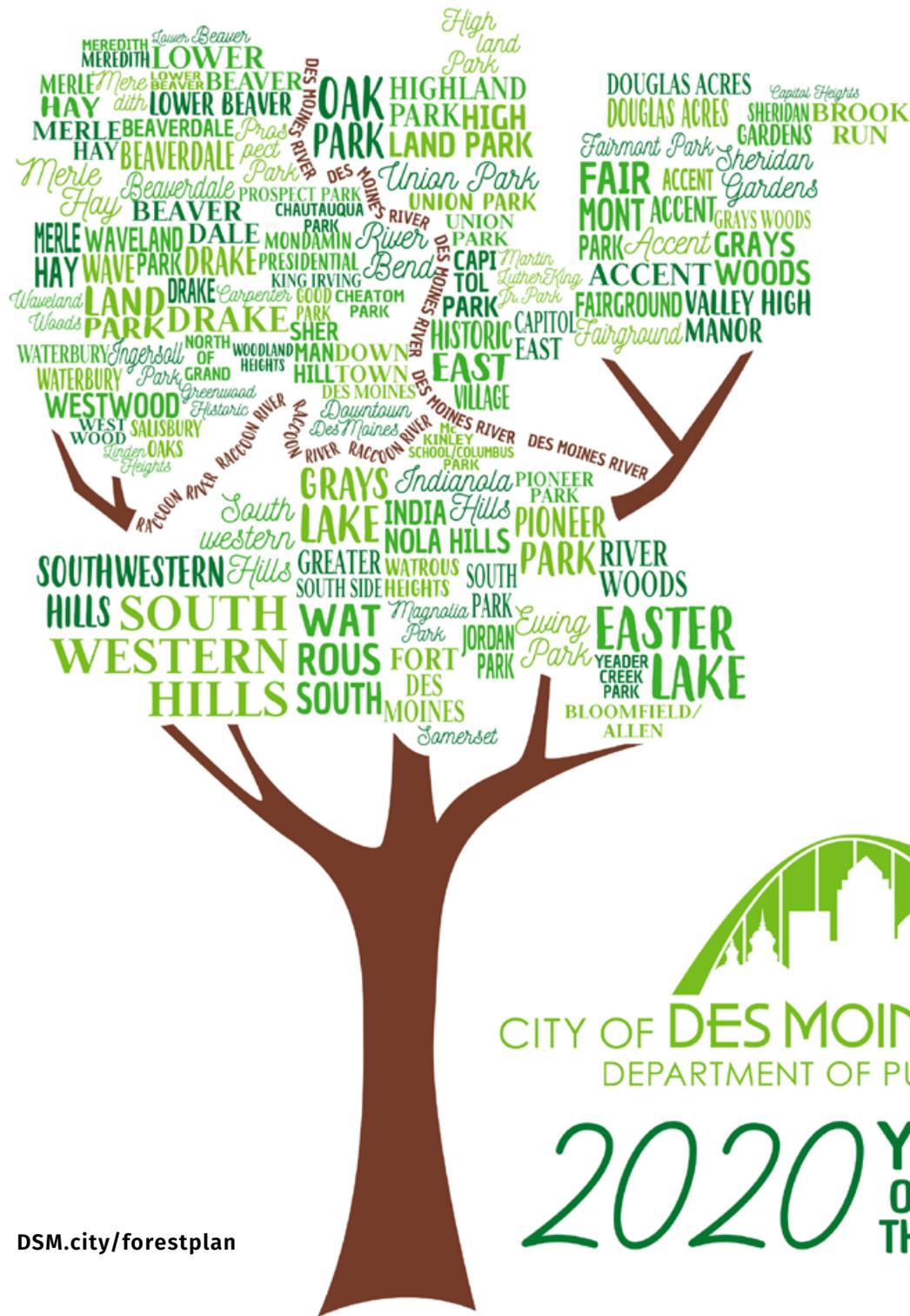
	PLANTING	MAINTENANCE	EDUCATION
INTRODUCTION AND SUMMARY	<p>PLANT 3800 TREES ANNUALLY THRU 2045</p> <p>Increase planting budget to \$1 million annually</p> <p>Seek corporate commitments to plant for energy savings</p> <p>Seek Federal funds for equity programs</p>	<p>Create sustainable jobs in urban forestry</p> <p>Support DMACC to create an Arborist training program</p> <p>Create jobs by utilizing wood waste</p>	<p>Create a public awareness and education campaign to promote trees (benefits), volunteerism, corporate connections</p> <p>Declare 2020 'The Year of the Tree in Des Moines'</p> <p>Build corporate, business and neighborhood relationships directly and through Trees Forever</p>
STORMWATER	<p>Plant trees over hard surfaces</p> <p>Plant trees in and adjacent to parking lots</p> <p>Plant trees in riparian areas</p> <p>Plant trees as green infrastructure</p> <p>Plant natives to survive changing climate</p>	<p>Increase maintenance of existing trees</p>	<p>Educate City staff and residents that 'Green over green keeps us clean, but Green over gray Saves the Day!'</p>
CLIMATE CHANGE	<p>Increase tree planting in response to heavier rain events</p> <p>Adjust species for slightly warmer climate and longer growing seasons</p>	<p>Maintain existing trees to prolong life</p>	<p>Anticipate longer pollen seasons</p> <p>Anticipate minor changes in species</p>
GREEN STORMWATER INFRASTRUCTURE	<p>Develop tree planting goals by watershed</p> <p>Plant in areas of high storm runoff</p> <p>Plant trees 'as' green infrastructure, and 'as part of' gray infrastructure projects</p> <p>Employ suspended pavement systems</p>	<p>Preserve existing large trees</p>	<p>Develop a cross-departmental repository of GI projects and practices</p> <p>Set goals and make plans to reduce impervious area of parking lots citywide, both public and private</p>
RIPARIAN ZONES	<p>Plant water loving species</p> <p>Adopt a stream buffer ordinance</p>	<p>Survey and assess condition of all riparian zones in the city</p> <p>Create two-tier riparian zones wherever possible</p> <p>Restrict vegetation removal, construction of permanent structures, livestock grazing, and chemical use in riparian zones</p> <p>Maintain educative trails along riparian edges</p>	<p>Provide public education along riparian trails</p>
STREET TREES	<p>Plant 'green streets' wherever possible</p> <p>Strategically plant trees in high foot traffic areas for safety and shelter</p>	<p>Conduct study of tree lined streets across the metro to understand benefits and challenges</p>	<p>Provide public education regarding 'Complete Streets' and 'Green Streets'</p>
WILDLIFE	<p>Plant more native trees</p> <p>Plant diverse species and sizes in corridors</p>	<p>Identify threats to wildlife and mitigate impact</p> <p>Aim for multi-age canopy</p>	<p>Provide educational media and programming to foster appreciation of wildlife</p>
POLLINATORS	<p>Plant native species in corridors</p> <p>Plant diverse species</p> <p>Plant varying heights of trees</p>	<p>Develop pollinator habitat and food sources along riparian areas</p> <p>Keep dead tree stags if safe to do so</p>	<p>Educate residents on use of native plants</p> <p>Encourage homeowner BMP's for pollinators</p>

	PLANTING	MAINTENANCE	EDUCATION
RESILIENCY	Increase planting to offset expected losses to climatic influences (weather, insects, disease) Plant many diverse species, but be sure to include hybrid elm, bald cypress, blackgum, sycamore, pecan, Persian ironwood, and oak in the white oak family	Develop and maintain a cyclical pruning program Actively manage insects and disease	Stimulate community support for trees Encourage private property planting
BIG TREES		Invest in maintenance of existing trees for health and longevity Plan proactive treatment for known insects and disease	Educate residents on need to prolong life of trees through timely maintenance Celebrate older BIG trees
INSECTS DISEASE INVASIVE PLANTS	Ramp up planting to replace ash trees Plant for diversity	Continue ash removal program through completion	
REPORT CARD	Strive toward 3% canopy increase Budget 1 million dollars to meet 3% canopy goal Continue to use Right Tree, Right Place planting protocol	Keep TreeKeeper8 inventory perpetually updated Enforce tree protection standards during construction	Work with all neighborhoods to help establish tree canopy percentage goals Develop a public awareness program on benefits of trees
LARGE LANDOWNERS	Cooperatively establish planting and maintenance benchmarks to meet 3% canopy goal	Connect large landowners with TreeKeeper Volunteers to plant and maintain new trees	Educate large landowners regarding the benefits of trees
REGIONAL COOPERATION	Create multi-jurisdictional natural resource plans Plant in corridors between municipalities	Maintain corridors between municipalities Together, create and promote an Arborist apprentice program, possibly through DMACC	Invite 17 municipal leaders (The Tomorrow Plan) to support cross-jurisdictional forestry initiatives Continue quarterly forestry meetings
URBAN WOOD REUSE		Forestry staff retain valuable logs for potential sale to processors	Educate City workers and the public to treat removed trees as a natural resource Create and promote wood reuse programs
VOLUNTEERISM AND NONPROFITS	Encourage corporate and neighborhood planting projects Encourage development of an employment program in a nonprofit (TF) tree nursery		Continue training TK Volunteers Participate in Upcycle Stewards program Encourage volunteerism Promote corporate and nonprofit funding
RECOMMENDED SPECIES	Plant diverse species Plant with climate change in mind		Educate property owners on upcoming changes to the urban tree canopy
MANAGEMENT PLAN	Increase planting to 3800 trees per year Increase planting budget to 1 million dollars Encourage planting on private property	Invest in cyclical pruning Continue existing maintenance and removal operations Ensure timely removal of dead, dying or structurally unsound trees and stumps	Create a public outreach concerning the elements of the UFMP Encourage good tree care and planting on private property

	PLANTING	MAINTENANCE	EDUCATION
RESIDENT SURVEY	Ensure equitable planting in all areas of the city. Provide more trees and tree services in low tree canopy areas, and to under-resourced neighborhoods	Seek creative maintenance solutions to the needs of seniors and residents with disabilities Invest in additional street sweeping every autumn in areas of high leaf litter	Initiate contact with all neighborhoods to establish tree priorities Assist neighborhoods to set tree canopy goals
ENVIRONMENTAL EQUITY	Increase tree planting in low to middle-income areas Engage diverse demographics with the Tiny Trees and other tree distribution programs	Increase tree maintenance in low to middle-income areas Ensure equity in delivery of maintenance	Provide education about how expanding and maintaining the tree canopy will benefit residents
URBAN HEAT ISLAND	Plant trees strategically along streets and sidewalks, next to buildings and A/C units Plant trees in and around parking lots Use City tree distribution programs to initiate abundant tree planting on private property	Develop a cyclical pruning program Find ways to keep and maintain older BIG trees for their sizable contribution to the environment	Educate residents on placement of plantings
ENERGY	Increase street tree planting Establish energy efficiency program that emphasizes the use of trees		Educate residents to plant with energy reduction in mind
SOCIETAL EFFECTS	Plant Plant Plant for all the benefits associated with trees such as stormwater retention, mitigation of climate change, to reap the benefits of green infrastructure and reduce the cost of installing and maintaining gray infrastructure, as riparian buffer, as wildlife habitat, to provide food source and shelter for pollinators, to build environmental resiliency, to take the place of BIG trees when they retire, to mitigate the effects of insects, disease and invasives, to provide environmental equity, to combat and reduce the effect of urban heat island, and to save energy		Education: Provide community education to health care providers and residents concerning physical and mental health benefits of trees Notify hospitals of Tree Campus Healthcare program Notify DM Public Schools of Tree Campus K-12 program Notify universities of Tree Campus USA program Assist all groups to meet criteria and seek recognition Provide education to retailers about economic benefits Provide education to neighborhoods and police about possible reduction in crime along treed streets
HISTORY OF TREES	Take and make opportunity to maximize the planting of street trees	Hire 6 additional Arborists to invest in a cyclical pruning program	Educate other City departments on stormwater, energy and community safety benefits of trees







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2020 YEAR OF THE TREE

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