2013 PRELUDE

to an

Urban Forest Master Plan

Acknowledgements

Prelude to an Urban Forest Master Plan (UFMP)

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(RealWorld Externships for Teachers of Science, Technology, Engineering and Mathematics)

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Introduction

Des Moines serves not only as Iowa's capital; it is also the most populated city with 206,668 people according to the 2012 census estimate. Located along the Des Moines and Raccoon Rivers, the city was first incorporated as Fort Des Moines, and later as Des Moines in 1857, receiving its name from the Des Moines River.[1] Providing beauty as well as tremendous economic and health benefits, the Des Moines urban canopy blankets this proud community. An elaborate connection of sky walks link the downtown, while spacious parks and seemingly endless bike trails weave neighborhoods together. Throughout the business and residential districts an estimated 50,000 street trees quietly provide not only shade and cooling, but an immense amount of environmental benefits such as the reduction of rainwater overloading storm water systems.

The urban forests in Iowa are an extremely beneficial and important part of our daily life. Unlike most states, the rural areas of Iowa actually support a smaller forest canopy per acre than the urban centers such as Des Moines. It is estimated that the coverage of forest canopy in Iowa state-wide is currently 7.8%, while Des Moines as a city contains a tree canopy of 26-27%. However, the canopy of Des Moines has been declining according to reports which show there was 30% canopy in 1950.[2,3]

A major goal for the Des Moines community should be to protect and preserve the existing urban canopy and make plans to replace trees lost to development, disease and old age. The result will be a healthier and expanded urban canopy. To channel these efforts, planning is essential, but before this Urban Forest Master Plan (UFMP) becomes a final working document, the completion of a tree inventory is an absolute requirement. A comprehensive tree inventory will provide specific information about the number, type, size, age, health, and location of each tree as well as potential locations for new plantings. The inventory will then serve as a critical tool for purposeful planning, allowing for decision making based on collected data.

A future final UFMP, supported by the tree inventory, will serve as a precursor to conversations, and a catalyst to action, providing a single vision for the community of Des Moines as it attempts to improve the urban canopy. Decisions on investments of time and energy, ranging from a single tree planted by a home owner on private property, to thousands of public trees planted and maintained by city staff, will be focused on the same shared goals. Volunteer and community organizations along with schools and businesses will be able to combine efforts to help protect, preserve and even expand the urban canopy and ensure it will continue to thrive for future generations.

References

1. State Historical Society of Iowa: Des Moines History; River Front Becomes State Capital. Advameg Inc. 2009.

2. Nowak, David J.; Greenfield, Eric J. 2010. Urban and community forests of the North Central West region: Iowa, Kansas, Minnesota, Missouri, Nebraska, North Dakota, South Dakota. Gen. Tech. Rep. NRS-56. Newtown Square, PA: U.S. Department of Agriculture, Forest Service, Northern Research Station. 70 p.

3. Peterson, Nick, (ISU Environmental Science), Just, Danny (ISU Forestry), Jahn, David (Municipal Arborist, City of Des Moines*), Urban Tree Canopy Analysis*, City of Des Moines, May 2013.

Why Des Moines Needs an Urban Forest Master Plan

Cities across the United States and even here in Iowa have recognized the reasons for an Urban Forest Master Plan (UFMP) to guide long term planning of human resources, equipment and budget, while combining resources from a variety of agencies and organizations toward a common goal.

Reason #1: Baseline metrics and clear goals will crystallize planning and outcomes.

Before the creation of an UFMP begins, a comprehensive tree inventory will have to be completed in order to provide information essential to the writing of the plan. The data gathered will assess the current size, characteristics, and condition of Des Moines' urban canopy in order to establish goals and benchmarks, including planting and management strategies. For example, the plan could establish a timeline for the maintenance of trees or provide a schedule for planting specific types of trees in predetermined locations.

Reason #2: Current and future environmental challenges will require action.

Water and air quality, potential devastation from emerging tree pests, and complex environmental issues continue to challenge our region. Trees provide substantial environmental benefits helping conservation including reduced energy use, decreased carbon dioxide levels, improved air and water quality, and reduced stormwater runoff and erosion.

Reason #3: Economic and Health benefits will impact the entire community.

Each tree in the urban canopy will add economic benefit not only from energy savings, but also from greater patronage in retail districts, and increased value of private and commercial property. The preserved canopy will also provide health benefits including mental and physical well-being and increased neighborhood safety and cohesiveness.

Reason #4: A coordinated vision will lead to positive change in the urban canopy.

Protecting and maintaining Des Moines' urban canopy involves a wide range of public and private stakeholders. Organizations include city departments, environmental agencies, public utilities and public schools, while the private sector may involve non-profits, developers, business owners, and city residents. A master planning initiative creates a coordinated and singular vision for Des Moines' urban canopy while providing an opportunity to unite stakeholders focused on common objectives. The UFMP will increase efficiency through coordinated efforts with urban canopy partners, saving both time and money, while demonstrating cooperative visioning and planning.

Reason #5: Advocacy and increased civic participation will ensure long-term survival of the urban canopy.

A key element in developing, initiating, and updating Des Moines' UFMP is the creation of highly visible and accessible education for our community, fostering the commitment of current citizens and future generations to become stewards of our urban canopy.[1]

Planting Seeds at a 2012 Workshop

"Tree Des Moines, a local citizen advocacy group, wished to continue to promote their efforts to protect and enhance the urban tree canopy to a larger audience in the Greater Des Moines region. In association with representatives of RDG Planning & Design, Inc., they proceeded to plan for a half-day Community Forestry Workshop to achieve the following goals:

- Begin coalition building in support of an urban forest master plan
- Discover perceptions of the plan's potentials and challenges
- Gain input on implementation strategies to leverage opportunities and overcome obstacles
- Identify initial action steps and funding opportunities to achieve the plan
- Understand the possible role(s) of the plan in the Greater Des Moines region

The planning culminated in a Community Forestry Workshop at the Botanical Center in Des Moines on October 25, 2012. There were more than 90 people in attendance over the course of the event, including presenters. Keynote presentations were made by Jill Johnson of the U.S. Forest Service, Dan Lambe of the Arbor Day Foundation, and Josh Behounek of the Davey Resource Group. In addition to these presenters, local panelists Tammie Krausman (Director of the Resource Enhancement and Protection program at the Iowa Department of Natural Resources) and Todd Ashby (Director of the Metropolitan Planning Organization [MPO]) joined Moderator Mollie Cooney of KCCI-TV for a panel discussion to begin the event. Following is a list of key messages gleaned from the Workshop Report."[2]

Des Moines needs to plan and budget NOW for several important items.

1. **INVENTORY FUNDING** - First, Des Moines needs to conduct its first ever computerized tree inventory. This management tool is essential not only for regular management of the urban forest, but also as a tool to make plans for Emerald Ash Borer, the loss of hundreds (perhaps thousands) of mature oaks, and other serious tree problems. The documentation in an inventory will provide essential management and planning information such as species, size, condition, recommended maintenance and a host of other data that is required for the city to utilize in protecting and enhancing the urban forest. Many other parts of the UFMP will gain traction once the inventory is published, including new and enhanced opportunities to engage the Foundation community in building up the urban forest.

2. **MAINTENANCE FUNDING** – Workshop participants recognized that mature trees provide exponentially greater benefits to people and the environment and, therefore, should have priority budget considerations. The city has a good stock of mature trees (defined here as being over 18" in trunk diameter and 40-120 years old. We continue to lose mature trees to straight-line winds, storm damage, power line clearance, development, insects and diseases, so it is imperative that we invest today to keep our mature trees longer in order to maximize our returns on this 40 -120+ year old investment.

3. **EDUCATION FUNDING** – Workshop participants were very clear about their desire to see more education at all levels, including to "neighborhoods, schools, planning and development groups, elected and city officials, and tree organizations" Public education about all aspects of the urban forest is both desirable and necessary. Workshop participants felt strongly about communicating to the public concerning tree health, tree care, contractor qualifications, meeting the threats posed by Emerald Ash Borer and other destructive pests, and the many benefits of trees such as natural stormwater management, calmer traffic, increased property values that directly affect city budgets, lower crime, savings on energy bills, quality of air, quality of life that attracts economic development and many others. The city is encouraged to maximize public engagement by raising a sense of ownership and responsibility for trees. Community outreach requires an investment of time and money to promote the health, safety and economic benefits of trees.

4. **DESIGN A COMPREHENSIVE FUNDRAISING PROGRAM** to enable all urban forestry activities, including inventory, planning and design, inspection and enforcement, cyclical tree maintenance, planting, and community education.

Public/private partnerships should be explored to expand city budget, and a connection needs to be drawn concerning the important role trees play in stormwater management. Additional support from the city will be necessary so that funding partners are encouraged to get on board.

5. **CONSIDER WHETHER DES MOINES SHOULD BE PART OF A METRO-WIDE EFFORT TO CREATE AN URBAN FOREST MASTER PLAN (UFMP),** up to and including taking a leadership role in the process.
    - It appears workshop participants see an UFMP as doing more than protecting the urban canopy of the greater metro area.
    - They see the UFMP as a tool for regional collaboration, as a way to engage the public directly in community-building and natural resources protection.
    - They see the UFMP as a means for public education and building tree resources and advocacy throughout the metro.
    - Ultimately, they see a successful UFMP as a key piece of the overall high quality of life mix metro area residents continue to both expect - and personally work to ensure - in Greater Des Moines.

With workshop attendance so strong from the neighboring communities, and with an expressed desire to see something positive happen on a broader scale, Des Moines should consider both leading and participating in a collaborative process with these communities. Trees know no boundaries, and what affects the trees in Des Moines is also true in surrounding communities, so there is merit to making plans on a regional basis.

References

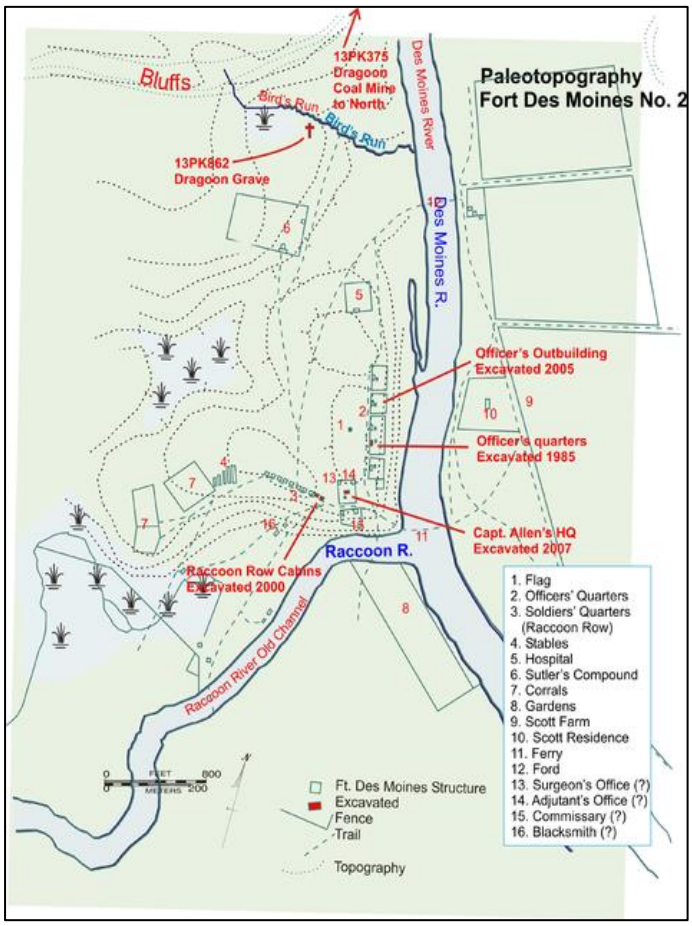
1. Adapted from: Pittsburgh Urban Forest Master Plan, A Road Map for the Effective Management of our Urban Forest; http://treepittsburgh.org/sites/default/files/PDFs/treesforthefuture_pghuf_masterplanframework_updated.pdf

2. Community Forestry Workshop: *A Report on October Community Forestry Workshop*, October 25, 2012.

History: If a Tree Could Talk….

It seems there is nothing more ancient and even wise on this earth than a tree. Trees may spark a memory, symbolize life, show evidence of past weather and climate through time, and have been silent witnesses to a community's past. Trees could be considered one of us in way, a productive 'citizen', being involved in one way or another in the history of our community. Des Moines is no stranger to our longest living citizens, the trees. Some tree out there has a sentimental memory to someone and can be a trigger to family history. It is anticipated that this Prelude to an UFMP will illustrate the vast benefits that our 'natural' citizens can truly provide, thus enabling the 'human' citizens to sustain our precious urban forest canopy through preservation, maintenance, and planting.

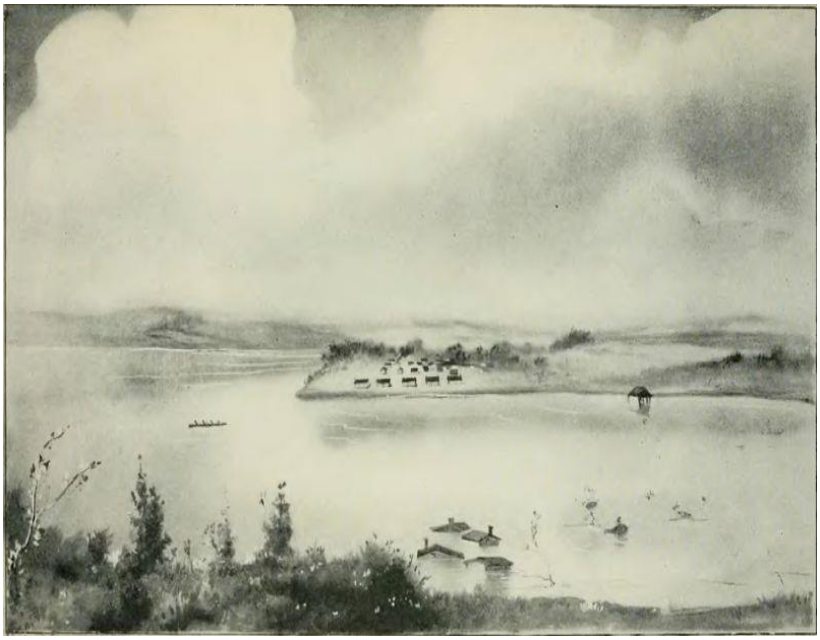
The Ground We Walk On



Location of Fort Des Moines No. 2, Downtown Des Moines, Iowa US, Bill Whittaker of English Wikipedia 2009

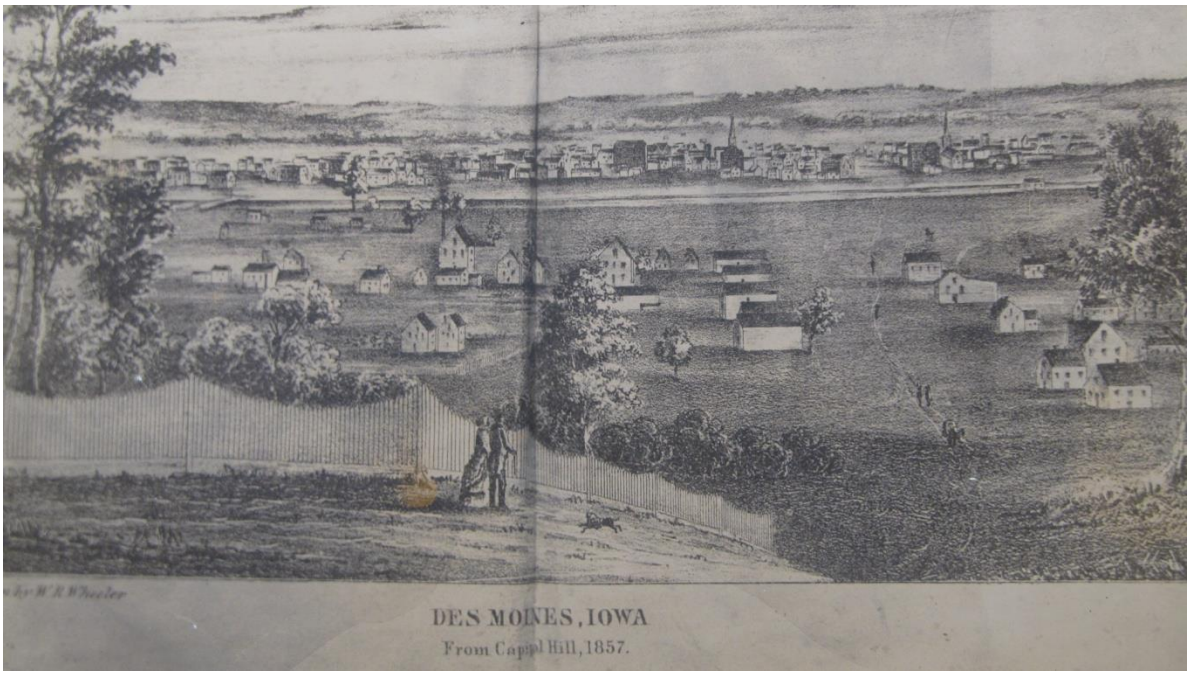
Des Moines has come a long way geologically speaking, starting with our land's prehistoric forests where cypress, magnolia, cinnamon, fig and palm flourished in Iowa, then the rise and receding of sea level, to our present day prairie and plain lands.[1] At least 3000 years ago, humans occupied villages such as the Raccoon River Village, the Des Moines River Village and the Bird's Run Village at the crossing areas of the Des Moines and the Raccoon rivers. The lands were hunted and harvested for vegetation in the rich fertile floodplains, the rivers were fished from the flowing waters, pottery was crafted from the dirt, and goods were traded for other goods from the settlers. Sound familiar? It should - it may remind one of a modern day farmer's market.

The government established Fort Des Moines in the vicinity of present day Principal Park baseball stadium and the Des Moines area became open for business to new settlers.



Soon after the Army left and with the flood of 1851, residential developments and industry took root. By the 1900s the railway brought in factories, coal mining and warehouses that covered much of the downtown area.

Des Moines River at Fort Des Moines in 1851, Source: History of Iowa From the Earliest Times to the Beginning of the Twentieth Century Volume 1.djvu, Benjamin F. Gue, 1903



Drawing of Des Moines from Capitol Hill 1857, State Historical Society

Later, people moved further from the downtown, abandoning some of those same warehouses and factories, and expanding the footprint of the city. The 1930s brought the rerouting of the Raccoon River to its current channel from what once entered the Des Moines River just south of the Martin Luther King Parkway changing the topography of Des Moines as we know it today.

Des Moines Looking East, F.J. Bandholtz 1907

In the 1990s, the downtown area was revived and downtown once again sprouted offices, residences and new businesses.[3]

East Village Locust Street

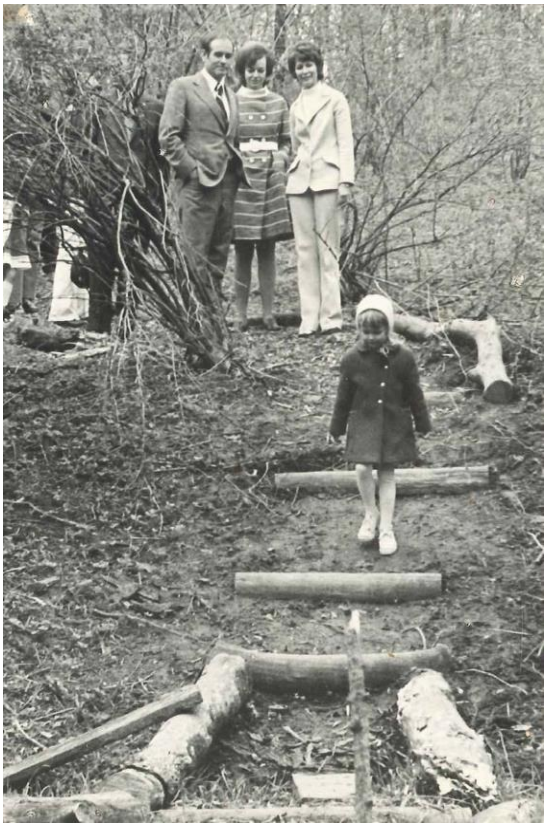
Humans have been living in the area of Des Moines for thousands of years, while trees have been around for millions more and will continue to be around long after we have left our historical mark. It is our responsibility to remain in a good faith relationship to our 'natural' citizens and appreciate their vital contribution to our urban community.

Tree Stories

For centuries, tree citizens have been making the human citizens feel at home and bringing notice to the city of Des Moines. Early settlers may have established their communities based on the location of trees. City streets were actually named in honor of trees. For instance, Grand Avenue took its name from the rich canopy the elms provided, covering the street with a grand tunnel of green. People depended on trees as a source of fuel, building materials, and protection from the ever changing Iowa weather. Trees are landmarks in our community and should stand tall as contributors to what has made Des Moines the city we love and cherish.

If trees could really talk, what would they say about us? The oak, hickory, maple, basswood, ash, walnut, cottonwood, and the remaining elm, may have words that are similar to those spoken by some of our current and past Des Moinians.

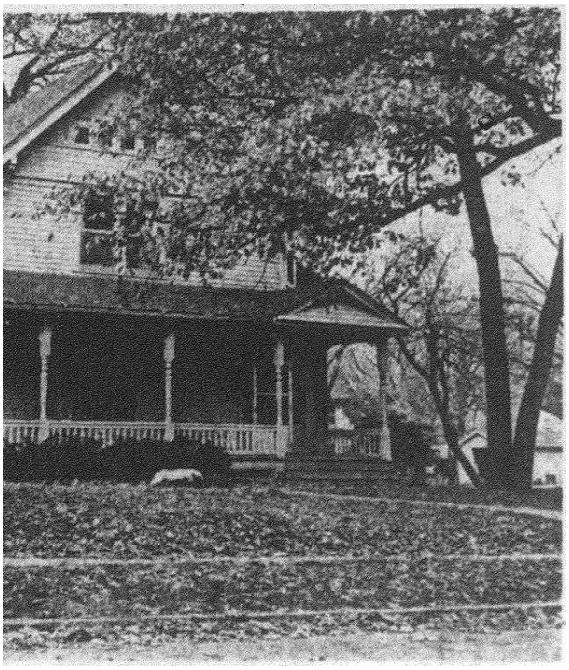
"My tree memory is not from just one tree but from wooded areas near my home. My parents believed in letting us explore our environment and there were two wooded areas I know quite well. One was called the 'yum yum trail'; it was full of mulberry trees and trails made from the neighborhood explorers over the years. We rode our bikes and horses through it, and cut through it on the way home from school on hot days to cool off and get a drink from bubbling springs. We built forts and spent most of our summers 'hiding out' from the view of adults. But my respect for trees came from my late grandfather, Sylvan T. Runkel, or Pops as we called him. He took us on many nature walks and talked of the trees and plants in a wooded area as if they had souls, calling them citizens of the forest and each of the jobs they undertook for their community. He did many great things for Iowa and Des Moines, but one that I hold dear to my heart was his undertaking of a nature trail behind my elementary school, Jefferson on Watrous, making me feel very important. I regret that it is no longer there or at least very little of it remains, but I will remember running through the trees, along the trails and being proud that my family had much to do with its existence." Beth A. (Runkel) Martin, DMPS teacher, citizen of Des Moines for 46 years, and co-author of the July 2013 first draft of the UFMP.



May 1973, Gov. Ray dedicates the Jefferson Nature Trail, Beth Anne Runkel at bottom, Governor Robert Ray, Marian Huck and Carolyn Lombard (neighbors to the trail) at top.

"……..One of my earliest tree memories involved climbing trees with my twin sister Julie. We were about 8 years old. My father did not approve of us climbing, not sure why, maybe it was because we might fall and hurt ourselves. My mother was actually instrumental in talking my father into letting us explore tree climbing. She told my father, "Herald, let them climb. They are little monkeys anyway. Let them burn off energy, build coordination and explore." So, we were allowed to climb all over our property. As a youngster, this is where I gained an understanding of trees, their structure and strength. Really started to look at the strength of trees and how well anchored they are – how phenomenally they are put together. As climbers, we had to understand the strength of each limb. Could we stand on it or not? Could a one inch diameter limb support us? Many could. The bark was there to scrape against. Very strong!

If it wasn't for my mother, Etta, I may not have gotten this early understanding of trees at such a young age……" Buz Brenton, Founder of Brenton Arboretum, citizen of Des Moines for 69 years.



Before 1900 and after 1962 pictures

"Little changed in exterior, this is Dr. Johnstone's home as it looks today (1962). Lewis A. Royal, an attorney, is the grandson of Dr. Johnstone. Tree with forked trunk at right is a "pignut" hickory, the same tree which shows in the picture taken 62 years ago (1900). Towering over roof in back of the house are branches of giant elm tree, which Royal says is about 200 years old." State Historical Society

New bungalows at left in 1949 located at 55th and 56th streets between Franklin and Hickman Rd. were post-war housing boom of 82 houses.

Today trees make the neighborhood so much more lively and livable.

Proud Citizens

Just as a child's accomplishments make a parent proud, likewise trees make all of us proud. Many of Des Moines' tree citizens have made their mark for simply doing what comes naturally.

Arie den Boer was an early member of the Des Moines Garden Club and also a member of the Founders of that organization. This smaller group became the organizers of what is now known as the Des Moines Founders Garden Club (DMFGC), a member of the Garden Club of America.

Mr. den Boer organized and documented the collection of crabapples in Water Works Park. For this he was honored in 1961 by the Garden Club of America with its highest award, the **Medal of Honor,** for his work of national acclaim on crabapple classification and hybridization in this collection.

Arie den Boer Arboretum, Waterworks Park

In 1994, the DMFGC won the Garden Club of America prestigious **GCA Founders Fund Award** for their work at Greenwood Park, known as ***Discovery Wetland Project***. In cooperation with other city organizations and the Des Moines Art Center, with artist Mary Miss, the two projects were combined in the naming of ***Greenwood Pond : Double Site***. DMFGC planted 21 David Crabs around the curve of the pond, as our part of this combined venture. This variety of crabapple tree had been named by Arie den Boer for his grandson.

Des Moines is the home of Iowa's Millennium Tree, located at the Henry Wallace House in the Sherman Hills Neighborhood. It is over 100 years old.

Henry Wallace House (756 16th St, Des Moines)- "Iowa's Millennium Tree," C.A. Tucker National Register of Historic Places, 93000412

Two other famous trees are located in the Glendale Cemetery, State Champions - Norway Spruce and White Fir - the biggest trees of their species in Iowa.

Terrace Hill was nominated in the Famous and Historical Trees of Iowa DNR edition of 1997, for its more than 200 trees and shrubs on the grounds and its design intended to be historically accurate with the location of its trees.[2]

The Des Moines Valley Friends Elm was also nominated as a famous and historical tree of Iowa. This American elm, maybe the only elm to escape the infection of by the Dutch elm wilt disease that killed multitudes of Iowa's elm trees in the late 1960s. It is located on the grounds of Des Moines Valley Friends Meeting House (4211 Grand Ave, Des Moines) and is approximately 100 years old. It is about 60 feet tall and is registered with the Elm Tree Research Institute of New Hampshire.[2]

References

1. Benjamin F. Gue, History of Iowa From the Earliest Times to the Beginning of the Twentieth Century Volume 1, 1903.

2. Famous and Historical Trees of Iowa- DNR Jun 1997

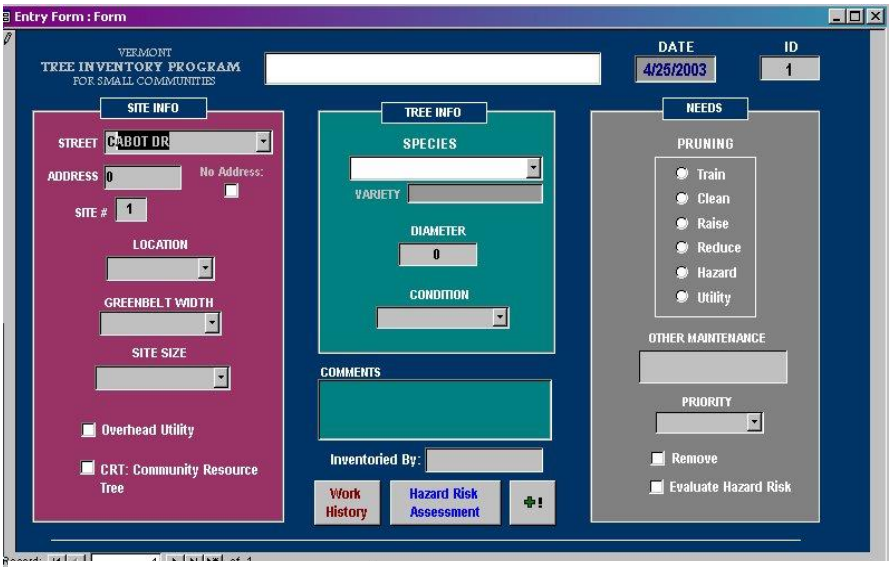
3. 2007 Archaeology Month Poster
   produced by Iowa's Office of the State Archaeologist and presents information about the change in the landscape of the Fort Des Moines No. 2 site over time.

Tree Inventory: How do you know what you need if you don't know what you have?

Periodically businesses take an inventory of what they have in order to make plans for purchasing, budgeting and more. Governmental agencies make assessments before planning for projects that need to be done such as the repair of roads or bridges. Even in our homes, we often check to see what we have on hand before making a trip to the local grocery store. This same concept should be applied to the trees in an urban canopy. In order to make informed and prudent decisions on where and when trees should be planted, including the type of tree and size, and the maintenance requirement for specific trees, a complete tree inventory is absolutely essential.

A tree inventory is a listing and description of trees and planting sites. It provides more than just a counting of the numbers of trees in a specific location. A professional tree inventory also:

- provides an overview of the ages, types, and condition of trees
- allows you to make a maintenance schedule backed by data
- makes it easy to set priorities for pruning and removal work
- is an excellent tool for budget planning and negotiation
- aids greatly in answering homeowner questions
- supplies guidelines for new tree selection
  (National Arbor Day Foundation)[1]



Tree inventory created by University of Vermont Extension using Microsoft's Access[1]

A *professional* inventory is made by trained and experienced professionals, now routinely using a computer program capable of advanced data storage, analysis and reporting.

Every inventory includes at least an address, species, size, condition, hazard potential, and necessary maintenance work for each tree. From this wealth of information, more informed

planning and decision making are possible, which elevates a tree inventory into a powerful management tool.

A tree inventory is an essential component of an UFMP. The information recorded is critical for maintaining a healthy and sustainable urban canopy. The inventory once completed, however, is but a snapshot of a moment in time. The community forest is continually changing as existing trees are pruned and removed, and new trees are planted. The usefulness of the inventory, therefore, depends to a large degree on maintaining current information. Having made the commitment to conduct an inventory, a community should make the additional commitment to update inventory data as trees are pruned, removed, and planted.

A Working Tree Inventory

A progressive example of a tree inventory that has been completed and now being utilized for decision making and public use is the one used in Ann Arbor, Michigan. In May of 2009, the city completed a comprehensive tree inventory. Not only did the study provide the species, size, diameter, and condition with maintenance needs for each tree, it also collected the geo-coded location. Using Google-Earth, the city has provided a link to allow the public to locate any tree surveyed and click on it to find out information about the tree.

http://gisapp.ewashtenaw.org/mapannarborx/Viewer.html?Viewer=A2Trees

Another interesting and informative part of the tree inventory for the city of Ann Arbor is the specific information that was gathered. Along with the information obtained for over 47,000 trees, the stumps of trees needing to be removed were located and nearly 9,000 potential sites for planting new trees were recommended. The tree inventory data was added as a layer on the city's geographic information system (GIS) and integrated with the asset management software Cityworks, which enables the City to manage trees in the same manner it manages other City assets. [3]

What Do We Have?

State of Iowa

There have been studies conducted on the total canopy statewide in Iowa; however, preliminary estimates of the Des Moines canopy indicate that the capital city does not mirror the statewide picture. According to a report released by the USDA on the North Central Region of the United States, urban land (with and without trees) in Iowa comprised about 3.6 percent of the state land area in 2000, an increase from 3.4 percent in 1990.[4] This signals an important distinction between rural and urban forests. Unlike most states, Iowa's rural areas do not contain the higher percentage of tree canopy per square mile. It is Iowa's urban canopy that produces the greater amount of ecosystem services. Urban and community areas statewide have 10.4 percent tree cover, whereas the statewide tree canopy cover today averages 7.8 percent. [4] It is worthy of note that Des Moines has 26-27% tree canopy.

Des Moines

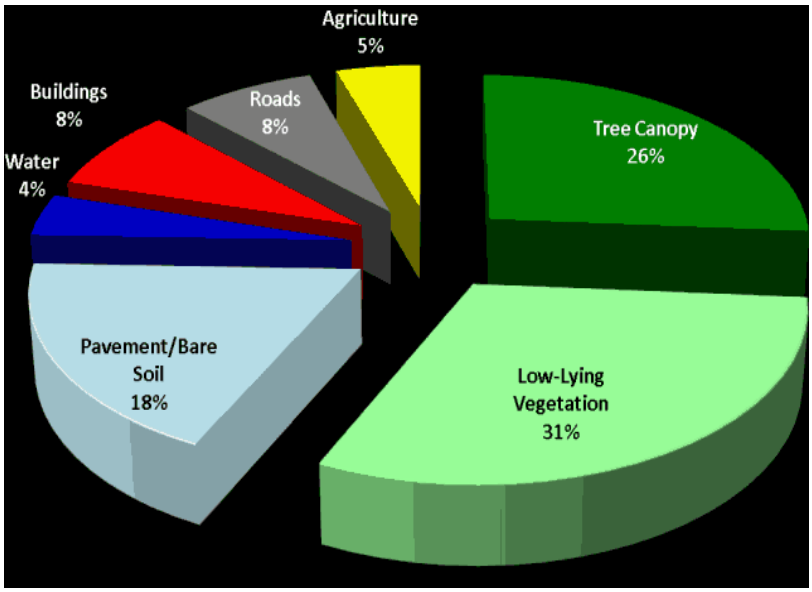
An important Urban Tree Canopy (UTC) assessment performed in 2009 by the U.S. Forest Service and the University of Vermont (UV) indicated that Des Moines has a 26% tree canopy cover. However, at this point a comprehensive tree-by-tree inventory has not been completed for the city of Des Moines. When this future inventory is completed, it will go beyond the simple reporting of a tree canopy percentage, to further serve as an invaluable tool for planning and management. Currently, the city of Des Moines has compiled two diminutive collections of tree information and two research studies of the urban canopy of Des Moines. One of these studies by Iowa State University (ISU) sampled sections of the city to complete a tree-by-tree analysis, and the other was done by UV and the US Forest Service aerial imaging analysis. Additionally, we have a separate study on natural resources within Des Moines' parks and conservation lands. All of this information is useful, but serves as only a partial indicator of what the tree inventory could deliver to the community.

The two collections of tree information previously mentioned are merely spreadsheets. The first contains information on over 6000 street ash trees owned by the city which was gathered in light of the threat of EAB (Emerald Ash Borer). The second collection is a summary of all the trees in the central business district which are being maintained to help keep the shopping and business district attractive and safe for citizens. These two data collections do not contain the quantity or quality of details of a comprehensive tree inventory, nor do they allow for the planning and budgeting necessary to engage in an optimum urban forest management program.

Beyond the two collections, there are the two aforementioned research studies (the separate parks study will be discussed later). In the first research study, three Des Moines neighborhood canopies were analyzed using i-Streets (a USDA Forest Service Software) and a collection of data compiled by ISU Urban Forestry students. The neighborhoods included Beaverdale, Drake, and Terrace Hill; however, it should be noted that only Terrace Hill is a 100% inventory (including private trees) while the other two neighborhoods only included street trees. The results of the study indicate a 3% decline in the urban canopy of Des Moines from 1950 to 2010 as shown.[5] This study reveals a sample of the overall change in the urban canopy that is not yet completely known. Keeping in mind only three neighborhoods were surveyed and only the Terrace Hill portion of that study was a 100% inventory, the analysis is just a sampling of the overall canopy. The results of a complete study may mirror these, but this will not be known until a comprehensive tree inventory is available.

Decade	Tree Canopy Cover (%)	Buildings (%)	Roads, sidewalks (%)	Other (%)
1950s	30.0	5.8	10.3	53.9
1960s	29.5	6.3	14.1	50.1
1980s	29.8	7.6	16.5	46.1
2000s	27.5	8.0	17.4	47.1
2010s	27.0	8.0	17.4	47.6

Urban Canopy Decline from 1950 to 2010 in Des Moines [5]
The 'other' referred to in the above chart includes non-treed green spaces and water bodies.



Percent of Urban Canopy in Des Moines [6]

In the second research study, the UV in cooperation with the USDA Forest Service conducted an aerial survey of the urban canopy of Des Moines. The result concluded that the urban canopy of Des Moines is 26%.[6] While it is extremely useful to know this, the information is not summative since the study does not provide sufficient detail on individual trees. The only method of gathering the type of specific information necessary to plan for the preservation and expansion of the urban canopy is by conducting a thorough tree by tree inventory.

The third study mentioned is the natural area analysis of the city's park lands conducted by the Des Moines Park and Recreation Department. This seminal work began in mid-2011, and contains data that forms the basis for planning and later development. A draft of the findings was released in February of 2013. The investigation used information from aerial surveys, field maps, field surveys and seed banks to determine the type, size, condition and location of different plant species, including trees, within 20 X 50 m plots or 290 m transects. The study reveals the ample species diversity within the Des Moines parks including 617 plant species with 441 native to central Iowa. The study also determined the presence of 12 problematic invasive plants including bamboo, honeysuckle, black locust, and buckthorn trees. The conclusions of this report to the Des Moines Parks and Recreation Department were purposeful, but even the study itself underscores the need for more information in order to make meaningful plans for dealing with habitat loss for trees, pollution concerns, and invasive species. [7]

What Could We Have?

We've just discussed the present state of the city's urban canopy based upon limited available research. A near future comprehensive tree inventory would serve as a tremendous resource, providing knowledge about the urban canopy of Des Moines and allowing for responsible planning and budgeting. The tree inventory would allow the city to develop of an UFMP, as a working document.

As stated in the Urban Forestry Best Management Practices for Public Works Managers: Urban Forest Management Plan,

> *"An urban forest management plan, based on recent tree inventory data and analysis of available staff, equipment, and budget resources, is an essential tool for protecting this valuable resource. An urban forest management plan is an action plan; it gives public works*

agencies detailed information, recommendations, and resources needed to effectively and proactively manage public trees." [8]

The specific information on each tree surveyed would include location, species, diameter, condition, maintenance need and priority, proximity to utility lines, traffic signs and signals, or sidewalks, insect and disease problems, and potential planting sites.

Tree Management Plan

Once a tree inventory is completed, the next obvious and logical step is to analyze the vast quantity of information from the study and begin determining what steps are necessary to maintain the existing positive attributes of the urban canopy and to make goals for areas of improvement.

Following the completion of a Tree Inventory in the city of Pittsburgh, a Seven-Year Urban Forest Tree Management Program was developed to organize and outline efforts to reach the city's goals for improving the urban forest. That tree management program made these 11 recommendations:

1. Perform all recommended tree removals and priority pruning.

2. Implement a continual maintenance cycle for the pruning of all trees every seven years.

3. Implement a Training Pruning Program for the large number of younger trees.

4. Implement an expanded public relations and education campaign to support the urban forestry program.

5. Expand the species diversity of the urban forest with proper species selection.

6. Establish a tree planting program to increase species diversity, and to establish replacements for significant landscape trees approaching senescence.

7. Educate all City personnel concerning proper mulching, pruning, general arboricultural treatments and techniques, and how to prevent equipment damage to trees.

8. Present an educational program to highlight the findings of the tree inventory to personnel and operations budget administrators for inevitable removals, the importance of healthy trees, and the need for continual preventive maintenance and planting.

9. Protect valuable mature trees and all young trees from construction damage and unnecessary removal, especially large specimen trees that are in good condition.

10. Implement a tree preservation program in conjunction with all building and infrastructure construction and renovation projects.

11. Review and/or revise the City's Tree Ordinance and issue fines to developers and contractors who continually ignore posted regulations.

(Source: City of Pittsburgh Public Works, Forestry Division[9])

References

1. Fazio, James, R. "How to Conduct a Street Tree Inventory" (Tree City Bulletin #23, National Arbor Day Foundation., 100 Arbor Ave, Nebraska City NE 68410). www.umass.edu/urbantree/factsheets/3treeinventory.html and Gene Olig and Robert Miller, 1997. "A Guide to Street Tree Inventory Software".

2. Bassuk, Nina, L. Dr., "Community Forest, Conducting a Street Tree Inventory", Department of Horticulture, Cornell University. March 22, 2011.

3. City of Ann Arbor, Tree Inventory conducted by Davey Resource Group, Davey Tree Expert Company, May, 2009.

4. Nowak, David J.; Greenfi eld, Eric J. 2010. Urban and community forests of the North Central West region: Iowa, Kansas, Minnesota, Missouri, Nebraska, North Dakota, South Dakota. Gen. Tech. Rep. NRS-56. Newtown Square, PA: U.S. Department of Agriculture, Forest Service, Northern Research Station. 70 p.

5. Peterson, Nick, (ISU Environmental Science), Just, Danny (ISU Forestry), Jahn, David (Municapal Arborist, City of Des Moines*), Urban Tree Canopy Analysis*, City of Des Moines, May 2013.

6. O'Neil-Dunne, Jarlath, Grove, Morgan, Cook, Randy, Nachtrib, Matthew. Urban Tree Canopy Assessment Des Moines. May 13, 2009.

7. Rosburg, Thomas, Natural Resources Inventory of the City of Des Moines Parks and Conversation Land. Department of Biology, Drake University. February, 2013

8. Urban Forestry Best Management Practices for Public Works Managers: Urban Forest Management Plan. APWA Press.

9. Davey Resource Group*, 7 Year Management Plan* for Pittsburgh, PA. Kent, Ohio, 2005. http://www.city.pittsburgh.pa.us/pw/html/forestry.html

Treeonomics:

A Tree's True Value

Our society puts a monetary value on just about everything and what is not 'counted', does not count in public decision making. City trees do not typically turn into commodities grown and managed for products that can be bought and sold on markets, nor are they consumers to include in a product marketing analysis, but they do provide many intangible services and benefits that have monetary value!

Putting a value on something can mean different things for different individuals. A tree could be considered a commodity for its lumber value, while someone else may see the value for sentimental reasons or the way it looks in their yard. Still others, hopefully after reading this master plan, will see the non-commodity economic values a tree can offer to its community. Economists and other social scientists have actually developed methods that will convert the intangible benefits into dollar sums and help us to see the non-market values of trees and benefits of trees.[1, 2]

Putting a Value on It

Residential Property

What is it that draws the attention of an individual to a place or setting? Is it what you heard verbalized about it? We often talk about what something looks like before any of its attributes are known or understood. Most of us judge things that do have natural elements as more aesthetically pleasing to the eye and of higher visual quality than those without natural elements. Aesthetic response is not only a reaction to what is beautiful or pleasant but is the product of a complex array of perceptual and cognitive processes that indeed drive behavior.[3] Economic consequences follow for example, as firms and talented workers are attracted to places that have high numbers of amenities and high quality natural environments.[4]

Trees and nature in the city are not left out of the equation of economic values. While it is rarely expressed in precise dollars, the value of nature to property owners and communities can be determined indirectly. Methods for nonmarket valuation or 'willingness to pay', include travel cost method (TCM) which is the time and travel cost expenses that people incur to visit a site, deferred and replacement cost analysis, and contingent valuation assessment.[5]

Home Sweet Home

Homeowners have been relying on hedonic pricing since the 1960s to assess a revealed willingness-to-pay market price. When looking for 'just the right' house to buy, most want to know how close they are to a good school or a local favorite grocery store. Trees around a house typically aren't considered for their cost effectiveness, but rather for their 'curb appeal'. Trees and a nicely groomed landscape appeal to a home buyer. Hedonic pricing can be used to capture the proportion of property prices that are derived from the non-use value of trees and other natural elements.

To Tree or Not to Tree

To tree or not to tree, that is the economic question. With very few exceptions, residential properties with trees that are visible from the street add value to residential property values and even appear to add value to adjacent properties up to 100 feet away.[7] Below are results from a selection of studies, with the trend across studies averaging a price increase of about 7 percent.

Price Increase	***Condition***
2%	mature yard trees (greater than 9-inch dbh)[6]
3%	larger street trees[7]
3-5%	trees in front yard landscaping[8]
6-9%	good tree cover in a neighborhood[9]
10-15%	mature trees in high-income neighborhoods[10]

Trees Retained Equals Value Gained

Market price studies show a range of value that trees can add to a community. It seems like a no brainer to preserve our trees in residential areas, but site developers might disagree, arguing that tree protection costs are prohibitive. It is important to understand the potential market value that different tree canopy conditions can provide, in order to understand the economics of urban canopy protection[11] that should be of interest to developers.

Price Increase	**Condition**
18%	building lots with substantial mature tree cover[12]
22%	tree-covered undeveloped acreage[13]
19-35%	lots bordering suburban wooded preserves[14]
37%	open land that is two-thirds wooded[15]

Value added by trees and urban canopy in development growth areas is a positive. Even though one study found that development costs were 5.5% greater for lots where trees were conserved,[16] builders have reported that they were able to recover the extra costs of preserving trees through a higher sales price for a house, and that homes on wooded lots sell sooner than homes on non-wooded lots.[17]

Room with a View

Just living close to a park or open space can pay off. More than 30 studies have shown that people are willing to pay more for a property located close to an urban open space than for a house that does not offer this amenity, a concept known as the "proximate principle."[18] The studies evaluate the effects of parks and open spaces that usually contain trees and forests.

Price Increase	Condition
10%	inner city home located within 1/4 mile of a park[19]
10%	house 2 to 3 blocks from a heavily used, active recreation park[18]
17%	home near cleaned-up vacant lot[19]
20%	home adjacent to or fronting a passive park area[18]
32%	residential development adjacent to greenbelts[20]

With few exceptions,[21,22] studies find that homes adjacent to naturalistic parks and open spaces are typically valued at about 8% to 20% higher than comparable properties[23] , even up to a 32% increase when adjacent to a greenbelt. Values show a linear decline with distance from the edge of an open space, with a positive price effect declining to near zero at about 1/2 mile away.[24,25,26] Other factors affecting property values include usage rate (more park users = lower property values), user activity (athletic fields and games = lower property values up to 500 feet away), and care and upkeep (lower maintenance = lower property values). For instance, the values of properties close to heavily used or un-kept parks are typically lower than similar properties farther away.

In addition, homes that have a view of a forest or wooded area will also have an increased property value. Forests near residential areas can provide not only recreational value, but also benefits such as noise reduction and lower energy use.

Price Increase	Condition
4.9%	multifamily unit with view of forested open space[25]
8%	house with a park view[21]

Seeing the Forest for Its Trees

Hedonic values can be captured by local governments as increased property tax assessments or as excise taxes paid on property sales.[18] The calculated value across all properties influenced by a natural feature can be aggregated. For instance, a study in Portland, Oregon, found that street trees add $8,870 to the sales price of a home, and applying the average tree effect to all houses in Portland yields a total value increase of $1.35 billion, potentially yielding increased annual property tax revenues of $15.3 million across the city.[7] What could this mean for a city like Des Moines? It could mean that this type of revenue could be applied to the annual debt and to management costs of an urban forest to even further support home values.

Trees Mean Business

Retail and Commercial Property

It is no secret that retail and commercial businesses influence not only the people of a community but also political attitude, and attitudes typically lean toward keeping development cost to a minimum. So how can dialogue change the perception that retail and business will incur the extra costs of planting trees without the monetary benefits? The solution is to emphasize that a quality urban canopy will in fact provide both indirect and long-term economic benefits.

Contingent valuation method (CVM) is a way to provide our retail and consumer environments the potential returns from tree investment. CVM is used to estimate both use and non-use economic values for all types of ecosystem and environmental services. This method is called 'contingent', because people are surveyed to indicate their willingness to pay more on specific environmental service contingent in a specific hypothetical scenario and description of the environmental condition or service they might receive.

Location, Location, Location

We often hear 'Location, location, location' in the retail world as a key to increasing sales. Through a series of CVM studies exploring how shoppers respond to the urban canopy across different business settings, we've learned that business owners could more appropriately start saying, 'Trees, trees, trees'. In these studies, scenarios are presented to study participants viewing images and drawings, generally comparing a place with a high quality urban canopy to a similar place that is well maintained but contains no trees. Survey participants are then asked what they would be willing to pay for a set of goods and services in each scenario, and their responses are statistically compared. Generally, shoppers are willing to spend more when shopping in pleasing natural settings.

Price Increase	**Condition**
9%	goods and services in forested business districts in small cities[27]
11-12%	goods and services in forested business districts in large cities[28]
9%	goods and services in landscaped strip malls[29]
7-11%	goods and services in retail districts adjacent to vegetated freeway rights-of-way[30]
23%	homes within 1/4 mile of "excellent" commercial corridors[13]

Just as a private resident values a home's curb appeal, consumers evaluate shopping experiences beginning at the retail curb, even before entering a store. Storefront features and sidewalk character can create favorable or negative impressions that subconsciously affect shopper behaviors. Trees that are well kept provide such favorable impressions. Patronage behavior is important. For instance, Des Moines metro shoppers, prior to the introduction of local major malls, may have been willing to travel to Minneapolis, Kansas City or Chicago to have a different shopping aesthetic experience, resulting in extra travel costs. Shoppers will travel to do business, and not just

because they need something, but because they also want a positive shopping experience when making a purchase. Once on site, shoppers report that they would stay longer, which in turn means greater sales revenue.[31] It appears that a quality urban canopy in a district can affect such impressions.

Trees Mean *More* Than Business

In summary, our thinking about trees should not be reduced to purely economic terms. Trees are part of the natural foundation of our communities and for the most part, they embody meaning and principle that go beyond indirect valuations of nature.[32] The beauty and restorative qualities of trees have been observed for centuries. We are just starting to get to know our trees and the plethora of benefits they can offer. Revealing the narrow estimated monetary direct or indirect value of a tree may in fact limit public debate about the greater importance of trees in communities. The point of using any valuation analysis is not so much to think exclusively in money or market terms but to frame choices and make clear the trade-offs between alternative outcomes.[33] Non-market valuations are important contributors to local decision-making as well. How do the costs and benefits of investing in 'natural' capital compare to investing in other urban services such as law enforcement? Is the trade-off justifiable? These are the types of questions for which even preliminary valuation can provide useful information and continue the conversation of what trees can provide for a community's best interests.

References

1. Wolf, K.L. 2009. More in Store: Research on City Trees and Retail. *Arborist News* 18, 2:22-27.

2. Wolf, K.L. 2007 (August). City Trees and Property Values. *Arborist News* 16, 4:34-36.

3. Kaplan, R., and S. Kaplan. 1989. *The Experience of Nature: A Psychological Perspective.* Cambridge University Press, Cambridge, 340 pp.

4. Florida, R. 2005. *Cities and the Creative Class*. Routledge, New York, 198 pp.

5. de Groot, R.S., M.A. Wilson, and R.M.J. Boumans. 2002. A Typology For the Classification, Description and Valuation of Ecosystem Functions, Goods and Services. *Ecological Economics* 41:393–408

6. Dombrow, J., M. Rodriguez, and C.F. Sirmans. 2000. The Market Value of Mature Trees in Single-Family Housing Markets. *Appraisal Journal* 68, 1:39-43.

7. Donovan, G.H., and D.T. Butry. 2010. Trees in the City: Valuing Street Trees in Portland, Oregon. *Landscape and Urban Planning* 94, 1:77-83.

8. Anderson, L.M., and H.K. Cordell. 1988. Influence of Trees on Residential Property Values. *Landscape and Urban Planning* 15:153-164.

9. Morales, D.J., B.N. Boyce, and R.J. Favretti. 1976. The Contribution of Trees to Residential Property Value: Manchester, Connecticut. *Valuation* 23, 2:26-43.

10. Theriault, M., Y. Kestens, and F. Des Rosiers. 2002. The Impact of Mature Trees on House Values and on Residential Location Choices in Quebec City. In Rizzoli, A.E. and A.J. Jakeman (eds.), *Integrated Assessment and Decision Support, Proceedings of the First Biennial Meeting of the International Environmental Modeling and Software Society*, Volume 2:478- 483.

11. Nelson, N., J. Dorfman, and L. Fowler. 2002. *The Potential For Community Forests to Be Self-Financing: An Hedonic Analysis of The Enhancement Value of Georgia's Trees*. University of Georgia, Department of Agricultural and Applied Economics, Athens GA, 26 pp.

12. Morales, D.J., F.R. Micha, and R.L. Weber. 1983. Two Methods of Valuating Trees on Residential Sites. *Journal of Arboriculture* 9:21-24.

13. Payne, B.R., and S. Strom. 1975. The Contribution of Trees to the Appraised Value of Unimproved Residential Land. *Valuation* 22, 2:36-45.

14. Thorsnes, P. 2002. The Value of a Suburban Forest Preserve: Estimates from Sales of Vacant Residential Building Lots. *Land Economics* 78, 3:426-441.

15. Payne, B.R. 1973. The Twenty-Nine Tree Home Improvement Plan. *Natural History* 82, 9:74-75.

16. Hardie, I., and C. Nickerson. 2004. *The Effect of a Forest Conservation Regulation on the Value of Subdivisions in Maryland*. WP 03-01 (Revised). Department of Agricultural and Resource Economics, University of Maryland, College Park, 35 pp.

17. Seila, A.F., and L.M. Anderson. 1982. Estimating Costs of Tree Preservation on Residential Lots. *Journal of Arboriculture* 8:182-185.

18. Crompton, J.L. 2001. The Impact of Parks on Property Values: A Review of the Empirical

Evidence. *Journal of Leisure Research* 33, 1:1-31.

19. Wachter, S.M., and K.C. Gillen. 2006. *Public Investment Strategies: How They Matter for Neighborhoods in Philadelphia*. Working Paper, The Wharton School, University of Pennsylvania, Philadelphia, 12 pp

20. Correll, M.R., J.H. Lillydahl, and L.D. Singell. 1978. The Effect of Greenbelts on Residential Property Values: Some Findings on the Political Economy of Open Space. *Land Economics* 54, 2:207-217

21. Luttik, J. 2000. The Value of Trees, Water and Open Space as Reflected by House Prices in the Netherlands. *Landscape and Urban Planning* 48:161-167.

22. Schroeder, T.D. 1982. The Relationship of Local Park and Recreation Services to Residential Property Values. *Journal of Leisure Research* 14, 3:223-234.

23. Crompton, J.L. 2001. *Parks and Economic Development*. PAS Report No. 502. American Planning Association, Chicago, Illinois.

24. Hammer, T.R., R.E. Coughlin, and E.T. Horn. 1974. The Effect of a Large Park on Real Estate Value. *Journal of the American Institute of Planners* 40:274-277.

25. Tyrväinen, L., and A. Miettinen. 2000. Property Prices and Urban Forest Amenities. *Journal of Environmental Economics and Management* 39:205-223.

26. More, T.A., T.H. Stevens, and P.G. Allen. 1988. Valuation of Urban Parks. *Landscape and Urban Planning* 15:139-152.

27. Wolf, K.L. 2005. Trees In the Small City Retail Business District: Comparing Resident and Visitor Perceptions. *Journal of Forestry* 103, 8:390-395.

28. Wolf, K.L. 2003. Public Response to the Urban Forest in Inner-City Business Districts. *Journal of Arboriculture* 29, 3:117-126.

29. Wolf, K.L. 2009. Strip Malls, City Trees, and Community Values. *Arboriculture & Urban Forestry* 35, 1:33-40.

30. Wolf, K.L. 2005. The Urban Forest in the Roadsides: Public Values and Transportation Design. In: *Promoting Professional Tree Care, Proceedings of the 9th National Conference of the International Society of Arboriculture*, Australia Chapter (ISAAC). ISAAC, Launceston,Tasmania, 9 pp.

31. Wolf, K.L. 2005. Business District Streetscapes, Trees and Consumer Response. *Journal of Forestry* 103, 8:396-400.

32. Ackerman, F., and L. Heinzerling. 2004. Assessing Natural Resources: Price vs. Value. *Renewable Resources Journal* 22, 3:16-21.

33. Boyer, T., and S. Polasky. 2004. Valuing Urban Wetlands: A Review of Non-Market Valuation Studies. *Wetlands* 24, 4:744–755.

Grays Lake

Human Health: Nature's Benefits

We will often pay very close attention to what type of plant or tree will adorn our lawns to make them aesthetically appealing and get the most "bang for our buck", and consider whether a plant needs full sun, partial sun or shade areas to stay healthy and live a full life. But do we pay equally close attention to knowing the benefits that these natural individuals can contribute to our well being – how much shade a tree's canopy can provide to human health, for instance?

It is hard to disagree that trees, parks, gardens and other natural areas in a metro or urban setting brings a curb appeal to any town or city, and many people know the benefits these nature experiences brings to our lives. But few understand the depth that trees, and other natural "citizens" of our communities, can truly offer to improve human health and well-being. Yet nearly 40 years of scientific studies have been telling us otherwise.

Human Health Issues

Obesity

As many of us know, an inactive lifestyle and the rise of obesity are causing an epidemic of poor health in our communities. Although a change of diet and medication can help, daily moderate activity is essential for weight control. Sixty-five percent of U.S. adults are overweight and one in three are obese, putting them at increased risk of chronic diseases such as heart disease, high blood pressure, stroke, Type II diabetes, arthritis, cancer, and resulting in billions of dollars in annual medical costs.[2]

Recent research indicates that quality outdoor environments affect activity, attitudes and behaviors.[1] Trees and other greening 'citizens' of our urban settings can encourage the physical activity needed to make this improvement.

Asthma

Asthma symptoms are often caused by allergens like pollen, and non-allergenic triggers like pollution or weather changes.

According to the National Asthma Education and Prevention Program (NAEPP), initiated in March 1989 to address the growing problem of asthma in the United States, asthma is a major public health problem in the United States. The disease affects approximately 15 million people, nearly 5 million of whom are under the age of 18. People with asthma experience well over 100 million days of restricted activity annually; and the total annual costs of asthma related issues are estimated at $11.3 billion. The rise in 'childhood' asthma is another cause for concern. Between 1980 and 1994, the prevalence of asthma in the United States increased 75 percent overall and 74 percent among those between the ages of 5 and 14. It is estimated that more than 7 percent of children now have the disease. [3]

The Natural Solution

Chronic diseases can be preventable,[2] and to avoid these diseases or decrease their severity, regular physical activity and healthy eating habits are essential. Not all activity needs to be an intense workout in a gym; in fact a brisk 30 minute walk per day can benefit one's physical health as well as one's mental health. People who use parks and open spaces are three times more likely to achieve recommended levels of physical activity than non-users.[4] Most people prefer nearby, attractive, and larger parks and open spaces with natural views for their activity.

Estimated total annual air pollution removal (of ozone, particulate matter, NO_2, SO_2, and carbon monoxide- (some of the triggers to asthma) across 55 U.S. cities is 711,000 metric tons, representing $3.8 billion in public value.[5] It seems that trees could make a difference. A study done to see if trees had any relation to the effects of asthma, indicated that an increase of 343 trees/km^2 was associated with a 29% lower early childhood prevalence of asthma in New York City.[6]

While trees and other "citizens" of nature are not a cure for such chronic diseases, they seem to indirectly affect the severity of the ever increasing rate of obesity and asthma, by reducing the levels of airborne pollutants and increasing the frequency of physical activity of children and adults.

Mental Health Issues

Your Attention Please

The region of the brain that reacts to stress is linked to the autonomic nervous system, which controls basic physiological functions. When experiencing stress our attention heightens, muscle tension increases, blood pressure rises, the pulse quickens, respiration increases, the digestive system slows, and the body produces more adrenaline.[7,8]
Exposure to nature in the form of trees, grass, and flowers can effectively reduce stress,[9,10] particularly if initial stress levels are high.[11,12] Measureable recovery benefits are detected by merely having a visual encounter with nature.[13]

Nature Deficit Disorders

According to Stephen Kaplan of University of Michigan, there is a significant understanding of nature's calming effect on the human mind through studies of attention. Kaplan's work around attention restoration theory (A.R.T.) discusses how a person can engage in two types of attention, involuntary and voluntary.

Involuntary attention is a rather effortless form of engagement with the world. Voluntary attention requires a good deal of focus and energy and is susceptible to cognitive fatigue and can be restored through sleep, but it can also be restored during waking hours when a person's involuntary attention becomes highly engaged, essentially giving direct attention a breath of fresh air. Kaplan and his collaborators found that nature is especially conducive to our involuntary engagement. [14]

While it is developmentally appropriate for children to have trouble at one time or another to stay focused on a task, Attention Deficit/Hyperactive Disorder (ADHD) is a neurobehavioral disorder that can affect the ability to pay attention to tasks, control impulse behaviors, like acting without thinking of the results, or being overly active, that these children do not typically outgrow. National estimates of the number of children reported by their parents to have ever been diagnosed with ADHD, and the percentage of children with ADHD currently taking ADHD medications were published in 2005 using data from the 2003 National Survey of Children's Health (NSCH). [15,16] This report describes results from the second administration of NSCH in 2007[17], which indicated that the percentage of children aged 4-17 years with a parent-reported ADHD diagnosis (ever) increased from 7.8% to 9.5% during 2003-2007, representing a 21.8% increase in 4 years.

Studies show that childhood ADD symptoms can be reduced through activities in green settings and that "green time" may be an important supplement to established drug-based and behavioral treatments.[19] In one study, the greenness of a child's home did not significantly affect ADD

symptom severity, but greenness of play setting was related to a reduction of symptom severity (see Table 1).[18] Children who played in windowless indoor settings had significantly more severe symptoms than those who played in grassy, outdoor spaces with or without trees.[18]

Likely Setting	*Best*	*Worst*
Green (e.g., fishing, soccer)	85% (17)	15% (3)
Ambiguous (rollerblading, playing outside)	56% (43)	44% (34)
Not Green (video games, TV)	43% (53)	57% (69)

NOTE: Numbers in parentheses are *n*s for each group.

Activities judged as best and worst for ADD symptoms by parents[18]

In another study, children diagnosed with Attention Deficit Hyperactivity Disorder (ADHD) performed better on an objective concentration test after exposure to a relatively natural urban setting as compared to a less natural urban setting.[19] Children with ADD can benefit from spending more time in green settings on a daily basis, and during attention demanding activities (like school and homework).[18] Providing nature experiences in the school day and class environment is important for all children, and particularly so for those with ADD.

Working 9-5

Just about everyone can relate to a stressful feeling or situation and the tension it can cause on a person's psychological, physiological and even behavioral being. Urban life can sometimes add and compound to the element of stress in one's life. Unresolved, long-term stress can lead to secondary symptoms and illnesses[20]. The experience of nature is one antidote to stress, and the body's positive response is remarkably fast.

Studies show that improved employee morale, decreased absenteeism, and increased worker efficiency result from such workplace enhancements.[21] Having plants within view of workstations decreases both illness incidence,[22] and the amount of self-reported sick leave.[23] One study found that workers with workstation views that included green elements were more satisfied at work and had more patience, less frustration, increased enthusiasm for work, and fewer health problems.[23] Not having nature views or indoor plants are associated with higher levels of tension and anxiety in office workers.[24]

Stress Re-'Leaf'

The experience of nature appears to be an antidote to the stress effects of urban living. In a key experiment people who viewed a video of a natural setting, after viewing a visual stressor, displayed faster and more complete physiological recovery than those seeing built environments.[25]

Kiwanis Nature Island

In one study, the longer participants stayed in a park, the less stress they exhibited.[26] More than 100 studies have shown that relaxation and stress reduction are significant benefits associated with spending time in green areas.[27]

Recovery Time

Having a good view can mean more than just mood elevation; studies have shown that patients with a view of nature that included deciduous trees, can have restorative influences. Patients with the natural window view versus one with a brown brick wall, had shorter post-operative hospital stays, fewer negative comments in nurses' notes ("patient is upset," "needs much encouragement"), and tended to have lower scores for minor post-surgical complications such as persistent headache or nausea requiring medication. Moreover, the wall-view patients required many more doses of potent painkillers, whereas the tree-view patients more frequently received weak oral analgesics such as acetaminophen. [28]

To the Root of the Problem

First the trees and then the humans…..ironically, the trees are teaching a hard life lesson. With the invasion of the Emerald Ash Borer in several US states, came an unplanned natural experiment. The results of a study after significant loss of ash trees, showed an increase in mortality related to cardiovascular and lower-respiratory-tract illnesses in counties that became infested with the emerald ash borer. Even though this borer doesn't directly affect humans, it definitely affects our ash tree population, with an associated 6,113 additional deaths related to illness of the lower respiratory system and 15,080 cardiovascular-related deaths in the 15 states where data was collected. [29]

This finding adds to the growing evidence that our citizens of nature do in fact provide major public health benefits.

1. Wolf, K.L. 2008. City Trees, Nature and Physical Activity: A Research Review. *Arborist News* 17, 1:22-24 Obesity

2. Centers for Disease Control and Prevention. 2012 Overweight and Obesity. www.cdc.gov/obesity/data/adult.html

3. http://www.nhlbi.nih.gov/about/naepp/naep_pd.htm

4. Giles-Corti, B., M.H. Broomhall, M. Knuiman, C. Collins, K. Douglas, K. Ng, A. Lange, and R.J. Donovan. 2005. Increasing Walking: How Important is Distance to, Attractiveness, and Size of Public Open Space? *American Journal of Preventive*

5. Nowak, DJ, DE Crane, and JC Stevens. 2006. Air Pollution Removal by Urban Trees and Shrubs in the United States. *Urban Forestry & Urban Greening* 4, 3-4:115-123

6. Lovasi, GS, JW Quinn, KM Neckerman, MS Perzanowski, and A Rundle. 2008. Children Living in Areas with More Street Trees Have Lower Prevalence of Asthma. *Journal of Epidemiology and Community Health* 62:647-49

7. Atkinson, RL, et al. 2000. *Hilgard's Introduction to Psychology.* Harcourt College Publishers.

8. Grahn, P, and UK Stigsdotter. 2010. The Relation Between Perceived Sensory Dimensions of Urban Green Space and Stress Restoration. *Landscape and Urban Planning* 94, 3-4:264-275.

9. Ulrich, RS. 1986. Human Responses to Vegetation and Landscapes. *Landscape and Urban Planning* 13:29-44.

10. Kaplan, R, and S Kaplan. 1989. *The Experience of Nature: A Psychological Perspective.* Cambridge University Press, New York.

11. Ulrich, RS, and DL Addoms. 1981. Psychological and Recreational Benefits of a Residential Park. *Journal of Leisure Research* 13, 1:43-65.

12. Ulrich, RS, U Dimberg, and BL Driver. 1991. Psychophysiological indicators of leisure benefits. In: BL Driver, LR Brown, and GL Peterson (eds) *Benefits of Leisure.* Venture Publishing, State College PA, pp. 73-89

13. Ulrich, RS, and R Parsons. 1992. Influences of passive experiences with plants on individual well-being and health. In: D Relf (ed) *The Role of Horticulture in Human Well-Being and Social Development: A National Symposium.* Timber Press, Arlington VA, pp. 93-103.

14. *Kaplan, S., & Berman, M.G. (2010). Directed attention as a common resource for executive functioning and self-regulation. Perspectives on Psychological Science, 5, 43-57 http://personalsustainability.com/tag/attention-restoration-theory/*

15. CDC. Mental health in the United States: prevalence of diagnosis and medication treatment for attention-deficit/hyperactivity disorder---United States, 2003. MMWR 2005;54:842—7.

16. Blumberg SJ, Olson L, Frankel MR, Osborn L, Srinath KP, Giambo P. Design and operation of the National Survey of Children's Health, 2003. Vital Health Stat 2005;1(43).

17. Blumberg SJ, Foster EB, Frasier AM, et al. Design and operation of the National Survey of Children's Health, 2007. Vital Health Stat;1(in press).

18. Taylor, A. F., F.E. Kuo, and W.C. Sullivan. 2001. Coping with ADD: The Surprising Connection to Green Play Settings. *Environment and Behavior* 33, 1: 54-77.

19. Kuo, F.E., and A.F. Taylor. 2004. A Potential Natural Treatment for Attention-Deficit/Hyperactivity Disorder: Evidence From a National Study. *American Journal of Public Health* 94, 9: 1580.

20. Baum, A, R Fleming, and JE Singer. 1985. Understanding Environmental Stress: Strategies for Conceptual and Methodological Integration. In: A Baum, and JE Singer (eds) *Advances in Environmental Psychology, Vol. 5: Methods and Environmental Psychology*. Lawrence Erlbaum, Hillsdale NJ, pp. 185-205

21. Lohr, V.I., C.H. Pearson-Mims, and G.K. Goodwin. 1996. Interior Plants May Improve Worker Productivity and Reduce Stress in a Windowless Environment. *Journal of Environmental Horticulture* 14, 97-100.

22. Fjeld, T., B. Veiersted, L. Sandvik, G. Riise, and F. Levy. 1998. The Effect of Indoor Foliage Plants on Health and Discomfort Symptoms Among Office Workers. *Indoor and Built Environment* 7, 4: 204.

23. Kaplan, R. 1993. The Role of Nature in the Context of the Workplace. *Landscape and Urban Planning* 26, 1-4: 193-201.

24. Chang, C.Y., and P.K. Chen. 2005. Human Response to Window Views and Indoor Plants in the Workplace. *Hortscience* 40, 5: 1354-59

25. Ulrich, RS, RF Simons, BD Losito, E Fiorito, MA Miles, and M Zelson. 1991. Stress Recovery During Exposure to Natural and Urban Environments. *Journal of Environmental Psychology* 11, 3:201-230.

26. Hull, R.B., and S.E. Michael. 1995. Nature-Based Recreation, Mood Change, and Stress Restoration. *Leisure Sciences* 17, 1: 1-14.

27. Davis, J. 2004. *Psychological Benefits of Nature Experiences: An Outline of Research and Theory.* Naropa University.

28. Ulrich, R.S. 1984. View through a window may influence recovery from surgery. Science 224:420–421.

29. Am J Prev Med. 2013 Feb;44(2):139-45. doi: 10.1016/j.amepre.2012.09.066. Donovan GH, Butry DT, Michael YL, Prestemon JP, Liebhold AM, Gatziolis D, Mao MY. Pacific Northwest Research Station, U.S. Department of Agriculture Forest Service, Pacific Northwest Research Station, Portland, Oregon, USA. gdonovan@fs.fed.us, The relationship between trees and human health: evidence from the spread of the emerald ash borer.

Stormwater Management: Nature's Sump Pumps

The management of stormwater is a major concern for municipalities. Stormwater runoff is the water that flows over the ground surface without being absorbed into the soil or captured by the canopy of a tree. This runoff is created when precipitation falls on paved surfaces such as driveways, parking lots, or streets and buildings including factories, malls, and homes. The stormwater that becomes runoff quickly generates a large volume and then flows at a greater rate than water that falls on areas with vegetation.

Increased velocity and volume of stormwater runoff leads to erosion and even flooding. In addition, the rapidly flowing water collects pollutants and sediments found on the paved surfaces, adding contaminants to our sewage system which are costly to remove. As will be explained later in this chapter, an increase in tree canopy helps to minimize the erosion and water pollution caused by stormwater runoff, which may reduce water management costs to municipalities.

Stormwater Runoff

Contamination

The contaminants from stormwater runoff range from sediments, pesticides, fertilizers and nutrients to household products such as cleaners, motor oil or lawn care products, up to and including wildlife waste.[1]

The specific contaminants in the Des Moines waterways vary depending on the river or stream. Each has its own set of pollutants of concern, as outlined in the Watershed Assessment Program Report. [3]

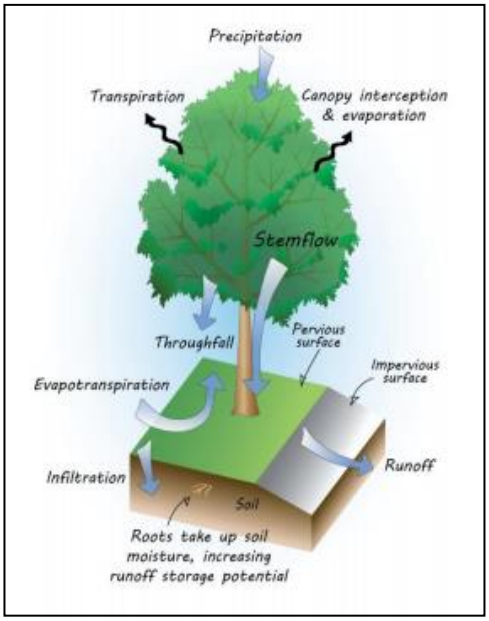
It should be noted that Des Moines does have areas of combined sewer where stormwater can overflow into the sanitary lines.

These areas are close to the Des Moines and Raccoon Rivers. As a result these rivers have their own set of pollutants associated with overflows. This underscores the importance of proper stormwater management and the need to minimize runoff. The solution includes the use of trees to serve as nature's sump pump.[3]

The Des Moines River is a source of community pride [2]

Stormwater Recovery from Trees

The amount of tree canopy in a community will have a direct impact on the amount of stormwater runoff. In the same manner that paved surfaces will increase the speed and volume of water flowing, the amount of tree canopy decreases the rate and volume at which water flows. For example, in a continuous canopy, four inches of rainfall will capture 108,000 gallons of water per year. [8] This captured water will slowly move down the tree and into the soil to be utilized by the tree and surrounding plants. The result is less erosion and less pollutants being carried in the stormwater runoff, a financial benefit by reducing the amount of contaminants which need to be removed from the stormwater runoff, and less negative environmental impact.



Recapture of water with tree canopy

How to Calculate Runoff Reduction with Trees

Since trees capture so much water, they are poised to have a huge impact on reducing the amount of stormwater runoff in a given area. At this point a complete tree inventory has not been completed for the city of Des Moines. Inventory data is necessary to have an accurate calculation of the amount of storm water being captured by the trees. What we know so far is that the city has a 26-27% canopy based on an aerial study. In addition, a tree study was completed on three portions of our community, including the Beaverdale neighborhood, the Drake neighborhood and Terrace

Hill. These studies indicate that the total annual amount of storm water captured was 428,672 gallons by the 1288 trees in Beaverdale (46 % canopy), 785,460 gallons by the 1050 trees in Drake (42.1 % canopy), and 287,808 gallons by the 242 trees in Terrace Hill (50.5 % canopy). It should be noted that a smaller number of trees in Drake captures more stormwater because so many of these trees are large and mature, so they intercept more water. [9]

Trees Provide Stormwater Re-'Leaf'

For municipalities and their customers the benefit of decreasing stormwater runoff by reducing paved surfaces and adding more trees is found in significant financial savings. The expense and effort to control or reduce the erosion caused by runoff is a major concern. Furthermore, the cost of removing sediments and contaminants from water supplies is also substantial, and these additional costs channel resources and energy away from other priorities.

Case Study: Minneapolis

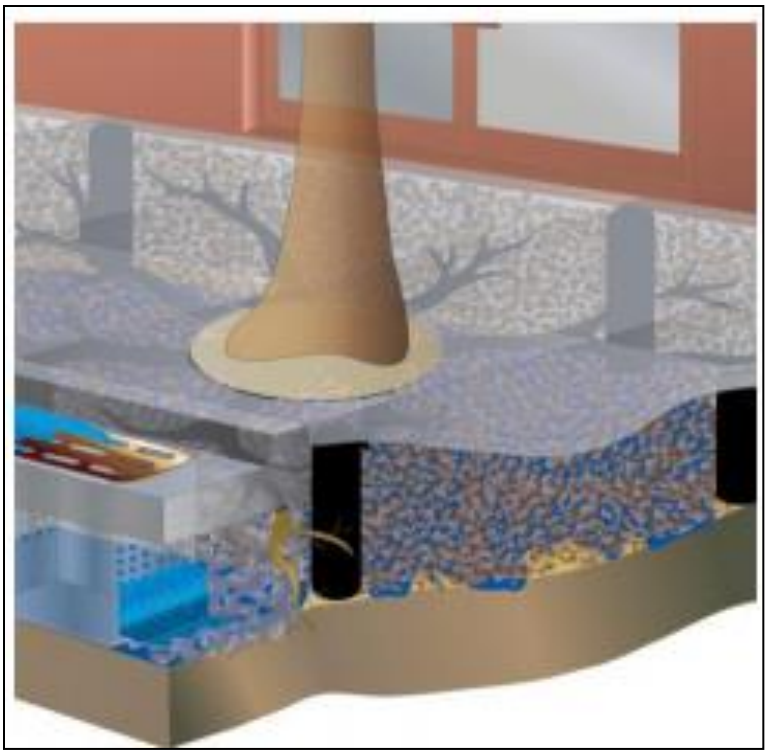
In the city of Minneapolis, a street tree planting project included installation of underground structural cells to create conditions that promoted healthy mature trees and improved stormwater management in the core of the downtown district. The project installed 173 trees along a new bus corridor using a modular system of structural cells that supported the sidewalk. The system created a void space that held 10 cubic feet of soil per unit (10,800 units were installed), allowing space for existing or future utility pipes, protecting tree roots from compaction and providing room for stormwater. The system can temporarily hold large volumes of stormwater that will either be used by the trees (Evapotranspiration) or will soak into the ground (infiltration). [10]

In a suspended pavement structural cell system, like the one mentioned in Minneapolis, the ground surface is supported by a network of pillars, piles, or structural cells. The suspension system supports the weight of the pavement above and allows the soil below to remain uncompacted, accommodating tree roots and filtering and managing storm water runoff. Suspended pavement can accommodate large volumes of soil needed for larger tree growth. [10]

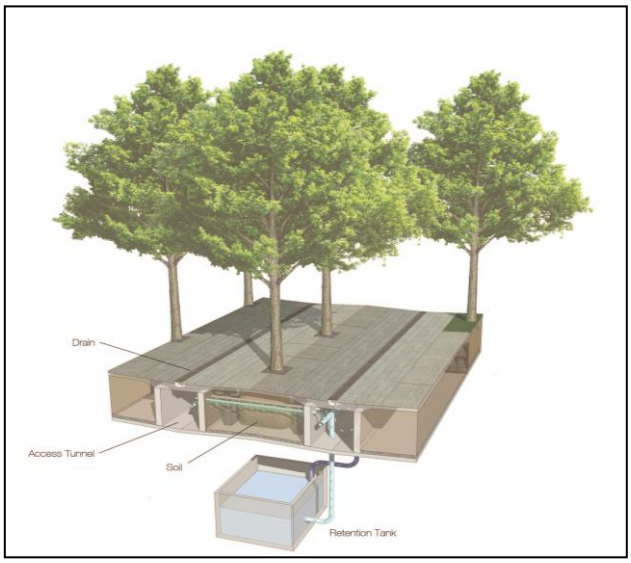
After-photo of a structural cell system in Minneapolis

Case Study: World Trade Center Memorial

Designed by Michael Arad and Peter Walker and Partners, a California-based landscape architecture company, the World Trade Center Memorial Plaza was designed to be one of the most sustainable green plazas ever built. The memorial features approximately 400 swamp white oak and sweet gum trees planted using a suspended pavement system. The memorial is designed to collect the stormwater that drains into tanks below the surface. The stormwater storage potential exceeds the irrigation needs of the plaza, thus irrigation requirements for the trees are met by the harvested stormwater. [11]



Suspended pavement/structural cell system (black pillars in photos) supports pavement, creating large subsurface areas of uncompacted soil for root growth, bioremediation, and storage of stormwater.



The World Trade Center Memorial is a massive green roof, a fully constructed ecology that captures and re-uses stormwater to support plant life.

Source (Peter Walker, FASLA, PWP Landscape Architecture, American Society of Landscape Architects)[11]

Stormwater Runoff Management

Education

An important first step toward effective and sustainable change in the management of stormwater runoff with tree canopy begins with education. This includes collaborative efforts between municipalities and the schools to make future decision makers aware of the issues involved and to provide information to current property owners. However, the learning process is not limited to just students in the classroom or public awareness efforts. To stimulate meaningful change, the education needs to reach developers and architects as well as business owners and the managers of parks and public property. For example, a developer or an owner would be more likely to include trees bordering or throughout a new parking lot if they were aware of the long term benefits of the trees, and the amount of money that would be saved by having them present on the property.

Parking lot with no trees contributes stormwater runoff.

Parking lot with trees helps to reduce stormwater runoff.

Smart Growth and Expansion

Any future goal to increase the percent of tree canopy in Des Moines and to reduce stormwater runoff will require planning and cooperation. Tree planting efforts by city departments, volunteer organizations and individual homeowners each year, should take into account the overall goals to increase tree canopy to reduce stormwater runoff. Along with targeting established areas within the community that have the greatest need for water capturing, new developments and improvement projects should include stormwater management plans during the planning and design process. These plans would outline utilization of specific types of trees and the number of trees at designated locations in order to maximize the recovery of water by the canopy, and minimize the amount of stormwater that escapes as runoff.

Riparian Buffers

Riparian buffers are vegetated areas next to water resources that protect water resources from NPS pollution and provide bank stabilization and wildlife habitat. [12]

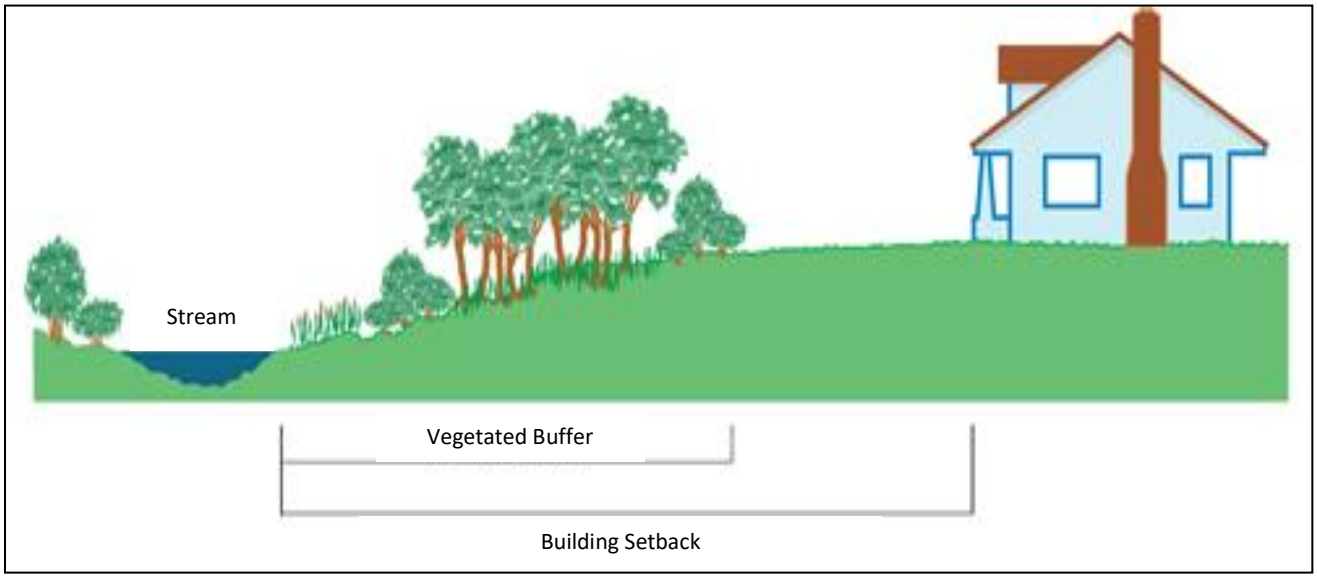
The USDA Forest Service defines a riparian buffer as follows: [13]

> *"……the aquatic ecosystem and the portions of the adjacent terrestrial ecosystem that directly affects or is affected by the aquatic environment. This includes streams, rivers, lakes, and bays and their adjacent side channels, floodplain, and wetlands. In specific cases, the riparian buffer may also include a portion of the hill slope that directly serves as streamside habitats for wildlife."*

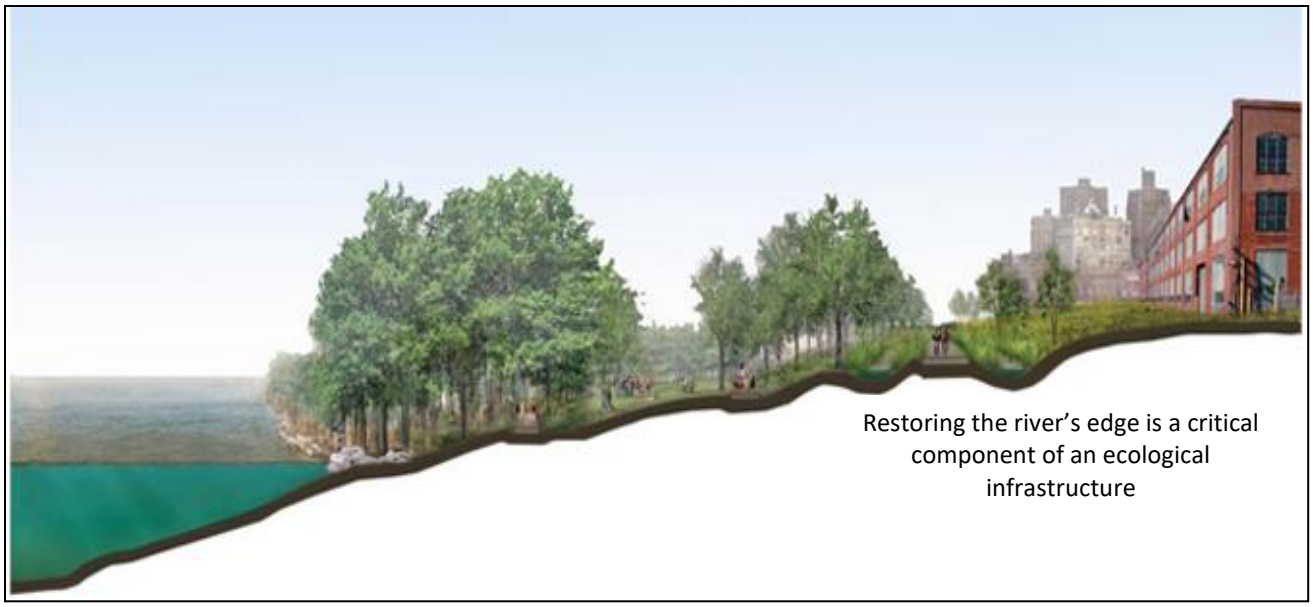
Leading experts (Lowrance, Leonard, and Sheridan, 1985) on riparian buffers define them as: [14]

> *"…..a complex assemblage of plants and other organisms in an environment adjacent to water. Without definitive boundaries, it may include stream banks, floodplain, and wetlands, as well as sub-irrigated sites forming a transitional zone between upland and aquatic habitat. Mainly linear in shape and extent, they are characterized by laterally flowing water that rises and falls at least once within a growing season."*

Natural riparian buffers are composed of grasses, trees, or both types of vegetation. If riparian buffers are maintained, they can exist under most land uses including agricultural, and urban.



Riparian Buffer Diagram



Riparian Buffer to reduce stormwater runoff. [15]

Funding and Incentives

The inclusion of trees, especially the quantity needed to increase the percent of the canopy and to affect stormwater management, will require a financial commitment. As a result, funding opportunities or financial incentives may be necessary to encourage tree planting and the proper maintenance of established trees.

References

1. Managing Storm water Runoff to Prevent Contamination of Drinking Water, www.epa.gov/safewater, United States Environmental Protection Agency, Washing ton D.C. , 2004

2. Des Moines photos – Bing Images http://www.bing.com/images/search?q=des+moines+photos&qpvt=des+moines+photos&FORM=IGRE

3. Leckband, Jesse, Environmental Storm Water Techincian. *Water Shed Assessment Program Report*, Des Moines Public Works, City of Des Moines, 2012.

4. http://water.epa.gov/polwaste/nps/outreach/point1.cfm

5. Water National Quality Inventory, 1994

6. www.ecowaterofatlanta.com

7. ISU Extension Ag Decision Maker Publication A1-75, "Value of Soil Erosion to the Land Owner" (August 2012); Mike Duffy.

8. Center for Urban Forest Research, Pacific Southwest Research Station, USDA Forest Service, Davis, California. July, 2002

9. Dr. Jan Thompson ISU-NREM

10. Storm Water to Trees: Engineering Urban Forest for Storm water Management. United States Environmental Protection Agency.

11. Peter Walker, FASLA, PWP Landscape Architecture, Building the Garden at the National 9/11 Memorial, American Society of Landscape Architects.

12. http://www.soil.ncsu.edu/publications/BMPs/buffers.html

13. USDA. 1997. Riparian Forest Buffer Handbook for the Chesapeake Bay Watershed. United States Department of Agriculture, Environmental Protection Agency, Forest Service and Northeastern Area State & Private Forestry, NA-TT-02-97. Washington, DC.

14. Lowrance, R., R. Leonard, and J. Sheridan. 1985. Managing riparian ecosystems to control nonpoint pollution. J. Soil & Water Conserv. 40:87-97.Watershedbmps

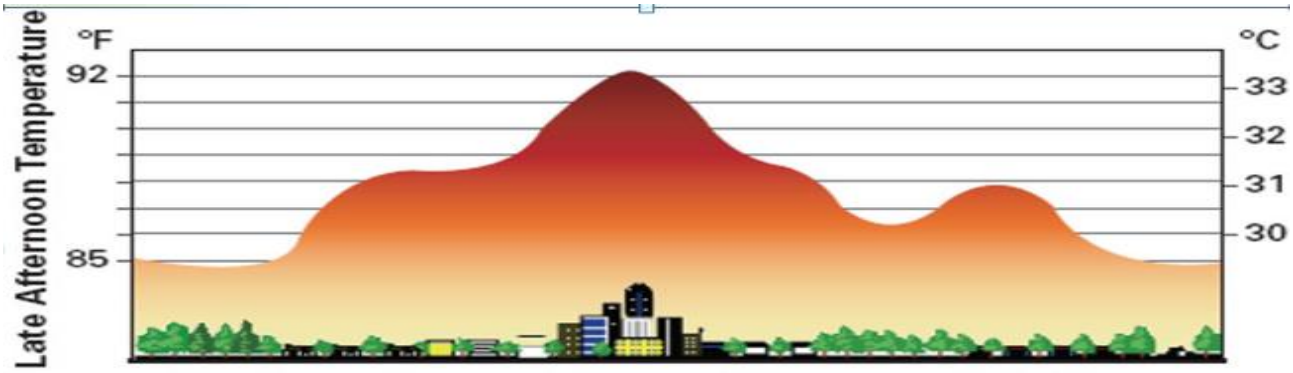
15. The Architect's Newspaper, LLC | AN Blog Admin Log in. Copy right 2011. The Architect's Newspaper LLC, 21 Murray Street 5th Floor | New York, New York 10007 | tel. 212.966.0630

Trees and Energy: Money Doesn't Grow on Trees.....*or Does It?*

The mood of our country has taken a slow turn since the Clean Air Act of 1970. In a nation wanting to improve the way we do business, companies throughout the United States went from thinking that pollution was the inevitable price of progress, to the notion that pollution doesn't stop at the borders of state lines (the Cross-State Air Pollution Rule due for full compliance in 2013). Businesses and the private sector have learned to practice 'Rethink, Reuse, Renew and Recycle' as a way of life. Many of us now think "green" when buying merchandise. The regulations that our government is providing are full of rules and ordinances to control and reduce pollutants from our air. These are all needed steps for improving our green infrastructure and will most definitely be a vital part of ensuring that future generations will have access to clean air and all the benefits that accompany healthy, vibrant communities. Completely changing the mood of the nation will not be an easy task and will not in itself clean dirty air. We still struggle with the difficult question of how to achieve that goal.[1,2]

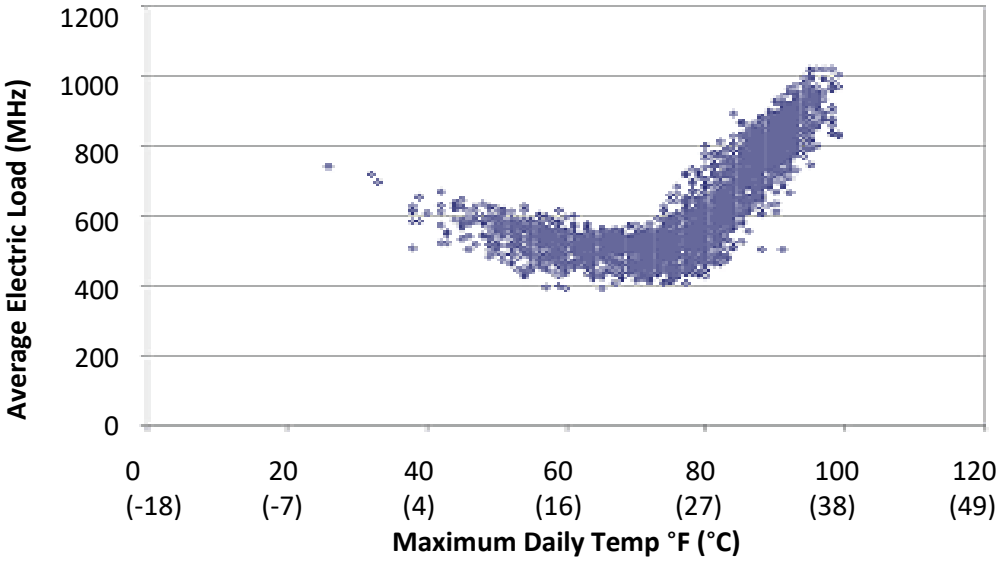
The Urban Heat Island

The term "heat island" describes developed areas taken over by concrete and manmade infrastructures that are typically hotter than nearby rural areas but not always. The annual mean air temperature of a city with 1 million people or more can be 1.8 to 5.4°F (1 to 3°C) warmer than its surroundings. In the evening, the difference can be as high as 22°F (12°C). Heat islands can affect communities by increasing summertime peak energy demand, air conditioning costs, air pollution and greenhouse gas emissions, heat-related illness and mortality, and water quality. [3]



Rural Suburban Commercial Downtown Urban Park

Summer brings a change in our mood, something that most look forward to after a long cold winter. But few would disagree about how uncomfortable we can be during a heat wave. Roof and pavement surface temperatures can be 50 to 90°F (27 to 50°C) hotter than the air, while shaded or moist surfaces remain close to air temperatures.[4] Air temperatures in cities, particularly after sunset, can be as much as 22°F (12°C) warmer than the air in neighboring, less developed regions.[5]



As in this example from New Orleans, electrical load can increase steadily once temperatures begin to exceed about 68 to 77°F (20 to 25°C). Other areas of the country show similar demand curves as temperature increases.

Credit: Sailor, D. J. 2002.Urban Heat Islands, Opportunities and Challenges for Mitigation and Adaptation. Sample Electric Load Data for New Orleans, LA (NOPSI, 1995). North American Urban Heat Island Summit. Toronto, Canada. 1–4 May 2002. Data courtesy Entergy Corporation.

Some impacts from the summer's heat and sun can have desirable benefits like lengthening the time your garden may grow. However, elevated temperatures from urban heat islands can have negative impacts to a community's environment and quality of life, and are the cause for a large rippling effect that many of us know about, but feel we have little control over.

Increased energy consumption is one example of a rippling effect. Elevated summertime temperatures in cities increase energy demand for cooling. Research shows that electricity demand for cooling increases 1.5 to 2.0% for every 1°F (0.6°C) increase in air temperatures, starting from 68 to 77°F (20 to 25°C), suggesting that 5–10% of community-wide demand for electricity is used to compensate for the heat island effect.[5] With an increase in energy needs, utilities are forced to supply us with electricity which typically relies on fossil fuel power plants to meet this demand, which in turn causes elevated emissions of air pollutants such as sulfur dioxide, nitrogen oxides, particulate matter, carbon monoxide and mercury. These pollutants are not only harmful to our air quality, but can cause major human health issues.[6] Increasing the use of fossil fuels also increases emissions of greenhouse gases such as carbon dioxide which contributes to global climate change.

The ripple goes on. Elevated temperatures can directly increase the rate of ground-level ozone formation, which is formed when nitrogen oxides and volatile organic compounds react to summer's sunlight and hot weather, making it sunnier and hotter.

As mentioned in detail earlier in this master plan, the ripple doesn't just stop at economic cost; it also affects human health and comfort. Increased daytime temperatures, reduced nighttime cooling, and higher air pollution levels associated with urban heat islands can affect human health by contributing to general discomfort, respiratory difficulties, heat cramps and exhaustion, non-fatal heat stroke, and heat-related mortality.

Impaired water quality is another ripple effect of elevated temperatures. High pavement and rooftop surface temperatures can heat stormwater runoff. Tests have shown that pavements that are 100°F (38°C) can elevate initial rainwater temperature from roughly 70°F (21°C) to over 95°F (35°C).[7] This heated storm water generally becomes runoff, which drains into storm sewers and raises water temperatures as it is released into streams, rivers, ponds, and lakes.

These ripple effects are related to conditions we as humans are directly affected by and see firsthand, but just imagine the ripples we don't typically see until pointed out. For instance, water temperature affects all aspects of aquatic life, especially the metabolism and reproduction of many aquatic species. Rapid temperature changes in aquatic ecosystems resulting from warm stormwater runoff can be particularly stressful, even fatal to aquatic life. One can only take an educated guess about the extent and total effects of these ripples.

What about the trees?

Shade east and west windows from late morning and afternoon sun, to maximize energy savings

Strategically planted trees and shrubs near buildings may be the best long-term investment for reducing home heating and cooling costs. Planting trees and shrubs has very little startup cost and is a long-term investment that will continually reduce energy and fuel consumption.

Research conducted by the US Department of Energy (DOE) has shown that proper placement of trees and shrubs around buildings can reduce summer energy needs as much as 50%. In addition, planting windbreaks can reduce your winter heating cost by 10% for urban communities and up to 40% for farmsteads. In fact, the DOE has estimated that properly placing as few as three trees can save the average household between $100 and $250 annually in energy costs.[8]

Trees Forever has created a website for individuals to see when trees are planted strategically, how they can reduce costs by creating a windbreak or shading your house and lawn.

Check it out: http://www.treesforever.org/Plant-Your-Way/Trees_Forever.html

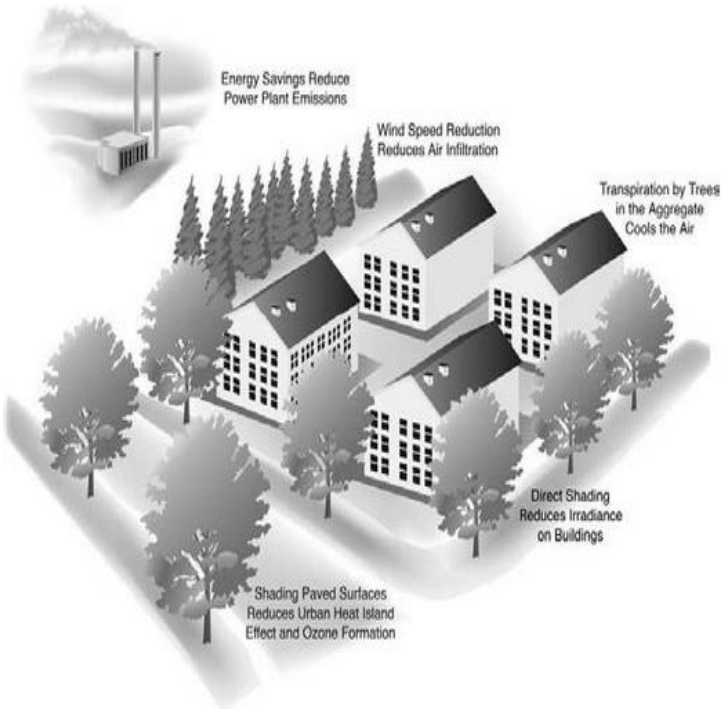
One Tree - Many Benefits

The oak is a common citizen of the Des Moines area, and this one species of tree can offer great benefits to a community.

The National Tree Benefits Calculator allows you to enter a species of tree specific to your zip code

and configures cost benefits appropriate to your communities' typical energy costs. *See below for the results of a sampling in Des Moines.*

An 18 inch Oak in Des Moines will conserve **249 Kilowatt / hours** of electricity for cooling and reduce consumption of oil or natural gas by 33 therm(s).Trees modify climate and conserve building energy use in three principal ways (see figure at left):



Shading reduces the amount of heat absorbed and stored by buildings.

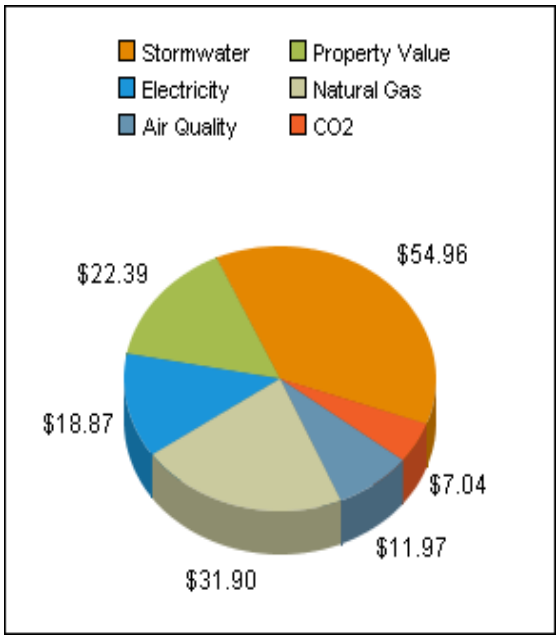
Evapotranspiration converts liquid water to water vapor and cools the air by using solar energy that would otherwise result in heating of the air.

Tree canopies slow down winds, thereby reducing the amount of heat lost from a home, especially where conductivity is high (e.g., glass windows).[9]

Strategically placed trees can increase home energy efficiency. In summer, trees shading east and west walls keep buildings cooler. In winter, allowing the sun to strike the southern side of a

building can warm interior spaces. If southern walls are shaded by dense evergreen trees on the other hand, there may be a resultant increase in winter heating costs.

Below is a measurement specific to the Des Moines Area of what one oak tree can offer in overall savings to the average private citizen and urban businesses.



An 18 inch Oak in Des Moines provides overall benefits of: **$147** every year.

While some functional benefits of trees are well documented, others are difficult to quantify (e.g., human social and communal health). Trees' specific geography, climate, and interactions with humans and infrastructure is highly variable and makes precise calculations that much more difficult. Given these complexities, the results presented here should be considered initial approximations—a general accounting of the benefits produced by urban street-side plantings.

Note: Benefits of trees do not account for the costs associated with trees' long-term care and maintenance.

If this tree is cared for and grows to 23 inches, it will provide **$193** in annual benefits.[9]

What if you could do this for every tree and every yard and street? Amazing! Des Moines would be well on its way to becoming 'Green Des Moines.' In 2006, the City Council adopted 12 goal statements, one of which was for Des Moines to become a Sustainable Green Community.[10]

1. http://www.epa.gov/cleanairactbenefits/whereyoulive/ia.html
2. http://www.epa.gov/greeningepa/energy/strategy.htm
3. http://www.epa.gov/heatislands/index.htm
4. Berdahl P. and S. Bretz. 1997. Preliminary survey of the solar reflectance of cool roofing materials. *Energy and Buildings* 25:149-158.
5. Akbari, H. 2005. Energy Saving Potentials and Air Quality Benefits of Urban Heat Island Mitigation (PDF) (19 pp, 251K). Lawrence Berkeley National Laboratory.
6. Center for Disease Control and Prevention. 2006. Extreme Heat: A Prevention Guide to Promote Your Personal Health and Safety.
7. James, W. 2002. Green roads: research into permeable pavers. *Storm water* 3(2):48-40
8. Dept of Energy http://www.mass.gov/eea/docs/doer/publications/landscapeee.pdf
9. http://treebenefits.com/calculator
10. www.greendm.org

Trees and Transportation Safety: All Rights and Green Lights

Court Avenue and 4th Street

This Trees and Transportation Safety section is still a sapling, and will be developed further.

The average citizen in a community is law abiding with maybe the occasional traffic violation or two, and if fortunate, avoiding traffic accidents altogether. Is it possible that our trees can help us to be better citizens while driving? Too often the answer to transportation safety and trees is to remove hazardous obstructions completely. The assumption has been that moving a tree 'obstruction' is deemed to be a life saver and what could be more important? Human vs. trees seems like a no-brainer.

However, a closer look at the research gives evidence to the contrary in an urban setting. Roadside vegetation can benefit a community's transportation safety issues.[1] Anyone who commutes through a busy urban section has probably experienced stressful road rage in one form or another. Studies show that drivers who experience visual natural roadside vegetation show lower levels of stress and frustration compared to those viewing all-built settings.[2] Less than 1% of national annual vehicle crashes account for tree related accidents on urban streets.[3] More recently, research has shown evidence that trees on city streets may improve driving habits, like speeding, road rage, and perceptions of safety.[4] Trees seem to make the law abiding citizen even more responsible. What if trees could do the same for those who are less abiding the law?

1. Wolf, K.L. 2006. Roadside Urban Trees: Balancing Safety and Community Values. *Arborist News* 15, 6:56-58

2. Parsons, R., L.G. Tassinary, R.S. Ulrich, M.R. Hebl, and M. Grossman-Alexander. 1998. The View From the Road: Implications for Stress Recovery and Immunization. *Journal of Environmental Psychology* 18, 2:113–140.

3. Bratton, N.J., and K.L. Wolf. 2005. Trees and Roadside Safety in U.S. Urban Settings, Paper 05-0946. *Proceedings of the 84th Annual Meeting of the Transportation Research Board*. Transportation Research Board of the National Academies of Science, Washington DC.

4. Naderi, J.R., B.S. Kweon, and P. Meghalel. 2008. The Street Tree Effect and Driver Safety. *ITE (Institute of Transportation Engineers) Journal* 78, 2:69-73.

Trees & Community Safety: The Whole Truth and Nothing But the Truth

Perhaps using CPTED principles would have saved these trees.

Trees and natural settings provide monetary value, healing and even improved health, but can they do even more? Vegetation has gotten a bad rap and is often implicated as a screen that hides criminal activity. Is that stating the truth and the whole truth? Should we be eliminating our trees, or work 'with' our trees to prevent crime? Reasons for crime are many and complicated, and can involve both social and environmental aspects. Only the offender really knows why a crime happens. Recent studies suggest that there is a pattern correlating the presence of trees and well kept vegetation in relation to a positive protective view; as opposed to the negative thinking that vegetation seems to support criminal activity. [1]

Barking Up the Wrong Tree

Disruptions and Incivilities

Although it seems logical to think that vegetation in an urban or residential setting can provide coverage for an intruder or offender of a crime, recent research may contradict that notion. Reports of crime in settings that lack vegetation correlate with higher amounts of graffiti, vandalism and littering than those compared to open spaces that do contain trees and grass.[1] In one study involving several urban communities in California, as high as 90% of vandalism incidents occurred in areas without vegetation compared to 10% in landscaped areas.[2] Additionally, in a Chicago study, similar findings were found, including higher rates of social disruption and incivilities such as the presence of noisy individuals, loitering strangers, and illegal activity, but all of these were lower in planted areas. [3]

Aggression and Violence

The presence of nature also has a positive influence on social interactions with a corresponding reduction in the rate of violent and aggressive crimes. A Chicago survey study, asking women to recall aggressive and violent behaviors occurring within their household, showed that those who had trees and grass cover outside their household reported significantly less aggression against their partners than those living in unlandscaped areas.[4] The same study also found a significant reduction in violence during a year's time, and across a lifetime, in green areas vs. barren ones. The table below shows a reduction of 25% or more in aggression and violent behaviors.

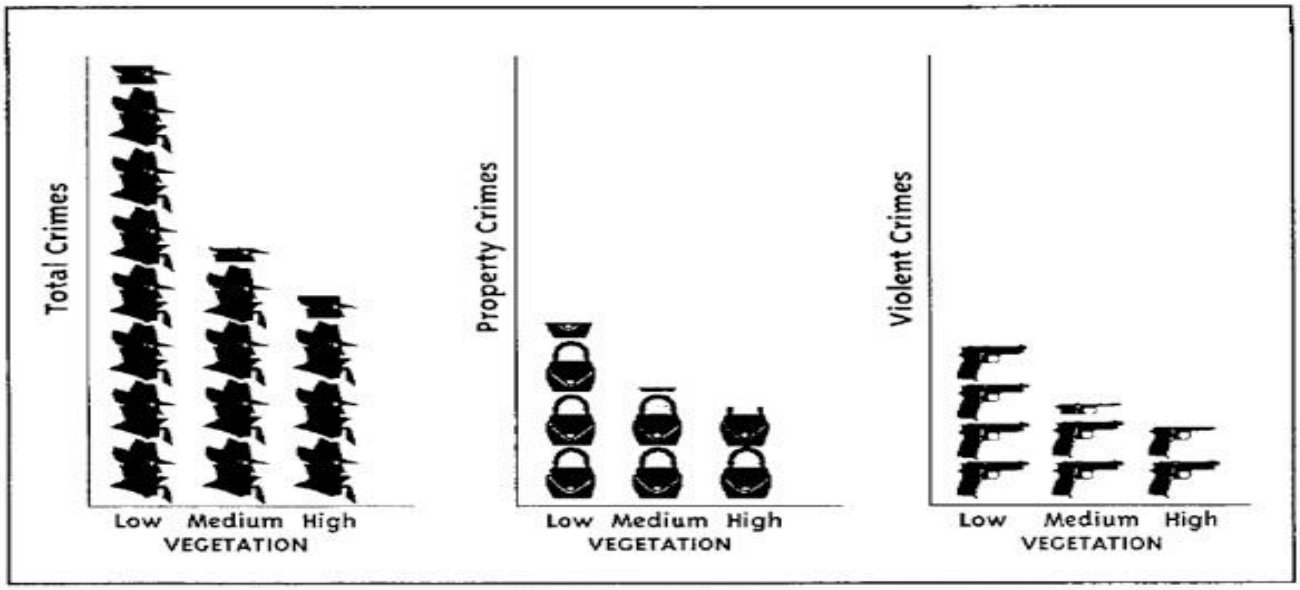
Table 1: Aggression behaviors and nearby nature, green setting vs. barren setting

Reporting Period	Behavior	
	Overall Aggression	Violence
During the past year	27% less (.76/1.04)*	33% less (.49/.73)*
Over the lifetime	28% (.32/.44)	25% less (.24/.32)

* statistically significant

Serious Crimes

Surveys aside, data collected over two years of police reports on property and violent crimes within public housing communities of inner-city Chicago, found the greener a building's surroundings, the fewer total crimes occurred.[1] A comparison of buildings with high, medium and low levels of vegetation, recorded 52% fewer total crimes in the high level, 48% fewer property crimes, and 56% fewer violent crimes than those with low level vegetation. As the graph indicates below, even buildings with a medium level of vegetation reported fewer crimes.[1]



Mean number of crimes reported per building with different amounts of vegetation (each icon is one reported crime)

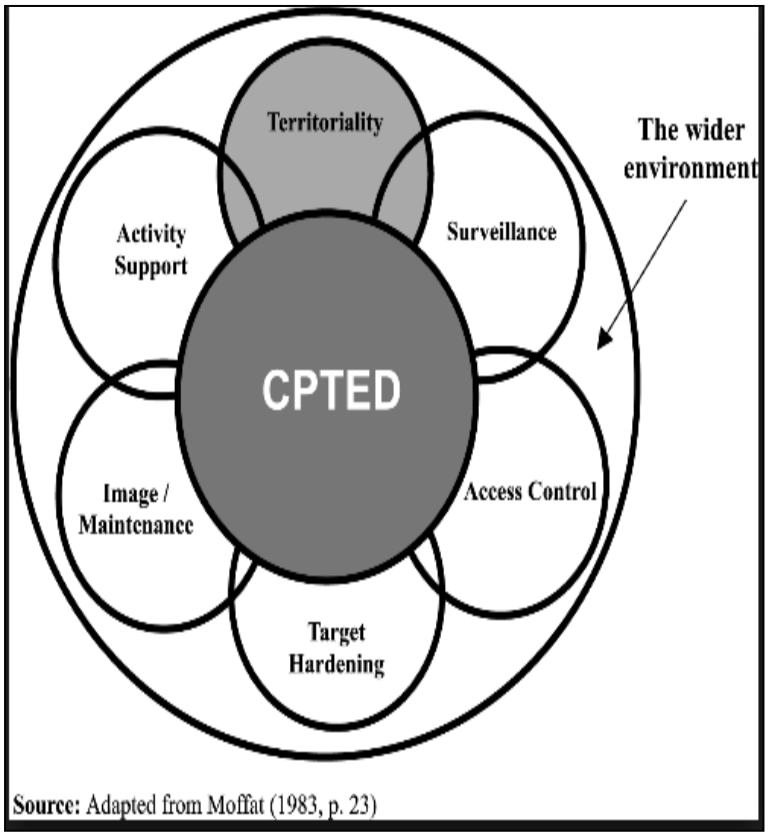
Chicago is not the only community interested in the relationship between the amount of vegetation and level of property crime. Tallahassee, Florida measured the amount of vegetation in ten subdivisions utilizing Normalized Difference Vegetation Index (NDVI) satellite data compared to property crimes and socio-economic variables. NDVI found that the more abundant the vegetation around a house, the less property crimes would occur.[5]

The effects of street trees, and trees on residential lots, was also investigated in a recent study in Portland, Oregon. [6] Larger trees in the public right-of-way were associated with a reduction in crime whereas smaller view-obstructing trees showed a tendency to increase crime.

Thoughtfully placed trees and well maintained vegetation could be a signal to potential criminals to stay away, indicating this house is well cared for and in turn subjected to more effective citizen policing than those without vegetation.

Feeling Safe

Can trees offer us safety? Safety is a feeling that can only be defined as a personal perception. As most know, perceptions can influence behavior. When the perception of an area is that it has a high crime rate, people tend to avoid these areas all together. Imagine living in a crime infested area; the odds are high that you would want to refrain from socializing with your neighbors and stay inside.[7,8]



Source: Adapted from Moffat (1983, p. 23)

The prevention of crime through environmental design is not a new concept. Changing the surroundings that we live in to deter acts of criminal behavior has long been the purpose of crime prevention through environmental design (CPTED). While crime may never be fully eliminated from our communities, the idea behind CPTED strategies is to influence an offender's decision about whether to commit a crime in the first place.[9]

Trees get people outside, socializing more frequently with their neighbors, relaxing under the shade they provide or just enjoying nature. When people are outside, they are self policing their neighborhood whether they realize it or not. Imagine if these people also had a nearby park area or more trees, and felt inclined to go walking? They could also extend their eyes and ears to policing a larger community and give a feeling of safety for those residing there. Social contact with neighbors and informal surveillance are, in turn, linked to stronger communities and lower crime rates.[10]

When looking at the generic pictures below, in which of these neighborhoods would you be more inclined to take a walk?

Treeless neighborhood

Neighborhood with well kept trees

Besides getting out and being a good neighborhood watchperson, when people are outside, they tend to get to know one another and create bonds unlike other friendships. Being a good neighbor has multiple meanings, and when people create strong social ties, they form very effective influential social groups.[11,12] Neighborhood associations in Des Moines have created similar social groups, and like other neighborhoods across the country with strong ties, have become more capable of building consensus on values and norms,[13] monitoring behavior, intervening if problem behaviors occur,[10] and defending their neighborhoods against an increase in crime.[14]

Perhaps residents who know and trust each other are more effective in instituting local social control over what goes on in the spaces outside their homes.[15] Studies show that the presence of trees in residential outdoor spaces help promote ties among neighbors, and is linked with more successful territorial intervention.

The Acorn Doesn't Fall Far From the Tree

Trees are our good neighbors. When linked with well kept vegetation, trees appear to be linked to lower levels of crime. Residential vegetation is linked to a greater feeling of safety, fewer incivilities and less aggressive and violent behaviors. Trees are the answer to many of our urban societal issues and concerns, and along with well kept understory vegetation can transform a once abandoned urban lot from a crime infested area to a more inviting, pleasant, and safe place to live. Such inviting spaces serve to create good neighbors, deter crime and in turn establish healthier, safer urban communities.[16]

1. Kuo, F.E., and W.C. Sullivan. 2001. Environment and Crime in the Inner City: Does Vegetation Reduce Crime? *Environment and Behavior* 33, 3:343-367. online summary

2. Stamen, T. 1993. Graffiti Deterrent Proposed by Horticulturalist [Press release]. University of California, Riverside, Riverside, CA

3. Brunson, L. 1999. Resident Appropriation of Defensible Space in Public Housing: Implications for Safety and Community. Unpublished Doctoral Dissertation, University of Illinois, Champaign-Urbana, IL.

4. Kuo, F.E., and W.C. Sullivan. 2001. Aggression and Violence in the Inner City: Effects of Environment Via Mental Fatigue. *Environment and Behavior* 33, 4:543-571

5. Lorenzo, A.B., and D. Wims. 2004. Do Designed Landscapes Deter Crime? *Proceedings of the Florida State Horticultural Society* 117:297-300.

6. Donovan, G.H, and J.P. Prestemon, J.P. 2012. The Effect of Trees on Crime in Portland, Oregon. *Environment and Behavior* 44, 1:3-30

7. Nasar, J., and D. Julian. 1995. The Psychological Sense of Community in the Neighborhood. *Journal of the American Planning Association* 61, 2:178-184

8. Nasar, J. 1998. *The Evaluative Image of the City*. Sage Publications, Thousand Oaks, CA, 182 pp.

9. http://en.wikipedia.org/wiki/Crime_prevention_through_environmental_design

10. Taylor, R.B. 1988. *Human Territorial Functioning: An Empirical, Evolutionary Perspective on Individual and Small Group Territorial Cognitions, Behaviors, and Consequences*. Cambridge University Press, New York, 351 pp.

11. Greenbaum, S.D. 1982. Bridging Ties at the Neighborhood Level. *Social Networks* 4:367–384.

12. Warren, D.I. 1981. *Helping Networks: How People Cope With Problems in the Urban Community*. University of Notre Dame Press, Notre Dame, Indiana, 248 pp.

13. Dubow, F., and D. Emmons. 1981. The Community Hypothesis. In: D.A. Lewis (ed.), *Reactions to Crime*. Sage Publications, Beverly Hills, California.

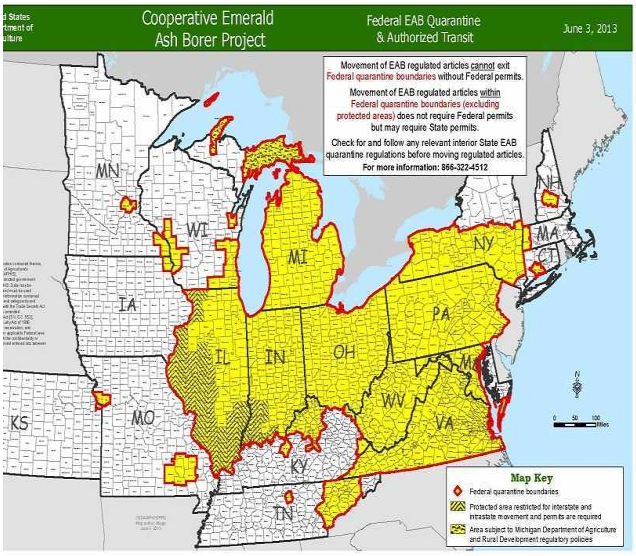
14. Perkins, D.D., P. Florin, R.C. Rich, A. Wandersman, and D.M. Chavis. 1990. Participation and the Social and Physical Environment of Residential Blocks: Crime and Community Context. *American Journal of Community Psychology* 181:83–115

15. Greenberg, S.W., W.M. Rohe, and J.R. Williams. 1982. Safety in Urban Neighborhoods—A Comparison of Physical Characteristics and Informal Territorial Control in High- and Low-Crime Neighborhoods. *Population and Environment* 53:141–165.

16. Kuo, F.E. 2003. The Role of Arboriculture in a Healthy Social Ecology. *Journal of Arboriculture* 29, 3:148-155.

Emerging Threats: Ready or Not Here It Comes

Emerald Ash Borer (EAB)



Emerald ash borer (EAB) is an exotic insect that infests trees and rapidly causes the tree to decline and die. EAB is native to China and eastern Asia and the first U.S. detection was in the Detroit area in 2002. Specifically, EAB has been responsible for the decline or death of tens of millions of U.S. ash trees. The native range of the emerald ash borer (EAB) includes China, Mongolia, North Korea, South Korea, Japan, Taiwan, and the Russian Far East. The EAB was unknown in North America until its discovery in southeast Michigan, but by June of 2013, EAB infestations had been detected in 19 states, including Iowa.[1,2] In July, 2013, EAB was discovered in Burlington, IA (Des Moines County), and also in Fairfield, IA (Jefferson County).

Infestation

Adult EAB begins emerging in mid to late May with peak emergence in June. Shortly after emergence the adults mate, and the females lay eggs two weeks later. Each female can lay 60 to 90 eggs in their lifetime with eggs typically hatching in 7-10 days.[3,4] After the tiny larvae hatch, they start to bore through the bark and feed on the phloem which is the activity that will eventually kill the tree. The larvae will continue to feed through October before wintering in a small chamber in the outer bark or outer

Emerald Ash Borer Life Cycle. [5]

inch of wood. The larvae will typically pass through four stages eventually reaching the pupae stage between 1 to 1.25 inches in length. In the spring, EAB pupae start to transform into adults and in 1 to 2 weeks a new generation of EAB adult beetles emerge through D-shaped exit holes and the adults begin the life cycle process all over again.[4]

Evidence of EAB Larvae Feeding on phloem tissue and size of EAB larvae. Source: University of Madison Wisconsin[6]

Economic Cost of Treatment and Removal

This insect invasion is endemic to the northern hardwood forests and includes white ash *(Fraxinus americana*), green ash (*Fraxinus pennsylvanica*), and black ash (*Fraxinus nigra*) trees. Each species is adapted to different sites in our forests, serving as critical ecological resources, particularly in riparian zones. Ash trees are also important economically with 8 billion ash trees on U.S. timberlands valued at $282.25 billion (USDA FS FIA). Moreover, ash trees are one of the most prevalent trees in urban areas, agricultural lands, and shelterbelts, and the costs to communities and landowners for removal and replacement will continue to escalate. The 2003 Federal Register reported costs of ash removal and replacement at $11.7 billion (not million!) for six infested southeastern Michigan counties alone. [7]

EAB has created a huge concern for communities which are already struggling to take care of aging trees and attempting to plant new trees to increase canopy. As dead ash trees fail, they fall on homes, cars and people and are unsafe to climb even by tree removal professionals. Elimination of these high risk trees should be part of a management plan, but it will be very expensive. For example, the City of Midland, Michigan was forced to take funds from street paving, water-sewer projects and parks just to remove standing dead ash trees over a period of five years at a cost of 2 million dollars with an average removal cost of $621 per tree. [8] So, it becomes clear that the present costs of preserving desirable trees and planting new trees will now be expanded exponentially as municipalities grapple with the added burden of treating and removing tens of thousands of ash trees.

Source: http://bioforesttech.wordpress.com/, original source: Dan Herms OSU

Toledo, Ohio June 2006

Toledo, Ohio August 2009

Midland, Michigan has been forced to cut down hundreds of trees and treat thousands more as a result of emerald ash borer. [9]

Treatment

Alongside any removal program for potentially dangerous ash trees affected by EAB is a possible treatment program. The opinions on treating trees to prevent EAB vary greatly. Some cities or organizations have elected to simply do nothing and wait for the insect to arrive. Others are making detailed plans for detection, treatment and removal of trees. Additional groups are somewhere in between.

From these approaches three plans could be viewed as possible preparation for the onset of EAB.

1. Do nothing and bear the cost of all tree removal
2. Proactive advance removal of trees

a. Removal of diseased or structurally compromised trees
b. Removal of selected trees based on location
c. Removal of trees with other health issues

3. Proactive chemical treatment
    a. Treat all ash trees
    b. Treat selected trees based on health and location
    c. Treat selected trees based on landscape value
    d. Treat any and all trees to allow time for removal operations to keep up with demand.

Contrasting Treatment Plans

Oakville, Ontario

Oakville has the most aggressive management plan in North America to combat EAB. The City Council approved a plan to treat 75 per cent of the public ash canopy (approximately 6,000 city-owned trees) on streets and in parks. To protect resident safety and property, the town will remove the remaining 25 per cent of the public ash canopy over the next few years and replace it with trees of different species, a program that began on November 1, 2012.

Ash trees will be treated if they are at least 20 cm in diameter (8" U.S.), measured 1.3 meters from the ground (54" above ground U.S.) AND if they do not have holes in their trunk AND if at least 70 percent of the upper branches are healthy. [10]

Fort Wayne, Indiana

The City of Fort Wayne owned approximately 13,500 ash trees along the city streets in 2009. The Ash population accounted for 25% of the total urban canopy in Fort Wayne. The Forestry division decided in early March of 2009 to save as many of their Ash trees as possible. The treatment plan was divided into two parts. The first specifications were written for trees 1" to 17" in diameter. The method of treatment was soil injection of Imidacloprid with fertilizer and organic soil amendments added. The City of Fort Wayne treated 10,636 Ash trees under this contract. The second specification was written for the trees measuring 18" to 48" in diameter. The method used in this specification was trunk injection using Arborsystems Direct-Inject Wedgle. The city treated 1302 Ash trees with the Wedgle trunk injection system. The plan for any tree removal was based on the outcome of the treatment program which would eventually dictate the population reduction needed.[11] In a telephone interview with Fort Wayne's City Arborist, the author learned that the treatment of ash trees was viewed to be successful. The arborist stated that he would not recommend treatment of trees with over 25% canopy loss, but he certainly said the cost analysis shows the advantage of treating trees over the cost of removal and replacement. [12]

Rolling Meadows, Illinois

Other communities take a completely different approach to the option of treating trees with EAB. "Should we be spending money to try to save a tree that's going to die sooner or later anyway, especially when we don't know for sure that this will even work?" asked Alderman John D'Astice of Rolling Meadows, where officials ultimately decided not to treat most of the 1,700 public trees.[13]

Management Plan

States that have already been affected by EAB are making suggestions for the states that will soon face the same circumstances. Wisconsin is one of them.

Wisconsin's Urban Ash Management Guidelines recommend the following: [14]

1. Make a plan; failure to plan will cost more in the long run
2. Start with a tree inventory; planning will require an understanding of the quantity and condition of trees
3. Preemptive removal of at least some ash
4. Diversity of replacement trees

The American Public Works Association suggests that a strategy to deal with EAB or any other emerging threat will minimize cost, minimize canopy lost, minimize environmental impact, minimize hazards and liability, and spread catastrophic cost over decades.

With these goals in mind, the APWA recommends:

1. Tree removal and replacement
2. Bi-annual treatment of selected ash
    a. Annual tree condition monitoring
    b. Wound response assessment
    c. EAB population monitoring
3. Performance assessments and adaptive management
4. Assessment and integration of new management options

Oak Wilt

Oak wilt is the most damaging disease of oak trees in Iowa, and it has killed many forests in the Eastern and Central United States. Oak Wilt was first identified in Wisconsin in the early 1940s, but disease survey records suggest that it had been present there since at least 1912. The disease has not devastated its host species mainly because its spread from diseased to healthy trees has been relatively slow and sporadic. Virtually all counties in Iowa have reported the disease. The regional distribution of oak wilt has changed little in the last 50 years, although its incidence has fluctuated sharply in many localities.

Leaves infected with Oak Wilt

Oak Tree with Oak Wilt

The fungus that causes oak wilt, *Ceratocystis fagacearum*, invades the water-conducting tissues (xylem) of oak trees. The trees respond to this attack by plugging the xylem vessels. This blockage prevents the normal upward flow of water through the vessels, causing the foliage to wilt and die.

Oak wilt symptoms in red oak will first appear in late spring or early summer. Leaves discolor, wilt, and fall at the top of the tree first and later at the tips of the lateral branches. Leaves turn a dull, bronzed brown at the tips and along the outer margins, with a sharp line separating discolored from normal green tissue. [15]

Bur Oak Blight

Tree with Bur Oak Blight

Bur Oak Blight is a disease that has been recognized in several Midwestern States since the 1990s with Iowa reporting its first occurrence in 2004. . The disease is caused by five known species of fungus that attack the leaf on only bur oak trees. Severe symptoms of BOB have only been observed on bur oak that produces smaller acorns. BOB occurs primarily on naturally established trees, and especially on mature trees on upland sites that appear to be remnants of savannah forests. Leaf symptoms typically appear in late July or August with the infected leaves developing purple-brown lesions along the mid-vein and major lateral veins on the underside of leaves. As the lesions increase in size, dark veins become noticeable on the upper leaf surface giving the leaf an overall wilted or scorched appearance. The symptoms of wilting and leaf scorch resemble, and have been confused with, symptoms induced by oak wilt, but one main difference is that the Bur Oak Blight will first impact leaves toward the bottom of the tree while Oak Wilt is first recognized at the top of a tree. [16]

Leaves infected with Bur Oak Blight

References

1. Emerald Ash Borer Found in New Hampshire, Article in Tree Care Industry Association, treephys.oxfordjournals.org/content/22/2-3/205.full.pdf

2. United States Department of Agriculture

3. Source Animal and Plant Health Inspection Service APHIS

4. McCullough, Deborah and Usborne, Robin. Emerald Ash Borer Fact Sheet. Michigan State University and the United Forest Service: (http://www.emeraldashborer.info/faq.cfm#sthash.4ZKfCOFj.dpuf

5. Cappaert, D., D. G. McCullough, T. M. Poland, and N.W. Siegert. 2005. Emerald ash borer in North America: A research and regulatory challenge. American Entomologist, 51:152-16

6. Russel, University of Madison Wisconsin: http://labs.russell.wisc.edu/eab/other-ash-problems/

7. United States Department of Agriculture, Forest Service

8. Biememann, David, "Emerald Ash Borer: Destroying ash trees, creating public safetyhazards, and wreaking havoc on city budgets. APWA Reporter, Jan. 2012.

9. Simonetti, Thomas, Deadlier Than Dutch Elm: U.S. Trees Stricken by a Plague of Ash Borers., Time Magazine, May 25, 2011. http://www.time.com/time/nation/article/0,8599,2073835,00.html#ixzz2YCLOLtmc

10. City of Oakville, Ontario Canada: http://www.oakville.ca/residents/emerald-ash-borer.html

11. Tinkel, Chad, Manager of Forestry Operations, Emerald Ash Borer Update, Parks and Recreations website for the city of Fort Wayne, Indiana.

12. Tinkel, Chad, phone interview by Dennis Vaughn, conducted on July 15, 2013 at 2:30 pm.

13. Silverberg, Mellisa. "How the emerald ash borer is changing the suburban landscape", Daily Herold, August 19th, 2012.

14. Wisconsin Urban and Community Forests (quarterly newsletter, DNR UF program)

15. Gleason, Mark. Oak Wilt Identification and Management, Iowa State Extension and Iowa DNR

16. Pokorny, Jill. Pest Alert, Bur Oak Blight. U.S. Forest Service. United States Department of Agriculture.

Debris Management:

Trouble in Paradise

The Federal Emergency Management Agency (FEMA) encourages state and local governments to take a proactive approach to coordinating and managing debris removal operations as part of their overall emergency management plan. The agency believes that communities with a debris management plan are more prepared to restore public services and ensure the public health and safety in the aftermath of a disaster. [1]

Polk County Emergency Management formulated a Debris Management Plan which was updated in June of 2013 to meet all FEMA eligibility requirements prepared for any incidents whether funding was possible or not. The plan prepares for an expedient, yet safe clearance and removal of debris in the most efficient and cost effective method possible and to coordinate these efforts with state and federal agencies when necessary. [2]

Even without any storm events, each year the city of Des Moines generates a huge volume of debris from trees and other vegetation. Much of this material is chipped to create compost. Below is a current photo showing the city's tree debris pile and the wood chip pile which was at approximately 5,000 cubic yards, both near capacity.[3] During the 2012-13 fiscal year, Metro Waste Authority received and chipped over 32,600 cubic yards of compost. The brush and tree parts were contributed by citizens during Spring Cleanup to Remove Urban Blight (SCRUB) events, and by tree and landscape contractors.

Metro Waste Compost Facility

Storm Debris Management

To prepare for a storm or disaster, a plan is currently being developed to handle the debris produced from such events. As of July 2013, it still remains for all municipalities in the Des Moines Metro area to agree to this plan. Referenced in the following chart, during a minor event the removal of all debris remains the sole responsibility of the property owner; during a major event drop off sites will be opened for property owners (not contractors); and during a "destroyed" event, the city will offer curbside collection of the material.

MINOR	MAJOR	DESTROYED
• Vegetative debris removal **responsibility of the private property owner** for areas meeting the Minor criteria • Place vegetative debris at the curb following collection guidelines for normal yard waste collection (resident pays) • Private property owner may also choose to hire a solid waste contractor, tree service contractor or use a commercially owned yard waste drop off sites (resident pays)	• **The city will attempt to assist residents with disposal options** • Commercial haulers will not be permitted at debris management drop off sites • Proof of residency will be required • Property owners will also have the option of hiring a private contractor for removal and disposal (resident pays)	• City will perform **curbside collection and disposal** at no cost for areas meeting the Destroyed criteria • Debris management drop off sites may be opened

Minor

Major

Destroyed

Following storms the volume of debris obviously increases greatly, putting added pressure on the city to deal with the added volume of material. This may include damage to trees caused by strong winds during violent thunderstorms in the summer or from ice storms during winter months.

Debris Management from Developing Events

In addition to storms, another monumental concern that could potentially create a massive increase to debris is the emerging threat of Emerald Ash Borer (EAB). In states that have experienced the devastation of this infestation, the increase in debris from trees has been enormous, reaching several times normal volume. When EAB arrives, there will be a prolonged period of approximately 5 years during which this extra debris will have to be managed.

References

1. Federal Emergency Management Agency, U.S. Department of Homeland Security. Debris Management Guide, June 15, 2013.

2. Polk County Emergency Management: Polk County Emergency Management Plan June 15, 2013

3. O'Connor, Rhonda, Metro Waste Authority, personal communication. July 26, 2013.

Preservation of an Urban Forest: Protecting Our Future

Tree Preservation Equals Life Preservation

A well maintained urban forest is an invaluable contribution to a community and provides countless benefits that help preserve the quality of life for its residents. While the introduction of new trees is vital for maintaining or increasing the urban canopy of Des Moines, protection and maintenance of 'existing' trees provides an exponential increase in benefits. By investing time and resources into the preservation of established and mature canopy, the Des Moines community will harvest the benefits from this commitment for generations to come.

Walmart Hilton Head, SC. An example of preserving trees during development.

> *"Someone is sitting in the shade today because someone planted a tree a long time ago." Warren Buffet*.

This quote certainly makes a valuable point, but we could add a second quote as follows:

> *"Someone is sitting in the shade today because someone helped protect and maintain a tree." Dennis Vaughn, STEM Extern*

Since the urban forest provides so much benefit to a city, community efforts to promote trees or to increase the tree canopy have often been focused on new tree planting. However, it is crucial to concentrate on the preservation of existing trees as well. This includes the training of young trees for the first few years after planting.

Given that close to 80 percent of the population of the conterminous United States lives in an urban area, the positive attributes provided by urban forests touch most U.S. citizens. Nationally, urban forests in the United States are estimated to contain about 3.8 billion trees, with an estimated structural asset value of $2.4 trillion (Nowak et al. 2002).[1] The management of the urban canopy typically involves a variety of activities such as inventorying tree populations; enacting tree and land use planning ordinances and policies; developing and implementing long-term management and maintenance plans, annual work plans, and budgets; and promoting community education and participation (Dwyer et al. 1992, Elmendorf et al. 2003).[2]

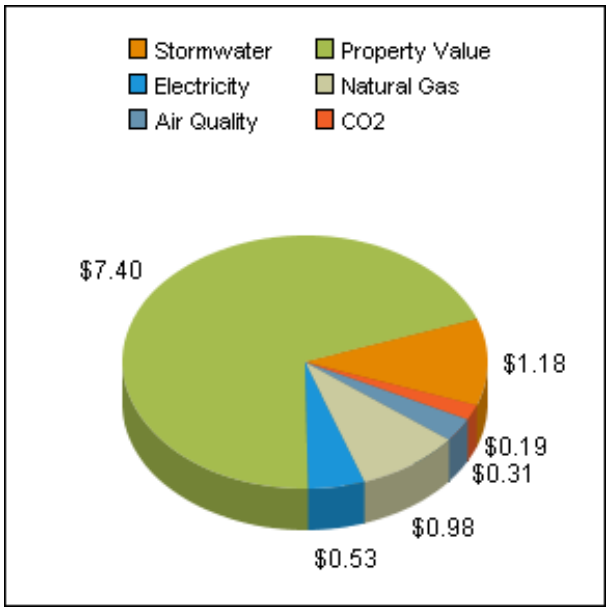
Entry drive to Hilton Head Walmart

The Iowa State Extension Service promotes pruning as the most important maintenance practice. When done properly, pruning can improve the health and structure of trees, and provide a safer environment for people, pets, and property. Proper pruning includes knowing which branches to remove, when to do it, and how to minimize damage to the tree. Pruning within the first 15-20 years of a tree's life is critical because it promotes good branch structure and tree strength, making a tree less susceptible to damage from wind, ice, and snow storms. [3] Many arborists consider the first three years of a tree's life to be the most critical in terms of both survival and interventions. This could easily be paralleled with the development of a child where the first few years of life have a pivotal impact on the well being of the infant.

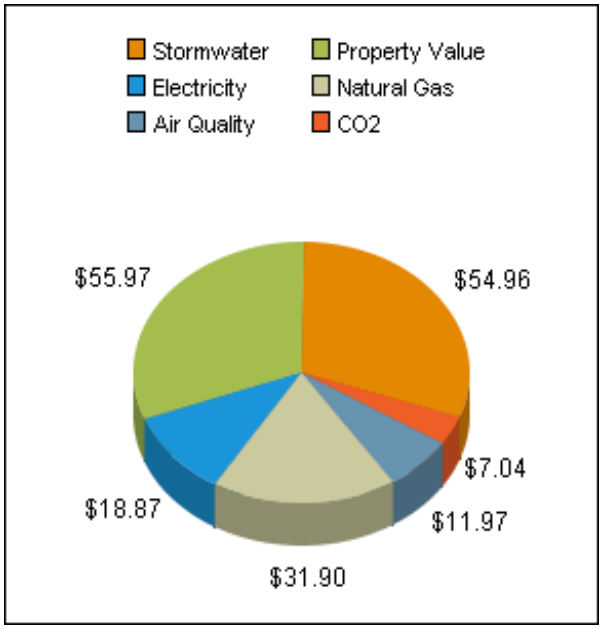
The early investment in maintenance offers a huge return for an urban canopy. According to the Center for Urban Forest Research, Pacific USDA Forest Service, a large tree will cost $18 dollars a year to maintain, but provides $4400 in value to a community where a small tree would cost $14 dollars to maintain each year but would only provide $270 in value to a community.[4] The report was emphasizing the economic value in planting small trees versus planting large trees, but the information is applicable to the exponential difference between the benefits provided from a young newly planted tree in a community in comparison to a mature well established tree.

To make a comparison of the specific value of a juvenile tree with a mature tree in terms of economic value, a tree calculator has been developed by Casey Trees and Davey Tree Expert Company. Using the tree calculator, http://www.treebenefits.com/calculator, the economic value of a tree may be determined based on its size, species, climate zone, and land use area. For example, for the Midwest climate of Des Moines in a single family residential neighborhood, a 2 inch diameter oak tree (approximate planting size) would provide an economic value of $11 per year, while an 18 inch diameter tree (approximate established size) would provide an economic value of $181 per year.

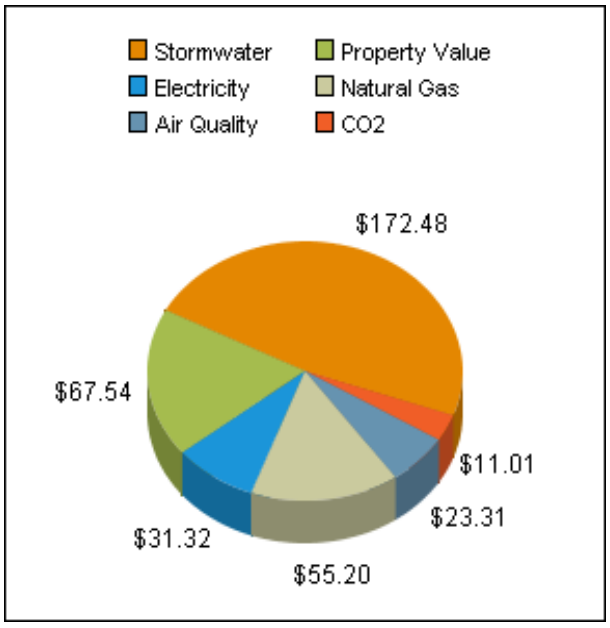
A 36 inch diameter oak tree (mature size) would provide $361 of economic value annually. [5]
See figures below.



Economic value of a 2 inch diameter oak tree in a single family residential area in Des Moines



Economic value of an 18 inch diameter oak tree in a single family residential area in Des Moines.



Economic Value of a 36 inch diameter oak tree in a single family residential area of Des Moines.

While some functional benefits of trees are well documented, others are difficult to quantify (e.g., human social and communal health). Trees' specific geography, climate, and interactions with humans and infrastructure are highly variable and make precise calculations that much more difficult. Given these complexities, the results presented in the preceding graphs should be considered initial approximations—a general accounting of the benefits produced by urban street-side plantings. NOTE: benefits of trees do not account for the costs associated with trees' long-term care and maintenance.

From this information it becomes easy to see that maintenance pays huge dividends. The economic and environmental value of an existing tree is exponentially greater than the benefits of a smaller tree of the same species in the same climatic zone. It is also noteworthy that investment in maintenance doesn't just help maintain the benefits of the existing trees, but actually helps to extend and increase their impact. For example, the 18 inch Oak tree shown previously, was providing an economic value of $181 annually, but with proper maintenance over the next 5 years, the same tree would increase to a value of $233 annually. [5]

May the Forest Be With You

Maintenance and protection of existing trees should be a key component of an UFMP, but how should this take place? Pruning and other positive interventions along with protection efforts should be common practices carried out by not only the forestry department of a municipality, but also by volunteer groups, schools, businesses, and residential property owners.

Policy

Cities across the United States have changed public policy to help preserve trees and ensure their proper maintenance. Lacey Washington, for example, adopted the following. [6]

a. Before any residential or business development, the city Arborist will be required to evaluate the site for trees that should be protected.
b. Requirement of setting 5% of a development as protected tree tract.
c. Replanting requirements for land where trees have been cleared.
d. Residence will only be allowed to remove existing diseased or hazardous tree after a visit from the city Arborist.
e. No tree removal is permitted without a land clearing permit.

Other cities have implemented more general policies for the preservation of established trees. In Austin, Texas, home owners must obtain a permit to remove any tree at least 60 inches in circumference (or 19 inches in diameter) and businesses are required to accurately locate all trees 8 inches in diameter or 25 inches in circumference or larger for development review. [7]

In Kansas City, the city ordinance requires the identification of trees to be removed and trees to be preserved during the development of the subject property with the goal of saving trees that are not required to be removed for the development of the property *(Ord. No. 120939, § 1, 12-20-2012).* In addition, a licensed surveyor, professional engineer, or landscape architect must delineate the existing edge of the tree canopy. The survey must identify the critical root zone of all trees at the mapped canopy cover boundary with a diameter breast height (DBH) of 10 inches or greater. The

surveyor may identify specific tree species to more accurately delineate the riparian vegetation boundary if the mature vegetation appears to extend into uplands. The riparian boundary is assumed to exist when less than 50% of the mature trees (10-inch DBH or greater) are of riparian or bottomland species as defined by The Terrestrial Natural Communities of Missouri and approved by the city. The surveyor must delineate the canopy cover boundary of the mature riparian tree specimens. [8]

In the City of Chicago, parkway tree planting is required by city ordinance under the following conditions:

1. Construction of any principal building
2. Additions to a building in excess of 1,500 square feet of floor area.
3. Repair or rehabilitation of a building if the cost exceeds $10,000 or 50 percent of the building's replacement cost, whichever is greater.
4. The construction or installation of any parking area containing more than four parking spaces.
5. The repair, rehabilitation or expansion of any existing surface parking area, containing more than four parking spaces, if the expansion will increase the number of parking spaces by four spaces. [9]

To help preserve the existing trees, a Tree Removal Permit shall be issued only in the event the city finds that all reasonable efforts have been undertaken in the architectural layout and design of the proposed development to preserve existing street trees. As a condition of the Tree Removal Permit, replacement trees and/or compensation for lost value may be required. This includes

A) Building placement and driveway, walkway and parking areas to be designed in such a way as to avoid unnecessary removal of existing trees.

B) Every effort shall be made to protect existing trees during the placement of utility service. [9]

Even simple measures may offer meaningful protection to the critical mature trees in our canopy. Proactive planning to prevent mature tree losses is the key to success.

Before construction, the property owner should take stock of all trees on the site, make an inventory of existing trees and then establish a Tree Protection Zone (TPZ) which is a protected area that preserves roots and soil and keeps branches clear of contact with construction equipment and materials.

Efforts have also been made across the country to protect mature established trees to ensure their aesthetic and economic value will branch from present day to the future generations. Specific areas may be marked with signs to prevent any destruction, spraying or other potential harm.

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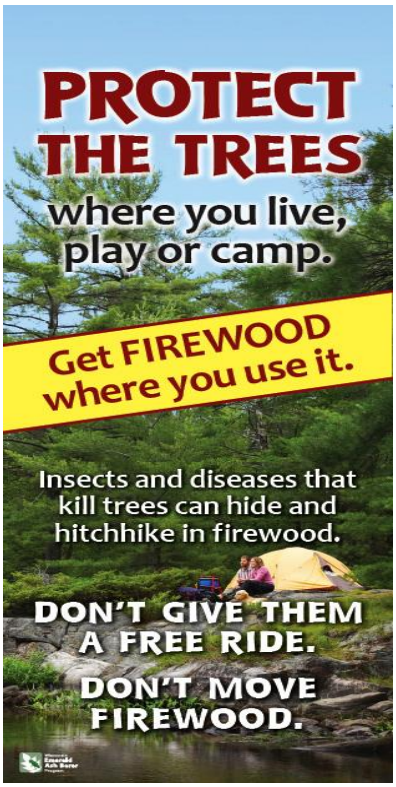
For example, the Oakville Ontario City Council has adopted several by-laws to provide preservation of the tree canopy. These by-laws were intended to regulate the destruction or injury of all trees of any size located on

municipal property and private trees greater than 20 centimeters in diameter measured at breast height (1.37 meters).[10]

Identification of Tree Preservation Area

Identification of Efforts to Protect Trees

Education



Anti-Wood Hauling Advertisement. [11]

All of the policies and governmental efforts to protect and preserve the existing trees in a community will not be successful without education. An informed public will be more likely to make prudent decisions involving the preservation of trees and be willing to commit resources toward the goals of maintaining and improving an urban forest. The education component of tree preservation involves many branches stemming from the common root goal of an increased tree canopy with healthier trees and more economic benefit for the community. The branches may include collaboration with schools, public awareness campaigns, informational websites, seminars, partnering with businesses, and hands-on demonstrations at public events.

An excellent example of the need for public education for the protection of trees is the concern over transportation of firewood into campgrounds. The practice of hauling firewood for camping risks transport of insects and disease that potentially harm other trees. Efforts to reduce or eliminate the hauling of firewood will take an assertive and collaborative public education effort.

1. Nowak, D.J.; Crane, D.E.; Dwyer, J.F. 2002. Compensatory value of urban trees in the United States. Journal of Arboriculture. 28(4): 194-199.

2. Elmendorf, W.F.; Cotrone, V.J.; Mullen, J.T. 2003. Trends in urban forestry practices/programs, and sustainability: contrasting a Pennsylvania, U.S. study. Journal of Arboriculture. 29(4): 237-248.

3. Forestry Extension, Department of Natural Resource Ecology and Management, Iowa State University, Ames, Iowa

4. McPherson, E.G.; et. al. 2003. Northern Mountain and prairie community tree guide: benefits, costs and strategic planting. Center for Urban Forest Research, Pacific Southwest Research Station, USDA Forest Service. 92p.

5. The National Tree Benefit Calculator was conceived and developed by Casey Trees and Davey Tree Expert Co.

6. City of Lacey, Washington: http://www.ci.lacey.wa.us/

7. City of Austin, Texas: http://austintexas.gov/department/city-arborist

8. ZONING AND LAND DEVELOPMENT CODE, City of KANSAS CITY, MISSOURI, Codified through Ordinance No. 130136, enacted April 25, 2013. (Supp. No. 3)

9. Official website of the city of Chicago. http://www.cityofchicago.org/city/en/depts/ah/supp_info/rules_and_ordinances.html

10. Official website of the city of Oakville, 2013. http://www.oakville.ca/residents/trees-protection-removal.html

11. Department of Natural Resources for the State of Wisconsin; dnr.wi.gov.

Next Steps: Cultivating the 'Final' Urban Forest Master Plan

The logical next steps before a final Urban Forest Master Plan (UFMP) may become a functioning living document will be a) the completion of a comprehensive tree inventory, b) the introduction of the inventory data into all of the UFMP content, and c) the research of remaining vital topics.

The inventory will provide an estimated 30 data points for each tree in the urban canopy, which information will be available in an electronic document that will be updated and expanded with use. It will serve as the knowledge data base about the trees of Des Moines and as the mechanism for developing an action plan to improve the community canopy.

Eventually, the Des Moines UFMP will replace this preliminary plan, guide us to create goals, set strategies for attainment, and foster mechanisms for successful urban forest management.

The topics in this Prelude to an UFMP require further development. The following list of topics, as yet unexplored and not yet exhaustive, will require research and development before being included in the UFMP.

- Green Infrastructure
- Tree Management Plan
- Public Trees
- Private Trees
- Funding
- Community Needs and Opinion
- Education: Children, Youth, Adult
- Street Trees
- Parks, Cemetery, and Golf Course Trees
- Partners
- Development: Preservation and Mitigation
- Canopy Goals
- Riparian Borders
- Historical Landscapes: e.g. former prairies
- Wildlife and Environment
- Other landowners: Private golf courses Des Moines Water Works, schools, federal and state land, Zoo