Frankfort Avenue Street Tree Master Plan

June, 2012

Acknowledgments

Louisville Metro Councilperson Tina Ward-Pugh

Billy Goat Hill Garden

Billy Goat Hill Garden Tree Canopy Committee

Lorene Hunter, Chair
Virginia Forest
Pam Vetter

Stakeholders (in alphabetical order):

American Printing House for the Blind
Center for Neighborhoods
Clifton Community Council
D.D. Williamson
Frankfort Avenue Business Association
Greater Louisville Council for the Blind
Guide Dog Users of Kentucky
Kentucky School for the Blind
Louisville Gas and Electric
Louisville Metro: Parks, Planning and Design
Public Works
Metropolitan Sewer District
Neighborhood Pedestrian and Bicycle Access
Committee
Urban Design Studio

Residents

Table of Contents

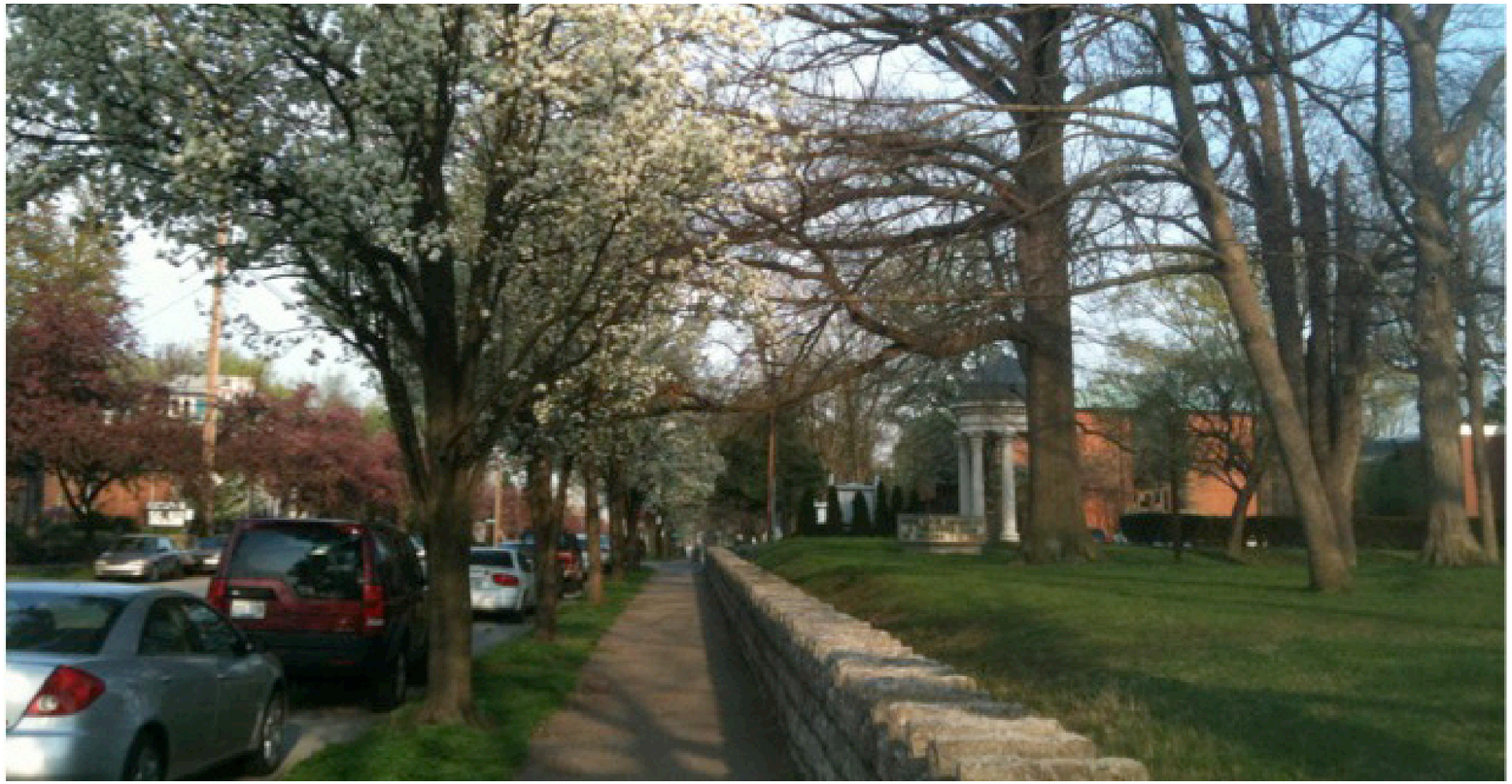
Overview

Trees are one of the few parts of the urban infrastructure that increase in value over time, particularly if they are well maintained. Trees in the public realm form an integral part of a community's green infrastructure, and as such, warrant thoughtful planning and budgeted management. With new information emerging about the benefits of the urban forest and the development of innovative technologies that can improve the planting success and health of urban trees, it is time to develop a comprehensive plan to address trees along the Frankfort Avenue corridor.

This Street Tree Master Plan builds upon the positive elements of the Clifton neighborhood, studying Frankfort Avenue between Mellwood Avenue on the west and Ewing Avenue on the east. The adoption of this document will assist governmental agencies, property owners, businesses and institutions in planning and maintaining a diverse and vital urban forest. Subsequent pages outline the goals, strategies, and criteria that will help guide urban forestry decisions within the study area for the selection, placement, and proper maintenance of trees.

Mission Statement

To improve the tree canopy, plant diversity and health of trees within the Frankfort Avenue study area, enhancing livability and creating green spaces in the form of a walking arboretum to connect people with nature and each other, improve the urban environment, and reduce storm water runoff.



History and Background

From 1991 to 1993 approximately 200 trees were planted on Frankfort Ave between Mellwood and Ewing Avenues as part of the Clifton Commercial Corridor Task Force. Tree well locations were selected on a consistent spacing without regard of the surrounding context creating undesirable tree placement. In 2000, the Clifton Neighborhood Plan recommended replacing the street trees with more appropriate tree species for the urban setting. In 2003, a Frankfort Avenue Streetscape Plan was developed by Veritas, but the plan was not implemented due to funding limitations, nor was it species specific.

The Clifton Community Council Beautification Committee completed a tree inventory and tree assessment in August 2008 and although efforts to secure funding from MSD did not materialize, the Beautification committee continued to meet until May, 2010. In April 2011 the group reconvened as the Tree Canopy Committee of the Billy Goat Hill Garden and by mid-summer 9th District Councilperson Tina Ward-Pugh had committed funding to complete the Street Tree Master Plan (phase 1).

Since 1993, many of the street trees on Frankfort have deteriorated from road salts, disease, drought, and increasingly violent weather episodes. Vehicular damage has occurred from delivery and garbage trucks and TARC buses. Property owners have improperly pruned and even cut down the trees. Certain species, like the crabapple trees produce fruit that drop on the sidewalks, causing hazards for pedestrians. They also require a regular maintenance plan to remove suckers, and after 18 years, have reached their maximum life span in their urban setting.

Planning Process

During the spring of 2012 three stakeholder meetings were held at the Clifton Center to seek input and refine the project. A public meeting to present highlights of the Street Tree Master Plan and hear from the broader Clifton neighborhood was held on May 10th and was followed by a similar presentation to the Clifton Community Council on May 15th. As the study area is within the Clifton Preservation District, the Clifton Architectural Review Committee of the Landmarks Commission will consider the Street Tree Master Plan for approval and adoption at its meeting in July . The Landmarks staff will utilize the adopted Street Tree Master Plan to approve the location and tree species and issue a Certificate of Appropriateness for any new street trees planted or replaced within the study area.

Goals

The original contract identified and the stakeholder group reinforced the following goals for the Frankfort Avenue Street Tree Master Plan:

1.) Increase the urban forest canopy and reap the sustainable benefits of a well-planned and well-executed street tree environment.

2.) Preserve and maintain the healthy existing canopy trees.

3.) Enhance the character and visual appeal of Frankfort Avenue to encourage walkability and commerce and to improve the overall experience along the corridor.

4.) Establish a diverse and site appropriate tree planting palate to be planted in suitable conditions that will support the life of the tree well into the future.

5.) Select trees that will provide seasonal character and diversity.

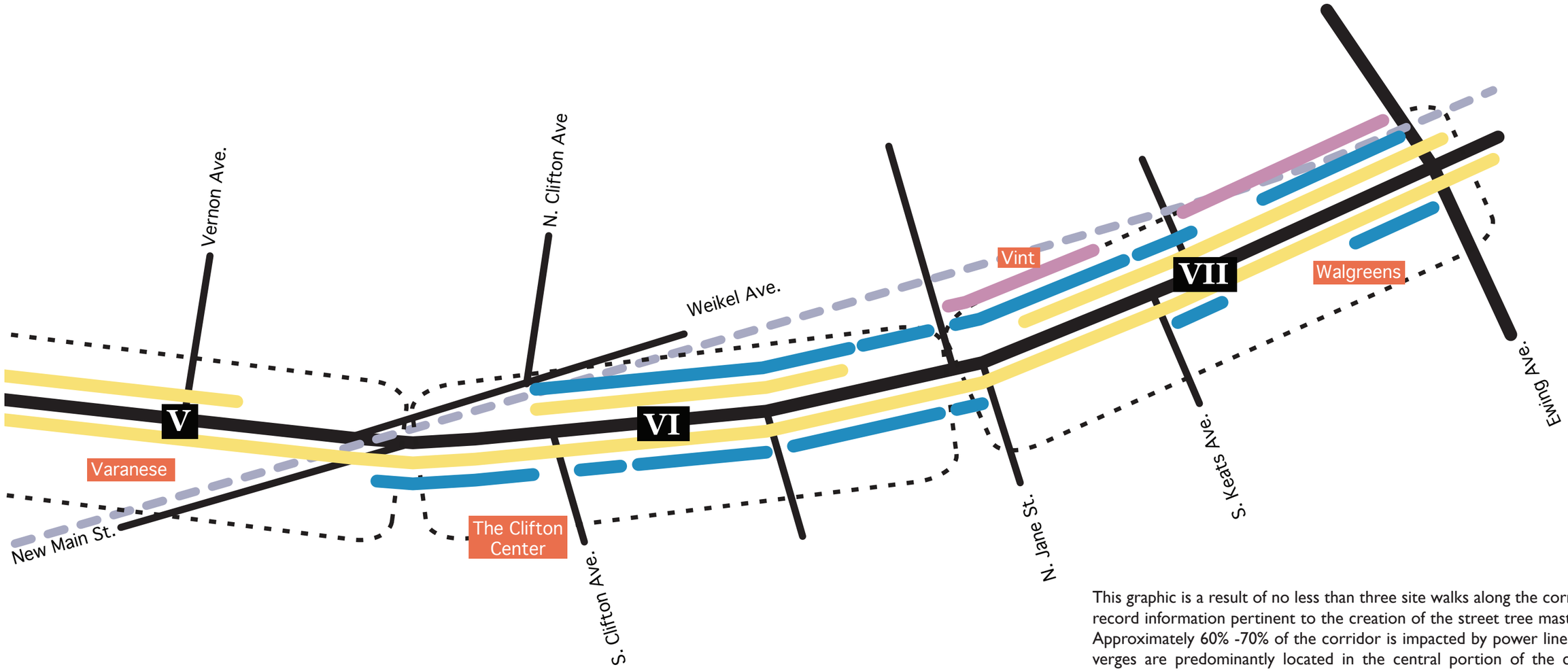
6.) Propose tree locations that take into consideration surrounding context, including storefront visibility, utility lines, residential character, and other factors.

7.) Develop a master plan that aids in obtaining funds to implement the project over time.

Inventory and Analysis

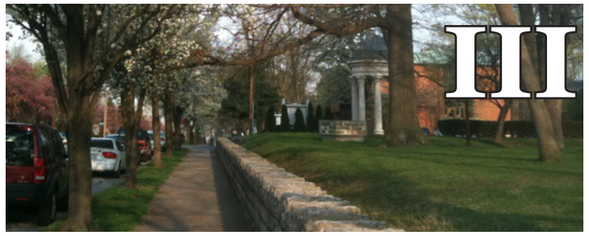
The study of conditions along the Frankfort Avenue corridor revealed that seven subsets or zones exist that can be defined by their different characters. The zones at the ends of the corridor have the poorest character, greatest amount of impervious surfaces, and the weakest tree canopy. The central zones contain the largest trees, have the best planting conditions, and the strongest streetscape character. These seven zones have been evaluated on the following pages as to their urban, tree, and sidewalk characters. This inventory serves to set the parameters for the Master Plan and its subsequent recommendations.

Overall Corridor Analysis



This graphic is a result of no less than three site walks along the corridor to record information pertinent to the creation of the street tree master plan. Approximately 60% -70% of the corridor is impacted by power lines. Grass verges are predominantly located in the central portion of the corridor where residential and institutional uses occur, producing a most conducive environment for lush tree growth. At either end of the corridor, narrow sidewalks limit tree planting options. The corridor naturally divides into seven zones or character areas, as described more fully on the following pages.

Inventory and Analysis

Urban Character	Tree Character*	Sidewalk Character	Zones
A relatively equal mix of commercial and residential, exists even though many businesses are in converted houses. With the exception of the corner at Mellwood, the majority of structures retain a small scale, residential character set back from the sidewalk.	The tree maturity and quality is poor, with a tree cover of 15 - 20%.	The sidewalks are of medium width and have few functional tree planting areas.	
A mixture of commercial, residential and institutional uses is typical. Commercial tends to be close to the intersection corners, two stories and built to the sidewalk. Residential and institutional structures have a front yard setback.	Tree quality is fair to good, especially on the south side, and tree cover is 45 - 50%.	Sidewalks are of medium width on the north side and wider with a verge on the south side.	
Predominantly institutional due to the large frontage of the Kentucky School for the Blind and the American Printing House for the Blind, there are many larger residential structures as well. Structures tend to be two story buildings with front yard setbacks.	Tree quality is good, probably the best within the study area, with a tree cover of 75-80%.	Sidewalk character is medium to wide with ample verge width for tree planting.	
A mixture of commercial, residential, and institutional has the major uses concentrated at the intersection corners. Structures vary from modern one and two story commercial and apartment buildings to two-story Victorian residences and large church facilities.	Tree quality is fair to good, with a tree cover of 55-60%.	The sidewalk is narrowing with tree wells on the north side and the verge gradually disappearing on the south side.	
Predominantly commercial, this area has a large concentration of multi-family residential, and a significant volume of surface parking lots. Buildings are a mixture of one to four story structures mostly built at the sidewalk line, although a few front yard setbacks exist.	Tree quality is fair with a sharp decline approaching the railroad crossing, and tree cover is 25-30%.	Sidewalks are medium to narrow in width with tree wells.	

Zones	Urban Character	Tree Character*	Sidewalk Character
	Commercial uses predominate with the majority of the remaining residential structures converted to commercial. Buildings are one - two stories and located close to the sidewalk, with only a few having front yard setbacks.	Tree quality is poor, and tree cover is 15-20%.	Sidewalks are medium to narrow and broken by large curb cuts, with limited locations for tree wells
	The area is predominantly small commercial with one and two-story structures built at or near the sidewalk line.	Tree quality is poor, and tree cover is 25-30%.	The sidewalk is narrow with occasional tree wells.

*As based on aerial photography and general observation

Considerations for the Guiding Principles

While trees provide many benefits in urban areas, there are a number of factors in the built environment that must be addressed when considering tree placement. Selecting the right tree based on site conditions can solve many of these potential conflicts and decrease the overall maintenance costs required to correct them.

Mature tree size both above and below ground level must be considered when planting in areas where there are overhead utilities, buildings within close proximity to the planting area, or where other infrastructure such as sidewalks and curbs are located close to the trunk and roots of the tree. Conflicts with utility lines and the need for severe trimming can be minimized with proper tree placement. Potential damage to buildings or obstructions to views and services can be avoided through proper tree selection.

Considerations of safety and clear sight lines are especially important with street trees located along transportation routes. Making sure that vehicles, bicyclists, and pedestrians have unobstructed views by selecting trees that will not block sight lines with low foliage is crucial to the safety of all users. This includes maintaining open sight lines for street signage and lighting elements. Potential damage to sidewalks and other transportation infrastructure caused by root growth needs to be considered.

Concerns about property damage and maintenance issues like excessive leaf or fruit drop also influence the success of urban trees. When trees begin to impinge upon infrastructure, sidewalks, and sewer lines, requests for removal can impact the development of the urban canopy and influence which tree species are used in the future.

The built environment impacts the growing conditions for trees through increased levels of impervious surface and pollution. This results in reduced rainwater infiltration to rooting zones, increased storm water runoff, soil compaction, increased salt levels from winter deicing, higher temperatures, and increased incidence of accidental damage to tree trunks.

Clifton Local Preservation District Guidelines (adopted 2007) include Cultural Landscape guidelines and principles, which address vegetation, key views and vistas, including Frankfort Avenue. These guidelines and principles should be adhered to in implementation of this plan.

Guiding Principles

1. The sidewalk minimum dimension for planting of trees is 7'-0" from inside of sidewalk to curb. Curbs are typically an additional 6" in width.*

2. The tree well minimum width is 3'-0"as part of a continuous tree planting zone with pervious paving.*

3. The tree well minimum length is 6'-0".*

4. A clear passage of 4'-0" must be maintained in all sidewalk conditions. No branches to extend into the 4' passage below 2 Meters (6'-8").*

5. Where buildings sit on the front property line (0 setback), trees should be spaced to align with the building's side property lines (and, where a building houses multiple businesses, with each business' side property lines). This will improve site lines for commercial signage, minimize interference at entry points, and reduce the possible conflict with sidewalk café usage.*

6. At street and alley corners and intersections, trees should be located 20 ft to 35 ft from the intersection and a 4 ft clear vertical space from 2 ft to 6 ft from the ground shall be maintained for pedestrian and vehicle safety.

7. Trees should be spaced from a minimum of 25 ft to a maximum of 50 ft apart depending on the tree species, its canopy specifics, and location setting.

8. The verge (continuous grassy area between the sidewalk and curb) minimum width should be 4'-0", except for current conditions. The sidewalk must be wide enough to leave a 4' clear passage.

9. The verge length may be any length beyond 8'-0".

10. Where LGE/utility power lines limit tree height, understory-type trees must be planted.

11. Columnar or vase shaped tree canopy forms should be selected for areas where there are no power lines and buildings are built to the property line (at the sidewalk).

12. Tree species with larger canopy forms should be selected where there are no power lines, buildings are set back from the property line, and there is adequate front yard setback.

13. New street trees installed will have a minimum 3 inch caliper and be limbed up to 6'-8" at maturity.

14. Alternative green options like roof top gardens, planter boxes, urns, vertical gardening and arbors should be considered where the sidewalk is too narrow for street trees.

15. Root zone preparation is necessary for any new street tree plantings to assure healthy growth and longevity of tree life.

16. Prior to any removal, an arborist should evaluate and determine the condition of existing trees along the corridor to determine those that should be conserved.

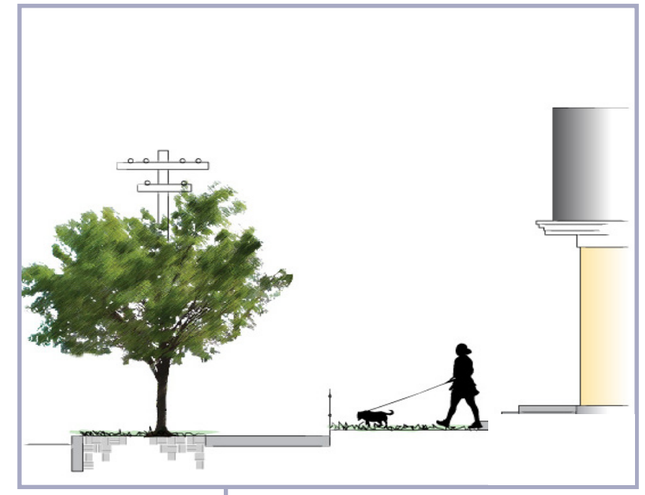
*Exceptions may be granted on a case by case basis by Louisville Metro Public Works with the addition of a permeable surface installed within the tree well.

*As per Louisville Metro Public Works regulations. Exceptions may be granted on a case by case basis by Louisville Metro Public Works with the additions of a permeable surface installed within the tree well.

Urban Design and Planting Conditions

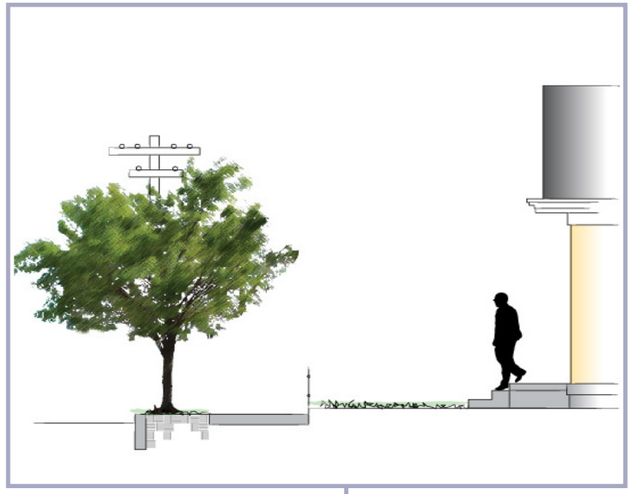
Street setback/ Existing verge

Street setback/ Existing verge/ Powerlines

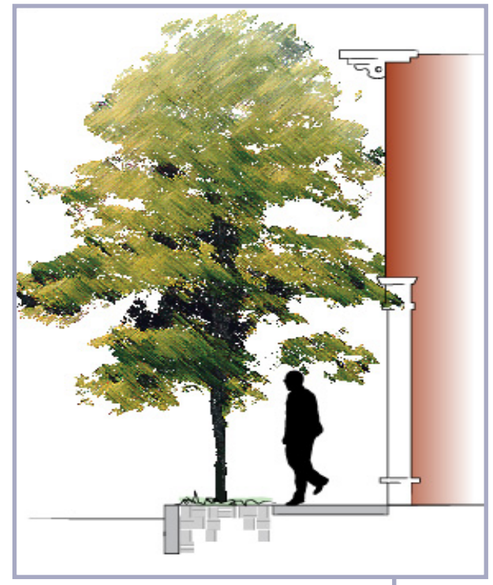


Mellwood
William St.
Pope St.
State St.
Kentucky School for the Blind
Haldeman Ave.
Coral Ave.
Clifton Baptist Church
North End Cafe
Third Lutheran Church
Mellwood
William St.
Pope St.
State St.
Stoll Ave.
Haldeman Ave.
Overhead Powerlines
0 50 100 200 400
Scale: 1” = 200’

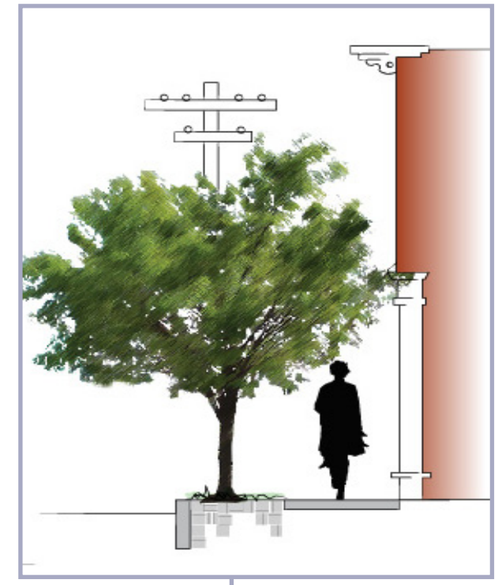
Street setback/ Tree well/ Powerlines

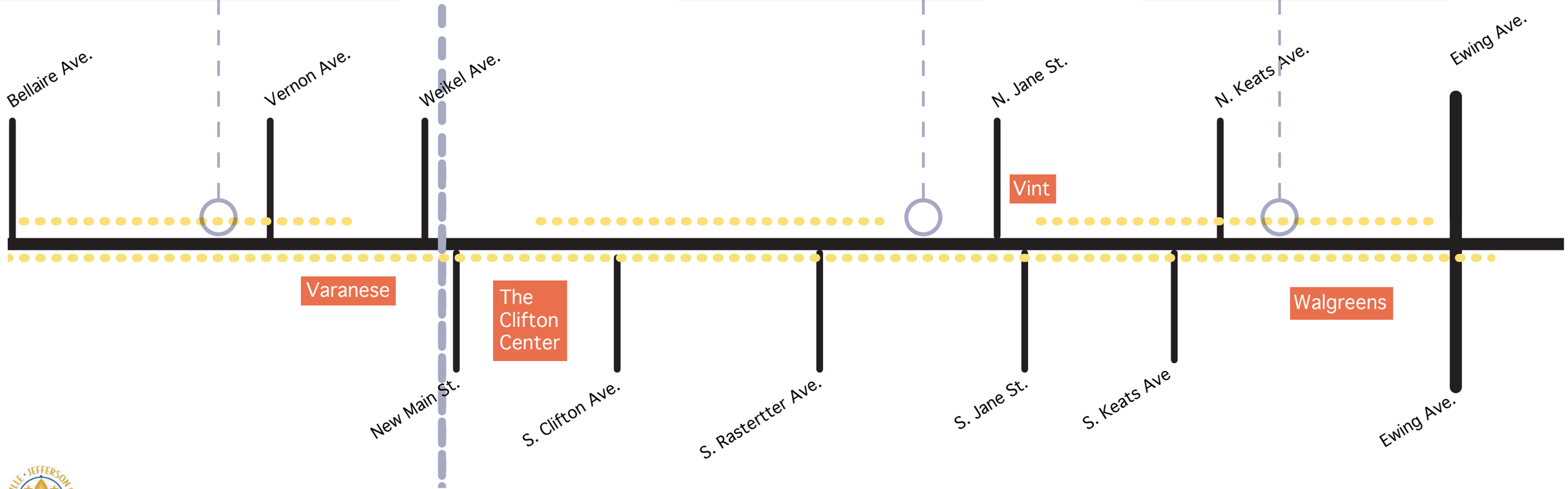


Zero lot-line/ Tree well

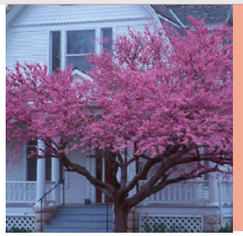


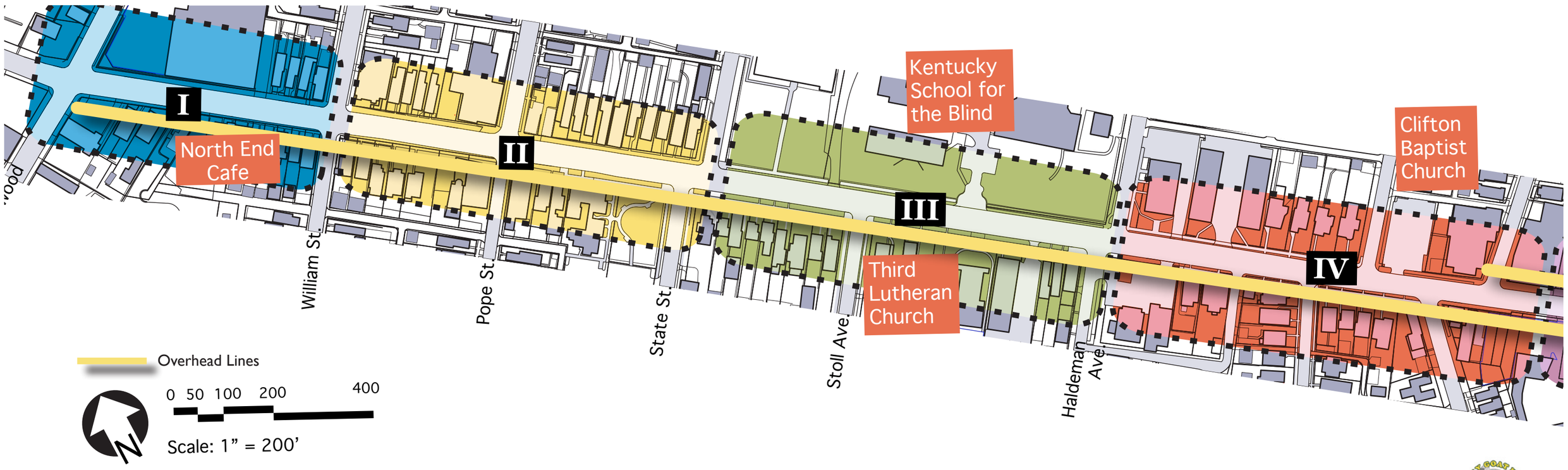
Zero lot-line/ Tree well/ Powerlines





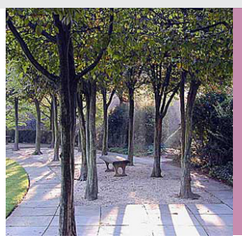
Master Plan

Zone	I	II	III	IV
North	 **Columnar English Oak** *Quercus robur 'fastigiata'*	 **Littleleaf Linden** *Tilia cordata*	 **London Planetree** *Platanus acerifolia*	 **Shingle Oak** *Quercus imbricaria michaux*
South	 **Cornelian Cherry Dogwood** *Cornus mas*	 **Fringetree** *Chionanthus restusus*	 **American Smoketree** *Cotinus obovatus*	 **Redbud** *Cercis canadensis*



V

Princeton Sentry Ginkgo
Ginkgo biloba 'Princeton Sentry'



American Hornbeam
Carpinus caroliniana

VI

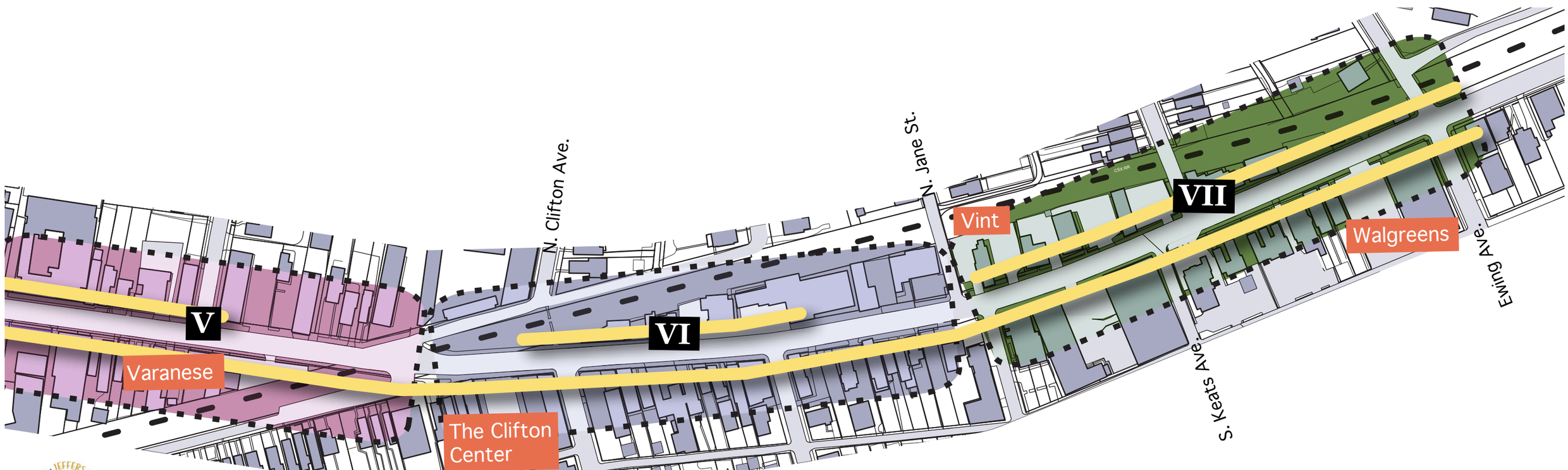
American Yellowwood
Cladrastis kentukea

Three-flower Maple
Acer triflorum

VII

Frans Fontaine Hornbeam
Carpinus betulus 'Frans Fontaine

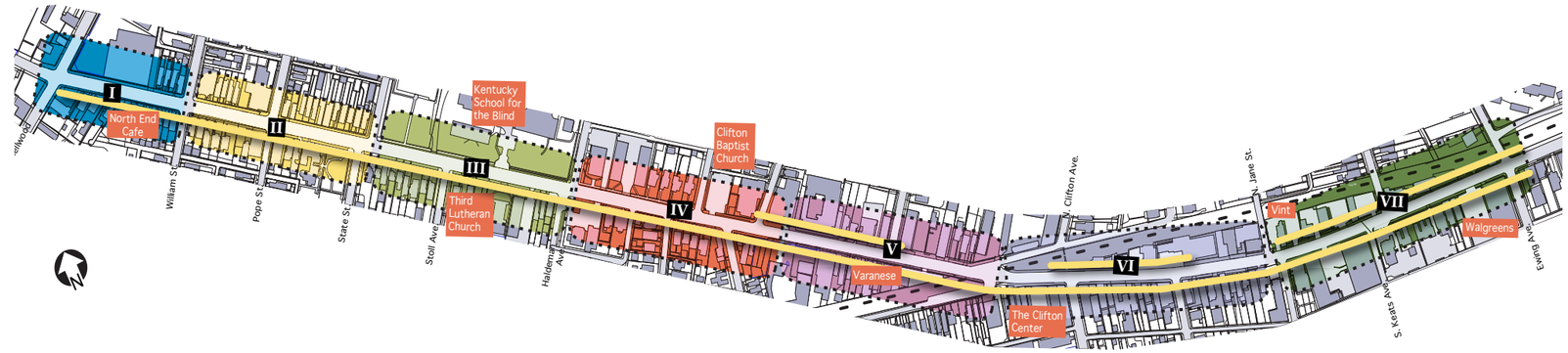
Trident Maple
Acer buergerianum



Tree Species

Species Assignment Chart by Zone

Within the zones defined at the right, two to three species will be assigned per zone to promote diversity and respond to natural and built environment influences, such as overhead power lines.



Diversity, Composition, and Design Implications

Diverse tree populations are better equipped to withstand environmental pressures so that urban canopy losses, as a percentage of total canopy cover, are minimized. The street tree inventory provides a means to measure and track tree species diversity when planning, designing, and selecting trees.

- Species diversity will be considered and coordinated based on site conditions and selecting the right tree for the location. Establishing a goal limiting any single species to 10%-20% of the total tree inventory reinforces diversity planning and minimizes potential large-scale losses of urban trees due to insect damage or disease.
- The maximum linear distance that a single species of trees is planted along a street corridor should be set at 1-3 blocks.
- The development and use of sequencing (planting multiple tree species on the same block) provides a model to increase diversity on a block by block basis. Pairing species for aesthetic and maintenance concerns will vary based on need and can be changed to tailor the planting scheme to meet conditions present on the site.
- Smaller tree species (approximately 30' at maturity) shall be planted under overhead utility lines to avoid potential hazards.
- Planning for ecological, functional, and structural diversity will increase the overall benefits the urban forest provides to residents and the urban environment.
- Trees need to be well proportioned to their site and should consider the architectural styles and sizes of adjacent buildings. Potential damage to buildings and the surrounding infrastructure can be minimized through proper tree selection and observations of the site conditions.

Clifton Street Tree Planting List - Frankfort Avenue
(no overhead lines)

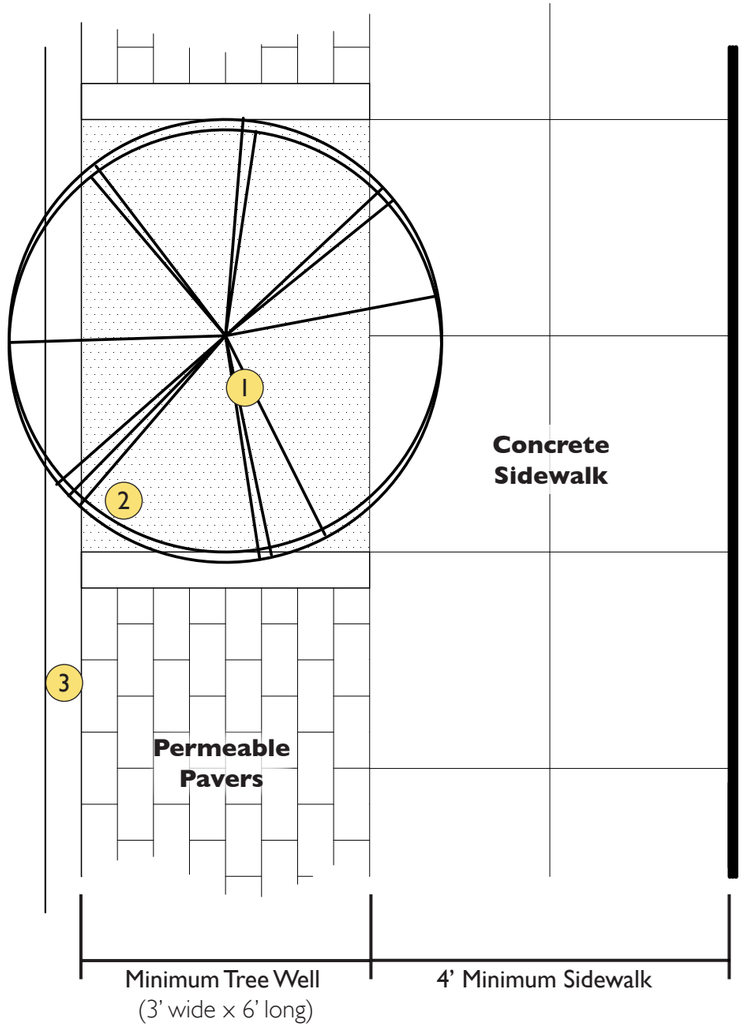
Tree Species		H	W	Form	Fall Color
Scientific Name	**Common Name**				
Quercus robur 'fastigata'	Columnar English Oak	50-60'	10-15'	Columnar	Copper
Tilia cordata	Littleleaf Linden	30-50'	25-40'	Pyramidal	Yellow
Platunus acerifolia	London Planetree	70-80'	60-75'	Pyramidal	Yellowish Brown
Quercus imbricaria michx.	Shingle Oak	50-60'	50-60'	Rounded	Yellow
Gingko biloba 'Princeton Sentry'	Princeton Sentry Gingko	40-70'	20-40'	Columnar	Yellow
Cladrastis kentukea	American Yellowwood	30'-40'	40'-55'	Rounded	Yellow
Carpinus betulus "Frans Fontaine"	Frans Fontaine Hornbeam	35-45'	20-30'	Columnar	Yellow

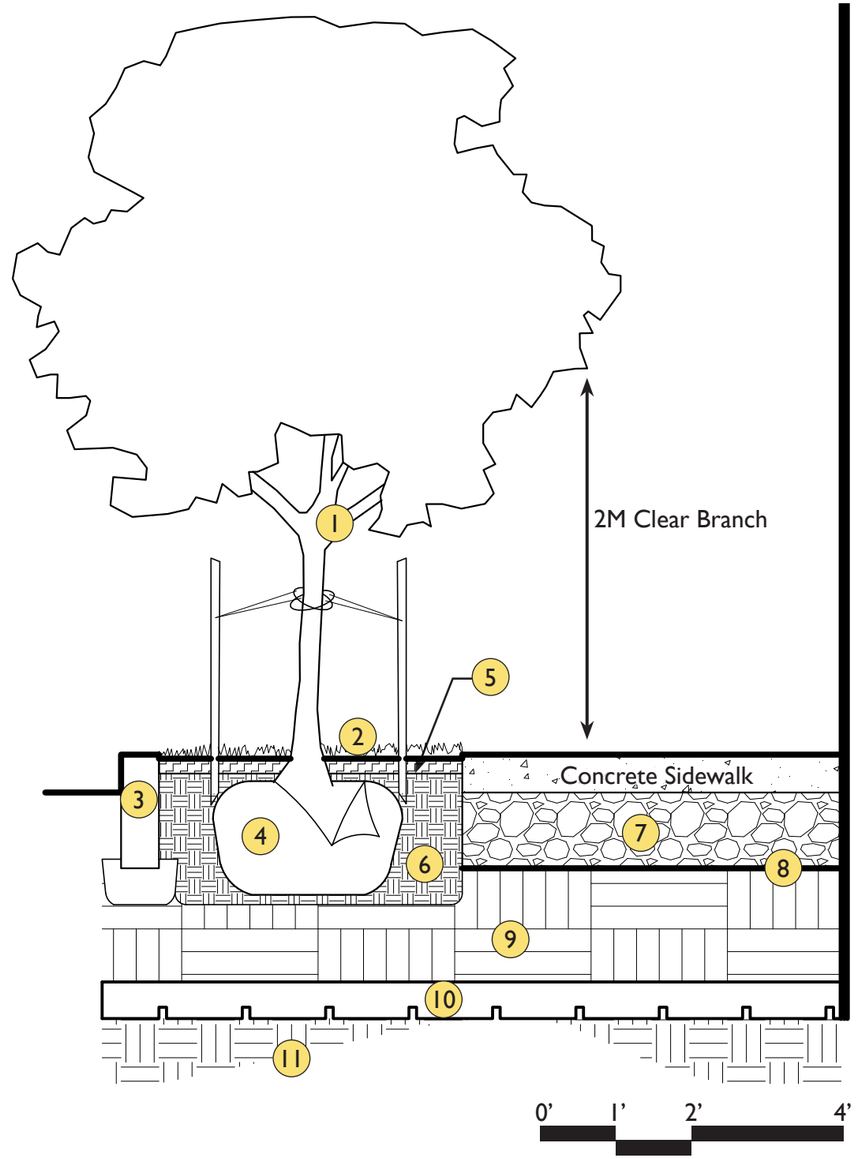
Clifton Street Tree Planting List - Frankfort Avenue
(overhead lines)

Tree Species		H	W	Form	Fall Color
Scientific Name	**Common Name**				
Cornus mas	Cornelian Cherry Dogwood	20-25'	15-20'	Rounded	Reddish-Purple
Chionanthus restusus	Fringtree	12-20'	12-20'	Rounded	Yellow
Continus obovatus	American Smoketree	20-30'	15-20'	Rounded	Yellow-Red
Cercis canadensisis	Redbud	20-30'	25-35'	Rounded	Not Showy
Carpinus caroliniana	American Hornbeam	20'-35'	20'-35'	Rounded	Yellow-Red
Acer triflorum	Threeflower Maple	20-30'	25-30'	Rounded	Orange-Red
Acer buergeranum	Trident Maple	25-35'	20-30'	Rounded	Yellow-Orange

* Produces acorns

Street Tree Planting Details Utilizing Structural Soils





Key -

1. Min. 3" caliper Staked Tree
2. Liriope or other Ground Cover
3. 6" Curb
4. Root Ball (root exposed)
5. 3" Mulch
6. Planting Soil Mix
7. 1' DGA #57
8. Filter Fabric
9. Structural Soil
10. Perforated Pipe
11. Filter Fabric
9. Structural Soil

Street Tree Planting Details

Innovative planting technologies including, but not limited to, engineered soils, increasing tree well size, and permeable paving are effective at increasing soil rooting volumes and reducing compaction while supporting pavements and active use of the streetscape in urban areas. These same technologies increase the infiltration of storm water reducing the volume sent into traditional storm water systems and improving water quality. Additional soil preparation by amending or physically loosening compacted soils can improve soil structure and increase root growth and overall tree success.

Tree Species and Characteristics

Trees planted in implementing the Plan shall use native species whenever appropriate. Street trees should be a minimum of 3 inches in caliper or larger at the time of planting and purchased from local growers for street tree application.

Tree management and maintenance guidelines and practices

An arborist should examine the trees to see if they have been damaged during transport to the site and if they need to be pruned.

Notes:

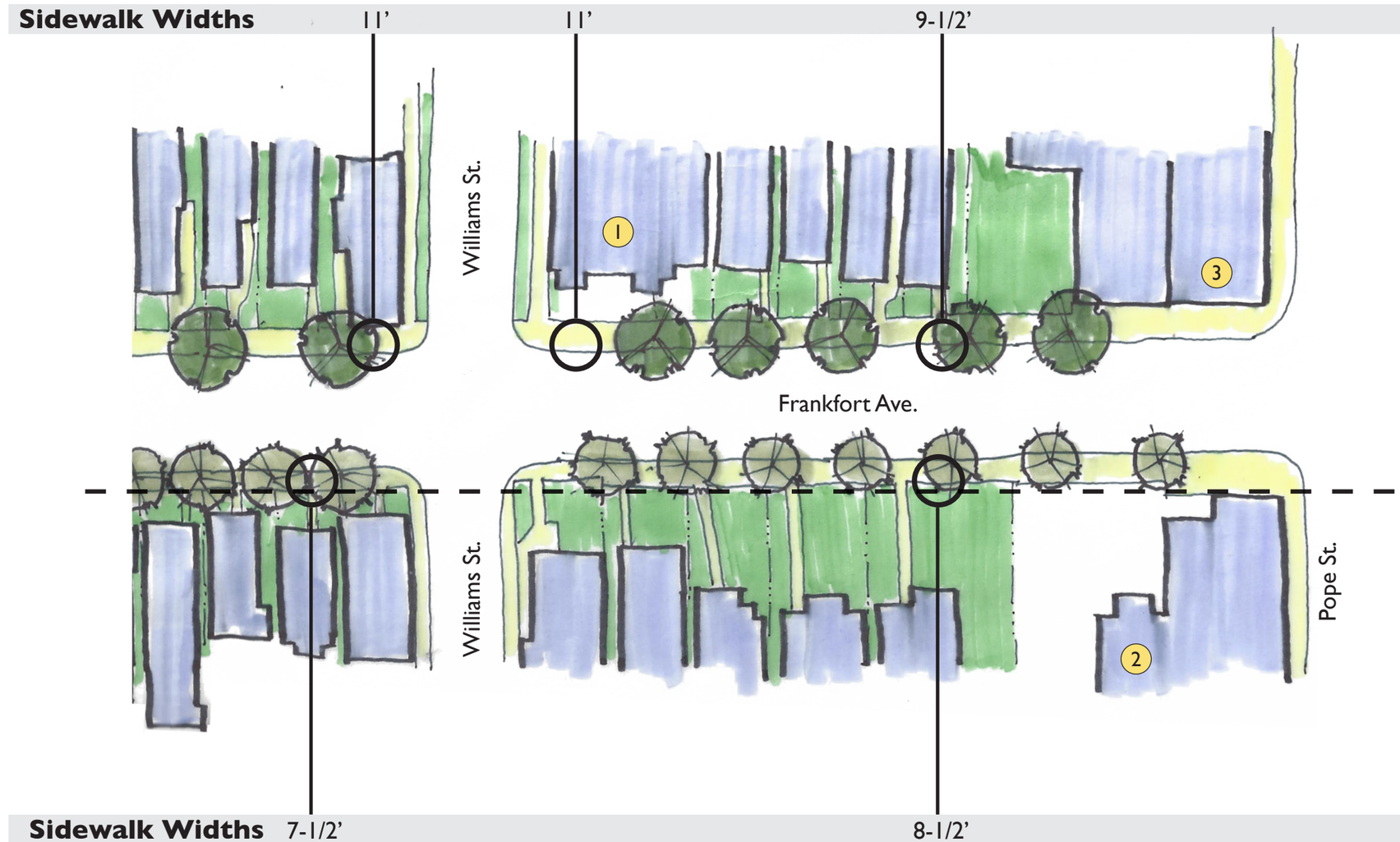
- Draft Details may be modified to meet specific requirements for Frankfort Avenue site specific conditions.
- No branches to extend into the 4' passage below 2 Meters (6'-8").

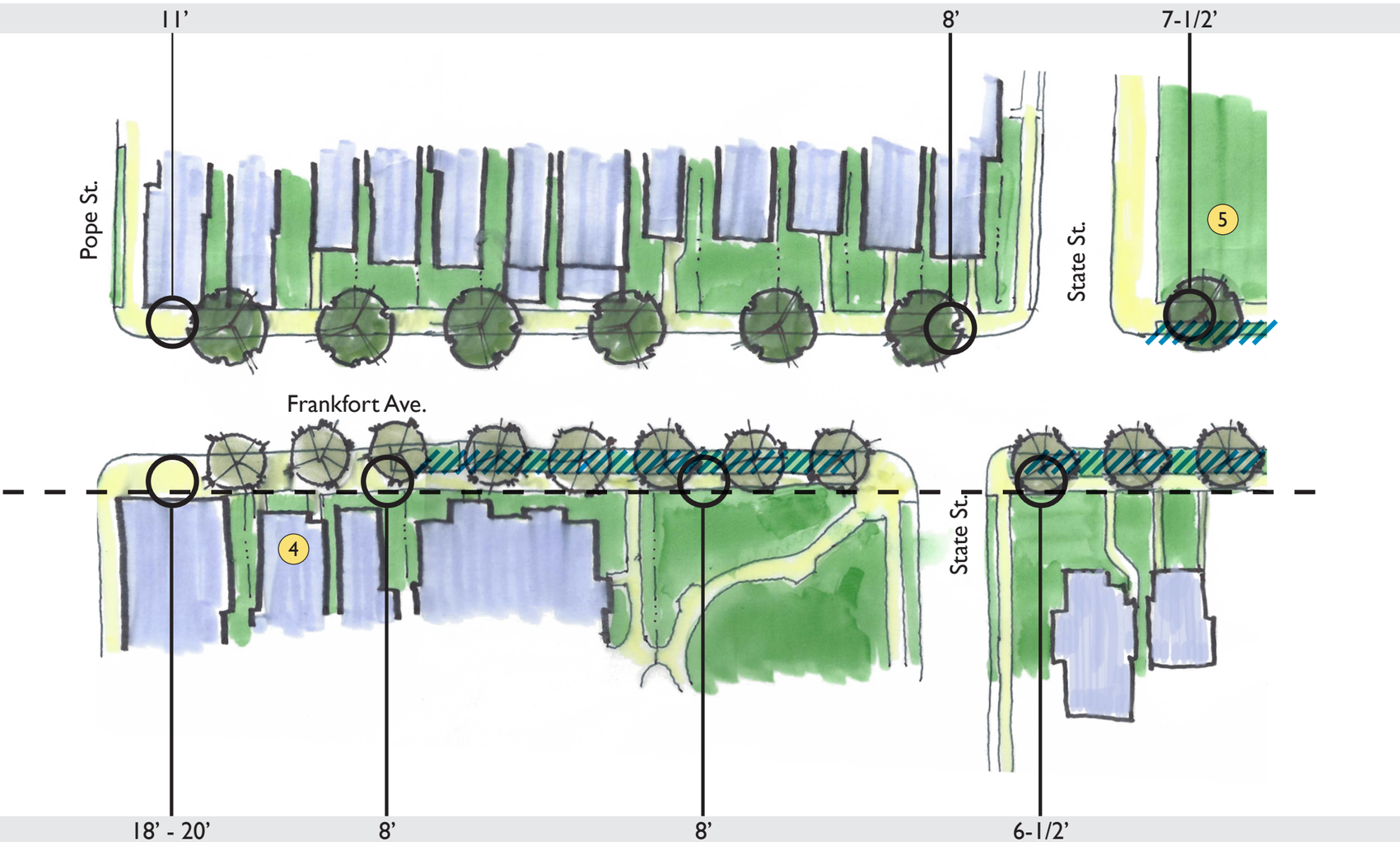
Model Block

This portion of Zone II was chosen as it demonstrates the diversity of tree planting and street character conditions along Frankfort Avenue. This exercise also allowed for the guiding principles to be tested and confirmed. Generally, tree placement falls on alignment with the property lines. Intersections where commercial or mixed use occurs are left open to allow for outdoor dining and open views to the building facades.

The south side of the street impinged upon by the overhead power lines would be planted from William St. to State St with either Little Leaf Lindens or Paperback Maples. The north side would be planted with Fringetree. Some of the best growing medium along the Frankfort Ave. Corridor exists west of State, where the verge is wide and continuous.

Overall sidewalk widths are called out at various points and are shown at the top and bottom of the drawing.





Key -

- Grass Verge
- Overhead Lines
- 1 James Lees Memorial Presbyterian Chruch
- 2 Maido
- 3 Silver Dollar
- 4 Sweet Surrender
- 5 Kentucky School for the Blind

0' 25' 50' 100'

Green Alternatives

In applying the Guiding Principles along the corridor, it is apparent that certain locations are too narrow to meet the minimum standards for tree planting. This is especially true on the eastern end of the corridor. Other conditions exist, for example at commercial sites or intersections, where the particular context may make tree planting difficult. Therefore we have suggested a series of alternatives for greening these areas in other ways. Some ideas can be accomplished on the public right-of-way, while others require the cooperation and support of private property and business owners. A list of the greening alternatives includes:

Encouraging Planting on Private Property particularly where sidewalks are narrow but buildings are setback. Planting trees or small gardens in these setbacks would continue a green corridor while keeping sidewalks clear and passable.

Alternatively, trees could be planted on the alleyways, streets and in small yard spaces behind Frankfort Avenue helping to create and enlarge Louisville's urban forest.

Green Walls - like trees - can be used to beautify streetscapes and soften impersonal urban environments. These can be created by covering entire walls with plant materials, training vines up the facade or hanging planters and filling drain pipes on the walls. Some companies have also put in green walls as a form of signage both beautifying the street and identifying their business.

Shade Structures such as awnings and umbrellas create cool oasis areas and enliven the sidewalks within a community while keeping narrow walkways passable.

Public Art can be used to create shade as well as build community-wide interest and neighborhood identity while again keeping narrow walkways passable.

Appendix A - Alternative Tree Species

Species Appropriate for Areas Without Overhead Lines:

Shumard Oak
Quercus shumardii
H: 60'-80'
W: 30'-50'
FORM: Rounded

Bald Cypress
Taxodium distichum
H: 50'-70'
W: 20'-30'
FORM: Pyramidal

Black Gum
Nyssa sylvatica
H: 30'-50'
W: 20'-30'
FORM: Pyramidal

Species Appropriate for Areas With Overhead Lines:

Seviceberry
Amelanchier arborea
H: 15'-25'
W: 15'-25'
FORM: Rounded

Carolina Silverbell
Halesia carolina
H: 30'-40'
W: 20'-35'
FORM: Rounded

Hedge Maple
Acer campestre
H: 30'-35'
W: 30'-35'
FORM: Rounded

Amur Maackia
Maackia amurensis
H: 20'-35'
W: 15'-25'
FORM: Rounded

Kousa Dogwood
Cornus Kousa
H: 20'-30'
W: 15'-20'
FORM: Vase

Frankfort Avenue Street Tree Master Plan

1st Stakeholder Meeting
Clifton Center
16 April 2012

Welcome and Introductions

Project Overview
- Mission Statement
- Timeline
- Product
- History and background – Trees planted in early 90's on regular spacing pattern along sidewalk, without regard for surrounding context.
- Powerpoint walking tour of the corridor

Blind/ visually impaired concerns
- Clear passage must be maintained
- Trees need to be tall enough that branches do not strike heads or faces, even in rainy conditions
- Adjacent owners are responsible for maintenance

Other concerns
- Before tree planting, corridor was barren, when trees went in, walking increased along the corridor
- Trees, new and old, should be limbed up to 7'- 0" because everyone is a pedestrian at some point, not just about people who don't have cars

Comments
- Avoid fruit and seed drop
- Tree wells should be planted or made safer
- Where outdoor dining is permitted, tables and chairs can block clear passage
- Curb cuts limit tree rhythm and consistent planting pattern
- Trees have been trimmed / damaged by businesses concerned about signage
- Education program in place for businesses as to how to properly trim trees
- Perhaps trees should be placed at party wall / property line locations at business locations
- Property owners may oppose trees in front of their location
- Emphasize how trees have added to overall quality of life
- Tree Canopy Committee wants to develop long term strategy for encouraging proper tree maintenance
- Honey Locust overused

Frankfort Avenue Street Tree Master Plan

2nd Stakeholder Meeting
Clifton Center
26 April 2012

Blind/ visually impaired concerns
- Stumbling over tree wells, hitting tree branches, correcting dogs
- Want to make sure trees are on the same area of the sidewalk all the way down the street
- Plants that encroach on the sidewalk from residential parcels - also a concern of bikers/ pedestrians
- Not just about beauty - about quality of life, community, environment - investment in the future of whole community

Other concerns
- Environmental benefits
- Owners' maintenance responsibility

Comments
- Very tight area at "El Mundo"
- Tree wells are tripping hazard -- how do we make them not a tripping hazard in future – tree grates are designed to be flush with sidewalk?
- MAINTENANCE -- So important to all issues
- Responsibility of the property owner - want examples of how this has worked in other cities
- Make sure all new trees have a canopy of 6'-7' when planted
- Cost questions - trees, watering, tree well enlargement, soil admin, install = $200
- Fill empty tree wells first OR decide on a target area to use as example / show piece
- Pilot area would be good way to get fund raising
- Shrubbery - considered a security risk, what was there was cut down by City
- Benches near/ under trees?
- Brought high line as interesting example
- Want big park like trees in the area - good spot at School for the Blind

Tree typology
- Power lines - defining characteristic
- Description of the tree matrix that is going to be developed
- 2 - 4 tree types per character area

Notes
- Sidewalk assessment plan - by community volunteers
- Would take 4 groups an hour or so to do the whole 1 mile corridor
- Use this area of a model for other areas of Louisville

Frankfort Avenue Street Tree Master Plan

3rd Stakeholder Meeting

Clifton center

7 May 2012

Comments

- Like the idea of putting trees at the lot line where the sidewalks and tree wells make the pedestrian corridor very small
- 4' passageway would be great - metro is beginning to require 5' for ADA.
- Talk with Works Department about reducing road salts so that the trees have a better chance
- Story and Frankfort - Linden Hill - would be great to have trees in that area.
- Plant trees or install tree wells near "Anson's"
- Native trees and trees with historical value should be considered
- Variety is important
- Repeat neighborhood business knows where it is going to shop, but tourist or convention visitors need businesses with easily seen signage.

Model block

- Might be easiest to pick an area and actually lay it out
- Might want to have two graphics - one with a block plan and one that is based only on rules (almost a transect)

Other concerns

- John wants a copy of the PowerPoint once it's complete (Thursday)

Tree typology

- Five street condition versions shown
- What about sycamore?

Notes

- Talk with City and LG&E arborists

Appendix C - Tree Inventory Grid

Tree Inventory Grid

Tree Species	Dia. "	Planting Location	Condition	Overhead Lines	Street Number	Empty TW	Paved TW
Malus spp	14	LBA	Moderate	No	2359		
Prunus spp	4	TW	Good	No	2347		
Japanese Tree Lilac	3	TW	Good	No	2345		
Malus spp	10	TW	Moderate	Yes	2341		
Betula nigra	12	LBA	Good	No	public pk lot		
Malus spp	12	TW	Moderate	No	public pk lot		
Malus spp	13	TW	Moderate	No	public pk lot		
Sweetgum	6	TW	Good	Yes	2255		
Sweetgum	6	TW	Good	Yes	2255		
					2255	1	
					2235		?6
Acer spp	2	LBA	Good	No	2221		
					2221		2
Norway Spruce	20	LBA	Good	Yes	bus stop		
Holly	10	LBA	Moderate	Yes	bus stop		
Holly	8	LBA	Moderate	Yes	bus stop		
Holly	11	LBA	Moderate	Yes	bus stop		

1

Appendix C - Tree Inventory Grid

Tree Inventory Grid

Tree Species	Dia. "	Planting Location	Condition	Overhead Lines	Street Number	Empty TW	Paved TW
Holly	11	LBA	Moderate	Yes	bus stop		
Holly	11	LBA	Moderate	Yes	bus stop		
Holly	3	LBA	Poor	Yes	bus stop		
Holly	10	LBA	Moderate	Yes	bus stop		
Malus spp	26	LBA	Moderate	Yes	bus stop		
Cercis canadensis	3	LBA	Good	Yes	bus stop		
Cercis canadensis	5	LBA	Good	Yes	bus stop		
Malus spp	13	TW	Moderate	No	2133		
Malus spp	12	TW	Moderate	No	2133		
Malus spp	13	TW	Poor	No	2123		
Malus spp	11	TW	Poor	Yes	2117		
Malus spp	15	TW	Moderate	Yes	2115		
Malus spp	13	TW	Poor	Yes	2115		
Japanese Tree Lilac	4	TW	Good	Yes	2115		
				Yes	2101	1	
Japanese Tree Lilac	4	TW	Moderate	Yes	2101		
Ulmus spp	94	LBA	Good	Yes	2039		

2

Tree Inventory Grid

Tree Species	Dia. "	Planting Location	Condition	Overhead Lines	Street Number	Empty TW	Paved TW
Malus spp	12	TW	Moderate	Yes	2031		
Malus spp	8	TW	Poor	Yes	2027		
Malus spp	14	TW	Poor	Yes	2023		
				Yes	2021	1	
				Yes	2019	1	
Lacebark Elm	7	TW	Good	Yes	2017		
Lacebark Elm	9	TW	Good	Yes	2015		
Lacebark Elm	10	TW	Good	Yes	2013		
Malus spp	14	TW	Poor	Yes	2007		
				Yes	2007	1	
Japanese Tree Lilac	4	TW	Moderate	Yes	2005		
Malus spp	10	TW	Poor	Yes	2003		
Malus spp	10	TW	Poor	Yes	1947		
Malus spp	7	TW	Poor	Yes	1947		
Malus spp	16	TW	Poor	Yes	1947		
Malus spp	15	Verge	Poor	Yes	1947		
Malus spp	14	Verge	Poor	Yes	1947		

3

Tree Inventory Grid

Tree Species	Dia. "	Planting Location	Condition	Overhead Lines	Street Number	Empty TW	Paved TW
Ornamental Pear	23	Verge	Moderate	No	1867		
Ornamental Pear	25	Verge	Moderate	Yes	1867		
Ornamental Pear	27	Verge	Moderate	No	1867		
Ornamental Pear	25	Verge	Poor	No	1867		
Ornamental Pear	22	Verge	Poor	No	1867		
Ornamental Pear	22	Verge	Poor	No	1867		
Ornamental Pear	22	Verge	Poor	No	1867		
Ornamental Pear	28	Verge	Moderate	No	1839		
Ornamental Pear	25	Verge	Moderate	No	1839		
Ornamental Pear	34	Verge	Moderate	No	1839		
					1839	2	
Ornamental Pear	27	TW	Moderate	Yes	1827		
Ornamental Pear	21	TW	Poor	No	1827		
Ornamental Pear	21	TW	Poor	Yes	1821		
Ornamental Pear	23	TW	Moderate	Yes	1817		
				Yes	1815	1	
				Yes	1813	1	

5

Tree Inventory Grid

Tree Species	Dia. "	Planting Location	Condition	Overhead Lines	Street Number	Empty TW	Paved TW
Ornamental Pear	25	TW	Moderate	No	1811		
Ornamental Pear	15	TW	Poor	No	1809		
Ornamental Pear	14	TW	Poor	Yes	1807		
Ornamental Pear	13	TW	Poor	Yes	1805		
Ornamental Pear	10	TW	Poor	Yes	1757		
					1757	1	
Ornamental Pear	19	TW	Poor	Yes	1757		
Ornamental Pear	13	TW	Poor	Yes	1749		
Ornamental Pear	27	TW	Poor	Yes	1747		
Ornamental Pear	21	TW	Moderate	Yes	1741		
Ornamental Pear	25	TW	Moderate	No	1741		
Lacebark Elm	20	TW	Good	No	1737		
Lacebark Elm	15	TW	Good	Yes	1737		
Lacebark Elm	20	TW	Poor	No	1733		
Lacebark Elm	20	TW	Poor	No	1731		
				Yes	Blue Wareh	5	
Lacebark Elm	10	TW	Poor	No	Blue Warehouse		

6

Appendix C - Tree Inventory Grid

Tree Inventory Grid

Tree Species	Dia. "	Planting Location	Condition	Overhead Lines	Street Number	Empty TW	Paved TW
Lacebark Elm	6	TW	Poor	No	Blue Warehouse		
Lacebark Elm	10	TW	Poor	No	Blue Warehouse		
Lacebark Elm	10	TW	Poor	No	Blue Warehouse		
Lacebark Elm	17	TW	Moderate	Yes	Blue Warehouse		
					1760	1	
Malus spp	14	TW	Poor	Yes	1758		
Malus spp	10	TW	Poor	Yes	1752		
Malus spp	7	TW	Poor	Yes	1752		
Malus spp	10	TW	Poor	Yes	1752		
Malus spp	6	TW	Poor	Yes	1748		
Malus spp	12	TW	Poor	Yes	1748		
Malus spp	14	TW	Poor	Yes	1742		
Ornamental Plum	30	TW	Poor	Yes	1804		
					1804	1	
Ornamental Plum	30	TW	Poor	Yes	1806		
Ornamental Plum	30	Verge	Poor	Yes	1810		
Ornamental Plum	30	Verge	Poor	Yes	105 State		

7

Tree Inventory Grid

Tree Species	Dia. "	Planting Location	Condition	Overhead Lines	Street Number	Empty TW	Paved TW
Ornamental Plum	25	Verge	Poor	Yes	105 State		
Ornamental Plum	23	Verge	Poor	Yes	105 State		
Ornamental Plum	25	Verge	Poor	Yes	105 State		
Malus spp	17	Verge	Poor	Yes	1828		
Malus spp	10	Verge	Poor	Yes	1828		
Malus spp	15	Verge	Poor	Yes	1830		
Malus spp	16	Verge	Moderate	Yes	1832		
Malus spp	16	Verge	Poor	Yes	1838		
Malus spp	16	Verge	Poor	Yes	1840		
Malus spp	16	Verge	Poor	Yes	1844		
Malus spp	14	Verge	Poor	Yes	1846		
Malus spp	13	Verge	Poor	Yes	1852		
Malus spp	11	Verge	Poor	Yes	1854		
Malus spp	11	Verge	Poor	Yes	1856		
Malus spp	14	Verge	Poor	Yes	1860		
Malus spp	11	Verge	Moderate	Yes	1864		
Malus spp	16	Verge	Poor	Yes	1864		

8

Tree Inventory Grid

Tree Species	Dia. "	Planting Location	Condition	Overhead Lines	Street Number	Empty TW	Paved TW
Malus spp	16	Verge	Poor	Yes	1874		
Malus spp	15	Verge	Poor	Yes	1870		
Malus spp	14	Verge	Poor	Yes	1878		
Malus spp	5	Verge	Moderate	Yes	1880		
				Yes/No	1904	2	2
Amelanchier spp	4	TW	Poor	Yes/No	1904		
Amelanchier spp	4	TW	Poor	Yes/No	1904		
Malus spp	14	Verge	Moderate	Yes	1912		
Malus spp	15	Verge	Poor	Yes	1914		
Malus spp	8	Verge	Poor	Yes	134 Waverly Ct		
Malus spp	9	Verge	Poor	Yes	134 Waverly Ct		
Malus spp	13	Verge	Poor	Yes	1938		
Malus spp	8	Moderate	Moderate	Yes	1938		
Malus spp	13	TW	Poor	Yes	2000		
					2004		1
Malus spp	16	TW	Poor	Yes	2030		
					2030	3	

9

Tree Inventory Grid

Tree Species	Dia. "	Planting Location	Condition	Overhead Lines	Street Number	Empty TW	Paved TW
Malus spp	13	TW	Poor	Yes	2030		
Malus spp	15	TW	Poor	Yes	2030		
Malus spp	14	TW	Poor	Yes	2030		
Malus spp	16	TW	Poor	Yes	2030		
Malus spp	16	TW	Poor	Yes	2030		
Malus spp	16	TW	Poor	Yes	2030		
Malus spp	10	TW	Moderate	Yes	2034		
Malus spp	17	TW	Moderate	Yes	2038		
Malus spp	16	TW	Moderate	Yes	2040		
					2040	1	
Malus spp	13	TW	Moderate	Yes	2042		
					2044	1	
					2050	1	
Japanese Tree Lilac	6	TW	Good	Yes	2052		
Japanese Tree Lilac	4	TW	Good	Yes	2054		
Japanese Tree Lilac	3	TW	Good	Yes	2106		
Japanese Tree Lilac	3	TW	Good	Yes	2106		

10

Appendix C - Tree Inventory Grid

Tree Inventory Grid

Tree Species	Dia. "	Planting Location	Condition	Overhead Lines	Street Number	Empty TW	Paved TW
Japanese Tree Lilac	3	TW	Good	Yes	2106		
Malus spp	8	TW	Moderate	Yes	2106		
Malus spp	6	TW	Poor	Yes	2106		
Malus spp	12	TW	Poor	Yes	2106		
Malus spp	8	LBA	Moderate	No	2106		
Malus spp	12	LBA	Moderate	No	2106		
					2106	1	
Malus spp	9	LBA	Moderate	No	2132 New Main		
Malus spp	12	LBA	Moderate	No	2132 New Main		
Malus spp	14	LBA	Moderate	Yes	2138		
Malus spp	9	LBA	Moderate	Yes	2140		
					2134	1	
Malus spp	11	TW	Poor	Yes	2117 Payne		
					2117 Payne		?3
Malus spp	8	TW	Poor	Yes	2117 Payne		
Malus spp	9	TW	Poor	Yes	2117 Payne		
Malus spp	8	TW	Poor	Yes	2144		

11

Tree Inventory Grid

Tree Species	Dia. "	Planting Location	Condition	Overhead Lines	Street Number	Empty TW	Paved TW
Malus spp	15	TW	Poor	Yes	2206		
					2208	1	
					2210	1	
					2214	1	
					2222	1	
					2224	1	
					2230	2	
Malus spp	16	TW	Poor	Yes	2232		
					2232	1	
Lacebark Elm	3	LBA	Good	No	2232		
					2240	1	
					2244	1	
					2246	1	
					2248	1	
Malus spp	6	TW	Moderate	Yes	2250		
Malus spp	13	TW	Poor	Yes	2258		
Acer triflorum	4	TW	Good	Yes	2300		

12

Tree Inventory Grid

Tree Species	Dia. "	Planting Location	Condition	Overhead Lines	Street Number	Empty TW	Paved TW
Acer triflorum	4	TW	Good	Yes	2300		
Acer triflorum	4	TW	Good	Yes	2300		
Acer triflorum	3	TW	Good	Yes	2306		
Acer triflorum	4	TW	Good	Yes	2306		
Acer triflorum	5	TW	Good	Yes	2320		
Acer triflorum	3	TW	Good	Yes	2320		
Acer triflorum	4	TW	Good	Yes	2320		
Acer triflorum	6	TW	Good	Yes	2320		
Acer triflorum	3	TW	Good	Yes	2320		
		LBA			2330	1	
Malus spp	12	TW	Poor	Yes	2330		
Malus spp	8	TW	Poor	Yes	Dan Burch Assoc		
Malus spp	14	TW	Poor	Yes	2338		
Malus spp	8	TW	Poor	Yes	2338		
Malus spp	6	TW	Poor	Yes	2342		
					2346	1	
Malus spp	13	TW	Poor	Yes	Los Aztecas		

13

Tree Inventory Grid

Tree Species	Dia. "	Planting Location	Condition	Overhead Lines	Street Number	Empty TW	Paved TW
Malus spp	15	TW	Poor	Yes	Los Aztecas		
Malus spp	15	TW	Poor	Yes	2352		
Schubert Cherry	4	TW	Good	Yes	2354		
Malus spp	8	TW	Poor	Yes	2368		
					2368	1	
					2368		1

14

Practice Guide #30

May 2012

The Public Urban Forest: Planning and Managing a City's Tree Resource

by

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Table of Contents

Tables

Introduction

Approximately 84 percent of the population of the United States lives in urban areas (United Nations, 2009; United Nations, 2011). This trend is expected to continue with an estimated 90 percent of the population in the United States residing in urban areas by 2050 (United Nations, 2009; United Nations, 2011). Urbanization can have negative effects on both local and global environments. Urban areas cover 2 percent of the globe, but produce 78 percent of all greenhouse gases (Grimm et al., 2000). Trees are an important part of the green infrastructure of cities that can help ameliorate their negative ecological and social aspects.

Urban trees provide valuable services, known as *ecosystem services*, to the residents of cities. By shading buildings in the summer and serving as windbreaks in the winter, properly placed trees can reduce cooling and heating costs (Akbari et al., 1986; Heisler, 1990; Akbari, 2002). Trees improve air and water quality by filtering and trapping air pollutants (Lovett et al., 2000; Fowler, 2002). They also remove carbon dioxide (CO_2) from the air, which is used by the tree to create its food as well as its woody structure (Nowak and Crane, 2002). Thus, trees serve as an important carbon sink. By intercepting rainfall and taking up water that infiltrates soil, trees decrease runoff into streams as well as into Combined Sewer Overflow (CSO) pipes (Sanders, 1986; Xiao et al., 1998; Bolund and Hunhammar, 1999; Nowak and Dwyer, 2007). This valuable service decreases flooding and sewage overflow in cities that have CSOs. Trees also stabilize stream banks and help prevent erosion. In coastal regions, intact coastal forests and mangrove swamps lessen storm surge and help protect coastal cities from catastrophic damage (Gedan et al., 2011; Loder et al., 2009; Lopez, 2009).

Trees can also be used for *phytoremediation*, a technique that involves the use of plants to remove pollutants from contaminated soil (Raskin, Smith, and Salt, 1997). One of the primary applications of phytoremediation is for brownfields mitigation (Eberts et al., 2005; Cook et al., 2010; El-Gendy et al., 2010). Brownfields are defined by the U.S. Environmental Protection Agency (EPA) as "real property, the expansion, redevelopment, or reuse of which may be complicated by the presence or potential presence of a hazardous substance, pollutant, or contaminant" (U.S. Environmental Protection Agency [EPA], 2011). Common tree species used for brownfields remediation are poplar (*Populus* sp.) and willow (*Salix* sp.) (Cook et al., 2010). Trees also provide social benefits, such as providing locations for recreation (Jim and Chen, 2006), enhancing real estate values (Morales, 1980; Tyrväinen and Miettinen, 2000), providing a sense of place and aesthetic beauty (Smardon, 1988; Tyrväinen et al., 2003), potentially improving health outcomes in hospitals (Ulrich, 1984), and potentially reducing crime (Kuo and Sullivan).

Trees do have risks associated with them, such as trees or branches falling during storms, that can threaten peoples' health and safety as well as their property (Lopes et al., 2007). These risks can be minimized by proper tree selection, planting, and maintenance. Urban forest maintenance activities like pruning, cabling, and bracing are all examples of tree risk management activities that can reduce the possibility of harm or damage.

The urban forest is composed of trees in both the private and public domains. Trees in residential, business, and institutional areas are examples of privately-maintained trees. Public trees are those found in public rights-of-way and parks or any other publically-held lands. Public

managers can maximize the benefits provided by trees while minimizing costs by preserving or restoring native woodlands and managing trees in parks and on streets. In addition, land development and zoning policies and ordinances can provide and protect the preservation of forests and trees and ensure the general public's access to them as well.

This practice guide focuses on urban forest management from a municipal perspective and is meant to provide decision-makers, such as city arborists, public works officials, public policy makers, city managers, local non-profits, and park managers, with information to maximize the benefits and minimize the costs of improving and managing their public urban forest. The guide is divided into sections that give a broad overview of planning, planting, maintaining, and managing the urban forest resource. Case studies that illustrate some of these concepts in action are included, as well as an extensive list of tree-related resources.

Incorporating Trees into a Community's Planning Goals

Tree Planning

An important first step in a public urban tree program is to perform an inventory of the community's tree population to enumerate the city's current resources as well as to determine areas of need (Schwab, 2009). Tree inventories provide a range of information that contributes to the planning and management of the urban forest. Types of inventories vary depending on the nature of information urban forest managers want to collect. What follows is an overview of two types of inventories: 1) on-the-ground inventories and 2) large-scale inventories that use aerial imagery and Geographic Information Systems (GIS) analysis.

On-the-ground inventories are used for managing the tree resource in specific areas, such as parks or along streets. The collected data can then be used to determine individual tree maintenance needs, calculate ecosystem services, coordinate emergency management, and are vital in risk management (P. Barber, personal communication, *March 9,* 2012). Overhead, large-scale inventories can help with long-range planning including zoning regulations and decisions (P. Barber, personal communication, *March 9,* 2012). This type of information is also useful in estimating canopy coverage, a common measurement of the amount of land area covered by tree foliage, and establishing canopy-cover goals for both public and private trees.

Tree inventories are often done by certified arborists or experienced inventory arborists (American Public Works Association, n/d). If the city does not employ an arborist, one can be hired as a private contractor. Trained volunteers can also be used to perform tree inventories as long as the data are accurately collected (Bernhardt and Swiecki, 2001). Volunteers usually collect simple data on trees whereas arborists and urban foresters perform various levels of tree assessment and collect more complex data. Typical data collected on the target trees include (American Public Works Association, n/d; Bernhardt and Swiecki, 2001):

- Location
- Species
- Size (diameter-at-breast height, height, crown spread)
- Condition
- Age
- Maintenance need and priority

- Proximity to utility lines
- Traffic signs and signals
- Sidewalk and other hardscape damage
- Insect and disease problems
- Amount of canopy cover at the location
- Potential tree-planting sites

Ideally, a complete inventory of all public domain trees would be performed, but this may not be possible due to time and/or financial constraints. In this case, the inventory should focus on a specific subset of the public urban forest, such as street trees, and measure other components of the urban public forest as time and money allow. A statistical sample, for example, 3-6 percent of street trees or of public land area, could be used to estimate the urban forest resource (American Public Works Association, n/d). Bernhardt and Swiecki (2001) provide details on how to choose a representative subsample of the tree population for a partial inventory.

Tree inventories can be obtained by collecting data in the field via foot surveys or visual/windshield surveys. Foot surveys are used to collect detailed tree measurements as well as tree condition and management data regarding age and maintenance need. Visual or windshield surveys can be a way to evaluate trees by collecting limited data, such as tree species, size, location, and condition. The data can be written on paper inventory sheets (see Appendix A) or entered into handheld computers using commercial or public domain software inventory programs. Global positioning system (GPS) devices can be used to record tree location. (Examples of tree inventory and management software can be found at http://na.fs.fed.us/urban/inforesources/inventory/tree_inventory_mgmt_software_list.pdf.)

Geographic Information Systems (GIS) software and satellite data can be used to determine the extent of a community's green infrastructure and to estimate the benefits provided by all of its trees, not just those under public control (Schwab, 2009). Using GIS, planners can create a digital representation of tree cover in a community (Schwab, 2009). This green infrastructure layer can then be used to determine community-wide tree canopy cover as well as provide input into land use planning. Two-types of GIS layers can be created from different tree data sources: one is point-data, which uses individual tree location coordinates collected via GPS during the tree inventory, and the other is a digital green data layer consisting of land cover data obtained from satellites or aerial photography, which can then be used to determine the amount of tree canopy cover in a community (Schwab, 2009). Quantification of tree canopy coverage can provide information on where tree planting efforts need to be focused and over time can be used to map changes in tree coverage.

Tree canopy coverage information can be used to set urban forest canopy goals, which is another important step in developing a public urban tree program. As stated earlier, a healthy tree community provides urban areas with vital services such as improved air and water quality, decreased energy usage, and pollutant removal. American Forests has general guidelines for tree canopy coverage that are based on climate and planting zones (Table 1). Local climate, land use, geography, and politics would need to be taken into account to modify these goals for a specific community (Schwab, 2009).

Table 1

American Forests' Tree Canopy Goals

For Metropolitan Areas East of the Mississippi and in the Pacific Northwest	
Average total tree cover – all zones	40%
Suburban residential zones	50%
Urban residential zones	25%
Central business districts	15%
For Metropolitan Areas in the Southwest and Dry West	
Average total tree cover – all zones	25%
Suburban residential zones	35%
Urban residential zones	18%
Central business districts	9%

Another part of the tree planning process includes quantifying the services that public trees provide to city residents. The USDA Forest Service has created a free suite of software tools that can be used to inventory the urban public tree resource as well as calculate the various benefits provided by these trees (http://www.itreetools.org/index.php).

Two of the programs calculate urban forest ecosystem benefits. The first program, i-Eco (formerly called the Urban Forest Effects or *UFORE* model), uses on-the-ground inventory methods to collect data on individual trees as well as plot attributes that are used to quantify the structure of the urban forest and the benefits it provides. The collected data are submitted to the server on the i-Tree website (http://www.itreetools.org/index.php) and the analysis is performed, free-of-charge, in one to two hours (R. Hoehn, personal communication, *January 17,* 2012). The newest release of i-Tree Eco (version 4.0) also has an automatic report generator. The second program, i-Streets, uses street tree inventory data to calculate the environmental and aesthetic benefits provided by street trees. The data are analyzed using "Streets" (formerly called STRATUM), which is downloaded to the user's computer. Data for both of these models can be collected using small, complete inventories or large-scale, partial inventories that use a simple or stratified random sampling protocol.

There are four other i-Tree tools available: the i-Tree Hydro, the i-Tree Vue, the i-Tree Design, and the i-Tree Canopy. The i-Tree Hydro (beta) allows users to analyze vegetation at the watershed scale as well as the effects of impervious cover on hydrology. The i-Tree Vue provides access to freely available National Land Cover Data maps that can be used to evaluate a community's land cover, including the amount of tree canopy coverage, to calculate some of the ecosystem services provided by the urban forest. The software can also be used to model different tree planting ideas and estimate how different scenarios will affect ecosystem benefits. The i-Tree Design (beta) is a simple tool that can be used to estimate the benefits provided by an individual tree. The final tool, i-Tree Canopy allows the user to estimate land-cover types, such as tree cover, using the aerial images available in Google Maps.

Tree Planting

When choosing tree species to plant, many factors should be considered, including species diversity. To avoid disasters, such as the massive loss of American Elm trees to Dutch Elm Disease in the 1950s and 1960s, it is important to use a variety of tree species to prevent catastrophic loss of urban tree canopy due to disease or insect pests. Species diversity should be considered not only at the community-wide level, but also for individual planting projects, such as trees along a street or in a neighborhood. Miller and Miller (1991) recommended that any one species should not exceed 10 percent of the total street tree population. However, Richards (1993) made the argument that rigidly sticking to this guideline could lead to species that are not adapted to harsh urban conditions being planted as street trees, where they will ultimately fail.

Instead of aiming for a strict species diversity guideline, a city could determine a palette of tree species that are adapted to the challenging growing conditions found at the sides of roads and streets and make a commitment to planting a variety of species from this list. Simons and Johnson (2008) suggest that if overuse of a particular species is an issue, capping a species at 20 percent and genus at 35 percent of the total tree population is a reasonable target. Other public forest areas, such as parks, could be used to increase overall city-wide public tree species diversity, since growing conditions in park settings are usually less challenging than along roadways. A preference for native species should also be considered in making a tree palette, but as stated above they must be suitable for the growing conditions in the area in which they will be planted.

Tree siting is also an important factor when planting new trees. An improperly sited tree may not only fail to thrive, but may also become a public hazard. Several site characteristics need to be considered in making the decision about whether to plant a tree in a given location as well as which species to plant at the site. Schwab (2009) suggests that local water availability, soil conditions, terrain, native-versus-non-native species, and the surrounding built infrastructure all need to be taken into consideration in planning tree plantings. The location of above- and below-ground utilities as well as the size of the planting space needs to be evaluated prior to planting. For example, small tree species (25 foot height or less) are the best choice to plant underneath or near power lines in order to prevent branches from interfering with power transmission (Fazio, 2003). Collaboration between local government officials and utility companies is essential to properly maintain trees near power lines. Some communities have instituted programs to reduce tree-power line conflicts. Columbia, Missouri has a Trade-a-Tree program that allows customers with qualifying trees to have them removed and replaced for free (http://www.gocolumbiamo.com/WaterandLight/Home/t-trade.php). The Bowling Green, Kentucky Tree Advisory Board has developed a tag that can be attached to tree species that are "utility friendly" (http://www.bgky.org/tree/utility.php).

Once a tree and planting location are selected, proper planting is imperative to give it the best chance of survival (Appendix B). The best time of year to plant is in the fall or spring, but specific planting dates depend on local climate. The International Society of Arboriculture provides detailed step-by-step instructions on tree planting (http://www.treesaregood.com/treecare/tree_planting.aspx).

Appendix D - The Public Urban Forest:

The American National Standards Institute (ANSI) has a voluntary set of tree care guidelines that were developed in conjunction with the Tree Care Industry Association that include instructions on how to transplant trees. An overview of the steps can be found at: http://www.treecareindustry.org/standards/part6/transplanting.htm. The page also contains a link to purchase the complete set of standards for tree care maintenance operations.

The Arbor Day Foundation has a series of videos that give instructions on how to plant bare root trees, balled and burlapped trees, and containerized trees (http://www.arborday.org/trees/tips/treePlanting.cfm).

Providing trees with optimal soil structure is important in increasing their chances of thriving in the potentially challenging urban environment. This is especially important for street trees. Tree pits need to be as large as possible to accommodate a tree's root growth and keep the roots from creating structural damage to sidewalks. According to the New York City Parks and Recreation's Tree Planting Standards Guide (2009), the ideal street tree pit should be 4-5 feet x 10 feet. However, sidewalk width can constrain the ability to meet this recommendation. The guide includes a table of sample tree pit configurations (http://www.nycgovparks.org/sub_permits_and_applications/images_and_pdfs/TreePlantingStandards.pdf, pages 19-20). If the planting area available along a sidewalk is inadequate, it would be better to consider alternate planting sites, since a too small tree pit will compromise the tree's health and longevity. Simons and Johnson (2008) suggest that in such situations alternate sites to consider, space permitting, are medians and private property "at least three feet from inside property line subject to easements and agreement." In areas of continuous sidewalk, trees can also be placed in planters, although this decreases longevity due to water stress and lack of root space (Simons and Johnson, 2008).

Another solution to increasing the health and longevity of street trees is the use of structural soil. Structural soil has been designed to be compactable, so it meets the load-bearing requirements of sidewalks and other paved surfaces, while at the same time providing suitable structure for root growth (Grabosky and Bassuk, 1995; Grabosky and Bassuk, 1996). The Cornell University Urban Horticulture Institute (http://www.hort.cornell.edu/uhi/outreach/csc/article.html) has designed a structural soil that is comprised of specific ratios by weight of crushed stone (100), clay loam (20), and a hydrogel stabilizing agent (0.03) with total moisture at mixing of 10 percent. Through their research, they have found that this mixture meets or exceeds the load-bearing requirements for sidewalks and provides a matrix in which tree roots can grow (Grabosky and Bassuk, 1995; Grabosky and Bassuk, 1996).

Tree Maintenance

Routine, long-term maintenance is necessary in order to protect a city's tree resource. Not only does routine maintenance increase a tree's health and longevity, it also helps reduce risks to life and property. Comprehensive tree maintenance includes "pruning, fertilization, integrated pest management, wound treatment, bracing and cabling, and hazard inspections" (Simons and Johnson, 2008). Many of these maintenance components have been addressed by the American National Standards Institute.

The *American National Standards Institute (ANSI) A 300 Standards for Tree Care Operations* are industry standards that were developed by the Tree Care Industry Association (TCIA). The standards are voluntary, based on accepted tree care principles, and are to be used to develop tree management practices. The committee that develops, reviews, and revises the standards as needed is composed of a diverse and experienced group of tree industry professionals, including commercial tree care organizations, utility managers, and government-sector employees. The standards are divided into the following parts and may be purchased on TCIA's website at http://www.tcia.org/standards/A300.htm:

1. ANSI A 300 (Part 1) – 2008 Pruning.
2. ANSI A 300 (Part 2) – 2011 Soil Management (includes fertilization).
3. ANSI A 300 (Part 3) 2006 Supplemental Support Systems (includes cabling, bracing, guying, and propping).
4. ANSI A 300 (Part 4) – 2008 Lightning Protection Systems.
5. ANSI A 300 (Part 5) – 2005 Management of Trees and Shrubs During Site Planning, Site Development, and Construction.
6. ANSI A 300 (Part 6) – 2005 Transplanting (includes planting).
7. ANSI A 300 (Part 7) – 2006 Integrated Vegetation Management (IVM).
8. ANSI A 300 (Part 9) – 2011 Tree Risk Assessment.
9. ANSI A 300 (Part 10) – 20xx Integrated Pest Management (IPM) – under development.

Another important aspect of proper tree maintenance is how often trees are pruned. The Society of Municipal Arborists has set standards for street tree pruning maintenance (Roush and McFarland, 2006). The minimum standard is to prune each street tree every eight years with the optimal schedule being to prune young trees every three years and older trees every five years (Roush and McFarland, 2006). Putting trees on such a cyclical pruning schedule can help reduce pruning and other maintenance costs. Browning and Wiant (1997) found that when line clearance tree pruning was delayed beyond the optimal time, which in their study was every five to six years, the cost of pruning increased significantly. They also determined that the amount of biomass removed increased as a tree was allowed to grow for longer periods of time and the greater the amount of biomass, the greater the disposal costs (Browning and Wiant, 1997). Miller (1997) calculated that the optimal tree pruning cycle in Milwaukee, Wisconsin was every five years, although young trees might need to be pruned on a three-year cycle. He proposed that this cycle would be appropriate for other communities with a northern temperate climate, but that an optimal pruning cycle depends on the species, age, and condition of a city's trees as well as the local climate (Miller, 1997).

Urban Forest Management

Unlike in natural settings, the urban forest has to be actively managed to keep it healthy and prevent it from becoming a hazard to human life and property. Proactive management also reduces the cost of maintaining the urban tree canopy and maximizes the important services that trees provide. Since trees and humans are highly interconnected in the urban environment, collaboration between many different groups and agencies is another important aspect of managing the urban forest. This section will look at ways to bring interested parties together to

work toward a sustainable urban forestry plan, conduct public outreach to engage citizen participation and support, and finally, find various funding mechanisms.

An important piece of urban forestry management is the creation of tree ordinances and urban forest master plans. Tree ordinances provide the authority for municipalities to manage public trees (Miller, 1997). They also outline which agencies are responsible for various tree care activities, create public tree management and maintenance standards, and define the conditions under which privately-owned trees can be declared nuisances (Miller, 1997). Separate tree ordinances are often written for different tree subpopulations, such as street trees or park trees, because there may be different management requirements as well as different agencies in charge of a specific subpopulation's management. Bernhardt and Swiecki (2001) have grouped tree ordinances into three broad categories based on a survey of city and county tree ordinances in California: 1) street tree ordinances, 2) tree protection ordinances, and 3) view ordinances. View ordinances are adopted to provide guidelines for resolving conflicts between property owners when trees block views (Bernhardt and Swiecki, 2001). According to Miller (1997), a tree ordinance will contain some or all of the following components:

1. Purpose of the ordinance and its necessity.
2. Definitions.
3. Establishment of a tree board.
4. Description of the education and experience requirements for the city arborist or forester.
5. Duties of the city arborist/forester.
6. Statement of the authority granted to the city arborist/forester or other municipal agencies to plant, maintain, and protect urban trees.
7. The requirement of permits for the removal of public trees by anyone other than the urban arborist/forester and/or designated municipal agencies.
8. Maintenance standards.
9. Requirement for private tree owners to keep their trees from obstructing streets, sidewalks, and signage.
10. Definition of nuisance trees and the authority to condemn them.
11. Prohibition of public tree abuse or mutilation.
12. Protection of public trees during construction and other potentially harmful activities.
13. Guidelines for enforcement of the tree ordinance, penalties for violations of the ordinance, and an appeals process.

Tree ordinances provide the guidelines for management of the urban forest by codifying which personnel and agencies have the authority to manage public trees. According to Bernhardt and Swiecki (2001), tree ordinances should be part of a larger urban forestry management plan. There are seven broad areas that need to be covered in the management plan:

1. Assessing the public tree resource.
2. Reviewing past tree management practices.
3. Identifying urban forestry needs.
4. Establishing specific goals
5. Developing a management strategy to address urban forestry goals
6. Implementing the urban forest management plan.
7. Evaluating the results and revising as needed (Bernhardt and Swiecki, 2001).

Urban forestry management plans incorporate both short- and long-term planning goals. Short-term goals focus on day-to-day management of the urban forest and include activities such as determining work priorities, scheduling personnel, and maintaining equipment while long-term management incorporates setting and prioritizing goals and objectives, and making plans to accomplish these goals (Miller, 1997).

Maintaining the urban forest is not solely the responsibility of municipal agencies. Because of the interdependency between trees and humans in urban settings, it is important to gain the support and involvement of a city's residents. One way to accomplish this is to establish a tree advisory board. Tree advisory boards or commissions are composed of volunteer, local citizens who are interested in the preservation and maintenance of the urban forest. Some of the tasks that tree advisory boards may perform are public outreach and education, communicating with elected officials, small tree maintenance projects, and working on funding by applying for grants and obtaining private donations (American Public Works Association, n/d). Tree advisory board members serve in an advisory capacity only and are primarily committed to providing citizen-based input to municipal tree managers (American Public Works Association, n/d). A tree board is one of the four qualification standards for the Arbor Day Foundation's Tree City USA recognition program along with a tree care ordinance, $2 per capita expenditure on community forestry, and an official Arbor Day event (Arbor Day Foundation, 2012).

In many cities, an urban arborist or forester is responsible for public tree care and enforcing urban forest ordinances (Fazio, 2003). People holding this position may have degrees in forestry, horticulture, landscape architecture, or other areas of natural resource management (Schwab, 2009). Where the urban arborist is placed depends on a municipality's approach to urban forestry. Urban arborists may work within the public works department, the parks department, the planning department, or head a separate urban forestry division (Schwab, 2009).

Public Outreach, Education, and Involvement

Collaboration is a vital component in promoting and maintaining the urban forest. Not only is it important for various public officials and departments to work together to create and enforce ordinances and urban forest management plans, but the participation of private citizens is also necessary in order to have a vital and sustainable urban forestry program. In many cities much of the urban forest resource is in the hands of private citizens (Schwab, 2009). The better educated the citizenry is about proper tree care, the healthier the urban forest will be. Support from private citizens for the public tree resource is also imperative. Citizens can volunteer to help plant and maintain trees, which helps extend limited public funding (Schwab, 2009). Community members are also more apt to make public tree funding a priority when they understand the benefits that trees provide and the importance of properly caring for the public urban tree resource.

There are many ways to build public outreach and education into an urban forestry program. The public media can be used to make public service announcements, inform the public of scheduled maintenance activities, disseminate information on proper tree care, and publicize public events, such as Arbor Day festivities (Miller, 1997). A city-developed website that contains information on various aspects of tree care as well as the city's urban forest management plan and ordinances, and relevant contact information is an important resource for a city's residents. Organized volunteer activities provide opportunities for education in tree planting and

maintenance from tree professionals while building support for public trees. Direct mailings, phone calls, and e-mails can be used to contact specific subsets of a city's population in order to build support for a public tree project or target tree owners (Fazio, 2003).

Funding

While volunteer citizen activities can help a city meet some of their public forestry needs, it is virtually impossible to have a sustainable public tree program without adequate funding. The commitment to public tree replacement and care must be part of a city's budget (Fazio, 2003). Long-term maintenance requires a financial commitment to the public urban forest in the form of personnel and equipment as well as replacement tree plantings (Schwab, 2009). It may be necessary to educate public officials about the cost-saving benefits trees provide to municipalities such as decreasing the amount of storm water runoff, potentially decreasing the cost of cooling and heating public buildings, and decreasing pollutant levels - some of which may already be goals for the city - in order to get their commitment to providing adequate funding for public trees. Federal and state programs may have grant opportunities to finance urban forestry programs (Fazio, 2003). Corporate sponsorships, private donations, and grants from charitable foundations are also sources for monetary support for trees (Fazio, 2003). Local or regional utility companies and water/sewer districts may even contribute to tree planting programs in order promote energy savings and decrease storm water runoff.

There are also many creative ways to generate needed funds without applying for grants or depending on government financing. Fazio (2003) suggests a number of different ideas that can be used to earmark collected money for urban forestry needs. They include:

- Memorial tree planting program donations
- Selling plaques to put on public benches
- Selling firewood, lumber, or mulch from removed trees
- Hosting garage sales, bake sales, or auctions
- Instituting a tax-form check-off that provides an opportunity for citizens to donate money to community forest programs
- Selling special tree-themed license plates
- Setting up a tree bank that allows developers to donate money as a form of mitigation

Other ideas for alternative funding could be generated at brainstorming sessions of public tree officials, tree advisory board meetings, or by volunteer organizations (Fazio, 2003).

Case Studies

Tree Planning

Louisville, Kentucky

After Louisville, Kentucky's trees were devastated by both the remnants of Hurricane Ike in September 2008 and a significant ice storm in January 2009, residents of the Cherokee Triangle neighborhood formed the Cherokee Triangle Tree Association. The residents sought guidance from experts at the Kentucky Division of Forestry and the University of Louisville on how to inventory and evaluate the street trees in their neighborhood. The neighborhood volunteers

inventoried a total of 1,233 street trees by recording the species, size, and condition for each tree. As a result, they found that only a third of the street trees were thriving. The association recommended that medium-sized species be planted as street trees in the future and that larger tree species be limited to being planted in private yards. The Cherokee Triangle Tree Association also made a list of tree species, grouped by size, that are suitable choices for urban settings and Kentucky's climate (Millar, 2011a). As a follow-up project, the association hired arborists to inoculate the 24 largest and healthiest ash trees inventoried to protect them from damage by Emerald Ash Borer larvae. The treated trees comprised about one-third of the total number of ash trees planted along streets in the neighborhood (Millar, 2011b).

The Tree Committee is currently sending letters to residents of the neighborhood to gain permission to enter their yards and inventory the trees. The committee hopes that they will be able to obtain a comprehensive survey of *all* trees – both public and private - in their community in order to most effectively plan and manage the tree canopy and increase species diversity. They have received two grants to plant trees, a $1,000 matching grant from Louisville Gas & Electric and seven-year, $40,000 grant from the Metropolitan Sewer District (J. Millar, personal communication, *May 8,* 2012).

Palm Beach County, Florida

After suffering sizable losses of tree canopy due to hurricanes, Palm Beach County, Florida obtained Federal Emergency Management Agency (FEMA) grant money to commission a study to quantify tree losses as well as the subsequent losses in tree ecosystem services. An Urban Ecosystems Analysis was performed in conjunction with American Forests at two scales – moderate resolution and high resolution – using satellite imagery. The analysis provided the county with information on whether tree canopy losses were due to hurricane damage or to development pressures. CITYgreen software was used to quantify losses in ecosystem services due to changes in land cover, such as loss of trees. The county now has a GIS land cover map created by the satellite imagery analysis as a tool for county planners when prioritizing tree planting efforts. (American Forests, 2007)

Baltimore County, Maryland

In 2005, Baltimore County, Maryland created a comprehensive Forest Sustainability Program that contained three goals: assess forest health, protect remaining forests, and reforest priority lands). Priority lands included riparian buffers, reservoir watersheds, and urban communities. Urban communities were a priority because 75% of the county's forests are under private management. The Baltimore County Forest Sustainability Strategy was created by a steering committee that was formed during a sustainability issues forum in 2003.

The Steering Committee crafted a vision statement and identified 15 ecological and economic issues as being the most important for Baltimore County's forest sustainability initiatives. The Steering Committee also drafted a set of guiding principles to help them move forward with their program and then detailed recommended goals, actions, and assessment and data needs. The primary audience for this forest sustainability strategy is Baltimore County agencies and leaders and the document provides a framework for the creation of a county-wide forest management program. Although it is not a work plan, it provides an example of how to create an urban and community forest plan (Outen, 2005).

Tree Maintenance

Urbana, Illinois

As part of their urban forestry program, Urbana, Illinois employs cyclical tree pruning and emphasizes public outreach and education. In the past, the city's public tree pruning was driven by citizen complaints, but the city arborist, Mike Brunk, implemented a system of pruning street trees on a 13-year rotation. A thorough tree inventory determined which trees were imminent public hazards and these trees were given the highest priority for intervention. The initial pruning cycle ran from 1995-2008. This method was expected to reduce tree maintenance costs and shifted the focus of tree maintenance from crisis management to prevention (Schwab, 2009).

Since citizens were accustomed to calling the city and getting a quick response to tree concerns, Brunk needed to sell the public on the idea of long-term tree maintenance. He did this by contacting citizens by phone and spending time in neighborhoods. He noticed a significant decline in phone calls after the first few years of the program's initiation. Brunk and his staff continue to focus on community education and outreach by disseminating information on tree planting and care, producing tree-themed publications, and using local media to spread the message about the importance of trees and proper tree care (Schwab, 2009).

Conclusion

Trees in the urban setting provide valuable benefits by reducing the amount of storm water that has to be actively managed and decreasing the amount of pollutants that are washed into urban waterways. Urban forests also filter air pollutants, cool buildings and the surrounding environment, store and sequester carbon, provide habitat for wildlife, and bring pleasure and beauty to the built urban environment. To optimize the benefits provided by this living green infrastructure, it is imperative that communities actively manage the urban forest resource by adopting *and enforcing* tree ordinances, creating comprehensive urban forest management plans, evaluating and revising plans as needed, and educating the public about the importance of maintaining a healthy urban forest.

Caring for the public urban forest is collaborative and depends on the combined efforts of public officials, urban arborists, public works employees, park managers, planners, developers, and private citizens. Everyone benefits from the services provided by public trees and it is important that there is extensive support for the care and continuance of a healthy urban tree population. A broad consensus that trees are an important part of a city's green infrastructure is necessary to create the funding and long-term commitment necessary to have a viable, productive urban forest. "Trees are not merely amenities; they are assets that pay regular dividends when well managed" (Schwab, 2009).

Resources

General Tree Information

Alliance for Community Trees: http://actrees.org/site/index.php

American Forests: http://www.americanforests.org/

Arbor Day Foundation: http://www.arborday.org/

Ecosystem Services: Information and links to publications from the U.S.D.A. Forest Service on the ecosystem services provided by trees: http://www.fs.fed.us/ecosystemservices/

International Society of Arboriculture:
- Provides information on tree care, tree ordinance guidelines and planting specifications: http://www.isa-arbor.com/home.aspx
- Trees Are Good: Source of information aimed at the general public on a variety of tree care topics http://www.treesaregood.com/

State Urban and Community Forest Programs (EPA Region 4):
- Alabama: Alabama Forestry Commission: http://www.forestry.state.al.us/Default.aspx
  Alabama Cooperative Extension System: http://www.aces.edu/ucf/
- Florida: Florida Forest Service: http://www.floridaforestservice.com/forest_management/cfa_urban_index.html
- Georgia: http://www.gfc.state.ga.us/index.cfm (click on "Community Forests" link)
- Kentucky: http://forestry.ky.gov/Urban%20Forestry%20and%20Community%20Programs/Pages/default.aspx
- Mississippi: http://www.mfc.ms.gov/urabancommunity.php
- North Carolina: http://ncforestservice.gov/Urban/Urban_Forestry.htm
- South Carolina: http://www.state.sc.us/forest/urban.htm
- Tennessee: http://www.tn.gov/agriculture/forestry/urbanforests.shtml

U.S.D.A. Forest Service: Urban and Community Forestry Program: http://www.fs.fed.us/ucf/

U.S.D.A. PLANTS Database: http://plants.usda.gov/java/

Urban Forestry Coordinators by State: http://www.arborday.org/programs/treeCityUSA/forestryCoordinators.cfm

Vermont Division of Forestry: Community Forestry Library: http://www.vtfpr.org/urban/for_urbcomm_library.cfm#Developing

Tree Inventories

Guidelines for Developing and Evaluating Tree Ordinances: http://www.isa-arbor.com/tree-ord/

Tree Inventory and Management Software List of Resources (Revised September 2010): http://na.fs.fed.us/urban/inforesources/inventory/tree_inventory_mgmt_software_list.pdf

Appendix D - The Public Urban Forest:

GIS Information

ESRI (Environmental Systems Research Institute, Inc.) GIS software (commercial): www.esri.com

GRASS (Geographic Resources Analysis Support System) GIS software (freeware): http://grass.osgeo.org/

Informational poster from the United States Geographical Survey: http://egsc.usgs.gov/isb/pubs/gis_poster/#what

Kentucky Geography Network: a geospatial data resource for the Commonwealth of Kentucky: http://kygeonet.ky.gov/

List of GIS software resources from the University of Colorado created in 2004, so not all links are functional: http://www.colorado.edu/geography/virtdept/resources/vendors/vendors.htm

Tree Planting

City of New York Parks and Recreation: Tree Planting Standards guide contains valuable information on planting, including a table of different tree pit dimension configurations: http://www.nycgovparks.org/sub_permits_and_applications/images_and_pdfs/TreePlantingStandards.pdf

Cornell University Urban Horticulture Institute: A number of tree planting resources, including: a woody plants database and a 128-page guide of urban tree recommendations: http://www.hort.cornell.edu/uhi/outreach/index.htm

International Society of Arboriculture: Graphic and written resources on tree planting: http://www.isa-arbor.com/education/onlineResources/cadPlanningSpecifications.aspx?utm_source=homepageclicks&utm_medium=homepagebox&utm_campaign=IAmA

Selecting the right tree for the right place: http://selectree.calpoly.edu/right_tree.html

Structural soil: Information from Cornell University's Urban Horticulture Institute: http://www.hort.cornell.edu/uhi/outreach/csc/article.html and http://www.hort.cornell.edu/uhi/outreach/index.htm#soil

Trees Are Good (International Society of Arboriculture): http://www.treesaregood.com/treecare/tree_planting.aspx

ANSI (American National Standards Institute) tree transplanting guidelines: http://www.treecareindustry.org/standards/part6/transplanting.htm

National Arbor Day Foundation videos: http://www.arborday.org/trees/tips/treePlanting.cfm

Tree Maintenance

Best Management Practices for Community Trees: A Technical Guide to Tree Conservation in Athens-Clarke County, Georgia (2001): https://athensclarkecounty.com/DocumentView.aspx?DID=280

Cabling and bracing trees: http://www.treecareindustry.org/pdfs/A300Part3TCICablingArticle.pdf; https://utextension.tennessee.edu/publications/Documents/SP659.pdf

Fertilization: http://www.extension.umn.edu/distribution/horticulture/dg7410.html; http://www.clemson.edu/extension/hgic/plants/landscape/trees/hgic1000.html; http://www.treecaretips.org/Fertilization/Fertilization.htm

Insect and disease problems: http://www.treesaregood.com/treecare/insect_disease.aspx; http://www.treecaretips.org/Diseases/Diseases.htm

Integrated Pest Management: http://www.epa.gov/pesticides/factsheets/ipm.htm

Mulching: http://www.treesaregood.com/treecare/mulching.aspx; http://www.treecaretips.org/Mulching/Mulchrings.htm

Pruning: http://www.treecaretips.org/Pruning/Pruning.htm
Young trees: http://www.treesaregood.com/treecare/pruning_young.aspx
Mature trees: http://www.treesaregood.com/treecare/pruning_mature.aspx

Recognizing and managing tree hazards: http://www.treesaregood.com/treecare/hazards.aspx; http://www.na.fs.fed.us/spfo/pubs/howtos/ht_haz/ht_haz.htm#cabl

Urban Forest Management

Guidelines for writing tree ordinances: http://www.isa-arbor.com/tree-ord/; http://www.dec.ny.gov/lands/5276.html

General guidelines for urban forest master plans:
The Road to a Thoughtful Street Tree Master Plan: A practical to systematic planning and design: http://www.urbanforestrysouth.org/resources/library/the-road-to-a-thoughtful-street-tree-master-plan
Guidelines for Developing Urban & Community Forestry Plans: Strategic Plans & Management Plans for Street and Park Tree Management: http://www.vtfpr.org/urban/documents/PlanGuid.pdf
Urban Forestry Best Management Practices for Public Works Managers: Urban Forest Management Plan: http://www2.apwa.net/documents/About/CoopAgreements/UrbanForestry/UrbanForestry-4.pdf

Examples of urban forest master plans:
City of Seattle, WA: http://www.mrsc.org/govdocs/s42urbanforest.pdf

City of Portland, OR:
Urban Forest Management Plan (2004):
http://www.portlandonline.com/parks/index.cfm?a=184641&c=38306
Urban Forest Action Plan (2007):
http://www.portlandonline.com/parks/index.cfm?c=38294&a=226238
City of Charlottesville, VA (May 2009):
http://www.charlottesville.org/Index.aspx?page=1721
City of Baltimore, MD (Draft – April 2007):
http://www.louisvilleky.gov/NR/rdonlyres/CB60DA78-EBC7-4D45-A280-264C9061C7EE/0/TreeBaltimoreUrbanForestManagementPlan.pdf

Funding

Note: Each state has dedicated funding from the federal government to support urban and community forestry (P. Barber, personal communication, *March 9,* 2012). This funding is awarded on an annual basis. The name of the program may change, so it is necessary to check the individual state's forestry website periodically for information on what is currently available.

Alliance for Community Trees: Information on funding opportunities:
http://actrees.org/site/resources/funding/

Community Forestry Program: A grant program that "authorizes the Forest Service to provide financial assistance to local governments, Tribal governments, and qualified nonprofit entities to establish community forests that provide continuing and accessible community benefits":
http://www.fs.fed.us/spf/coop/programs/loa/cfp.shtml

EPA Region 4:
Alabama:
Urban and Community Forestry Financial Assistance Program:
http://www.forestry.state.al.us/urbanfinancialassistanceprogram.aspx?bv=4&s=1
Florida:
Urban and Community Forestry Grant Program:
http://www.floridaforestservice.com/forest_management/cfa_urban_grants.html
Georgia:
Urban and Community Forestry Grant Program (check for current availability):
http://www.gfc.state.ga.us/CommunityForests/Grants.cfm
Kentucky:
Urban and Community Forestry Grant Program:
http://forestry.ky.gov/grantopportunities/Pages/default.aspx
Bluegrass Pride provides community grants for 7 counties in Kentucky (Clark, Estill, Garrard, Lincoln, Madison, Montgomery, and Powell):
http://www.bgpride.org/PRIDECommunityGrants.htm
Mississippi:
Urban and Community Forestry Grant Program (check for current availability):
http://www.mfc.ms.gov/grant-funding.php
Mississippi Department of Wildlife, Fisheries, and Parks: Land and Waters Conservation Fund's Outdoor Recreation Grant:
http://home.mdwfp.com/more.aspx

North Carolina:
Urban and Community Forestry Grant Program:
http://ncforestservice.gov/Urban/urban_grant_overview.htm
Community Firewise and Urban Interface Grant Program:
http://ncforestservice.gov/ui_firewise_grant/ui_firewise_grant.htm
South Carolina:
No current state-level grant programs for community and urban forestry
Tennessee:
Urban and Community Forestry Grant Program Information (contacts at end of document): http://www.tn.gov/agriculture/forms/infopak.pdf
Tennessee Agricultural Enhancement Program: Community Tree Planting Projects Information (contacts at end of document):
http://www.tn.gov/agriculture/publications/forestry/TAEPforestry.pdf

Global ReLeaf (American Forests): Provides cost-share grants for restoration tree planting projects conducted by non-profit organizations and public agencies:
http://www.americanforests.org/our-programs/global-releaf-projects/global-releaf-grant-application/

National Urban and Community Forestry Advisory Council Challenge Cost-Share Grant Program (check for current deadlines): http://www.fs.fed.us/ucf/nucfac.html

State and Private Forestry Redesign Competitive Grant Program:
http://www.fs.fed.us/spf/redesign/index.shtml

Appendix D - The Public Urban Forest:

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Appendix D - The Public Urban Forest:

Appendix A

Name: .....
Street: .....
Date: .....

1. Tree Characteristics
Tree ID: .....
Species: .....
Local Name: .....
DBH: .....
Height: .....
Spread: .....
Form:
- ☐ generally symmetric
- ☐ minor asymmetry
- ☐ major asymmetry

2. Site Condition
Site topography:
- ☐ flat
- ☐ slope
- ☐ others: .....

Root surface cover:
- ☐ paved .....%
- ☐ turf .....%
- ☐ bare soil .....%
- ☐ others: .....

3. Tree Health
Foliage color:
- ☐ normal
- ☐ chlorotic
- ☐ necrotic

Foliage density:
- ☐ dense
- ☐ sparse

Vigor class:
- ☐ good
- ☐ average
- ☐ poor

4. Hazard Status
Trees defect:
- ☐ poor taper
- ☐ co-dominants
- ☐ multiple attachments
- ☐ included bark
- ☐ excessive end weight
- ☐ cracks
- ☐ hangers
- ☐ girdling
- ☐ wounds
- ☐ decay
- ☐ cavity
- ☐ conks/mushroom
- ☐ sap flow
- ☐ loose/cracked bark
- ☐ deadwood/stub
- ☐ termites/ants
- ☐ cankers
- ☐ galls
- ☐ lean
- ☐ exposed root

Tree part most likely to fail:
.....

Target under the tree:
- ☐ building
- ☐ parking
- ☐ traffic
- ☐ pedestrian
- ☐ landscape
- ☐ hardscape
- ☐ utility lines

Can target be moved?
- ☐ yes
- ☐ no

Occupancy:
- ☐ occasional use
- ☐ frequent use
- ☐ constant use

Hazard ratings:
- ☐ low
- ☐ medium
- ☐ high
- ☐ severe

Hazard abatement:
- ☐ remove defective part
- ☐ reduce end weight
- ☐ crown clean
- ☐ crown thin
- ☐ raise canopy

5. Comment

Source: Streethan et al. 2011

Key for the tree inventory sheet that follows:

Using the Tree Inventory Data Sheet

The following items will be found on the sheets. For each response mark an X in the appropriate location. The items are as follows:

Tree information

Tree number – Record the Tree Number
Code – Record a two letter Species Code (ie: **AR** = Acer rubrum)
DBH – Record Diameter at Breast Height

Tree Condition

Place an X in the appropriate box
G = Good
F = Fair
P = Poor
D = Dead
H = Hazard

Planting Location

Record the location where the tree is located on a map of the street or park
Swlk = Sidewalk planting pit
<4' = Planting strip less than four feet of area
>4' = Planting strip more than four feet of area
Lwn = Lawn area

Condition

Weak Fork = Weak Fork
Over Wires = Overhead Utility Wires
Dead Wood = Dead Wood in Crown
Cav = Cavity

If Pruning Needed, What Type?

Clean = Crown Cleaning
Raise = Crown Raising
Reduc. = Crown Reduction

Comments

Example = Broken sidewalk
Bark damage
Broken support stake
Needs additional inspection

Source: USDA Forest Service, Northeastern Area

Date:____ Map#:____

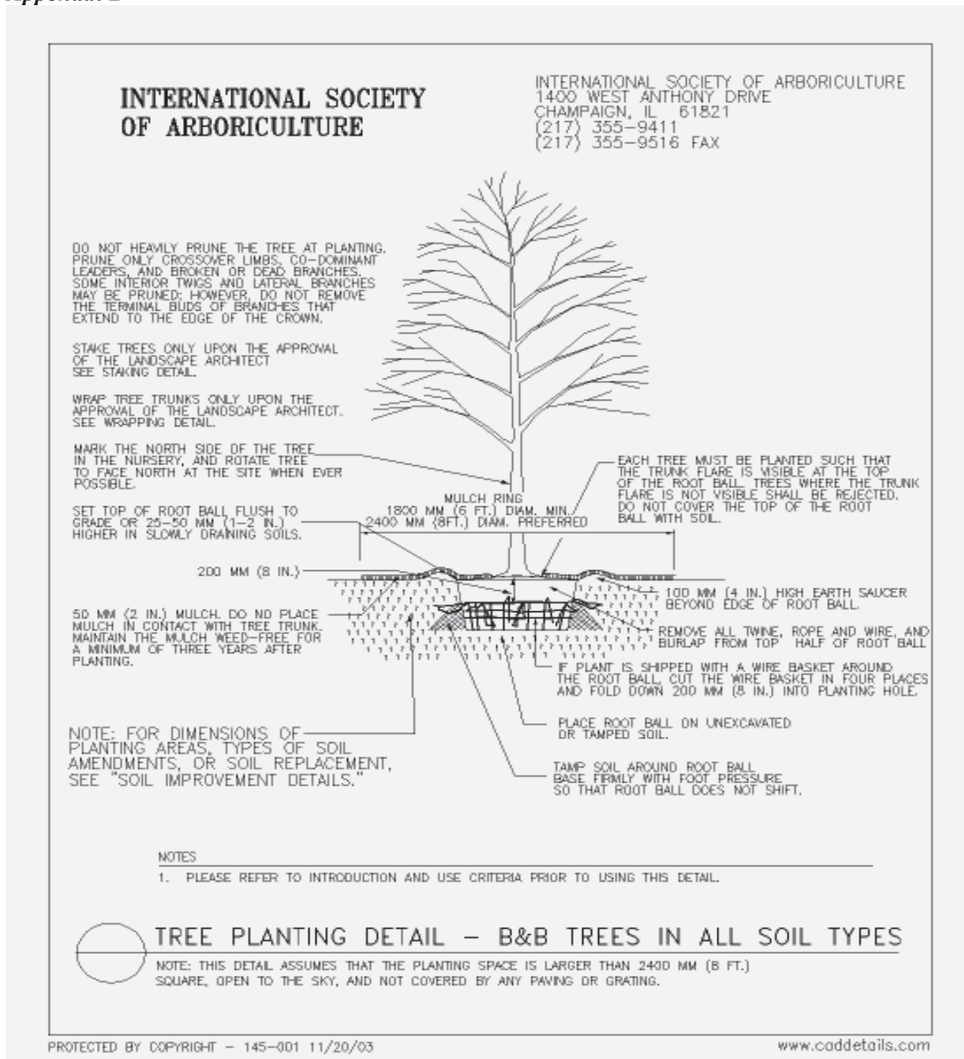
Tree Inventory Data Sheet

Tree Information			Tree Condition					Planting Location				Conditions				If Pruning Needed What Type?			Comments
Tree #	Code	DBH	G	F	P	D	H	Swk	<4'	>4'	Lwn	Fork	Wires	Wood	Cav	Clean	Raise	Reduct.	

Legend:
(Tree Condition) G = Good F = Fair D = Dead H = Hazard
(Planting Location) Swlk = Sidewalk <4' = less than 4' >4' = more than 4' Lwn = Lawn
(Conditions) Weak Fork = Weak Branch Fork Connection Over Wires = Overhead Utility Wires Dead Wood = Dead Wood in Crown Cav = Cavity in Trunk
(If Pruning Needed What Type?) Clean = Crown Cleaning Raise = Crown Raising Reduct. = Crown Reduction

Source: USDA Forest Service, Northeastern Area

Appendix B



Source: International Society of Arboriculture