Trees and Tech: Arboricultural Management
Beyond Planting and Pruning

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Urban Trees: A Balancing Act

Trees provide a variety of benefits
  • Environmental
  • Economic
  • Aesthetic
  • Societal functions
  • Health effects
  • Wildlife habitat

Tree failures can pose significant consequences
  • Public health & safety
  • Property damage
  • Disruption of services & activities
Economic Benefits of Trees

Roughly 80% of the US population live in urban areas 
(Nowak et al. 2010)

• US urban forests: estimated 3.8 billion trees: approximate value of $2.4 trillion (Nowak et al. 2002)

Ecosystem Services:

• Reduced energy costs - $2 billion annually 
(Donovan & Butry 2009)

• Remove 784,000 tons of air pollution = $3.8 billion annually (Nowak et al. 2006)

• 770 million tons of stored carbon = $14.3 billion 
(Nowak & Crane 2002)
Population

- 2010: 18.8 Million
- 2070: 33.7 Million
Florida: Urban Sprawl 2010-2070
The Intergovernmental Panel on Climate Change (IPCC) predicts that by the end of the 21st century:

- Temperature increase will likely exceed 2.7°F to 3.6°F
- Increased frequency & intensity of natural disasters
- Less Precipitation
*Last 7 years were the warmest on record*
# Top 10 Costliest US Hurricanes

<table>
<thead>
<tr>
<th>Hurricane</th>
<th>Year</th>
<th>Category</th>
<th>Adjusted Cost</th>
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<tbody>
<tr>
<td>Katrina</td>
<td>2005</td>
<td>3</td>
<td>$186.3B</td>
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<tr>
<td>Harvey</td>
<td>2017</td>
<td>4</td>
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<tr>
<td>Ian</td>
<td>2022</td>
<td>4</td>
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<td>Maria</td>
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<td>Sandy</td>
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<td>Irma</td>
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<td>Ike</td>
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<tr>
<td>Ivan</td>
<td>2004</td>
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www.ncei.noaa.gov
Harsh Urban Environments

Urban trees have a high mortality rate

- Poor soil quality
- Compacted soils
- Small planting spaces
- Increased temperatures
- Drought-like conditions
- Changes in land-use
- Construction damage
- Lack of maintenance
- Prematurely removed
Right Tree, Right Place

Before Planting:

• Figure out what grows well in your area
• Assess the site prior to planting
• Determine desired species traits
• Survival at the site?

Goal:

• Maximize tree related benefits
• Minimize potential for future risk
Desired Species Traits

- Function in the landscape
- Mature size
- Growth rate
- Mature form
- Ornamental features
- Deciduous vs. evergreen
- Wood characteristics
- Tolerance of urban conditions
- Cold hardiness
- Native species
Site Evaluation

- Above ground characteristics
  - Environmental factors
  - Urban Factors
- Below ground characteristics
- Possible site modifications
- Future tree & site management
Florida Trees
For Urban and Suburban Sites

Find Trees Recommended for your Site

Search Trees by Characteristics

Identify a Tree
Additional Info

- Useful tool for public/professionals
- Similar websites – none FL specific
- Promotes “right tree, right place”
- Expert System (AI): 100’s of rules/questions
403 tree & shrub species fact sheets

676 tree species fact sheets
Quercus muehlenbergii: Chinkapin Oak

Edward F. Gilman and Dennis G. Watson

Introduction
Chinkapin oak is seen at 70 to 90 feet in height when found in the wild but is more often seen at 40 to 50 feet in height with an equal or greater spread when grown in cultivation. It grows at a moderate rate when young but slows considerably with age, eventually developing into a broad, rounded canopy with strong branches. Young trees often exhibit a straight central leader with numerous branches originating at the same node. The light/dark green, deciduous, lobed leaves turn shades of red, yellow, orange and brown before dropping in fall. Veins are distinctively prominent on the undersides of the coarsely textured leaves. The acorns which are produced are edible.

General Information
Scientific name: Quercus muehlenbergii
Pronunciation: KWERK-us mew-len-BER-ee eye
Common name(s): Chinkapin oak, chestnut oak
Family: Fagaceae
USDA hardness zones: 3A through 8B
Origin: native to North America
Invasive potential: little invasive potential
Uses: reclamation; street without sidewalk; shade; highway median; parking lot > 200 sq ft; tree lawn > 6 ft wide
Availability: somewhat available, may have to go out of the region to find the tree

Flower
Flower color: brown
Flower characteristics: not showy

Fruit
Fruit shape: oval, round
Fruit length: 0.5 to 1 inch
Fruit covering: dry or hard
Fruit color: brown
Fruit characteristics: attracts squirrels/mammals; not showy; fruit/leaves a litter problem

Trunk and Branches
Trunk/bark/branches: branches droop; not showy; typically one trunk; thorns
Pruning requirement: little required
Breakage: resistant
Current year twig color: brown
Current year twig thickness: thin, medium
Wood specific gravity: unknown

Range
Figure 2. Range

Description
Height: 40 to 60 feet
Spread: 50 to 60 feet

Use and Management
Small specimens are often grown with an upright, oval habit. Older trees develop a more open, rounded form. This oak should be grown with a single trunk and widely spaced branches to mimic its growth habit in the wild. The first permanent branch can be located three to five feet from the ground if the tree will be planted in an open lawn area and allowed to develop a wide crown. For those planted as street trees or in areas requiring clearance for vehicles or pedestrians, the first permanent branch should be higher on the trunk.

Chinkapin oak should be grown in full sun on well-drained soil. It reaches its greatest size on loose, bottomland soils and is well adapted to alkaline soils. This is an adaptable oak which has been planted often in the central part of the country where soils were often clayey and alkaline. It will grow quite nicely in other areas of the country as well.

Propagation is by seed but plants have been considered difficult to transplant. There are a number of root-promoting techniques developed for nursery production which should improve the branching of the root system, and this should improve the transplantability of this oak.

Pests and Diseases
No pests or diseases of major concern.

Culture
Light requirement: full sun
Soil tolerances: day; sand; loam; alkaline, acids; occasionally wet; well-drained
Drought tolerance: high
Aerosal salt tolerance: moderate

Other
Roots: not a problem
Winter interest: no
Outstanding tree: no
Ozone sensitivity: unknown
Verticillium wilt susceptibility: resistant
Pest resistance: resistant to pests/diseases

Figure 1. Middle-aged Quercus muehlenbergii: chinkapin oak
Credits: Ed Gilman, UF/IFAS
Florida Trees
For Urban and Suburban Sites

Find Trees Recommended for your Site

Search Trees by Their Characteristics

Identify a Tree

New Florida Trees Website
Value of the Site?

- Contains numerous educational materials & tools
- Specific to FL species & urban conditions
- Tree selection based on desired characteristics & site conditions
- Website - easy-to-use
- Mobile Friendly - accessible in the field
- Right tree in the right place
Wind-Tunnel simulations using 3D printed trees
• Assess interactions at root-soil interface
• 3 Acer rubrum L. ‘Florida Flame’
• LiDAR + imaging software - 3D model of the trees
• Static pull tests
Potential Applications for AI & Urban Landscapes

• Landscape design
• Tree inventory
• Tree health and risk assessments
• Plant growth models
• Searchable fact sheet
• Industry training simulators
• Tree selector 2.0
Summary

- Many factors can affect the success of urban trees
- Creative planning & Design
- High quality nursery stock + Right tree, right place
- AI = opportunities to promote more sustainable landscapes
Thank you for your time!
Questions?