

Trees and Tech: Arboricultural Management Beyond Planting and Pruning



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Summary

Urban Tree Management

Planting in the Urban Landscape

Florida Trees Website

Applications & Opportunities for AI

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

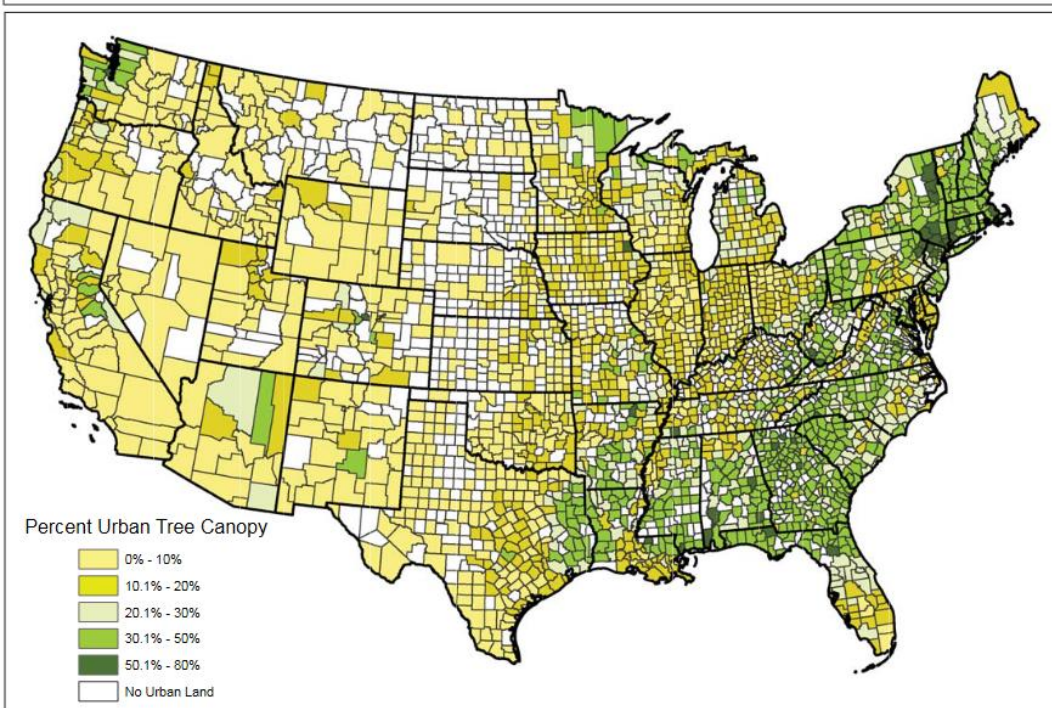
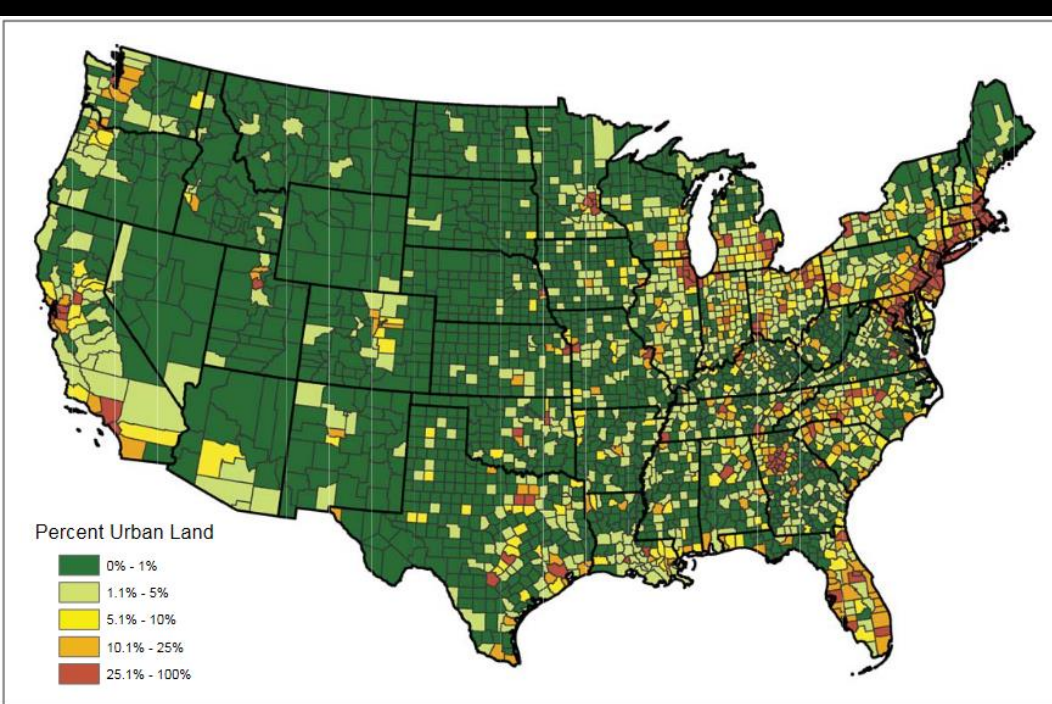
(Nowak et al.2010)

- 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)





Urban Sprawl

Benefits & Risk

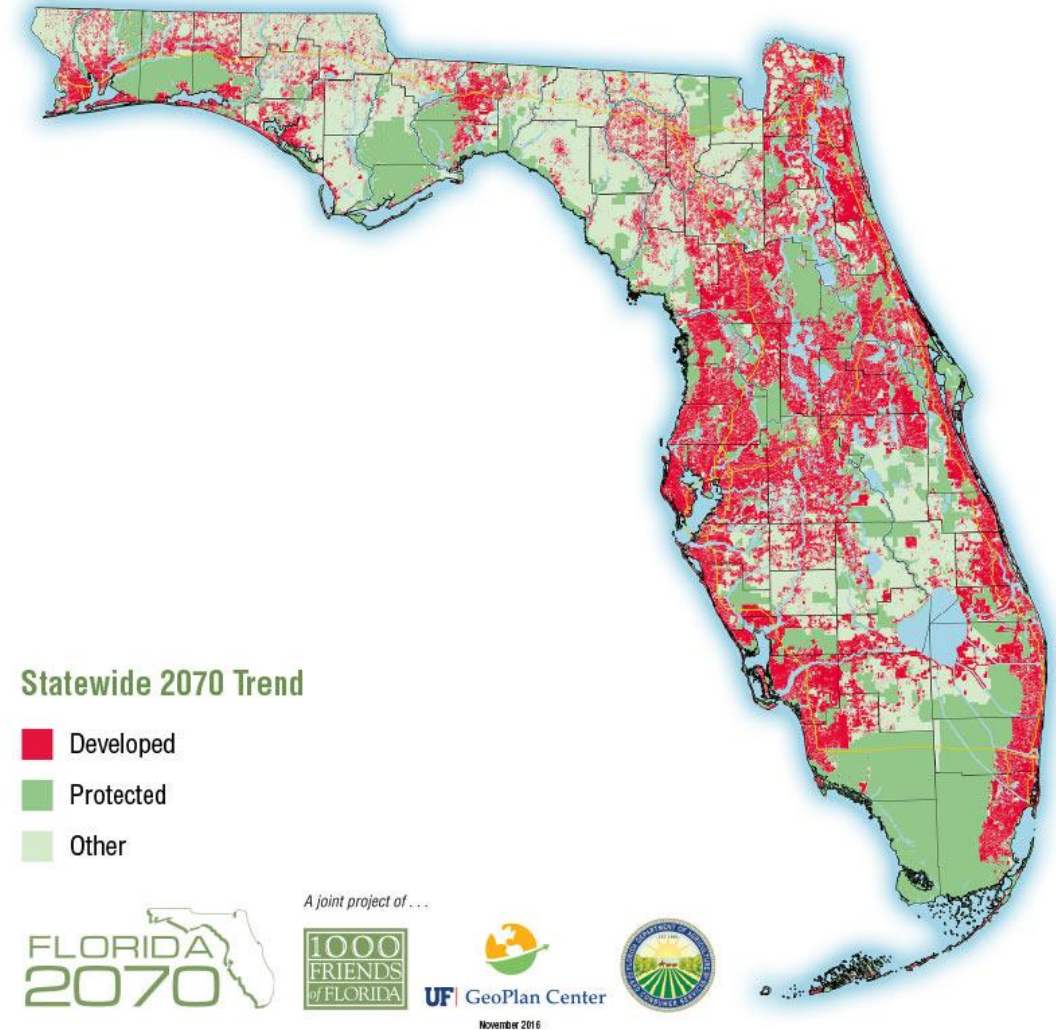
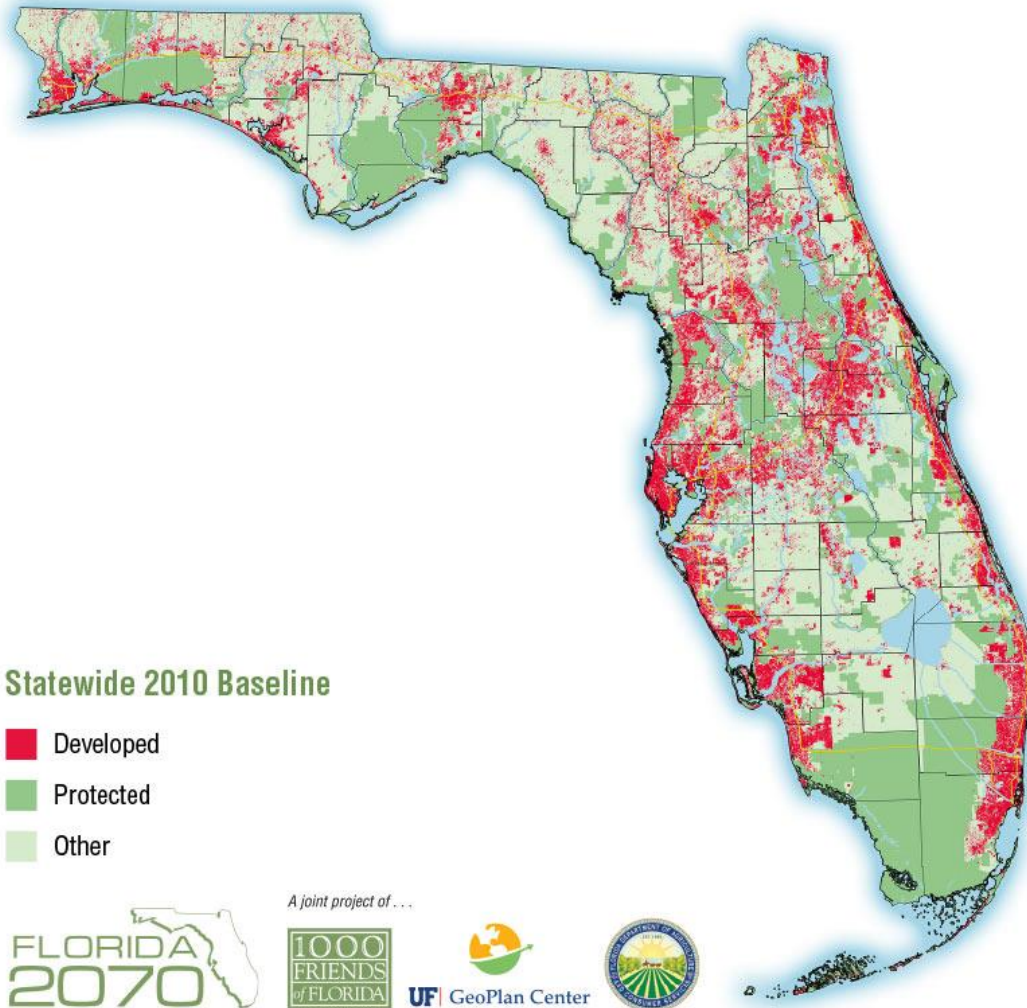
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Did They Leave Room for the Trees?

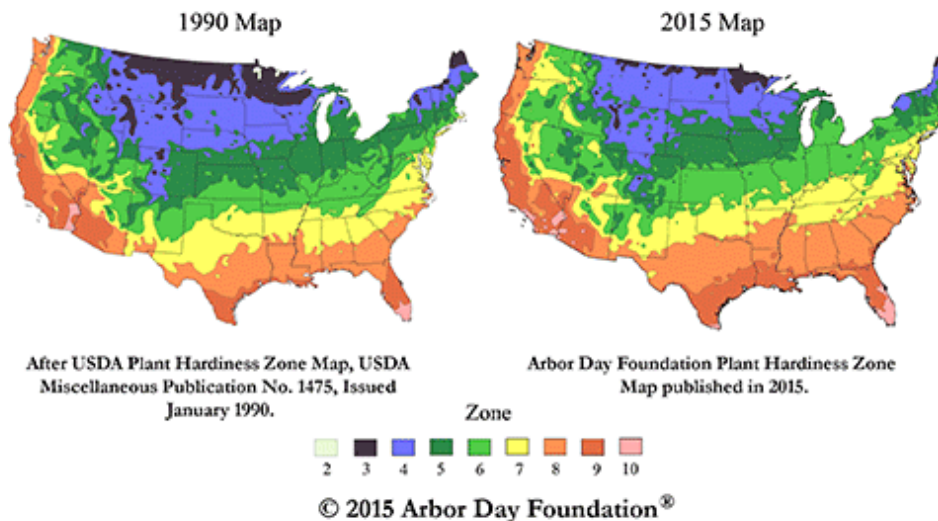
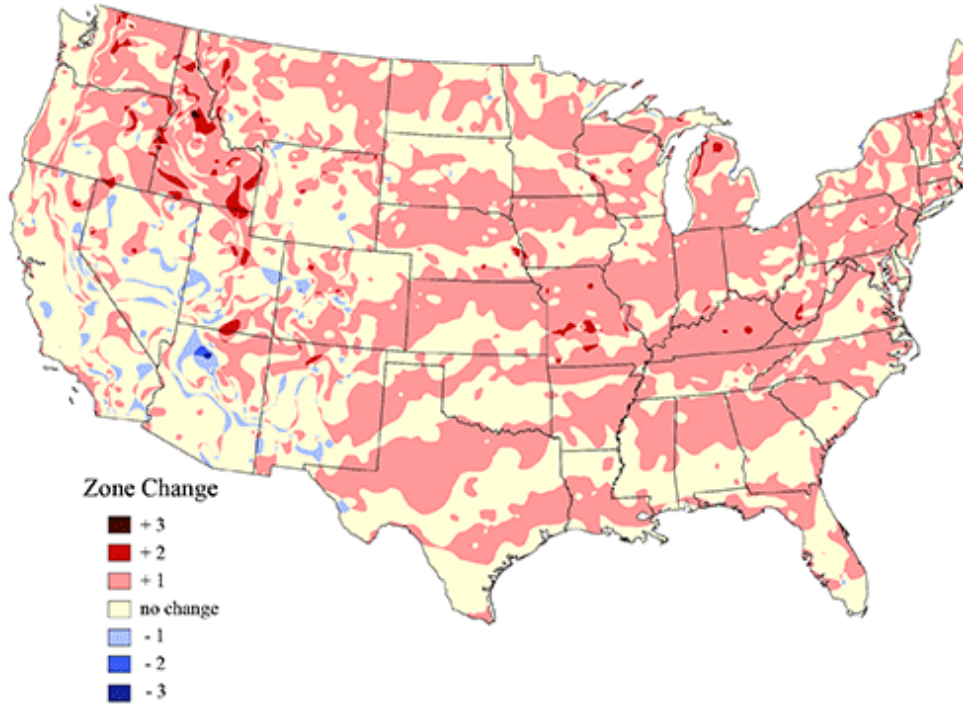
Population



Florida: Urban Sprawl 2010-2070



Differences Between 1990 USDA Hardiness Zones and 2015 Arborday.org Hardiness Zones

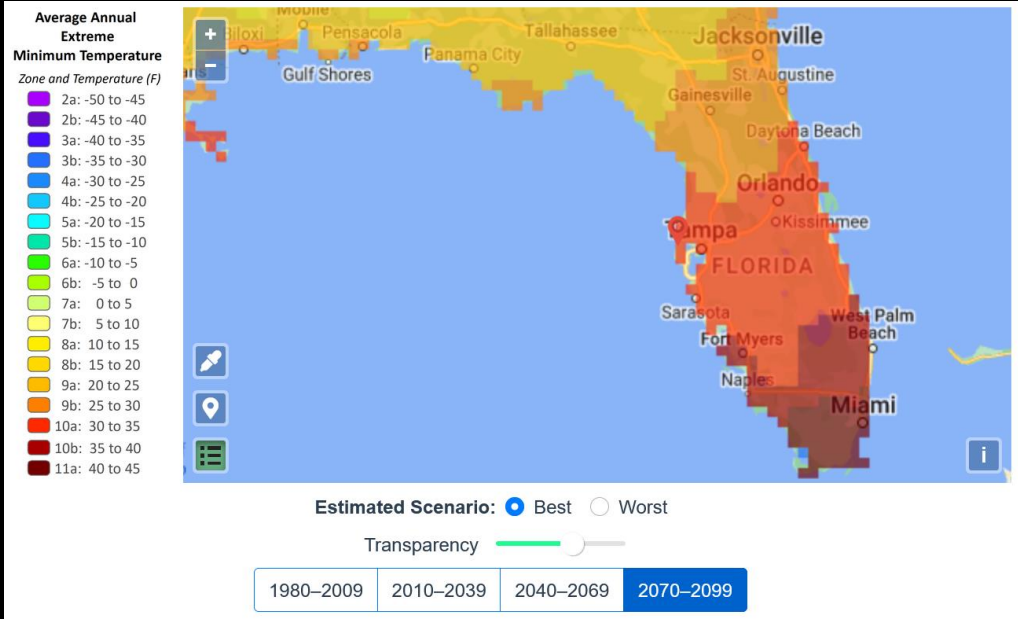
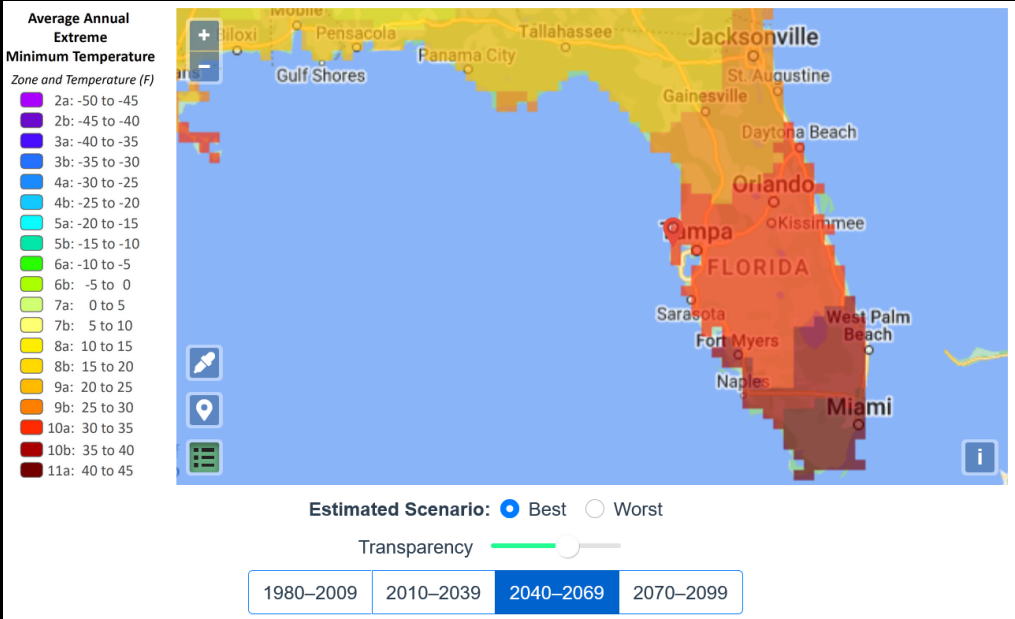
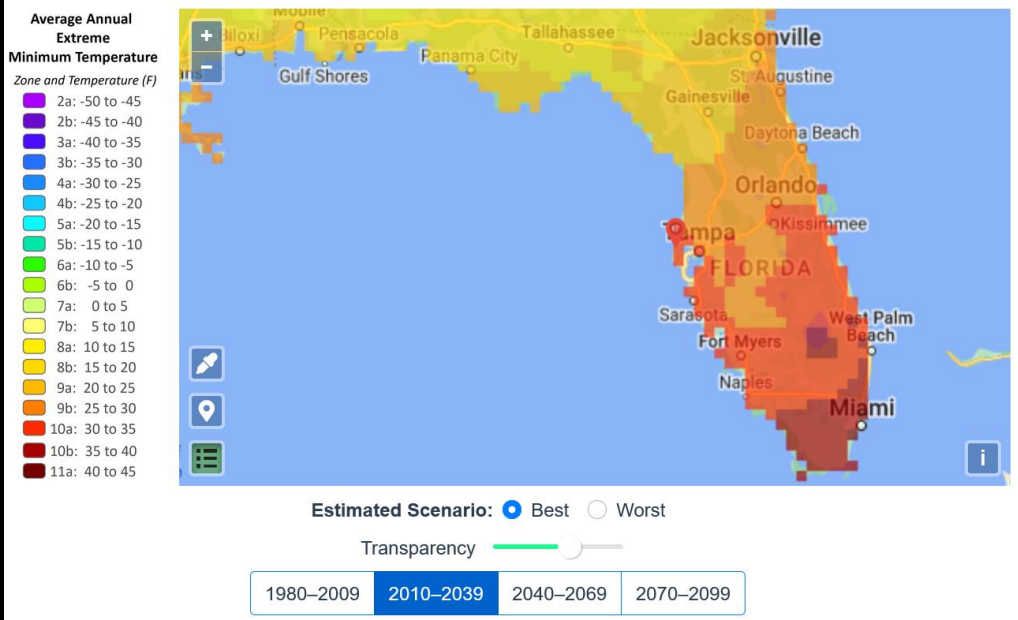
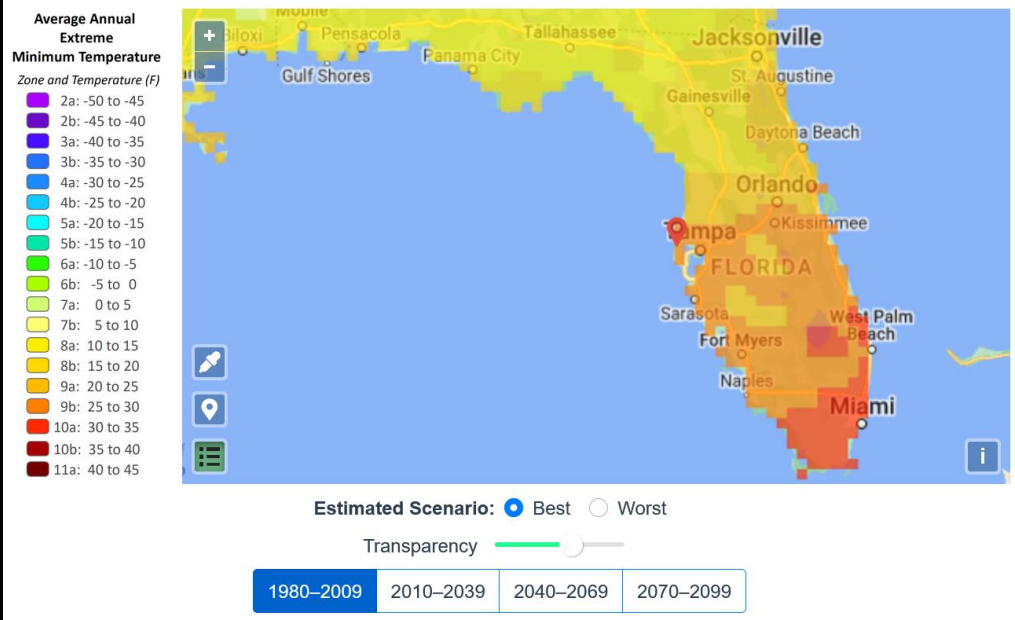


Climate Change

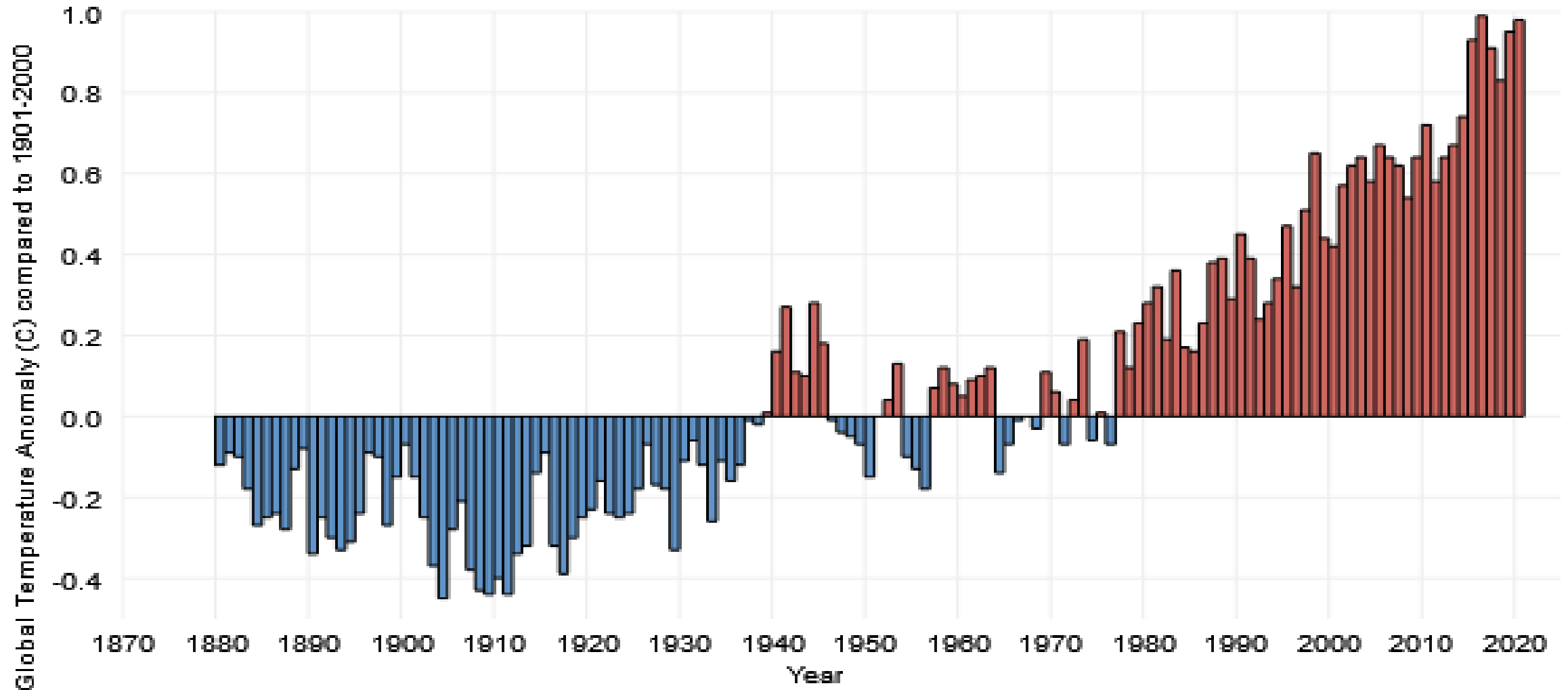
The Intergovernmental Panel on Climate Change (IPCC) predicts that by the end of the 21st century:

- Temperature increase will likely exceed 2.7°F to 3.6°F
- Increased frequency & intensity of natural disasters
- Less Precipitation

Future Plant Hardiness Zones

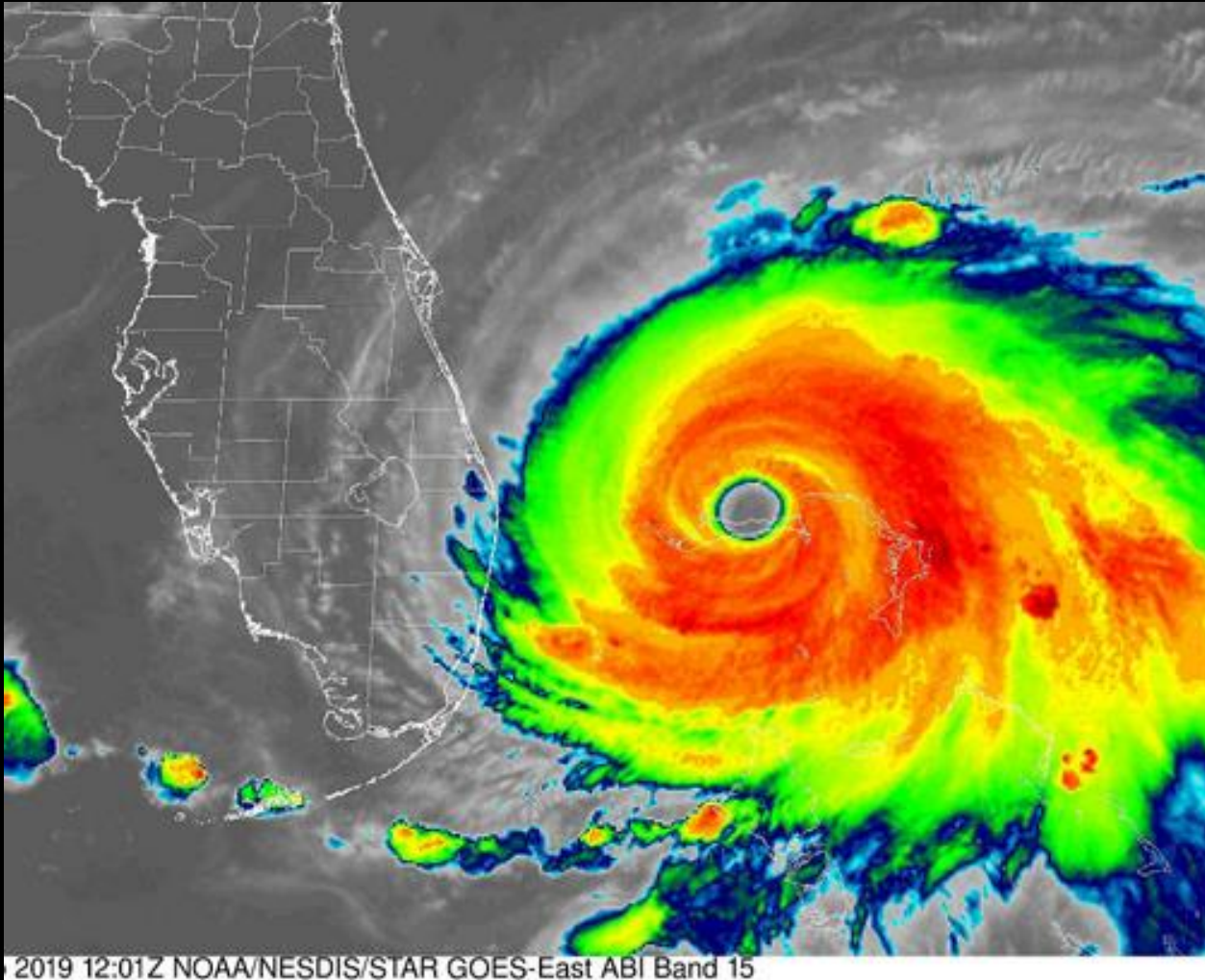


History of global surface temperature since 1880



*Last 7 years were the warmest on record

Top 10 Costliest US Hurricanes



Hurricane	Year	Category	Adjusted Cost
Katrina	2005	3	\$186.3B
Harvey	2017	4	\$148.8B
Ian	2022	4	\$112.9B
Maria	2017	4	\$107.1B
Sandy	2012	1	\$81.9B
Ida	2021	4	\$78.7B
Irma	2017	4	\$59.5B
Andrew	1992	5	\$55.9B
Ike	2008	2	\$40.2B
Ivan	2004	3	\$31.6B

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



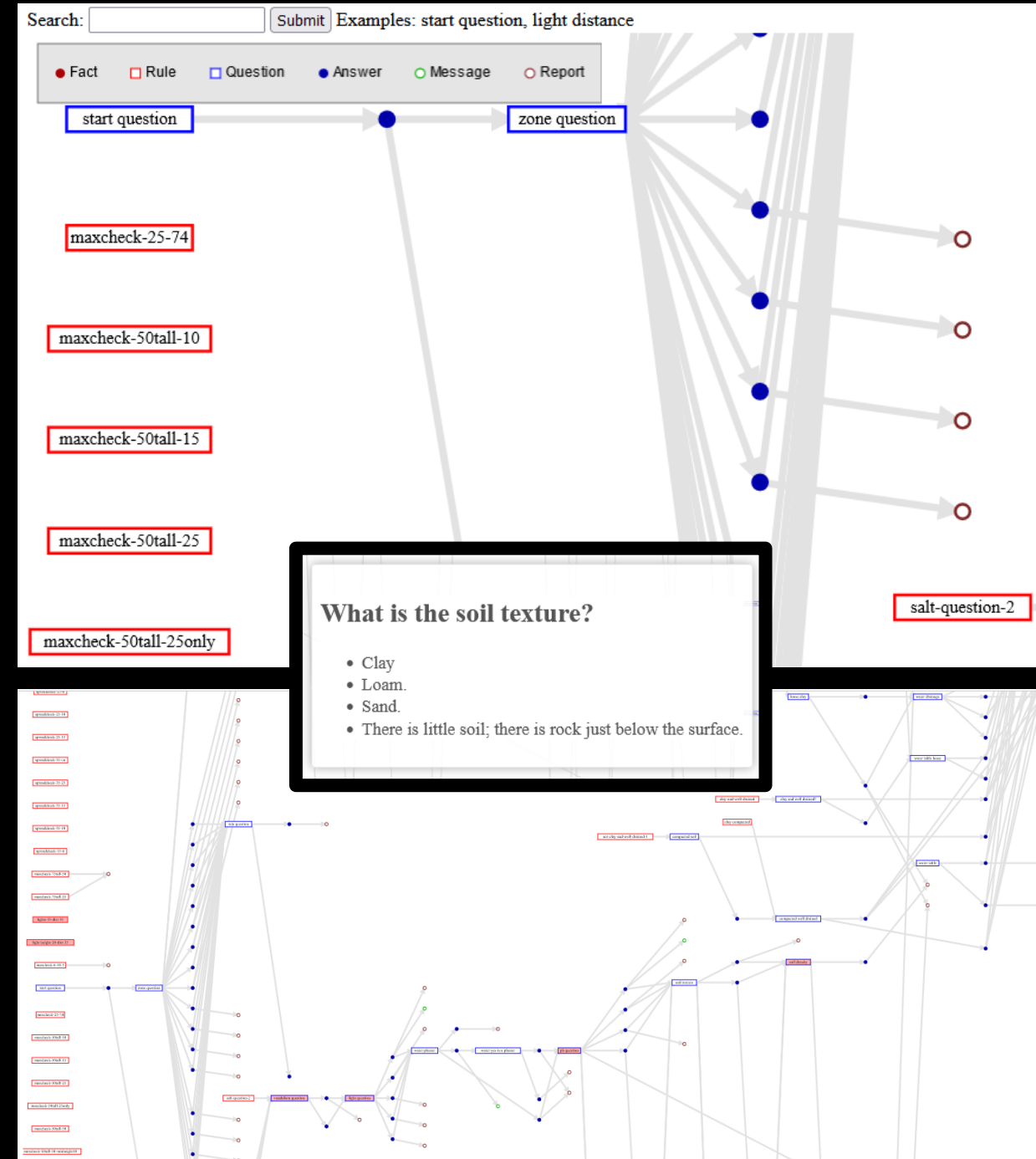
Search Trees
by
Characteristics



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

SOUTHERN TREES FACT SHEETS PUBLICATIONS

- *Abies concolor*: White Fir
- *Abies concolor* *Violacea*: *Violacea* White Fir
- *Abies firma*: Japanese Fir
- *Acacia auriculiformis*: Earleaf acacia

676 tree species
fact sheets

SHRUBS FACT SHEETS PUBLICATIONS

- *Abelia x grandiflora*: Glossy Abelia
- *Abelia x grandiflora* 'Edward Goucher': Edward Goucher Glossy Abelia
- *Abelia x grandiflora* 'Sherwoodii': Sherwoodii Glossy Abelia



RELATED RESOURCES

Environmental Horticulture Department
(ENH)

Crown uniformity: symmetrical
Crown shape: spreading, round
Crown density: moderate
Growth rate: fast
Texture: medium

Add Photos

Quercus muehlenbergii: Chinkapin Oak¹

Edward F. Gilman and Dennis G. Watson²

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 yellow/green, deciduous, lobed leaves turn shades of red, yellow, orange, and brown before dropping in fall. Veins are distinctly prominent on the undersides of the coarse-textured leaves. The acorns which are produced are edible.



Figure 1. Middle-aged *Quercus muehlenbergii*: chinkapin oak
Credits: Ed Gilman, UF/IFAS

General Information

Scientific name: *Quercus muehlenbergii*
Pronunciation: KWERK-us mew-len-BER-jee-eye
Common name(s): Chinkapin oak, chestnut oak
Family: Fagaceae
USDA hardiness zones: 3A through 8B (Fig. 2)
Origin: native to North America
Invasive potential: little invasive potential
Uses: reclamation; street without sidewalk; shade; highway median; parking lot island > 200 sq ft; tree lawn > 6 ft wide
Availability: somewhat available, may have to go out of the region to find the tree



Figure 2. Range

Description

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

Updates

Foliage

Leaf arrangement: alternate (Fig. 3)
Leaf type: simple
Leaf margin: dentate, undulate
Leaf shape: elliptic (oval), oblong, lanceolate, obovate
Leaf venation: pinnate
Leaf type and persistence: deciduous
Leaf blade length: 4 to 8 inches
Leaf color: green
Fall color: yellow
Fall characteristic: showy

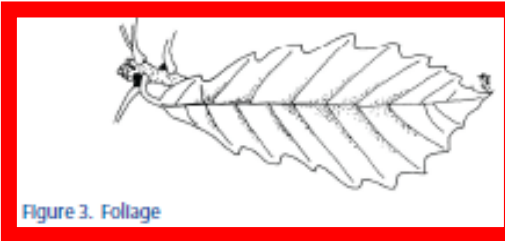


Figure 3. Foliage

Flower

Flower color: brown
Flower characteristics: not showy

Fruit

Fruit shape: oval, round
Fruit length: .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

Culture

Light requirement: full sun
Soil tolerances: clay; sand; loam; alkaline; acidic; occasionally wet; well-drained
Drought tolerance: high
Aerosol 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

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 are 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.

Add Wind Resistance

Florida Trees

For Urban and Suburban Sites



Find Trees
Recommended
for your Site



Search Trees
by Their
Characteristics



Identify a Tree

Value of the Site?

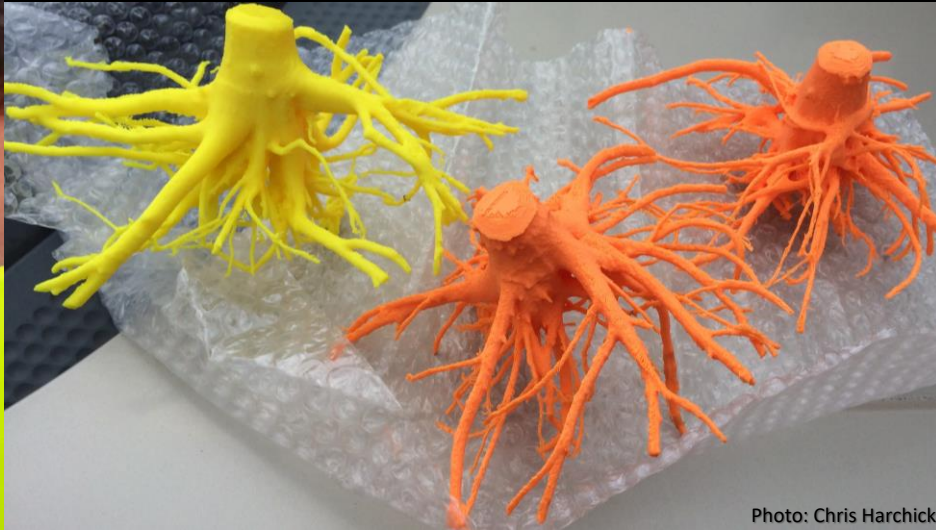
- Contains numerous educational materials & tools
- Specific to FL species & urban conditions
- Tree selection based on desired characteristics & site conditions
- Website - easy-to-use
- Mobile Friendly - accessible in the field
- Right tree in the right place



Wind-Tree-Soil-Root Interaction During Hurricanes

- 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

Leica ScanStation P50 – Long Range 3D Terrestrial Laser Scanner



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?

