The *Office of Sustainability and Climate* welcomes you our webinar on

Drought and Urban Forests

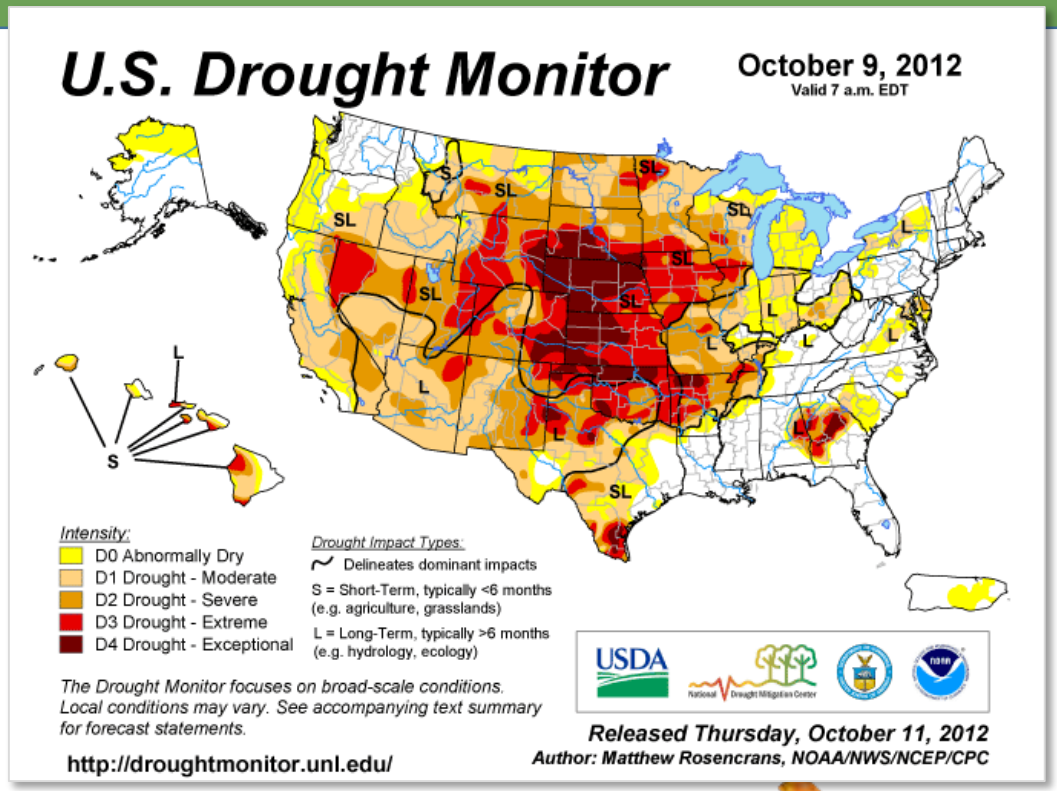
This webinar will be presented live on July 25, 2017 at 2PM Eastern via the Climate Science Webinar Portal.

For 'on-demand' viewing of this webinar or others presented by the USDA Forest Service Office of Sustainability and Climate, visit the Climate Science Webinar Portal at http://ClimateWebinars.net

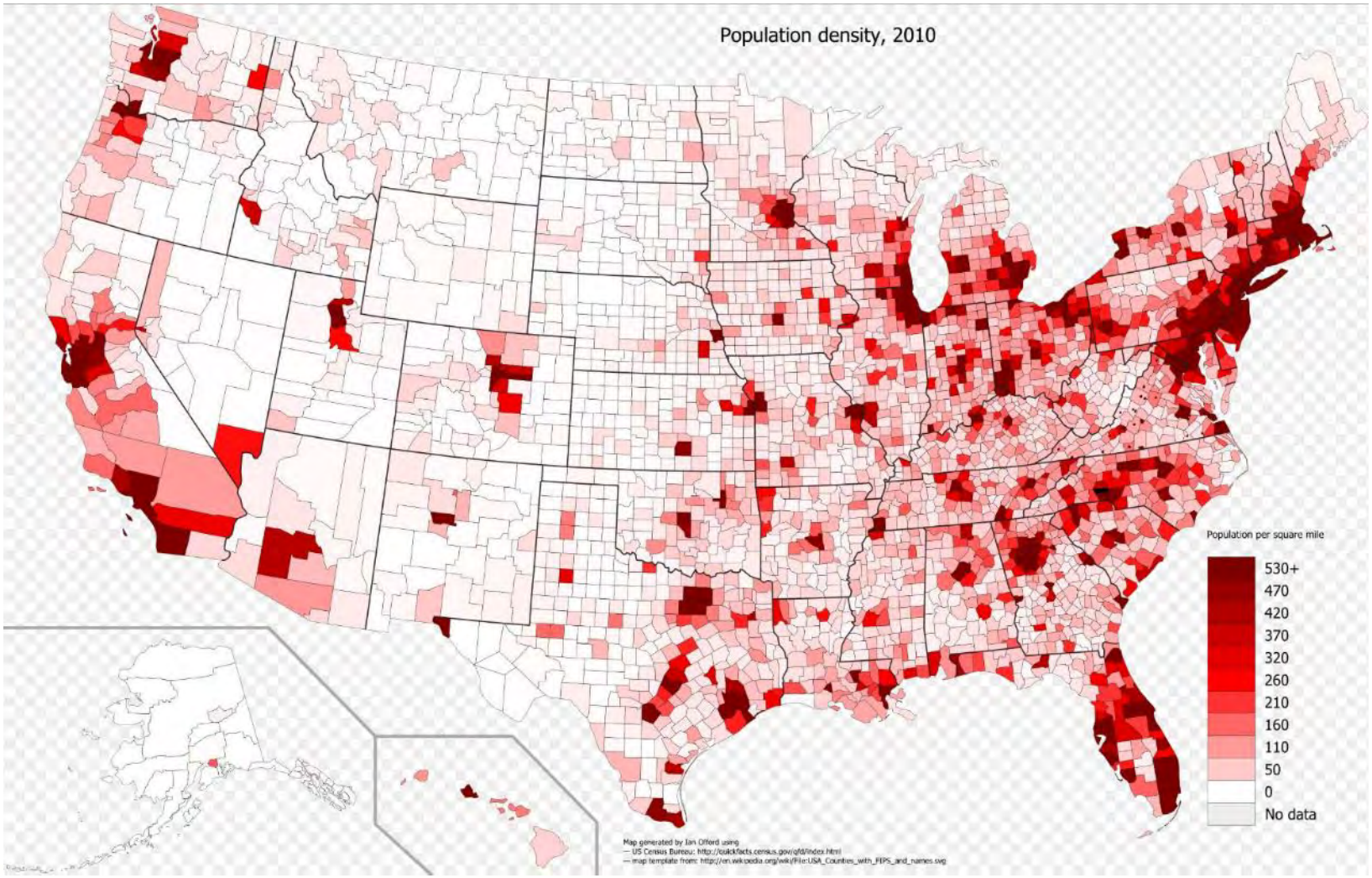
Drought and Urban Forests

Dixie Porter, Deputy Director Office of Sustainability and Climate

Drought – an increasing challenge nationwide



80.7% US Population live in urban areas: 2010 Census

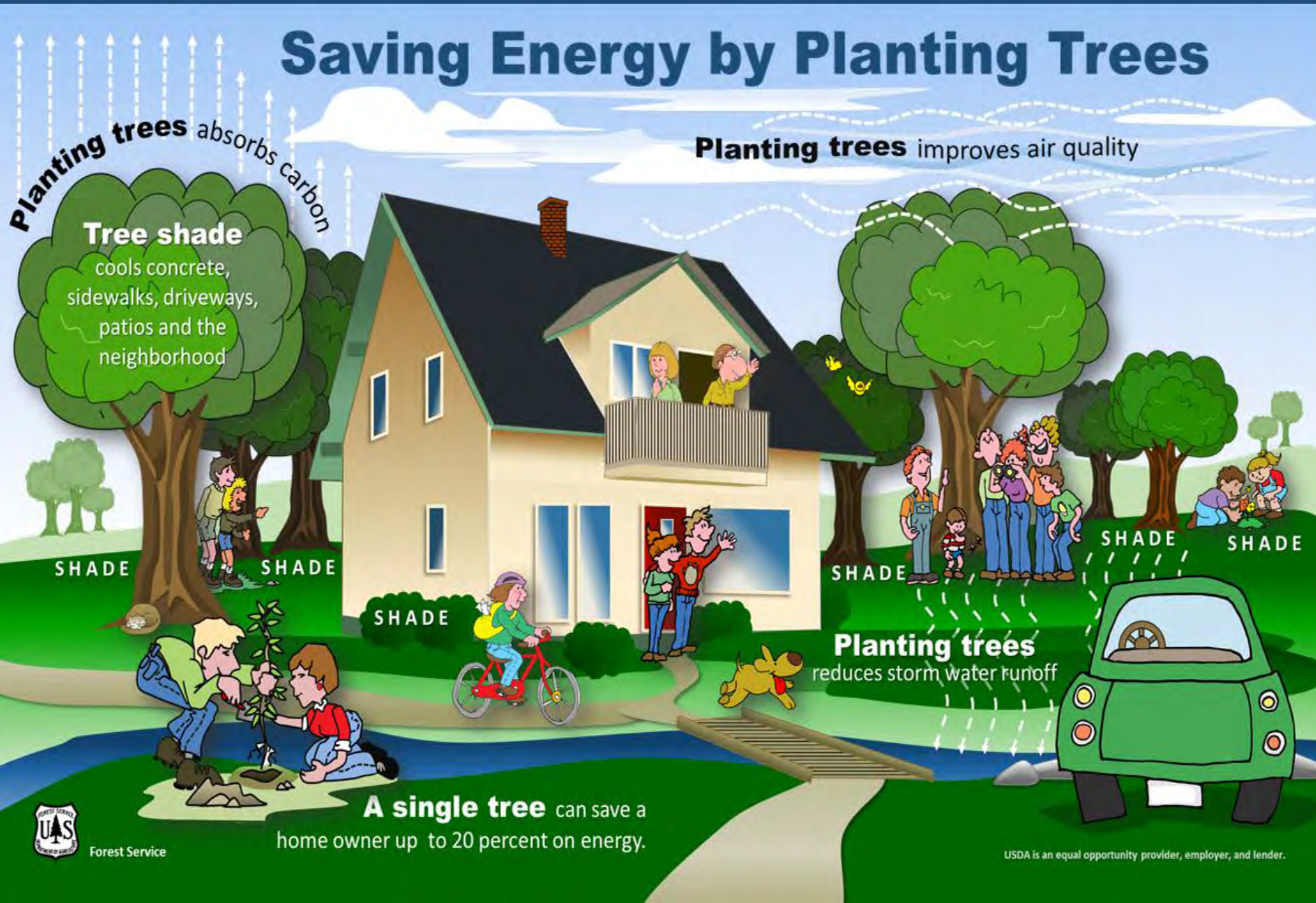


Benefits of Urban Forests

- Air and Water Quality
- Wildlife Habitat
- Health and well-being
- Lower energy costs
- Property values increase
- Recreation

USDA
United States Department of Agriculture

Saving Energy by Planting Trees



Forest Service

Adaptation Actions: Drought and Urban Forests

- Drought tolerant tree species
- Prioritize what trees get water
- Lessons learned in other areas
- Monitoring

Drought and Urban Forests

Steve Koehn, Director of Cooperative Forestry

Tree Health Assessment in the City

Richard Hallett
Research Ecologist
USDA Forest Service
NYC Urban Field Station

NYC Parks

Natural Areas Conservancy

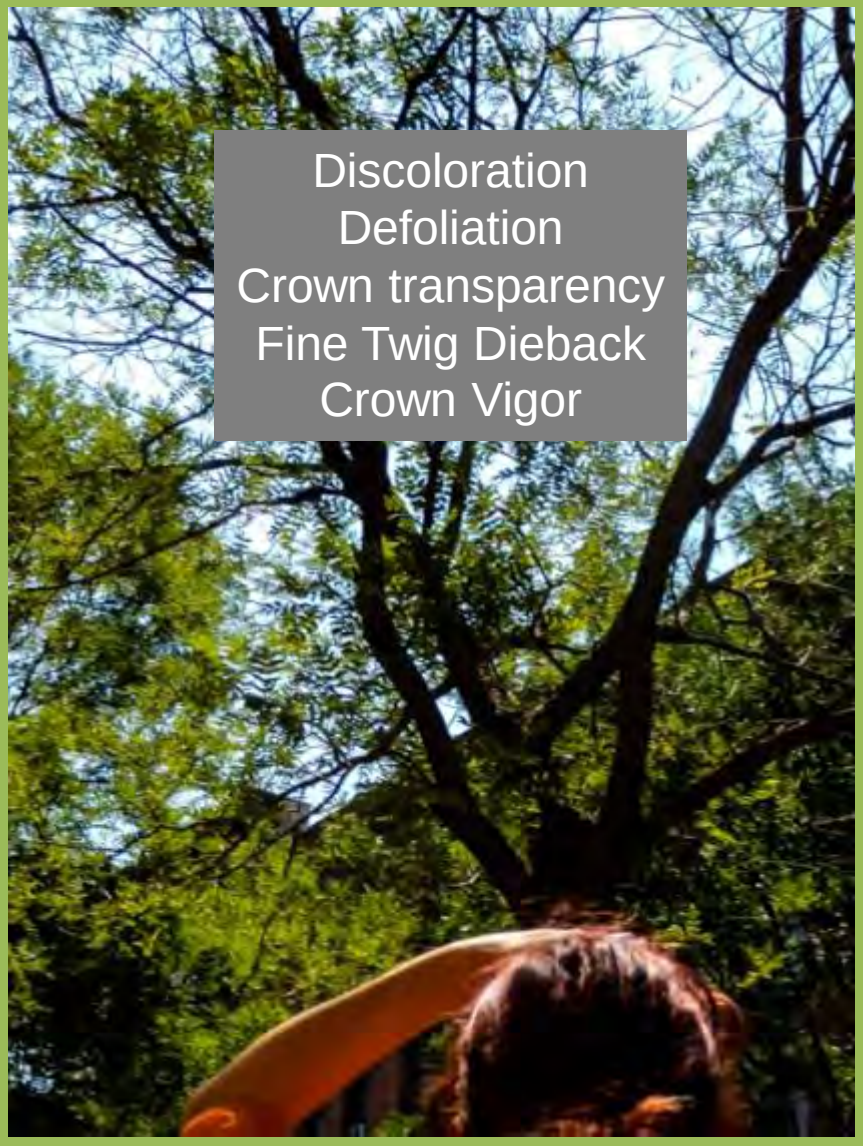
Moving beyond alive/dead.

If your primary care physician could only tell you if you were alive or dead you might want to find a different doctor…

Tree Health Assessment Method Criteria

- Quantify the full range of tree stress
- Non diagnostic
- Accessible for the non-expert
- Quantitative
- Consistent and verifiable
- Scientifically valid and rigorous

We focused on the crown of the tree.



Healthy Trees, Healthy Cities App

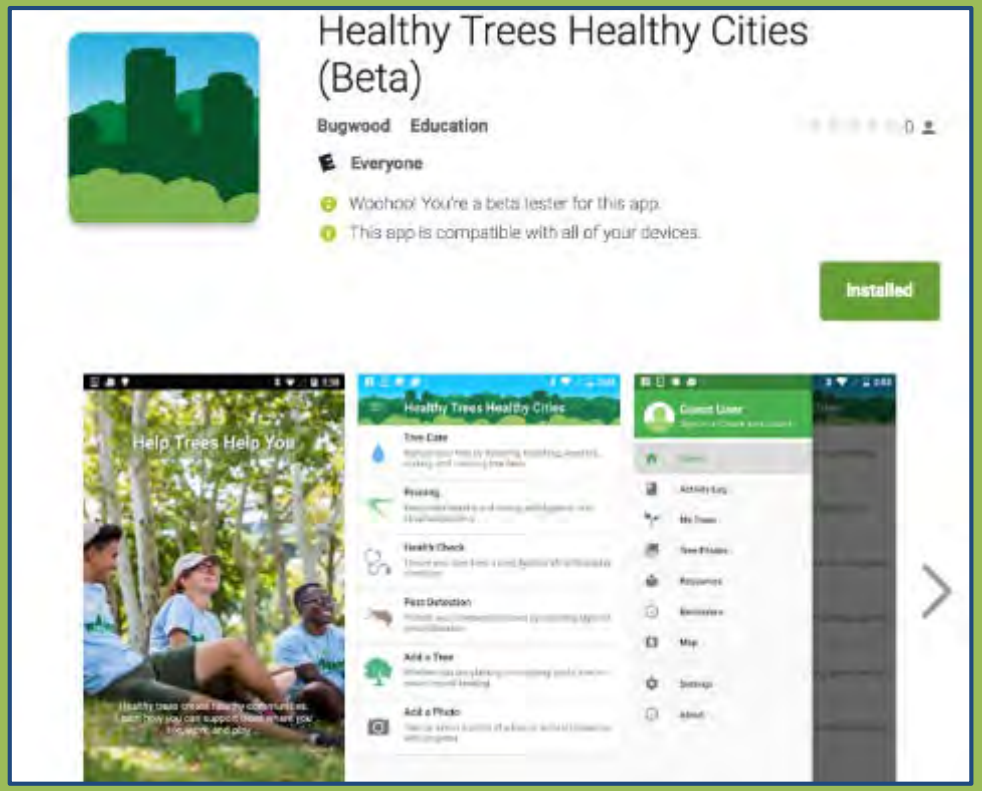
HEALTHY TREES · HEALTHY CITIES

Apple and Android App Stores

“Healthy Trees Healthy Cities”

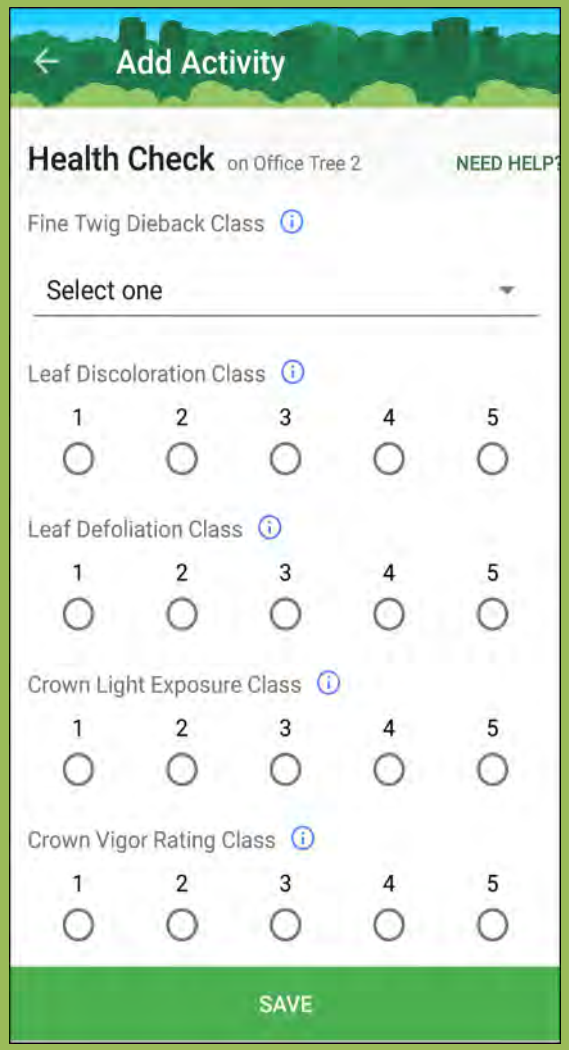
Download on the App Store

ANDROID APP ON Google play



Healthy Trees, Healthy Cities App

HEALTHY TREES · HEALTHY CITIES



Leaf Discoloration

Consider the combined leaf area of the crown.

- Class 1: 0-1% (trace)
- Class 2: 2-25%
- Class 3: 26-50%
- Class 4: 51-75%
- Class 5: 76-100%

Defoliation

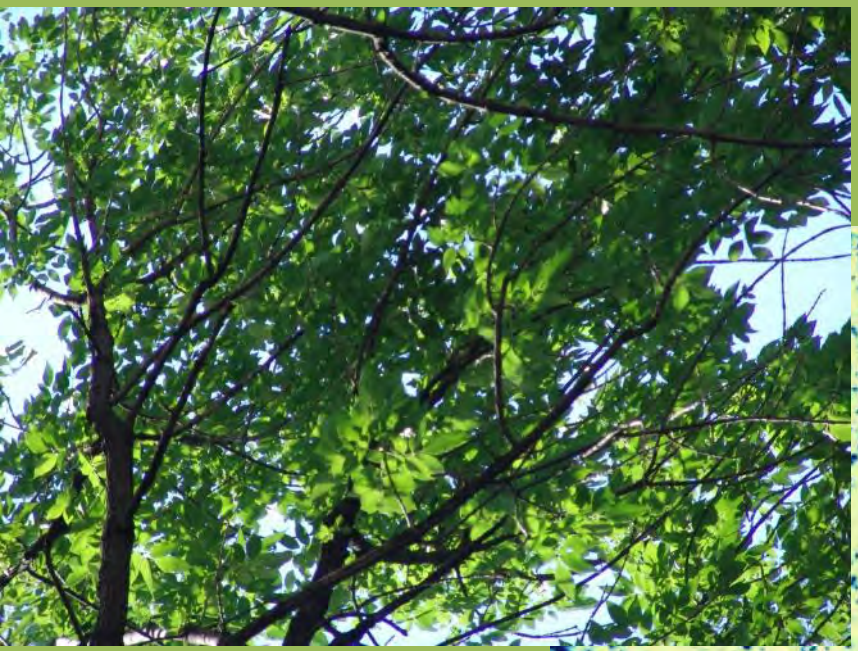
Consider the combined leaf area of the crown.

- Class 1: 0-1% (trace)
- Class 2: 2-25%
- Class 3: 26-50%
- Class 4: 51-75%
- Class 5: 76-100%

Fine Twig Dieback

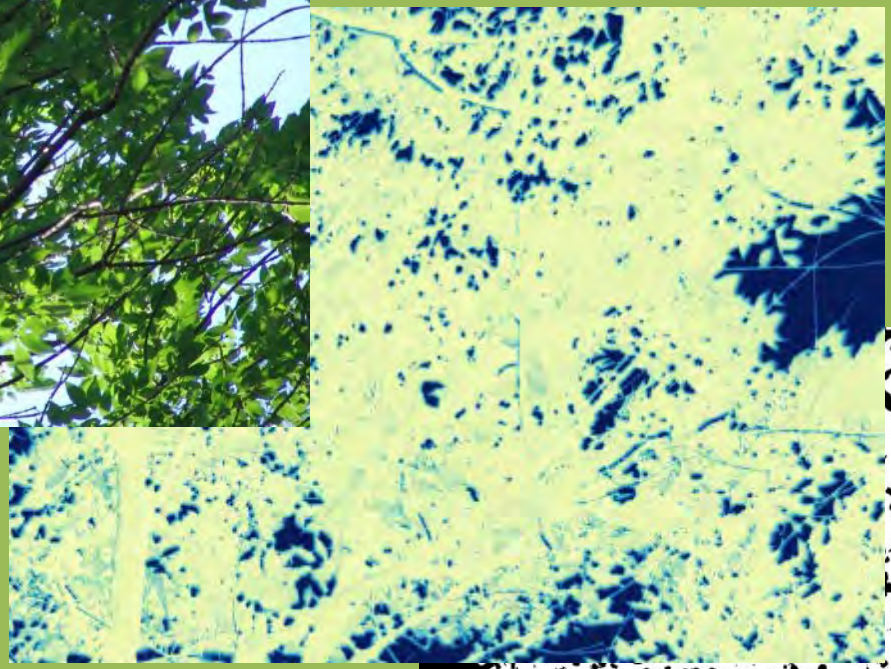
- Values:
  - 0-1% → none to trace
- Then 5% classes:
  - 2-5%
  - 6-10%
  - … etc
  - 90-95%
  - 96-99%
  - 100% → lots of dieback

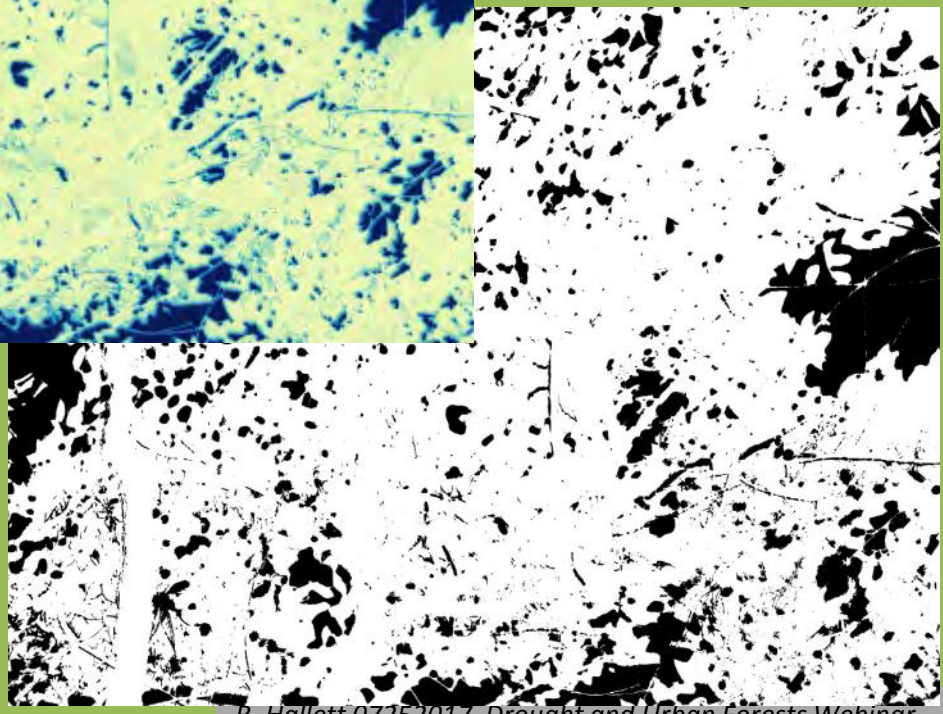
Canopy Transparency



Digital Photo taken vertically.

Higher transparency means the tree is allocating fewer resources to making leaves.





Automatically processed to count the number of pixels that are sky. Percent transparency is calculated.

Vigor

- Class 1:
  - Reasonably good health
  - No major branch loss
  - Less than 10% cumulative fine twig dieback, defoliation, and/or discoloration
- Class 2:
  - < 26% Major branch loss
  - 10-25% cumulative fine twig dieback, defoliation, and/or discoloration
- Class 3: <50% major branch loss and/or 26-50% cumulative…
- Class 4: > 50% major branch loss and/or >50% cumulative…
- Class 5: dead

Measuring Tree Stress

Non-Stressor Specific Evaluation of Tree Health

Methods adapted from:

Pontius, J., & Hallett, R. (2014). Comprehensive methods for earlier detection and monitoring of forest decline. Forest Science, 60(2).

Early Signs

Later Signs

Variable	Notes
Discoloration	Visual estimate
Defoliation	Visual estimate
Transparency	Digital estimate
Dieback	Visual estimate
Crown Vigor	Visual estimate

$$z = \frac{(X - \bar{X})}{s}$$

Tree Stress Index

$$\bar{X}\left(z_{Discoloration} + z_{Defoliation} + z_{Transparency} + z_{Dieback} + z_{Crown\,Vigor}\right)$$

Tree 36
Stress Index -0.783

Tree 71
Stress Index -.409

Tree 45
Stress Index -0.191

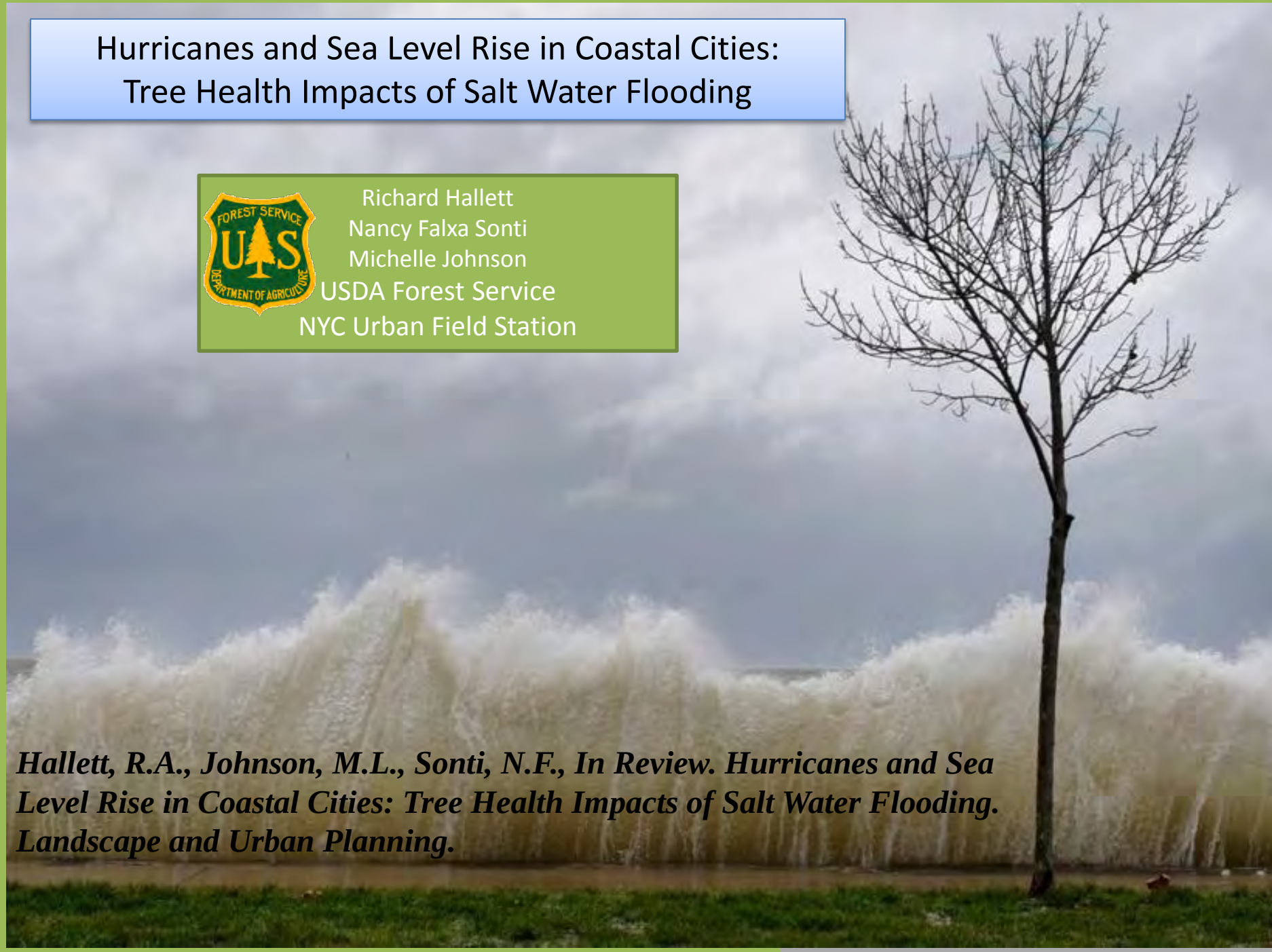
Tree 75
Stress Index -0.009

Tree 77
Stress Index 0.81

Tree 65
Stress Index 1.3

Hurricanes and Sea Level Rise in Coastal Cities: Tree Health Impacts of Salt Water Flooding

Richard Hallett
Nancy Falxa Sonti
Michelle Johnson
USDA Forest Service
NYC Urban Field Station



Hallett, R.A., Johnson, M.L., Sonti, N.F., In Review. Hurricanes and Sea Level Rise in Coastal Cities: Tree Health Impacts of Salt Water Flooding. Landscape and Urban Planning.

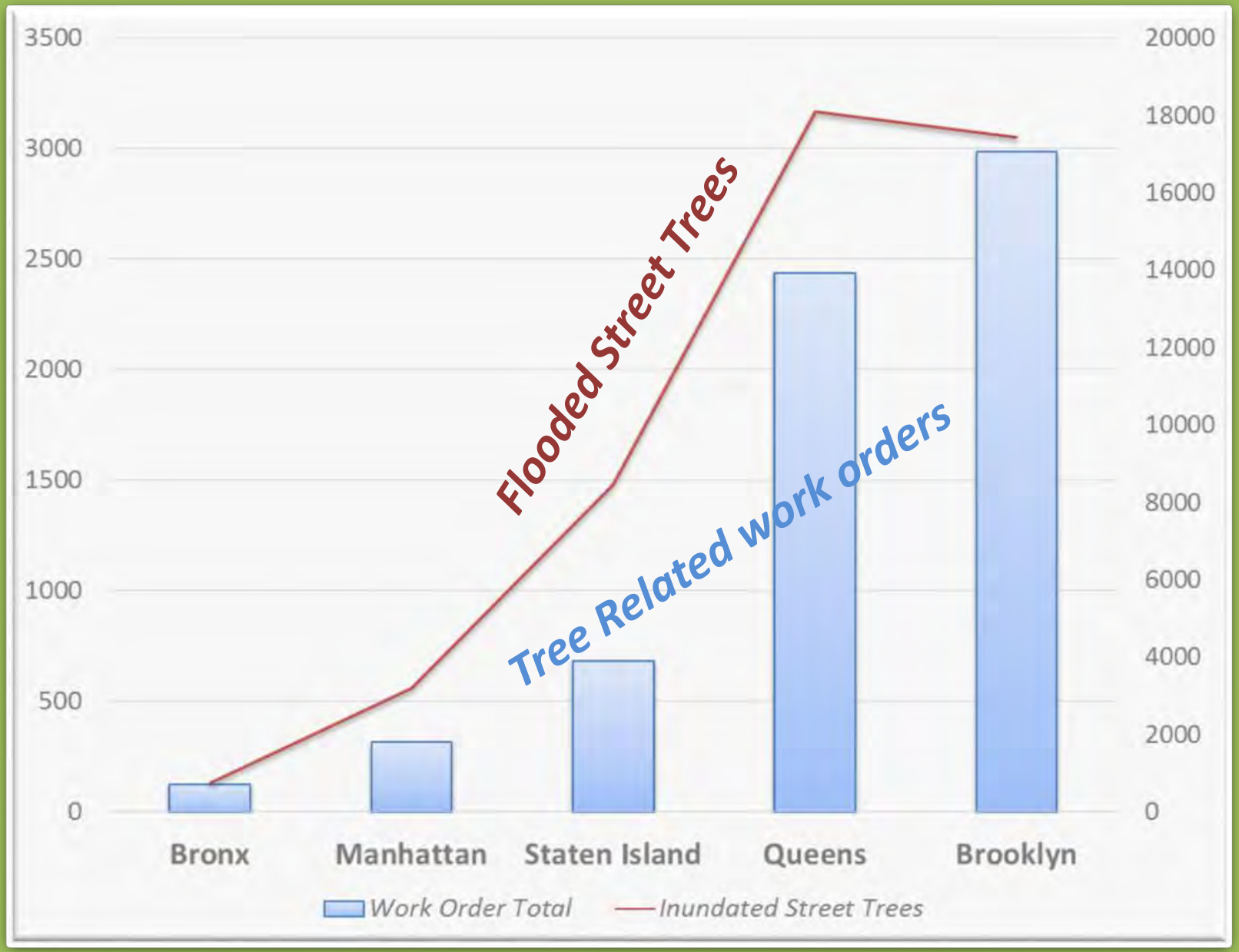
20,000 fallen trees in NYC

48,000 street trees were located in Sandy's inundation zone.

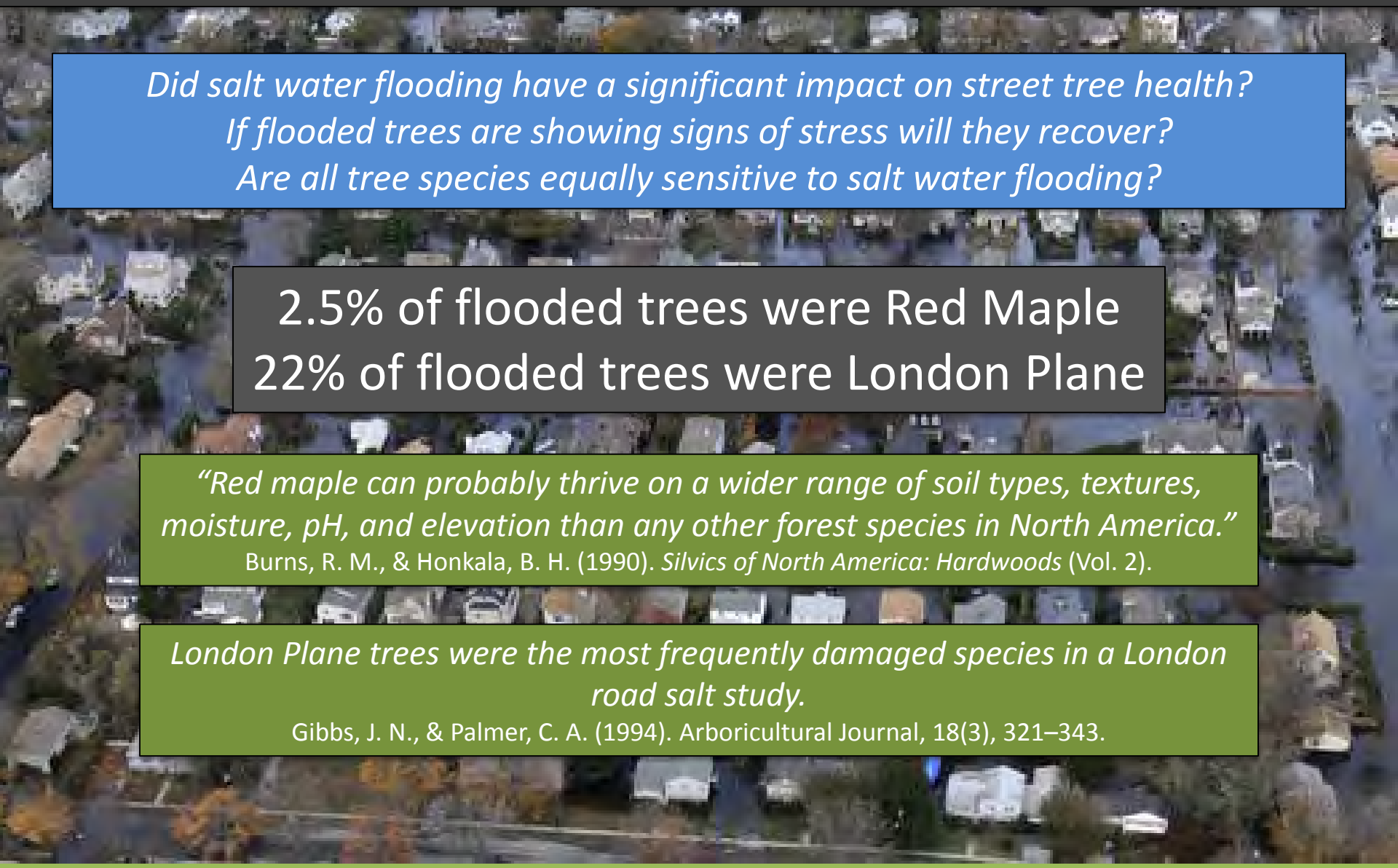
Post-Sandy
Late Leaf Out Survey

- Street trees in the inundation zones were not leafing out as expected in the spring of 2013.
- NYC Parks deployed 35-50 Foresters at the end of June/beginning of July in 2013 and again in August/September of 2014 – Trees were assessed for percent of expected leaf out in five classes - 0%, 25%, 50%, 75% or 100% leafed out.

Parks


# of tree related work orders.
# of inundated street trees.
3500
3000
2500
2000
1500
1000
500
0
20000
18000
16000
14000
12000
10000
8000
6000
4000
2000
0
Flooded Street Trees
Tree Related work orders
Bronx
Manhattan
Staten Island
Queens
Brooklyn
Work Order Total
Inundated Street Trees

48,000 street trees were located in Sandy's inundation zone.

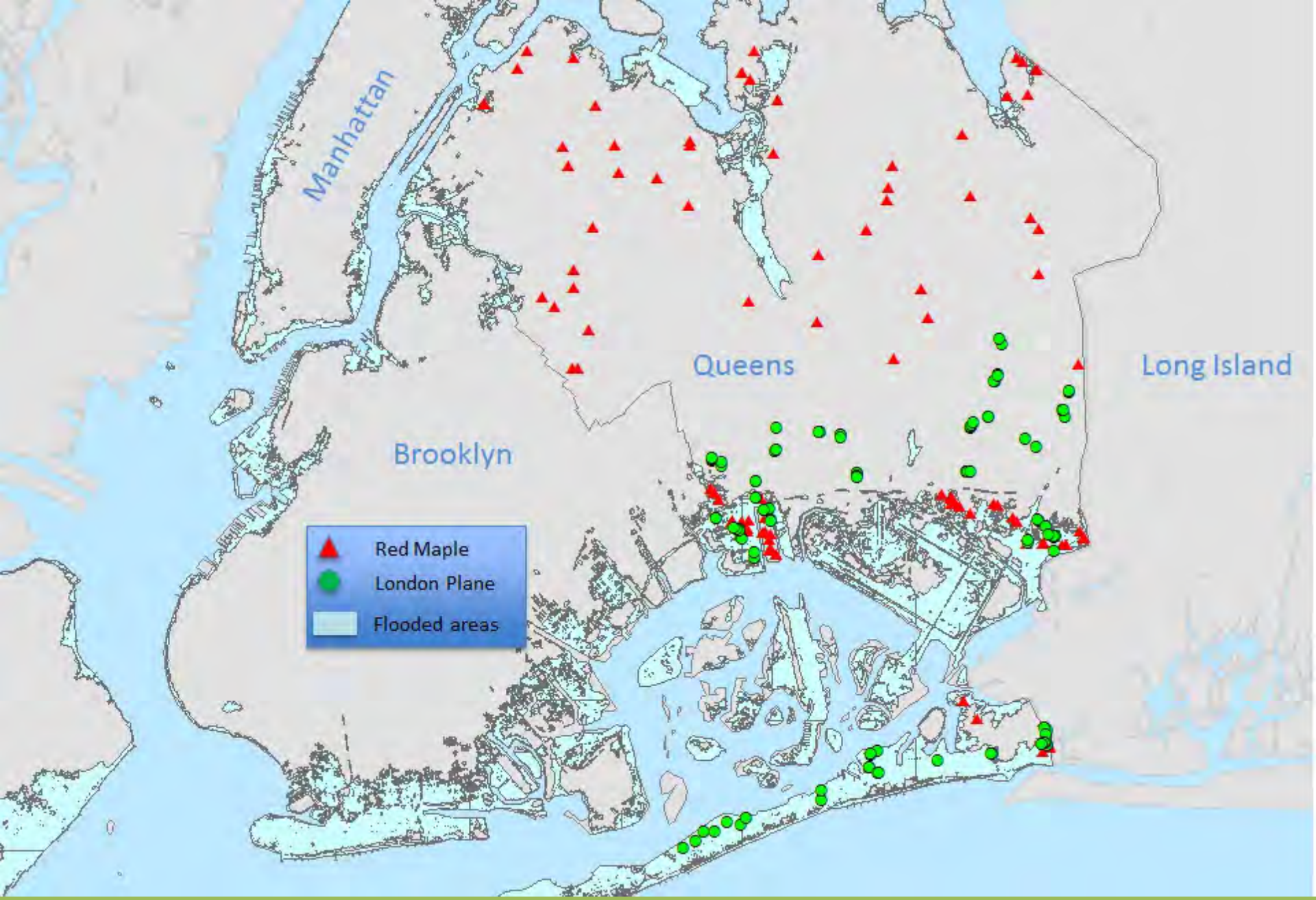


Did salt water flooding have a significant impact on street tree health?
If flooded trees are showing signs of stress will they recover?
Are all tree species equally sensitive to salt water flooding?

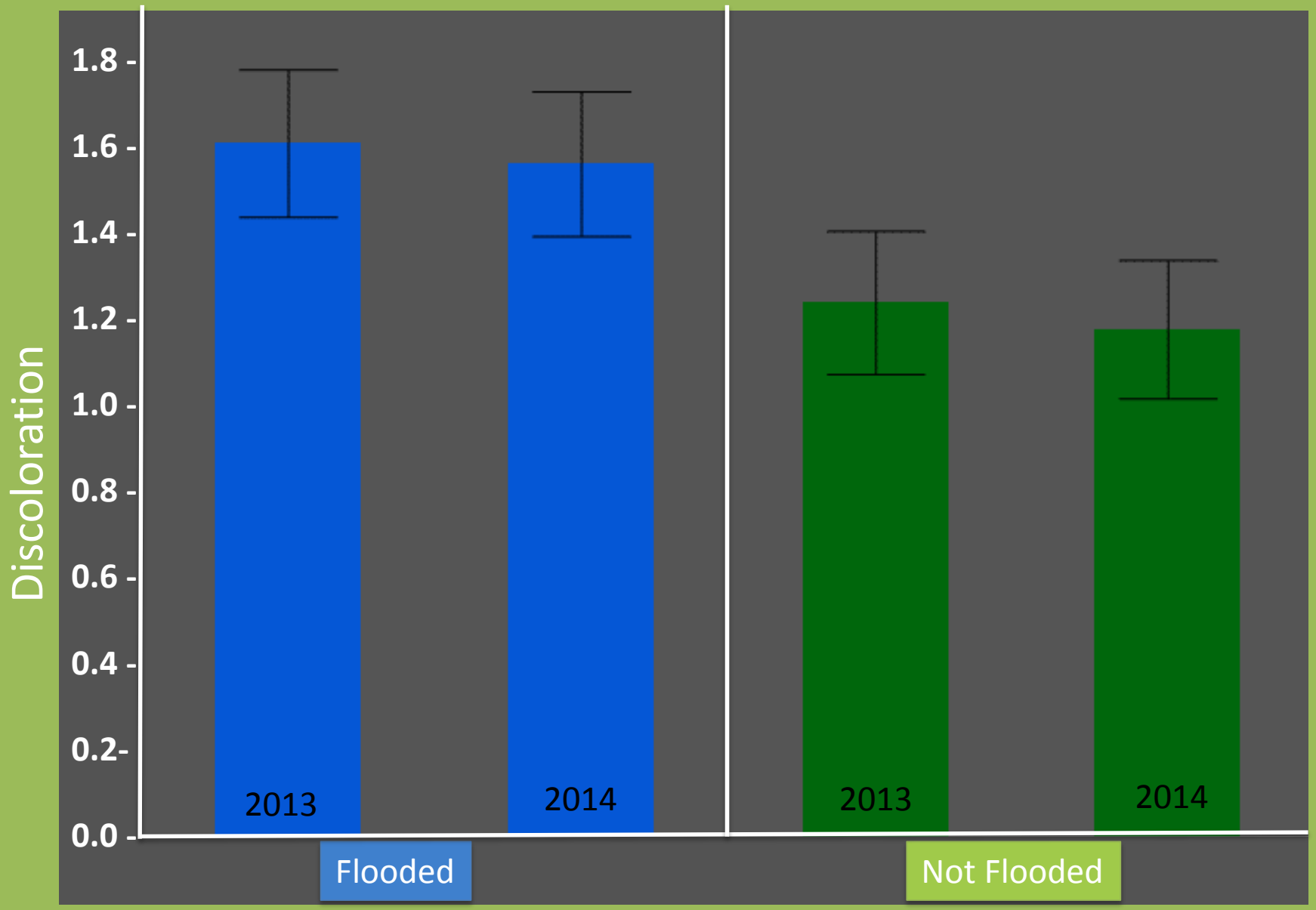
2.5% of flooded trees were Red Maple
22% of flooded trees were London Plane

"Red maple can probably thrive on a wider range of soil types, textures, moisture, pH, and elevation than any other forest species in North America."
Burns, R. M., & Honkala, B. H. (1990). *Silvics of North America: Hardwoods* (Vol. 2).

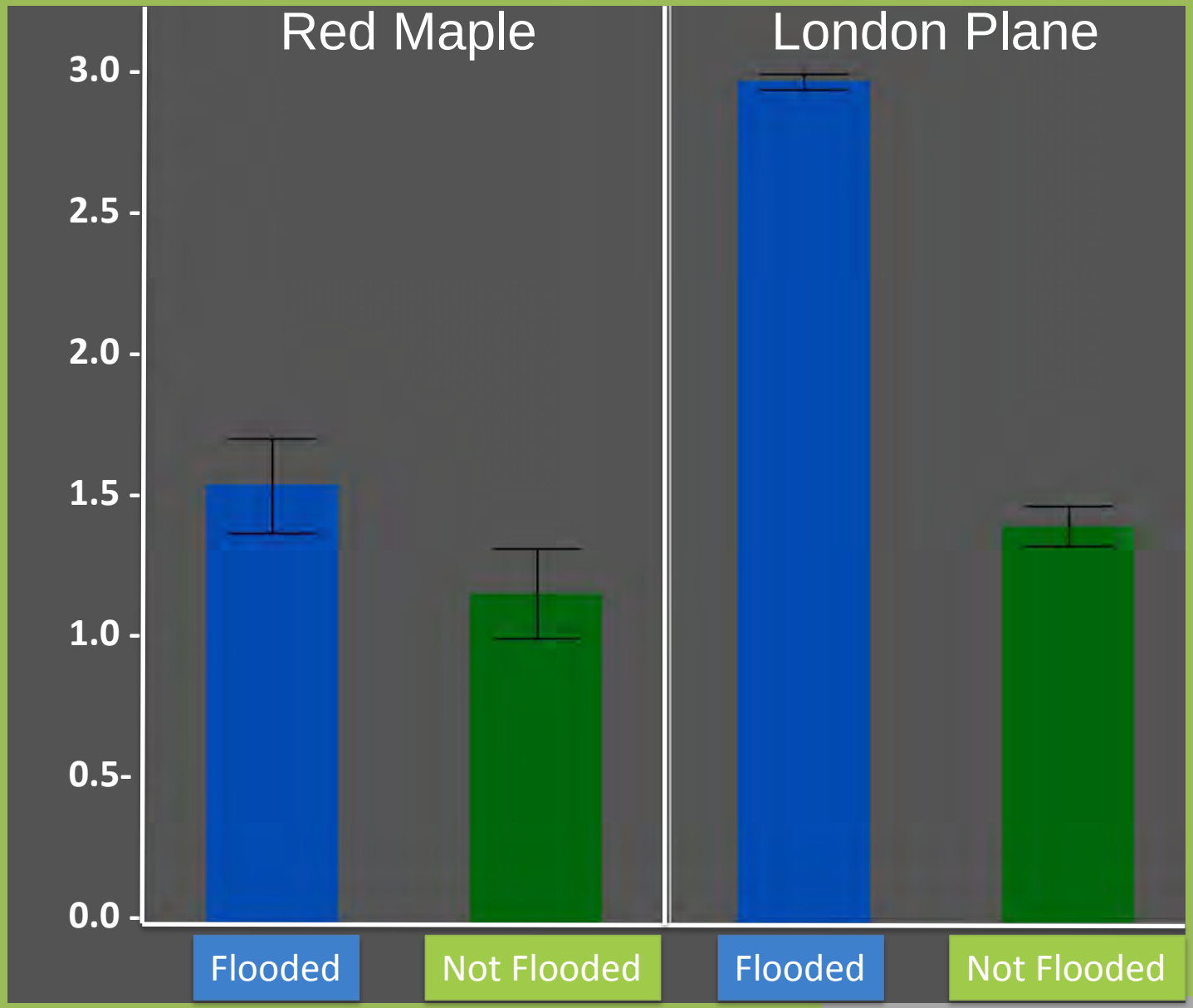
London Plane trees were the most frequently damaged species in a London road salt study.
Gibbs, J. N., & Palmer, C. A. (1994). Arboricultural Journal, 18(3), 321–343.


Manhattan
Queens
Long Island
Brooklyn
Red Maple
London Plane
Flooded areas

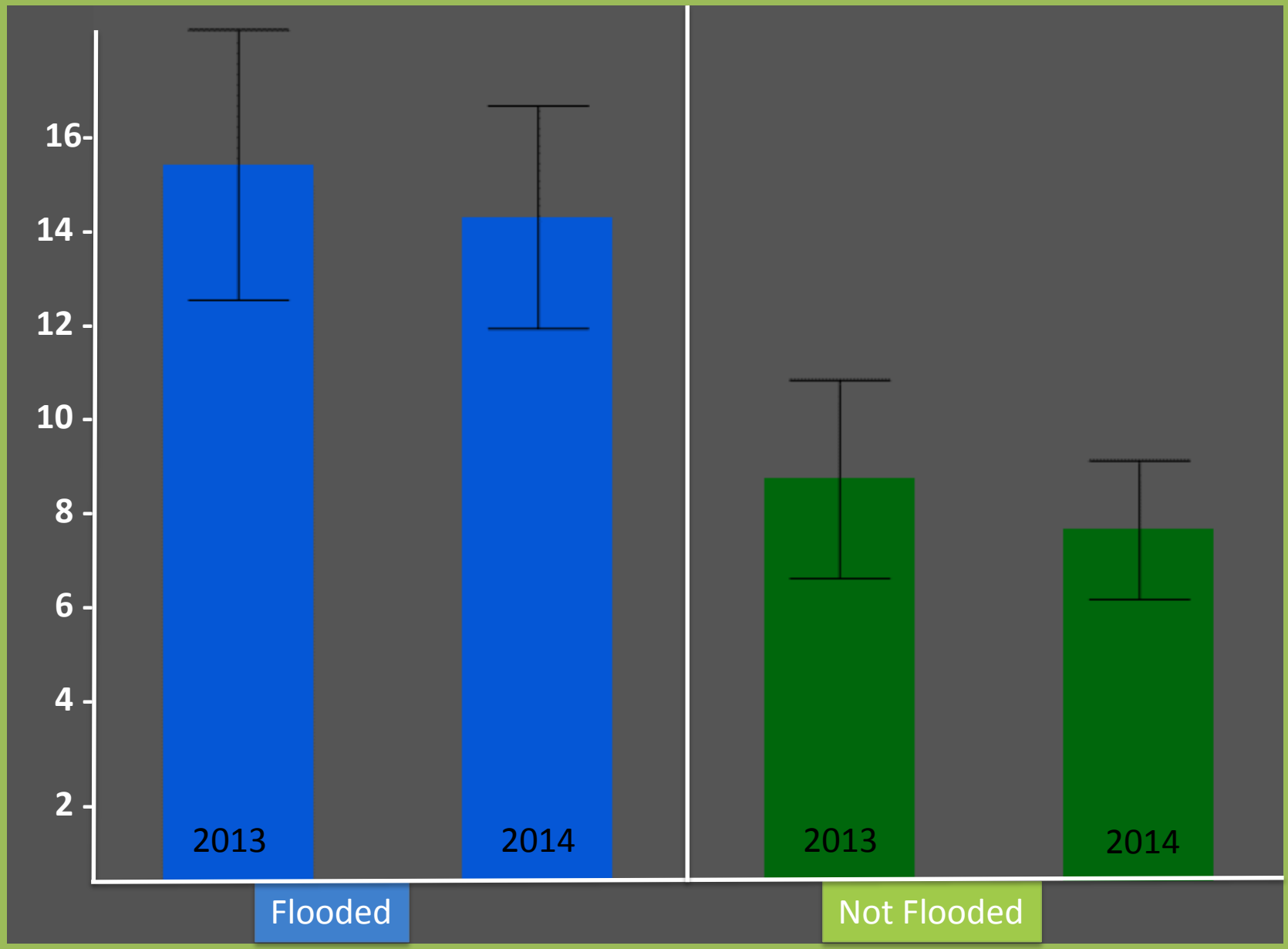
Red Maple Discoloration
1 and 2 years post Sandy



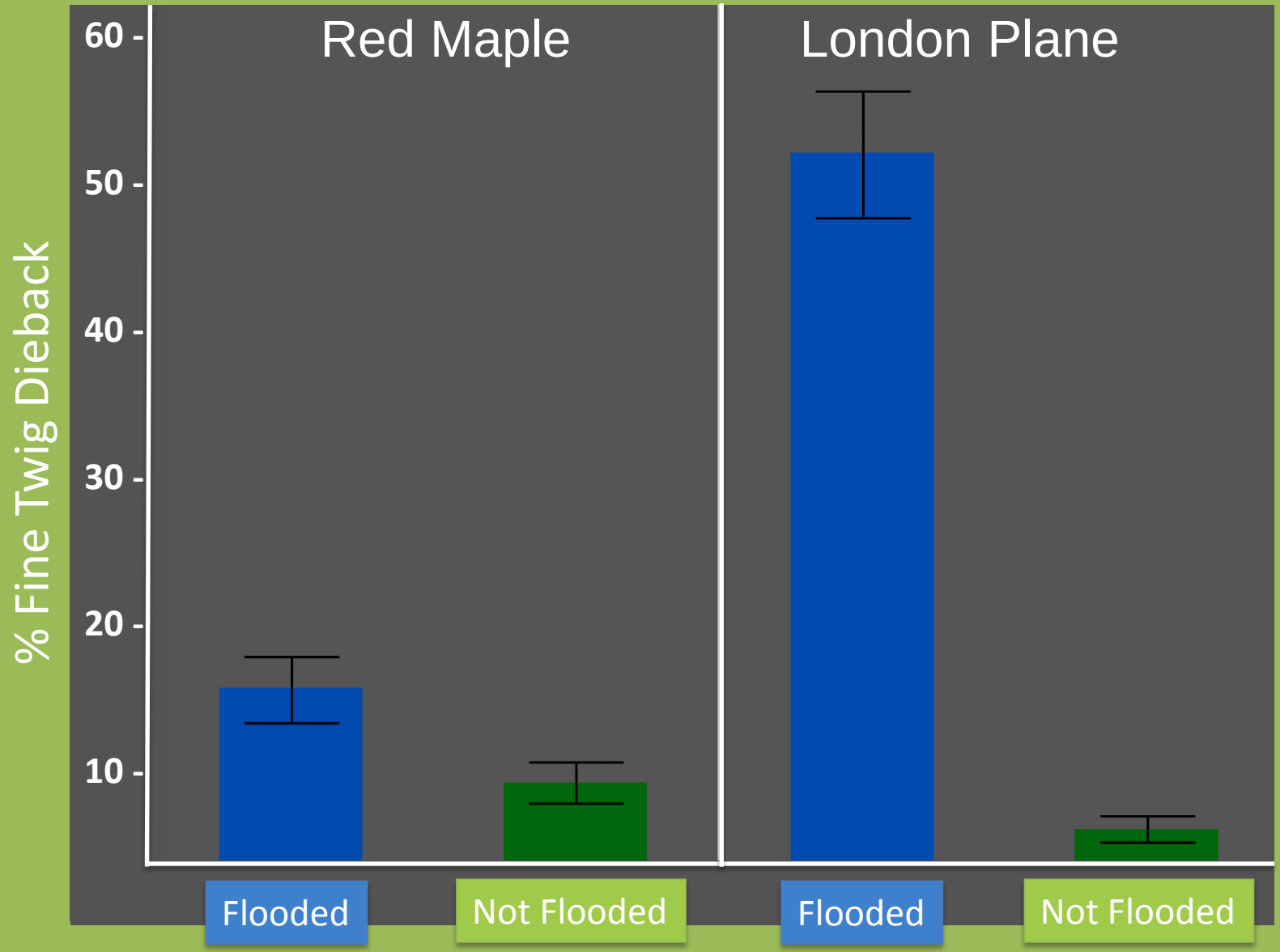
Discoloration 2014
2 years post Sandy



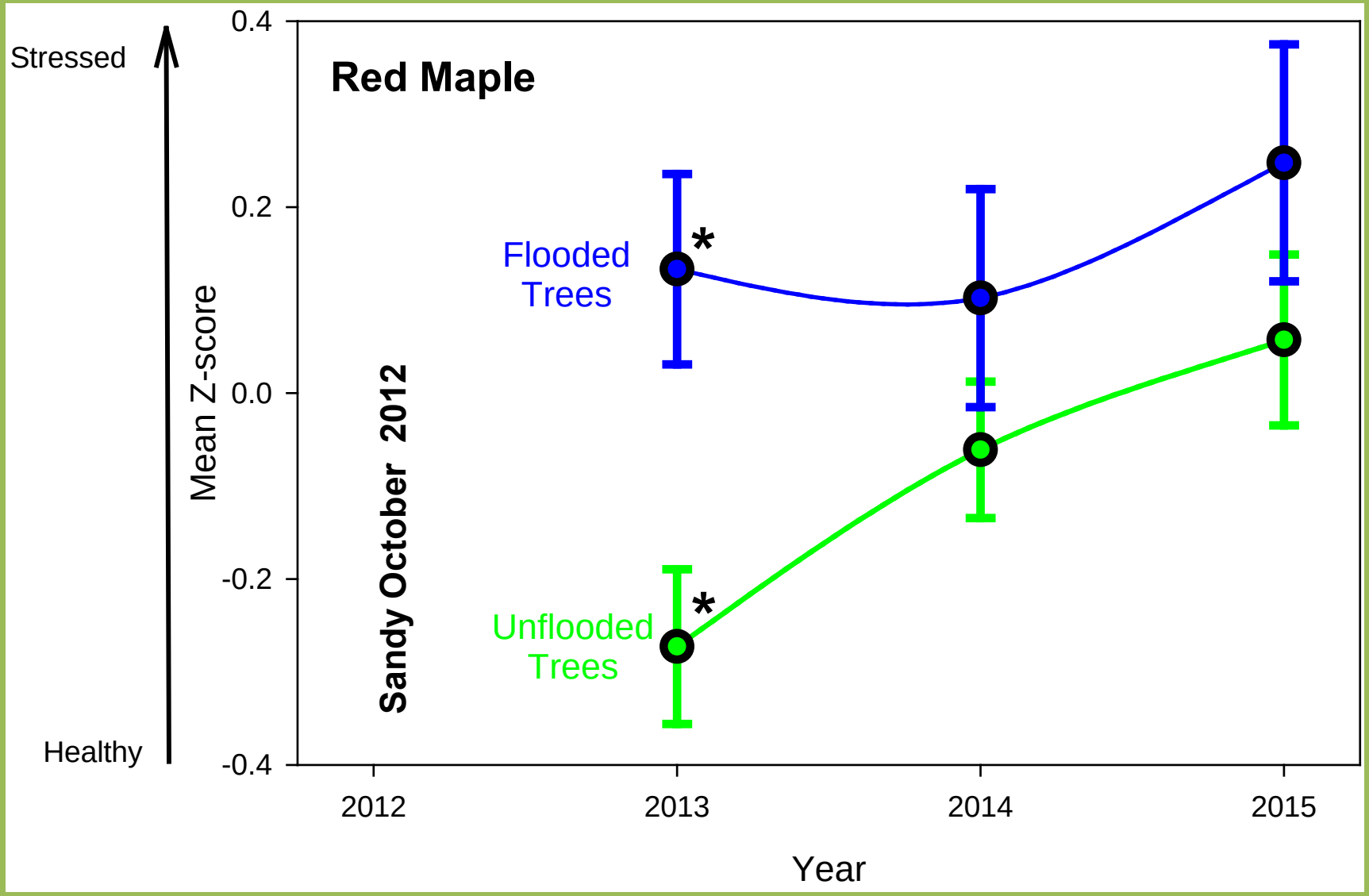
Red Maple Fine Twig Dieback
1 and 2 years post Sandy



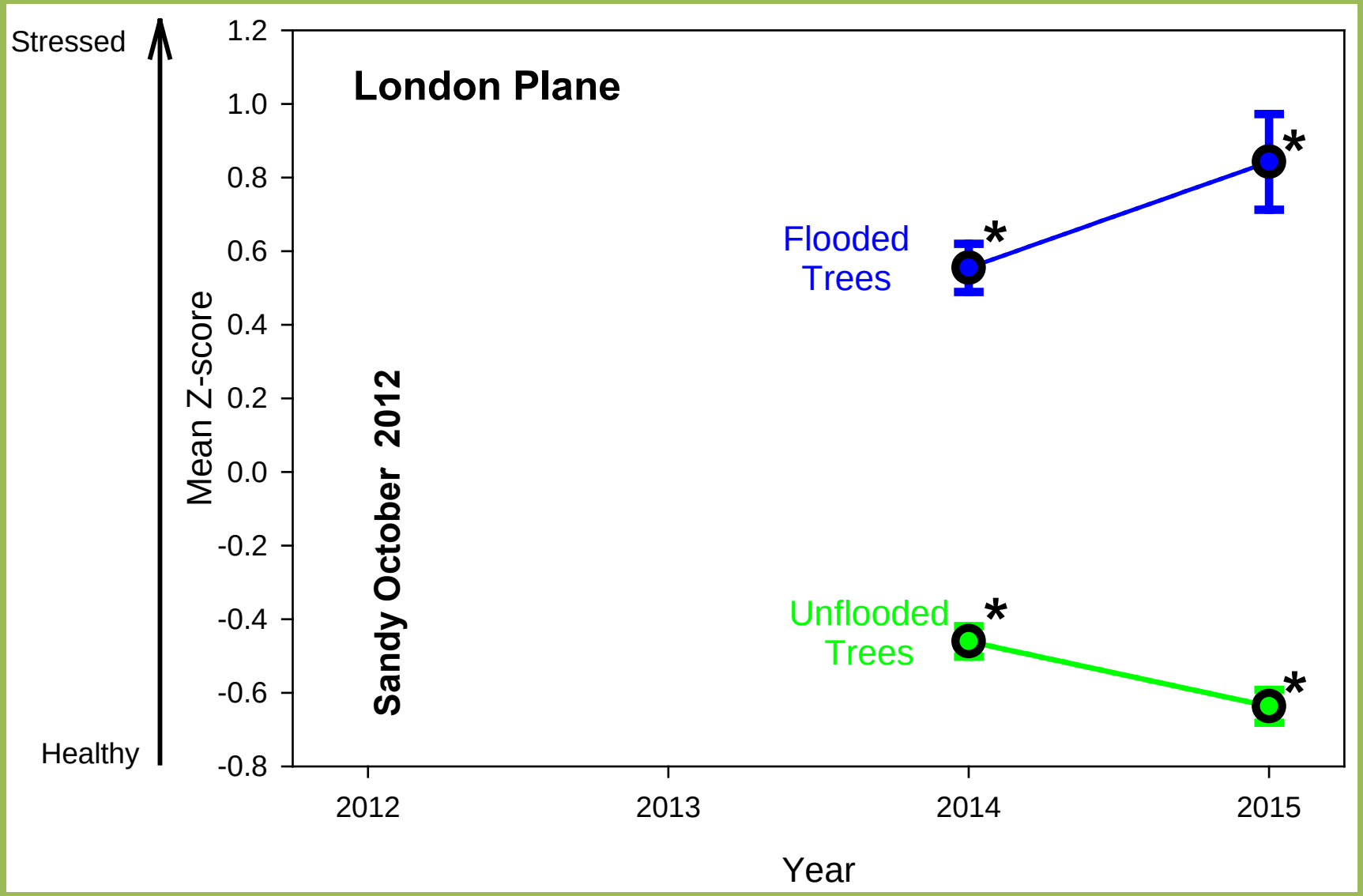
Fine Twig Dieback 2014
2 years post Sandy



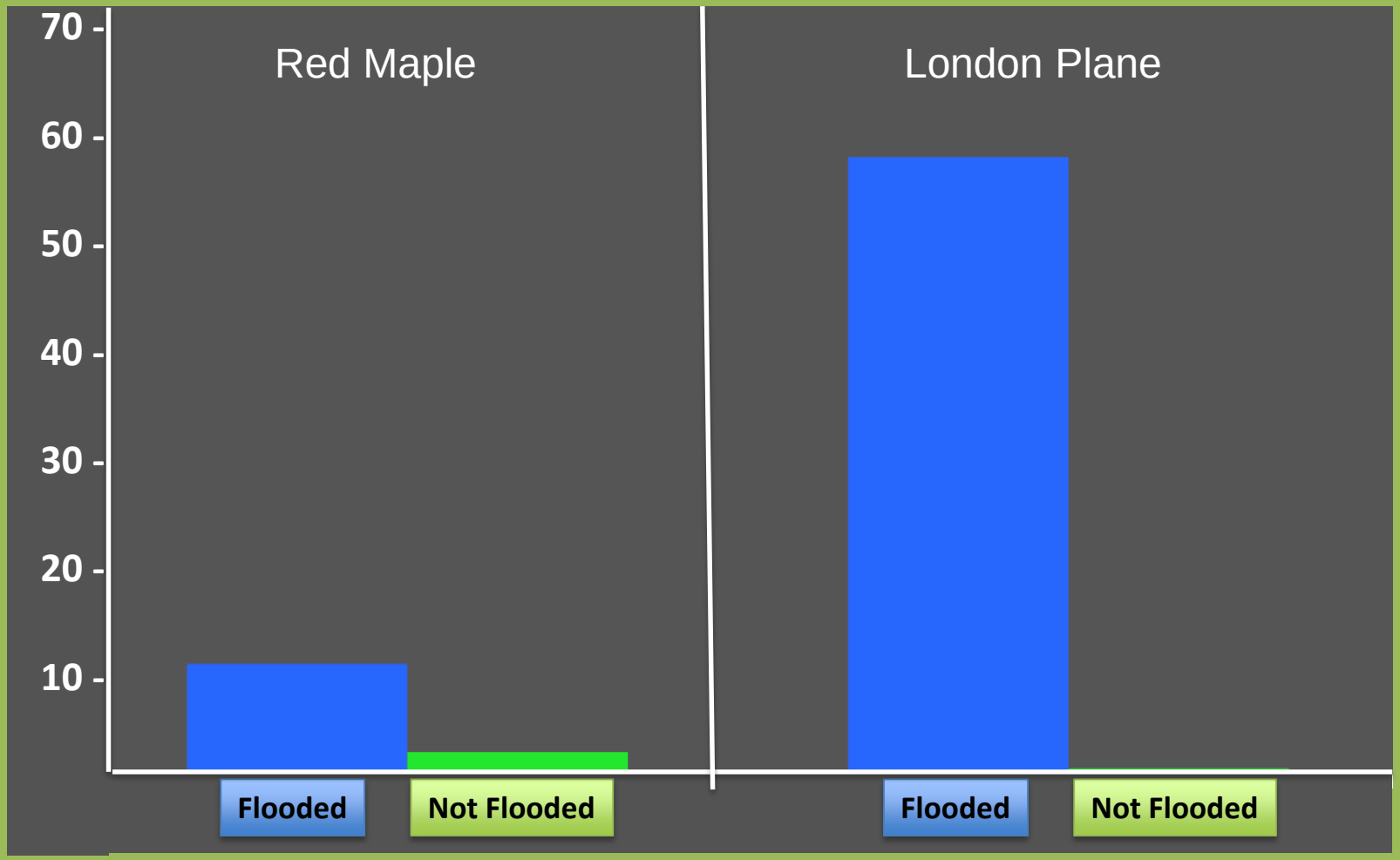
Overall Stress Index
Red Maple



Overall Stress Index
London Plane



Overall Mortality
% of Study Trees



48,000 street trees were located in Sandy's inundation zone.

Did salt water flooding have a significant impact on street tree health?

Flooded red maple trees were significantly more stressed one growing season after Hurricane Sandy. Flooded London plane trees were more stressed 3 years after Sandy.

If flooded trees are showing signs of stress will they recover?

Three growing seasons after flooding red maple appear to have recovered though there was 6% mortality. London plane have not recovered and over half died.

Are other species more or less sensitive to this stressor than red maple?

Flooded London plane trees were significantly more stressed two growing seasons after Hurricane Sandy. Indicating greater sensitivity to salt water flooding than red maple.

Thank you! Questions?

Questions & Answers

- By phone: Dial #2 to enter the queue.
- On your computer: Type your question into the Q & A pod on the left side of your screen.

TEXAS A&M FOREST SERVICE

ExTREEmes – Drought

Paul Johnson, ISA MW-0495BM

Urban and Community Forestry Program Leader

@treevangelist

Helping communities develop sustainable programs that provide Texans with healthy trees and forests.

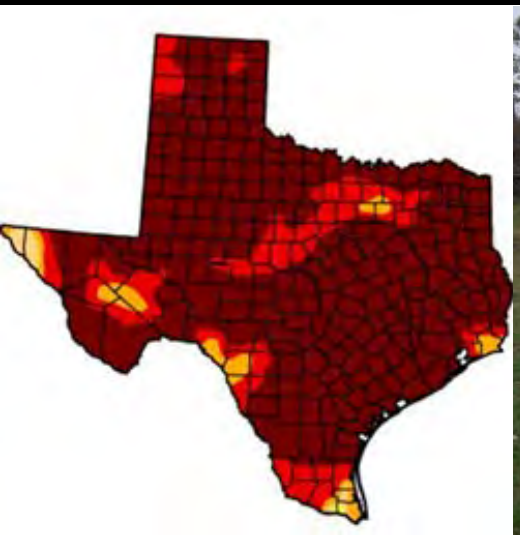
We need trees

Trees need water

Water trees during drought

2011 Drought
State of Texas Impact

- **Forest Areas** lost an estimated **301 million** trees
- **Urban Areas** lost an estimated **5.6 million** trees ~ 10%
- Estimated removal cost in urban areas ~ **$560 million**
- Economic & Environmental benefit loss is roughly **$280 million/year**



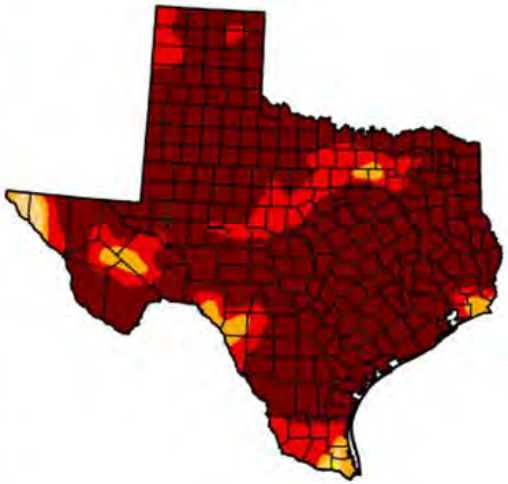
U.S. Drought Monitor

September 6, 2011
Valid 7 a.m. EST

Texas

Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	0.00	100.00	99.93	99.01	95.68	81.06
Last Week (08/30/2011 map)	0.00	100.00	99.92	99.01	95.04	81.08
3 Months Ago (06/07/2011 map)	1.97	98.03	96.53	94.05	85.41	57.83
Start of Calendar Year (12/28/2010 map)	7.89	92.11	69.43	37.46	9.59	0.00
Start of Water Year (09/28/2010 map)	75.57	24.43	2.43	0.99	0.00	0.00
One Year Ago (08/31/2010 map)	51.29	48.71	11.50	0.68	0.00	0.00



Intensity:

- D0 Abnormally Dry
- D1 Drought - Moderate
- D2 Drought - Severe
- D3 Drought - Extreme
- D4 Drought - Exceptional

The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text summary for forecast statements.

http://drought.unl.edu/dm

USDA

Released Thursd
National Drou

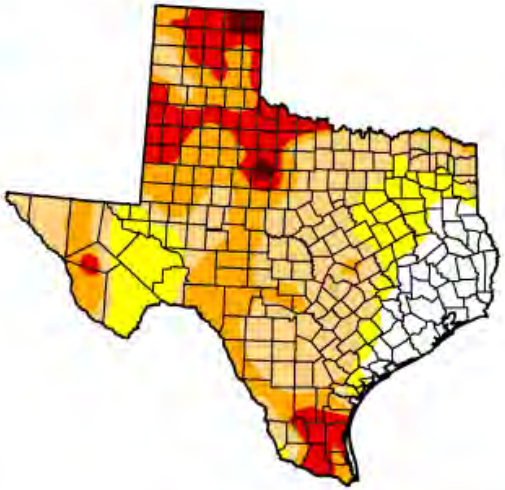
U.S. Drought Monitor

August 21, 2012
Valid 7 a.m. EST

Texas

Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	11.75	88.25	73.61	38.48	14.08	1.18
Last Week (08/14/2012 map)	11.08	88.92	78.72	44.03	12.59	0.82
3 Months Ago (05/22/2012 map)	9.00	91.00	57.92	33.55	13.54	1.15
Start of Calendar Year (12/27/2011 map)	0.01	99.99	97.83	84.81	67.32	32.36
Start of Water Year (09/27/2011 map)	0.00	100.00	100.00	99.16	96.65	85.75
One Year Ago (08/16/2011 map)	0.07	99.93	99.72	98.36	92.78	74.50



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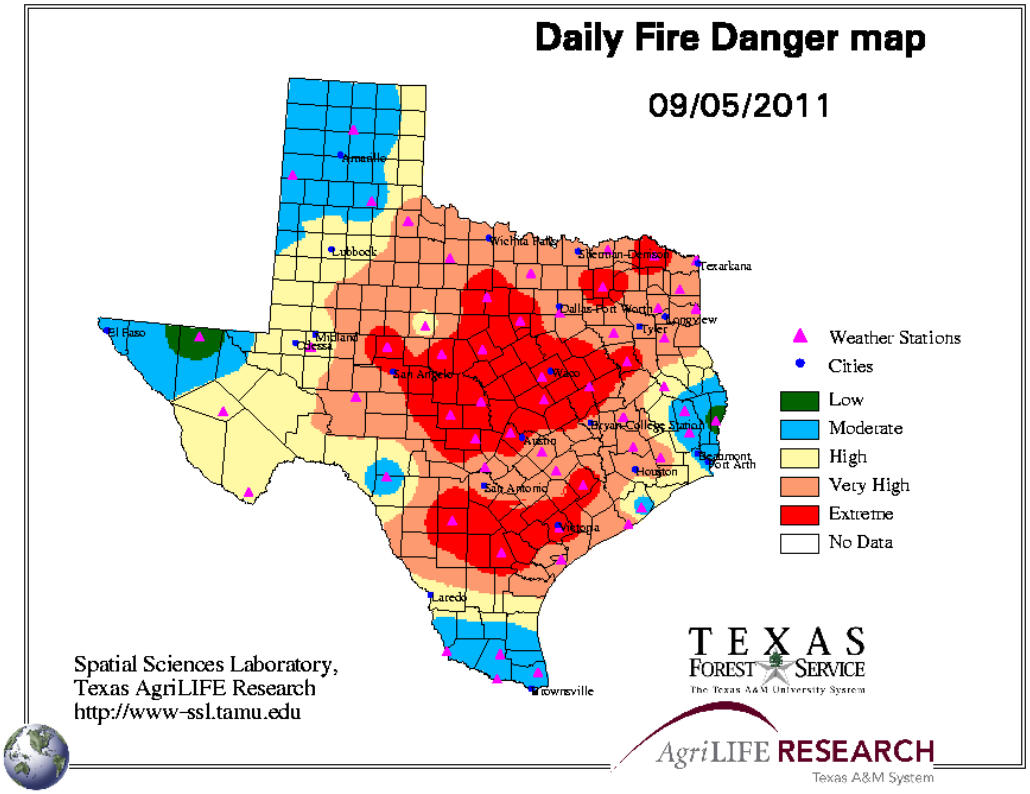
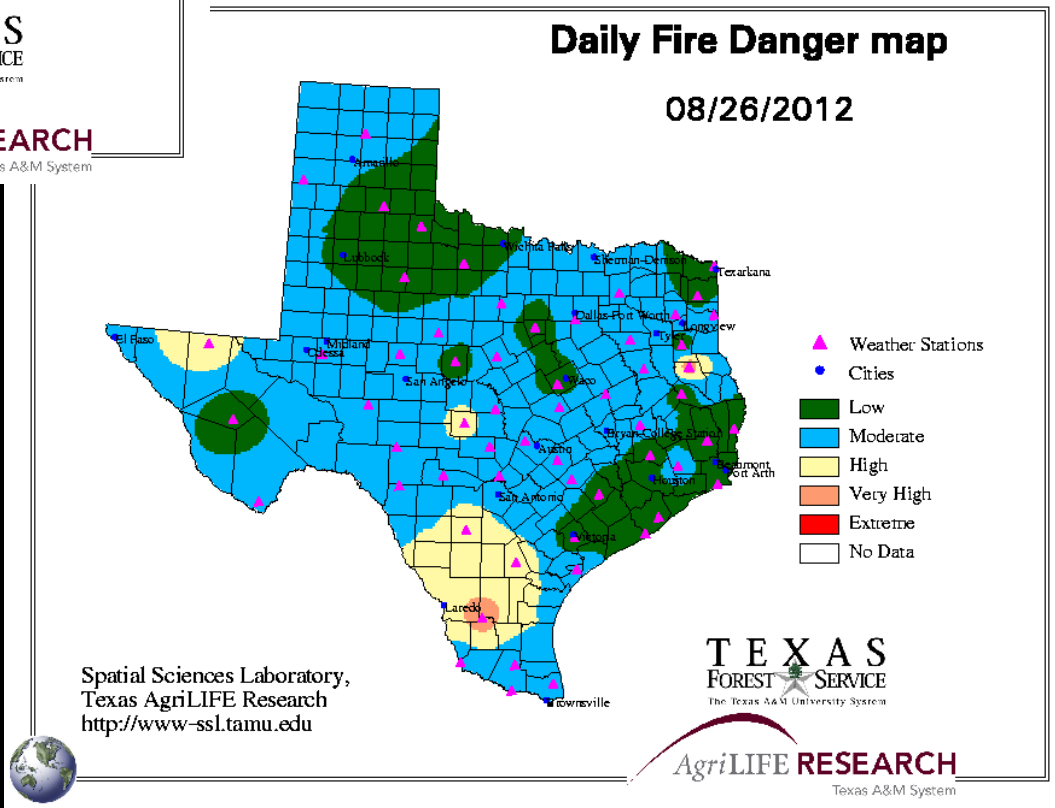
The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text summary for forecast statements.

http://droughtmonitor.unl.edu

USDA

Released Thursday, August 23, 2012
Michael Brewer, National Climatic Data Center, NOAA


Daily Fire Danger map
09/05/2011
Amarillo
Lubbock
Wichita Falls
Sherman-Denison
Texarkana
Dallas-Fort Worth
Tyler
Longview
El Paso
Midland
Odessa
San Angelo
Waco
Austin
Bryan-College Station
Beaumont
Port Arth
Houston
San Antonio
Victoria
Laredo
Brownsville
Weather Stations
Cities
Low
Moderate
High
Very High
Extreme
No Data
Spatial Sciences Laboratory,
Texas AgriLIFE Research
http://www-ssl.tamu.edu
TEXAS
FOREST SERVICE
The Texas A&M University System
AgriLIFE RESEARCH
Texas A&M System


Daily Fire Danger map
08/26/2012
Amarillo
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Texarkana
Dallas-Fort Worth
Tyler
Longview
El Paso
Midland
Odessa
San Angelo
Waco
Austin
Bryan-College Station
Beaumont
Port Arth
Houston
San Antonio
Victoria
Laredo
Brownsville
Weather Stations
Cities
Low
Moderate
High
Very High
Extreme
No Data
Spatial Sciences Laboratory,
Texas AgriLIFE Research
http://www-ssl.tamu.edu
TEXAS
FOREST SERVICE
The Texas A&M University System
AgriLIFE RESEARCH
Texas A&M System

Agency	Fires	Acres	Structures Lost	Structures Saved
State	3,271	2,882,248	5,872	29,002
Fire Departments	21,931	1,007,239	1,303	18,606
Totals	**25,202**	**3,889,487**	**7,175**	**47,608**

Total Fires

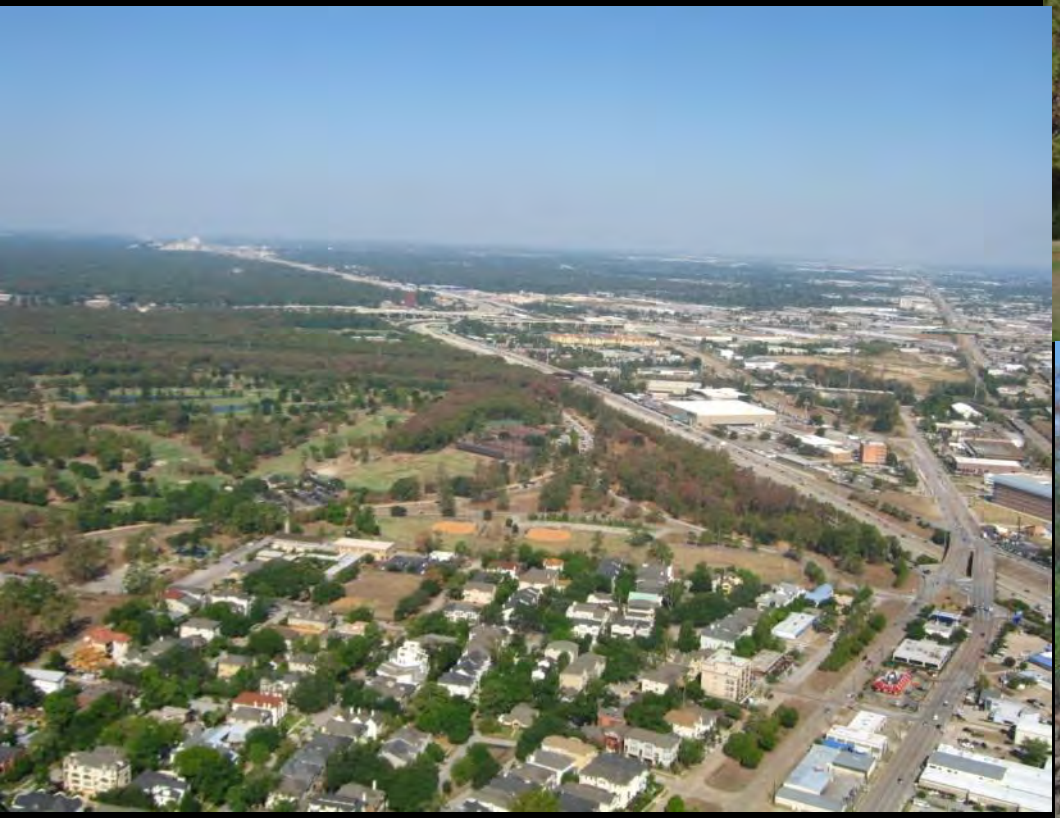
County	Fires	Acres	Homes Saved	Other Structures Saved	Homes Lost
Austin	55	327.25	41	38	1
Brazoria	93	825.4	25	10	0
Chambers	7	106	0	0	0
Colorado	20	3415.5	87	59	10
Fort Bend	85	7523.64	197	6	0
Galveston	15	47.5	1	0	1
Harris	109	2478.3	315	12	0
Liberty	93	1964.5	48	10	2
Matagorda	29	289.3	12	5	1
Montgomery	150	21121.2	787	200	74
Walker	106	6738.2	131	70	8
Waller	16	35.75	10	5	0
Wharton	1	200	2	0	0
Grand Total	**779**	**45,072.54**	**1,656**	**415**	**97**

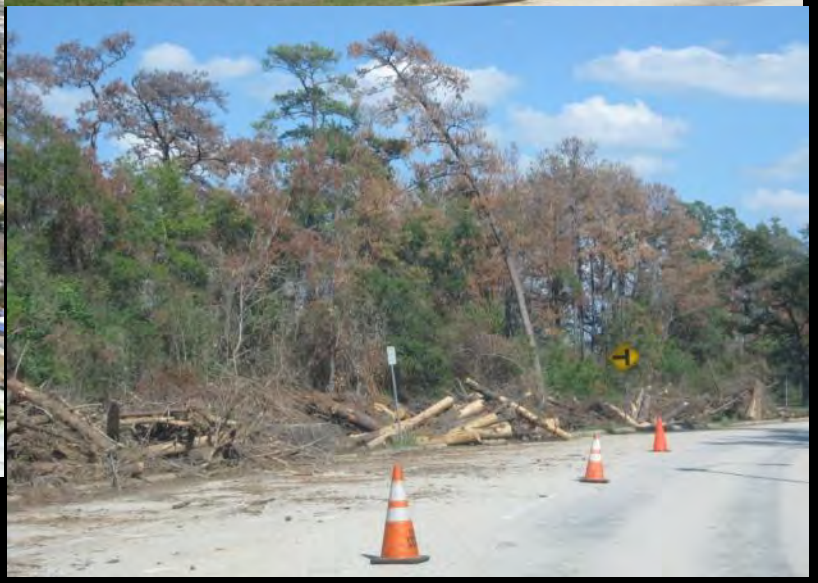

910
10 TANKER AIR CARRIER

Houston Region

- Below Average Rainfall
  - 24.57” in 2011
  - 25” deficit
  - 32” deficit 2010 – 11
- Excessive Temperatures
  - 45 days > 100
  - 24 days in a row
- Mature Trees
- Dense Understory
- Site Change

Memorial Park





Memorial Park – Sept. 2010

Memorial Park – Oct. 2011

Perfect Storm

- Removal
- Disposal
- Watering
- Lost Eco Services Value
  - Stormwater
  - Carbon
  - Pollutants
- Replacement Value
  - CTLA

- Removals – Totals
  - 50,521 trees
  - $10,951,398
  - $207/tree
- Disposal
  - Rolled into removal costs
  - City of Houston 200,000 cubic yards
- Watering (Trees For Houston)
  - $153,000
  - 5,590 trees (5 times/month)
  - $27.37/tree
  - 400 volunteer hours

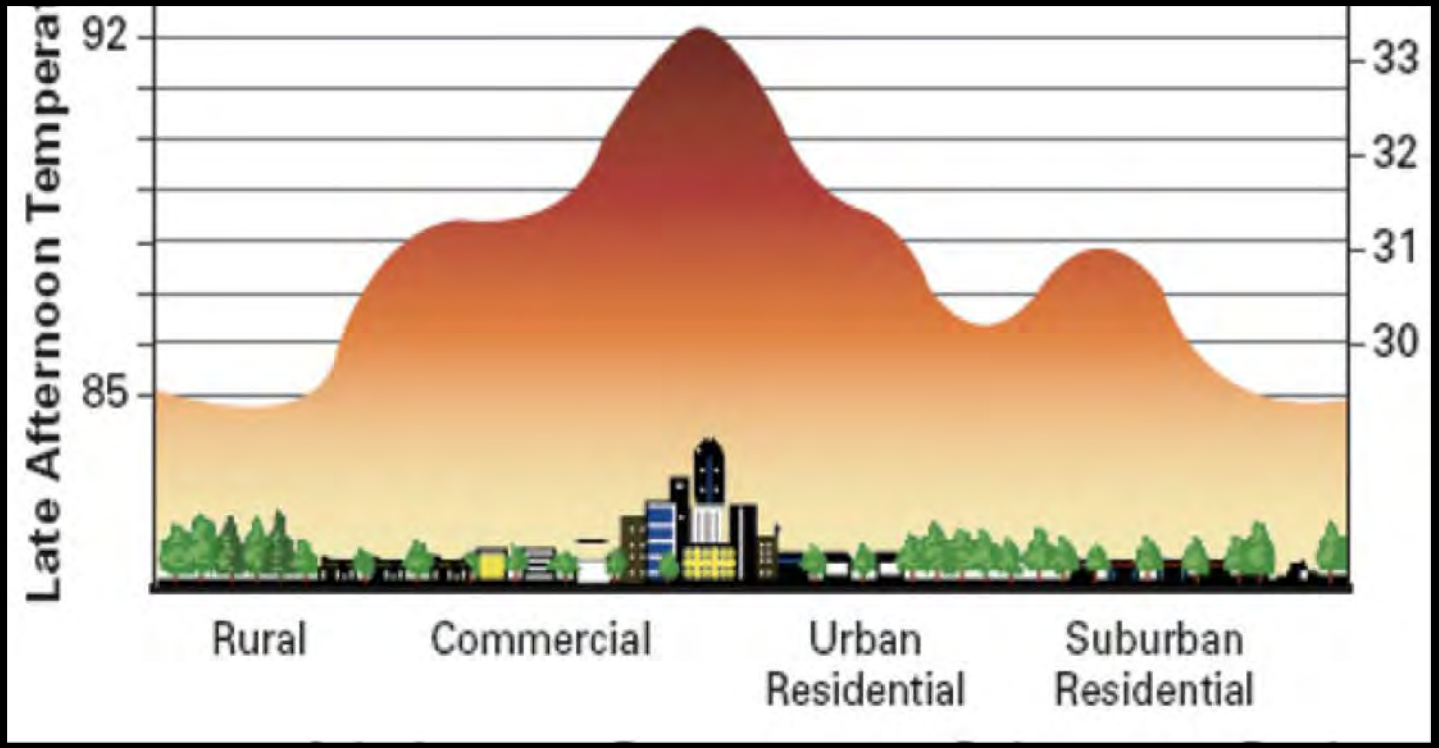
Associated Costs and Lost Values

- Lost Eco Services Value - **$1,202,400/yr**
- Replacement Value - **$10,290,066**

Based on average 16” dbh (62% pine, 38% hardwood)

It’s not just about irrigation water

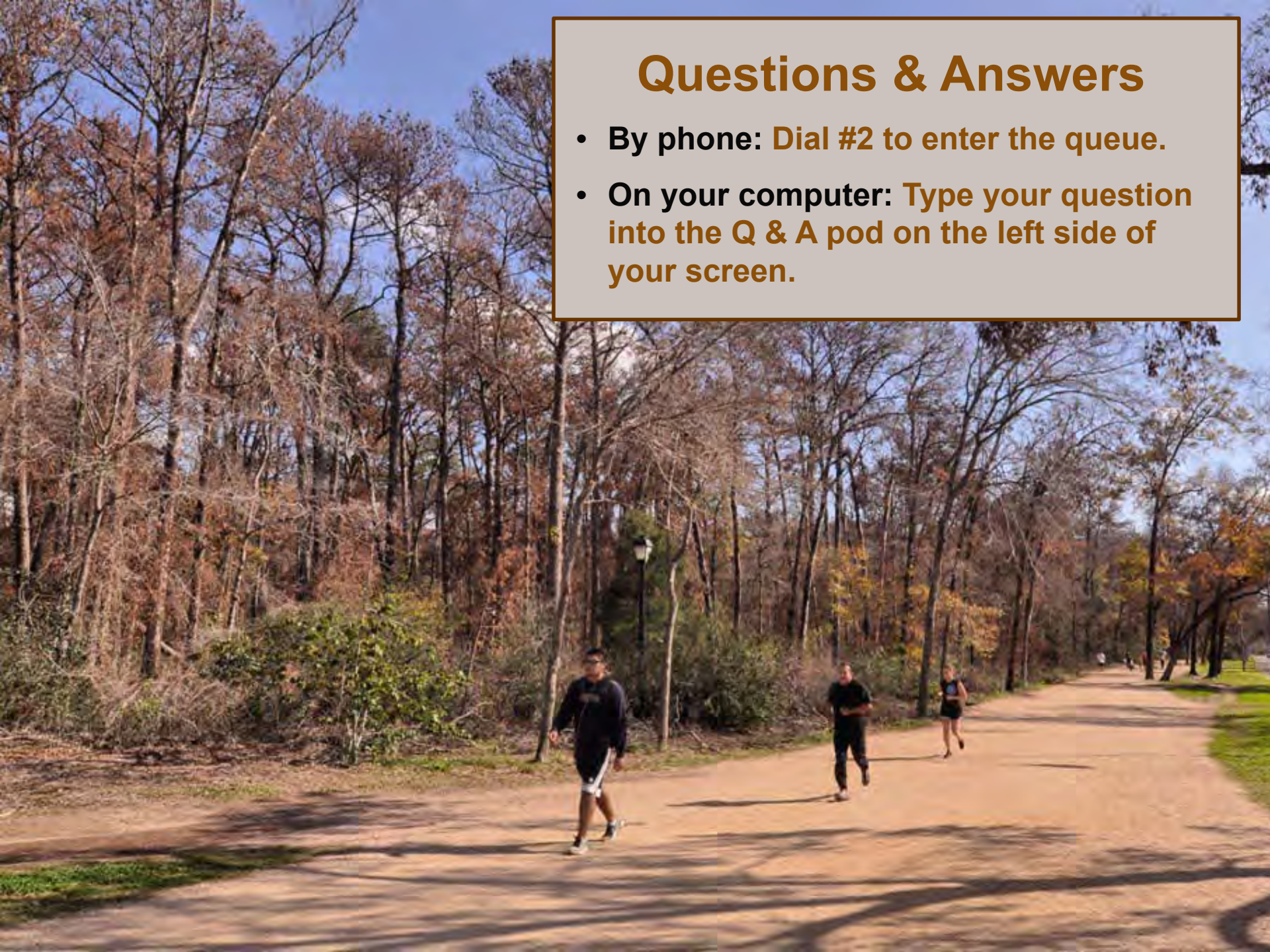
Urban Heat Island Effect



pjohnson@tfs.tamu.edu

@treevangelist

TEXAS A&M FOREST SERVICE



Questions & Answers

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Drought and Urban Forests: Creating Drought Tolerant Urban Landscapes

Dr. Greg McPherson
USDA Forest Service, PSW
Davis, California

U.S. Department of Agriculture
Pacific Southwest Research Station
Science that makes a difference

USDA Forest Service, Office of Sustainability and Climate Webinar, July 25, 2017

Pacific Southwest Research Station

Today

- Background
- Los Angeles Urban Forest Drought Assessment
- Climate-Ready Trees Study

California's Drought

- 2012-2015 severity unprecedented in 1,200+ year record

Geophysical Research Letters

AN AGU JOURNAL

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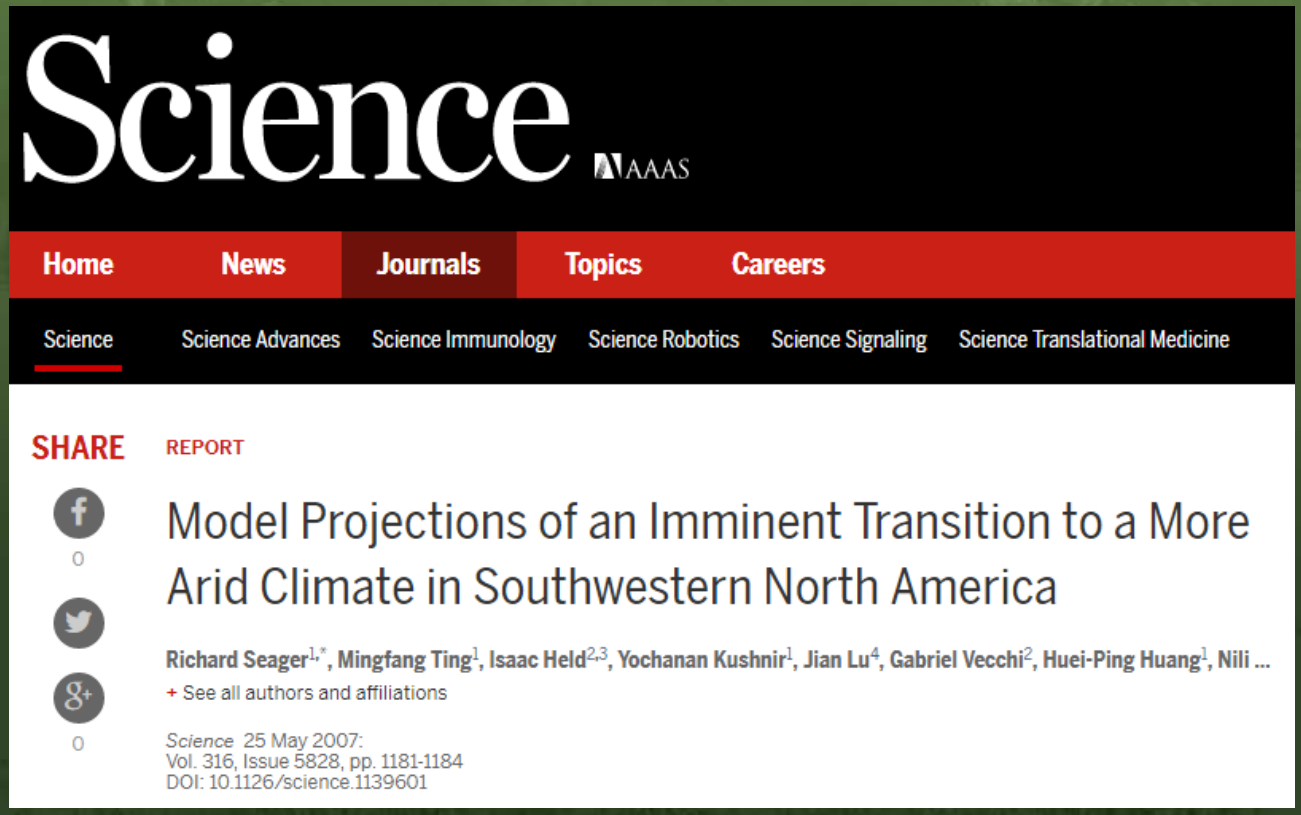
Research Letter

Revisiting the recent California drought as an extreme value

Scott M. Robeson

California's Drought

- Broad consensus that recent drought will be new climatology of SW



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REPORT

Model Projections of an Imminent Transition to a More Arid Climate in Southwestern North America

Richard Seager[1,*], Mingfang Ting[1], Isaac Held[2,3], Yochanan Kushnir[1], Jian Lu[4], Gabriel Vecchi[2], Huei-Ping Huang[1], Nili ...

+ See all authors and affiliations

Science 25 May 2007:
Vol. 316, Issue 5828, pp. 1181-1184
DOI: 10.1126/science.1139601

California's Drought

- Broad consensus that recent drought will be new climatology of SW

A black blizzard rolls through Stratford, Texas; 1935.

The Washington Post
Democracy Dies in Darkness

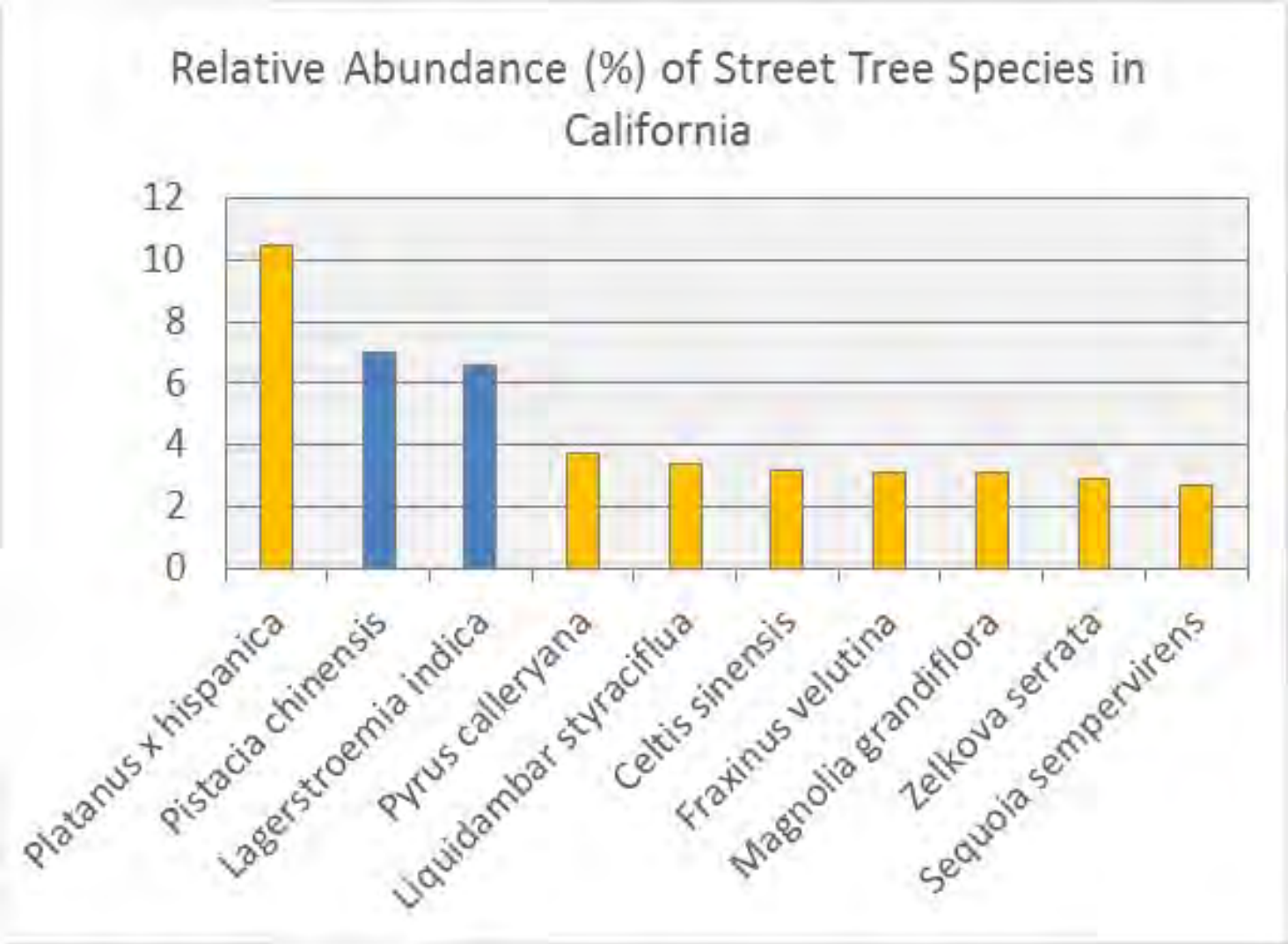
Health & Science

California's drive to save water is killing trees, hurting utilities and raising taxes

In declaring a drought emergency in April, Gov. Jerry Brown (D) said watering emerald-green grass every day "is a thing of the past." He neglected to say trees were exempt, so residents, businesses and local governments stopped watering them, too.

Now the state is losing millions of trees that beautify their cities, improve air quality, offer shade in areas where temperatures can reach 100 degrees and provide habitat for untold numbers of squirrels, birds and other animals.

Vulnerability to Drought?



Los Angeles Tim

$2.00 DESIGNATED AREAS HIGHER © 2017 WST †

THURSDAY, APRIL 20, 2017

MARK BOSTER, Los Angeles Times

WORKERS cut down a tree at Craig Regional Park in Fullerton, where many sycamores are stricken by the polyphagous shot hole borer beetle. The bug could kill as many as 27 million Southern California trees.

Bug has a stranglehold on region's urban trees

BY LOUIS SAHAGUN

The trees that shade, cool and feed people from Ventura County to the Mexican border are dying so fast that within a few years it's possible the region will look, feel, sound and smell much less pleasant than it does now.

"We're witnessing a transition to a post-oasis landscape in Southern California," says Greg McPherson, a supervisory research forester with the U.S. Forest Service who has been studying what he and others call an unprecedented die-off of the trees greening Southern California's parks, campuses and yards.

Botanists in recent years have documented insect and disease infestations as they've hopscotched about the region, devastating Griffith Park's sycamores and destroying more than 100,000 willows in San Diego County's Tijuana River Valley Regional Park, for example.

McPherson's is the first survey to quantify and assess the big picture.

It's not a pretty one.

His initial estimate is that just one particularly

Southern California's environmental terror: A beetle

Nearly 38% of all trees in some of Southern California's most populated regions are at risk of dying due to one type of beetle: the polyphagous shot hole borer.

Percent of trees at risk, by region

Southern California coast	Inland Empire	Southwest desert
33.5%	44.3%	34.5%

Tree species at most risk

The polyphagous shot hole borer breeds by penetrating into tree trunks and in the process emitting a lethal fungus that prevents the transport of water and nutrients from roots to the leaves.

Iran nu accord stay, fo

The U.S. says Tehran is complying with a deal that Trump once vowed to rip up, but it's under review.

BY TRACY WILKINSON

WASHINGTON — A skeptical Trump administration has confirmed that Iran continues to comply with the 2015 nuclear disarmament deal but says the White House is conducting an internal review of the landmark arms control accord that President Trump once called "the worst deal ever."

Secretary of State Rex Tillerson said in a letter to Congress that the National Security Council will lead an interagency review of whether easing economic sanctions against Iran as part of the accord "is vital to

Fox News could take as O'Reill

BY STEPHEN BATTAGLIO

The end came quickly for Bill O'Reilly.

The TV host has been the biggest star on Fox News for most of its 21-year existence, generating huge ratings and earnings.

But just 18 days after disclosures of sexual harassment complaints and settlements by multiple women, he was fired.

Fox didn't even wait until he returned from vacation in Europe to deliver the news.

The swift action underscores the rising clout of James and Lachlan Murdoch, the brothers who control 21st Century Fox and have demonstrated their

Newly discovered beetle decimates trees in Tijuana River Valley

September 1, 2016 by Nancy Aziz

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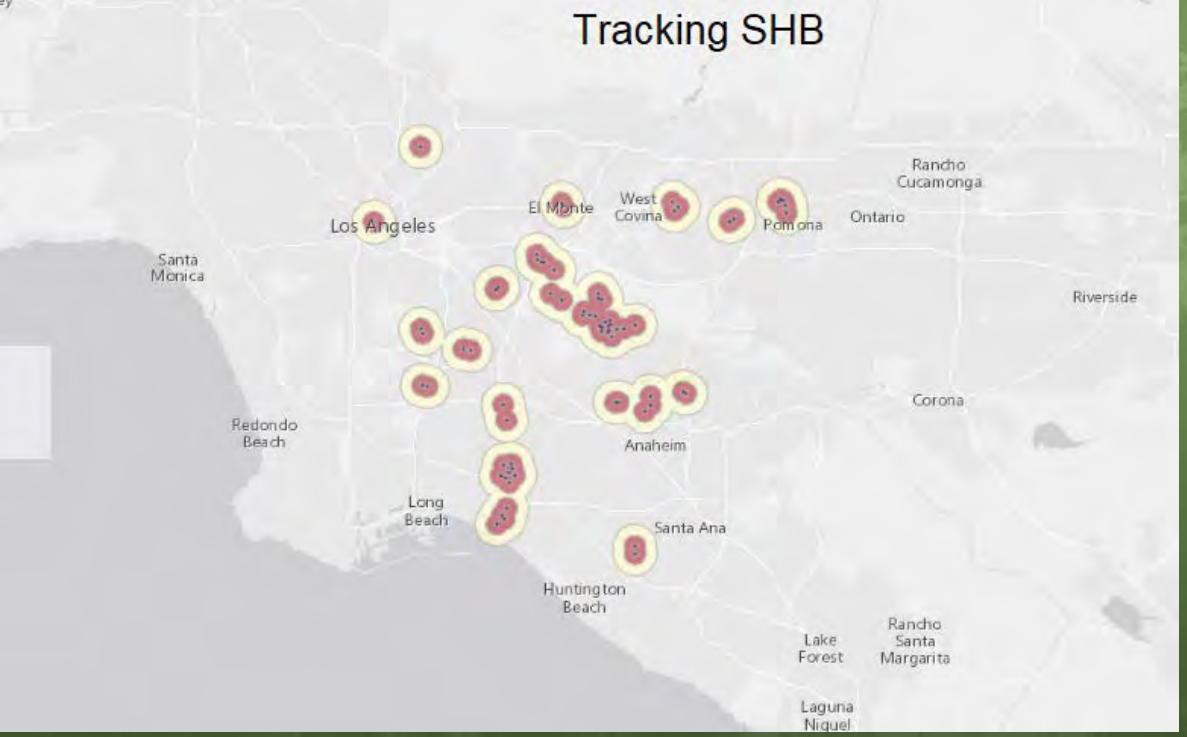
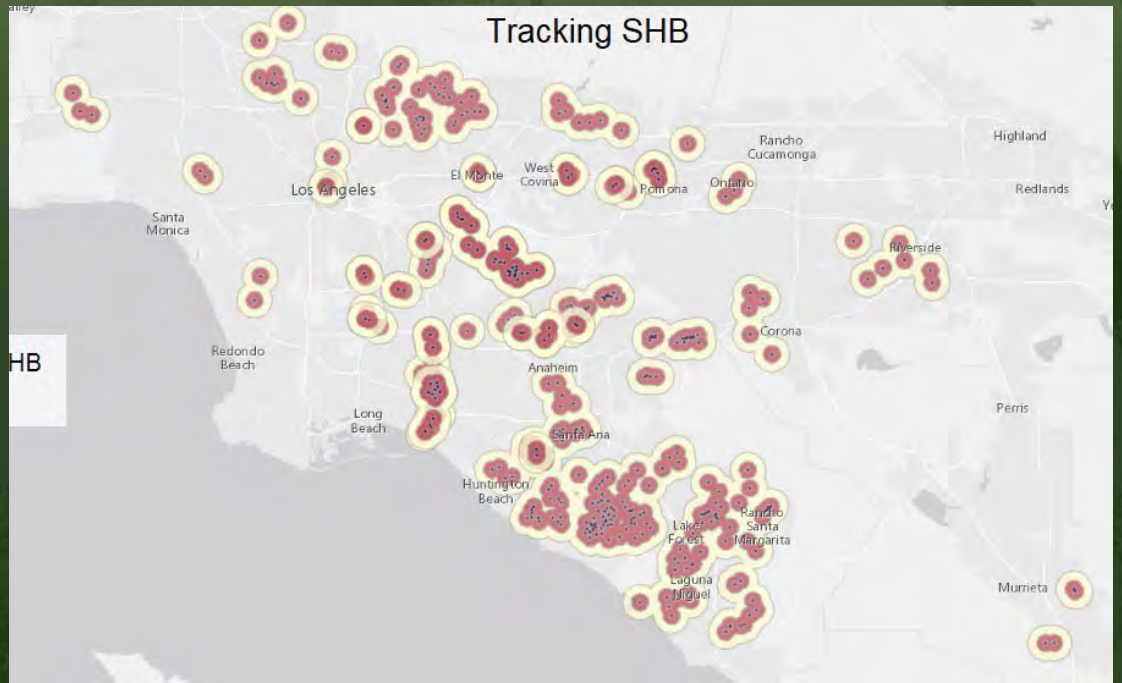

Tracking SHB
Rancho Cucamonga
El Monte
West Covina
Los Angeles
Pomona
Ontario
Santa Monica
Riverside
Corona
Redondo Beach
Anaheim
Long Beach
Santa Ana
Huntington Beach
Lake Forest
Rancho Santa Margarita
Laguna Niguel


Tracking SHB
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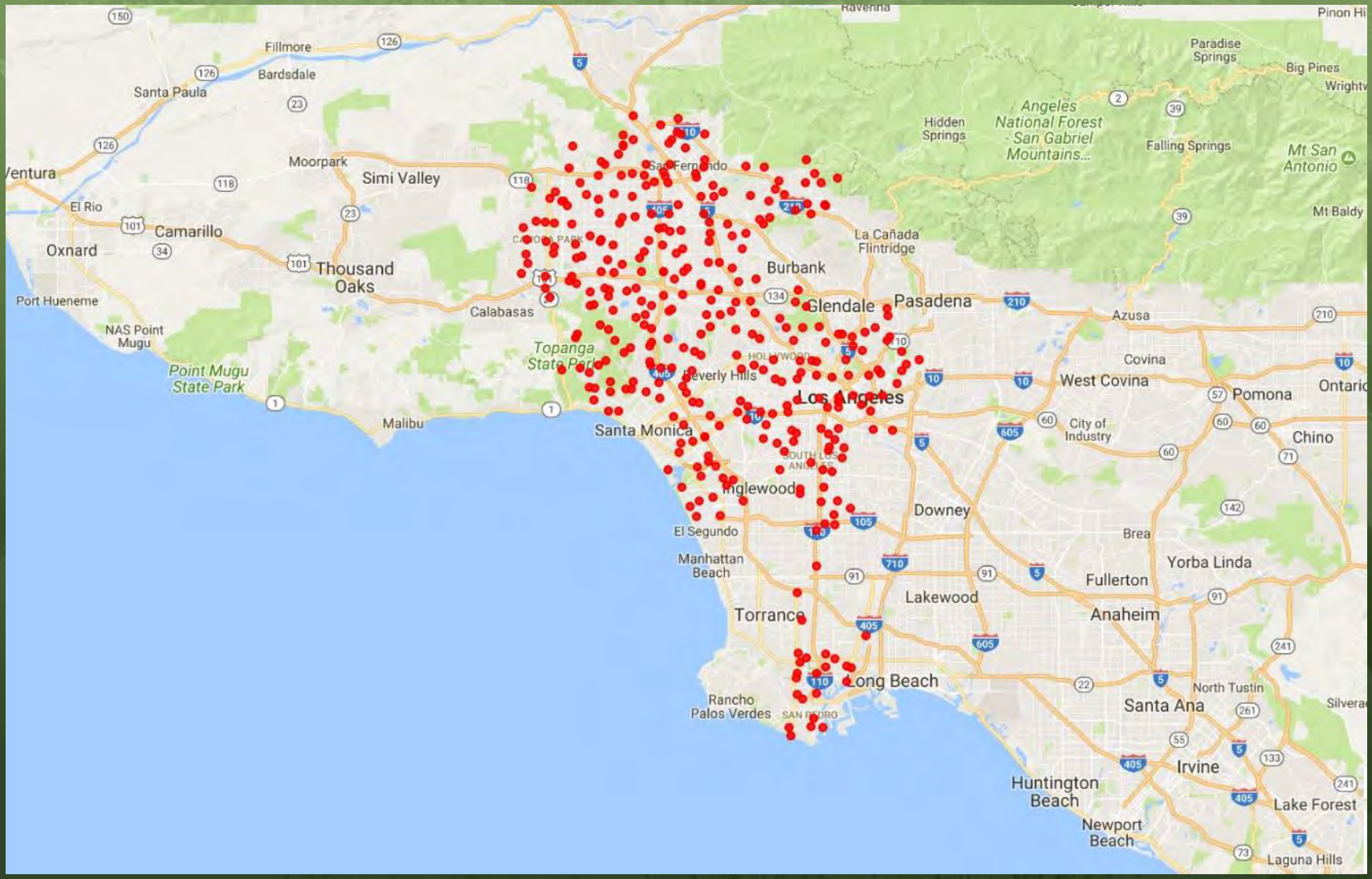
Corona
Redondo Beach
Anaheim
Perris
Long Beach
Santa Ana
Huntington Beach
Lake Forest
Rancho Santa Margarita
Laguna Niguel
Murrieta

Effects of Drought on Los Angeles' Urban Forest: 2016-18

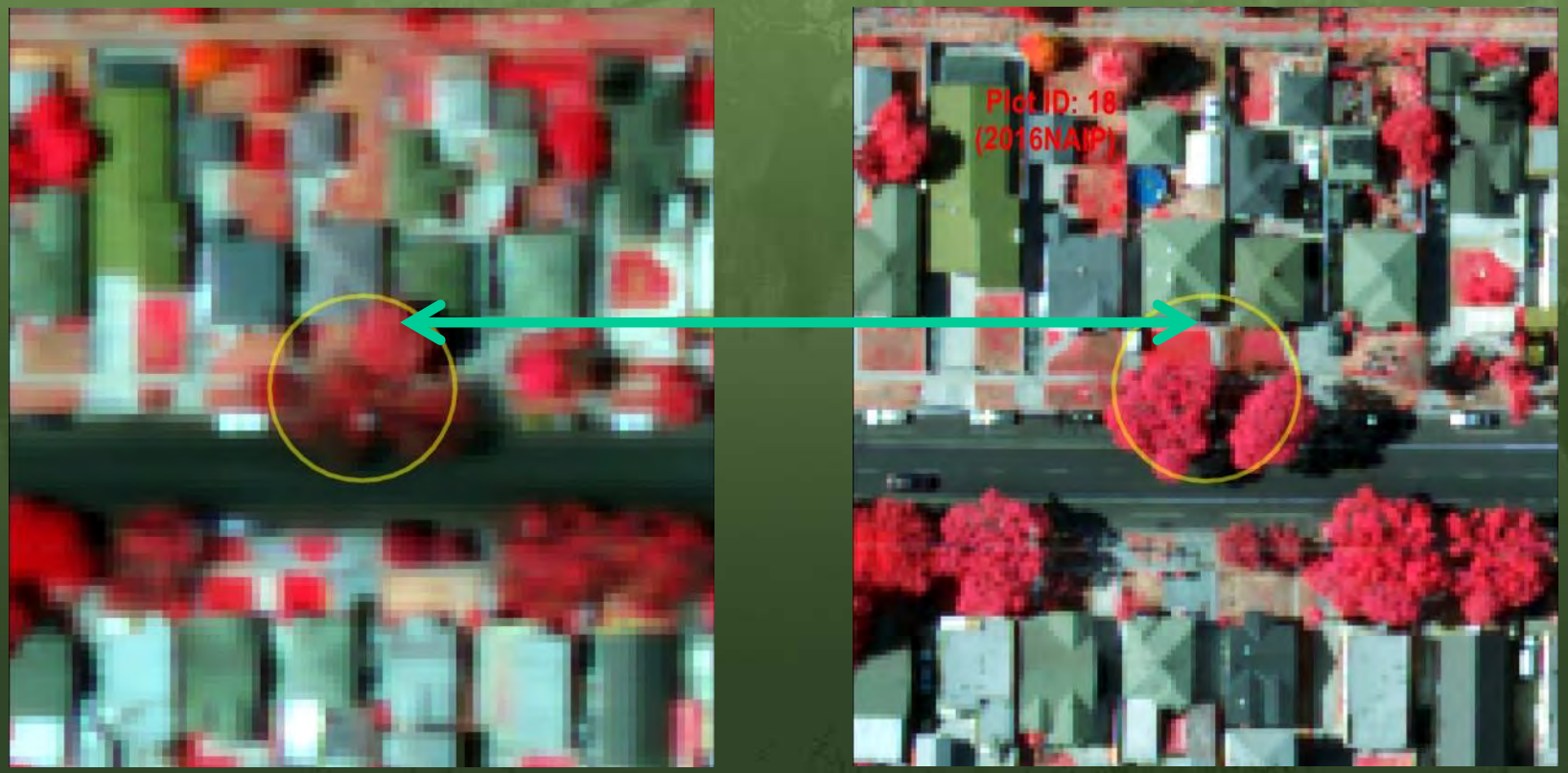
- Remeasure i-Tree Eco plots (2008 & 2016)
  - Change in size, species, condition
- Remeasure canopy cover
  - Change in cover, health
- Change in ecosystem services
  - i-Tree Eco

Natalie Van Doorn, USFS PSW
Qingfu Xiao, UC Davis
Darrel Jenerette, UC Riverside


Fillmore
Bardsdale
Santa Paula
Moorpark
Simi Valley
Ventura
El Rio
Camarillo
Oxnard
Thousand Oaks
Port Hueneme
NAS Point Mugu
Point Mugu State Park
Malibu
Calabasas
Topanga State Park
Santa Monica
Beverly Hills
Los Angeles
Burbank
Glendale
Pasadena
La Cañada Flintridge
Inglewood
El Segundo
Manhattan Beach
Torrance
Rancho Palos Verdes
Long Beach
Lakewood
Downey
Brea
Fullerton
Yorba Linda
Anaheim
North Tustin
Santa Ana
Irvine
Huntington Beach
Newport Beach
Lake Forest
Laguna Hills
Azusa
Covina
West Covina
Pomona
City of Industry
Chino
Ontario
Hidden Springs
Angeles National Forest - San Gabriel Mountains...
Falling Springs
Mt San Antonio
Mt Baldy
Paradise Springs
Big Pines


EcoPlot Area
Mapping Area
Analysis Area

i-Tree Eco Plot



2009

2016

i-Tree Eco Plot – 2016 Data

PLOT ID	18	18	18
Tree ID	4334	4333	18A
TREE SPECIES	Jacaranda mimosifolia	Jacaranda mimosifolia	Ligustrum ovalifolium
NO CHANGE	x	x	
DBH 1 (cm)	48	51	
TOT TREE HEIGHT (meters)	13.19	11.24	
CROWN BASE HEIGHT	5.48	3.29	
N-S	10	15.3	
E-W	8.85	12.9	
%CROWN COND (100%=dead)	4%	5%	
CROWN %MISS (100%=dead)	28%	35%	
% IMPER	58%	77%	
% SHRUB	0%	1%	
Distance to plot center (meters)	8.3	2.5	

Climate-Ready Trees Study

Drs. Greg McPherson, Natalie Van Doorn
Erika Teach
USDA Forest Service
PSW Research Station, Davis, CA

Dr. Alison Berry
Dept. of Plant Sciences
UC Davis, Davis, CA

Drs. Jim Downer, Janet Hartin,
Darrel Haver
UC Cooperative Extension

Goal: Gradual Transition to More Stable, Healthy and Functional Landscapes

Background

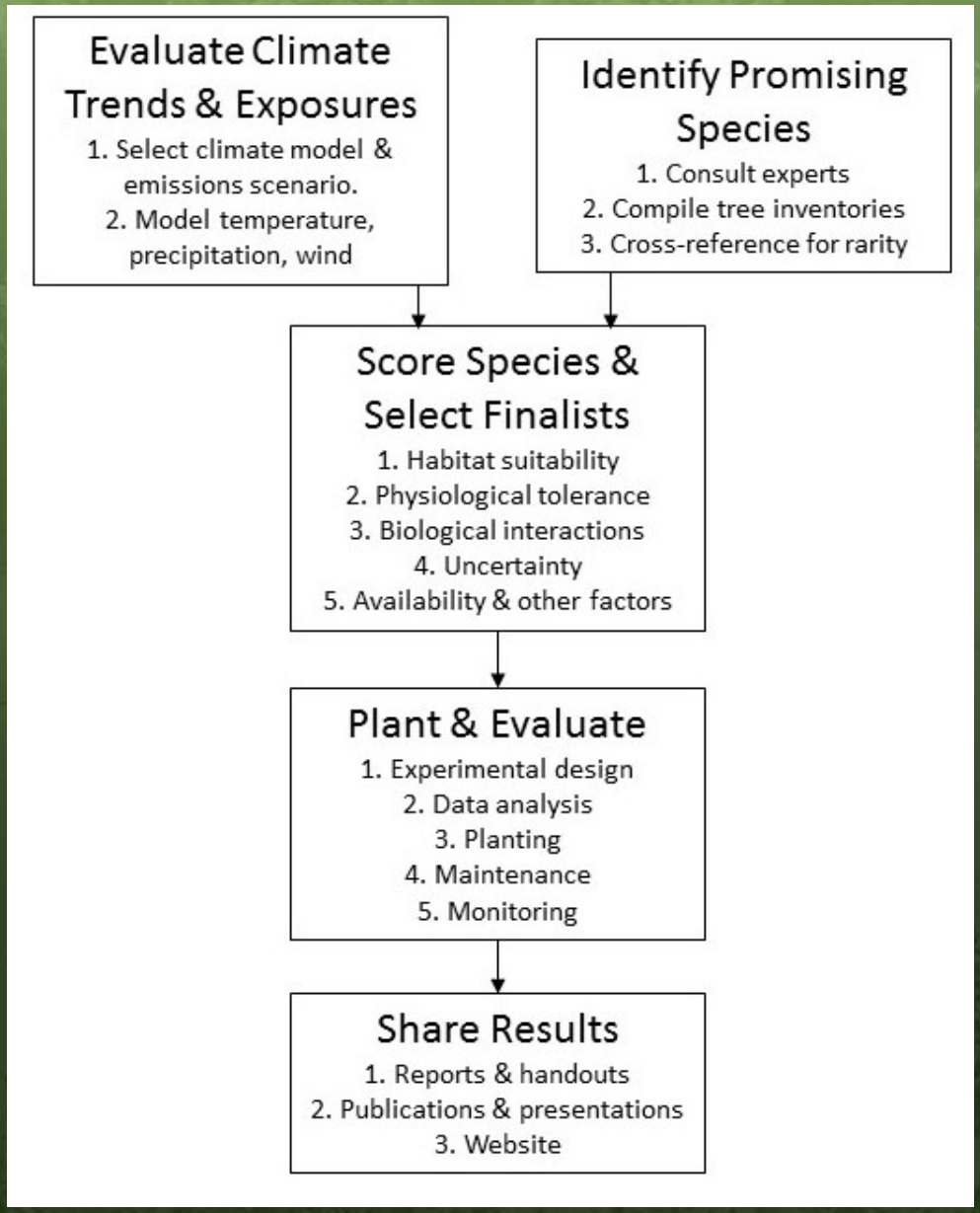
- Risk management
  - Increase diversity
  - Phase out poorly-adapted species
- Primary point of leverage
  - Tree selection

McPherson, E.G.; van Doorn, N.S.; Teach, E. 2017. Evaluation of six drought tolerant trees 17 years after planting in Northern California. Western Arborist. 43(1): 32-37.

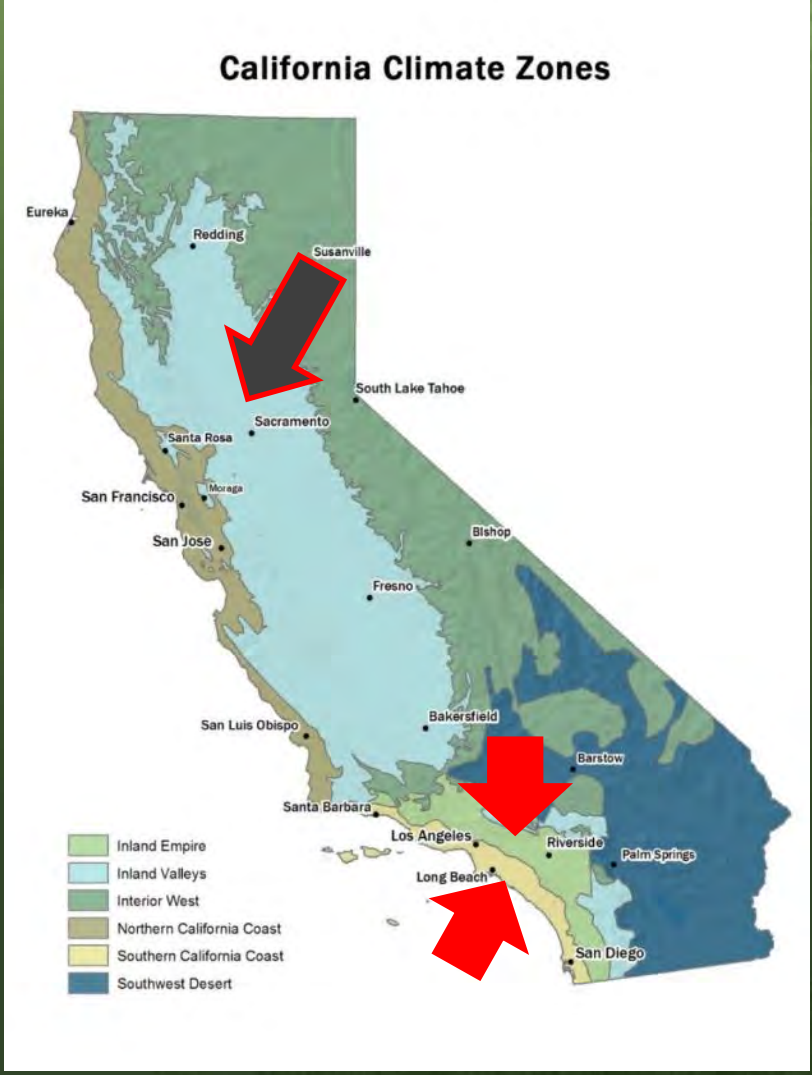
Adds increasing awareness of **potential climate change effects**

- Change tree palette to more resilient species
- 20-year study to test promising cultivars
  - Resilience to climate change
  - Other qualities

Five Step Process



Step 1: Climate Trends



Climate zones based on Brenzel (1997)

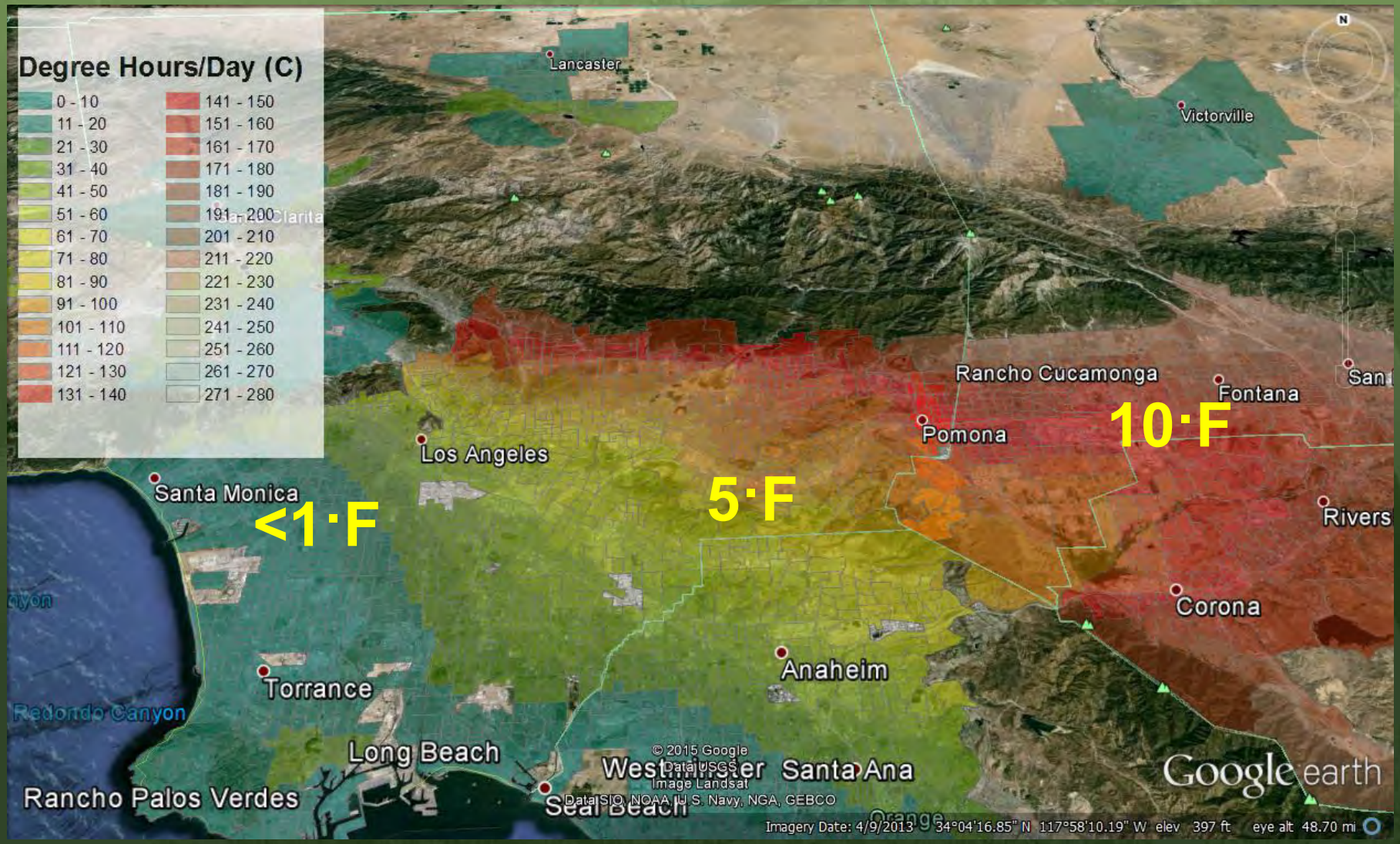
Study focus:

- Inland Valley, CA
- Inland Empire, CA
- Southern CA Coast

CalAdapt Climate Models Project Changes - 75 Years

1. Temperature (Hardiness)
   - Central Valley: 1 ½ zone change
   - Inland Empire & S. CA Coast: ½ zone change
2. Precipitation
   - More uncertainty
   - Generally: **more winter precip, less summer**.

Urban Heat Island Index (Cal – EPA)



KMZ downloaded from http://www.calepa.ca.gov/UrbanHeat/Index.htm

Step 2: ID Promising Species

- Currently not abundant.
- Proven successful in regions with somewhat warmer climates.
- Planting stock currently available in nurseries.
- Diversity of size and genera.

Experts helped identify promising tree species.

Step 3: Score Species

Habitat	Physiology	Biological interactions
Soil moisture	Drought tolerance	Invasiveness
Soil texture and pH	Wind tolerance	Major or minor pest and disease threats
Sunlight exposure	Salt tolerance	Emerging pest and disease threats

Based on System for Assessing Vulnerability of Species (Bagne et al., 2012)

Added Special Features

Special Features		
Biogenic emissions	SelecTree	(+1) Species has low biogenic emissions.
Root damage potential	SelecTree	(+1) Species has low root damage potential.
Longevity	SelecTree	(+1) Species' longevity is over 150 years.
Carbon storage	Urban growth equations	(+1) relatively high biomass for stature class

Special Features (cont'd)		
Aesthetics	SelecTree	(+1) Species has flowers or fall colors.
Tree litter	SelecTree	(+1) Species produces minimal litter
Shade potential	SelecTree	(+1) Species has moderate OR moderately dense in and out of leaf shade capacity
Biodiversity	Municipal inventories	(+1) Species is <1% of total abundance in climate zone or not in top 10 importance value

PHYSIOLOGY	
Drought Tolerance	(+1) Species has low or very low water needs.
Wind Tolerance	(+1) Species has strong branch strength.
Salt Tolerance	(+1) Species salinity tolerance is high.

Desert willow (*Chilopsis linearis*)

DATA SOURCE: Tree characteristics

General Notes

An open, fast-growing tree with weeping, long and linear leaves. Provides light shade.

Has fragrant Flower.

Native to Australia.

SelecTree: Tree Detail

SHOESTRING ACACIA

Acacia stenophylla

Leaves Linear, Gray Green, No Change, Evergreen.

Flowers Showy. FragrantPale Yellow. Flowers in Spring or Winter. Has perfect flowers (male and female parts in each flower).

Brown Pod, Very Large (Over 3.00 inches), fruiting in Spring, Summer or Fall.

Bark Dark Gray, Furrowed or Smooth.

Shading Capacity Rated as Moderately Low in Leaf.

Litter Issue is Dry Fruit.

Tree Site Conditions & Constraints

Sunset Zones 8, 9 and 12 - 24.

USDA Hardiness Zones 8 - 11.

Exposure Full Sun.

Moist to Dry and Well Drained Soil.

nt.

Sand Texture.

to Highly Alkaline Soil pH.

nce is Moderate.

nce is Good in Mild Zone.

ty & Environmental Concerns

th Rated as Weak.

Hazard.

able.

Special Uses & Values

Ornamental.

https://selectree.calpoly.edu/

DATA SOURCE: Invasiveness

http://www.cal-ipc.org/paf/

DATA SOURCE: Pest Vulnerability Matrix

	Abutilon	*Acacia*	*Acacia flor.*	*Agavacease*	*Albizia*	*Alnus*		
Probable Cause ↓	**Abutilon** (Abutilon spp.), **Chinese bellflower**, Chinese lantern	**Acacia** (Acacia spp.)	**Acacia floribunda**	**Agave** (Agave spp.); **Yucca** (Yucca spp.)	**Albizia** (Albizia spp.), **Mimosa**, Silk tree	**Alder** (Alnus spp.)	Notes	Problem Description
Pest overlap →	**5%**	**8%**	**2%**	**3%**	**6%**	**14%**		
Pest count →	**5**	**9**	**2**	**3**	**6**	**15**		
Proportion of all trees	1	1	1	1	1	1		
Abutilon mosaic virus.	1						Often produces a desired color on leaves	Leaves with yellowish blotch
Anthracnose: Apiognomonia; Cylindrosporium; Marssonia; Glomerella; Colletotrichum							Multiple pathogens, similar symptoms	Leaves brown, dead areas a severely affected. Pale blotc drop prematurely.
Armillaria root rot or Oak root fungus.			1			1	Common with overwatering; check species/cultivar!	Leaves discolor, stunt, wilt, Minute white fungus growths
Ash dieback on Raywood ash.							Only on '**Raywood**' ash	Foliage fades, yellows, brow die. Entire plant may die.
Bacterial blight and canker or Bacterial blast.							Not Important	Blossoms, leaves, and term base of leaves or on fruit. C
Bacterial **leaf scorch**, Xylella fastidiosa.							Important on **Oleander**	Leaves brown around edges
Botryosphaeria canker							When planted out of native range (esp. drought)	Foliage turns red, brown, th bark.
Chestnut blight, Cryphonectria (=Endothia) parasitica.							Not in western US; but deadly in the east!	Leaves turn yellow or brown prematurely. Orange canke becomes girdled and the tre

Instructions | PVM_Final | Modification_History | newpests | newtaxa | Hodel-Arec ...

Laćan & McBride 2008

12 Species Selected for Each Zone

Scientific Name	Common Name
California native	
Celtis reticulata	Netleaf hackberry
Hesperocyparis forbesii	Tecate cypress
Prunus ilicifolia ssp. Lyonii	Catalina cherry
Quercus tomentella	Island oak
Australia	
Acacia aneura	Mulga
Corymbia papuana	Ghost gum
Southwest US	
Mariosousa willardiana	Palo blanco
Oklahoma-Texas-Western US	
Prosopis glandulosa 'Maverick'	Maverick mesquite
Quercus fusiformis	Escarpment live oak
Asia/South America	
Dalbergia sissoo	Rosewood
Cedrela fissilis	Brazilian cedarwood
Other	
Pistacia 'Red Push'	Red Push pistache

Step 4: Plant and Evaluate

- Climate Zones
  - Central Valley
  - Coastal SoCal
  - Inland SoCal
- Reference Sites
  - 4 replicates
  - Excellent care
- Park Sites
  - 4 parks
  - 2 replicates each
  - Variable care

SPCODE	Scientific	Common_Nam	Size
AA	Acacia aneura	Mulga	#15
AS	Acacia stenophylla	Shoestring acacia	#15
CR	Celtis reticulata	Netleaf Hackberry	#15
CL	Chilopsis linearis 'Bubba'	Desert Willow	#15
DS	Dalbergia sissoo	Rosewood	#15
EE	Ebenopsis ebano	Texas Ebony	24 box
EP	Eucalyptus papuana	Ghost gum	#15
MP	Maclura pomifera 'White Shield'	White Shield Osage Orange	BR
PD	Parkinsonia x 'Desert Museum'	Desert Muesum Palo Verde	#15
PG	Prosopis glandulosa x Maverick	Thornless Honey Mesquite	24 box
QC	Quercus canbyi	Canby's oak	24 box
UP	Ulmus propinqua	Emerald Sunsine Elm	BR


Climate Ready Tree Sites
Holleigh Bernson Memorial Park
Hansen Dam Recreation Areas
Valley Plaza
Woodley Park
Jim Gilliam Recreation Center
Westchester
Vista Del Mar
Bogdanovich
UC Riverside Citrus Research Center
UC South Coast Research and Extension Center
Climate Ready Tree Parks
Reference Sites
Inland
Coastal
0 3.75 7.5 15 22.5 30
Miles
© OpenStreetMap (and) contributors, CC-BY-SA

Planting days

Woodley Park

Tree Monitoring

When?

- Every year for first 5 years
- Every 3 years after that

Measurements:

- Tree size: height, DBH, canopy diameter.
- Soil type: texture, nutrients, bulk density

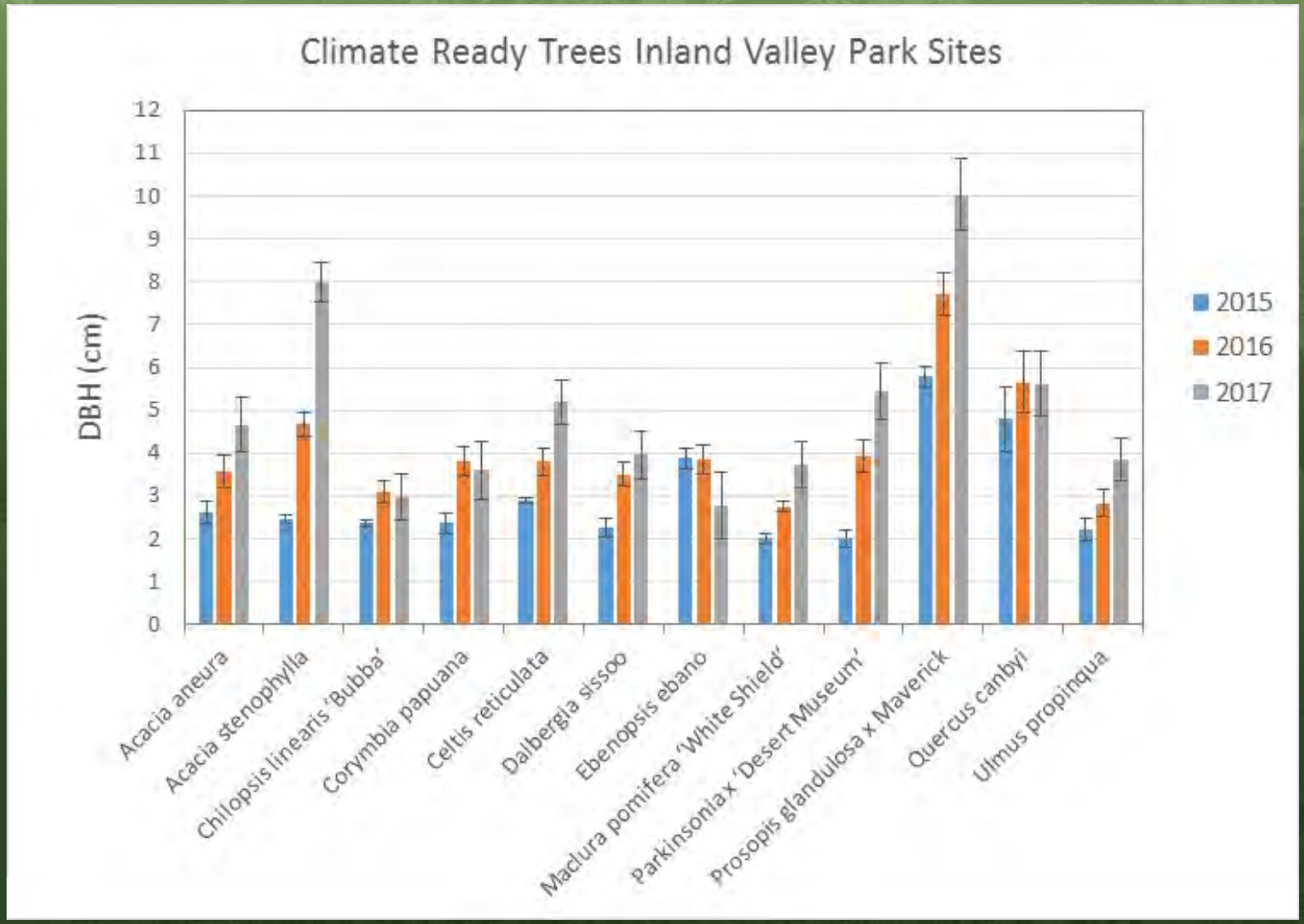
Monitor:

- Tree structure (branching, roots)
- Pruning done
- Any pests or diseases
- Potential causes for mortality

Environmental factors:

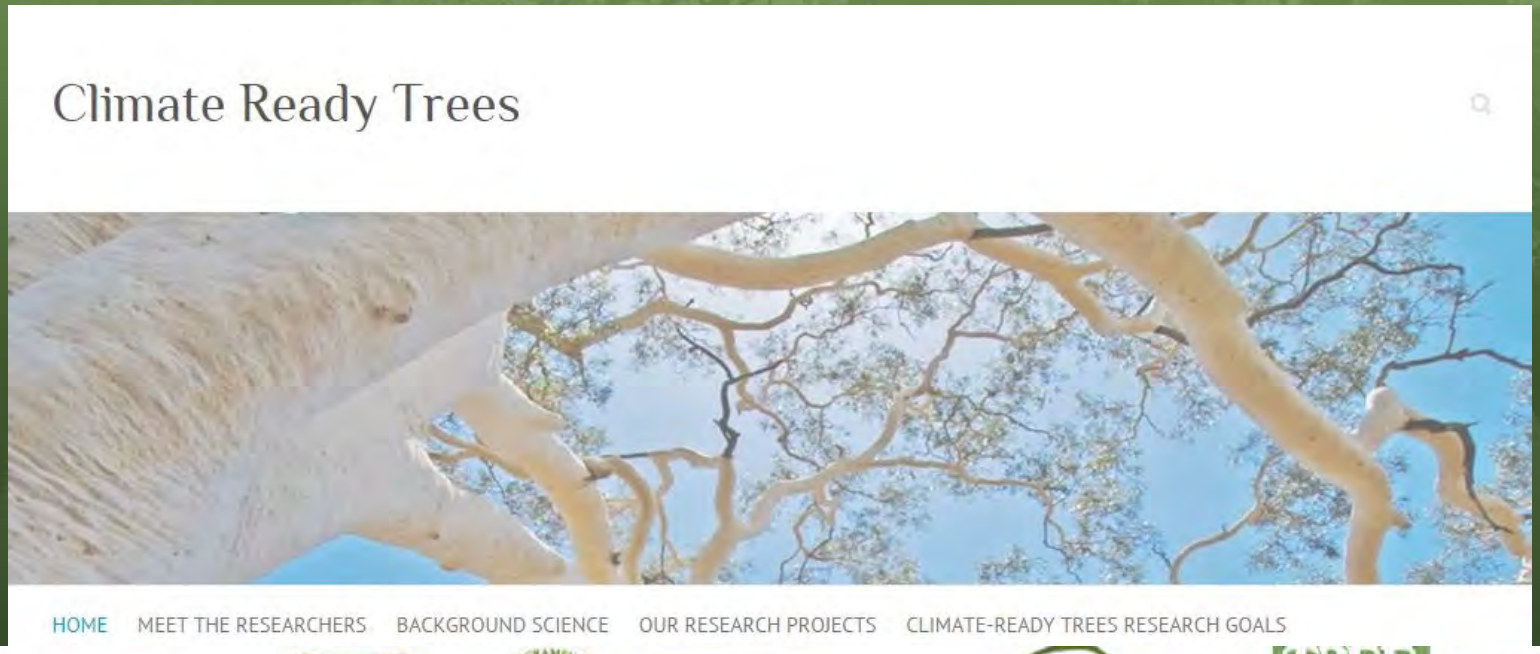
- Irrigation applied
- ET, minimum temperatures (CIMIS)

Data Analyses



Step 5: Share Results

http://climatereadytrees.ucdavis.edu/

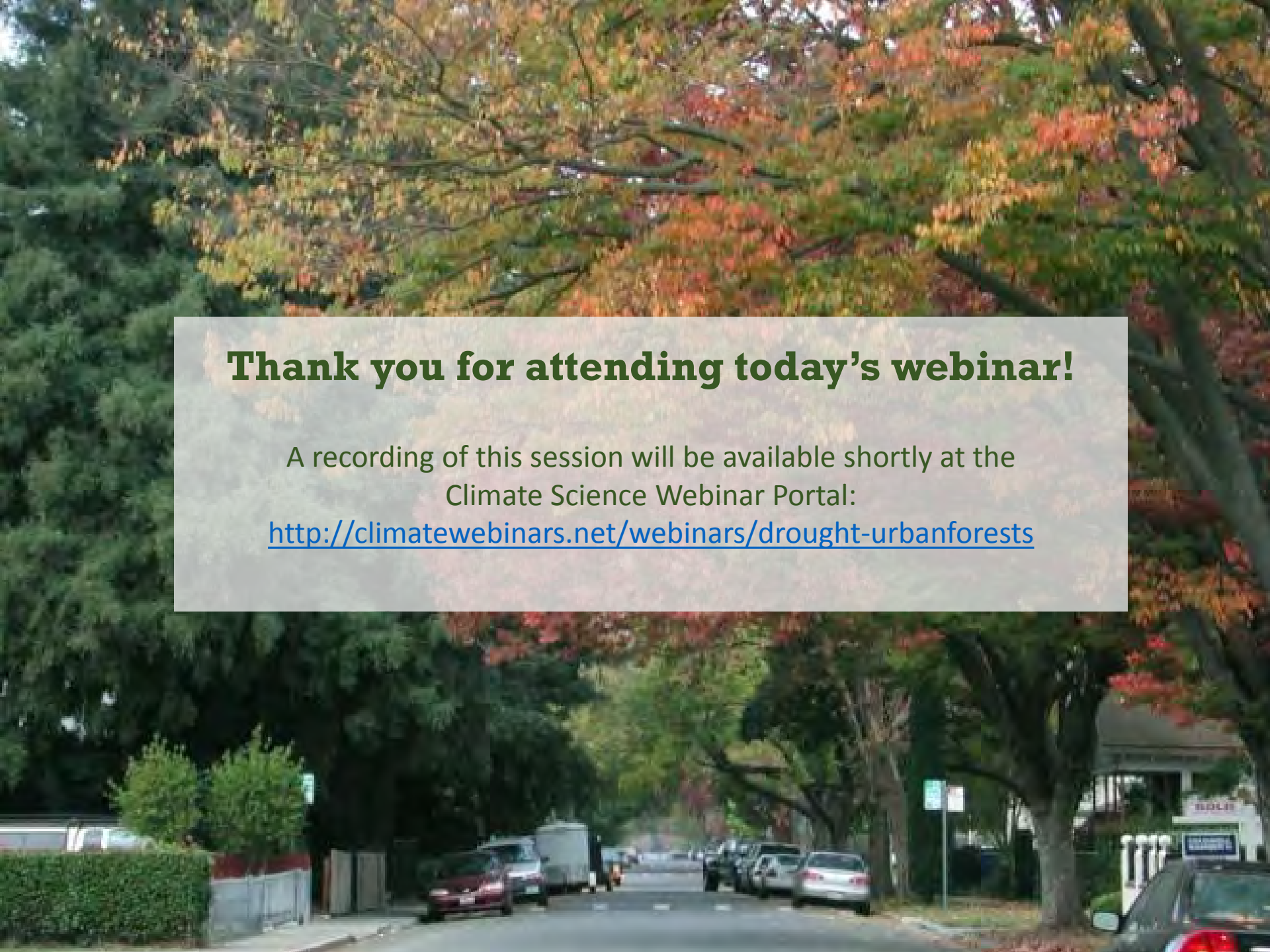


Questions?

http://www.fs.fed.us/psw/topics/urban_forestry/

Questions & Answers

- By phone: Dial #2 to enter the queue.
- On your computer: Type your question into the Q & A pod on the left side of your screen.



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http://climatewebinars.net/webinars/drought-urbanforests