UFI's Climate Adaptation Project

The Arboretum, State Botanical Garden of Kentucky

UK Main Campus

Lexington Residential Street Trees

Images (left to right): https://arboretum.ca.uky.edu/visit, https://www.lexingtonky.gov/news/10-01-2020/city-university-kentucky-respond-campus-activity, https://www.kentucky.com/news/local/article221433385.html

Imagine what climate resilience looks like for your community.

Climate Change in Kentucky

Expected Changes

Increased temperatures

Increased drought
The total amount of water running off into rivers or recharging groundwater is likely to decrease by 2.5-5%.

Increased rainfall (amount of rainy days will increase as well as the amount of rain that falls)
Rainfall has increased by 5% since the first half of the 20th Century and the amount of precipitation during heavy rainfalls has increased by 27%.

Consequences

Water

Storm events

Agriculture

Forests

Human Dimensions

Water

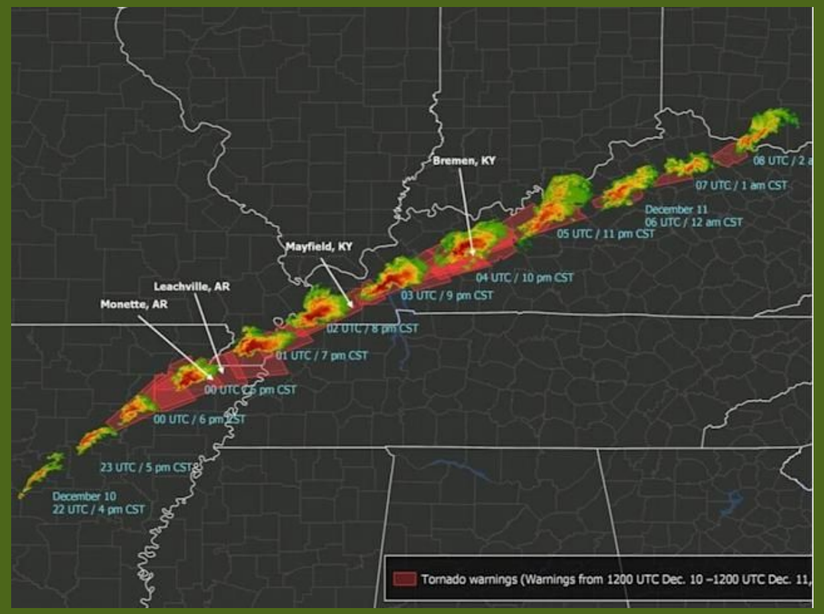
A barge passes by sandbars in the Ohio River near Paducah, KY in mid August 2005 (https://www.weather.gov).

Increased risk of flooding

Interruption of water navigation (including transportation of commercial goods)

Rivers and reservoirs may start to dry up, impacting communities who rely on those water resources for drinking water and electricity production (especially for the Ohio, Tennessee, and Cumberland Rivers)

Storm Events



Tornadoes in Western Kentucky, December, 2021 (https://www.independent.co.uk).

Increased moisture in the atmosphere due to hotter temperatures, which increases evaporation

More severe storm events- *The number of tornadoes touching ground during severe storm events has increased over the last 50 years, and "Tornado Alley" is moving northeast.*

Extreme weather events during unexpected times of the year

Agriculture

Cattle in Jessamine county during 2019 drought (https://www.wkyt.com).

Corn withering in 2012 drought in Western Kentucky (https://www.cbc.ca).

Longer frost-free growing seasons and increased levels of CO2 may increase crop yields, but more severe droughts will offset that increase, leading to a decrease in agriculture production (especially in soybeans and corn, two important cash crops for the state). Livestock will also suffer.

This is especially true for Western KY. *In the next 70 years,15-30 more days each year will have temperatures over 95 degrees F.*

Forests

Wildfire in Sky Bridge, RRG during 2019 drought (https://www.wlky.com).

Climate change poses new insect and disease threats to forests

Increased temperatures and rainfall could change forest composition (applies to built environment)

Increased droughts will decrease forest productivity

Increased risk of forest fires

Human Dimensions

Air quality alert in Louisville after West coast wildfires in 2021 (https://www.whas11.com).

Greater risks of strokes and dehydration

Increased temperatures increase the concentration of ground level ozone, which can provoke asthma and other lung diseases

These threats are more severe for vulnerable populations (the elderly, children, low income residents)

There will be an influx of climate refugees

We are all interconnected, and climate change impacts everyone.

Picture: Planet earth ... A large organism more and more complex and more and more interconnected, Renzo Biolchi.

Addressing Climate Change

Mitigation

Adaptation and Resilience

How can urban and community forests help us address climate change?

Climate Change and Urban Forests

Urban tree benefits

- Sequester carbon dioxide
- Provide shade and cooling
- Reduce stormwater runoff
- Improve mental health

Climate change threats

- Storm events
- Drought and precipitation
- Pests and pathogens
- Shifting climate

*I am referring to these forest systems as “urban forests” because this is where we conducted our study, but these ideas can still apply to rural communities and their trees.

Climate Adaptation in Urban Forestry

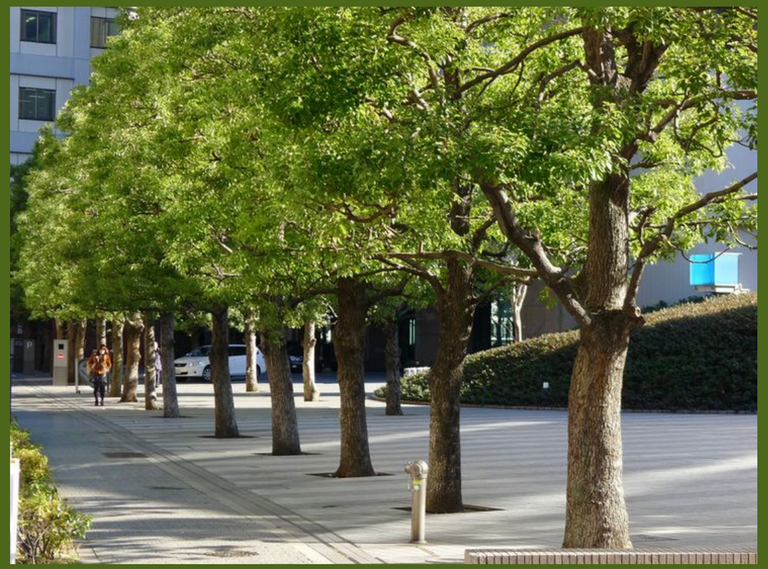


Image: https://www.wmky.org/post/greening-lexingtons-urban-landscape

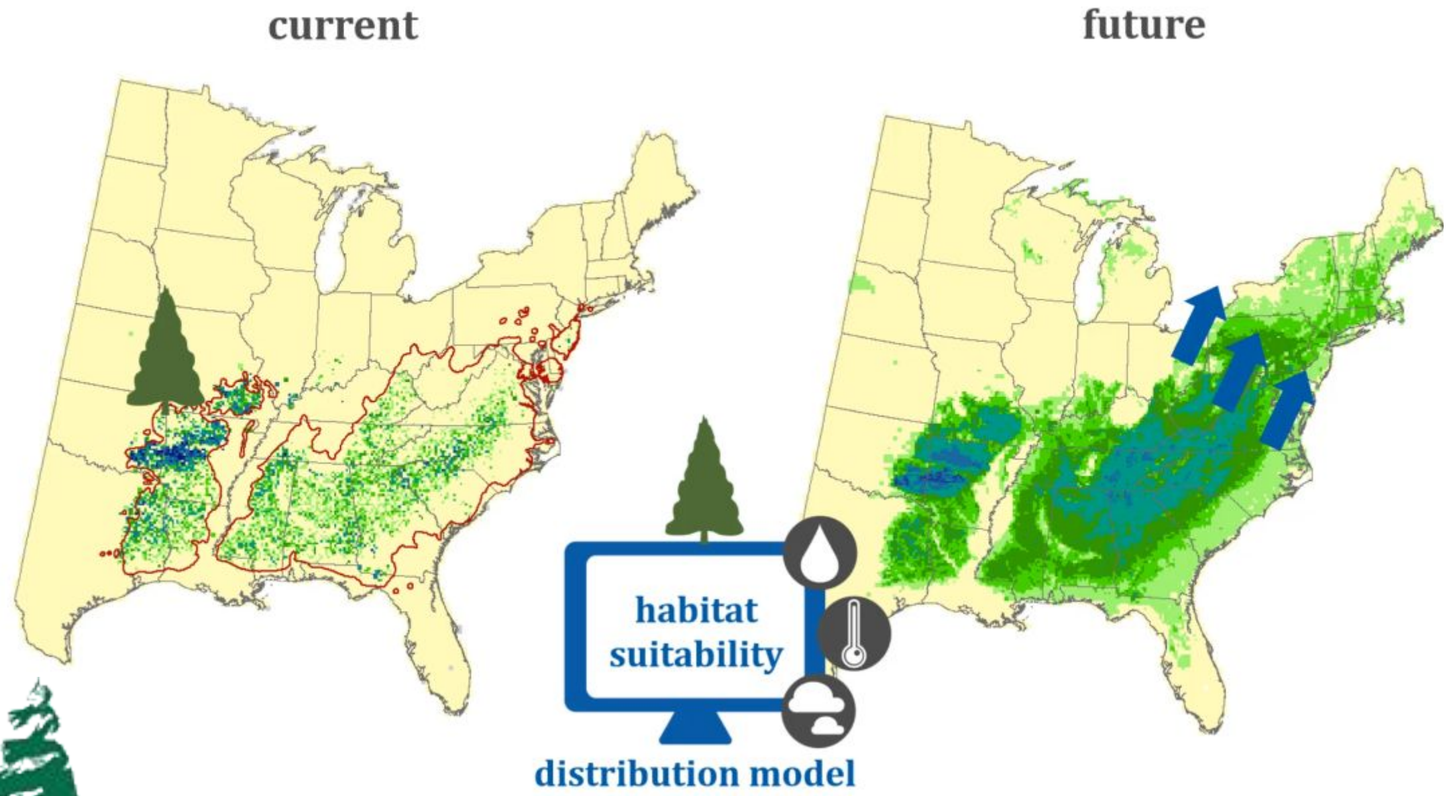
The ability of our urban forests to respond to climate change, avoid future canopy losses, and support a healthy tree canopy.

Climate Vulnerability Ratings

Assessment of how well a species will perform on the landscape using environmental, biological, and social factors and climate projections

Shifting suitability

Based on climate projection models

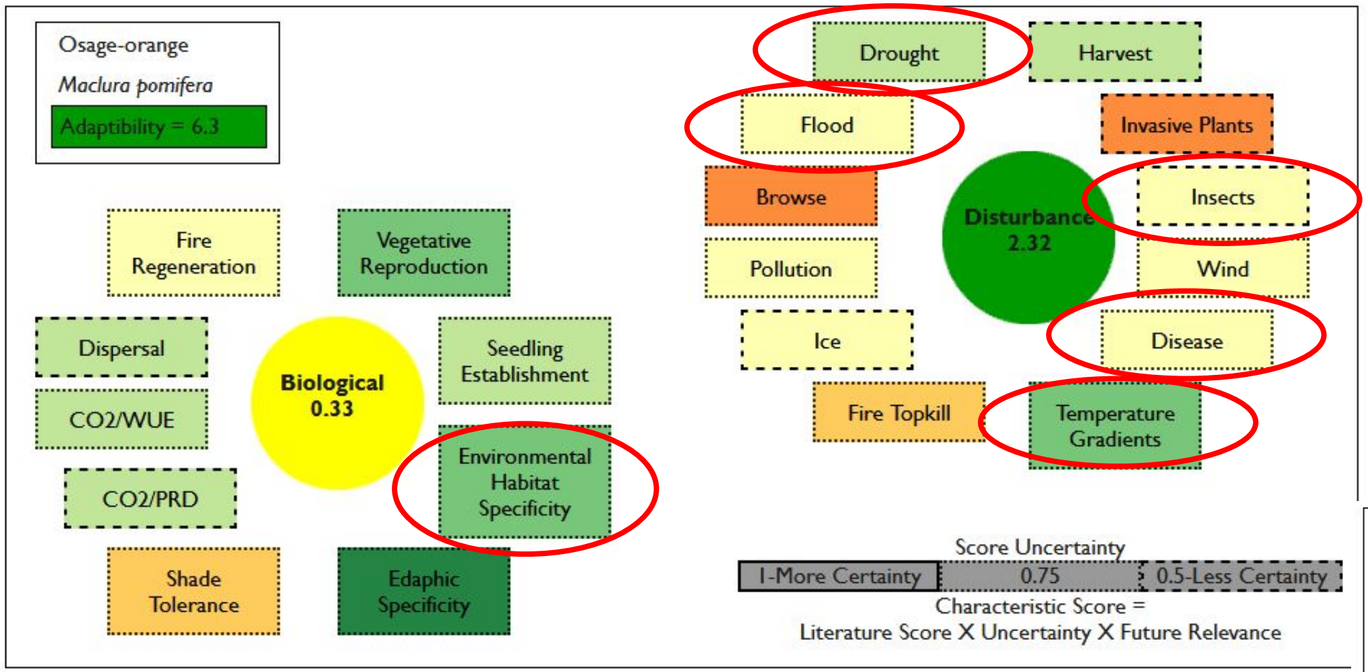


NIACS
Northern Institute of Applied Climate Science

Images (left to right): https://www.nrs.fs.fed.us/niacs/, https://www.fs.fed.us/nrs/atlas/tree/

Adaptive capacity

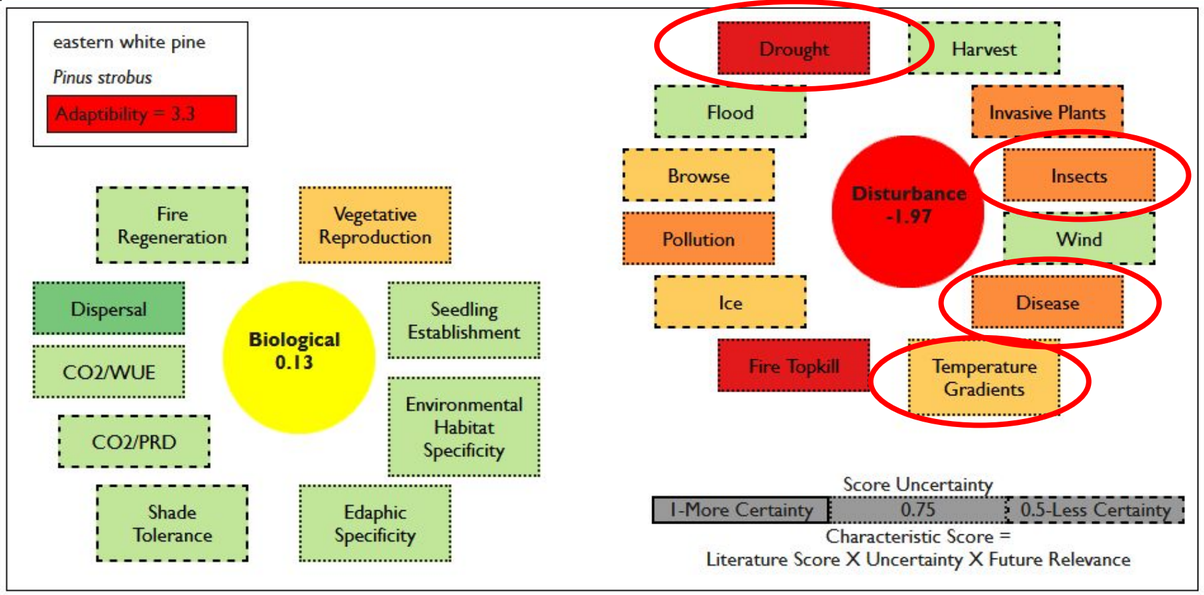
Based on biological and disturbance factors



V Hi Pos +3	High Pos +2	Low Pos +1	Minimal 0	Low Neg -1	High Neg -2	V Lo Neg -3

Osage orange-
high adaptability

Eastern white pine-
low adaptability



V Hi Pos +3	High Pos +2	Low Pos +1	Minimal 0	Low Neg -1	High Neg -2	V Lo Neg -3

https://www.fs.fed.us/nrs/atlas/tree/

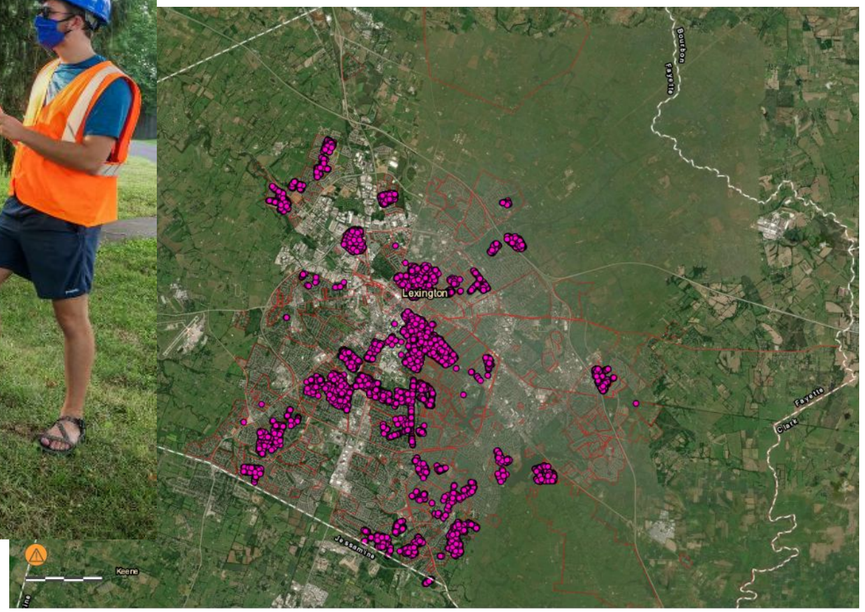
Tree Inventories and Assessments

Understanding the tree canopy

- Biodiversity
- Health-class distribution
- Size-class distribution
- Climate vulnerability

Patterns associated with tree canopy

- Socioeconomic status
- Neighborhood age
- Not equally distributed



Lexington's Tree Canopy

Species

123 different species

Red maple (*Acer rubrum*) made up 29.40% of the street tree canopy

Callery pear (*Pyrus calleryana*) made up 17.54% of the street tree canopy

Health

69.5% of the street tree canopy was in good condition

6% of the street tree canopy was in poor to dead or dying condition

Size

3/4 of street trees were less than 16 inches in diameter

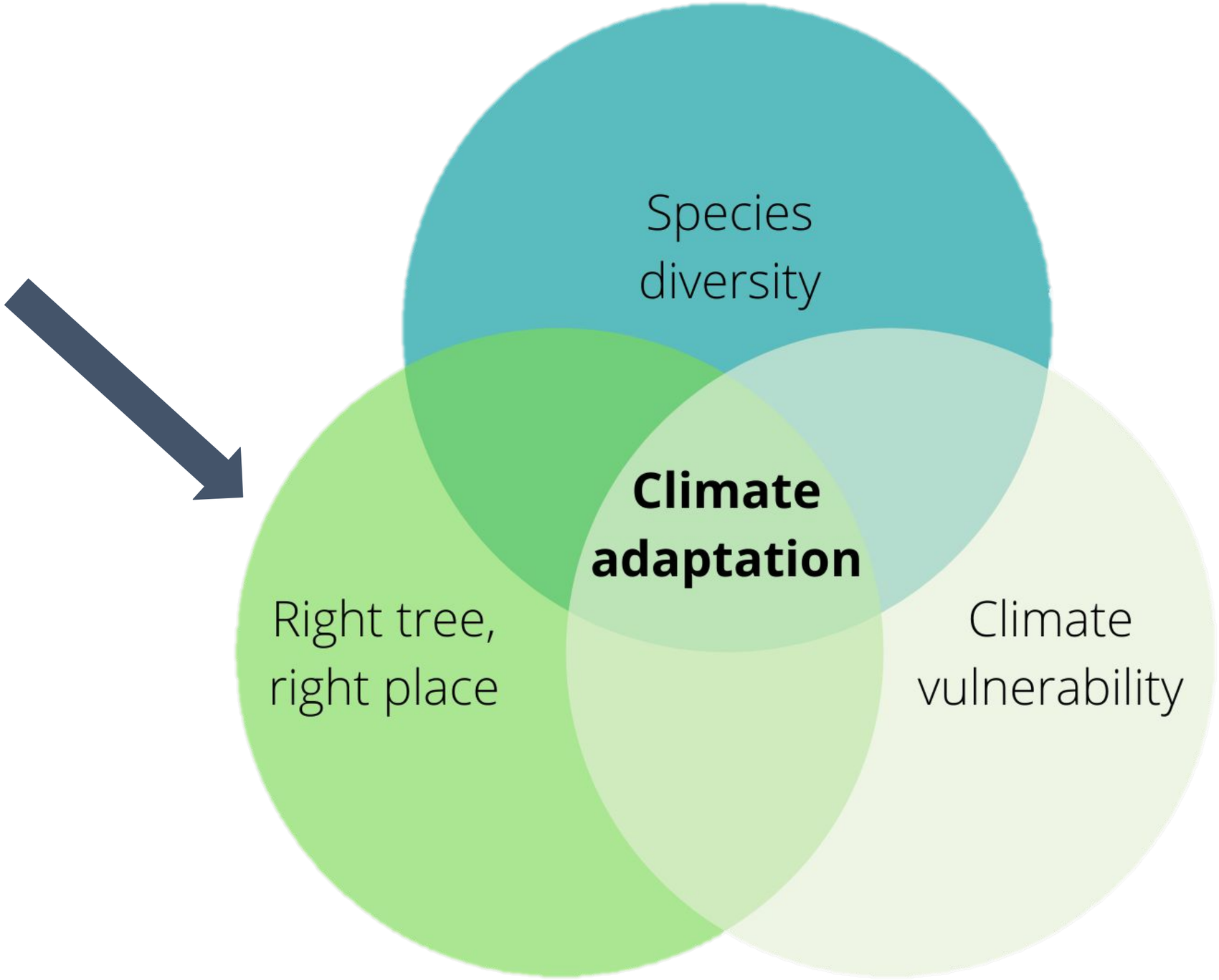
Pin oaks made up 1/4 of Lexington's largest street trees

Vulnerability

Over 1/2 of street trees had a low to low-moderate vulnerability rating

33.6% of street trees had a moderate-high vulnerability rating

Less than 1% were highly vulnerable


Species
diversity
Climate
adaptation
Right tree,
right place
Climate
vulnerability

Lexington's Tree Canopy

Neighborhood Age

Younger neighborhoods (built between 1990 and 2010) were less diverse than older neighborhoods (built between 1900 and 1950)

45 species were recorded in younger neighborhoods compared to 116 species in older neighborhoods

Younger neighborhoods had higher stem density but lower basal area than older neighborhoods

Neighborhood Socioeconomic Status (SES)

Low SES neighborhoods had lower stem density than high SES neighborhoods

Low SES neighborhoods had lower basal area than high SES neighborhoods

Low SES neighborhoods had a higher number of empty tree wells than high SES neighborhoods

Takeaways

There are significant tree deficits in Lexington's tree canopy in low SES neighborhoods- this is an environmental justice issue

Newer neighborhood developments need to prioritize tree diversity

These tree canopies are more vulnerable to climate change

Tree Reports

Purpose: to share findings, educate stakeholders, and help inform future management decisions

Lexington Street Tree Analysis

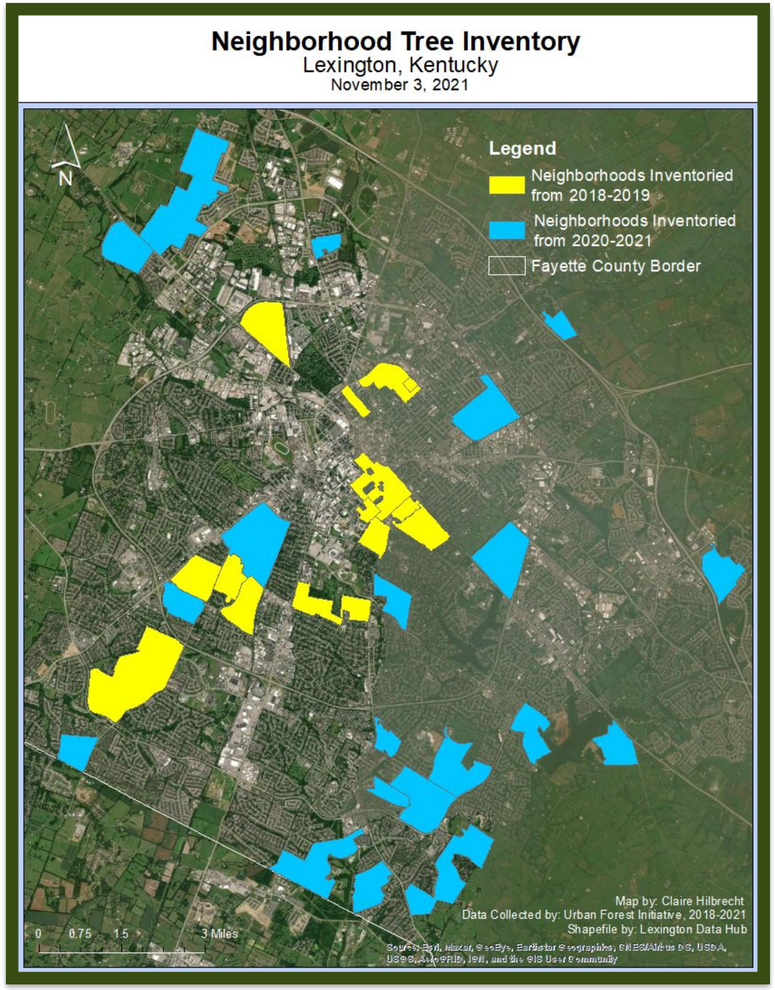
A pilot study conducted by the UK Urban Forest Initiative Core Team

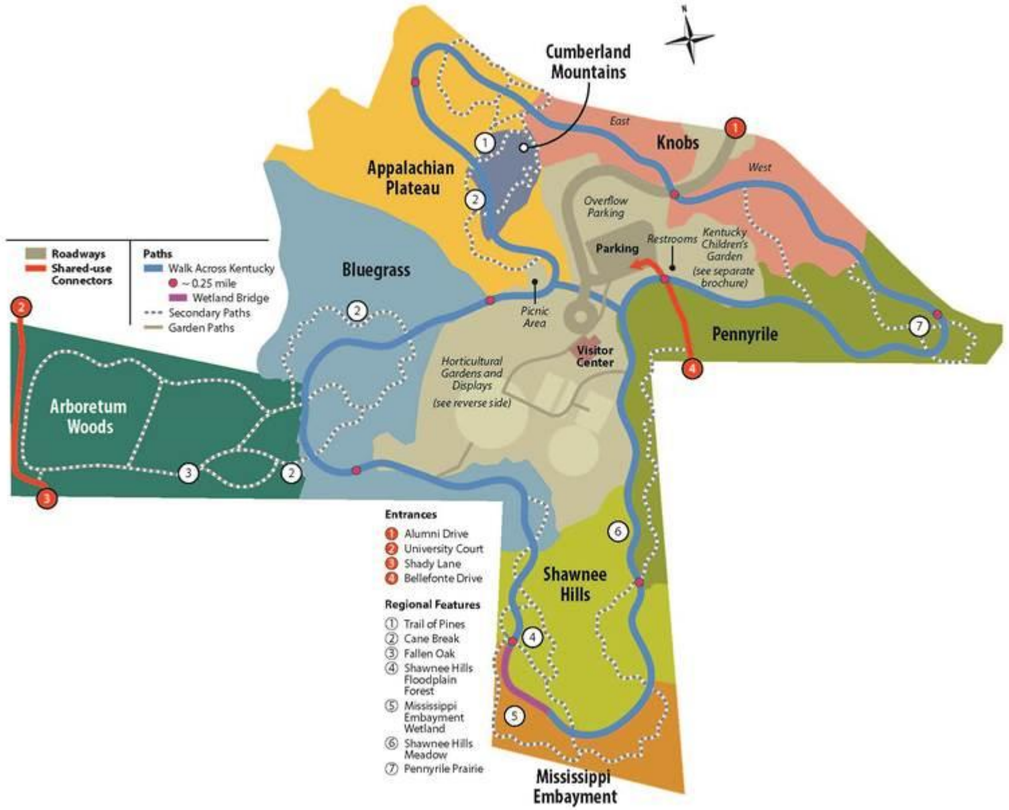
2018-2021

Claire Hilbrecht, Mary Arthur, Ph.D, Nic Williamson, M.S.,

Lynne Rieske-Kinney, Ph.D, and Chris Sass, Ph.D

URBAN FOREST INITIATIVE





The Arboretum's Climate Adaptation Plan

Working toward climate resilience in the Walk Across Kentucky Collection

what next?

Climate Adaptation in Community

Environmental justice - combatting unjust systems

People play a critical role in climate adaptation

Community awareness and involvement

Should happen in tandem with scientific research and policy

Climate Conversations

https://climateconversationslex.weebly.com/

Started with Tree Week 2021

Encouraging folks to imagine climate resilient communities

Yard signs (art, accessibility, positivity, conversation starters)

What if we could name 5 native trees?

Imagine a climate resilient Lexington.

The average American can name over 100 corporate logos and only 10 plants.

- Robin Wall Kimmerer

You can change that.

Join the #ClimateConversation

Order through Southland Print:
https://www.southlandprint.com/

What if we cared for trees like they care for us?

Imagine a climate resilient Paducah.

Trees are more likely to survive when they are properly mulched and pruned.

Join the #ClimateConversation

Order through Southland Print:
https://www.southlandprint.com
/

What if we supported our local farmers?

Imagine a climate resilient Georgetown.

Local food builds community, reduces resource consumption, and preserves our natural lands.

Join the #ClimateConversation

Order through Southland Print:
https://www.southlandprint.com
/

What if our yards were pollinator habitats?

Imagine a climate resilient Hazard.

Let's create pollinator friendly habitats to support local food and flowering plants.

Join the #ClimateConversation

Order through Southland Print:
https://www.southlandprint.com/

What if we had more community gardens?

Imagine a climate resilient Berea.

Community gardens...

- Increase fresh foods
- Support food security
- Improve mental health
- Provide educational opportunities for the community.

Join the #ClimateConversation

Order through Southland Print:
https://www.southlandprint.com/

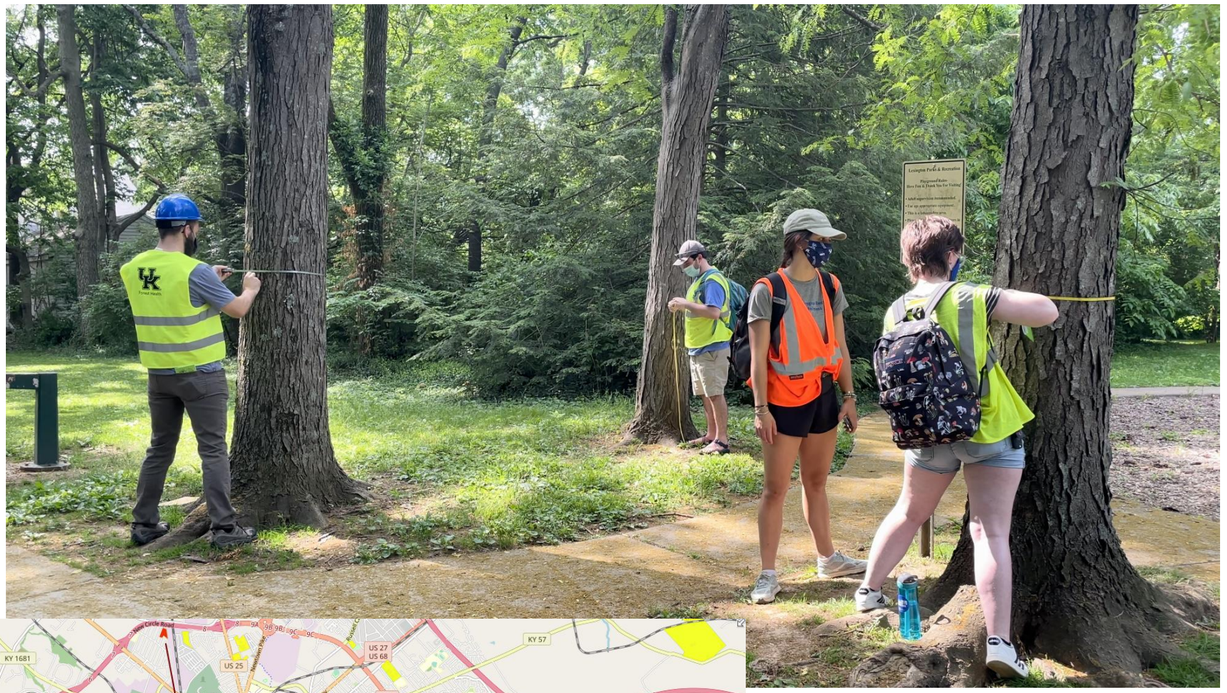
Upcoming community events

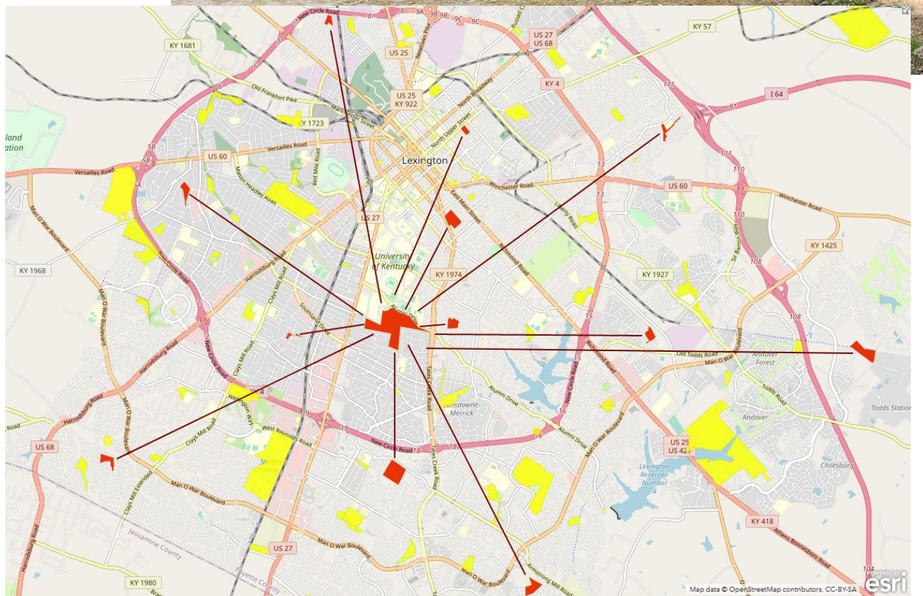
Tree Inventory Workshop at The Arboretum

- Saturday, May 14 10am EST
- Learn basic tree ID and assessment skills
- Email arboretum@uky.edu

Community parks inventories

- Gather data about trees in Lexington public parks
- Email claire.hilbrecht@uky.edu





Challenge: Have a climate conversation today.

Questions?