

# Advancing Useable Drought Prediction to Improve Urban Forest Ecosystem Drought Resilience

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# Project Team



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## Unfunded Collaborators



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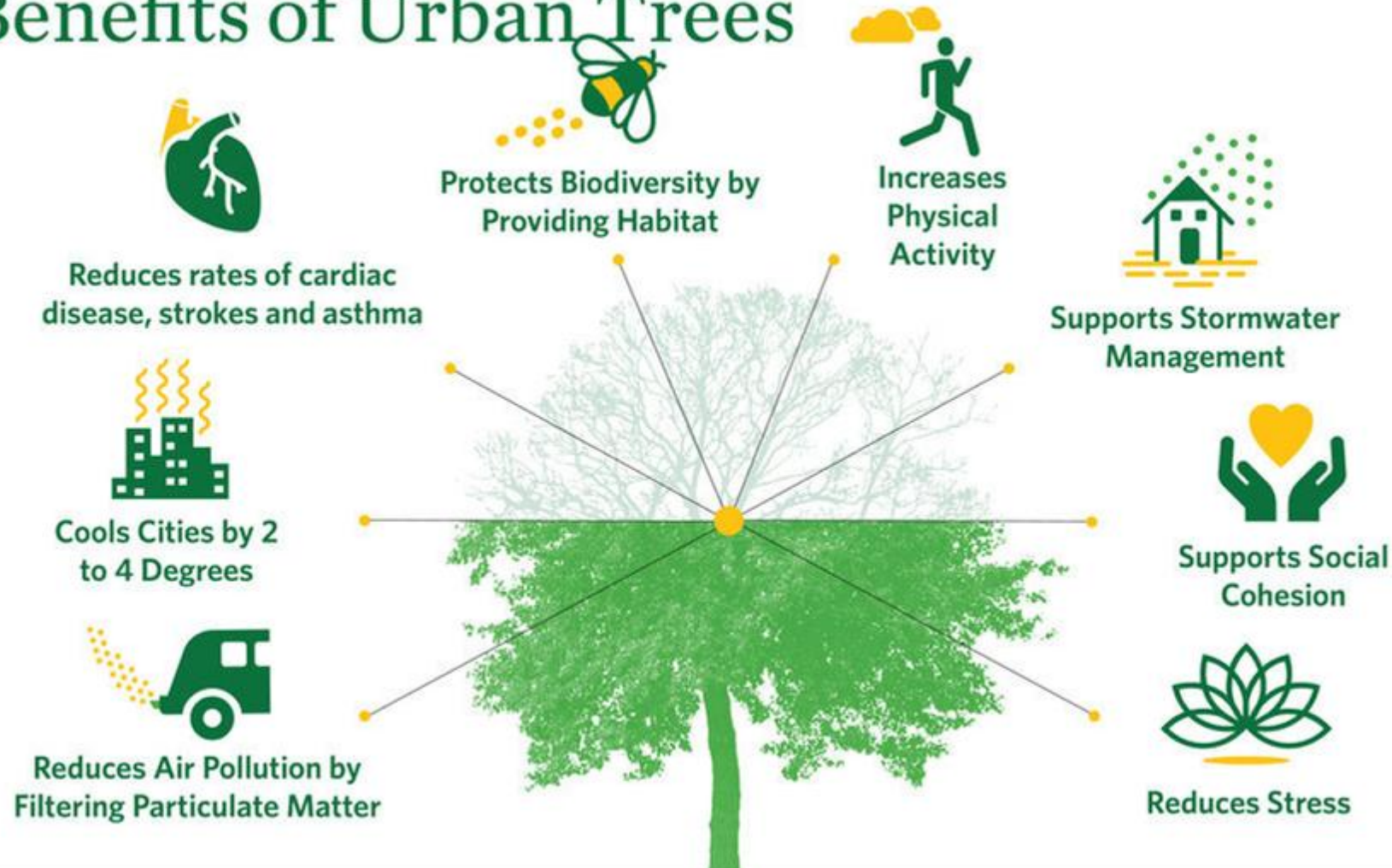


Dr. Ayo Deas

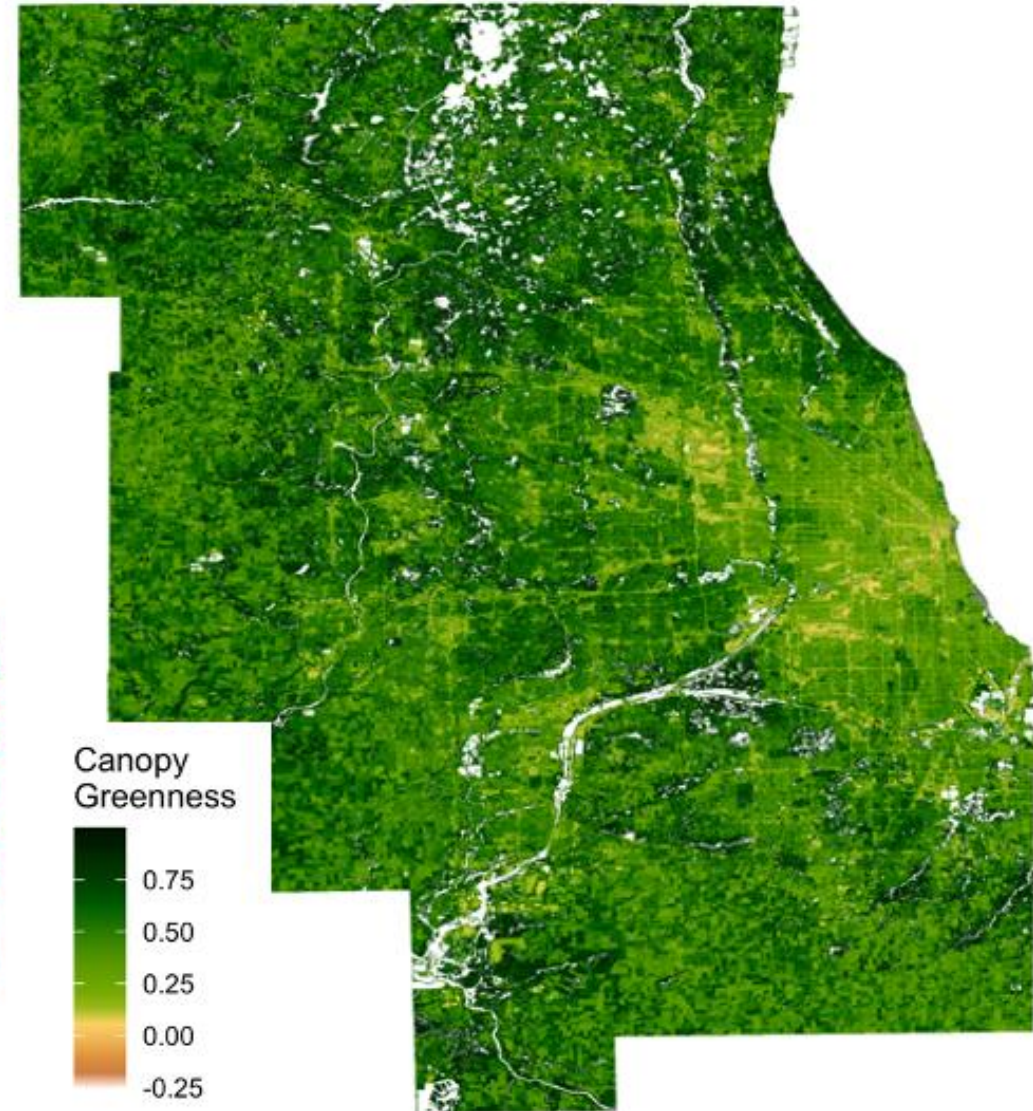
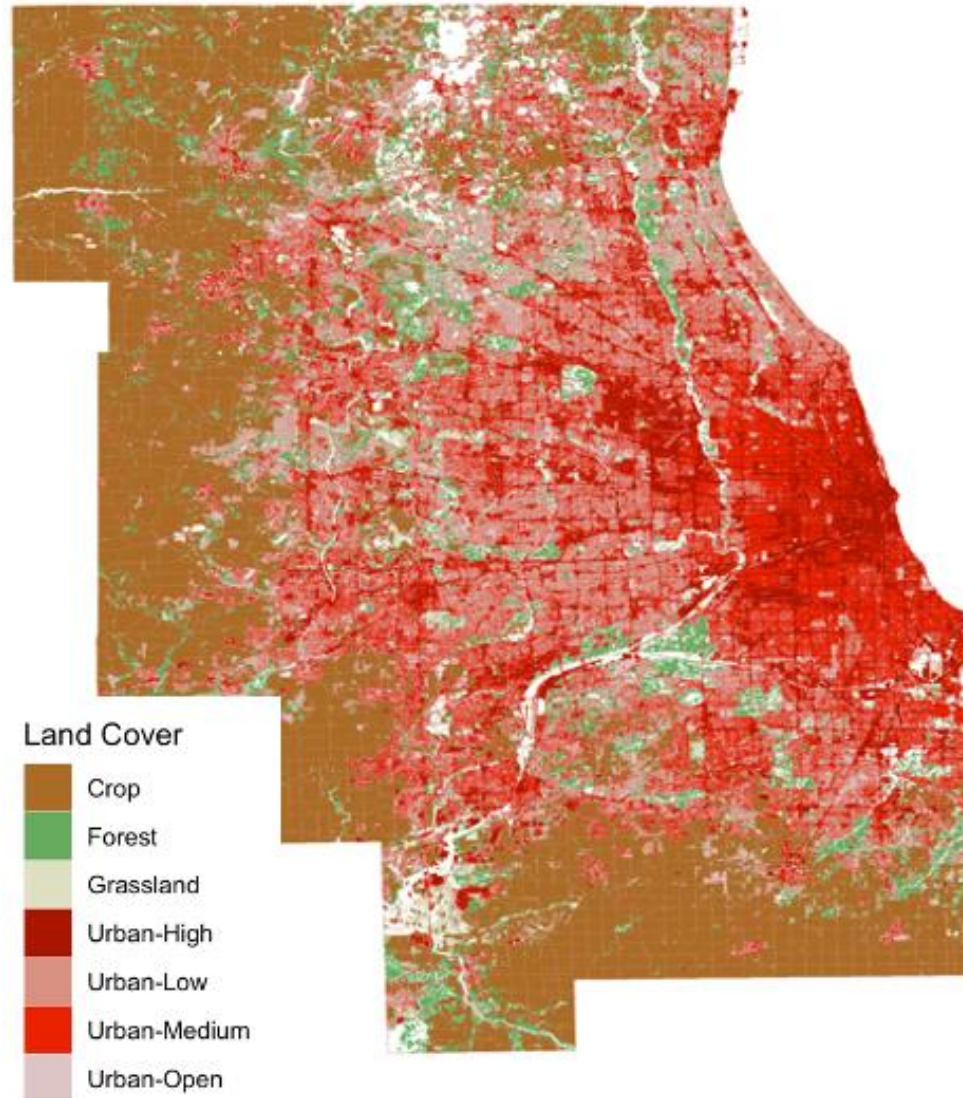
# Benefits of urban trees requires healthy trees.

- Global cities are spending millions to plant trees
- Resources and information needed to ensure those trees provide benefits

## Benefits of Urban Trees



# Variation in Greenness = Landcover + Weather (simplified version)





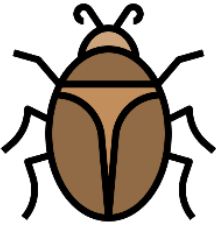
# Drought Impacts on Trees



Water Limitations



More Evaporative Demand



More Vulnerable to Pests



Slowed Growth



Risk of Wildfire & Wind Damage



# Early Warning Largely Misses Urban Ecological Drought

U.S. Drought Monitor

## Illinois

June 27, 2023

(Released Thursday, Jun. 29, 2023)

Valid 8 a.m. EDT

Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	0.00	100.00	92.73	58.73	1.10	0.00
Last Week 06-20-2023	0.00	100.00	82.02	30.67	0.00	0.00
3 Months Ago 03-28-2023	100.00	0.00	0.00	0.00	0.00	0.00
Start of Calendar Year 01-03-2023	35.34	64.66	3.98	0.00	0.00	0.00
Start of Water Year 09-27-2022	65.33	34.67	8.15	0.00	0.00	0.00
One Year Ago 06-28-2022	41.53	58.47	8.39	0.00	0.00	0.00

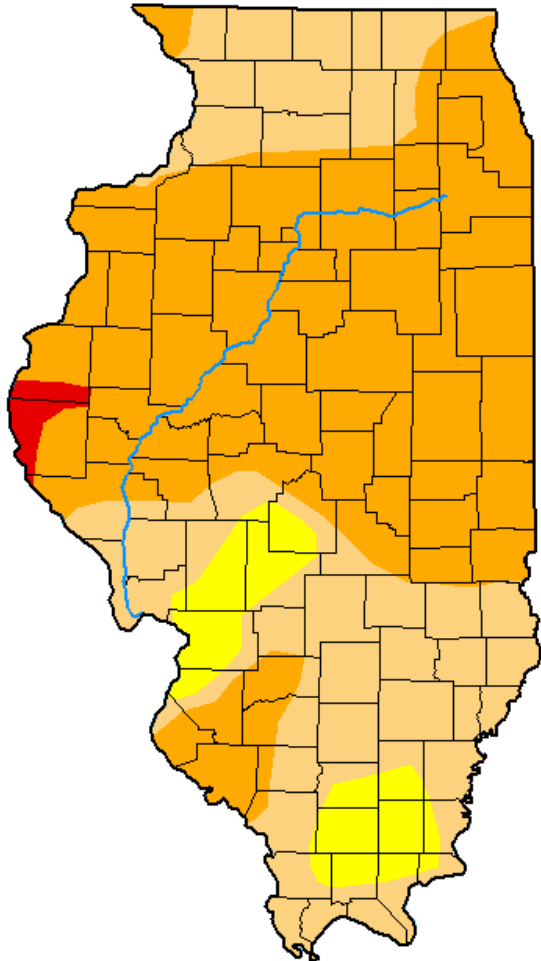
Intensity:

 None	 D2 Severe Drought
 D0 Abnormally Dry	 D3 Extreme Drought
 D1 Moderate Drought	 D4 Exceptional Drought

The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. For more information on the Drought Monitor, go to <https://droughtmonitor.unl.edu/About.asp>.

Author:

Curtis Riganti  
National Drought Mitigation Center

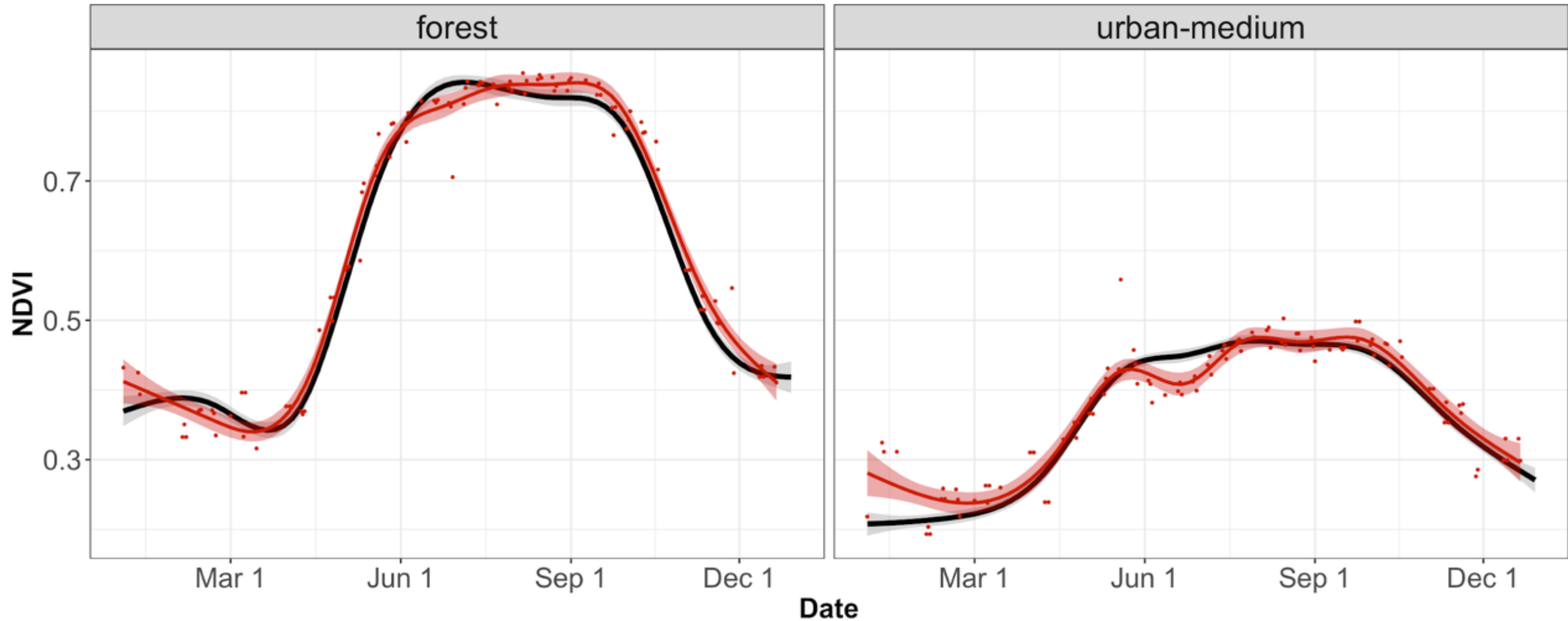


- Very little soil moisture information available in forested areas
- Many remote sensing tools tuned to cropland dynamics
- Impact reports hard to come by

**These issues are even worse in urban areas**

# Greenness as an Early Warning Indicator

— 2023 — normal




# Meeting Stakeholder Needs

- Zoom listening sessions with tree professionals and residents
- In-person workshop with tree professionals and municipal managers

**Keep it Simple & Useable**





Dashboard  
Analysis  
About

### Chicago Urban Greenness & Drought Portal

----- NOTE: This portal is in beta & still under development, some features may be incomplete or subject to change -----

Status for Land Cover Types - (Status Categories: **Much Greener than Normal**, **Greener than Normal**, Normal, **Browner than Normal**, **Much Browner than Normal**)

<b>Crop</b> Slightly Greener than Normal +11.3% from average	<b>Forest</b> Slightly Greener than Normal +7.9% from average	<b>Grassland</b> Slightly Greener than Normal +10.8% from average	<b>Urban-Open</b> Significantly Greener than Normal +16.7% from average	<b>Urban-Low</b> Slightly Greener than Normal +12.7% from average	<b>Urban-Medium</b> Slightly Greener than Normal +9.5% from average
<b>Urban-High</b> Slightly Greener than Normal +10.2% from average					

**Note:** NDVI values for **November–March** should be interpreted with caution — winter vegetation signals in the Chicago region are less reliable due to snow cover, leaf-off conditions, and low solar angle.

Latest Data Report

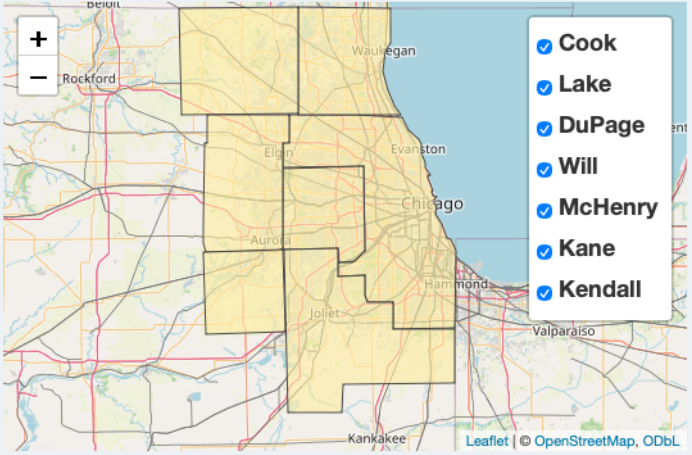
**Most Recent Data is from April 25, 2026**

**The NDVI percentiles below show how current vegetation conditions compare to those on the same calendar day in previous years for their respective land cover type.**

- Crop NDVI Percentile: 88.5%
- Forest NDVI Percentile: 76.9%
- Grassland NDVI Percentile: 88.5%
- Urban-High NDVI Percentile: 88.5%
- Urban-Medium NDVI Percentile: 88.5%
- Urban-Low NDVI Percentile: 96.2%
- Urban-Open NDVI Percentile: 96.2%

**A lower percentile suggests below-average greenness, while a higher percentile indicates above-average greenness**

For a more in-depth exploration, take a look at the other tabs or the directory.







- Dashboard
- Analysis
- >> NDVI Data Review
- >> Heat Maps for each LC Type
- About

## Chicago Urban Greenness & Drought Portal

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Overview of Feature | **By Landcover** | By Year

### Date window:

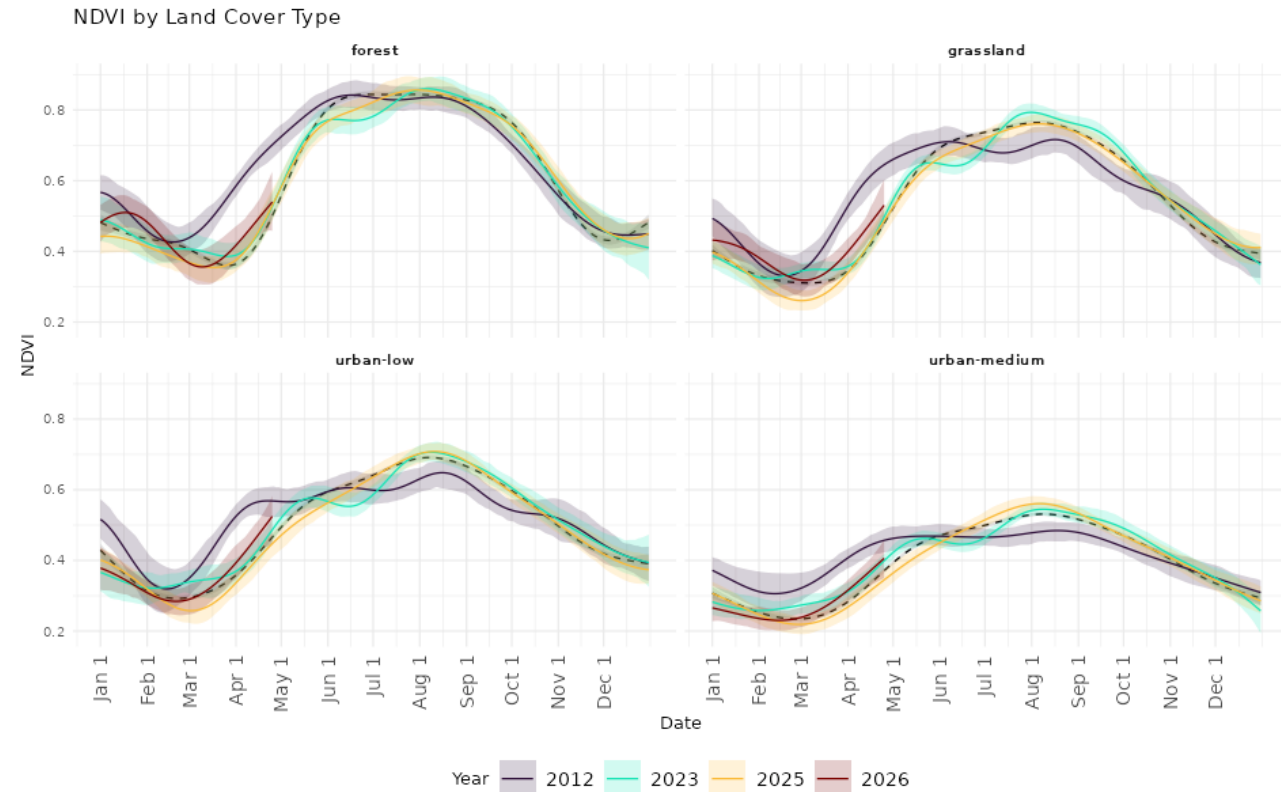
2026-01-01 to 2026-12-31

### Years to show:

- 2001  2002  2003
- 2004  2005  2006
- 2007  2008  2009
- 2010  2011  2012
- 2013  2014  2015
- 2016  2017  2018
- 2019  2020  2021
- 2022  2023  2024
- 2025  2026

### Land covers:

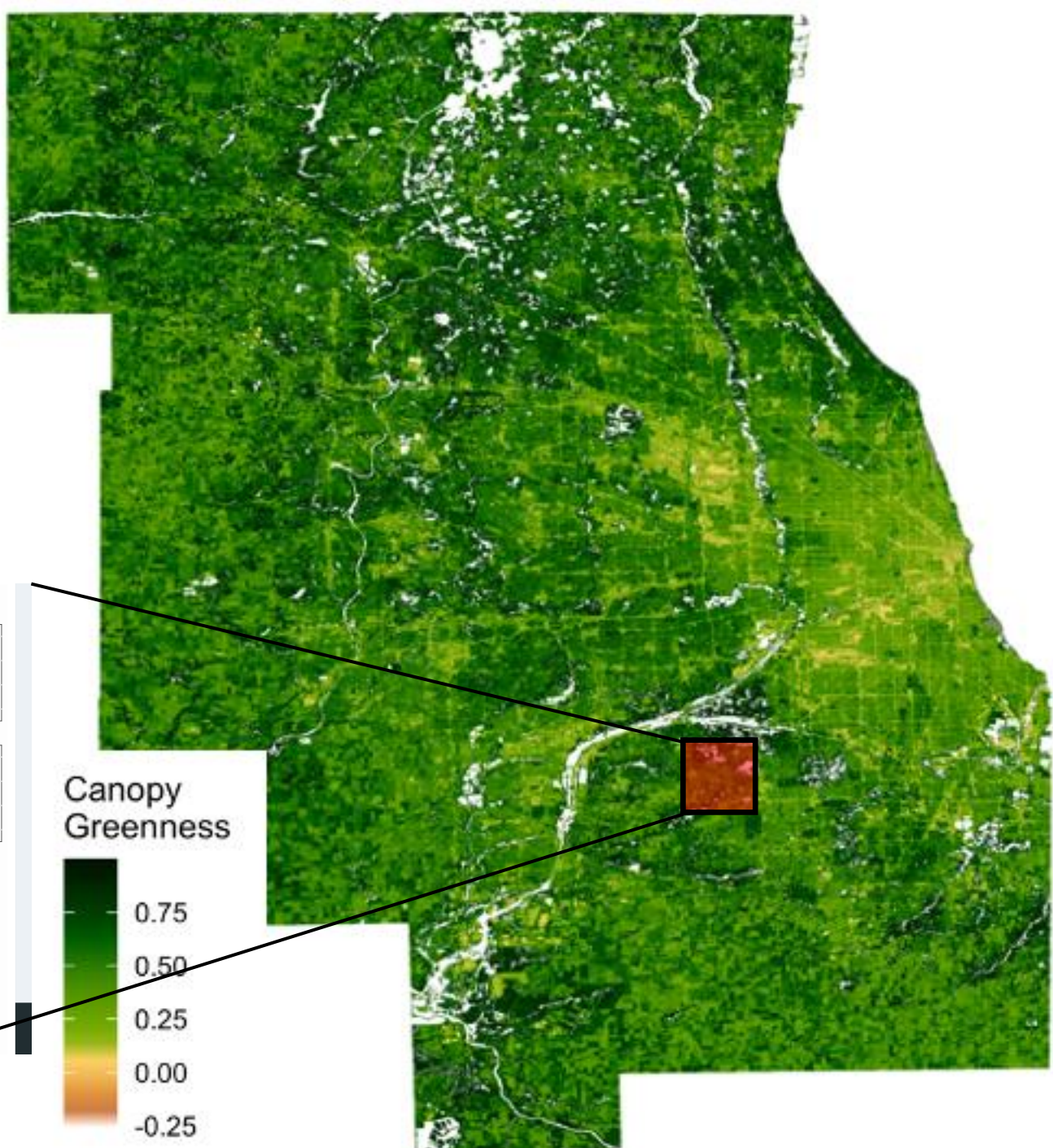
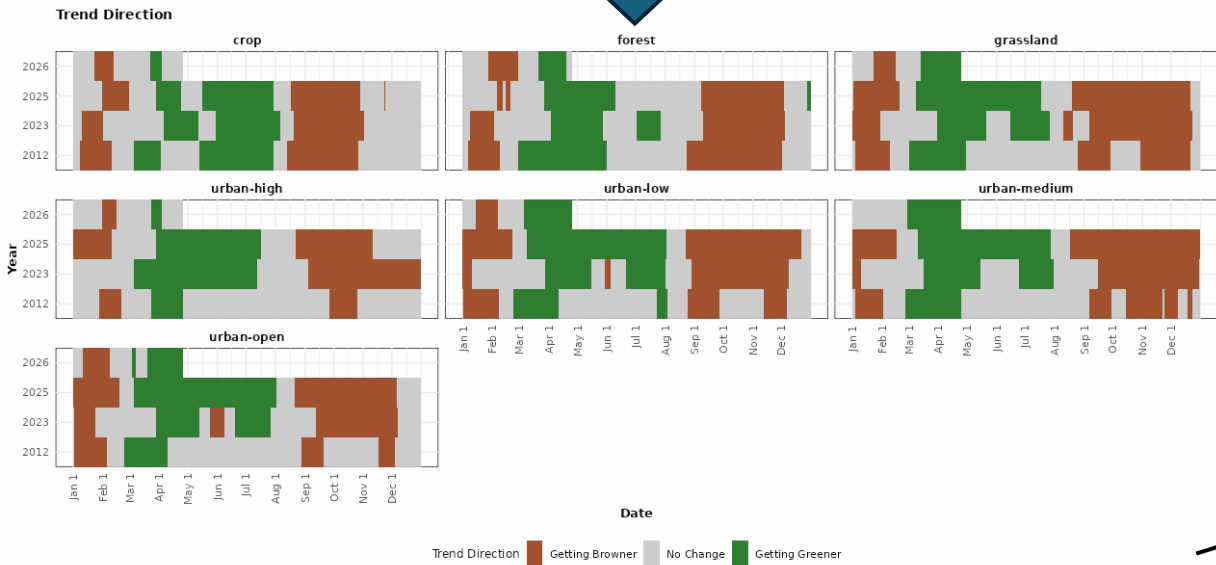
- crop
- forest
- grassland
- urban-high
- urban-low
- urban-medium
- urban-open
- Show summary stats



# Ongoing Advancements: Spatially Resolved Greenness Forecasts



## Extended Range Forecasts

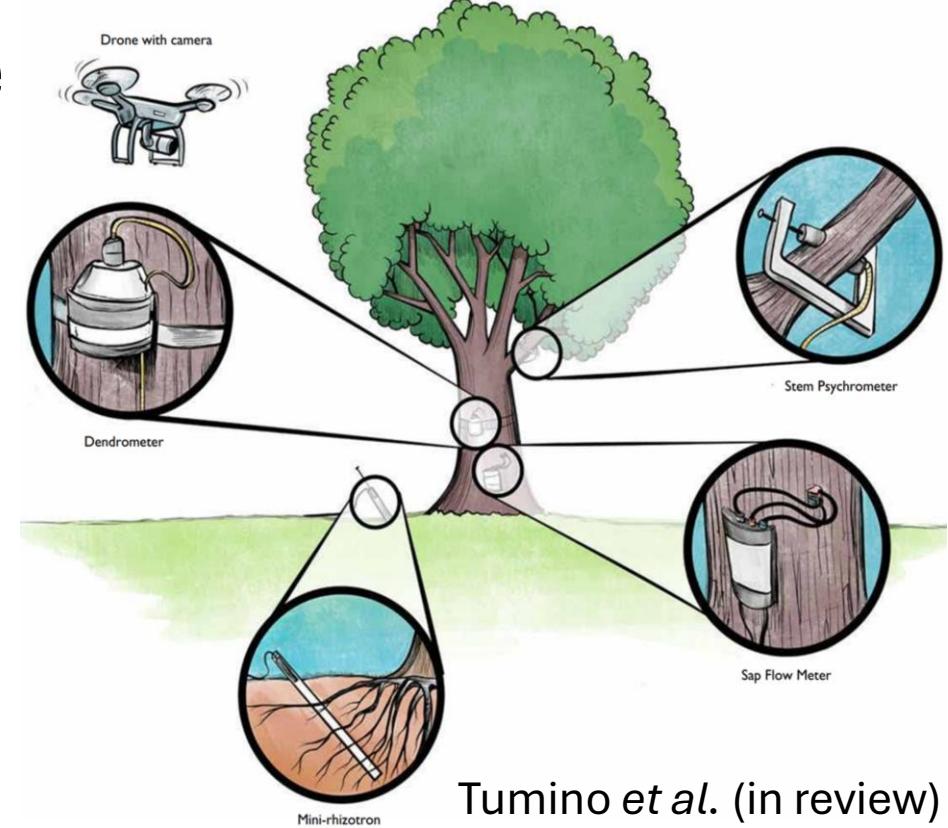


**Urban forest resilient requires connecting  
system-level exposure to tree-scale  
sensitivity.**

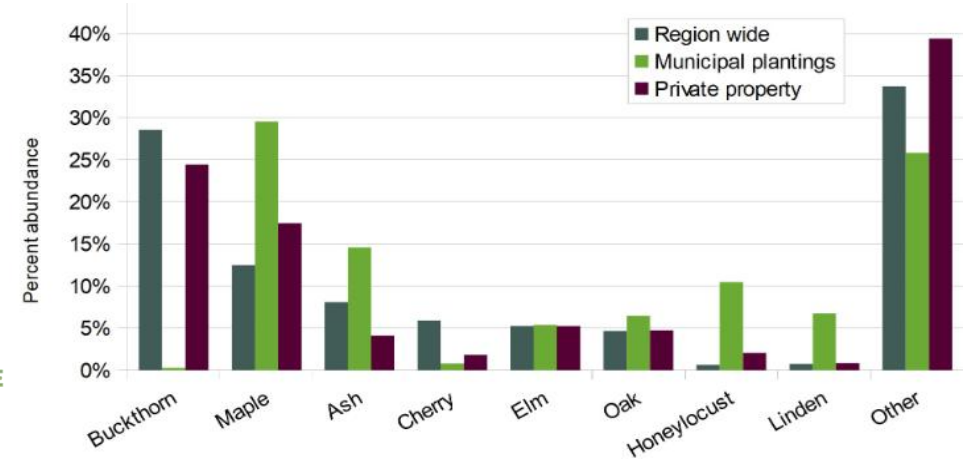


# Assessing Tree-Scale Drought Response

- Sampling dozens of sentinel species at four sites across Chicagoland
  - 2 urban: UIC campus
  - 2 suburban: Morton Arb
- Turgor pressure is highly correlative of tree drought response
- Leaf water potential at turgor loss point is a robust way of characterizing drought tolerance



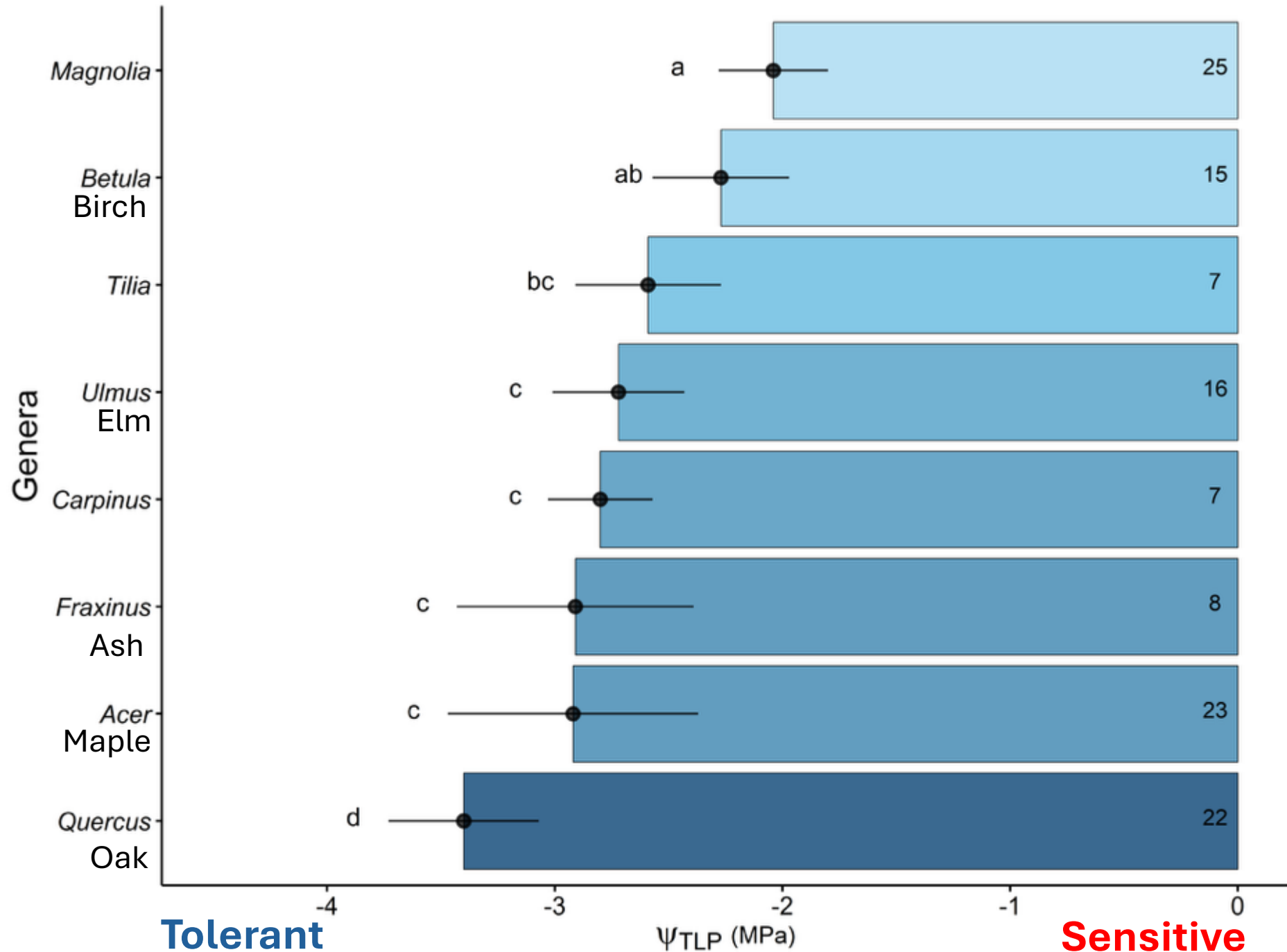
Tumino *et al.* (in review)



# Quantitative trait data can help.

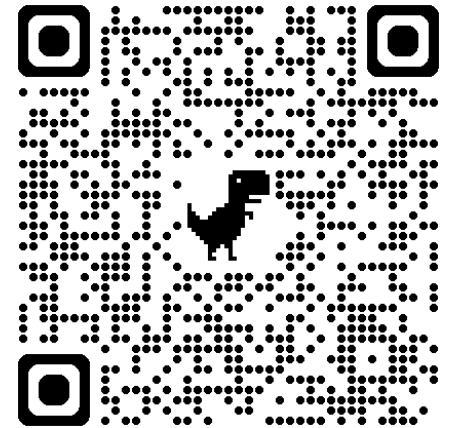
$\Psi_{TLP}$  is how much tension on the water column the tree can tolerate before it wilts.

(leaf water potential at turgor loss point)



# Our designations *for Chicago*

Species	Morton Arb.	Hirons & Sjöman 2019	N. IL Tree Species List	MO Botanic	U MN	USDA
Silver maple	Mod Tolerant	Mod Tolerant	Tolerant	Tolerant	Moderate	Sensitive
White Oak	Mod Tolerant	-	Tolerant	Tolerant	Tolerant	Moderate
Northern Red Oak	Tolerant	Mod Sensitive	Tolerant	Tolerant	Tolerant	Sensitive
American Elm	Tolerant	Mod Tolerant	-	Tolerant	-	-
Black Walnut	Mod Tolerant	Mod Sensitive	Moderate	Tolerant	Moderate	Sensitive
London Planetree	Mod Tolerant	Mod Tolerant	Tolerant	-	-	Moderate



The Morton Arboretum  
Plant Clinic  
Drought Tolerance Info

# More info available as species info on The Morton Arboretum's website



→ Overview

Determining Drought Tolerance

Important Considerations

Drought is a common stress experienced by plants during periods when they are unable to access and move enough water to support healthy growth and maintenance.

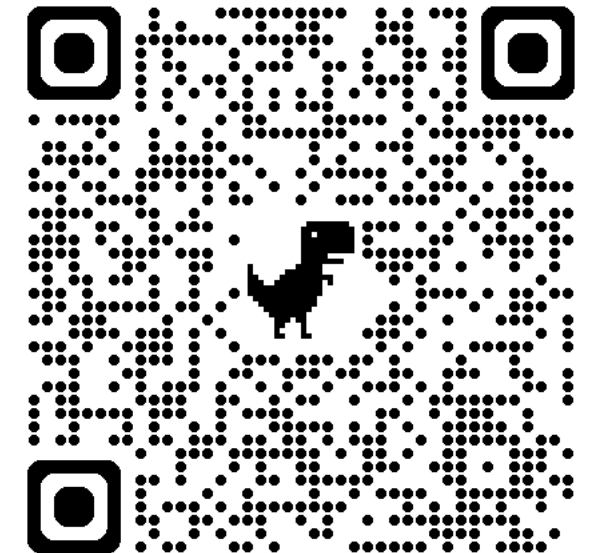
Drought stress may be the result of dry soil conditions, high air temperatures, or both. The frequency and severity of drought varies from mild and moderate short-term droughts, which often occur for a few weeks during summer, to more extreme and/or extended drought periods lasting a month or longer.

Most tree varieties used for landscaping or urban plantings are able to tolerate mild to moderate droughts. However, many are susceptible to more extreme or

Have tree and plant questions?  
Get expert help by contacting the Plant Clinic.

Email  
[plantclinic@mortonarb.org](mailto:plantclinic@mortonarb.org)

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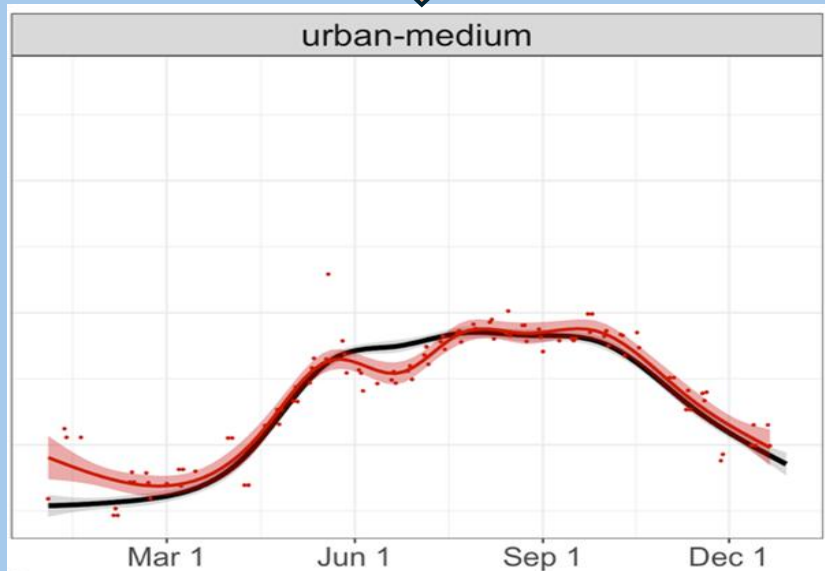


Publication & full table in peer-review (= hopefully coming soon)

The Morton Arboretum  
Plant Clinic  
Drought Tolerance Info

# Connecting It All: Early Warning to Tree Management

Neighborhood-Scale  
Greenness Forecasts



Targeted Early Warning  
by Trusted Messengers

