Millions, billions, and trillions – Do you have the tools to keep new trees alive?

Rachel Holmes

Urban Forestry Strategist

The Nature Conservancy

rholmes@tnc.org

Michelle Johnson

Research Ecologist

USDA Forest Service

Michelle.l.johnson@usda.gov

Rich Hallett

Research Ecologist

USDA Forest Service

Richard.hallett@usda.gov

Millions, Billions, Trillions – Tools to Keep Trees Alive

Urban Forest Connections Webinar
October 14, 2020

Dr. Michelle Johnson, USDA Forest Service
Dr. Rich Hallett, USDA Forest Service
Rachel Holmes, The Nature Conservancy

We have arrived…

TREES Act

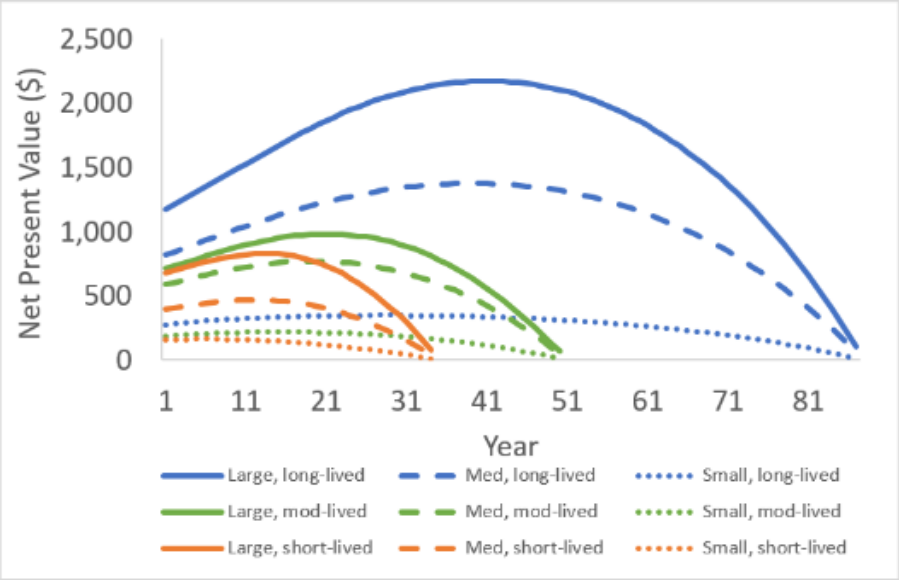
Trillion Trees Act

TREE Act

BUCKET
5 Gallons

Tree-planting in the Network

…through partnership



Graph courtesy of Dr. Dave Nowak, USDA Forest Service

Sweeter with Age…

Large long-lived trees provide the best ROI over time

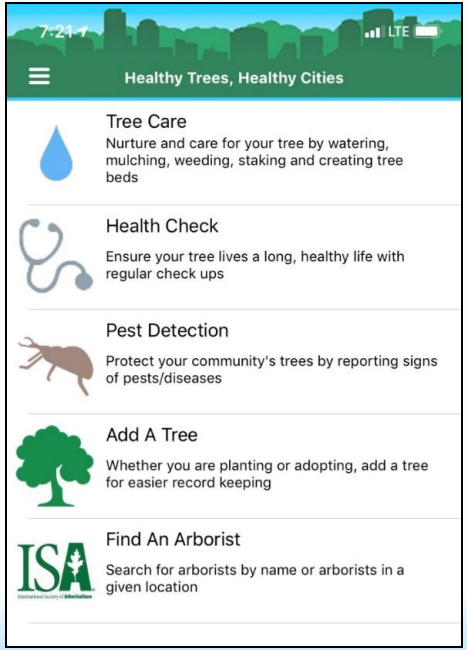
How will you track how your hundreds, thousands, or even millions of trees are doing?

What is Healthy Trees, Healthy Cities?

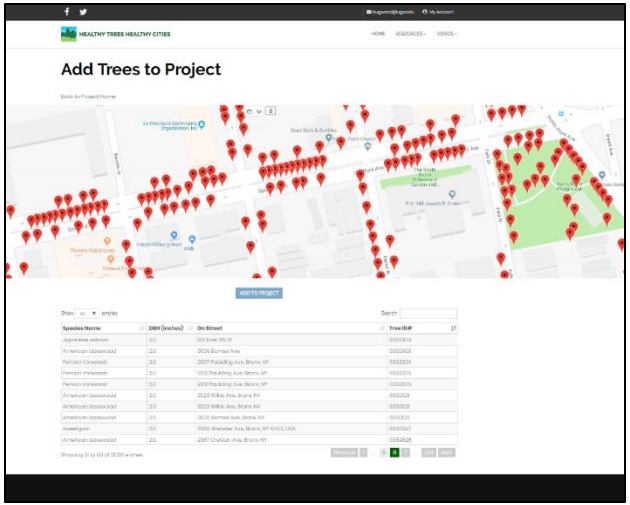
- Tree Health Monitoring/ Pest Detection, Stewardship Monitoring effort
- Partnership between USFS/TNC since 2014
- Suite of free tools and resources
  - **Smart phone application** – data collection, education, stewardship promotion
  - **Project management dashboard** – web-based platform
  - **Education/Training Resources** – videos, documents, in-person and remote trainings
- National Application: USFS Research, Monitoring
- Local Application: Engagement with tree stewards (paid or volunteer); Public/private tree management

Tools to help you… while helping others

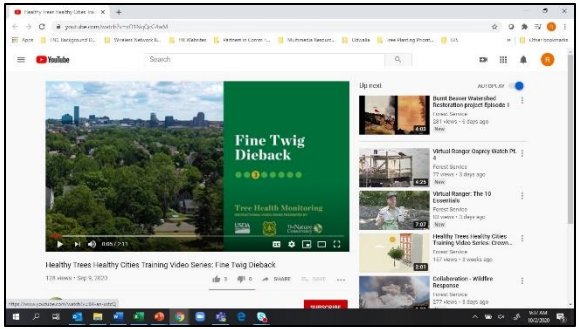
Mobile Device Application "App"



Web-based Project Mgmt Dashboard



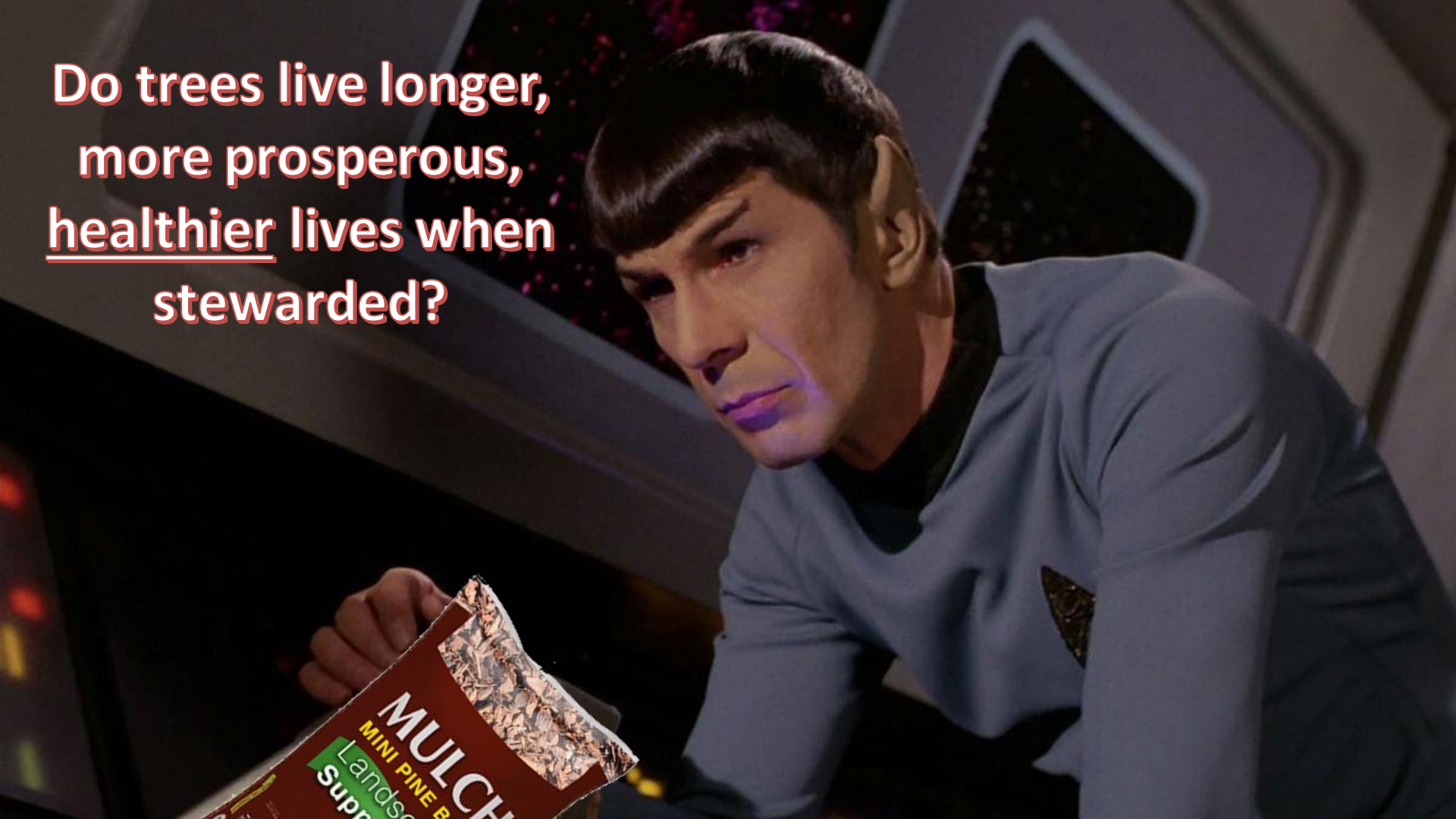
Training and Educational Resources



Local and National Impacts of HTHC Data

- Support Volunteer Stewards
- Prioritize Management Response
- Advocate for Stewardship Resources

- Support research initiatives
- Help track trends in decline


Do trees live longer,
more prosperous,
healthier lives when
stewarded?
MULCH
MINI PINE B

Michelle Johnson

The Science of Stewardship

Rich Hallett

The Science of Tree Health Monitoring

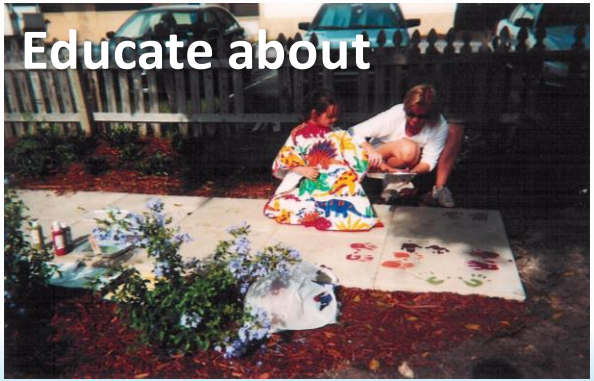
Rachel Holmes

Applying the Tools and Research

The Science of Stewardship

Dr. Michelle Johnson, USDA Forest Service

Types of Stewardship: Taking care of the local environment



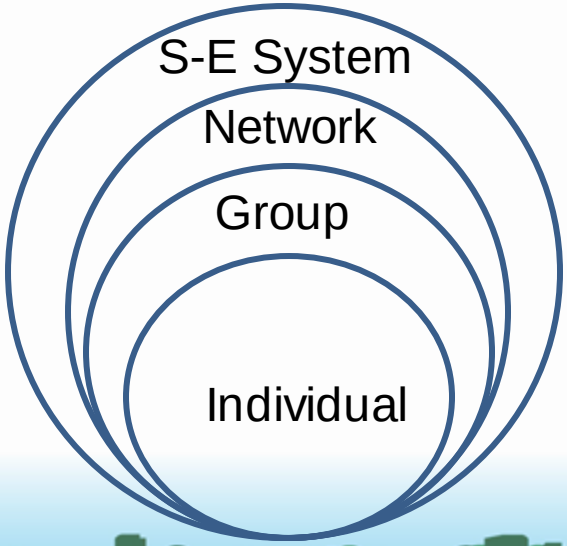
Svendsen and Campbell 2008; Fisher et al. 2012; Campbell et al. in press

Tree Stewardship On-the-Ground

- Planting trees
- Caring for trees
  - Mulching
  - Pruning
  - Watering
  - Weeding
- Monitoring trees
  - Location
  - Species
  - Size
  - Alive/Dead
  - Health

Stewardship: The role of civil society

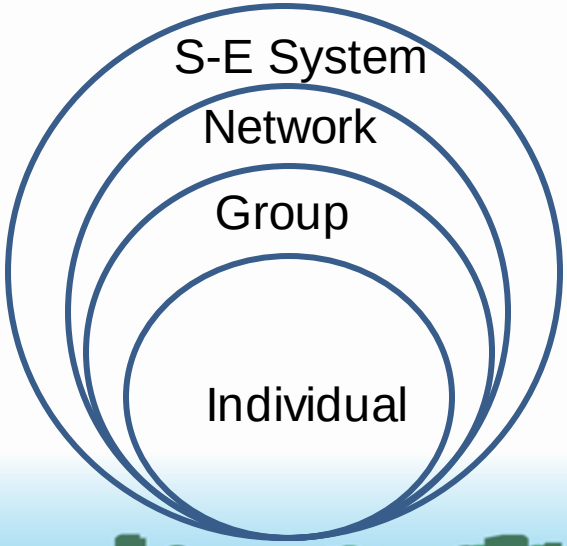
- Who is participating?
- How are they participating?
- Where are they participating?
- What is their effect on the social-ecological system?



Who is participating?

Individuals

- Attending events
- Working solo
- Working in groups



Planting trees with volunteers

- NYC Parks initiative from 2008 to 2014
- Engaging volunteers in planting trees across New York City
- In partnership with New York Restoration Project

Individual-level: Stewardship motivations

MillionTreesNYC Tree Planting

Taking care of where they live

Values for their children

Fun/enjoyable

Fisher et al. 2015

Monitoring trees with volunteers

- More than 2,200 volunteers
- Mapped more than 1/3 of 666,134 street trees in New York City
- Recorded species and dbh

TREES COUNT 2015

Individual-level: Motivations beyond tree planting

Values	Social	Outdoors
Fun/enjoyable	Incentive	Past experience
Contribute	Educate	Explore

Johnson et al. 2018

Individual-level: Motivations beyond tree planting

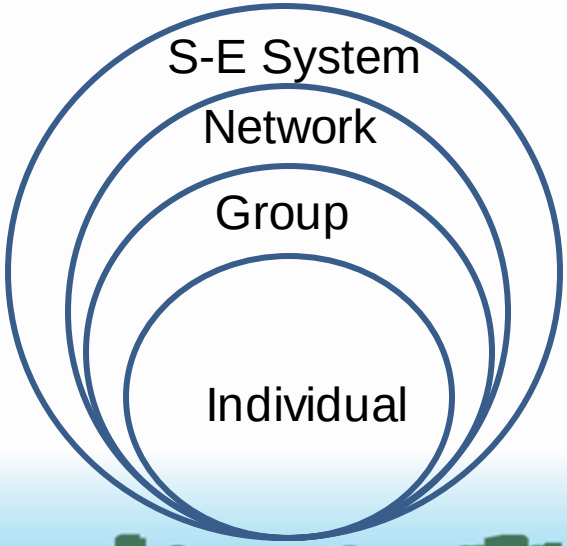
Values	Social	Outdoors
Fun/enjoyable	Incentive	Past experience
Contribute	Educate	Explore

Johnson et al. 2018

Who is participating?

Civic Groups and Stewardship Networks

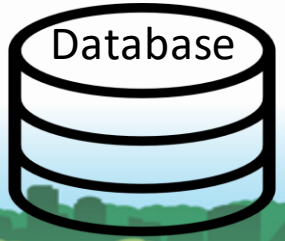
- Shaping governance and outcomes

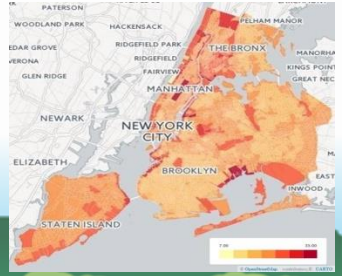


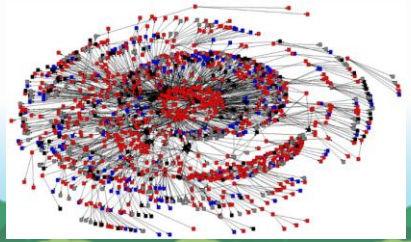
Stewardship Mapping and Assessment Project (STEW-MAP)

STEW-MAP

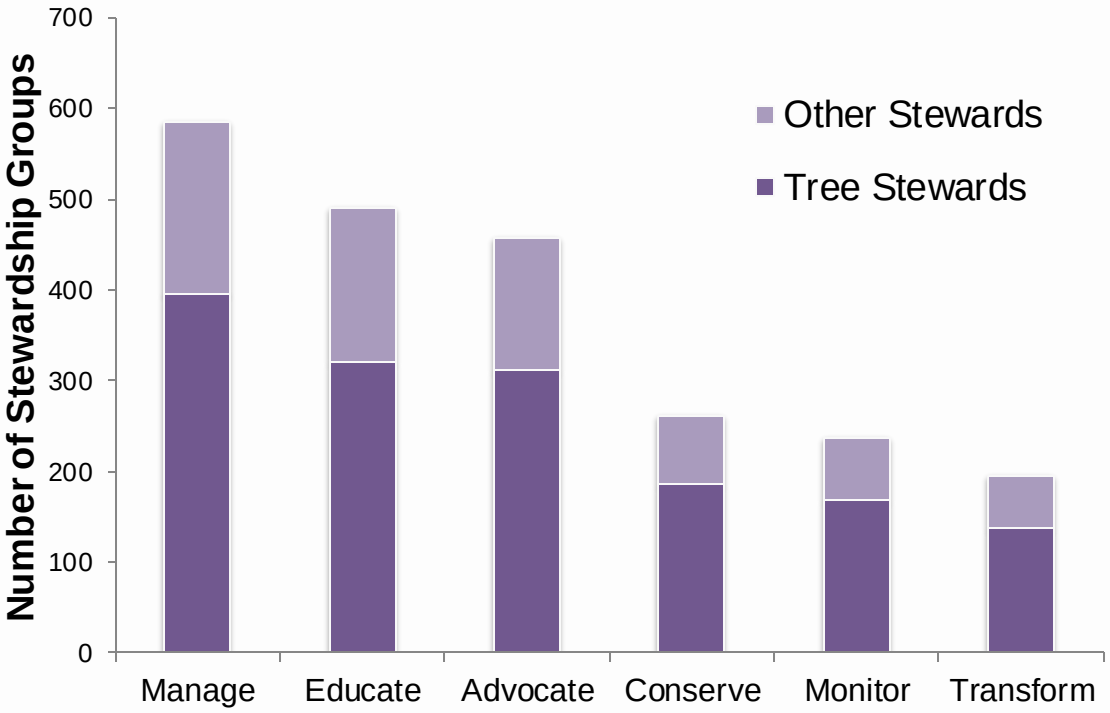
- Began in New York City in 2007 – now in more than 12 cities, regions, and landscapes
- Survey-based methodology
- Measures how, where, and why civic groups are stewarding the local environment





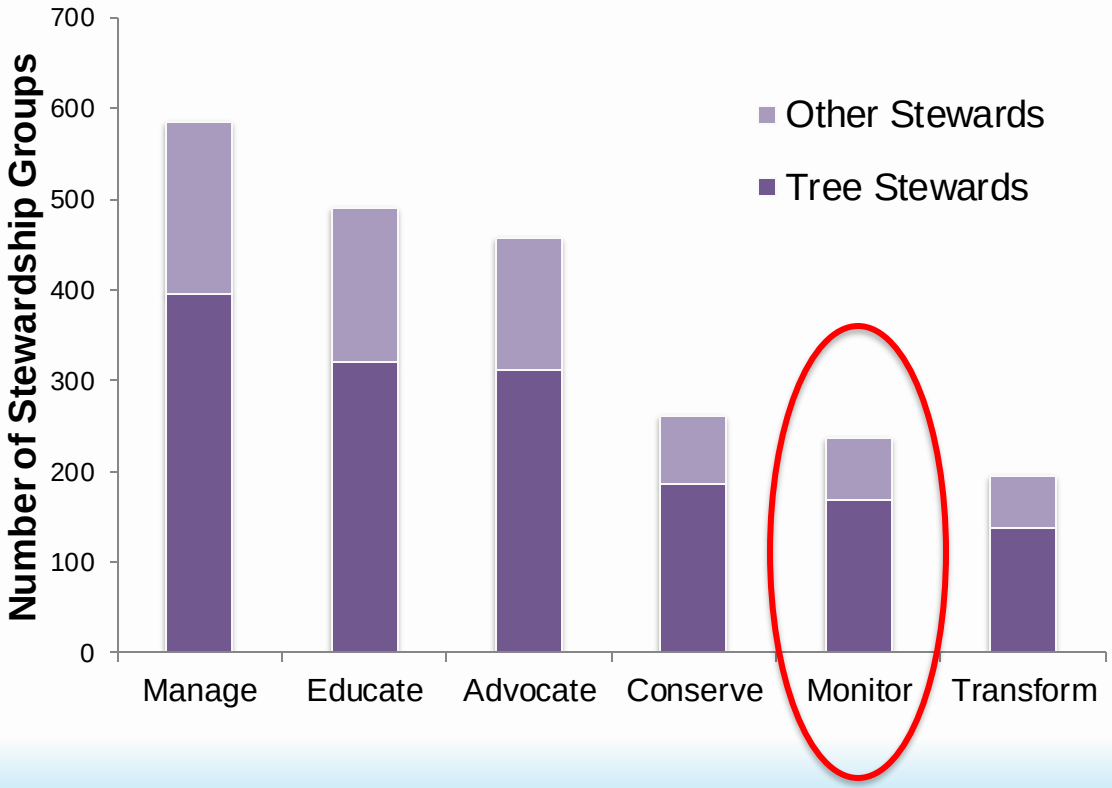


Stewardship actions (STEW-MAP NYC 2017)



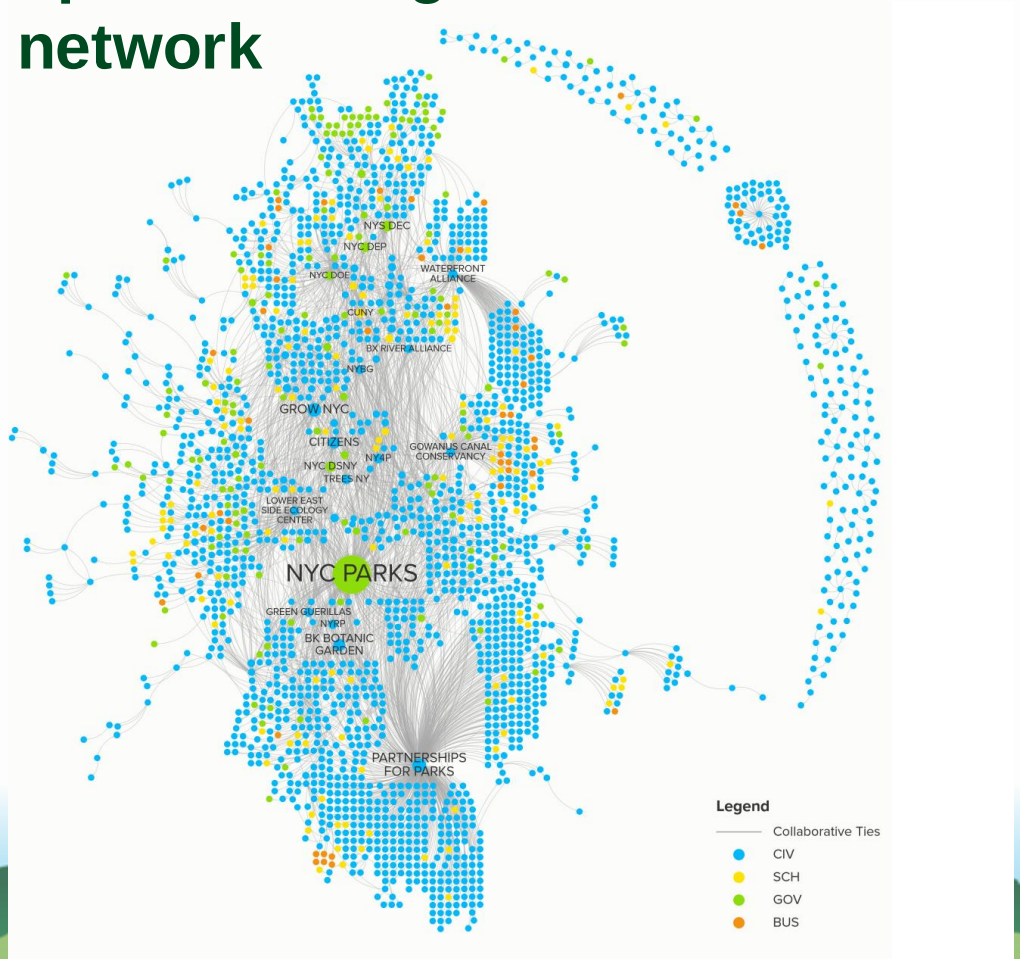
Landau et al. 2019

Stewardship actions (STEW-MAP NYC 2017)



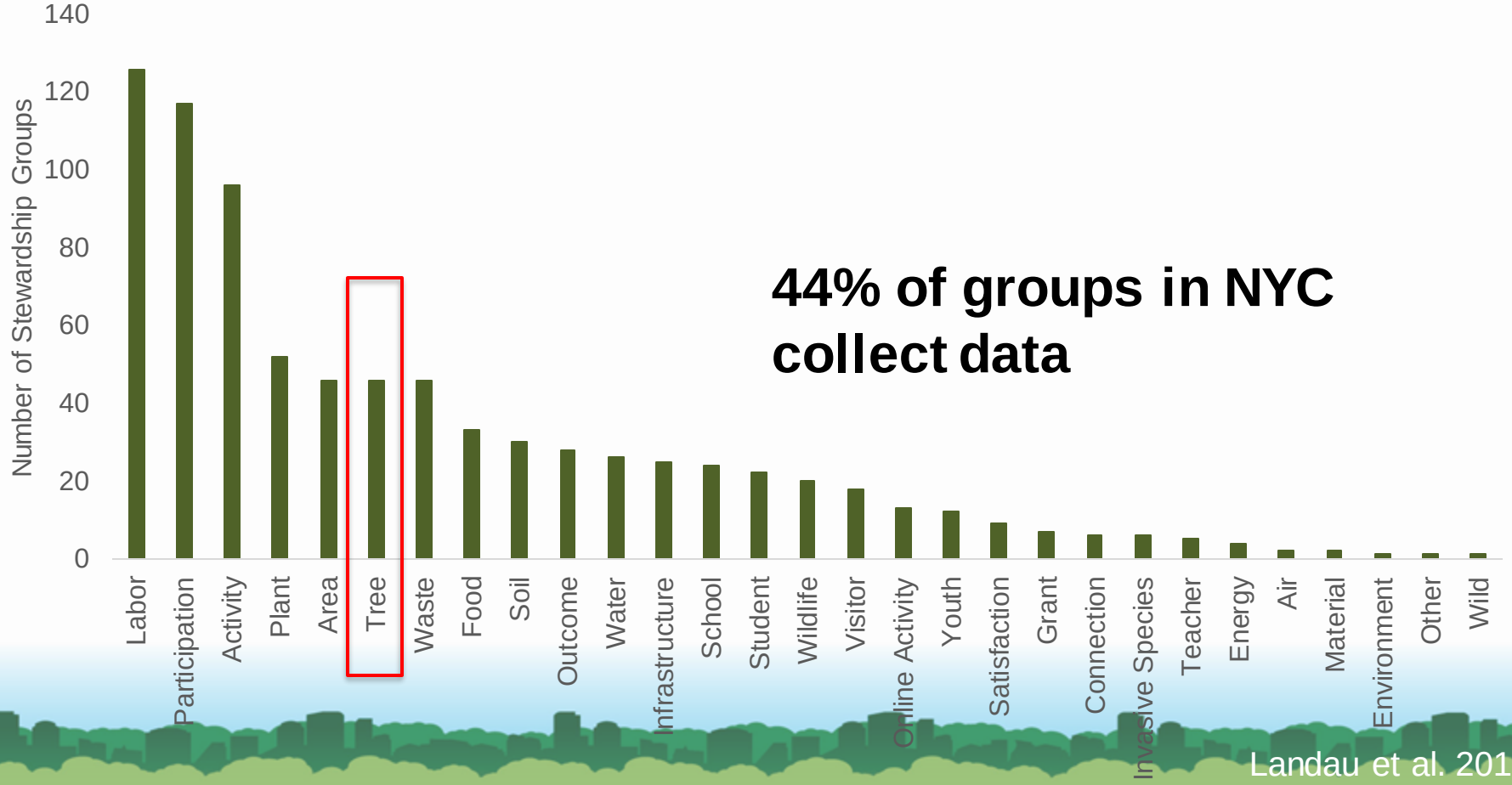
Landau et al. 2019

Stewards are part of a larger environmental governance network



Landau et al. 2019

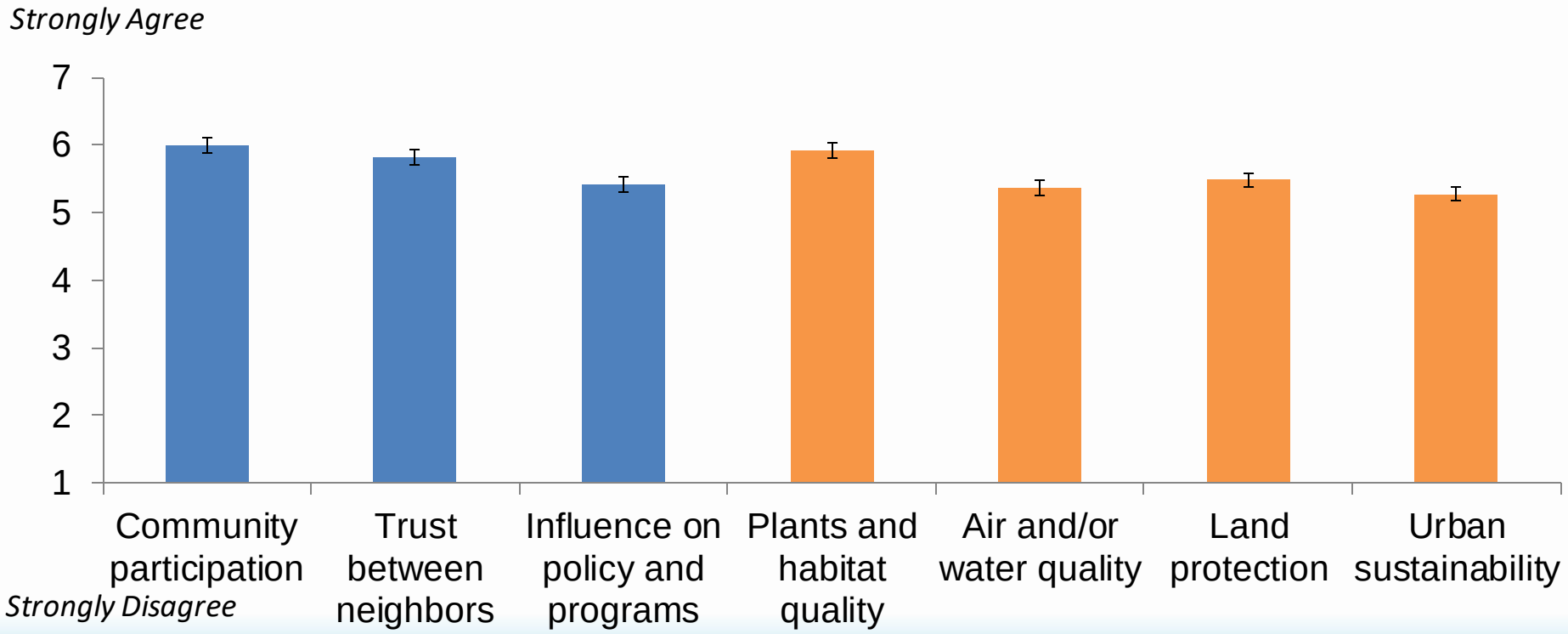
Stewardship groups as data collectors



44% of groups in NYC collect data

Landau et al. 2019

Perceived outcomes (STEW-MAP NYC 2017)



Social

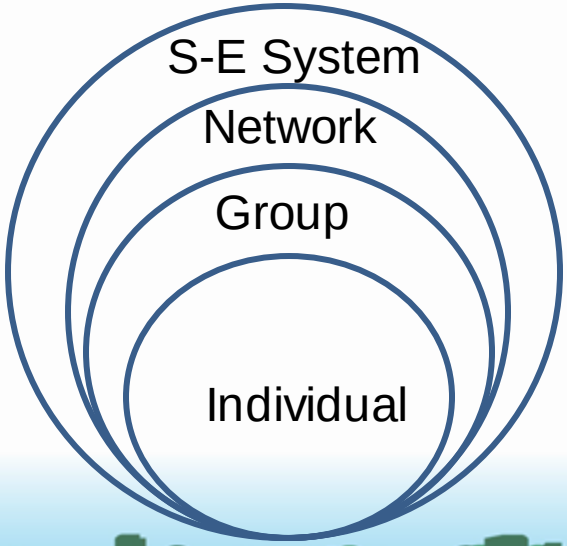
Environmental

Landau et al. 2019

What is their effect on the social-ecological system?

Social-Ecological System

- Amount and distribution of trees
- Tree health



The Science of Tree Health Monitoring

Dr. Rich Hallett, USDA Forest Service

Non-Stressor Specific Evaluation of Tree Health

Early Signs

Later Signs

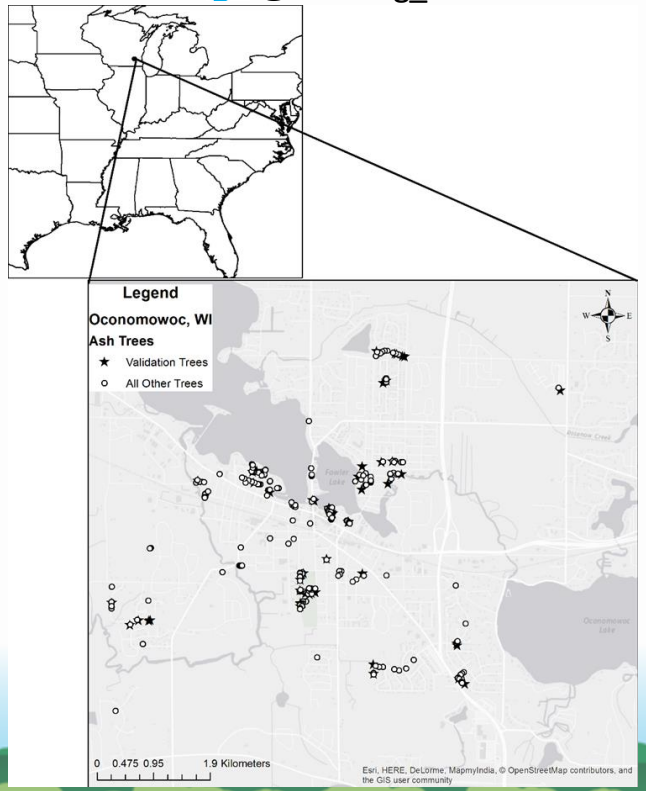
Variable
Leaf Discoloration
Defoliation
Crown Transparency
Twig Dieback
Crown Vigor

Tree 36	Tree 71	Tree 45	Tree 75	Tree 77	Tree 65
Stress Index -0.783	Stress Index -.409	Stress Index -0.191	Stress Index -0.009	Stress Index 0.81	Stress Index 1.3

Citizen Science and Tree Health Assessment: How useful are the data?

Dr. Richard Hallett
USDA Forest Service, New York City Urban Field Station

@working_trees



Hallett R. and Hallett T. 2018. Citizen Science and Tree Health Assessment: How useful are the data? Arboriculture & Urban Forestry 44: 240–50.

Boy Scout Troop 169
July 2015, Oconomowoc, WI

Goal: Use volunteers from a local Boy Scout troop to furnish the city of Oconomowoc, WI detailed health assessment data for all city owned ash trees.

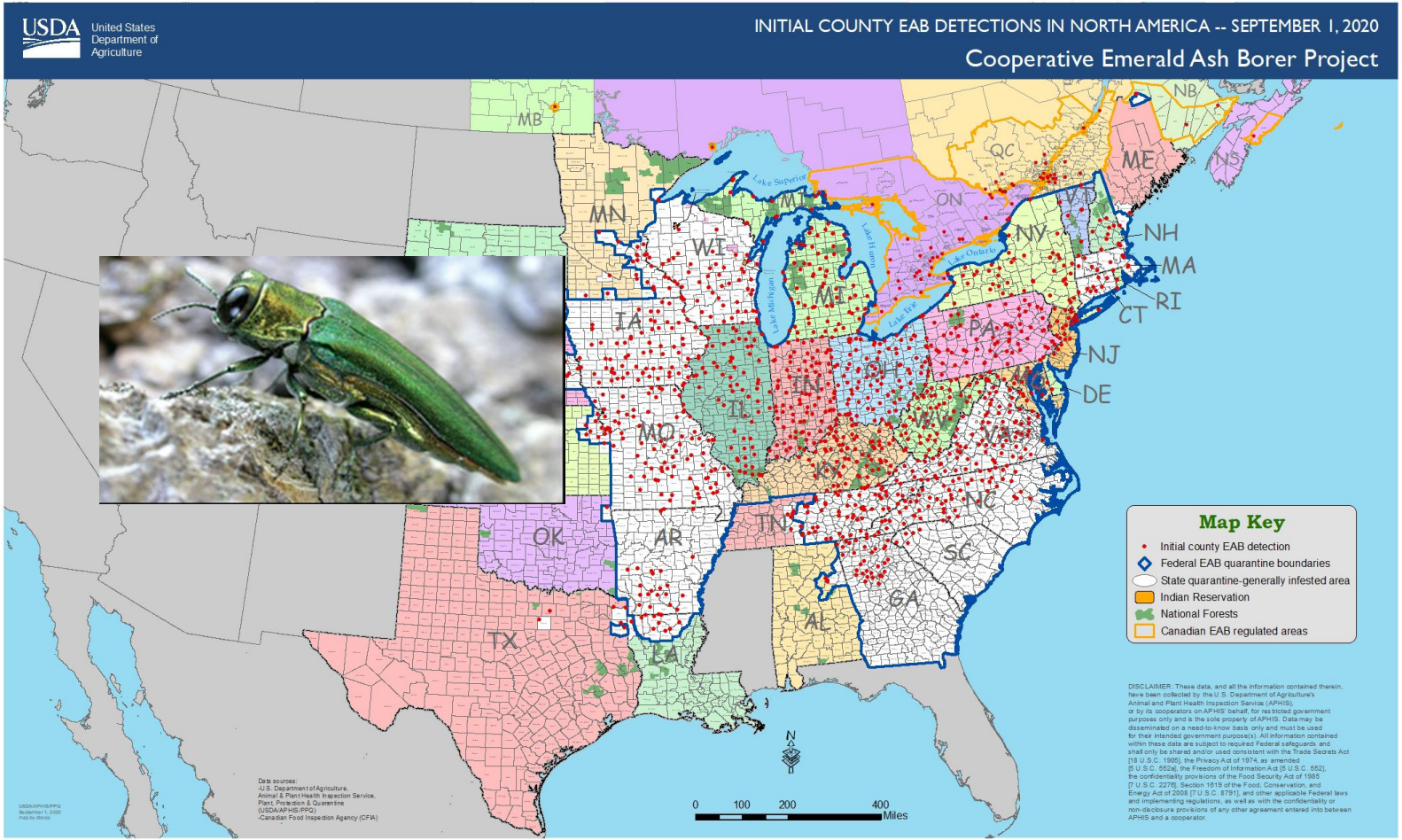
Research Questions

1. **Can volunteers trained in tree health assessment methods designed by the U.S. Forest Service collect data that are reliable enough to allow the city to prioritize ash trees for removal?**
2. **What is the level of agreement between data collected by volunteers and data collected on the same trees by an expert?**

Along the way we were able to create and test training protocols

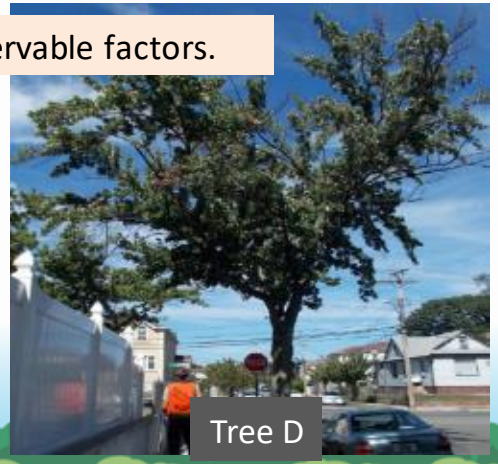
1. Introduction to the project stressing utility and importance of the data.

Describe The Problem



2. Pre-training tree health rating.

3. Guided discussion of observable factors.



4. Introduction of rubrics.

Contact:
Richard Hallett
rahallett@gmail.com

Tree Health Metrics: A Brief Field Guide

HEALTHY TREES · HEALTHY CITIES

The Nature Conservancy

Foliar discoloration is the proportion of the canopy with different coloration than a healthy tree of the same species.

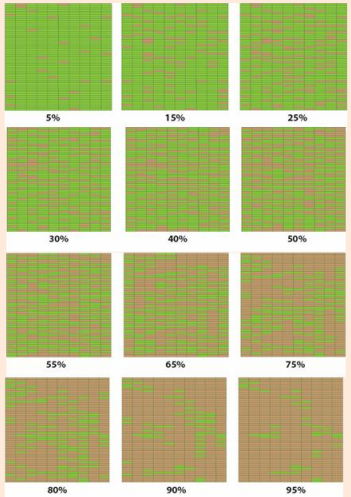
Class	Definition
1	0-1% (trace)
2	2-25%
3	26-50%
4	51-75%
5	76-100%

Possible symptoms: Dark spots on leaves, leaves that are yellow, brown, or even lighter in color than a healthy tree of that species.

Does not include cultivars with variegated or colored leaves
Applies to the total % of canopy that is discolored, not the % of leaves that are discolored.

Discoloration on leaves of a London Plane tree

Use these diagrams when estimating class rankings for **Foliar discoloration and Defoliation**



Defoliation applies to the proportion of the canopy with holes in leaves or missing sections of leaves.
The rating applies to the total proportion of the canopy that is impacted, *not* the percentage of leaves with some defoliation.

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

Transparency is an early, visual symptom of decline. It is often quantified through measurements of foliar transparency in the crown of the tree.
The rating applies to the total proportion of the canopy that you can see light through.

5% 15% 25% 35% 45% 55% 65% 75% 85% 95%

Class	Definition
1	0-5%
2	6-15%
3	16-25%
4	26-35%
5	36-45%
6	46-55%
7	56-65%
8	66-75%
9	76-85%
10	86-95%
11	100%

Contact:
Richard Hallett
rahallett@gmail.com

Tree Health Metrics: A Brief Field Guide

HEALTHY TREES · HEALTHY CITIES

Fine Twig Dieback measures the percentage of dieback in a tree's crown.
The rating applies as a percentage of the live crown area. Do not include self-pruning (natural dieback of the lower crown) or large, dead branches.

Class	% Dieback	Class	% Dieback
1	0-1%	55	51-55%
5	2-5%	60	56-60%
10	6-10%	65	61-65%
15	11-15%	70	66-70%
20	16-20%	75	71-75%
25	21-25%	80	76-80%
30	26-30%	85	81-85%
35	31-35%	90	86-90%
40	36-40%	95	91-95%
45	41-45%	100	96-100%
50	46-50%		

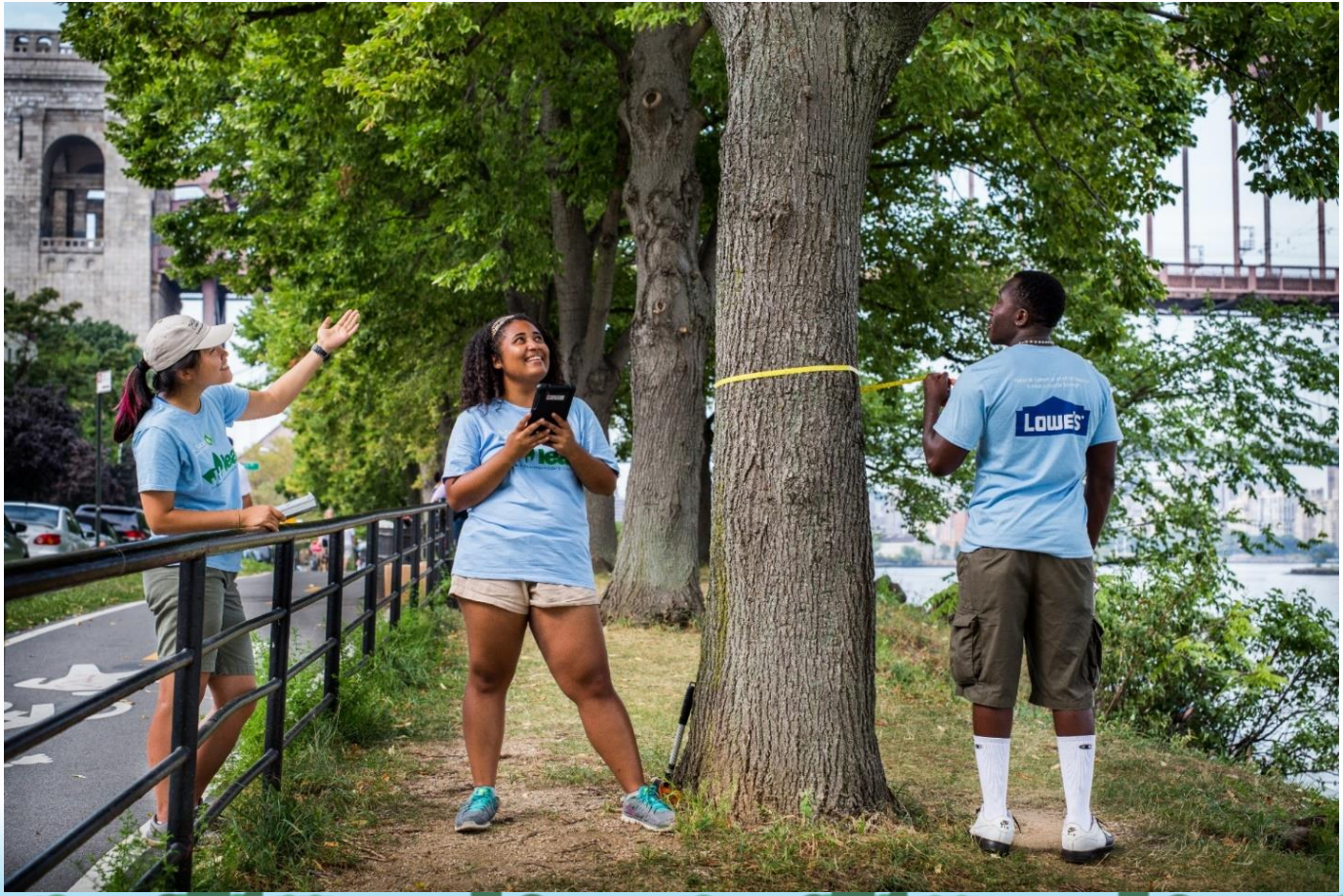
Fine twig dieback of a London plane tree.
Area pruned for powerline is not included in Fine Twig Dieback estimate!

Vigor is a measure of overall tree health.
For this measure, we use a 5-class scale using the guideline to the right.

Tree Portrait: A photo of the entire tree. You may need to move back to get a full view of larger trees!

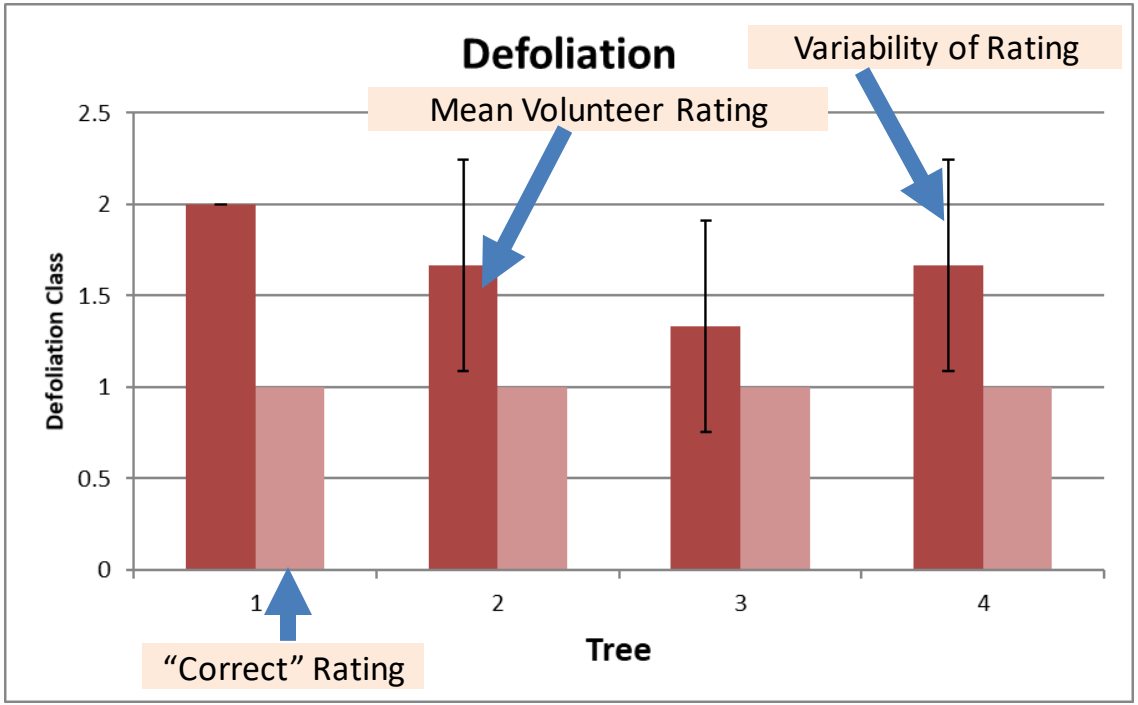
Class	Definition
1	Tree appears to be in reasonably good health with no major branch mortality or large broken branches. **Less than 10% cumulative** defoliation, discoloration, and crown dieback is present.
2	**10-25% cumulative** defoliation, discoloration, and crown dieback is present **and/or** crown area missing based on visual evidence of large broken (not pruned) or dead branches **less than 26%.**
3	**26-50% cumulative** defoliation, discoloration, and crown dieback is present and/or crown area missing based on visual evidence of large broken (not pruned) or dead branches less than 50%.
4	**More than 50% cumulative** defoliation, discoloration, and crown dieback is present **and/or** crown area missing based on visual evidence of large broken (not pruned) or dead branches **more than 50%.**
5	Tree is dead. Either standing or down, but greater than 4.5 feet tall.

5. Collaborative scoring of trees to norm scoring expectations.

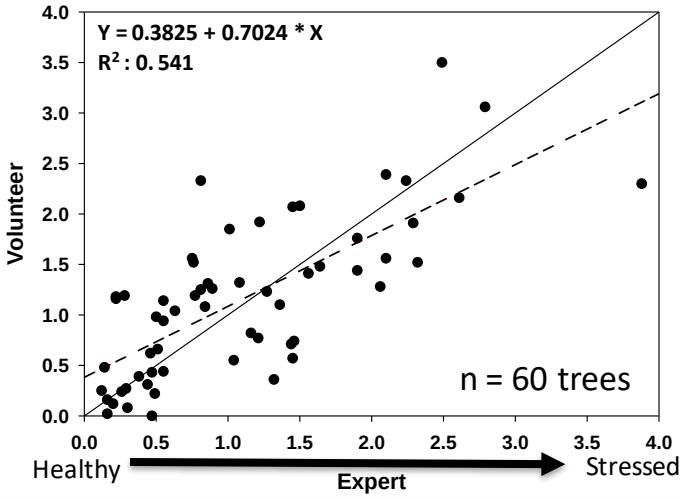


6. Blind scoring of practice trees.

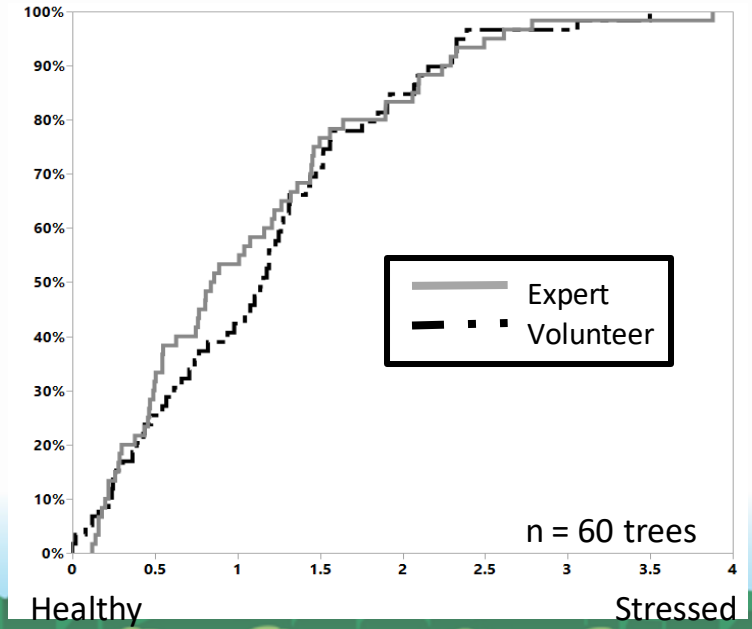
7. Error analysis and discussion



How did they do?



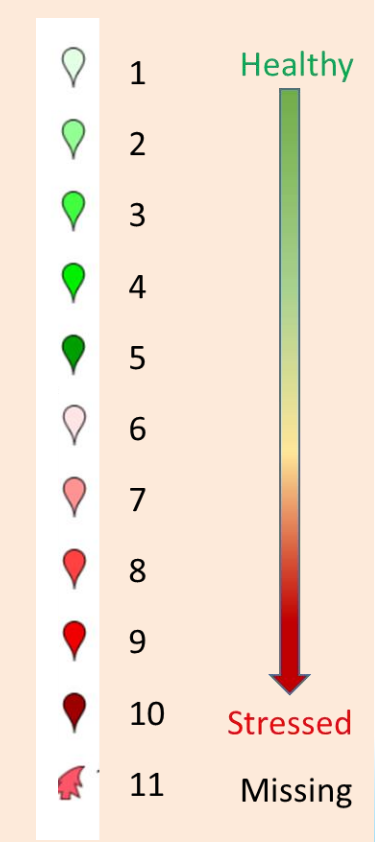
The stress index created from data collected by volunteers tended to overestimate stress at the low end of the scale and underestimate stress at the high end of the scale.

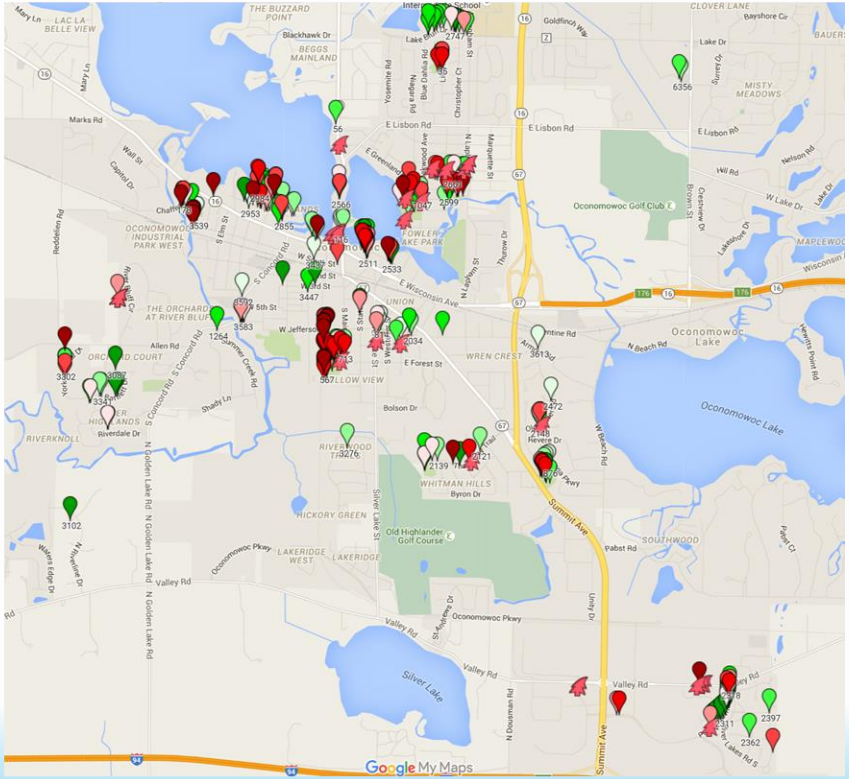


The matched pairs cumulative probability plot shows the deviation between volunteer and expert stress indices across the whole range of data. The greatest deviation occurred between the 25th and 60th percentiles.

Interactive Google Map

Map of 316 city owned ash trees classified by stress level.





Applying the Tools and Research

Rachel Holmes, The Nature Conservancy

Thus far…

STEWARDSHIP

TREE HEALTH

PUTTING IT IN PRACTICE

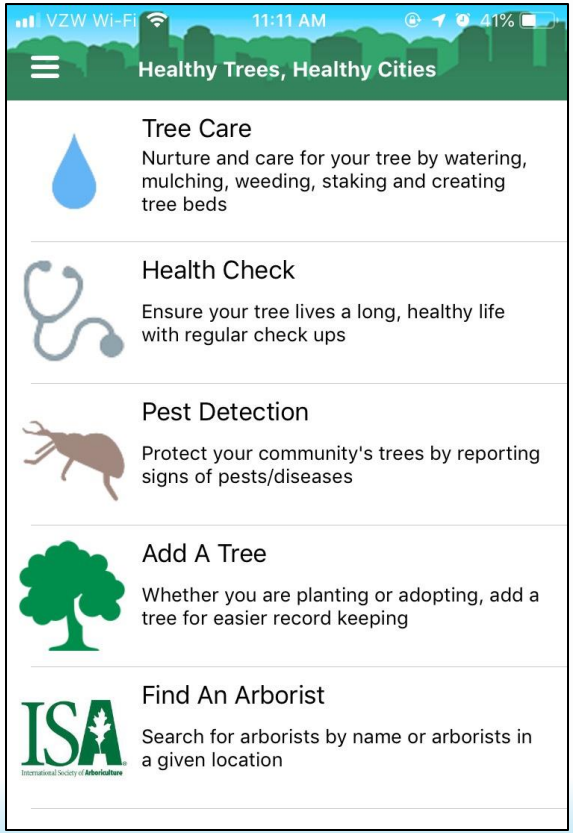
Presentation

AN OVERVIEW OF HTHC TOOLS AVAILABLE

CASE STUDIES

48

1. HTHC App (est. 2015)



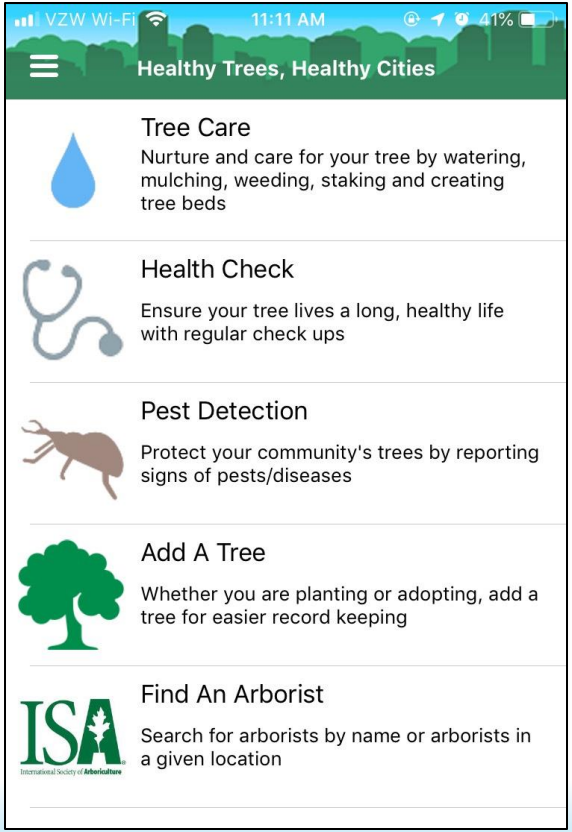
Download on the App Store

ANDROID APP ON Google play

1. HTHC App (est. 2015)

Three purposes:

1. Data Collection
2. Education
3. Connector



Download on the App Store

ANDROID APP ON Google play

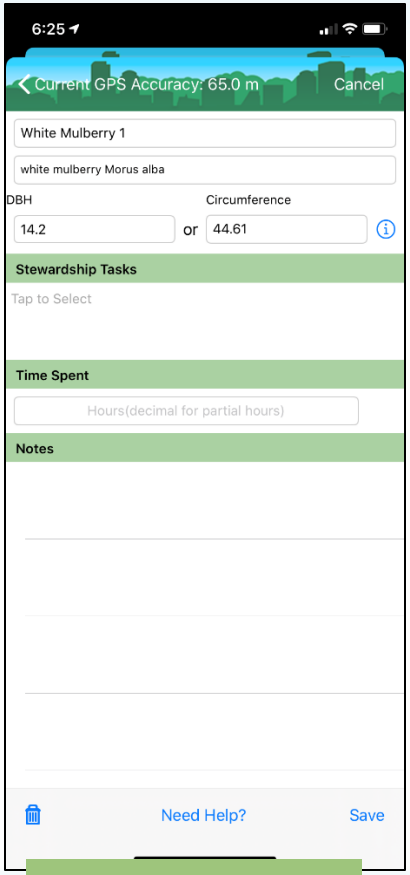
1. HTHC App (est. 2015)

Tree Stewardship

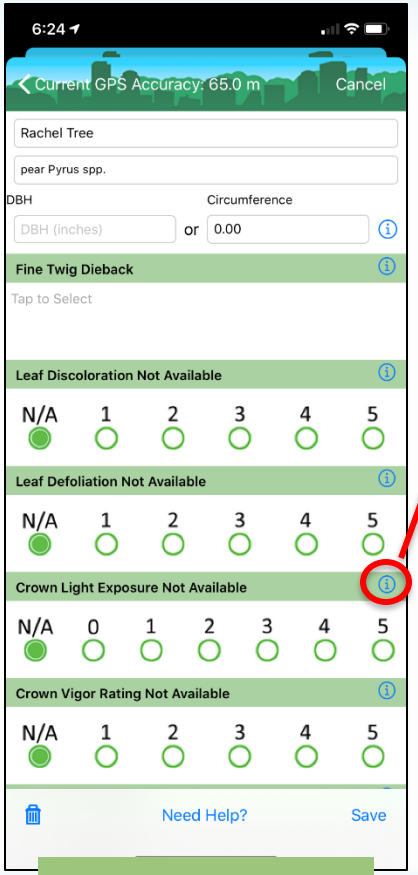
Health Assessments

Insect/ Disease Detection

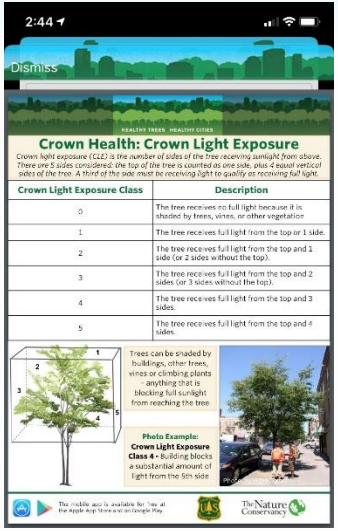
Tree Inventory

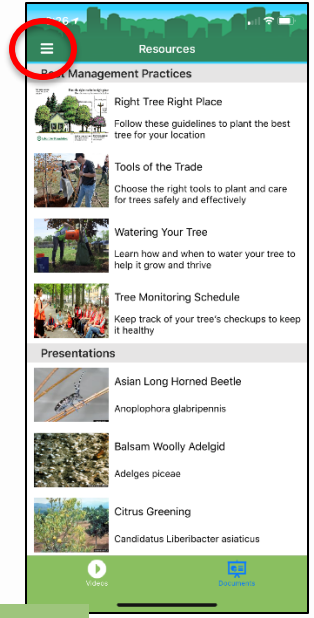


Stewardship



Health Check





Resources

2. HTHC Dashboard (est. 2019)

Project Management

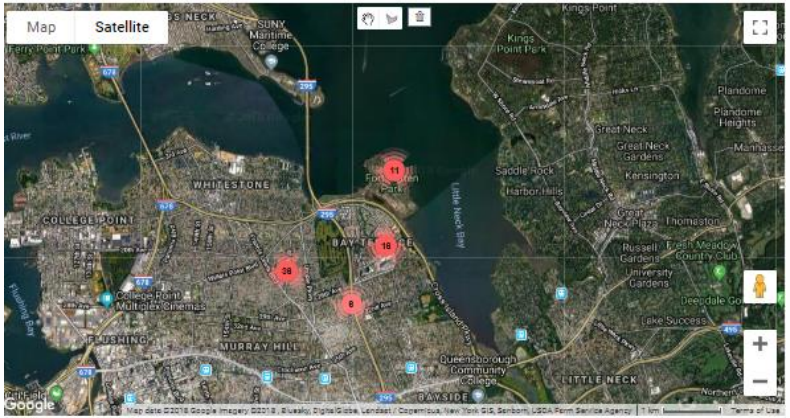
Data Visualization

Reporting

Management Response

Add Trees to Project

Back to Project Home



ADD TO PROJECT

= Not Added to Project

= Added to Project

Show 10 entries

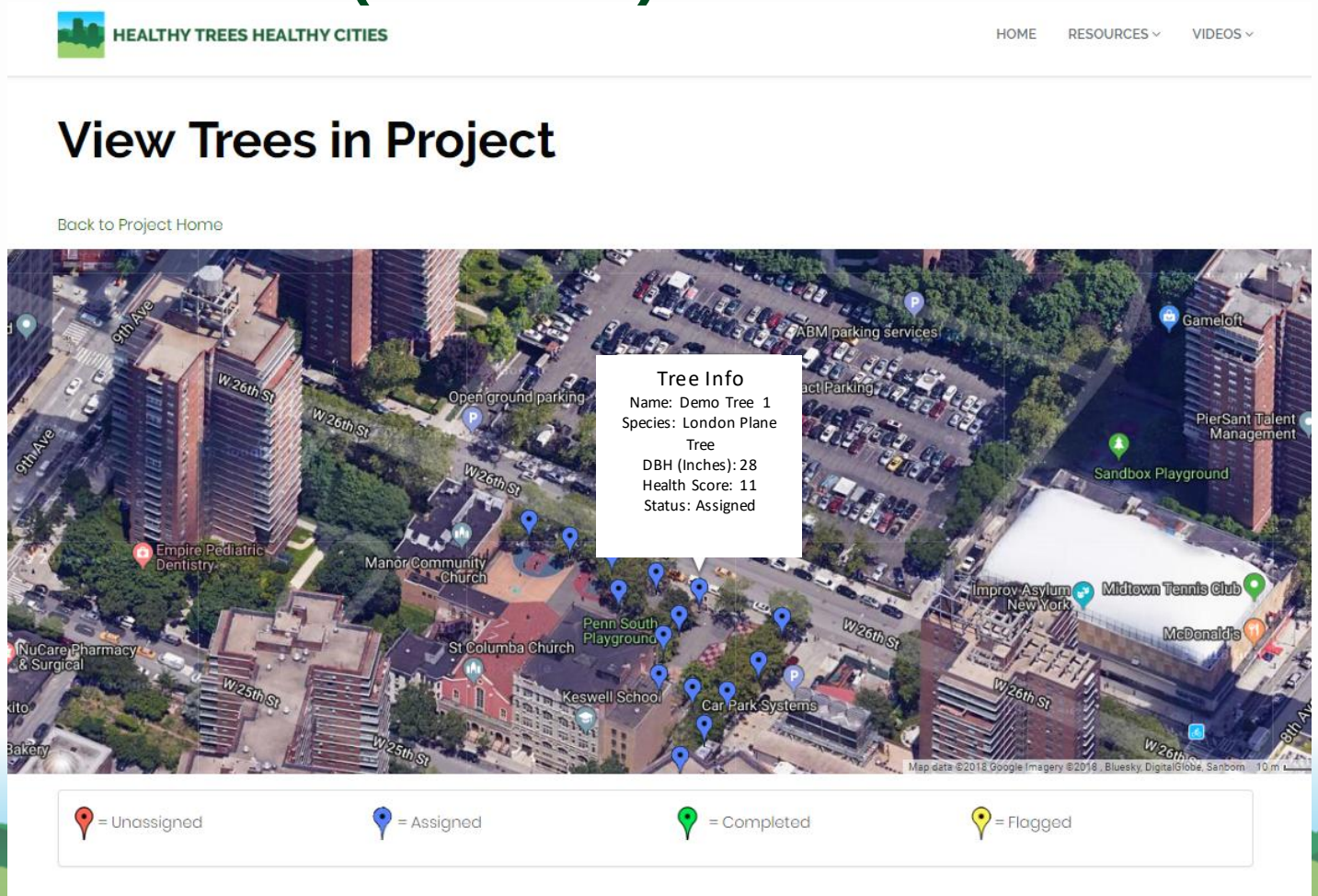
Search:

Species Name	DBH (inches)	On Street	Tree ID#
Japanese maple	15.0		Tester
Norway maple	30.0	Ordinance Rd, Bayside, NY 11359, USA	01-Ordinance-01
boxelder	8.0	431 Walter Reed Rd, Bayside, NY 11359, USA	Fhdjjsjbndhdj
boxelder	5.0	431 Walter Reed Rd, Bayside, NY 11359, USA	1394949
red maple	NaN		test
silver maple	100.0	Abbott Rd, Bayside, NY 11359, USA	01-Abbot-01
silver maple	37.0	413A Shore Road Bayside, NY 11359	thunder storm
green ash	11.0		Test Back Aah
pin oak	13.0		
pin oak	12.0		

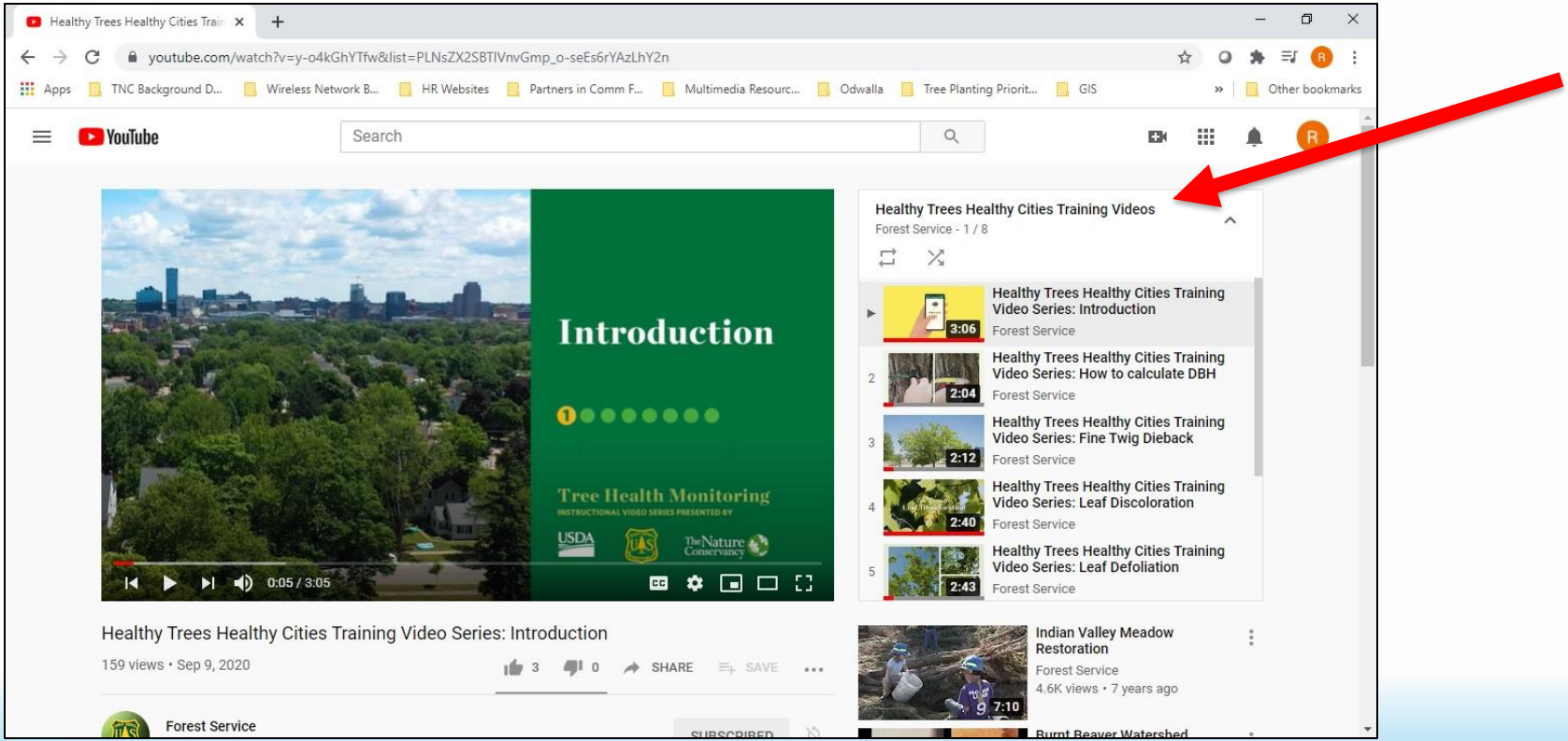
Showing 1 to 10 of 69 entries

Previous 1 2 3 4 5 6 7 Next

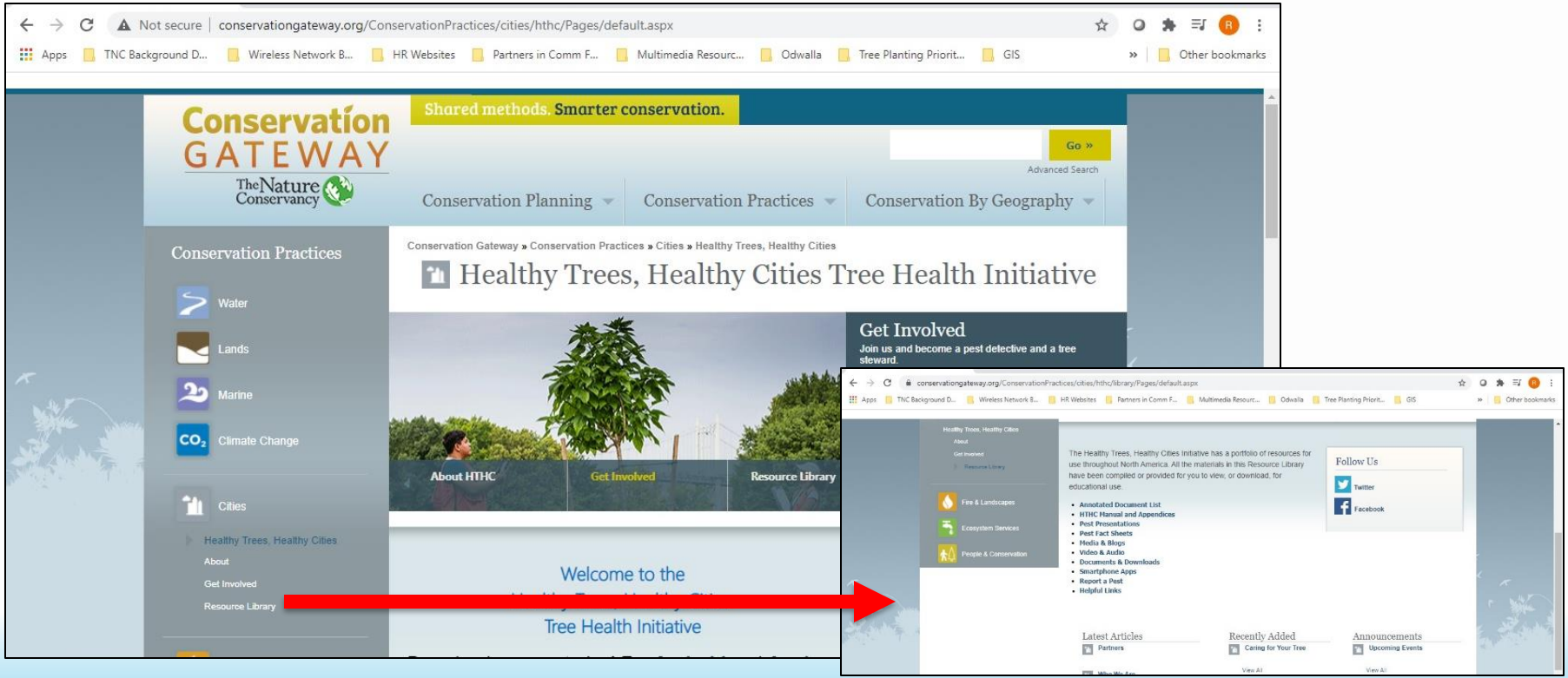
2. HTHC Dashboard (est. 2019)



3. Training Resources – USFS YouTube Channel



3. Training Resources – HTHC Website

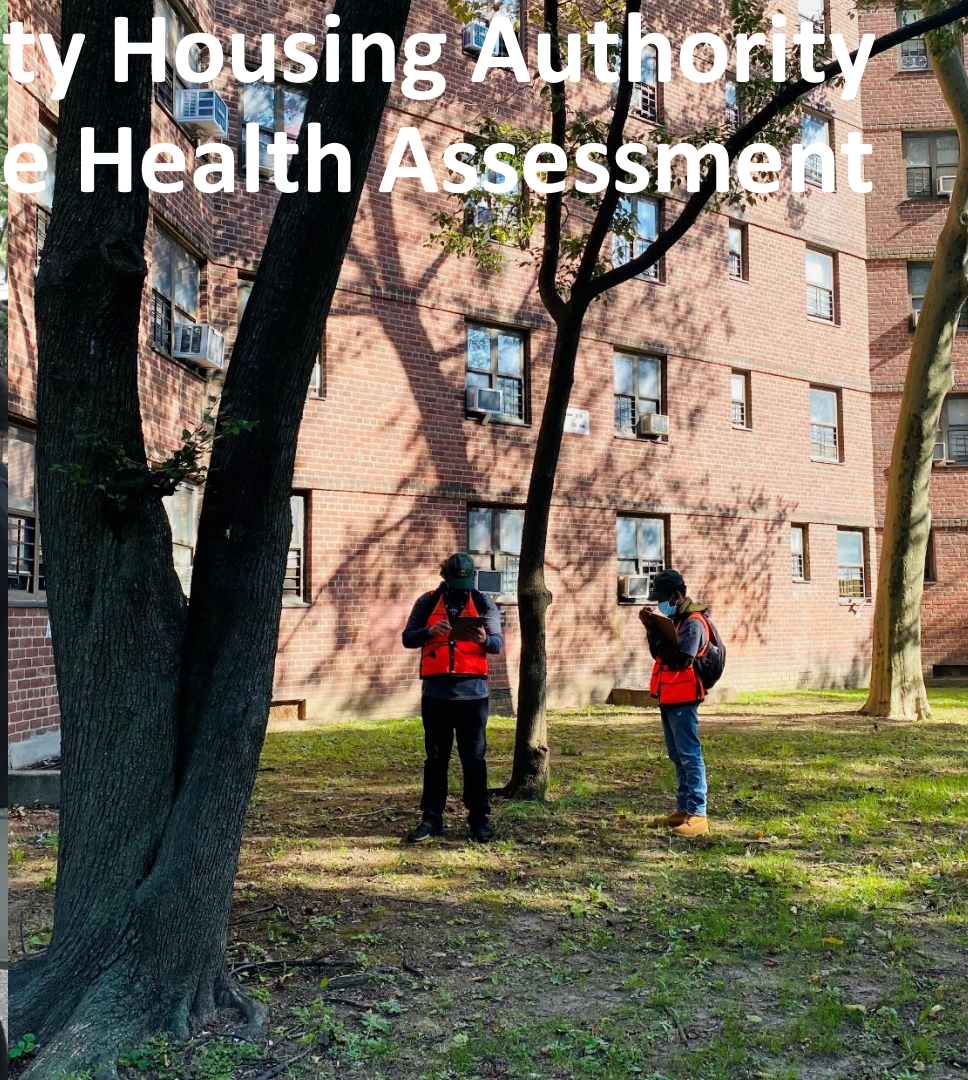


Case studies

https://mountsequoyah.org/

Tree Health & Equity

New York City Housing Authority Tree Health Assessment



Imani Green Health Advocates – Chicago: Socioecological Determinants of Health

Imani Green Health Advocates:
Tree Health Data in 2019 Advocate Aurora Trinity Hospital Community Health Needs Assessment

Join the Movement

1. Join our Spring webinar – updates, new tools
2. Reach out to us for support with training, experimental design, moral support, etc.

Conclusion

1. Tree planting is here to stay!
2. Mature trees provide optimal ecosystem services
3. Stewardship benefits both nature and people
4. In order to help our trees help us, monitoring is key
5. Community Scientists are the future of urban forestry
6. Your data can support scientific advancements in urban forestry

We thank you for all you do…

Michelle.johnson@usda.gov
Richard.Hallett@usda.gov
Rholmes@tnc.org