Session 3.1

Metropolis: Creating the policy and legal conditions to ensure that role urban forests in urban resilience is duly recognized

Chair: Jessica Thorn

World Forum on Urban Forests

CLEARINGHOUSE
中欧城市森林应对方案

For more resilient city: China's National Forest City

Wendy Y. Chen
The University of Hong Kong

Cheng WANG
Institute of Forestry, Chinese Academy of Forestry
Urban Forest Research Center of the National Forestry and Grassland Administration

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement n°821242 and National Key R&D Program of China under grant No. 2021YFE0193200.
该项目获得科技部重点研发计划（项目编号：2021YFE0193200）和欧洲H2020研究与创新计划的资助（拨款协议号码：821242）。

China’s National Forest City programme

Conceptualizing the National Forest City

A city **comprising an ecosystem centered around forests and trees, in which mountains, rivers, forests, farmlands, lakes, and grasslands form a resilient system across the rural, peri-urban and urban areas of the city**

Forest City Taiyuan，Shanxi Province

Incubation Before 2004 → Initial Stage 2004-2007 → Standardization 2008-2012 → Booming Development 2013-2019 → Quality Development 2020-now

The concept of urban forestry was introduced in the 1990s

2003, the establishment of Journal of Chinese Urban Forestry

2004, launch of the National Forest City program

2007: Seven NFCs

Developing Indicators of NFC

Established the UFRC in 2012

2012: 41 NFCs

Begin to be involved in key national strategies

Systematic strategic studies and practices

2019: 194 NFCs

National standard for NFC indicators in 2019

2022: 219 NFCs

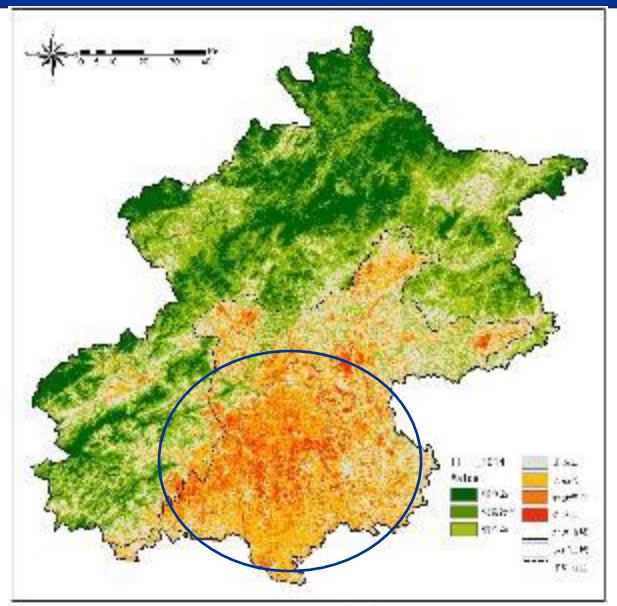
NFC clusters

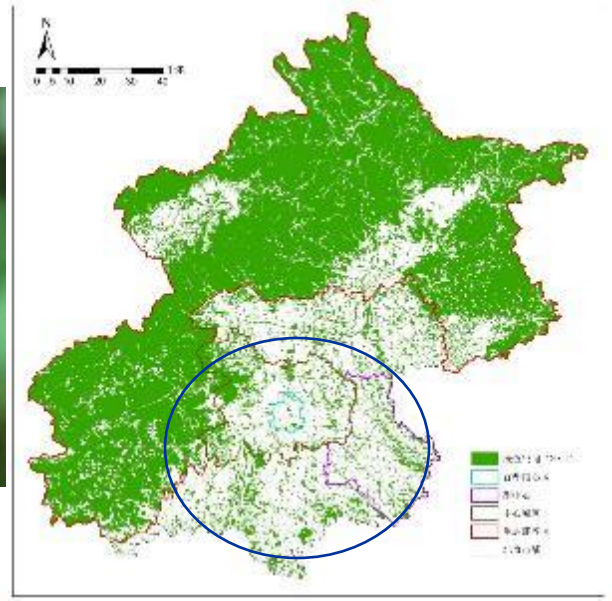
National Forest City Programme: more resilient cities

Enhanced ecological resilience

Rapid and intense urbanization since 1980s has resulted in widespread environmental pollution and ecological degradation

- ✓ Improved urban forest coverage
- ✓ Connected green-blue corridors
- ✓ Bio-diverse urban ecosystems
- ✓ Enhanced human-nature harmony





Enhanced social resilience

- ✓Satisfying social needs for recreation
- ✓Improving social interaction and cohesion

Enhanced economic resilience

- ✓To develop eco-tourism and forest products
- ✓To provide green, sustainable jobs for local communities

Key Performance Indicators of the National Forest City

- ✓ After 15 years of experimentation, the key performance indicators of the National Forest City were issued as a national standard in 2019
- ✓ Five key categories (36 KPIs)
  - ✓ Forest networks
  - ✓ Forest health
  - ✓ Ecological welfare
  - ✓ Ecological culture
  - ✓ Management mechanism


ICS 65.020.40
B 60

GB

中华人民共和国国家标准

GB/T 37342—2019

国家森林城市评价指标

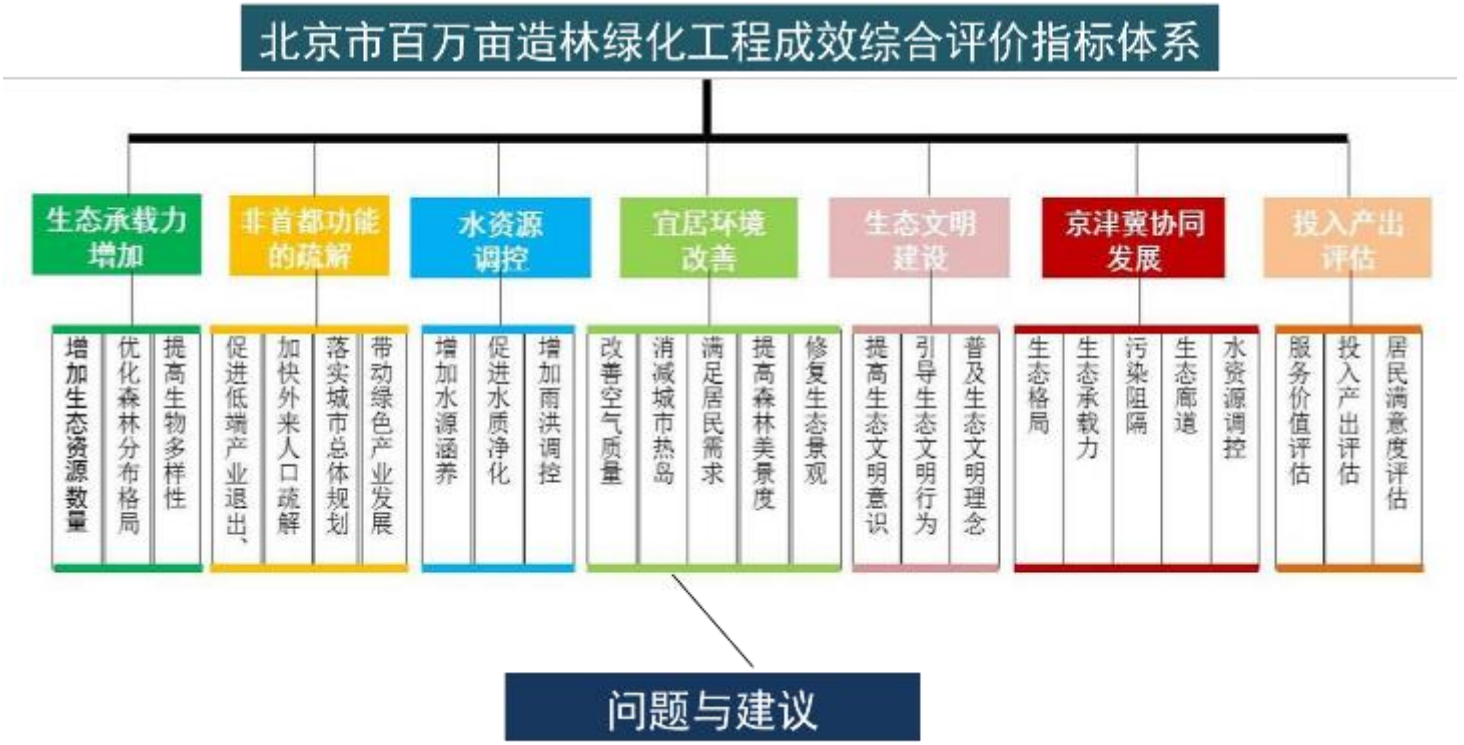
Indicators for national forest city

2019-03-25 发布　　2019-10-01 实施

国家市场监督管理总局
中国国家标准化管理委员会　发布

Beijing, an exemplar of China's National Forest City

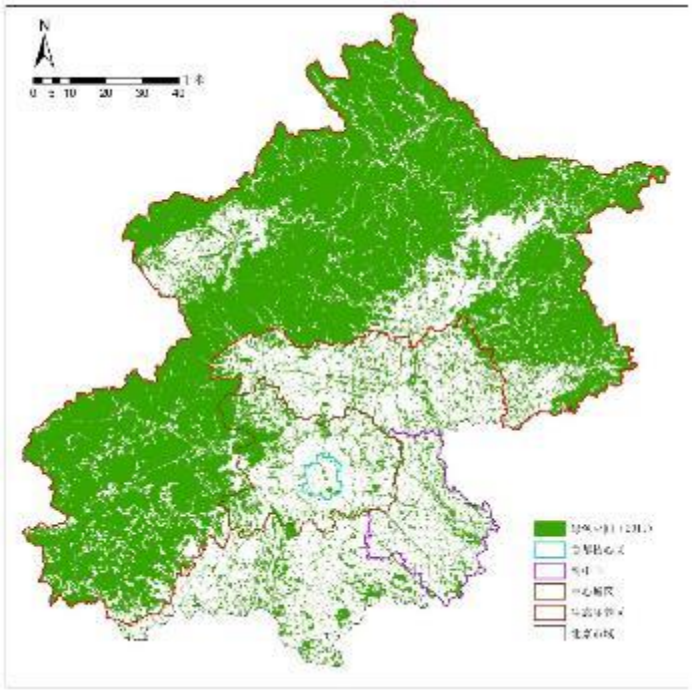
- ✓ 2011: analyzed the status quo of Beijing's urban forests and proposed development strategies
- ✓ 2012 to 2015: Municipal Government implemented a 1 million mu afforestation project
- ✓ 2017 to 2022: another 1 million mu afforestation project was implemented



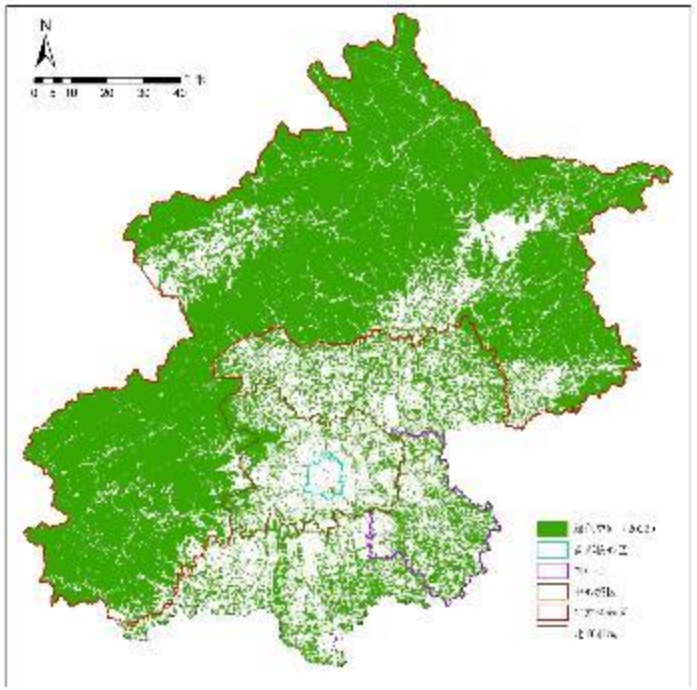
Training for urban biodiversity survey in May 2021

Survey of afforestation plots in May 2023

- ✓ The forest coverage rate has increased from 37.6% in 2011 to 44.6% in 2022;
- ✓ Large forest patches and ecological corridors have been established
- ✓ Except for Dongcheng District and Xicheng District, all 14 districts have met the National Forest City standards



2012



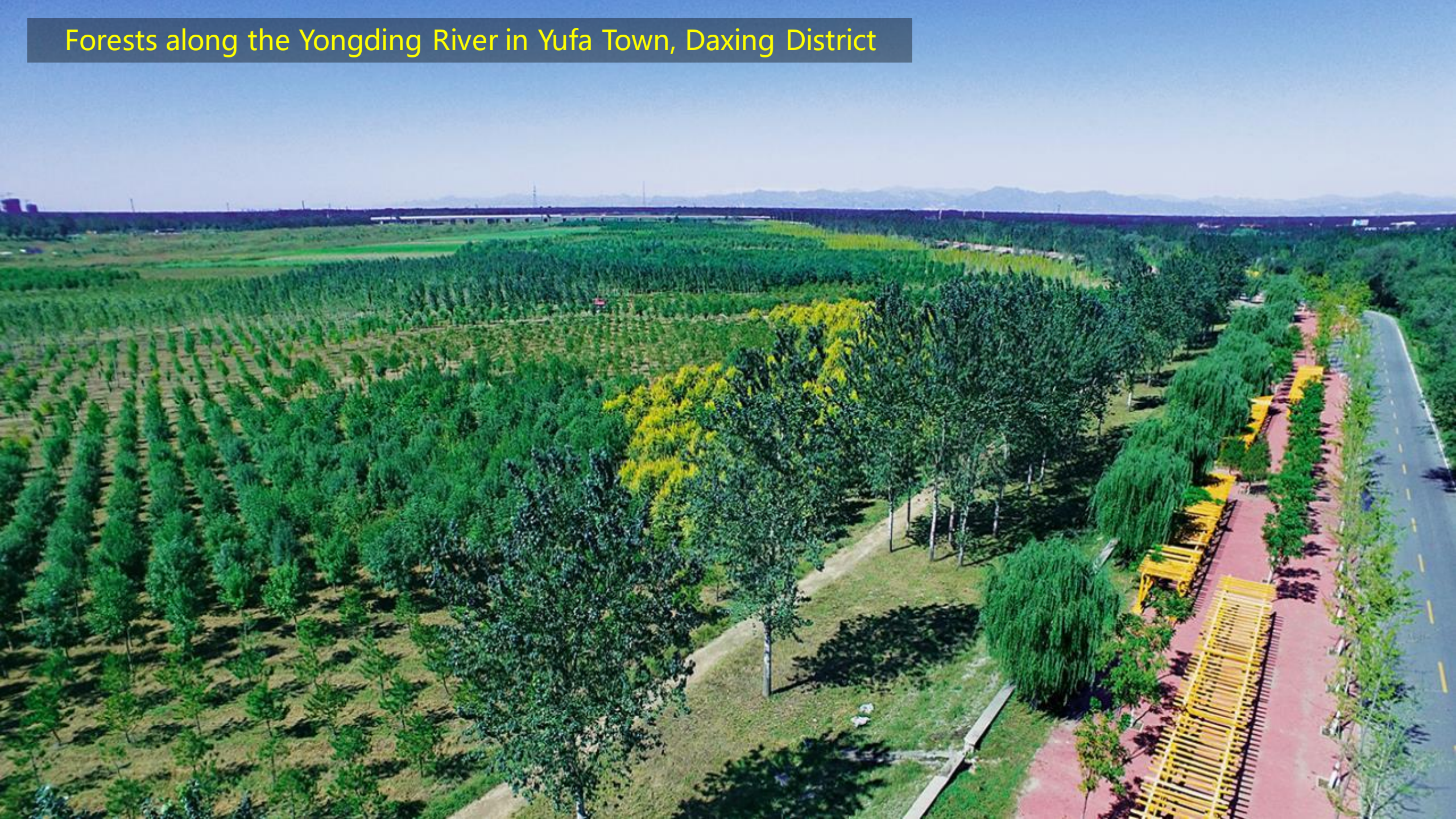
2022

- ✓ 295 biodiversity conservation hotspots and 491 micro-wetlands have been constructed
- ✓ 308 bird species were observed in Beijing from 2012 to 2017, and 498 bird species were observed from 2018 to 2022.






Forests around Future Science and Technology City, Changping District


Forests along the Yongding River in Yufa Town, Daxing District


Forests around the North Canal, Tongzhou District


Urban micro-wetland, Chaoyang District


Dahongluochang pocket park, Xicheng District

Our Experience

- ✓**Systematic framework of the National Forest City construction**
  - ✓ **Design and Planning:** sufficient guidance
  - ✓ **Implementation:** collaboration between central and local governments
  - ✓ **Key performance Indicators:** adequate evaluation
  - ✓ **Management**: continuous monitoring
  - ✓ **Evaluation:** periodic auditing

Future Challenges

- ✓ Land use conflict
- ✓ The quality of urban forests
- ✓ Large scale monitoring using new technologies
- ✓ Biodiversity of urban forests
- ✓ Integrated urban/peri-urban/rural forest landscapes

谢谢 Thank you

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hello@clearinghouseproject.eu

中欧城市森林应对方案

中欧城市森林应对方案

@CLEARINGHOUSE_

@CLEARINGHOUSE_H2020

CLEARINGHOUSE

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2nd World Forum on Urban Forests

2023

World Forum on Urban Forests

2nd World Forum on Urban Forests

Washington DC, 2023

Towards a biodiversity and governance strategy for La Paz city - Bolivia

Presented by

Juan Orgaz Espinoza & Fabio Salbitano

October 18, 2023

Climate change & Water crisis

Drought in Bolivia.

- 279 municipalities distributed among La Paz, Cochabamba, Santa Cruz, Oruro, Chuquisaca, Potosí, and Tarija departments.

- Municipal dams (La Paz) can only guarantee supply until January 2024.

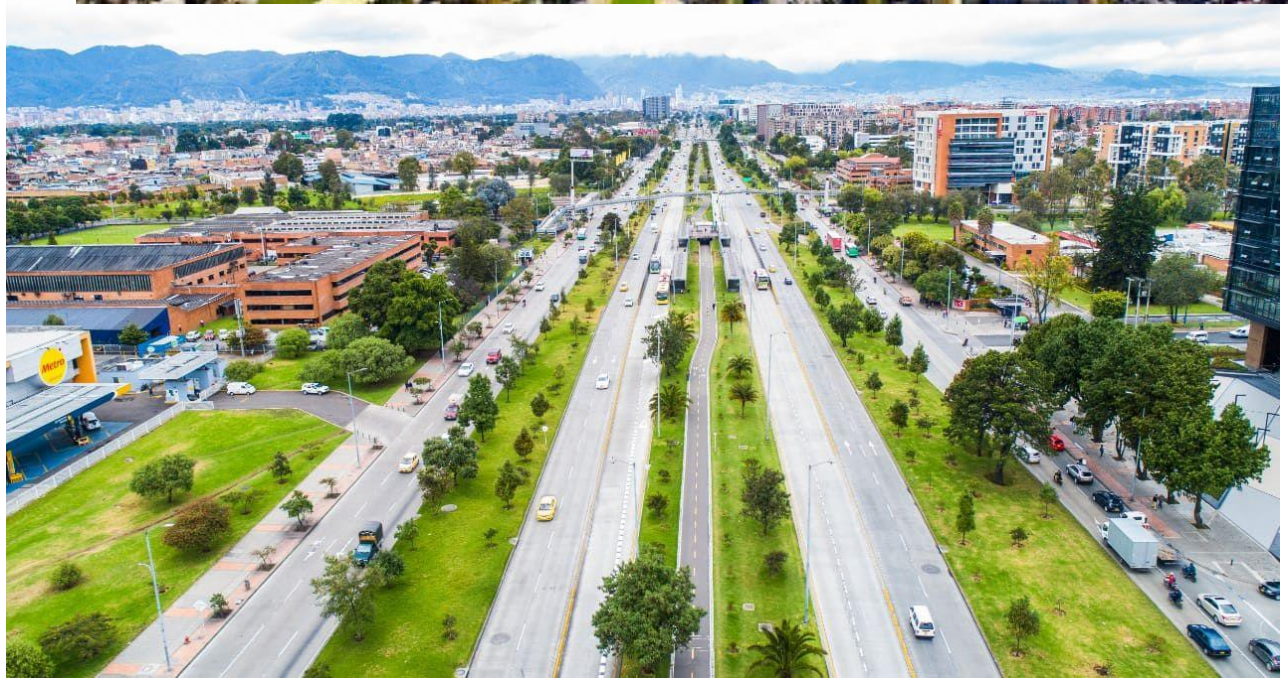
Currently: - 40%

Titicaca Lake (2023)

Resilient cities paradigm

- Cities like Barcelona are adopting the Biocity model.

- However, in Latin America we also have reference cities such as the city of Bogotá, Colombia.



Definition of Local Biodiversity Strategy and Action Plan - LBSAP

A guiding strategy, adopted by local governments to achieve realistic governance and adaptive management of biodiversity and ecosystem services.

Allow compliance with the global biodiversity framework (CBD) and the NBSAP of each country.

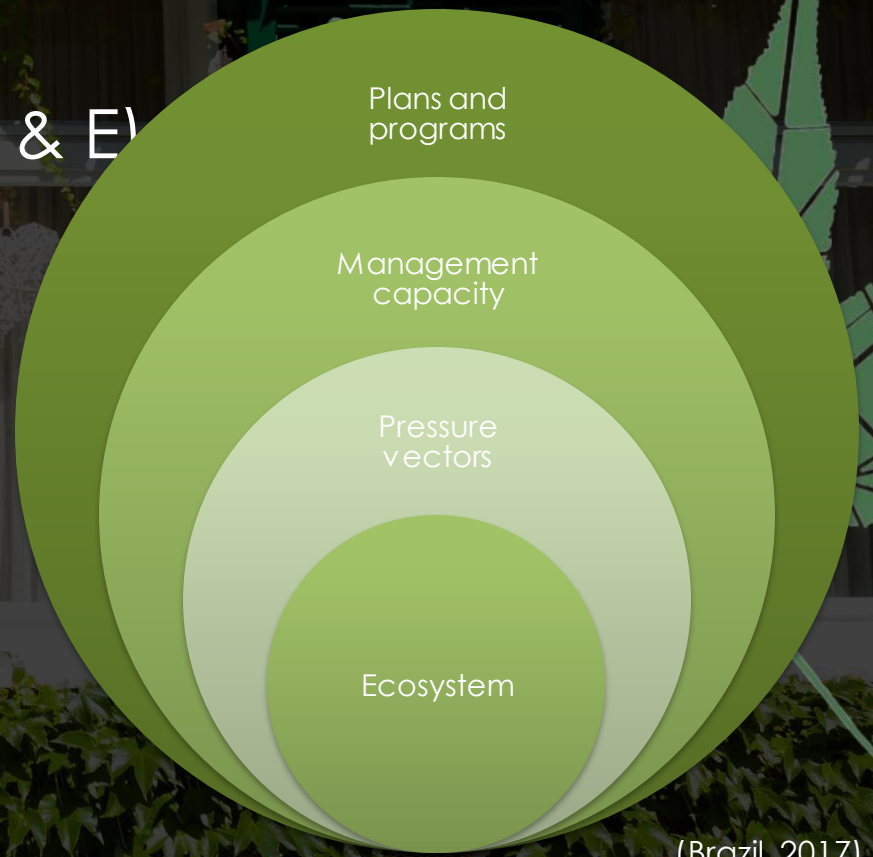
Where do we start?

La Paz metropolitan area is placed inside a region with high biological diversity; however, it does not have a local policy that allows to take advantage of the opportunities that biodiversity and the ecosystem services are continuously promoting.

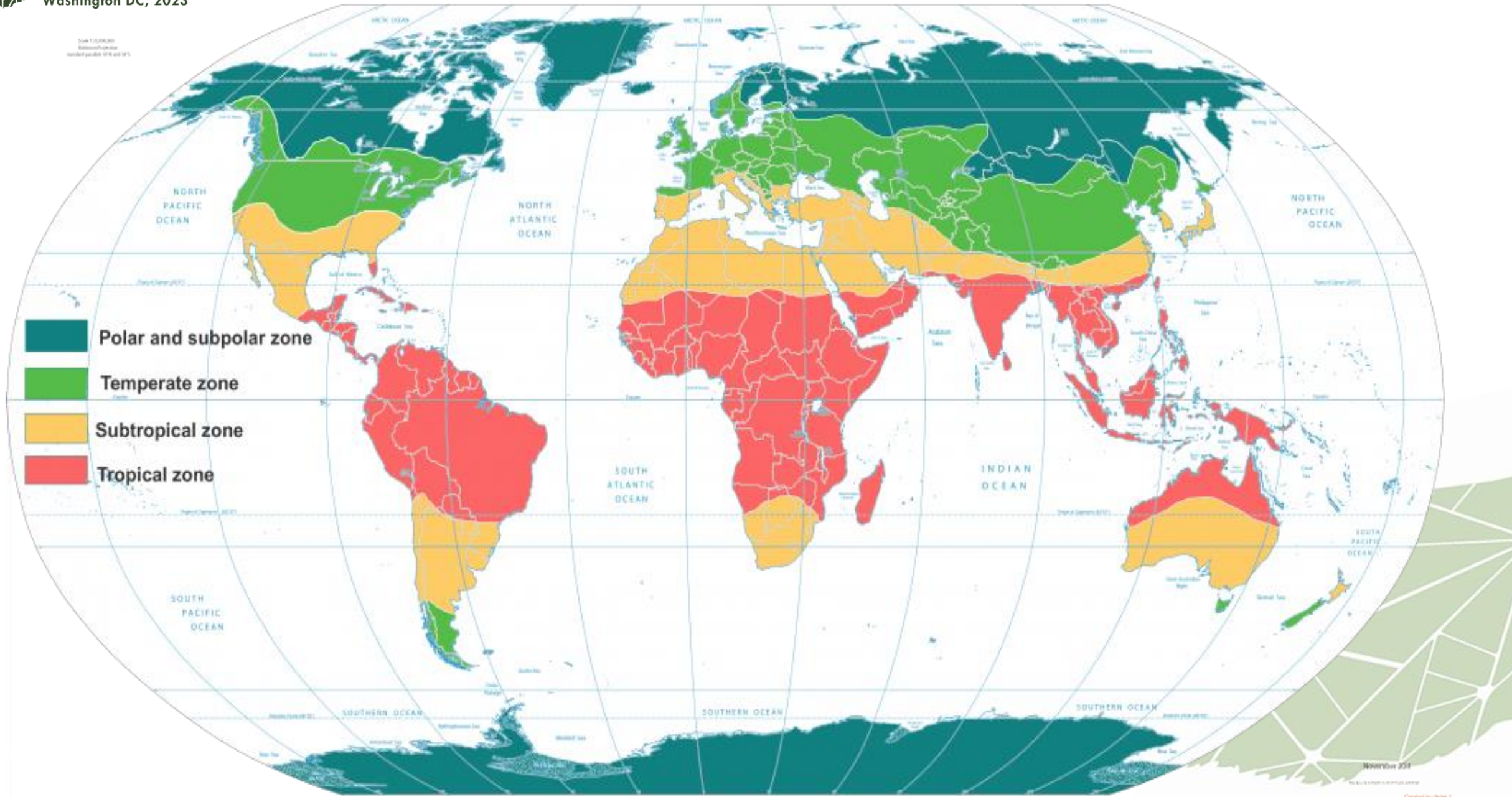
Methods

Multicriteria Analysis of 24 urban protected areas

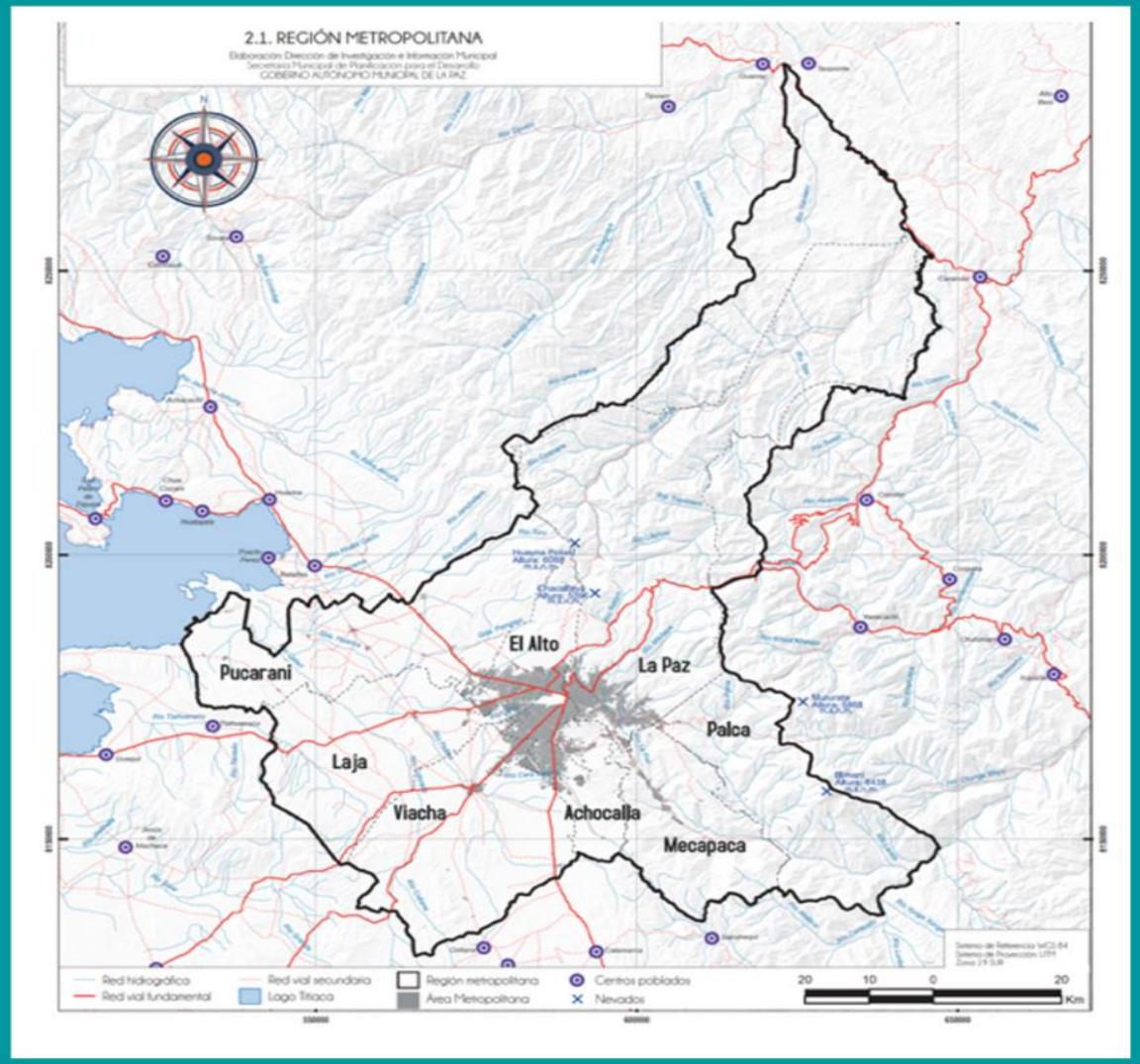
- GIS tools and analysis of biodiversity databases (iNaturalist, 2022)
- Presence/absence of conservation values (E & E)
- Pressure vectors identification

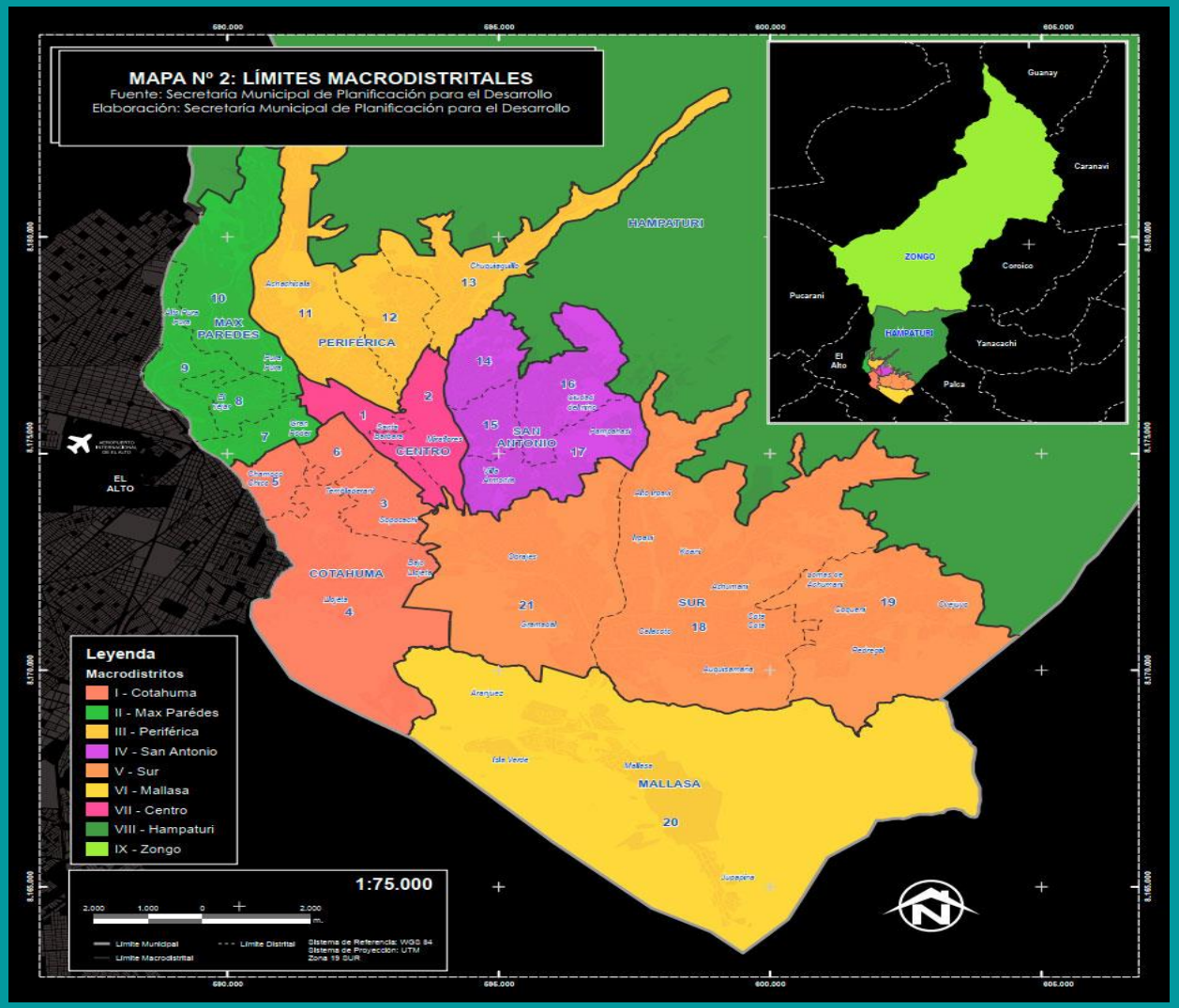


(Brazil, 2017)


Polar and subpolar zone
Temperate zone
Subtropical zone
Tropical zone
NORTH PACIFIC OCEAN
NORTH ATLANTIC OCEAN
NORTH PACIFIC OCEAN
SOUTH ATLANTIC OCEAN
INDIAN OCEAN
SOUTH PACIFIC OCEAN
SOUTHERN OCEAN
SOUTHERN OCEAN
SOUTHERN OCEAN

REGIÓN METROPOLITANA DE LA PAZ

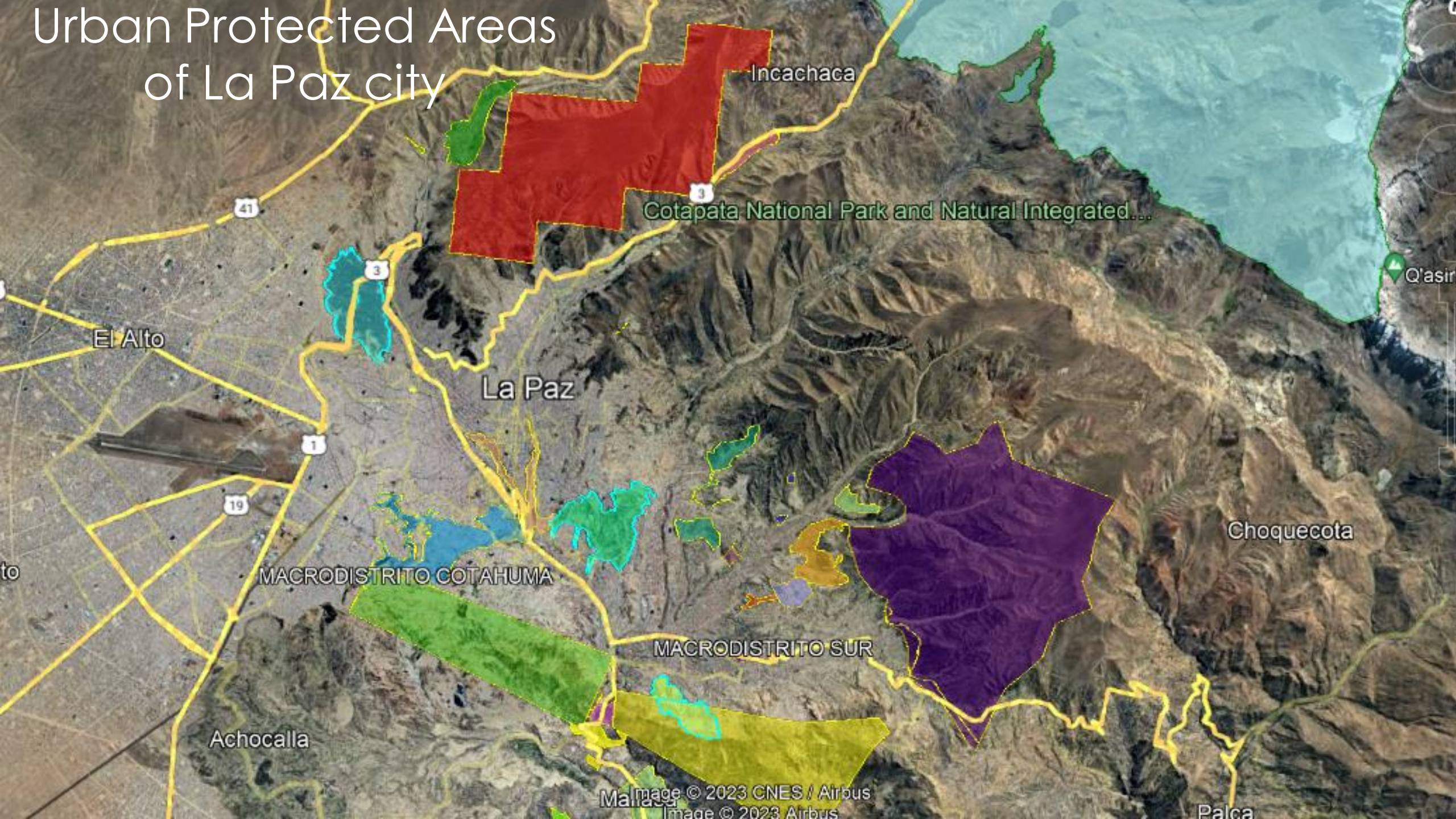




La Paz city

Main Characteristics
Ecoregion: Puna and Inter-Andean dry valley
Altitude range: 2200 - 5200 msnm
Annual precipitation: 600 mm

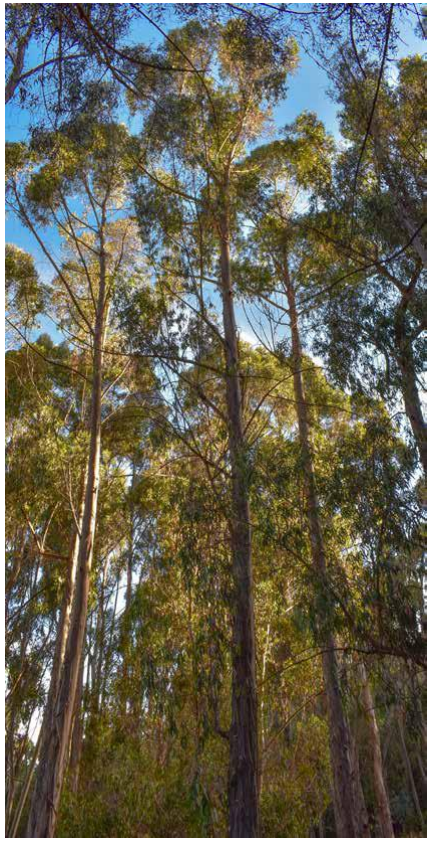
Urban Protected Areas of La Paz city

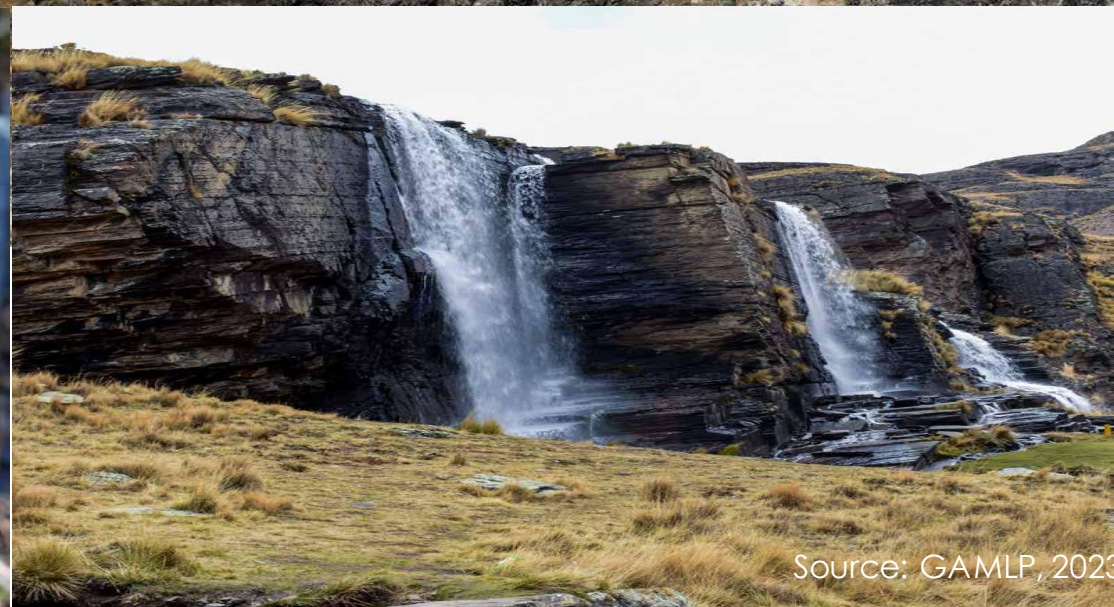



Condoriri
Botijlaca
Suapi
Padilla
Huayna Potosi
Chuccara
Bella Vista
Huarinilla
Coroico
Yolosa
600 km2
Trinidad Pampa
Chacaltaya
Vilaque Cochapampa
Mik'aya
Coripata
Incachaca
Yanacachi
El Alto
La Paz
Oquecucho
Puchucollo Alto
Achocalla
Image Landsat / Copernicus
La Paz Metropolitan Area

Results

- 7 urban biodiversity *hotspots* have been identified in the municipality
- Of the total species inventoried in the database, 62% (2,621) were found within the urban protected areas analyzed.
- The presence of endemic species has been identified in some of these preservation areas such as the *Liolaemus forsteri* and *Liolaemus aparicioi*.
- A management system for these 24 areas according to their ecological affinity and the provision of ecosystem services was proposed.





Source: GAMLP, 2023

Source: GAMLP, 2023

Reto Ciudad Naturaleza
La Paz 2023

¡Gracias a todas las personas que fueron parte de este logro a nivel mundial!

Mayor Nº de Observaciones

Mayor Nº de Especies

Mayor Nº de Participantes

¡SOMOS BICAMPEONES!

Resultados oficiales 8 de mayo

La Región Metropolitana de La Paz obtuvo el PRIMER LUGAR en las tres categorías del Reto Ciudad Naturaleza 2023

RESULTADOS

Observaciones	Especies	Participantes
126.435	5.344	3.025

Alberto Espinoza - ALWA

LA PAZ ENTRE 482 CIUDADES

Reto Ciudad Naturaleza
La Paz 2023

Observaciones	Especies	Participantes
6,8%	9,3%	4,6%

La Paz entre 6 centros urbanos sudamericanos

Advances for the LBSAP of La Paz city

- Initial diagnosis completed
- Rising of the Citizen Environmental Council
- Identification and articulation with key actors
- Advances in identification of key areas for the sustainable use of ES

Territorial and social empowerment

La Paz as a Biocity model in the Latino American region

- The municipality of La Paz represents one of the most peculiar places due to its geographical, climatic and biophysical characteristics, which positions it as an **urban hotspot** for the country and for all the Neotropical region.

- To achieve this, it is necessary to implement a municipal policy that generates an action framework that conceives the conservation of urban forests and biodiversity as the main local adaptation strategy that could contribute to positioning the city as an international benchmark for environmental policies towards biocities.


Huayna Potosí Mountain. ENC
Hampaturi
WE HOPE THE WORLD STAKEHOLDERS CAN RECEIVE THIS PROPOSAL AND WORK TO MAKE IT COME TRUE!
Source: GAMLP,

Thank you for your attention!

Juan Orgaz | Movimiento Propacha

+591 63121464

juan.orgaz.es@gmail.com

fsalbitano@uniss.it

2nd World Forum on Urban Forests

2023

World Forum on Urban Forests

2nd World Forum on Urban Forests

Washington DC, 2023

Borrowed Credentials and Surrogate Professional Societies

A Critical Look at the Urban Forestry Profession

Presented by

Keith O'Herrin, Ph.D.

Urban Forester

Union County, NC

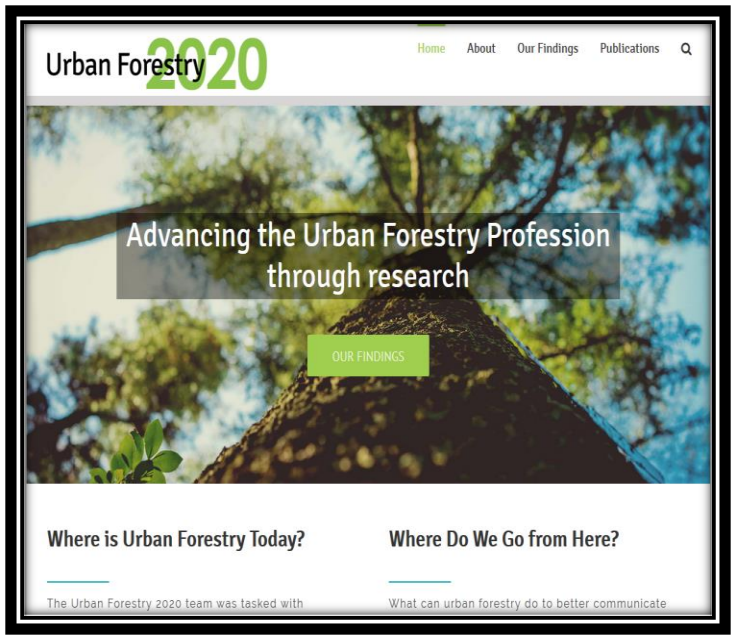
A little bit about us…

Keith O'Herrin — Union County, NC; North Carolina State University
Corinne G. Bassett — University of British Columbia
Susan D. Day—University of British Columbia; Virginia Tech
Paul Ries — Oregon State University
P. Eric Wiseman — Virginia Tech





Urban Forestry 2020



Contents lists available at ScienceDirect

Urban Forestry & Urban Greening

journal homepage: www.elsevier.com/locate/ufug

University student perceptions of urban forestry as a career path

Keith O'Herrin[a,*], Susan D. Day[b], P. Eric Wiseman[b], Curtis R. Friedel[b], John F. Munsell[b]

[a] City of Highland Park, IL
[b] Virginia Tech

Contents lists available at ScienceDirect

Urban Forestry & Urban Greening

journal homepage: www.elsevier.com/locate/ufug

Original article

Professional identity of urban foresters in the United States

Keith O'Herrin[a,*], P. Eric Wiseman[b], Susan D. Day[c], Richard J. Hauer[d]

Contents lists available at ScienceDirect

Urban Forestry & Urban Greening

journal homepage: www.elsevier.com/locate/ufug

Original article

Support for a new credential in urban forestry: Results from a survey of urban forest professionals

Susan D. Day[a,*], Paul Ries[b], Corinne G. Bassett[a], P. Eric Wiseman[c], Keith O'Herrin[d,e]

RESEARCH ARTICLE

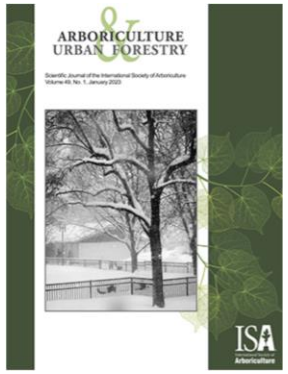
J. For. 116(2):151–163
doi: 10.1093/jofore/fvx006

urban & community forestry

Identifying a Career Ladder in Urban Forestry by Analyzing Job Postings and Interviews

Keith O'Herrin, P. Eric Wiseman, Susan D. Day, and Won Hoi Hwang

New research!



O'Herrin, K., Bassett, C.G., Day, S.D., Ries, P. & Wiseman, P. E. Borrowed credentials and surrogate professional societies: A critical analysis of the urban forestry profession. *Arboriculture and Urban Forestry* 49.3

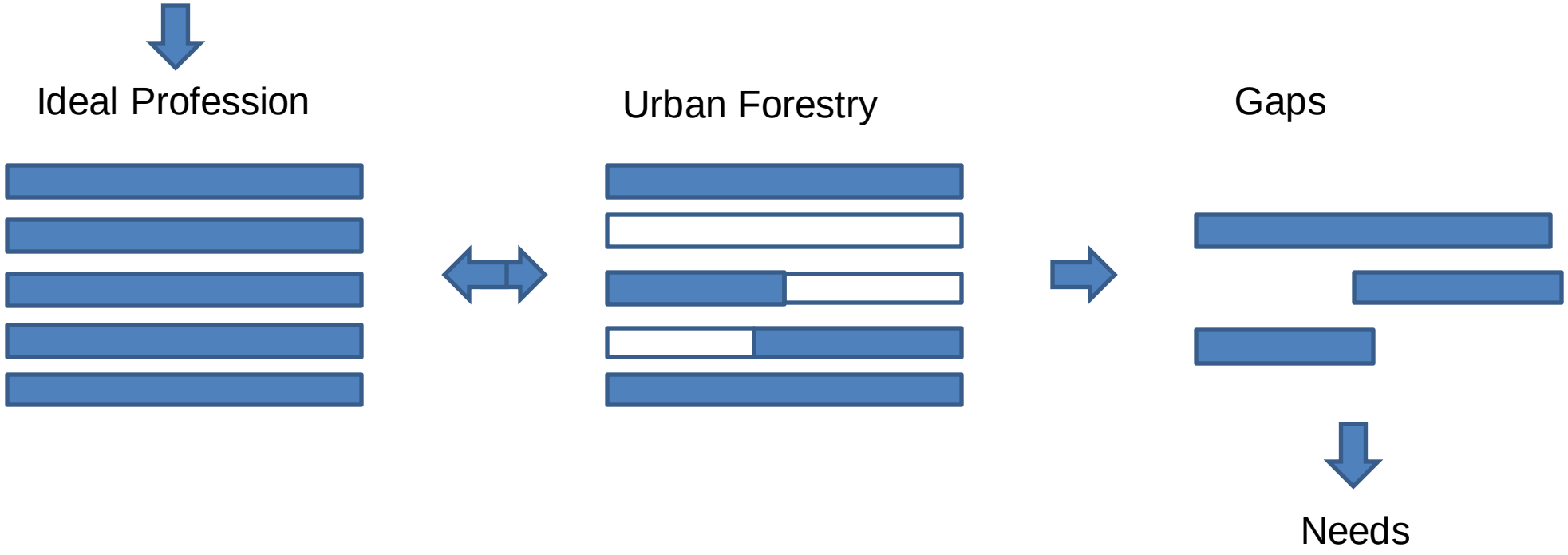
What defines a profession?

A profession provides an essential service to society and requires a high level of specialization and training (Freidson, 1999; Bayles, 2003).

What defines an ideal profession?

We researched 11 other professions:

Doctor, Nurse, Public Health, Pharmacist, Lawyer, Social Worker, Planner, Landscape Architect, Civil Engineer, Arborist, and Forester



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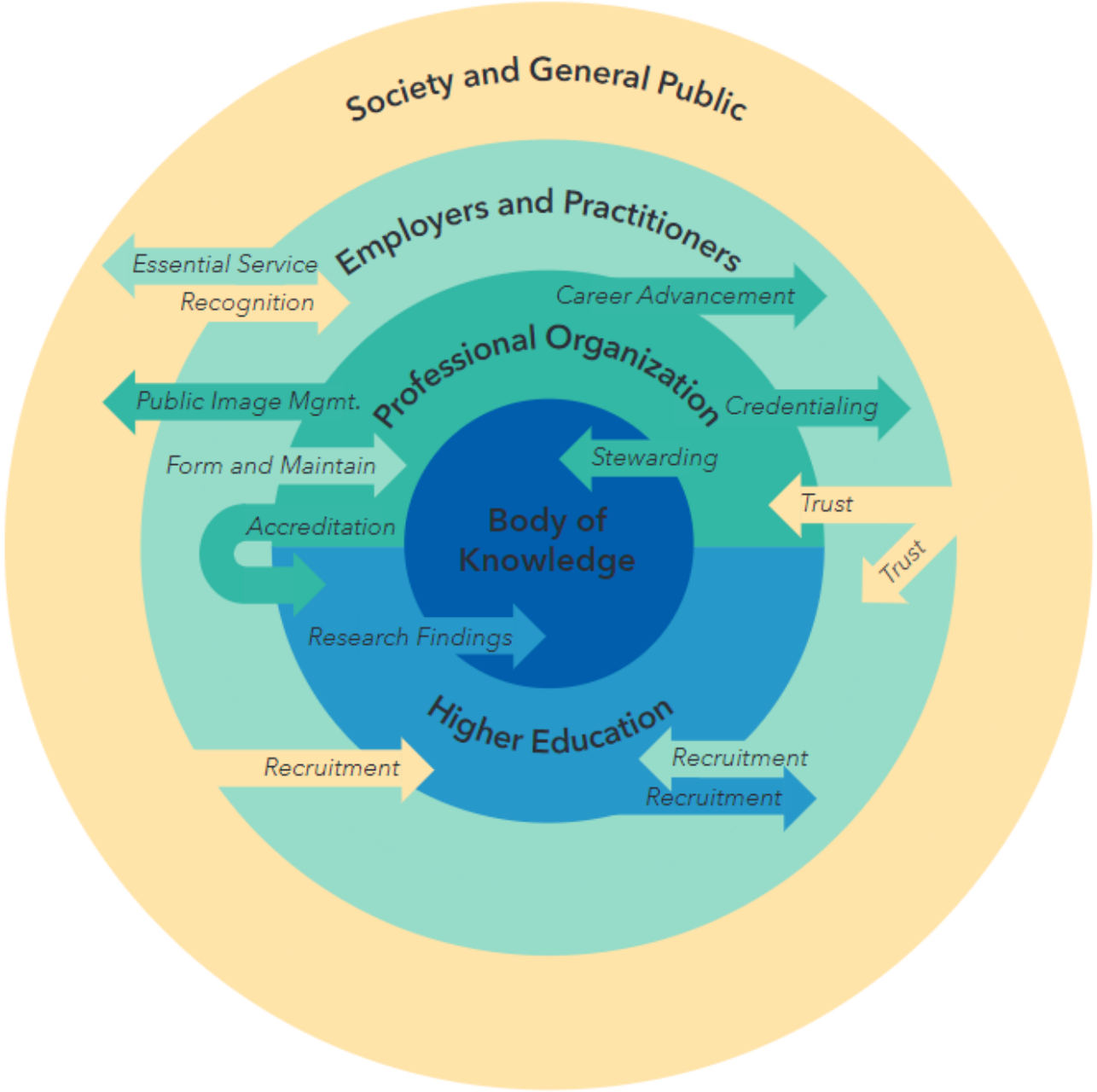
The Ideal Profession

1. Essential Service to Society
2. Body of Knowledge
3. Higher Education
4. Credentialing
5. Public Trust
6. Recruitment
7. Retention and Advancement
8. Professional Organization



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4. Credentialing

- Provided by a professional society
- Sets minimum level of competency
- Tool of ethical accountability
- Professions self-regulate their own members

What defines an ideal profession?

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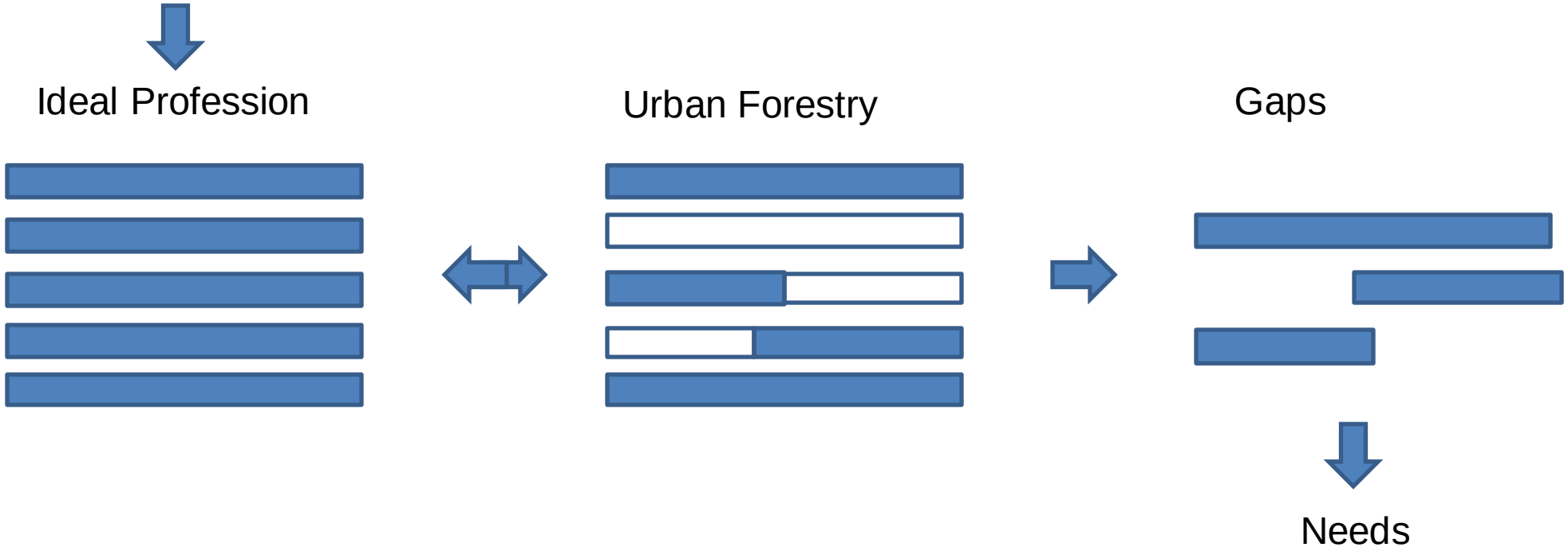
Doctor, Nurse, Public Health, Pharmacist, Lawyer, Social Worker, Planner, Landscape Architect, Civil Engineer, Arborist, and Forester



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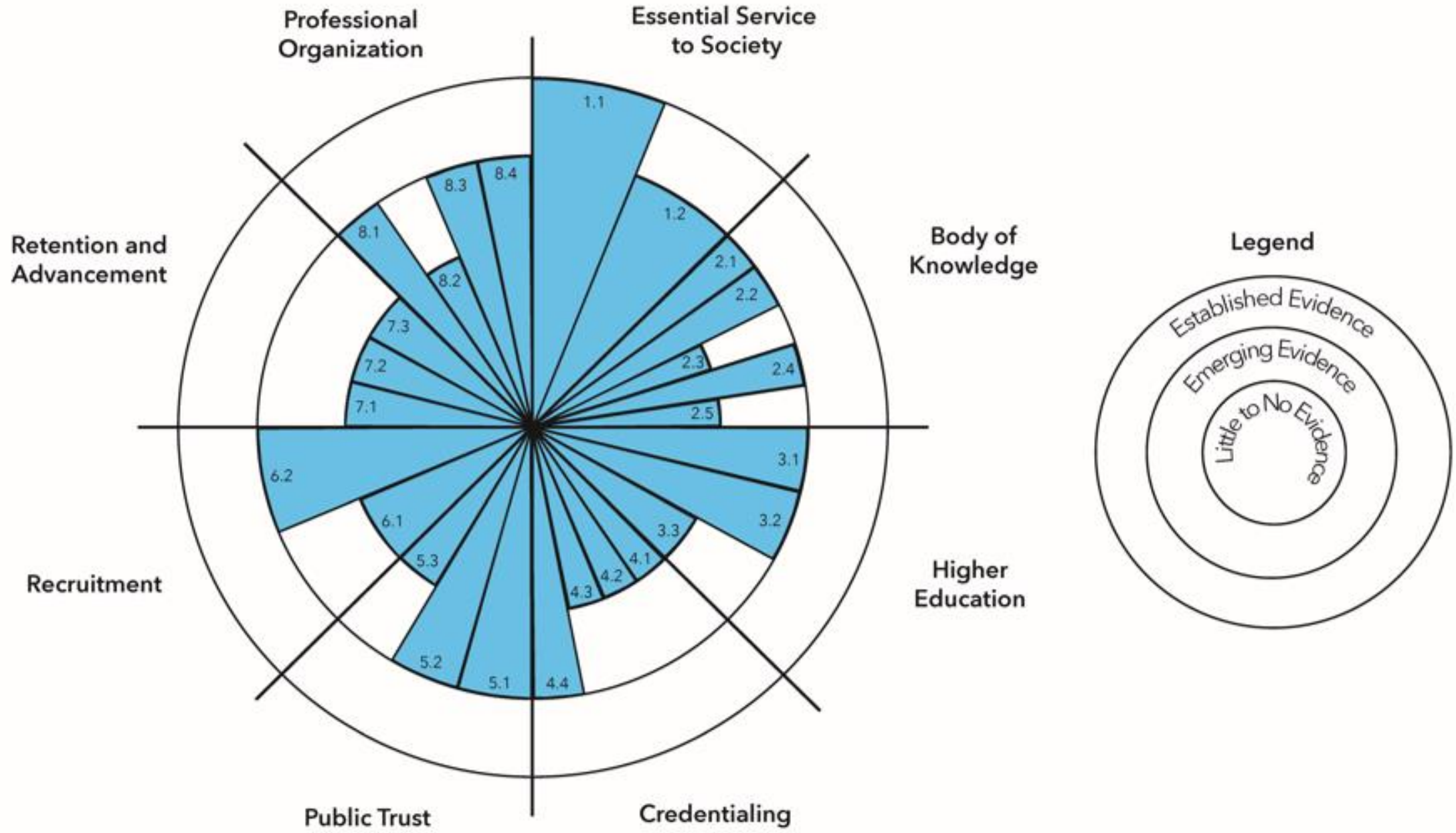
Professional Organization
Essential Service to Society
Retention and Advancement
Body of Knowledge
Recruitment
Higher Education
Public Trust
Credentialing
1.1
1.2
2.1
2.2
2.3
2.4
2.5
3.1
3.2
3.3
4.1
4.2
4.3
4.4
5.1
5.2
5.3
6.1
6.2
7.1
7.2
7.3
8.1
8.2
8.3
8.4
Legend
Established Evidence
Emerging Evidence
Little to No Evidence

4. Credentialing

- Provided by professional society
    - 1/3 – No urban forestry credential exists

- Sets minimum level of competency
    - 1/3 – No minimum level of competency

- Tool of ethical accountability
    - 1/3 – No enforcement of ethics

- Professions self-regulate their own members
    - 2/3 – Urban Foresters are diffused throughout other professions

Urban Forestry lacks a dedicated (custom-built) credential that can establish a minimum level of competency, enforce ethical standards, and foster professional unity.

Urban Forestry is unregulated and can be practiced by anyone

- new credential 2023-24

- update / rename 2024-25

Thank you

Keith O'Herrin, Ph.D. | Union County Extension, North Carolina
Keith.O'Herrin@UnionCountyNC.gov

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Food and Agriculture Organization of the United Nations

2nd World Forum on Urban Forests

2023

World Forum on Urban Forests

Growing Resilient Trees and Urban Forests Through Standards of Care

Richard Hauer, Ph.D.

Director of Urban Forestry | CN Utility Consulting

Emeritus Professor of Urban Forestry | UWSP

2nd World Forum on Urban Forests

Washington, D.C. USA | 16 – 20 October, 2023

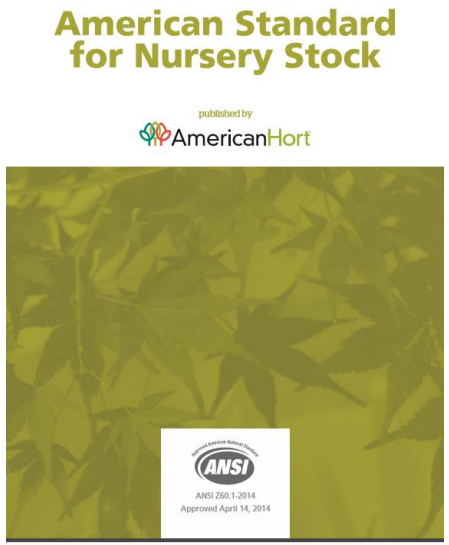
World Forum on Urban Forests

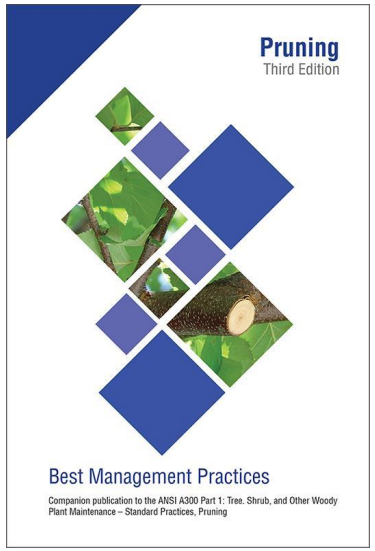
CNUC

Standards of Care … Standards of Practice

Nursery stock Specification for bulbs, corms and tubers

bsi. ...making excellence a habit"





Standards & Their Secrets

Objectives

Specifications

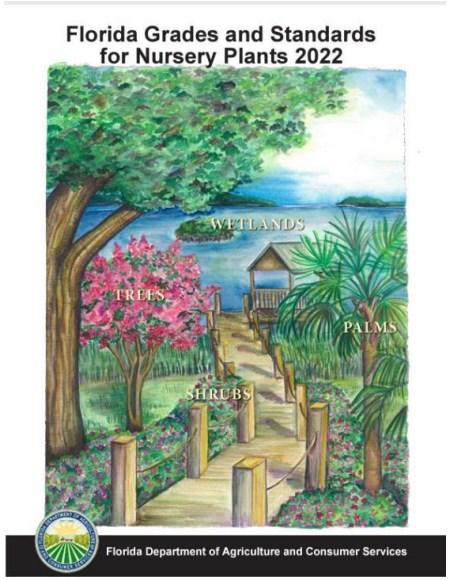
STANDARDS Australia

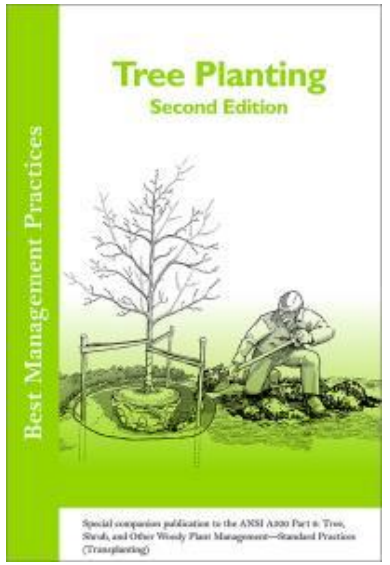
EUROPEAN NURSERYSTOCK ASSOCIATION

European technical & quality standards for nurserystock

ENA
European Nurserystock Association

ENA Edition 2010
www.enaplants.eu





The Urban Forest – Time Continuum

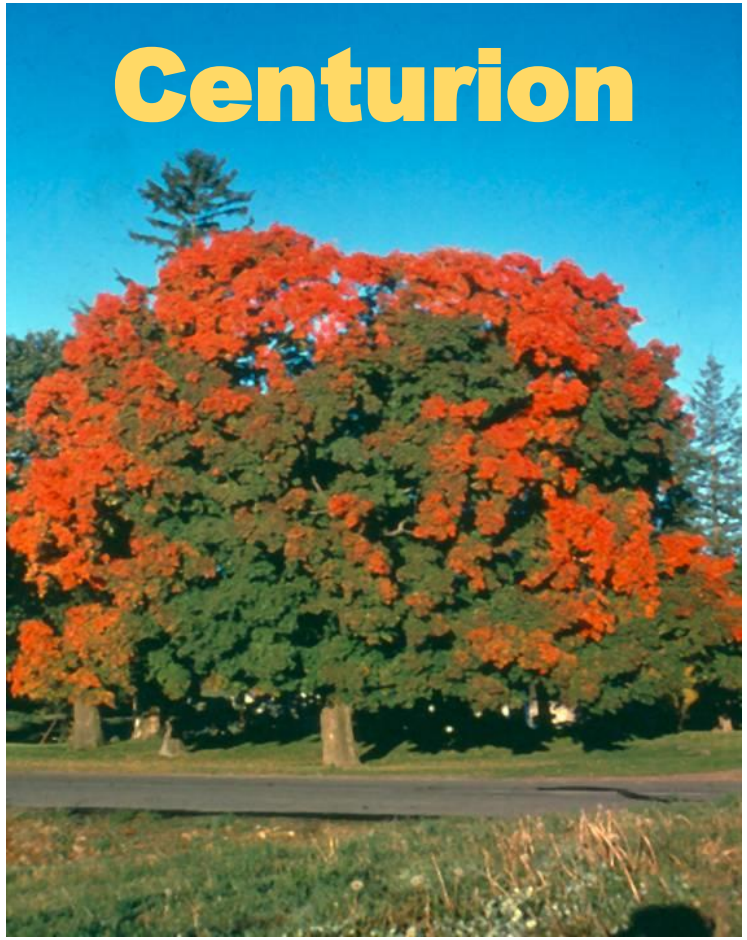
Urban & Community Forest Management

Performed to Meet Specific Objectives

Time Perhaps

100 Years

Or More



Setting a Centurion Standard for Work and Expectations

Objectives in Pictures

Ideally an Objective Results in Benefits

And the # 1 Answer is …. Shade

Always a popular objective

The Urban Forest – Time Continuum

Urban & Community Forest Management

Performed to Meet Specific Objectives

Time Perhaps

40 Years

Or More

Setting a Generational Standard for Work and Expectations

ONE MILLION TREES

Alliant Energy

TUCSON MILLION TREES

MAYOR

Regina Romero

TRILLION TREES AUSTRALIA

ONE MILLION TREES MOVEMENT

60 YEARS OF GREENING SINGAPORE

5 MILLION TREES FOR MARYLAN

PLANT A BILLION TREES

Help Us Plant ONE MILLION TREES

EcoMatcher INVESTANCIA

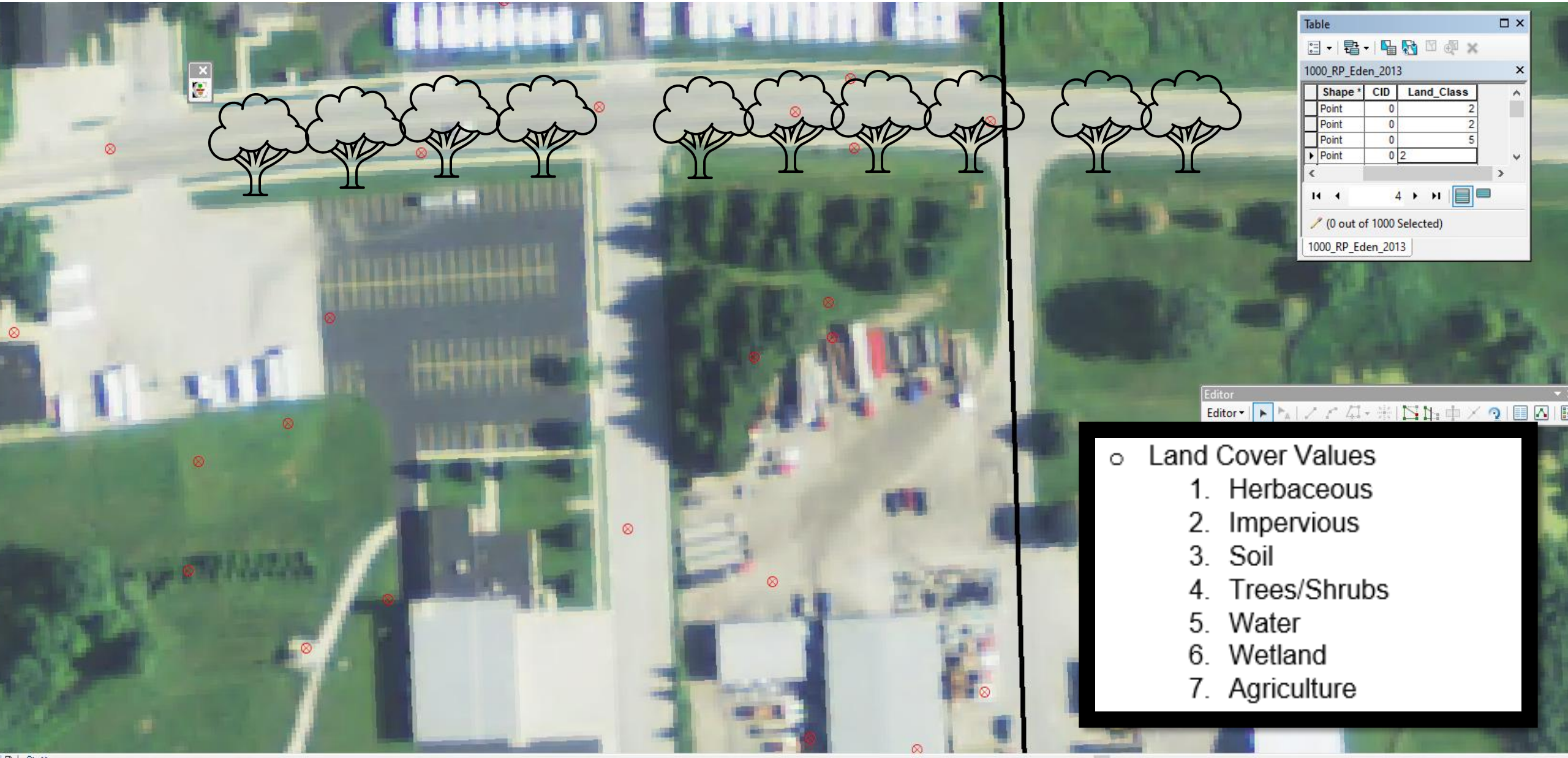
BILLION TREE TSUNAMI

Pakistans Largest Ever Tree Plantation Drive!

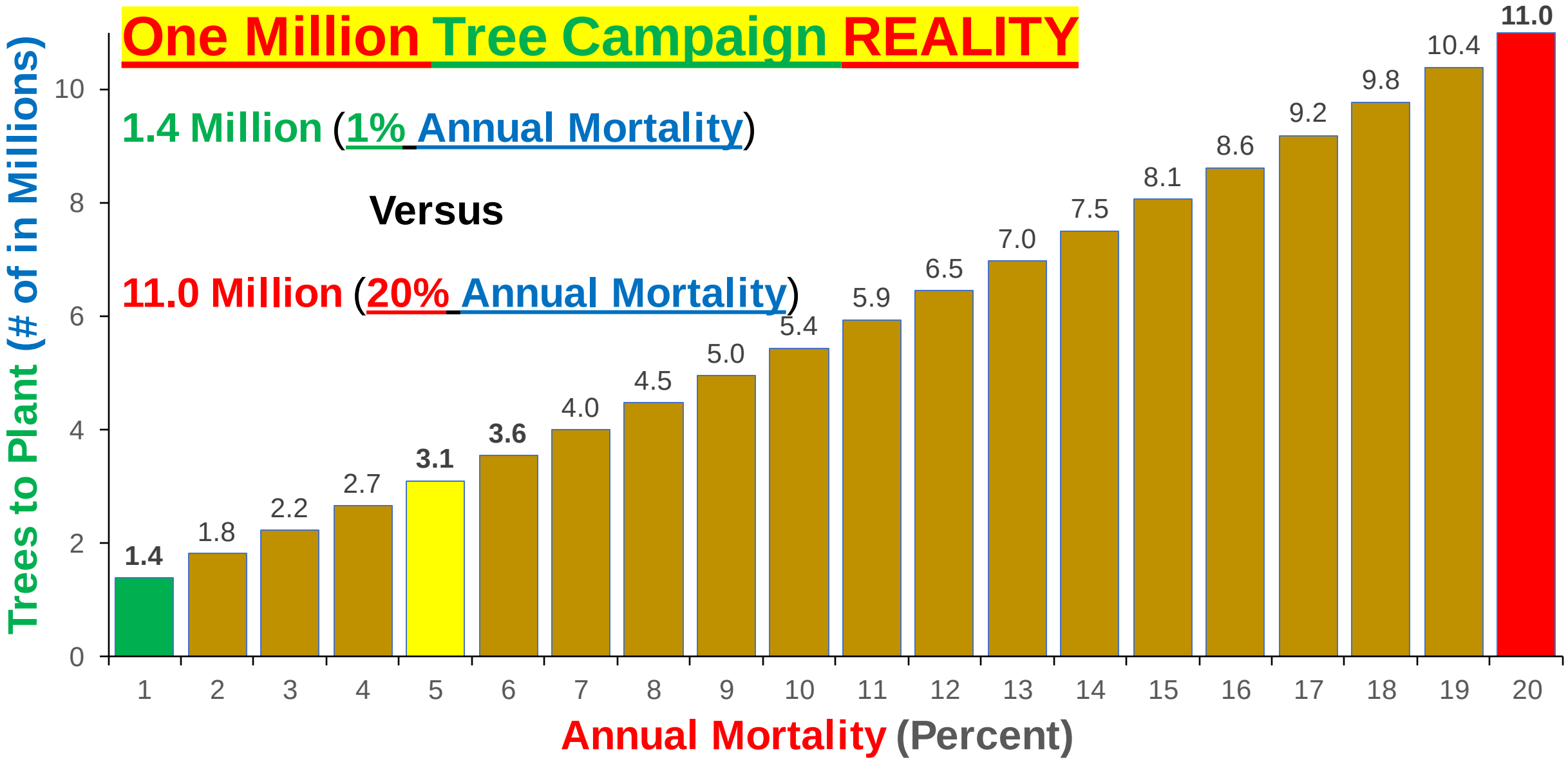
TRILLION TREES

WCS WWF BirdLife INTERNATIONAL

10 Tree Planting Locations



A Generational Question (40-year time period)

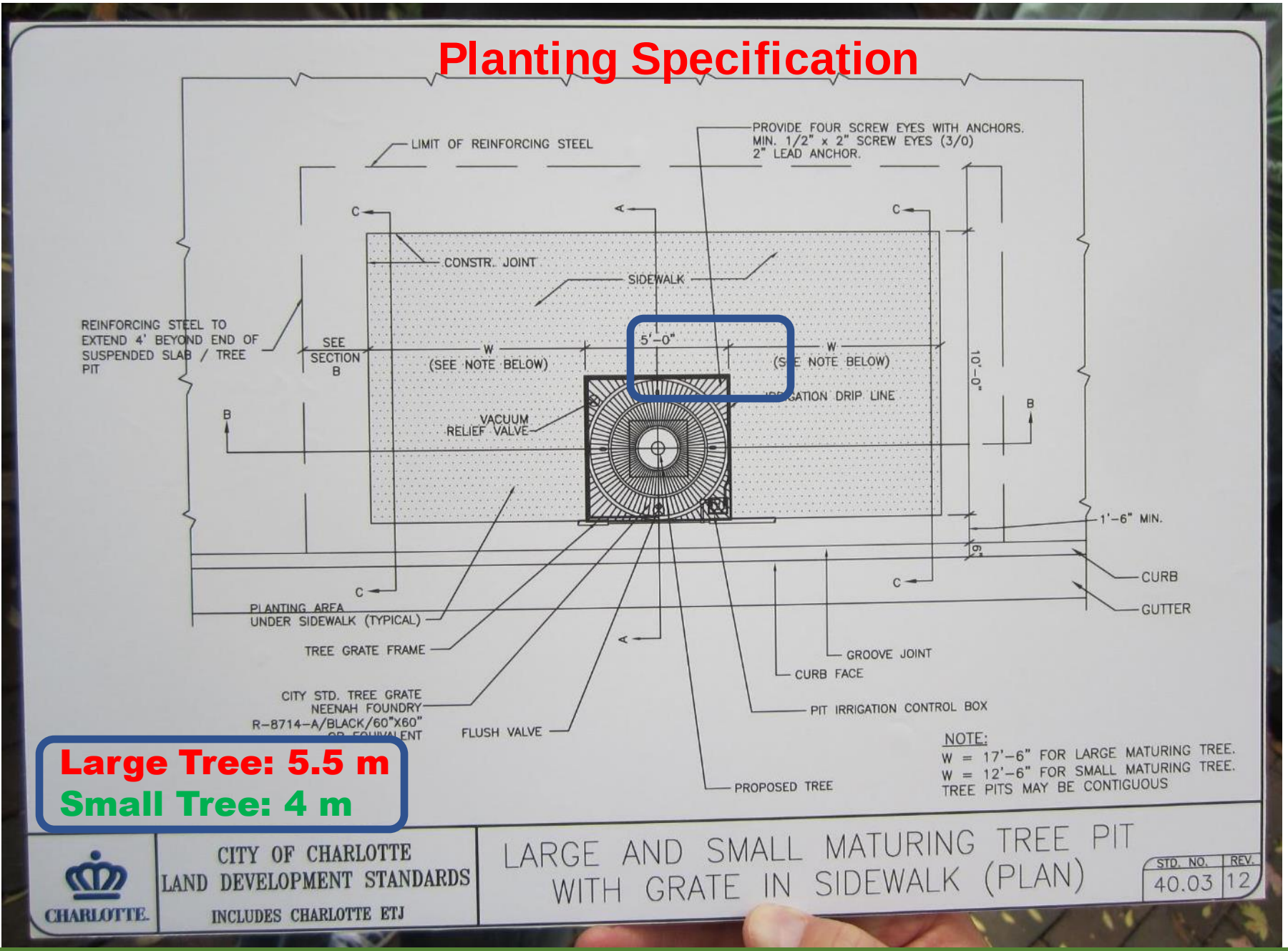


Setting a Standard for Work and Expectations

The Urban Forest and the **Built Environment**

A **Place & Space** (Charlotte, North Carolina USA)

Planting Specification



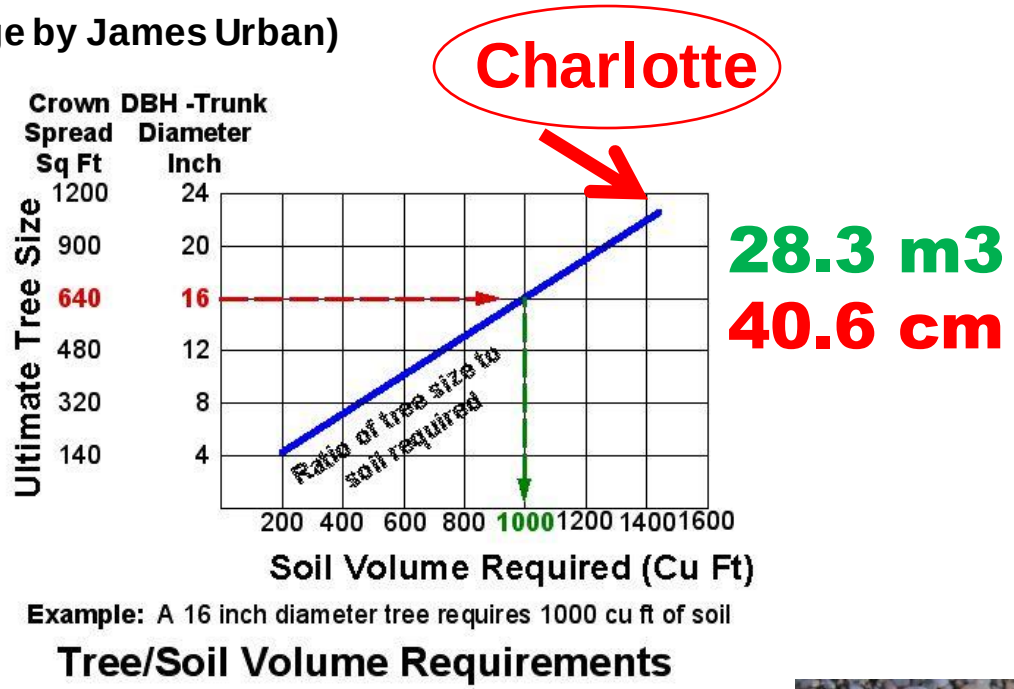
Large Tree: 5.5 m

Small Tree: 4 m

What are the solutions to this design?

Selecting Trees: *Design* for *Final Size*

(Image by James Urban)



28.3 m3

40.6 cm

Example: A 16 inch diameter tree requires 1000 cu ft of soil

Tree/Soil Volume Requirements

Restricted Planting Sites, Try Small Stature Trees

Why Do Urban Forests Setback or Fail?

- **Water** Supply
- **Arboricultural** Practice
- Plant **Health**
- Infrastructure **Conflict**
- **Climate** change
- And **More** …
- Maybe **Diversity**

Urban Forest Dystopia and Decline?

Why Do We Have Standards?

Attain

Quality

Measure

Normal

Why Do We Write Standards of Practice?

The Concept of Tree Pruning is Complex

Why Do We Write Standards?

SAFETY

- Ethel Hugg's son died while trimming
- April 1968 committee formed
- July 1971 Standard adopted
- December 1972 Standard approved

Reasons to Create the 1923 Horticultural Standards

- **Bidding**
- **Quotations**
- **Contracts**

"Members American Association of Nurserymen: All quotations, prices, contracts and grading both for purchase or sale are based on HORTICULTURAL STANDARDS adopted by this Association, June 1923."

SPRING 1925

Wholesale Price List of the

Kelsey Nurseries

G. L. WELCH & CO.

ST. JOSEPH, MISSOURI

FEBRUARY 10, 1925

All quotations, prices, contracts and grading, both for purchase or sale, are based on Horticultural Standards adopted by the American Association of Nurserymen, June 1923.

Use Nurserymen's Code in telegraphing.

Copies to customers on request

Correspondence and Inspection Invited

UNIVERSITY OF MISSOURI
AGRICULTURAL EXPERIMENT STATION
PLANT INSPECTION SERVICE

No. 2 Columbia, Missouri, August 18, 1924

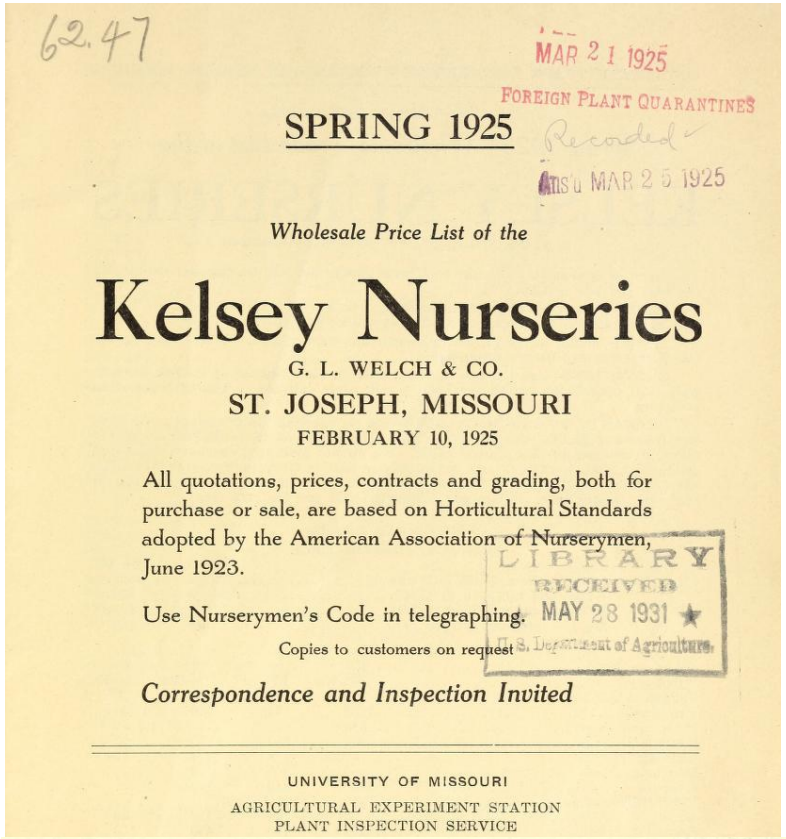
CERTIFICATE OF NURSERY INSPECTION

THIS IS TO CERTIFY, That in accordance with the Plant Inspection Act, passed by the Forty-seventh General Assembly and approved March 27, 1913, the nursery stock of **The Kelsey Nurseries**, grown at St. Joseph, Buchanan County, Missouri, was inspected on July 16, 1924, by a duly authorized inspector and found apparently free from dangerously injurious insects or plant diseases.

Valid until July 1, 1925, unless sooner revoked.

L. HASEMAN,
(Seal) Entomologist and Chief Inspector.

A to Z's *(A300, E.N.A. Z60.1, Z133)* and BMP's



62.47

MAR 21 1925

FOREIGN PLANT QUARANTINES

Recorded

MAR 25 1925

SPRING 1925

Wholesale Price List of the

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LIBRARY RECEIVED MAY 28 1931 U.S. Department of Agriculture

UNIVERSITY OF MISSOURI

AGRICULTURAL EXPERIMENT STATION

PLANT INSPECTION SERVICE

Time Perhaps

100 Years

Or More

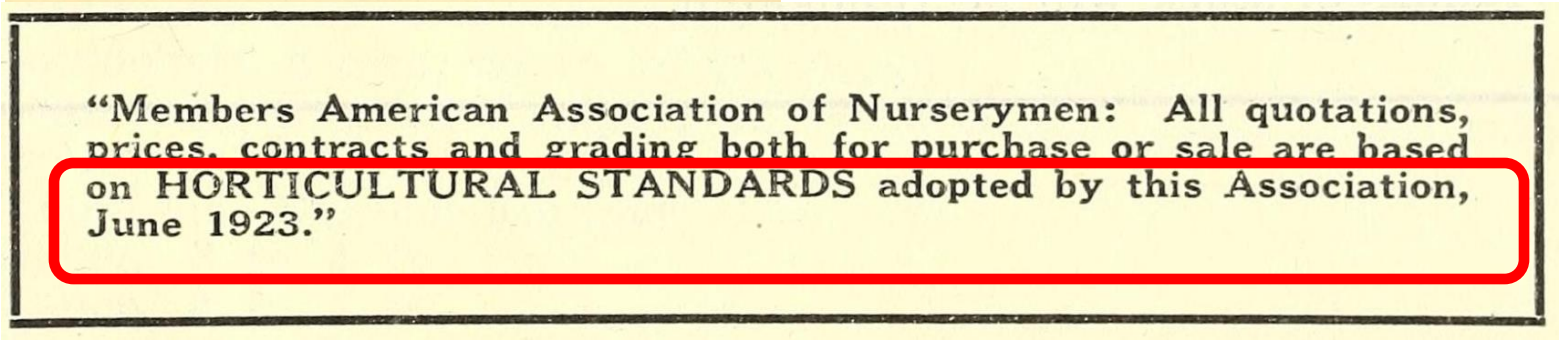
American Standard for Nursery Stock

published by AmericanHort

ANSI

ANSI Z60.1-2014

Approved April 14, 2014



"Members American Association of Nurserymen: All quotations, prices, contracts and grading both for purchase or sale are based on HORTICULTURAL STANDARDS adopted by this Association, June 1923."

Z60.1 Nursery Growing … A300 Part 6 Planting

Australian Plant Production Standard

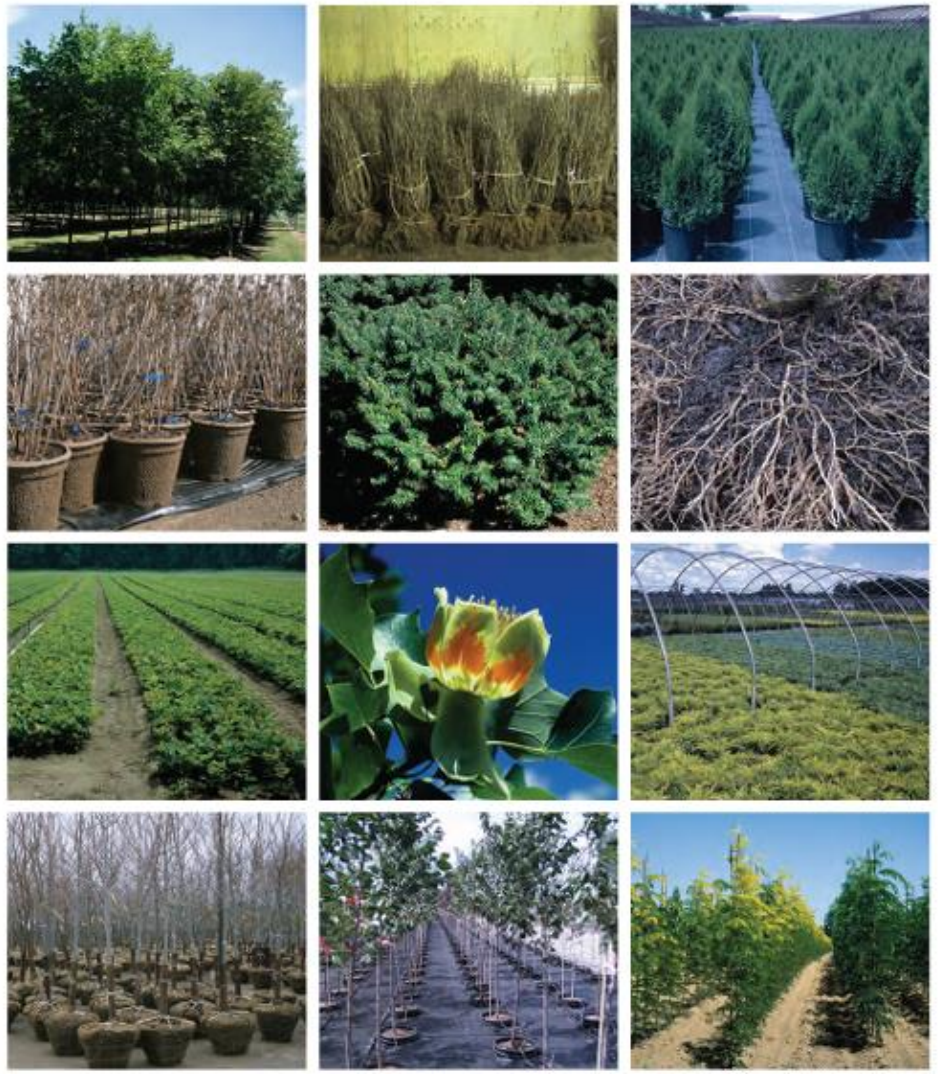
(APPS)

Landscape Tree Stock Specification

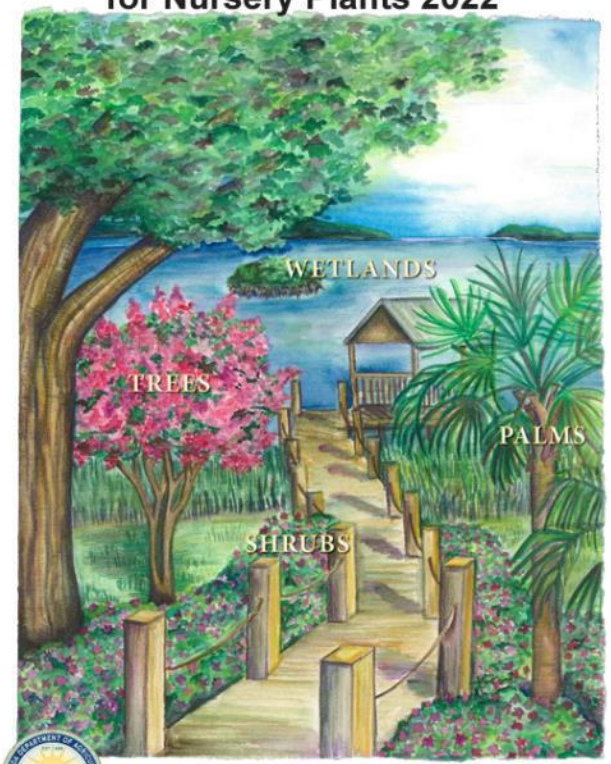
ACCREDITED NIASA NURSERY
Setting the Standards
Landscape Tree Stock Specification

CANADIAN NURSERY STOCK STANDARD

ninth edition



Florida Grades and Standards for Nursery Plants 2022



Florida Department of Agriculture and Consumer Services

BS 3936-9:1998

BSI Standards Publication

Nursery stock Specification for bulbs, corms and tubers

bsi.

...making excellence a habit.™

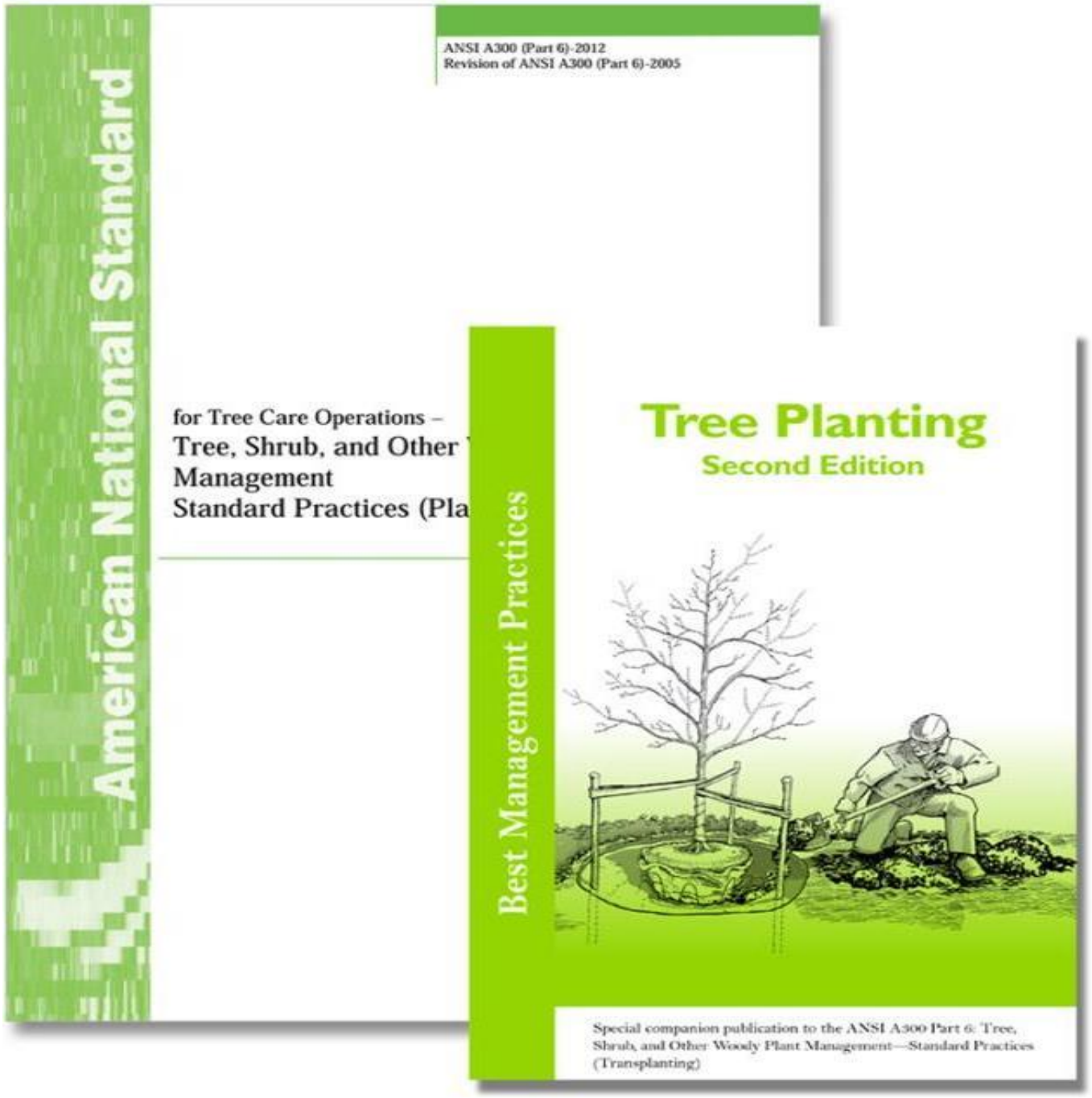
Canadian Nursery Landscape Association
Association Canadienne des Pépiniéristes et des Paysagistes

ANSI A300

(Part 6)

Planting and Transplanting

A Standard for Landscape Trees



Norway Maple (*Acer platanoides*) Decline (Circa 1990's)

Non Apparent **Initial Decline** **Advanced**

The Root of the Cause: Stem Girdling Roots (SGR's)

Sugar maple with 100% SGR's with decline evident

Importance of Water

Explains ~ 70 to 80% of Plant Growth

Specifications (For Purchase)

Written plant acceptance criteria **should include**:

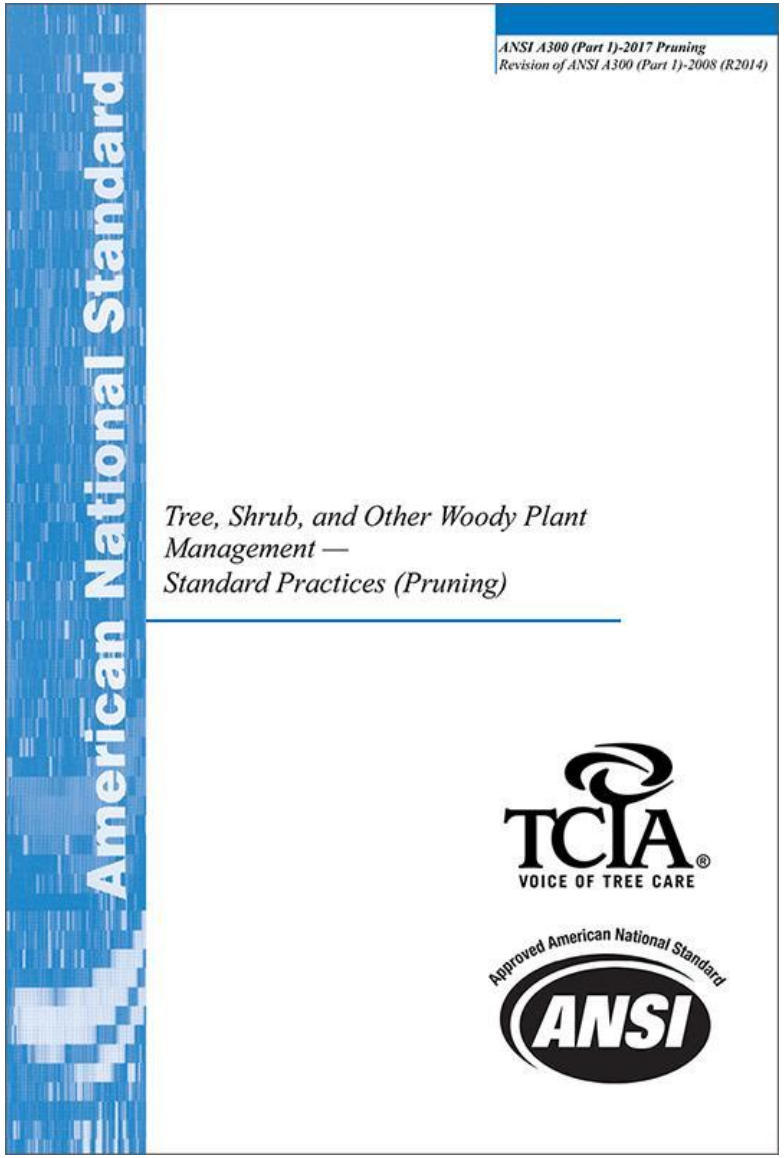
- **Plant size** (height and/or trunk diameter);
- **Root system dimensions** (i.e., shape, width/diameter, height);
- **Condition** (i.e., health, structure, and form) and root collar (or root initiation zone) visibility (height above grade, **root collar & soil**);
- Presence of existing or potential **stem girdling roots**; and
- Other issues **impacting** potential of **survival**.

Water Prescription for Establishment

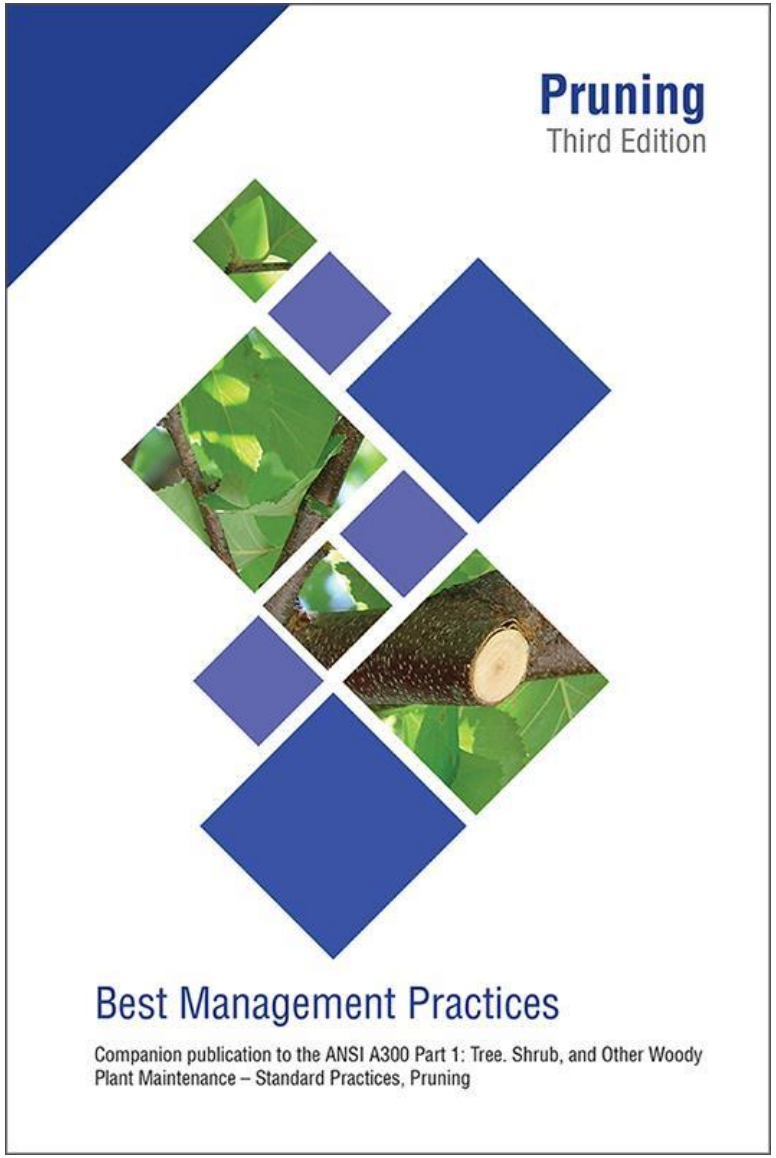
SIZE OF NURSERY STOCK	IRRIGATION SCHEDULE FOR	
	VIGOR	SURVIVAL
5 cm Less than 2 inch caliper	**Daily**: 2 weeks **Every other day**: 2 months **Weekly**: until established	Twice weekly for 2-3 months
5 to 10 cm 2-4 inch caliper	**Daily**: 1 month **Every other day**: 3 months **Weekly**: until established	Twice weekly for 3-4 months
greater 10 cm than 4 inch caliper	**Daily**: 6 weeks **Every other day**: 5 months **Weekly**: until established	Twice weekly for 4-5 months

Appropriate Doses of Water (Gillman & Sadowski 2007)

Not a “how to” manual for everyday use



Pruning



Standard and Your Professional Expertise

Australian Standard

AS 4373—2007

STANDARDS Australia

British Standard

BS 3998:2010

BSI Standards Publication

Tree work – Recommendations

More Precise Municipal Specification – Street Trees

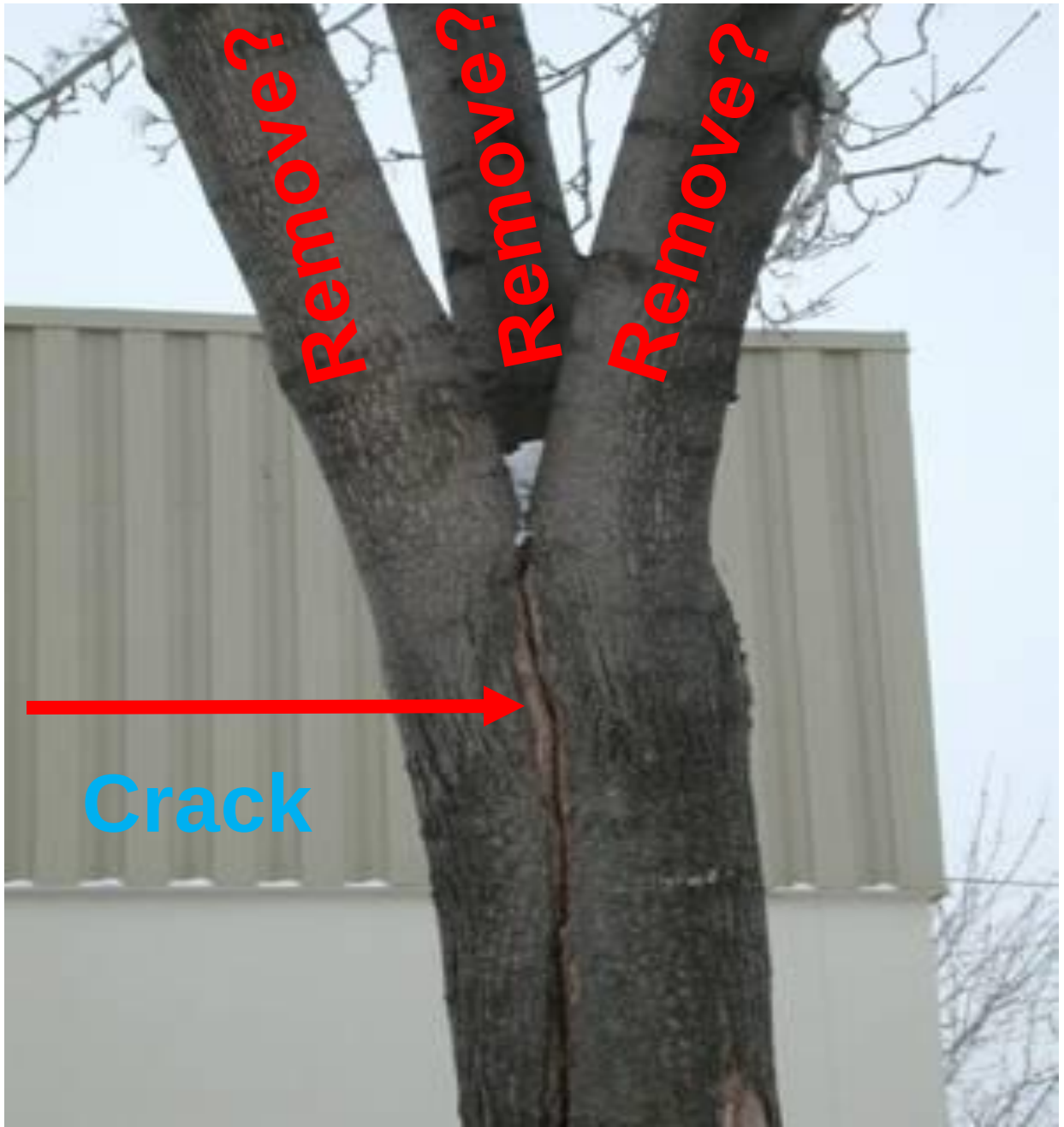
- Prune crowns of trees to remove ***dead, declining and broken branches >2" (5cm) diameter***
- Raise crowns of trees to provide ***a* minimum *of 15' (4.5 m)*** clearance above street ***from curb to curb***, and ***10' (3 m)* above sidewalks**
- Remove no more than ***25%*** of living foliage on any individual tree or branch
- Prune to improve structure ***(trees <12" (30 cm) diameter only)***:

  - ✓ ***Reduce or remove interfering, defective, weak, and poorly attached branches greater than 2" (5 cm) diameter***
  - ✓ ***Reduce or remove competing branches and leaders to develop strong scaffold branches with a minimum 24" (60 cm) spacing***
- ***Methods used shall comply with applicable portions of A300, Part 1, etc…***

Formative Pruning … Structural Pruning … Training

Pruning a necessary part of tree structure and health

Maturing Tree: Cracks = separation of wood fibers



Maturing: Where to Prune

Included Bark

Can Lead to Decay

Resulted in Failure

Hackberry and decay from included bark

Urban & Community Forest Management

Performed to Meet Specific Objectives

Time Perhaps

100 Years

Or More

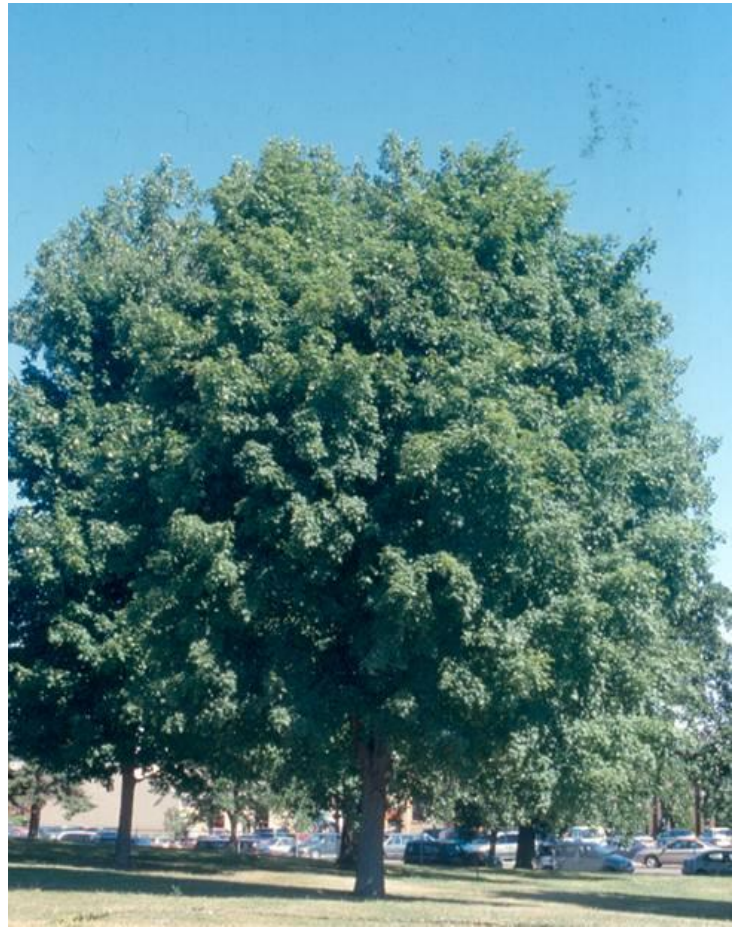
Urban & Community Forest Management

Performed to Meet Specific Objectives

Time Perhaps

40 Years

Or More



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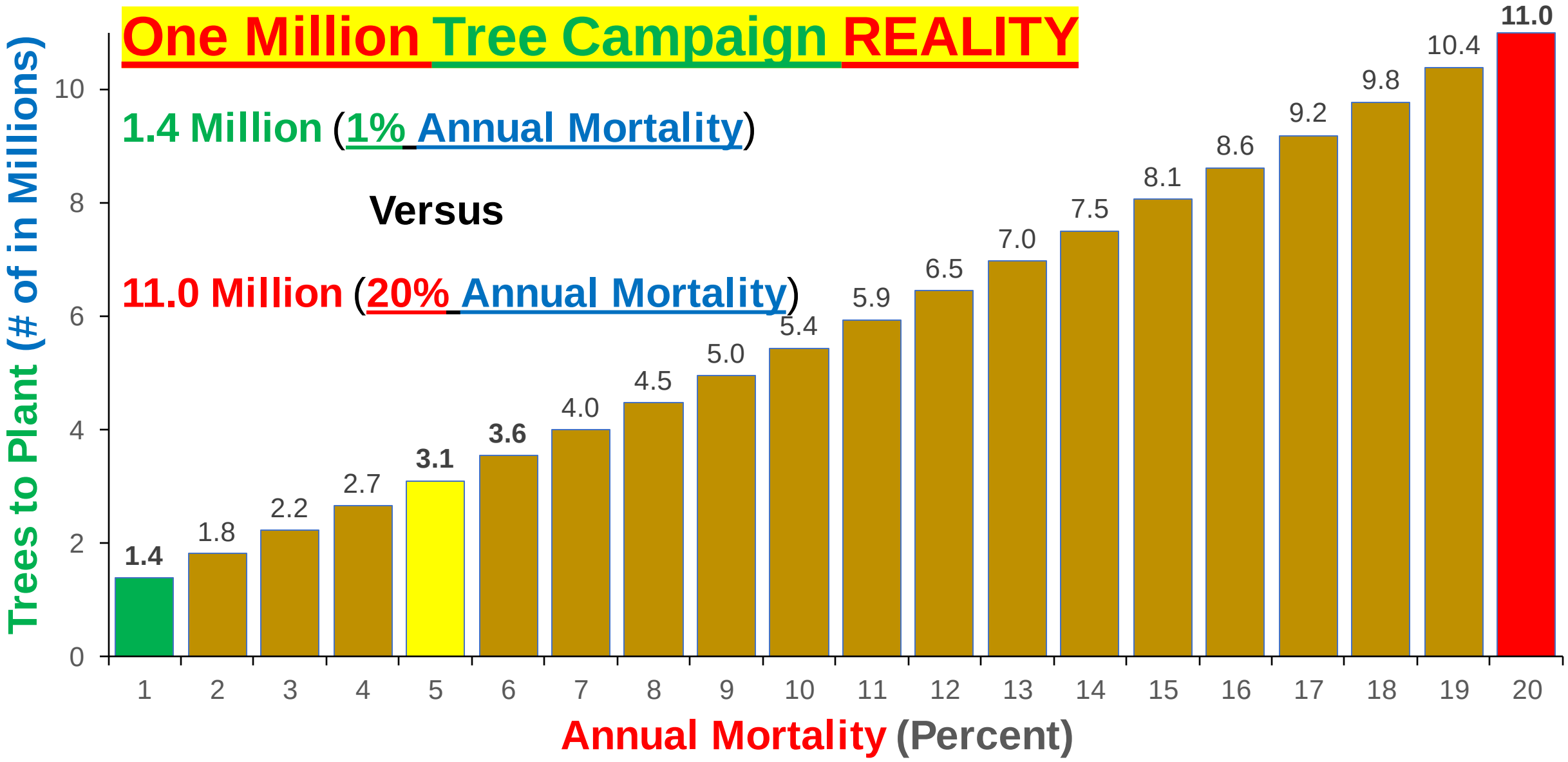


Setting a Standard for Work and Expectations


Thank You!

2nd World Forum on Urban Forests

2023

World Forum on Urban Forests

2nd World Forum on Urban Forests

Washington DC, 2023

Session: Metropolis

Building Towards a Future of Resiliency at the U.S. Capitol Grounds

Presented by

Melissa Westbrook

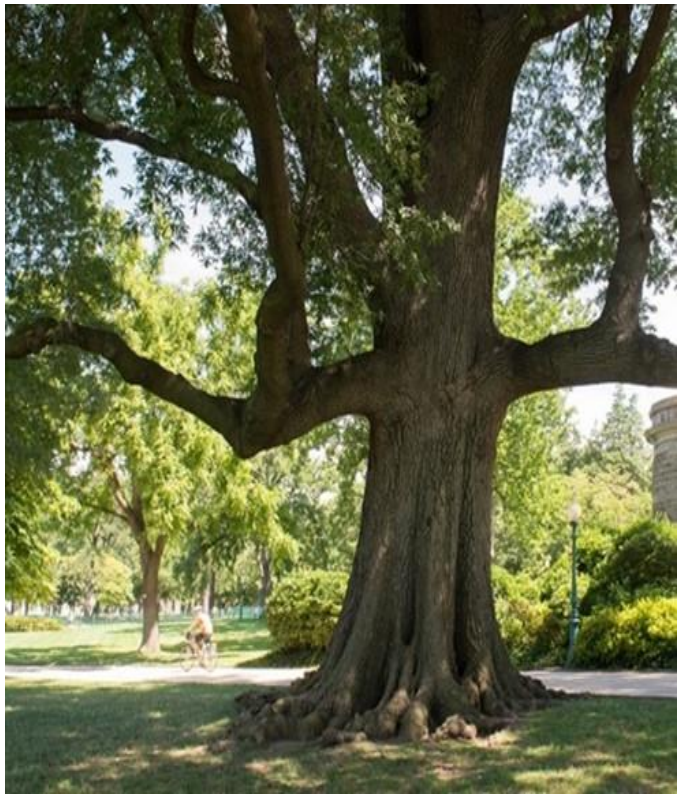
Urban Forester

U.S. Capitol Grounds and Arboretum

U.S. CAPITOL GROUNDS AND ARBORETUM (CGA)

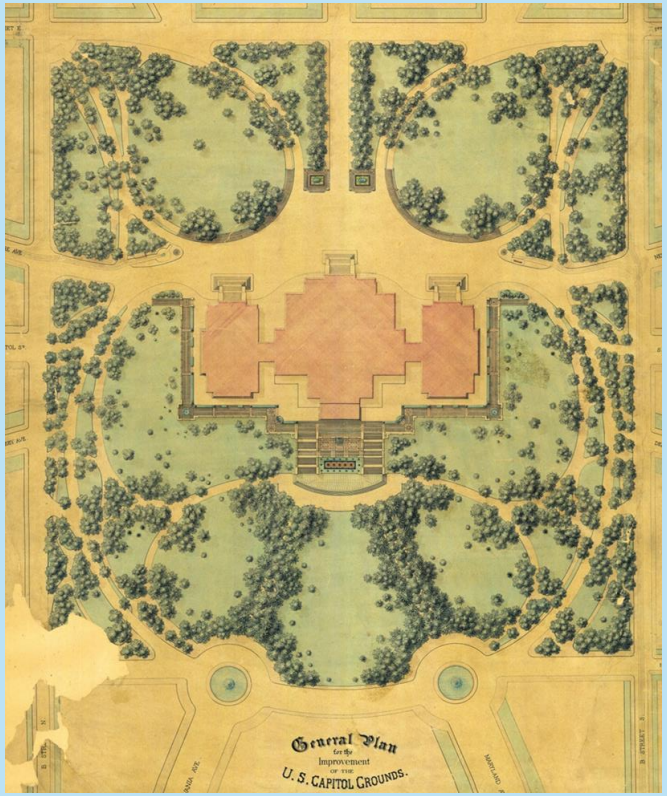
A historic landmark dating back to 1793

Management and preservation of 295 acres of landscape assets



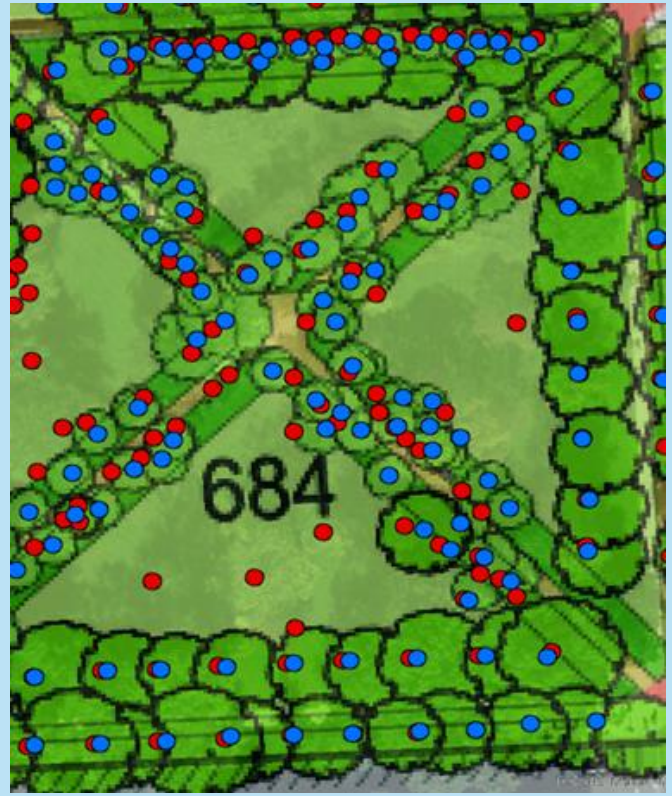
Level III accredited arboretum with over 5,000 tees

PRESERVATION ANALYSIS



1874 General Plan by Frederick Law Olmsted, Sr.

1882 Olmsted hand annotated partial Inventory over the 1874 General Plan



Spatial analysis of treatment recommendation and current tree inventory

AOC PRESERVATION POLICY AND STANDARDS

P Preservation

Requires retention of the greatest amount of historic fabric.

R Rehabilitation

Alteration to meet new uses while retaining the historic character.

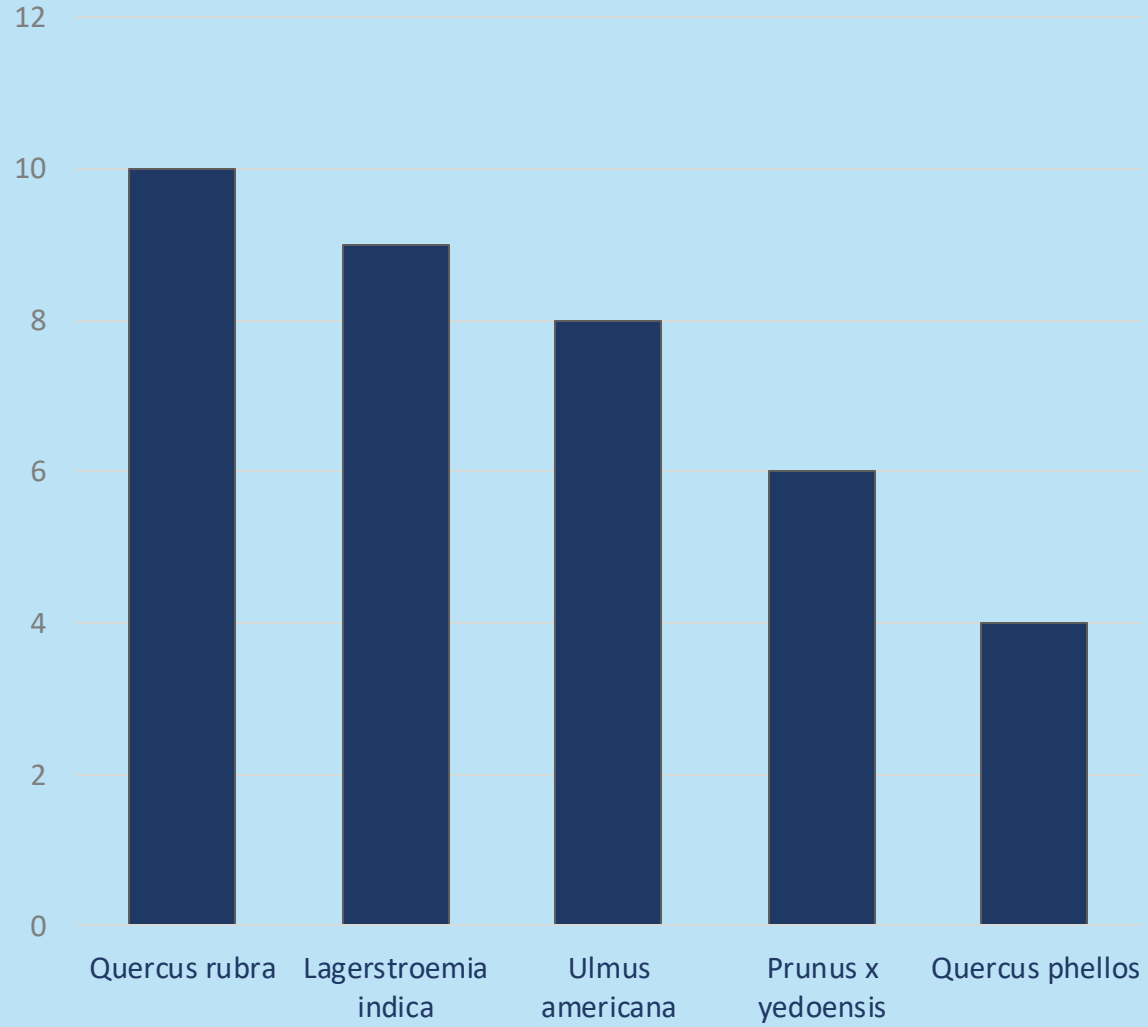
R Restoration

Depiction of a landscape at a defined period of significance.

R Reconstruction

Recreate using new materials, primarily for interpretive purposes.

CHALLENGES: HISTORY OF MONOCULTURES



10% ***Quercus rubra***
Reported as percent of total collections in 2019

9% ***Lagerstroemia indica***
Reported as percent of total collections in 2019

8% ***Ulmus americana***
Reported as percent of total collections in 2019

CHALLENGES: UNSUSTAINABLE HISTORIC SPECIES SELECTION

Predicted Changes from Climate Change	Tree Species	% of Olmsted 1894 Trees
Trees Expected to Fare WORSE as Climate Warms	tulip tree	7.26%
	sugar maple	3.07%
	American basswood	2.51%
	American beech	1.12%
	pin, scarlet and N. red oak	1.67%
	cucumber magnolia	1.59%
	silver maple	1.49%
	eastern redbud	1.49%
	bigleaf magnolia	1.12%
	box elder	0.93%
	red maple	0.93%
	Osage-orange	0.93%
	sweet & paper birch	0.74%
	swamp white oak	0.74%
	bur oak	0.74%
	sassafras	0.56%
	white oak	0.47%

30% of the Olmsted Design

Landscape Impact	Tree Species	% of Olmsted 1894 Trees
Non-native Invasive/ Noxious Weed	Norway maple	2.70%
	Japanese maple	2.05%
	golden raintree	1.95%
	hedge maple	1.86%
	pagoda tree	1.21%
	princess-tree	0.09%
	Chinese aralia	0.09%

Top 5 invasive species are nearly 10% of the total 1,075 trees used by Olmsted

CHALLENGES: PESTS AND DISEASES

Removal of Olmsted *Ulmus americana* in 1978 after decline

Impacts of Crape Myrtle Bark Scale in 2023.

CHALLENGES: LAND USE CHANGES

Construction of the Capitol Visitor Center in 2006

July 4th concert on the West Front of the U.S. Capitol

CHALLENGES: EVOLUTION OF PRESERVATION PRACTICES

Chemical application operation, circa 1910.

Historic arboriculture: concrete-filled cavity on Olmsted *Styphnolobium*

ARCHITECT OF THE CAPITOL

BUILDING RESILIENT SYSTEMS

PRESERVATION STRATEGY

Diversity

Protection against catastrophic loss

Redundancy

Replacement the event of stress, loss, or failure

Resilient Systems

Connectivity

Increase system interactions and reduce fragmentation

Adaptability

Ability to adjust management practices to function under stress

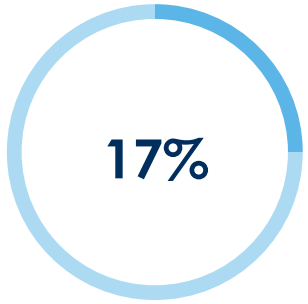
DIVERSITY IN RESILIENT SYSTEMS

Trees

Increased the total number of trees by 20% since 2018

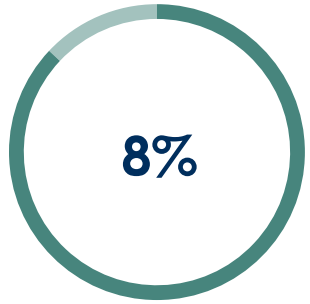
Taxa

New taxa added in the past 5 years, including 3 oak species of conservation concern



Quercus

Proportion of Quercus reduced by 4% since 2020

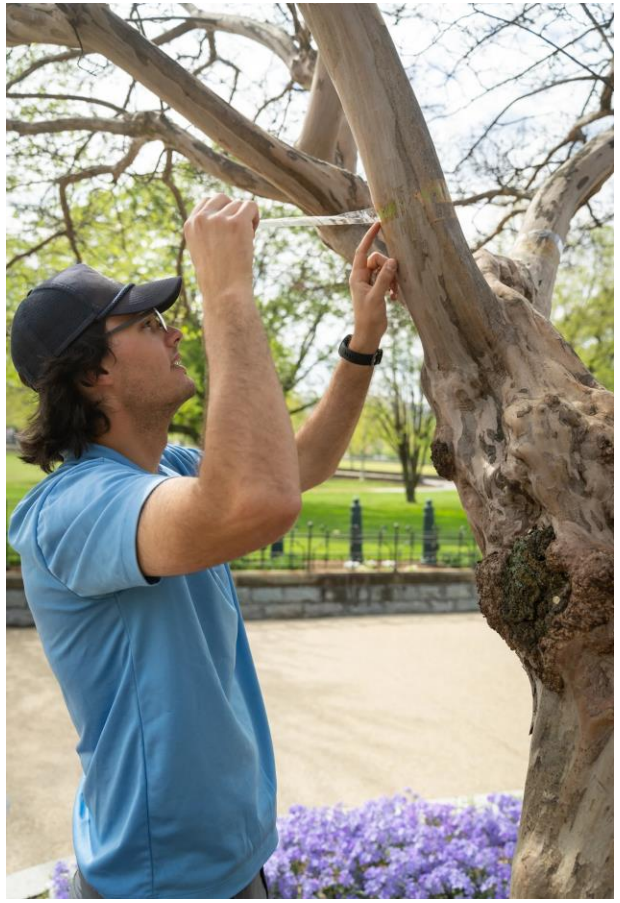


Quercus rubra

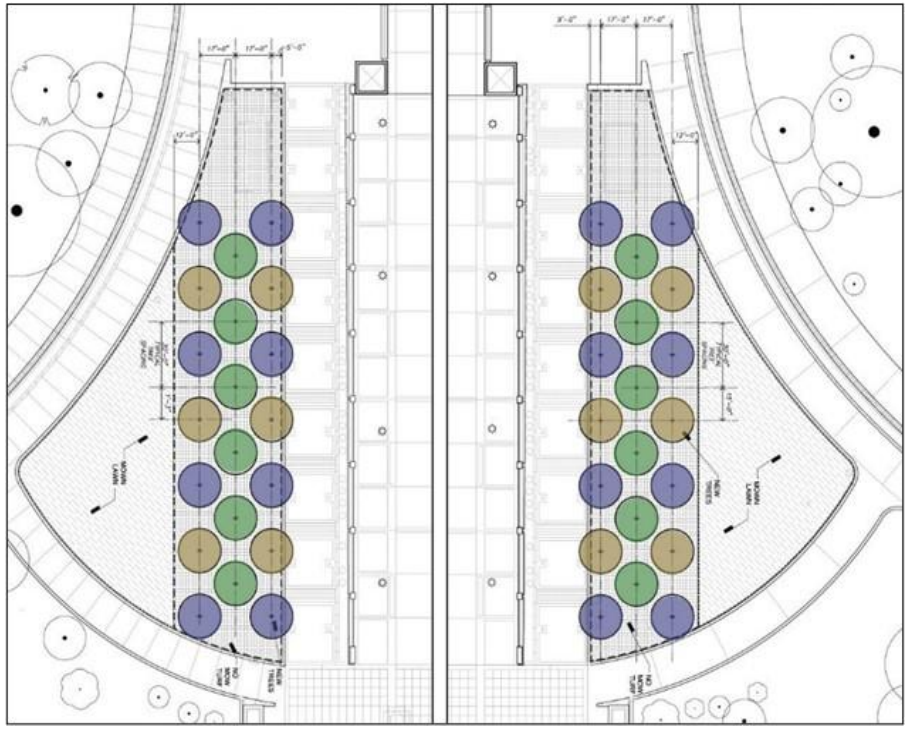
Reduced by 2% since 2020

CONNECTED LANDSCAPES

Integration of understory plantings that support increased beneficial habitats and reduce landscape fragmentation.



ADAPTIVE REHABILITATION

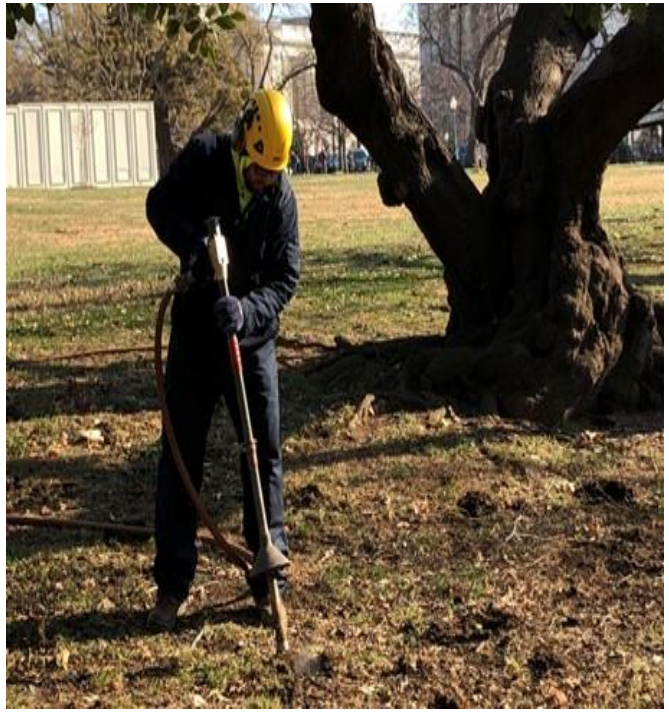


Proportionally replace trees in the historic quincunx pattern

- Plane tree (*Platanus* x *acerifolia* 'Bloodgood')
- Tulip tree (*Liriodendron tulipifera*)
- Redmond linden (*Tilia americana* 'Redmond')

PRESERVATION MAINTENANCE AND REDUNDANCY

Advanced Risk Assessments: Sonic Tomography to preserve historic trees



Improve soil health and mitigate impacts of use pressure

Replace with historic germplasm where appropriate.

ARCHITECT OF THE CAPITOL

QUESTIONS?

Melissa Westbrook; Urban Forester
melissa.westbrook@aoc.gov

James Kaufmann; Director
James.Kaufmann@aoc.gov

2nd World Forum on Urban Forests

2023

World Forum on Urban Forests

2nd World Forum on Urban Forests

Washington DC, 2023

Combining inter-and transdisciplinary research approaches to increase the resilience of urban forests to climate change impacts in Southwest Germany

GrüneLunge

Presented by

Dr. rer. nat. Somidh Saha

Karlsruher Institut für Technologie

itas Institute for Technology Assessment and Systems Analysis

Karlsruhe Institute of Technology, Germany

institut für geographie & geoökologie

SPONSORED BY THE

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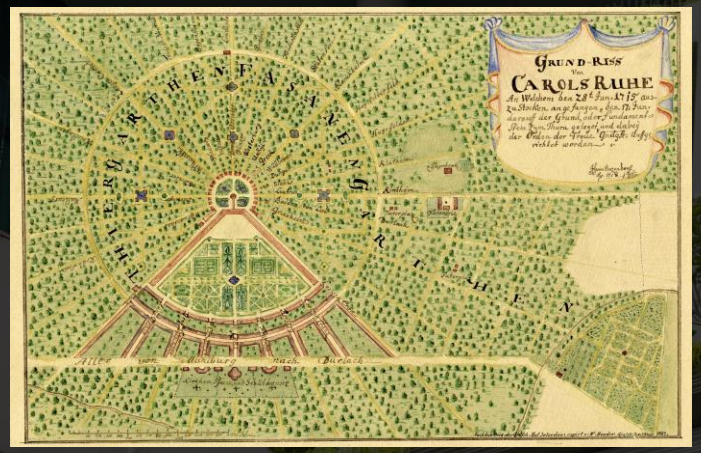
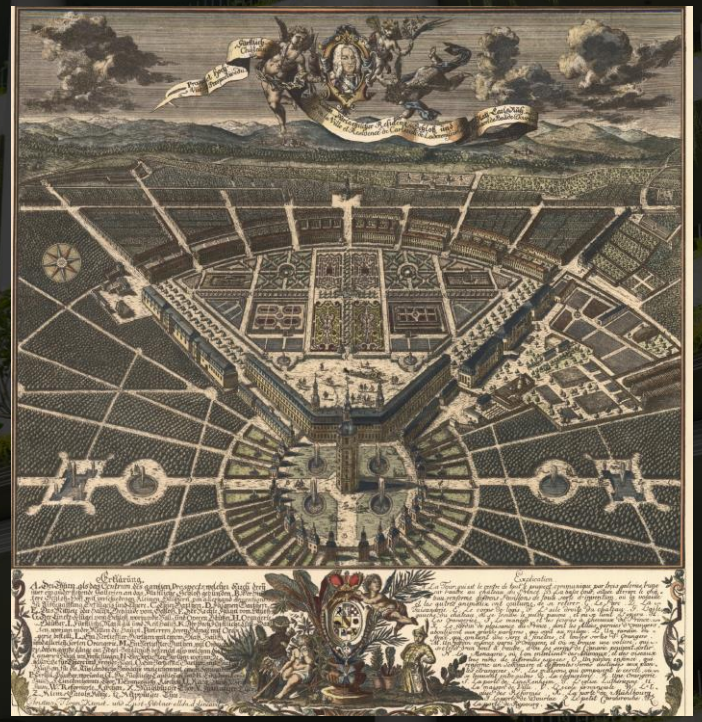
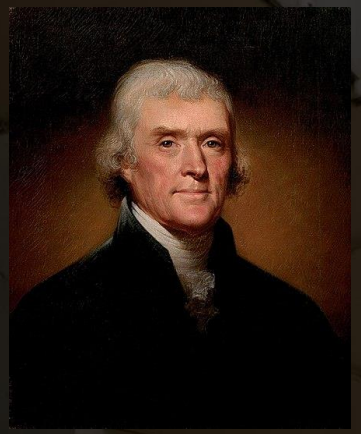
Karlsruhe and Washinton D.C. has a connection!







Thomas Jefferson, as a US Ambassador to Paris, visited Karlsruhe on 15th April 1788 to study the design of Karlsruhe and shared it with **Pierre Charles L'Enfant** which later influenced the design of Washington D.C. (Source: Archive of Karlsruhe city)

Photographs: Archive of Karlsruhe City, *Badische Neuste Nachrichten*, Wikipedia Commons

Urban and peri-urban forests

Solitary trees outside forests in cities to stand-forming trees within forest when a forest is within a city boundary (FAO-Rome of the UN)

Increase in thermal stress

Increase in pollution

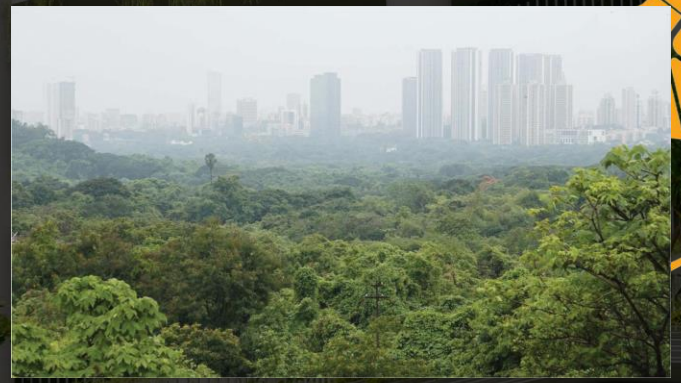
Decline in Ecological complexity

Street trees

Gardens

Parks

Peri-urban woodland-Berlin



Peri-urban woodland-Mumbai

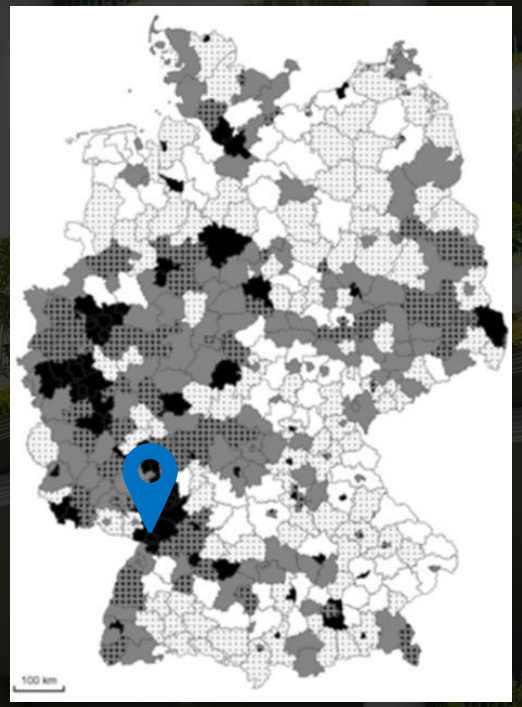
Challenges of UPFs in Karlsruhe

1. **High mortality of trees**
2. ***Densification of cities***
3. ***Loss of biodiversity***
4. ***Lack of financial and human resources to care for and manage***

Peri-uban woodland-Karlsruhe

Photo sources: Google Images, Wikipedia, Pixabay, and Somidh Saha

Climate change and urbanization in Karlsruhe, southwest Germany



Climate change vulnerability

Urbanization

Karlsruhe is in the warmest part of Germany and is facing the double trouble of climate change impacts and urbanization (DWD 2016, Rannow et al. 2010, Siedentop and Fina 2010)

Transition from natural to built environment

Increase in thermal stress

Increase in pollution

Decline in Ecological complexity

Urban and peri-urban forests

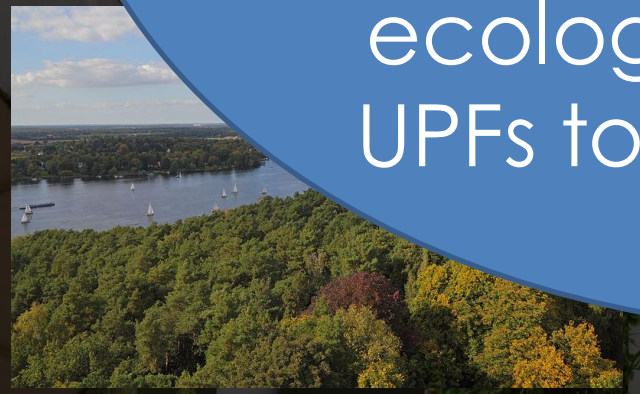
Solitary trees outside forests in cities to
within forest when a forest
(FAO-Rome of the UN)

UPFs are social-ecological system

GrüneLunge project's overall aim was to develop strategies for increasing the social-ecological resilience of UPFs to climate change impacts

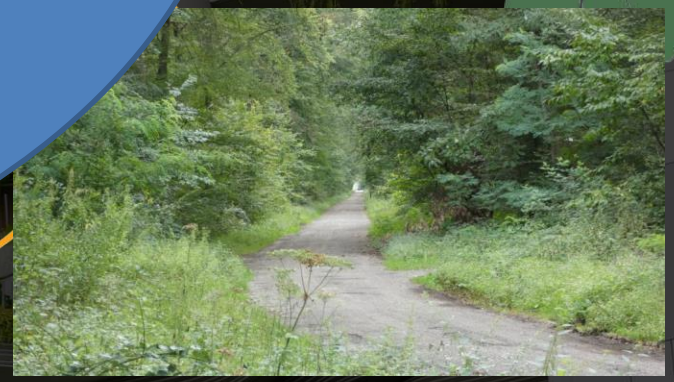
enges of UPFs in
arlsruhe

ty of trees
of cities
versity
ncial and human
o care for and manage



Peri-urban woodland-Berlin

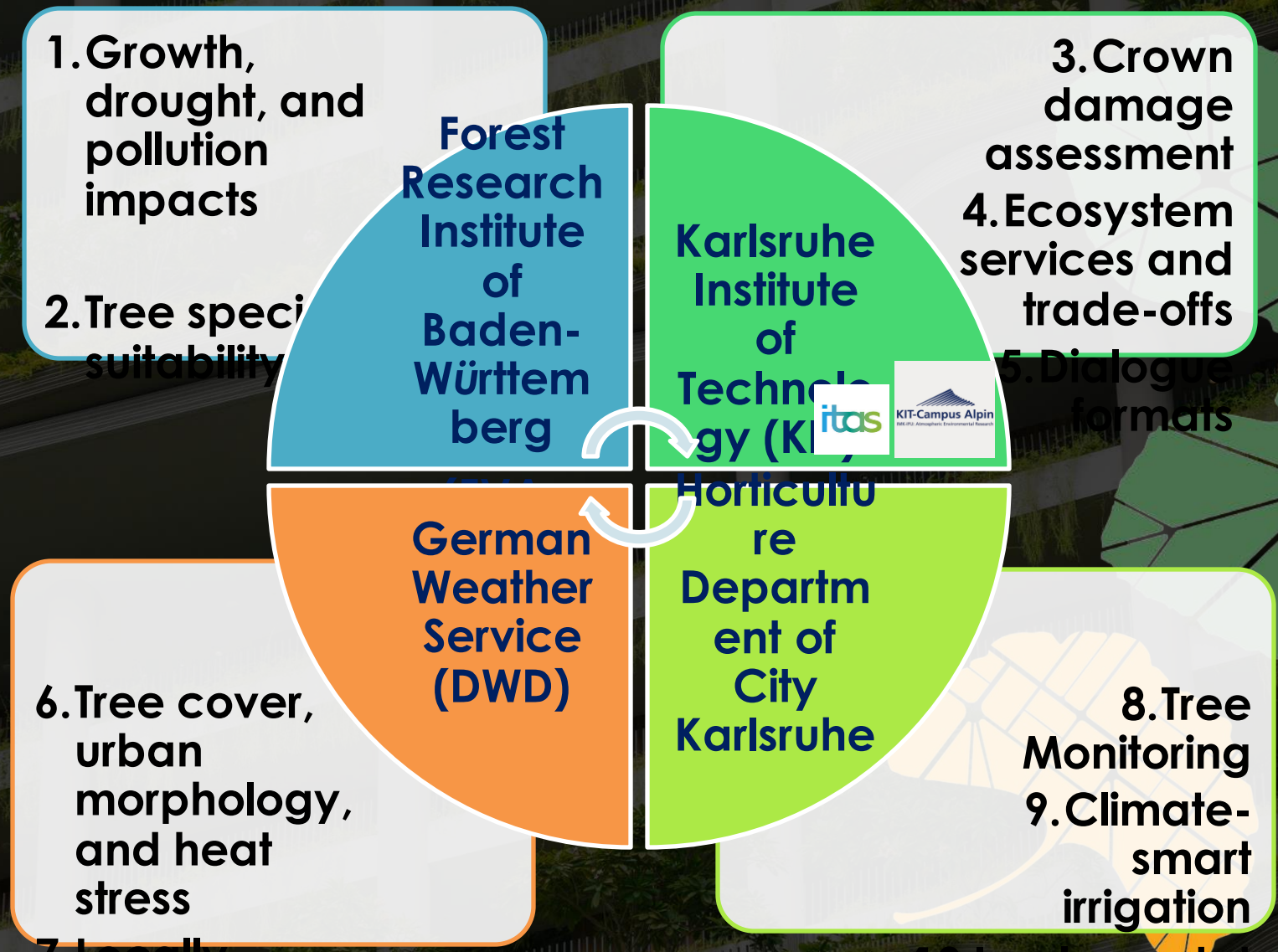
Peri-urban woodland-Mumbai



Peri-uban woodland-Karlsruhe

Photo sources: Google Images, Wikipedia, Pixabay, and Somidh Saha

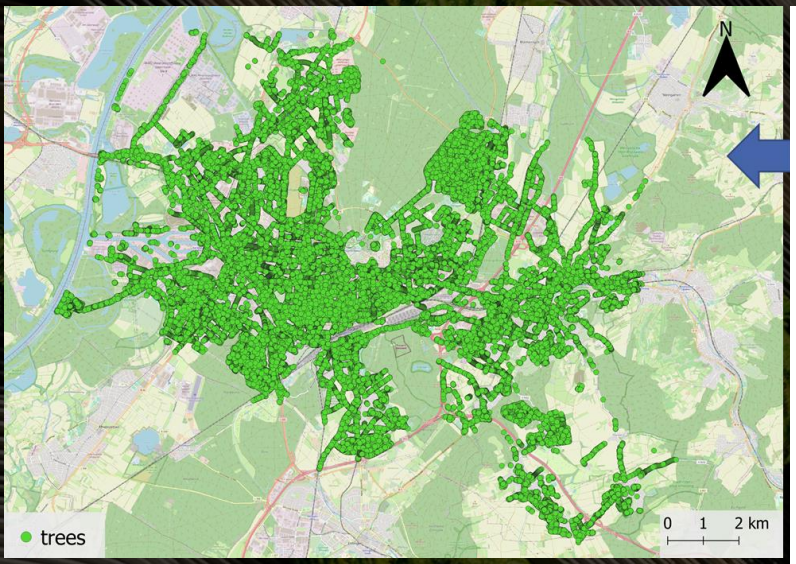
to increase the social-ecological resilience of UPFs



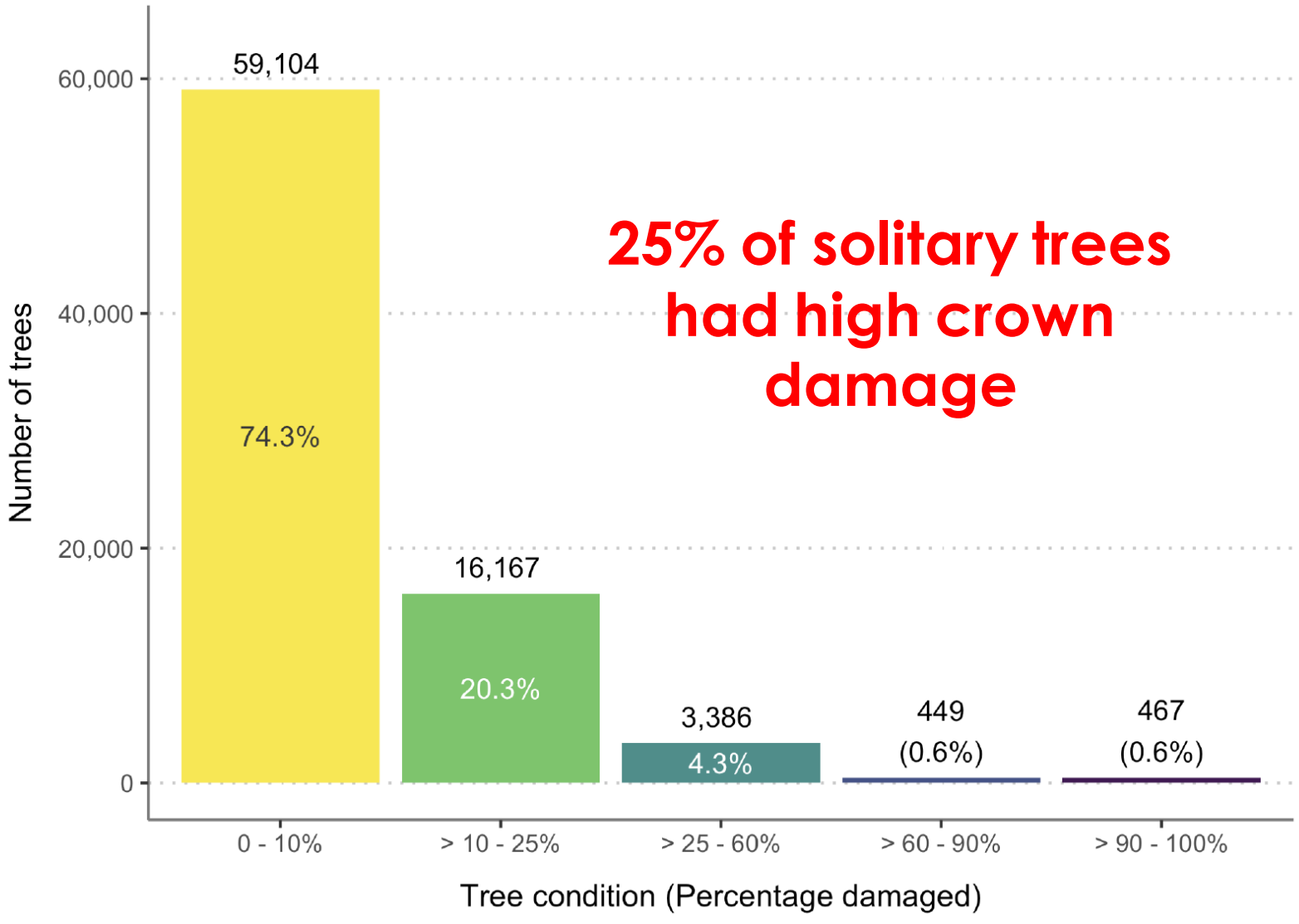
Diversity of disciplines and urgency to transfer research results in praxis to accelerate the social-ecological Transformation motivated us to inter- and transdisciplinary research.

Key results:
Crown damage assessment

Crown damage condition of solitary trees in Karlsruhe 2019 and 2020



N_{trees} = 79,573

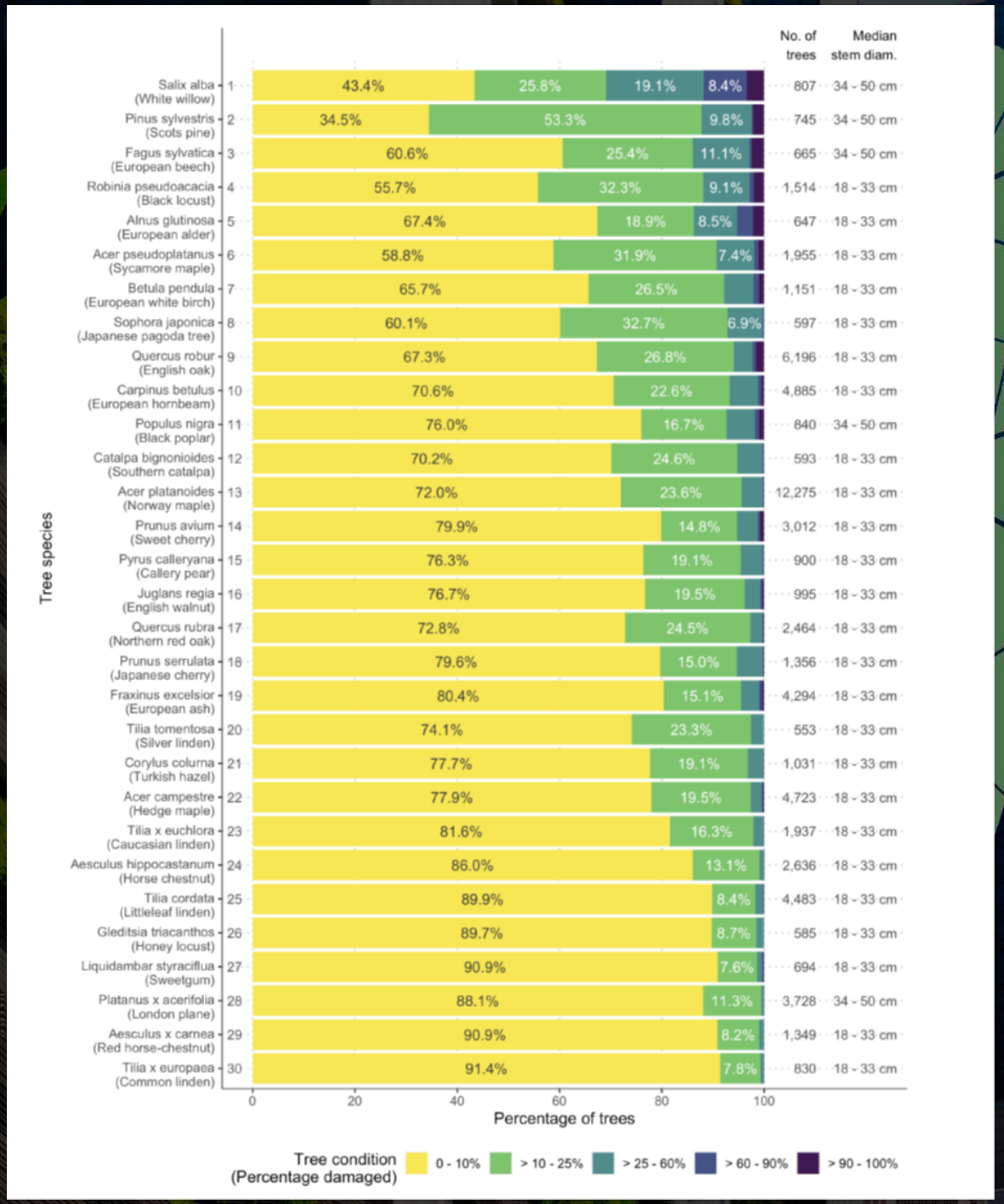


25% of solitary trees had high crown damage

Schobert, M. and Saha, S. (in preparation)

Crown damage of solitary trees

- 28 out of 30 species had 10% or more crown damage
- Evergreen trees are more prone to crown damage
- Tolerance of roots to soil compaction reduces crown damage
- Moderate level of crown damage increases with tree size

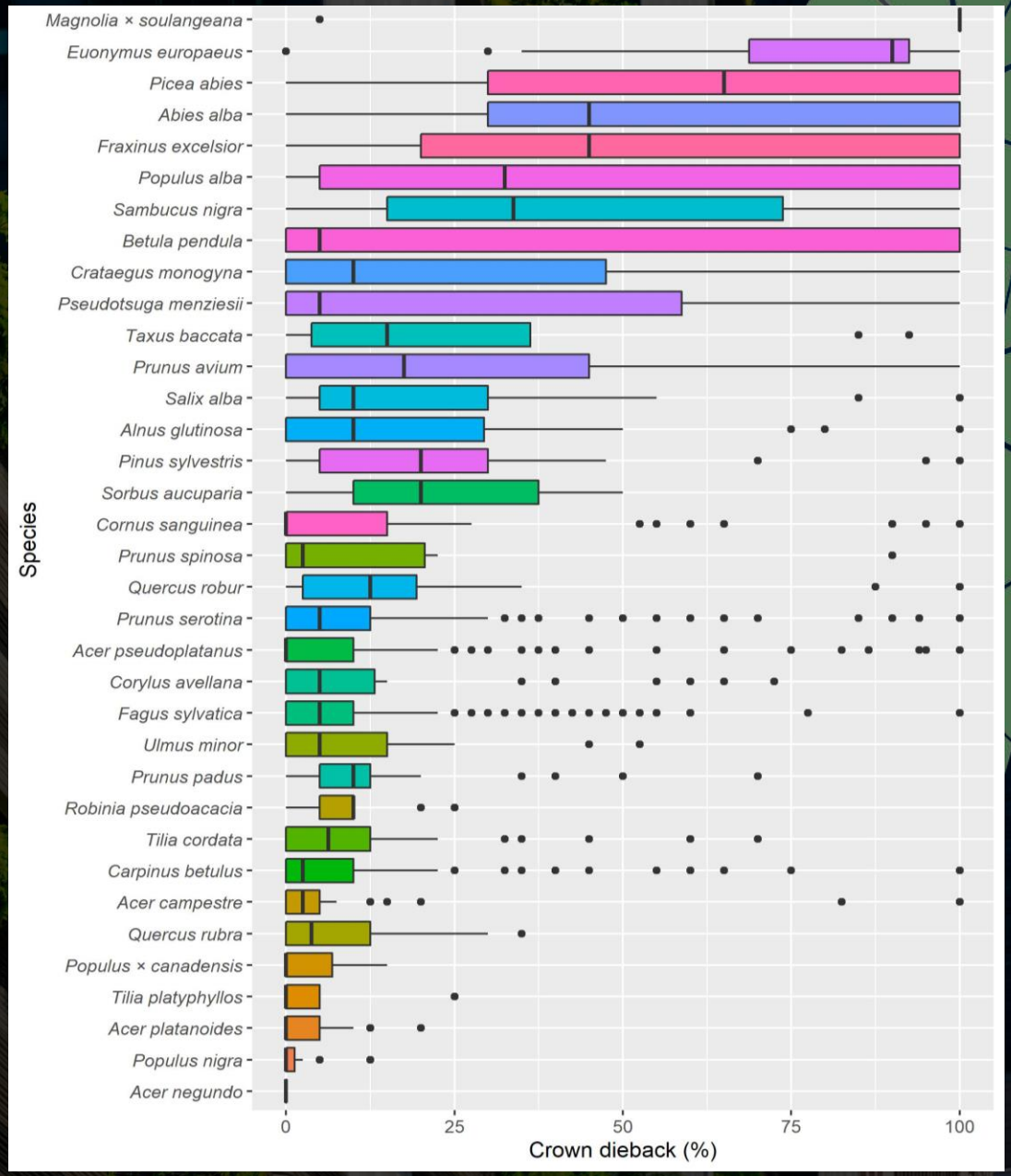


Schobert, M. and Saha, S. (in preparation)

High variation in crown die-back of tree species in peri-urban forests

Crown die-back in Hardtwald, a peri-urban municipal forest of Karlsruhe

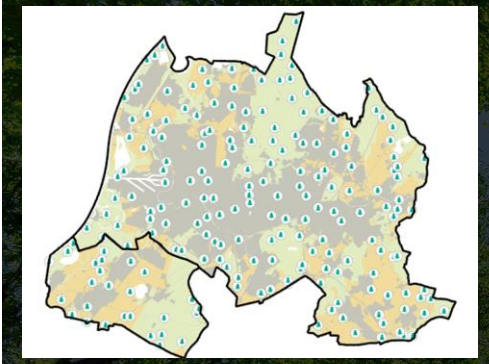
- 14 out of 28 native species had more than 10% crown die-back
- Drought tolerance and cavitation tolerance reduced mortality



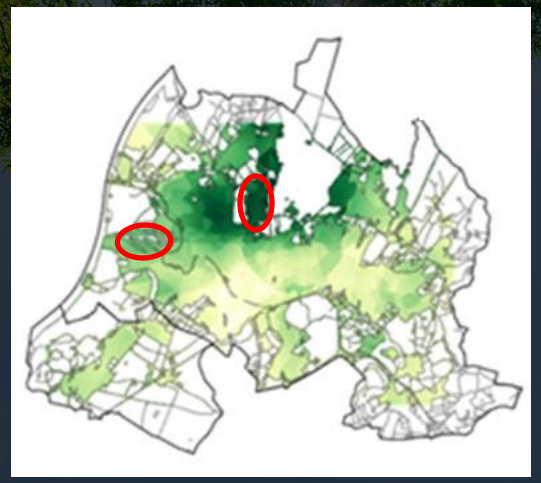
Lyu, H. and Saha, S. (submitted)
Photograph: Somidh Saha

Key results:
Ecosystem services, transdisciplinary formats

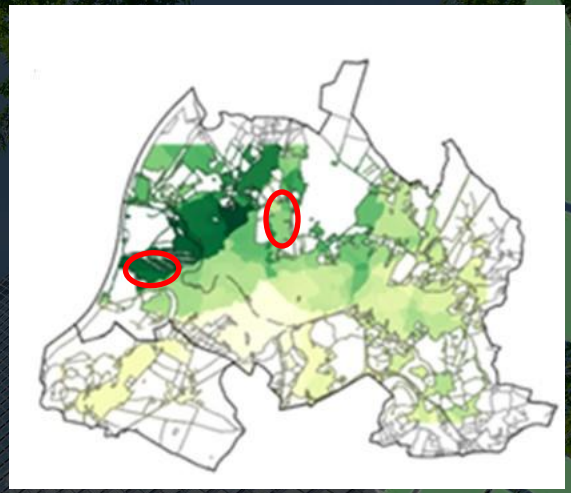
Trade-offs between regulating and supporting ecosystem services



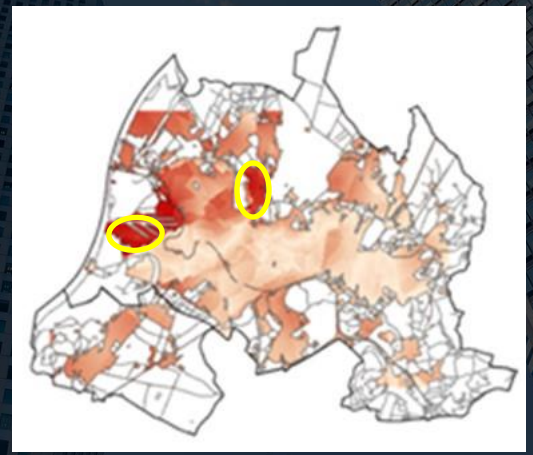
N_{plots} = 201
N_{trees} = 2968
(i-tree-eco survey plus health and tree-related microhabitats)



Supporting ES



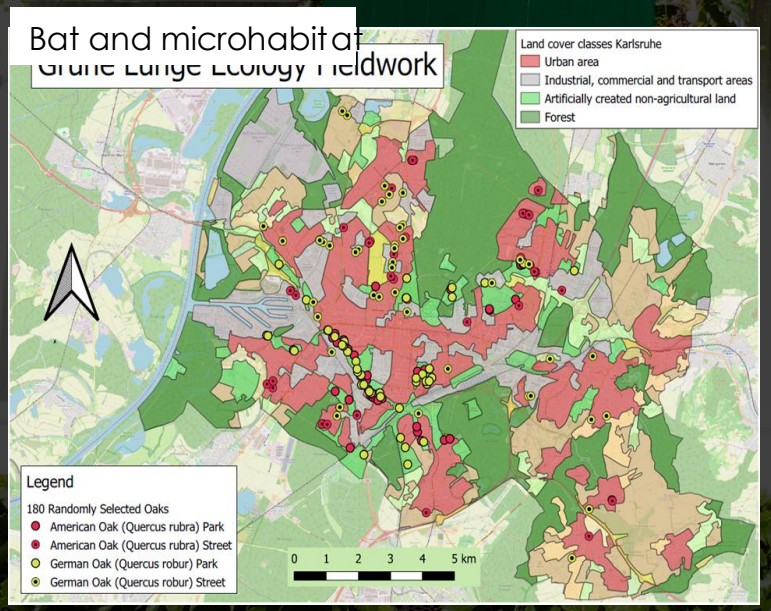
Regulating ES



Cueva, J.,…., **Saha**, S. 2022 *(Sustainable Cities and Society)*
https://www.sciencedirect.com/science/article/abs/pii/S221067072200225

Why did trade-offs occur between regulating and supporting ES?

One reason was large and habitat trees key for biodiversity but their frequency is getting lower, and such trees also have a lower amount of healthy leaf area



Native oaks (*Quercus robur*) supported more bat diversity than exotic oaks (*Quercus rubra*)

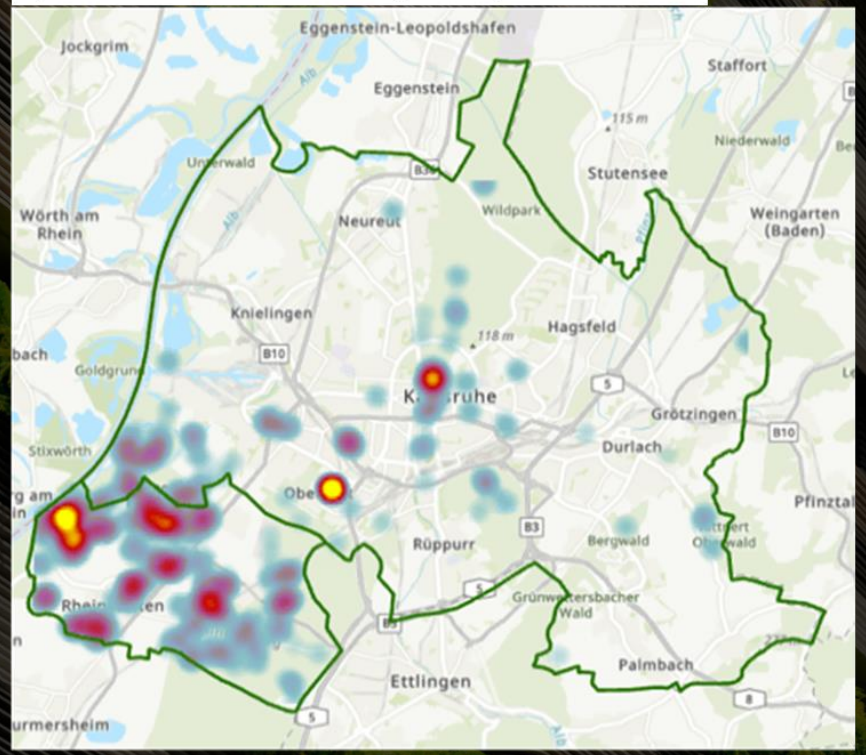
***Plecotus* bat can mostly be found near the native oaks in parks**

Photographs: Monika Laux, Lisa Spoden and Somidh Saha/KIT
Bat survey map: Monika Laux/KIT; Bat photo: Dietmar Nill/NABU-North Rhine Westfalia

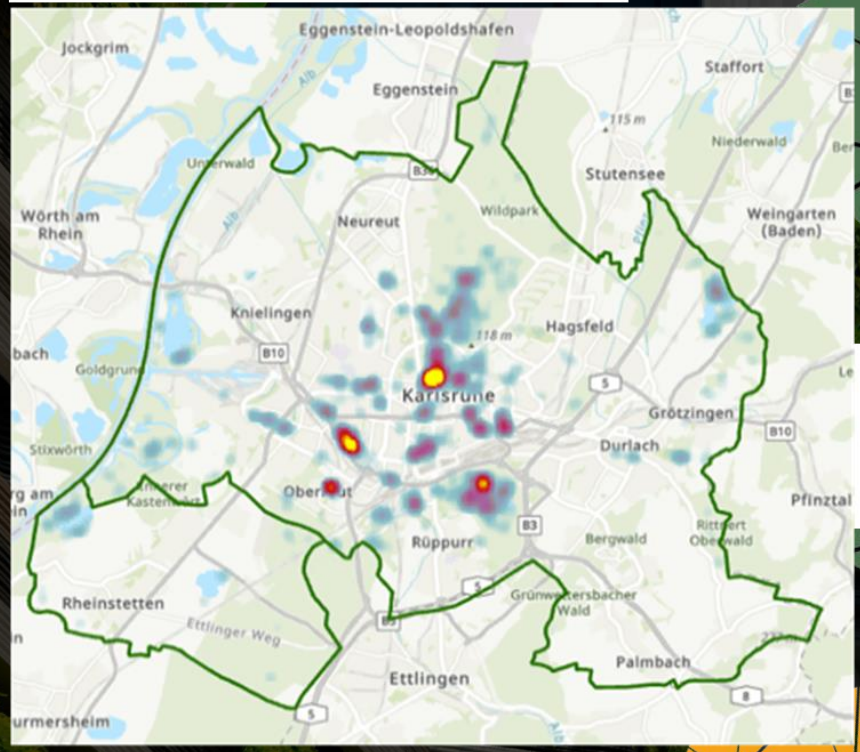
Laux, M.,…, **Saha**, S. (2022) *(Science of the Total Environment)*
https://www.sciencedirect.com/science/article/abs/pii/S0048969722057023

UPFs as critical infrastructure during COVID-19 crisis

Residents of Rheinstetten
(n=97; 316 evaluated points)



Residents of Karlsruhe
(n=402; 1253 evaluated)



Density of selected sites (weighted by the sum of the perception of all values of CES)

UPFs were key to 90% for stress reduction during the pandemic

70% visited more green spaces during the pandemic

People without balconies, private gardens, and view of trees from window visited more to UPFs during pandemic

Beckmann-Wübbelt, A., …, **Saha**, S. (Sustainable Cities and Societies)
https://www.sciencedirect.com/science/article/pii/S2210670721005175

Emerging conflicts between recreation services and climate change adaptation

- Increase in visitors hampered UPFs restoration
- Increase in accidents due to falling branches in UPFs
- **We found a stakeholders‘ consensus on awareness development and dialogue between citizens, municipalities, and other key actors**

Beckmann-Wübbelt, A., …, **Saha**, S.
https://www.nature.com/articles/s42949-023-00096-y

Transdisciplinary dialogue formats to care and preserve UPFs

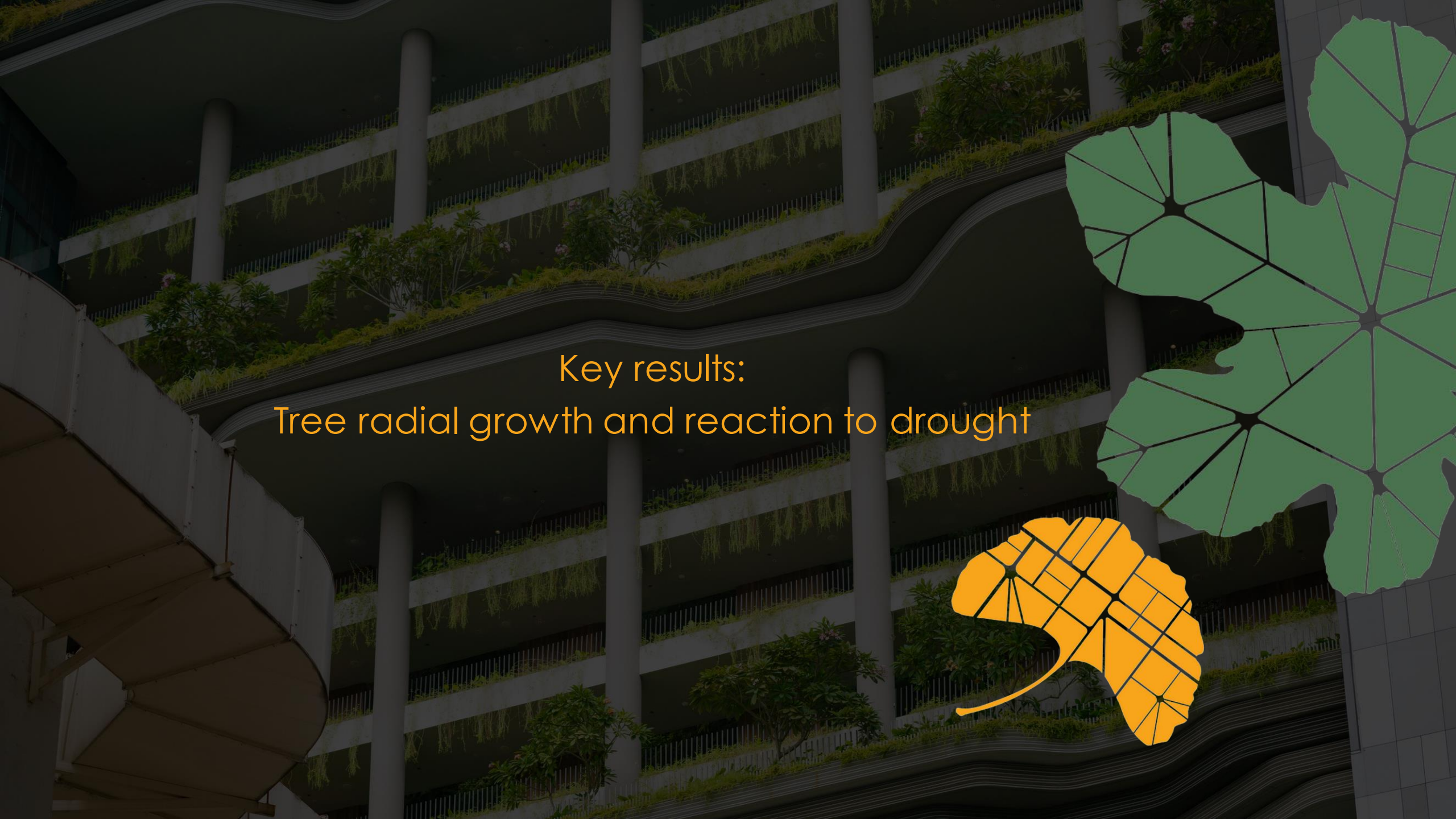
- **Stakeholders should be engaged early on from co-creation to co-implementation** and the dialogue format „**City Tree Forum**“ can help in this process

- We found that „**Real World Lab“ (*Reallabor* in German) can be an effective initiative to reach consensus and reduce polarization** in urban forestry discussion

- Our close-to-nature-urban gardening experiment demonstrated that **empowering citizens in urban biodiversity education and action can lead to an increase in diversity in private gardens**

Photographs: Annika Fricke and Clara Stuhlinger

Fricke, A., …, **Saha**, S. (Transformative Geographische Bildung) https://link.springer.com/chapter/10.1007/978-3-662-66482-7_36



Key results:
Tree radial growth and reaction to drought

Growth reaction to drought and NOx pollution

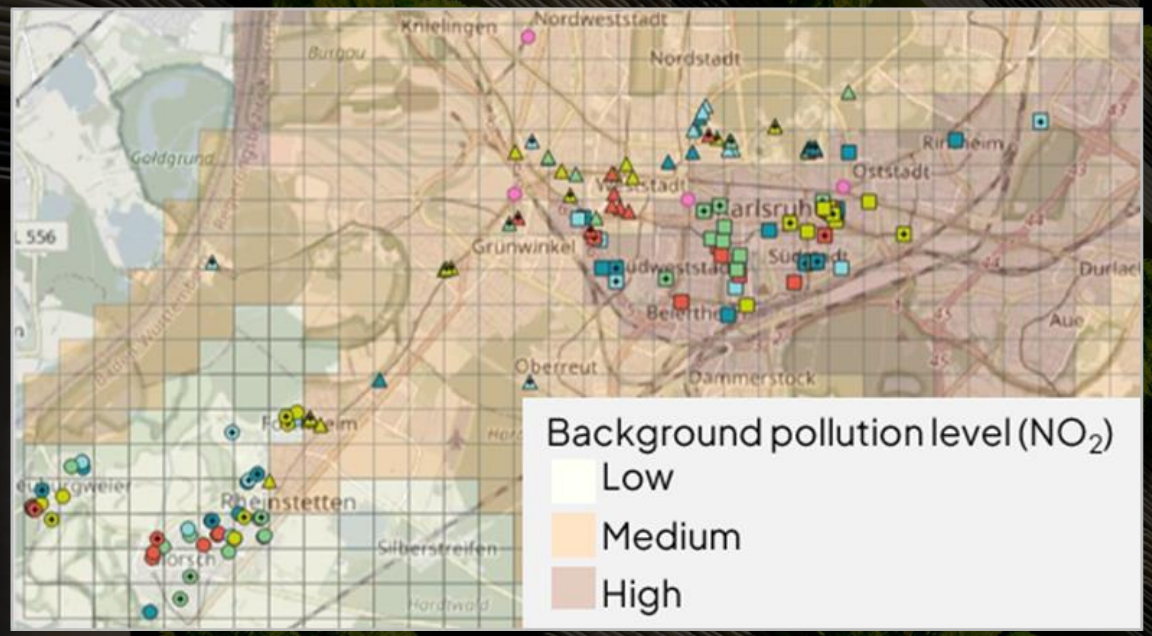
Norway maple
Acer platanoides

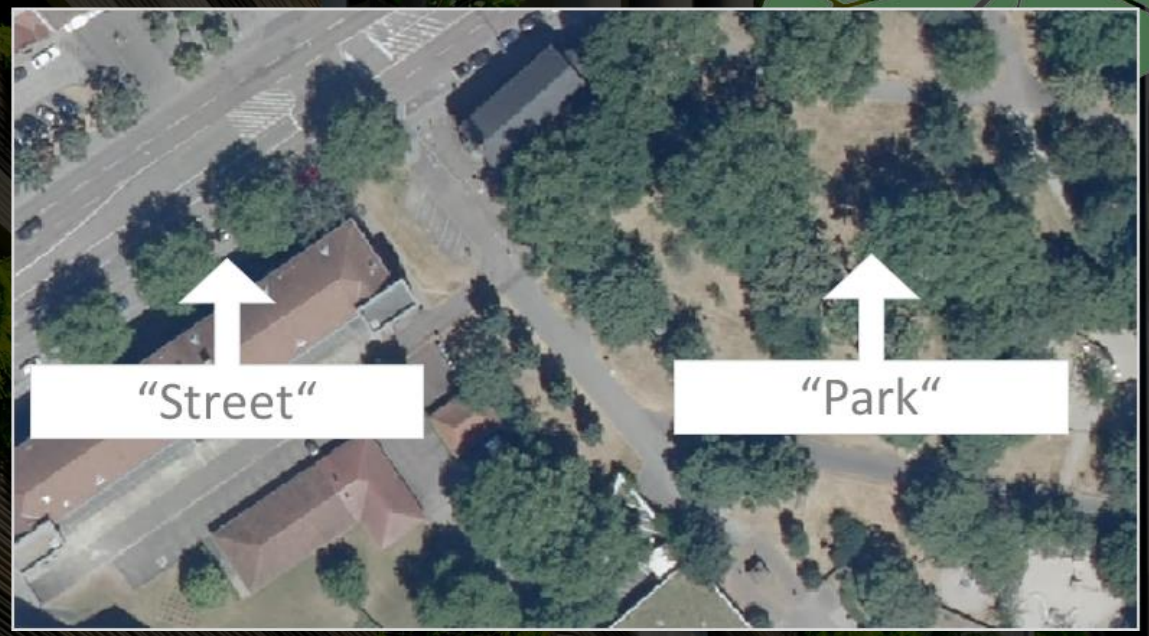
Hornbeam
Carpinus betulus

London plane
Platanus × hispanica

Common oak
Quercus robur

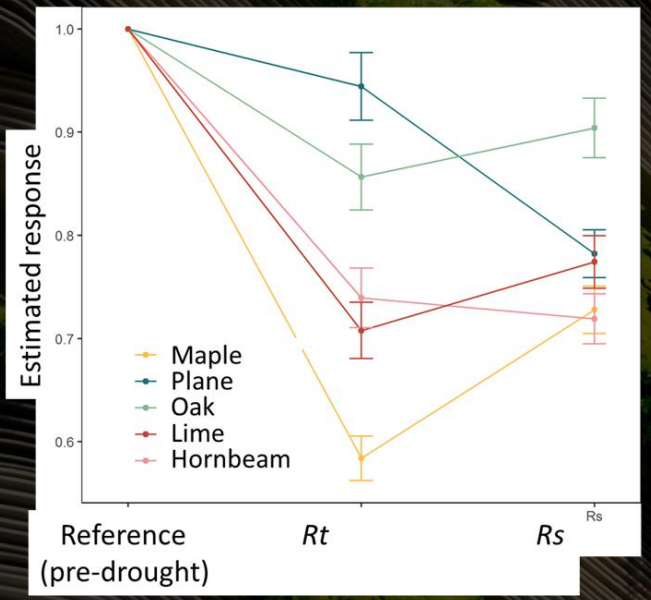
Small-leaved lime
Tilia cordata

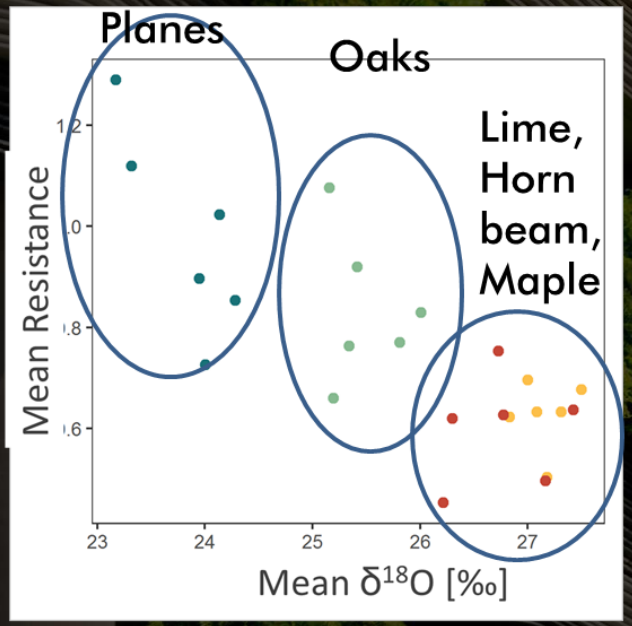




Photographs and maps: Mareike Hirsch

Plane and oak trees have a greater drought tolerance
Rainfall in spring was vital for growth in maple, oak and lime trees



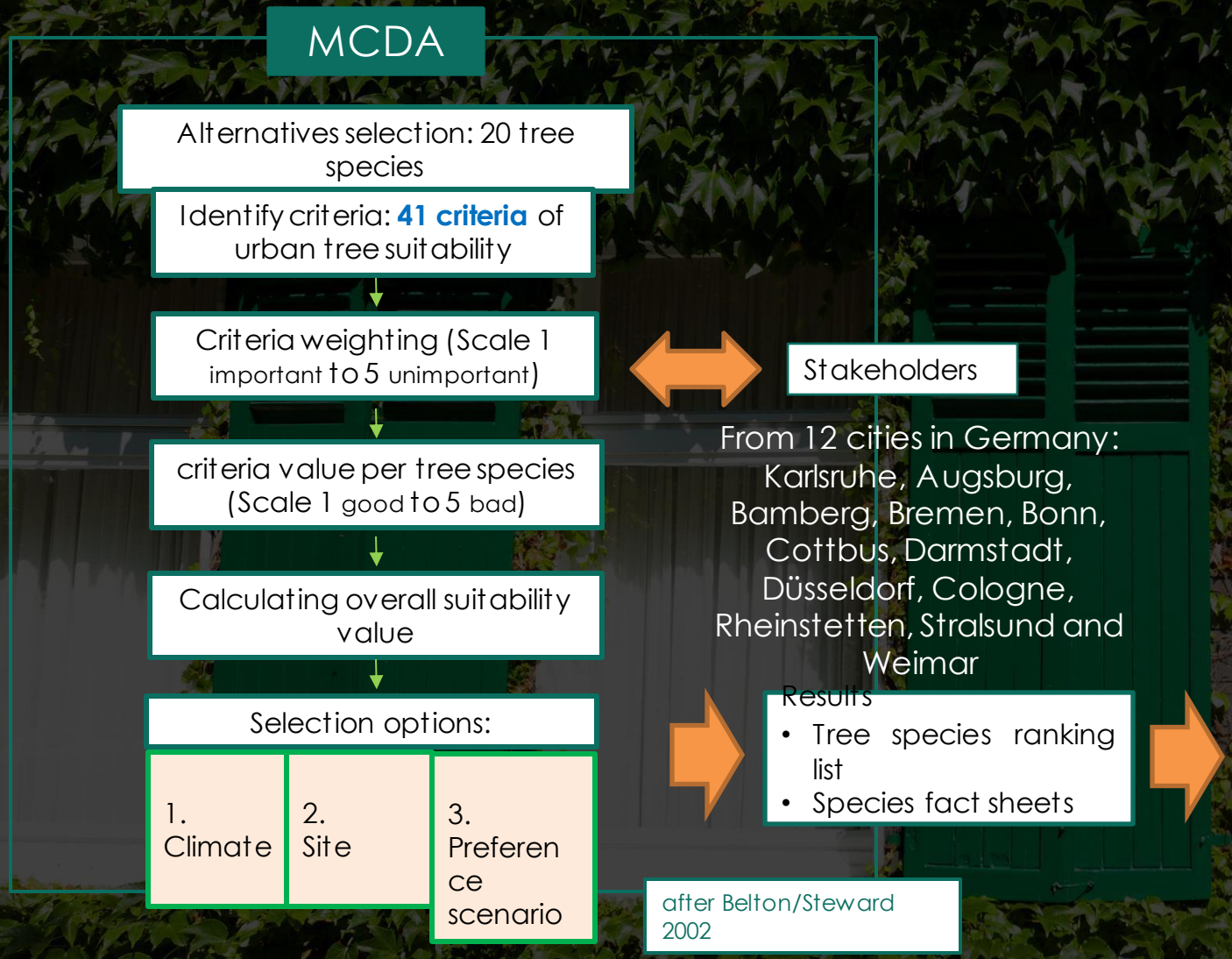


Time period: 1982-2018		March	April	May	June	July	Sum JJA (prev. year)
Maple	TRW_i	↑		↑			
	$\delta^{13}C$			↓			
	$\delta^{18}O$			↓			
Oak	TRW_i	↑		↑	↑		
	$\delta^{13}C$						
	$\delta^{18}O$			↓			
Hornbeam	TRW_i			↑			
Lime	TRW_i	↑		↑		↑	
	$\delta^{13}C$			↓			
	$\delta^{18}O$			↓			
Plane	TRW_i						↑
	$\delta^{13}C$						
	$\delta^{18}O$			↓			↑

Graphics and tables:
Mareike Hirsch/FVA

Hirsch, M.,…,**Saha**, S. (2023) *(Trees-Structure and Function)*
https://link.springer.com/article/10.1007/s00468-022-02294-0

MCDA-based tree species selection for future planting in cities



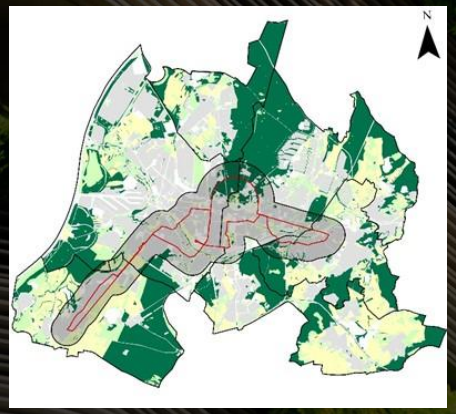
Example of a tree species ranking list

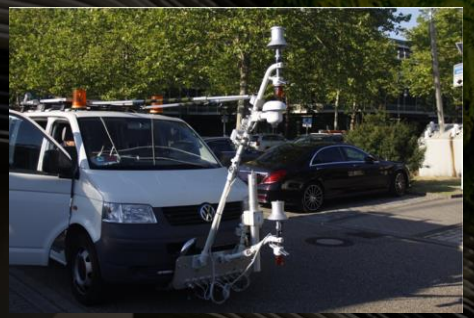
Tree species	Total value	Completeness
Amelanchier arborea	3.76	90%
Fraxinus pennsylvanica	3.89	95%
Alnus x spaethii	3.93	90%
Gleditsia triacanthos	4.05	78%
Ostyra carpinifolia	4.10	98%
Acer campestre	4.17	93%
Tilia tomentosa	4.27	85%
Carpinus betulus	4.31	85%
Fraxinus ornus	4.34	90%
Parrotia persica	4.36	85%
Quercus robur	4.51	85%
Tilia cordata	4.67	68%
Acer platanoides	4.76	73%
Quercus cerris	4.78	85%
Platanus x hispanica	4.82	90%
Sophora japonica	4.83	95%
Corylus colurna	4.89	95%
Liquidambar styraciflua	4.98	88%
Ginkgo biloba	5.11	93%
Robinia pseudoacacia	5.30	88%

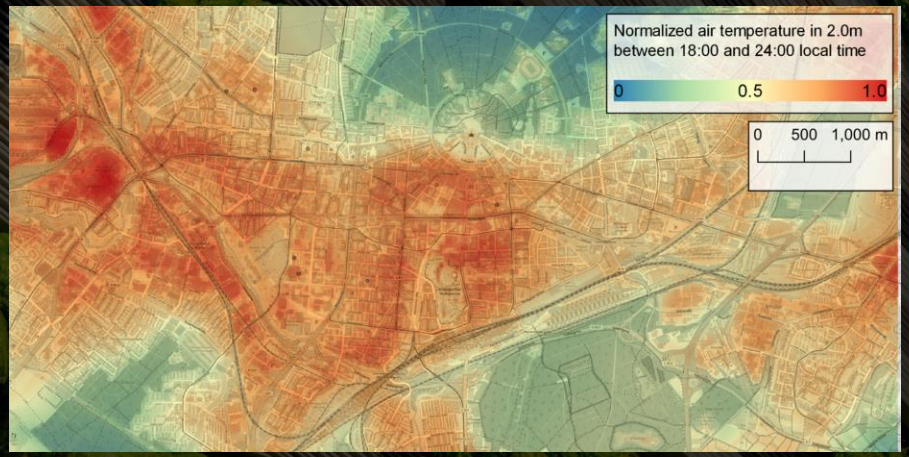
Courtesy: Friederike Stoll and Axel Albrecht, FVA-Freiburg, 2023

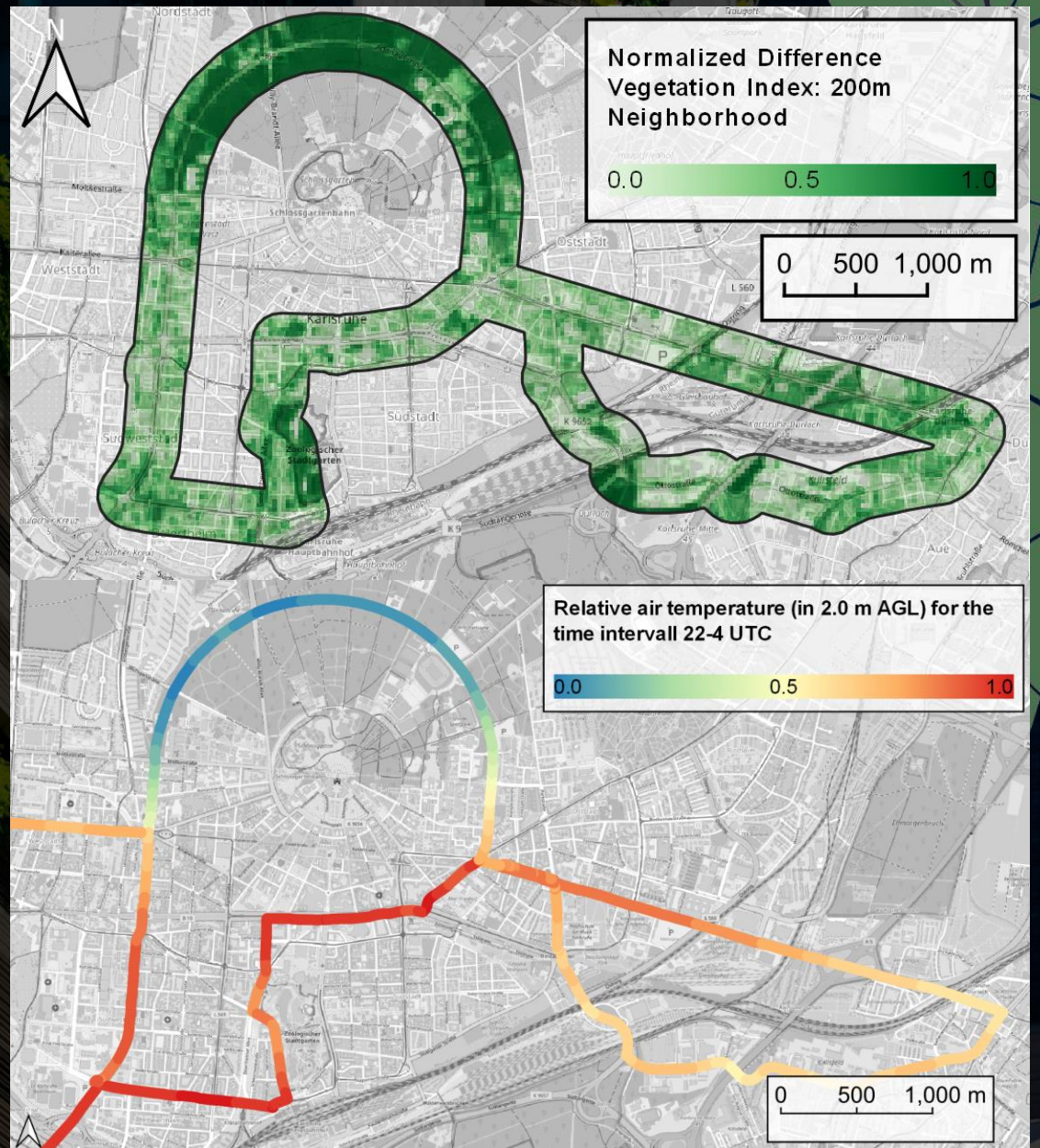
Key results:
Tree cover and heat stress reduction

Microclimatic modelling and linking to tree cover and urban morphology during heatwaves





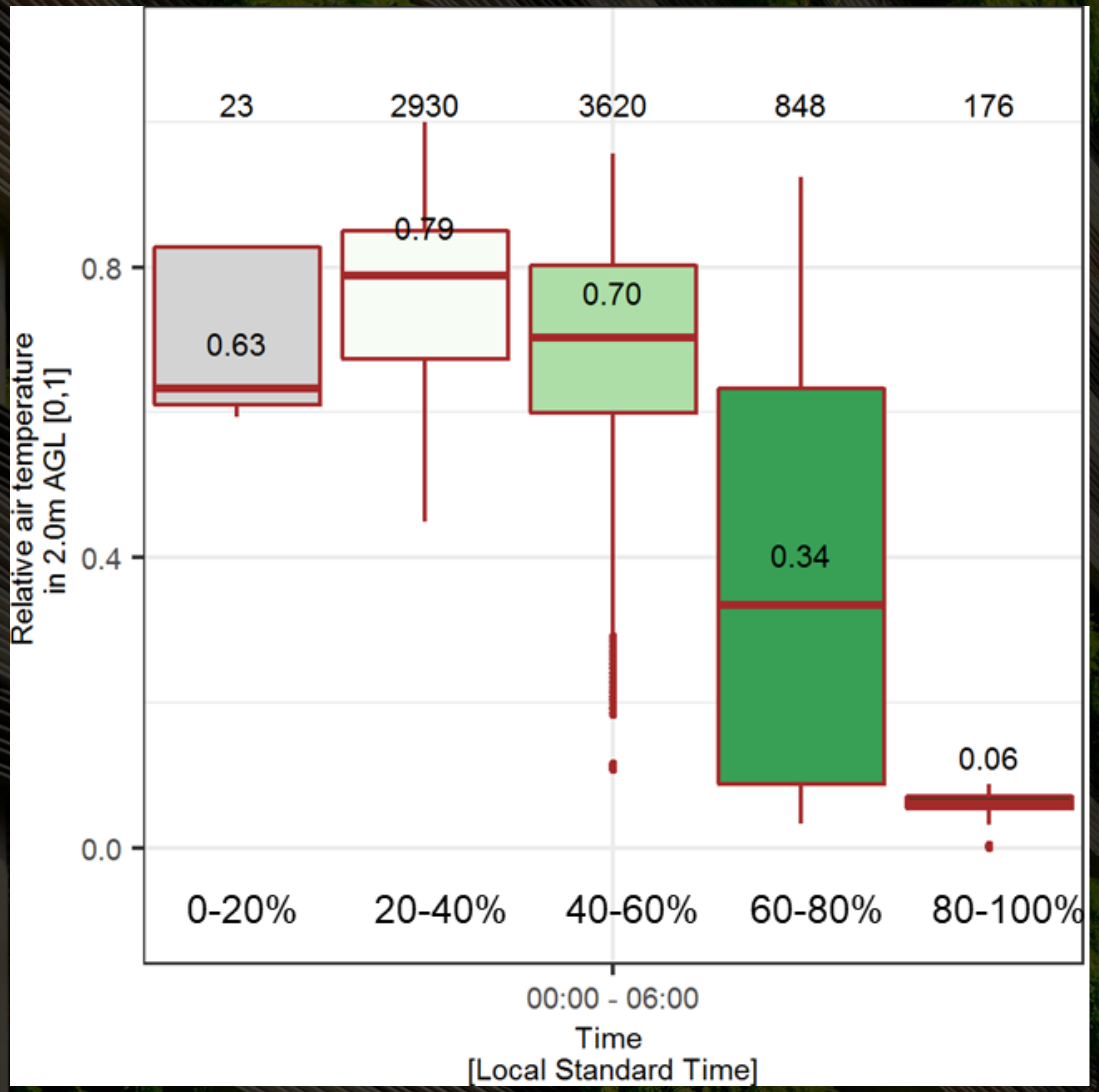


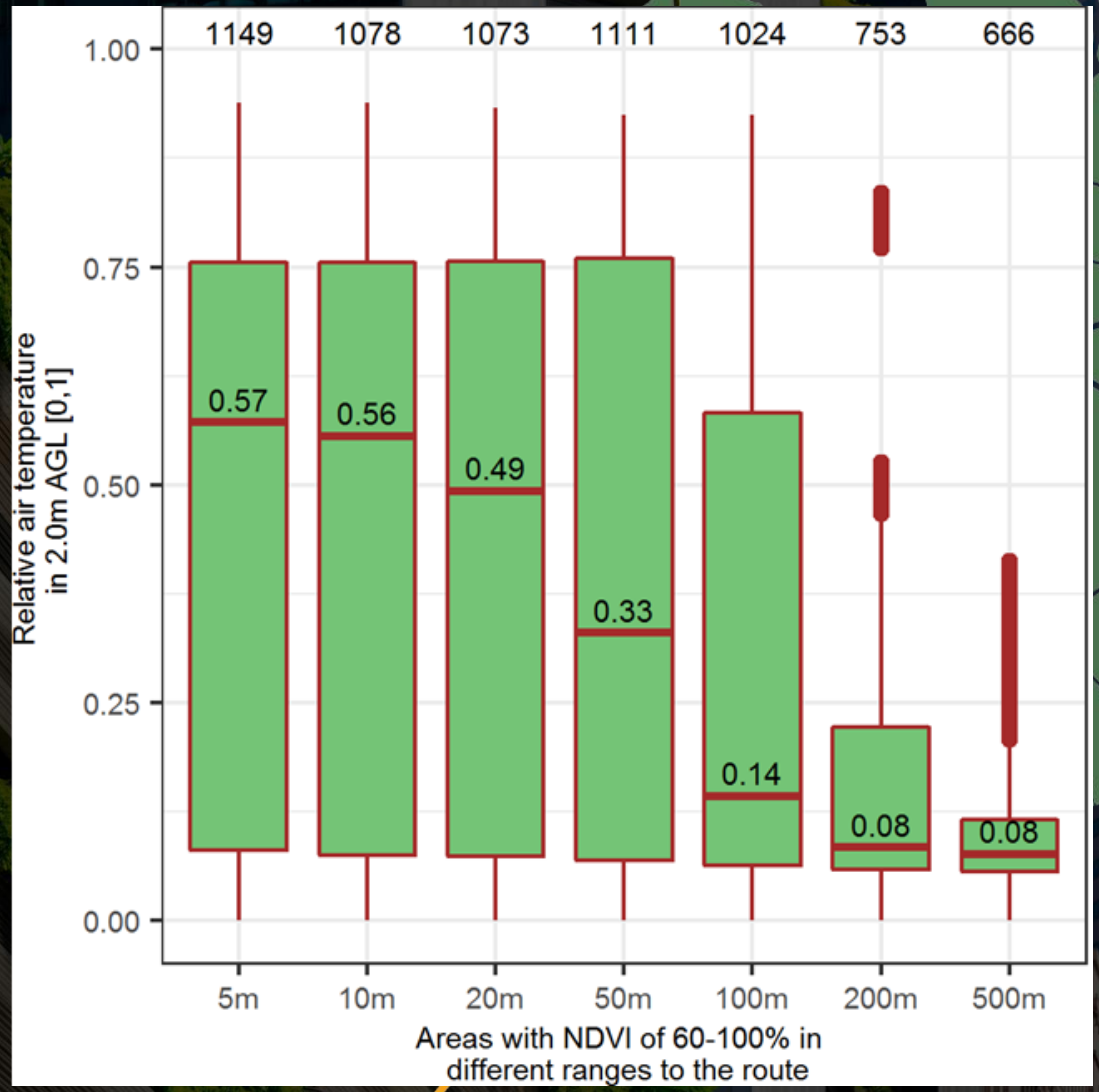


Graphics and photos:
Marcel Gangwisch/DWD

Gangwisch, M.; **Saha**, S.; Matzarakis, A. (2023)
(Urban Climate)
https://www.sciencedirect.com/science/article/pii/S2212095523002183

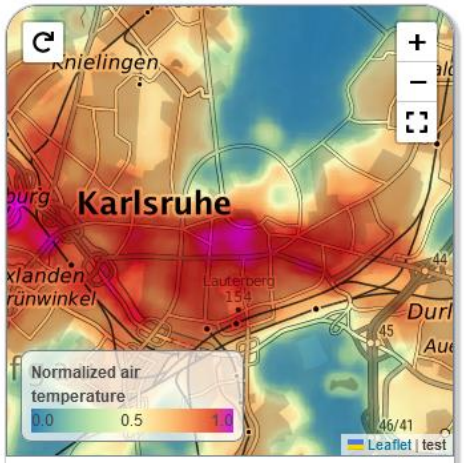
Cooling increased with tree cover percentage and proximity to green space





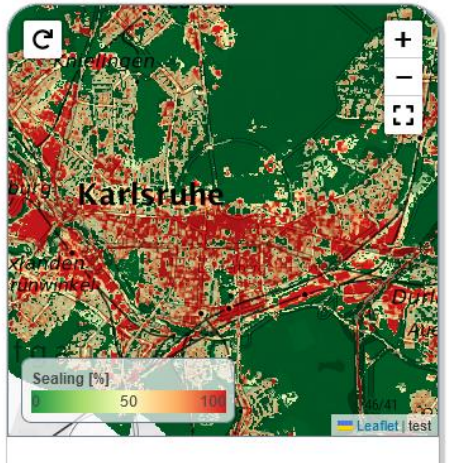
Gangwisch, M.; **Saha**, S.; Matzarakis, A. (2023) *(Urban Climate)*
https://www.sciencedirect.com/science/article/pii/S2212095523002183

Urban heat warning and information system



Spatially Resolved Normalized Air Temperature

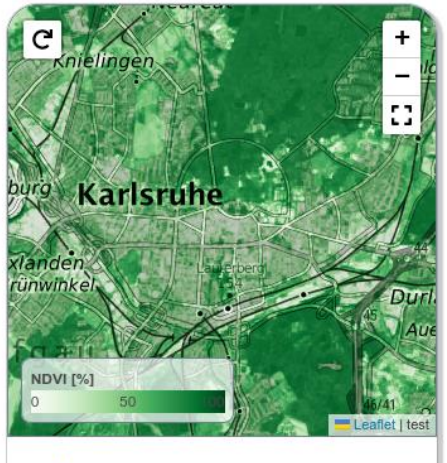
Average normalized air temperature with values ranging from [0,1].



Degree of Sealing

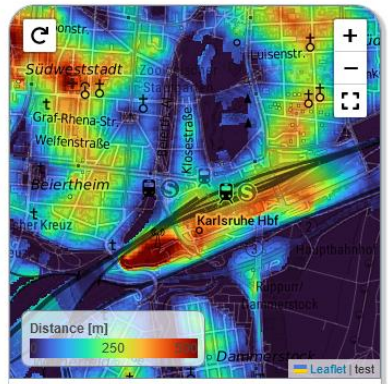
Sealing exacerbates the urban heat island effect and reduces drainage during heavy rainfall.

Thermal Risk



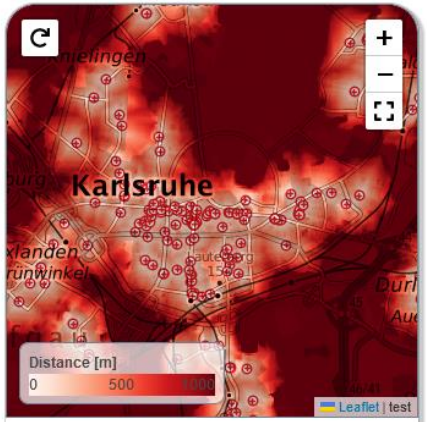
Normalized Difference Vegetation Index (NDVI)

The Normalized Difference Vegetation Index is a remote sensing product indicating the proportion of green spaces.



Accessibility of urban green space

Urban green spaces play a crucial role in mitigating the urban heat island effect during heat waves, providing cooling shelter for residents. However, the uneven distribution of these spaces can exacerbate environmental and social inequalities, leaving some communities more exposed to extreme temperatures.



Doctors Coverage within 1000m

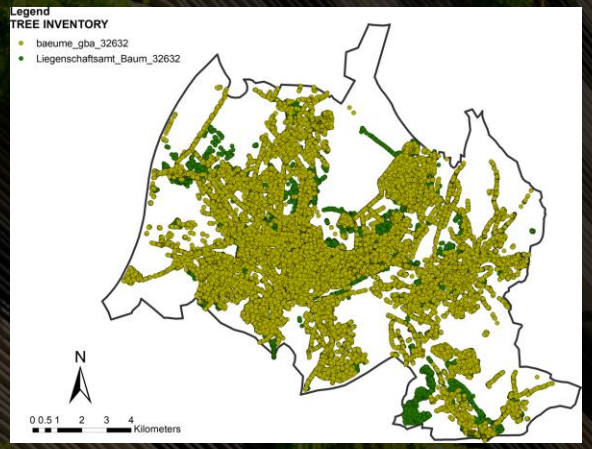
Physician density affects access to healthcare. Regions with few doctors may face challenges in providing timely care.

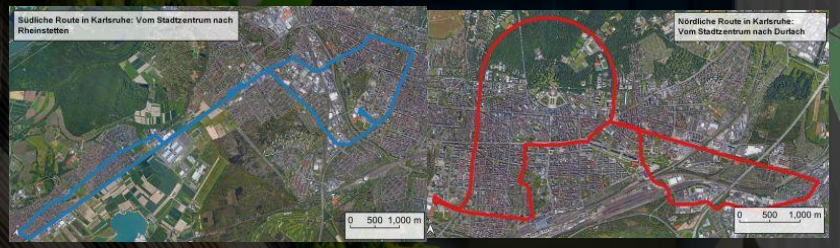
Nature-based solutions and good planning of critical infrastructure

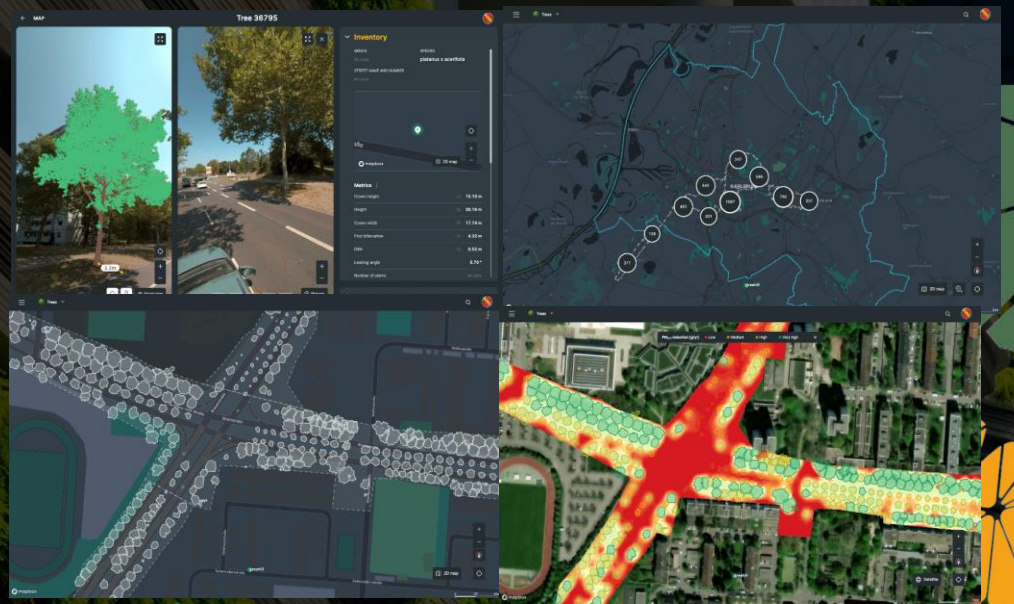
Graphics and photos:
Marcel Gangwisch/DWD

Key results
Tree monitoring, climate-smart irrigation

Digitalization and new monitoring system of Karlsruhe city trees







400.000 solitary trees in the city of Karlsruhe

City horticulture department: 135.000

2 – 4 Tree Inspectors only

greehill

Preliminary study

4720 trees surveyed across DWD's route

2 directions in Karlsruhe and Rheinstetten

Metric information
Tree Crown shapes

100% accuracy betwee
Greehill's AI prediction
and actual Baumkataste
species
identity

*Courtsey: Sayantan Dey, Marcel Gangwisch, Mario Köhler, Sven König Dey, S.,...**Saha**, S. Manuscript in preparation*

Smart and site-adapted city tree irrigation

Decision for efficient irrigation

Piloting and testing sensors, connectivity

Creating an irrigation information platform

Built up a representative sensor network (300 soil moisture sensors in Karlsruhe)

Monitor soil moisture and manage irrigation

Courtesy: Mario Köhler from City Horticulture Department

Synthesis

Social-ecological resilience

"Social-ecological resilience is the **capacity to adapt or transform** in the face of change in social-ecological systems, particularly unexpected change, in ways that continue to support human well-being" (Chapin et al. 2010, Biggs et al. 2015, Folke et al. 2016)

Drivers of social-ecological resilience detected in GrüneLune project

Increase Biodiversity

- Increase taxonomic diversity at local to regional scale
- Retain large trees/habitat;
- Increase drought and cavitation tolerance

Allow connectivity

- Allow continuous tree canopy;
- Create green corridors;
- Link roots to actual soil
- Allow flow of ecosystem services

Enhance Complex System Thinking

- Interdisciplinarity;
- Reduce trade-offs;
- Use MCDA or a similar approach in decision-making
- Positive aspects of digitalization and AI in urban ecology/forestry

Broaden Democratic formats:

- Creare new dialogue formats
- Use the *Realworldlab* approach for deliberative democratic discussion
- Involve stakeholders in the planning process

Implement Polycentric Governance

- Local emphasize on decision making: species selection
- Create local communities, voluntary groups for urban tree care
- More KIT-Karlsruhe city cooperation (university-praxis)

Requires inter- and transdisciplinary approaches, collaboration between academic institutions, municipalities, and civil society

Front of our institute today

Photo: Carolin Thomas

Future Bio City – Design Ecological and carbon neutral

Our wish in the next 20 years ☺

Creator: Carolin Thomas and Arturo Romero Carnicero-KIT/Landscape Architecture

Otto Dullenkopf Park Today

Photo: Carolin Thomas

Future Bio City – Design Ecological and carbon neutral

Wish in the next 20 years ☺

Creator: Carolin Thomas and Arturo Romero Carnicero-KIT/Landscape Architecture

Thank you

GrüneLunge project collaborators (in alphabetical orders of first name, *Co-principle investigators)

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4	Anna Dermann | Karlsruhe Institute of Technology
5	Annika Denner | Karlsruhe Institute of Technology
6	Annika Fricke | Karlsruhe Institute of Technology
7	Axel Albrecht* | Forest Research Institute of Baden-Württemberg
8	Diana Kramer | Karlsruhe Institute of Technology
9	Dietrich Schröder | Stuttgart Technology University of Applied Sciences
10	Doris Fath* | City Horticulture Department Karlsruhe
11	Fabian Collet | City Horticulture Department Karlsruhe
12	Ferdinand Betting | Karlsruhe Institute of Technology
13	Florian Dermann | Karlsruhe Institute of Technology
14	Friederike Stoll | Forest Research Institute of Baden-Württemberg
15	Gerhard Sardemann | Karlsruhe Institute of Technology
16	Hailiang Lyu | Karlsruhe Institute of Technology
17	Helena Trenks | Karlsruhe Institute of Technology
18	Iulia Almeida | Karlsruhe Institute of Technology
19	Jens Schirmel | University of Kaiserslautern-Landau
20	Jessica Cueva | Karlsruhe Institute of Technology
21	Jürgen Bauhus | University of Freiburg
22	Katrin Fröhlich | Karlsruhe Institute of Technology
23	Killian Wäschle | Karlsruhe Institute of Technology
24	Lisa Spoden | Karlsruhe Institute of Technology
25	Lynn Türk | Karlsruhe Institute of Technology
26	Marcel Gangwisch | German Weather Service-DWD
27	Mareike Hirsch | University of Freiburg
28	Mario Köhler | City Horticulture Department Karlsruhe
29	Martin Entling | University of Kaiserslautern-Landau
30	Martin Reuter | City of Rheinstetten
31	Metodi Sotirov | University of Freiburg
32	Monika Laux | Karlsruhe Institute of Technology
33	Moritz Heinzte | City Horticulture Department Karlsruhe
34	Oliver Parodi | Karlsruhe Institute of Technology
35	Rene Schütz | Karlsruhe Institute of Technology
36	Rocco Pace | Karlsruhe Institute of Technology
37	Rüdiger Grote | Karlsruhe Institute of Technology
38	Sebastian Haaff | City Horticulture Department Karlsruhe
39	Sebastian Schmidtlein | Karlsruhe Institute of Technology
40	Sven König | greeHill Deutschland GmbH
41	Ulrich Kienzler | City Forest Department Karlsruhe
42	Winfried Meier | University of Freiburg
43	Zita Sebesvari | United Nations University Bonn
44	Zoe Petridis | Karlsruhe Institute of Technology

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Session 3.1: Metropolis: Creating the policy and legal conditions to ensure that role urban forests in urban resilience is duly recognized

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