Leafy Ambitions:

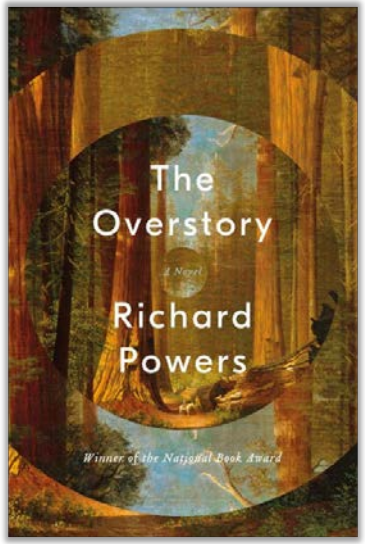
A critical look at the use of canopy cover targets in urban forest governance

Cecil C. Konijnendijk

UFORIA – Urban Forestry Research In Action lab, University of British Columbia

Outline

- Case studies of using canopy targets in urban forest governance – from Vancouver to Beijing
- Strengths of a canopy target approach
- Pitfalls of a canopy target approach
- Perspective



https://i.pinimg.com/736x/63/4b/d1/634bd1c523696bbb96d141c312326b60--canopy-beds-dollhouse-furniture.jpg

TREE

TREES KEEP US HEALTHY. FOLL

1 GET MOVING

Inspect trees and shrubs from the bottom up and look for specific problems such as brittle or dead branches, soft or decaying wood, small holes in trunk, or shallow pits in the bark and weak or off-color foliage.

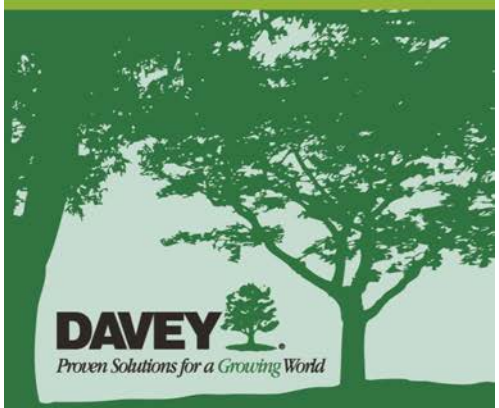
Help your
healthy by
release fe
nutrients a
resistance
disease, i
stressful w

WE NEED MORE TREES TO HANG THE HAMMOCKS

P.O. BOX 1045 6801 BA ARNHEM HOLLAND

Loesje

he American Cancer Society,
uable means of protection from the
cts of the sun's ultraviolet (UV) rays.
portant as a hat or sunglasses.



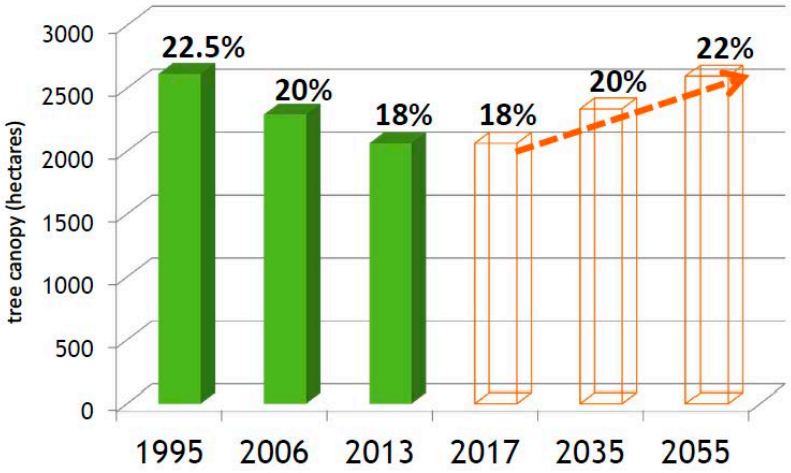
E
D
CES

d planning
your trees'
andscape's
when
tree in the

5 SCHEDULE REGULAR CHECK-UPS

Notice something that worries you? Schedule a check-up with a certified arborist to ensure the best care for your trees.

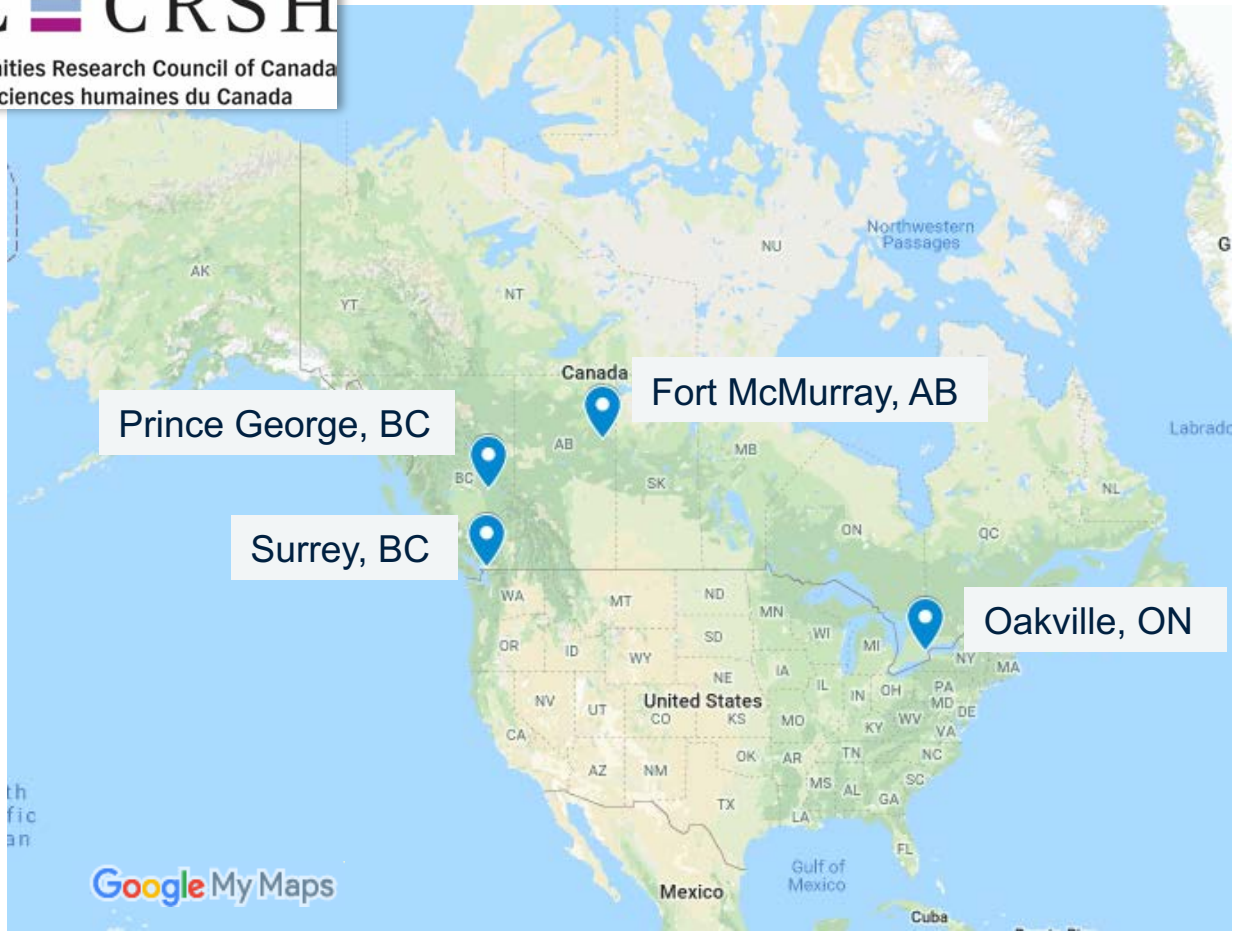
CITY OF
VANCOUVER
GREENEST
CITY 2020



Source: City of Vancouver, Urban Forest Strategy 2014

SSHRC CRSH

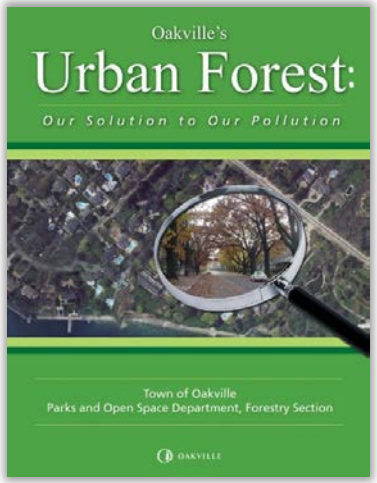
Social Sciences and Humanities Research Council of Canada
Conseil de recherches en sciences humaines du Canada



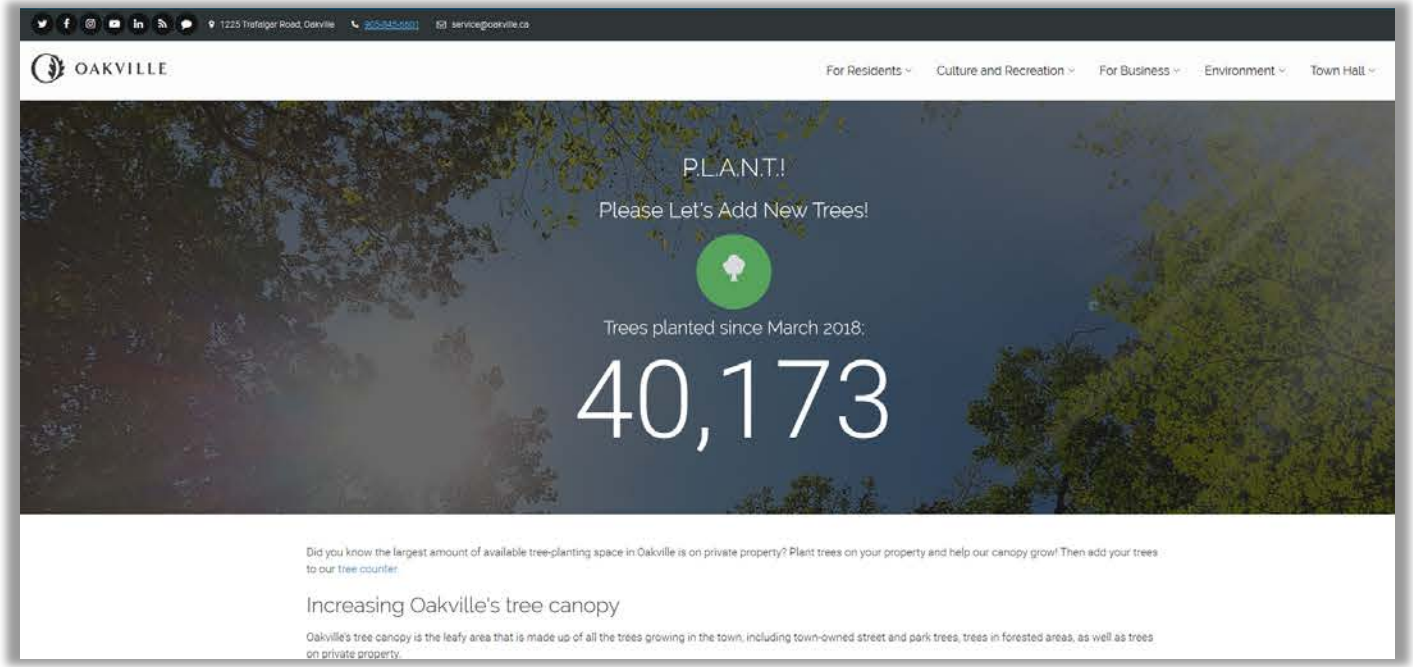
John McNeil, Oakville

Rob Burton, Oakville

https://oakvillenews.org/town-launches-2015-canopy-conservation-program-during-emerald-ash-borer-awareness-week-june-1-7/


Oakville's
Urban Forest:
Our Solution to Our Pollution
Town of Oakville
Parks and Open Space Department, Forestry Section
OAKVILLE

Oakvillegreen Conservation Association
289-813-1568, president@oakvillegreen.org, 2089 Nipigon Dr, Oakville ON


1225 Trafalgar Road, Oakville
service@oakville.ca
OAKVILLE
For Residents
Culture and Recreation
For Business
Environment
Town Hall
P.L.A.N.T.!
Please Let's Add New Trees!
Trees planted since March 2018:
40,173
Did you know the largest amount of available tree-planting space in Oakville is on private property? Plant trees on your property and help our canopy grow! Then add your trees to our tree counter.
Increasing Oakville's tree canopy
Oakville's tree canopy is the leafy area that is made up of all the trees growing in the town, including town-owned street and park trees, trees in forested areas, as well as trees on private property.

Contents lists available at ScienceDirect

Urban Forestry & Urban Greening

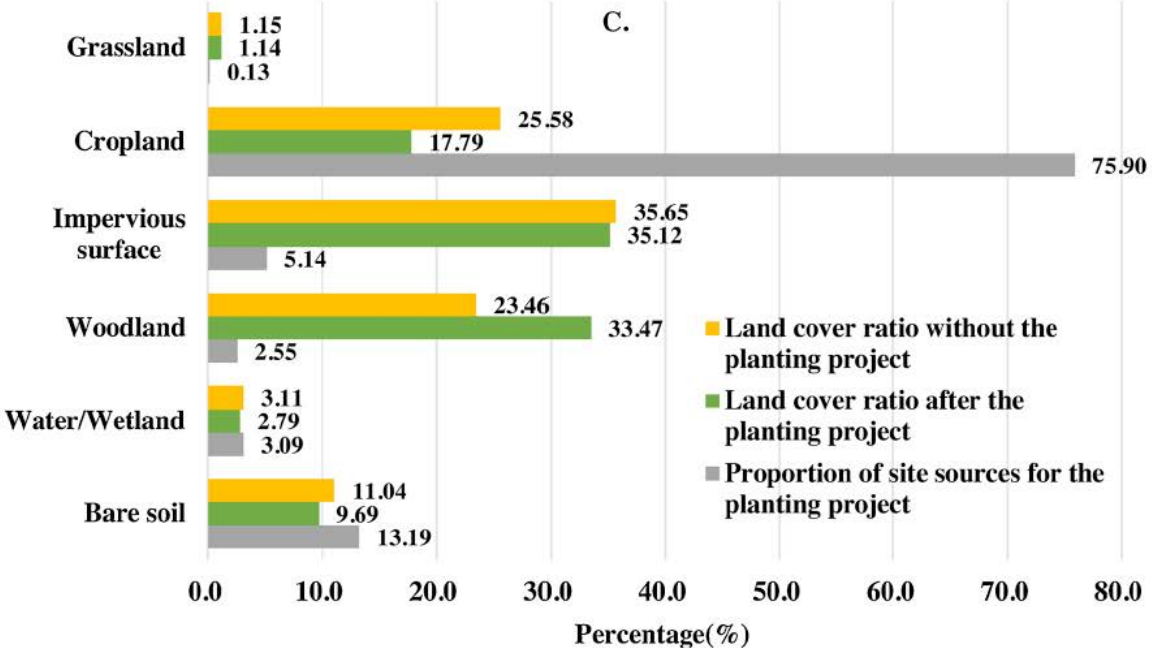
journal homepage: www.elsevier.com/locate/ufug

Original article

Beijing's 50 million new urban trees: Strategic governance for large-scale urban afforestation

Na Yao[a,b], Cecil C. Konijnendijk van den Bosch[b], Jun Yang[c], Tahia Devisscher[b], Zach Wirtz[b], Liming Jia[a], Jie Duan[a,d], Lvyi Ma[a,d,*]

Na (Alice) Yao

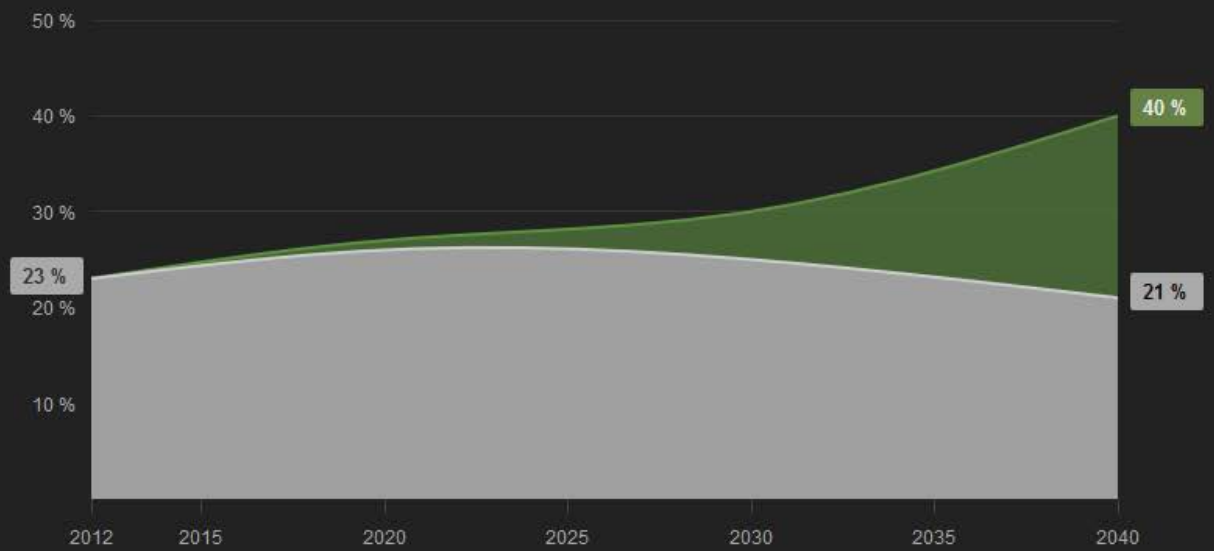


CITY OF MELBOURNE Urban Forest Visual

Intro Map Issues

Canopy Will tree canopy increase?

Melbourne's canopy graphed: with & without tree planting



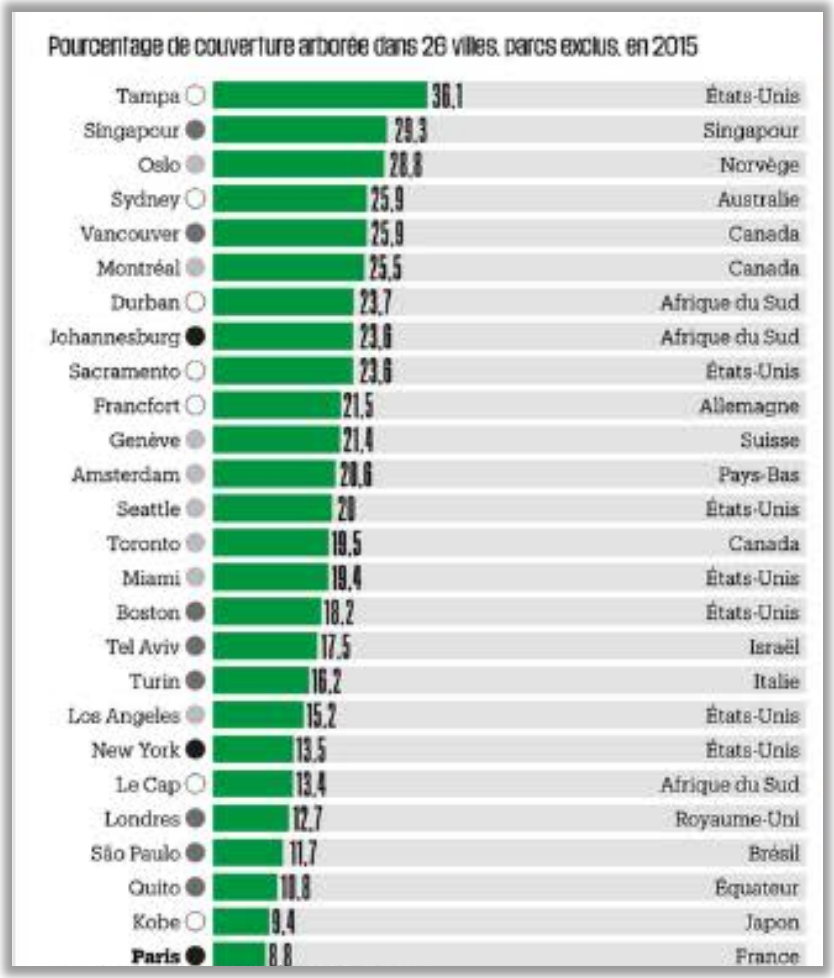
City	Current canopy cover	Desired canopy cover	Notes
Melbourne (AUS)	22	40 (2040)	GIS based; whole city jurisdiction area
New York (USA)	25	30 (2030)	GIS based, Whole city jurisdiction area. 30 by ’30 project
Toronto (CAN)	20	30-40 (2060)	Both point and GIS based methods used.
Barcelona (SPA)	25	30 (2037)	Includes large forested area (excluding this existing UTC may be 15%)
Copenhagen (DEN)	16	20 (2025)	i-Tree Canopy, areas in Copenhagen that are owned by the City of Copenhagen, apart from green municipal areas.

Source: Doick et al., 2017

VEGETALISATION

A travers le monde, les villes dégainent leurs arbres

Par Nelly Didelot — 25 juillet 2019 à 21:46



https://www.liberation.fr/planete/2019/07/25/a-travers-le-monde-les-villes-degainent-leurs-arbres_1742147

Contents lists available at ScienceDirect

Urban Forestry & Urban Greening

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

Canadian urban tree canopy cover and carbon sequestration status and change 1990–2012

Mark McGovern*, Jon Pasher

Table 2
Comparison of independent city estimates of percent urban tree canopy (UTC) cover to point based national sampling estimates.

City	Point Based UTC Estimate[a] (%)	Local Municipal Estimate UTC%	Year of Estimate
Vancouver	17.5	18.6	2010
Kelowna	12.2	13	2007
Calgary	9.3	7.1	2007
Edmonton	13.4	10.3	2007
City of Toronto	20.1	20.5	2007
Mississauga	16.1	15	2011
Brampton	8.9	11	2007
Oakville	22.8	29.1	2007
Ottawa	22.8	27	2007
Halifax	51.8	41	2007

[a] Regional estimate of UTC extracted from national point sampling estimate using municipal boundaries.

ISA International Society of Arboriculture

Arboriculture & Urban Forestry 2011. 37(3): 108–117

ARBORICULTURE & URBAN FORESTRY
Scientific Journal of the International Society of Arboriculture

Criteria and Indicators for Strategic Urban Forest Planning and Management

W. Andy Kenney, Philip J.E. van Wassenaer, and Alexander L. Satel

Abstract. The success of urban forest management is frequently predicated upon achieving absolute canopy cover targets. This two-dimensional view of the urban forest does not provide a comprehensive assessment of urban forest stewardship in a community and does not account for an area's potential to support a forest canopy. A comprehensive set of performance-based criteria and indicators concerning the community's vegetation resource, community framework and resource management approach is described. This set of broadly based measures provides a more useful tool for the evaluation of urban forest management success and strategic management planning.

Key Words. Canopy Cover; Municipal Planning; Relative Canopy Cover; Sustainability; Urban Forest Planning; Urban Forestry.

The succes of urban forest management is frequently predicted upon achieving absolute canopy cover targets. This ***two-dimenional view*** *of the urban forest* ***does not provide a comprehensive assessment*** *of* ***urban forest forest stewardship*** *in a community and* ***does not account for an area's potential*** *to support a forest canopy.*

Kenney et al. (2011)

Table 15.1 Ideal-typical governance arrangements according to Arnouts et al. (2012).

	Hierarchical	*Closed co-governance*	*Open co-governance*	*Self governance*
Actors	Mainly governmental actors	Select mixed group of actors	Large mixed group of actors	Mainly non-governmental actors
Power	With government	Pooled	Diffused	With non-government
Rules	Governmental coercion	Restricted cooperation	Flexible collaboration	Non-governmental forerunning

Sheppard et al. (2017) – Routledge Handbook of Urban Forestry

AMERICAN FORESTS
- SINCE 1875 -

DONATE

ABOUT US OUR WORK GET INVOLVED BLOG

The reason for that is simple: research no longer supports a universal 40 percent tree canopy recommendation, and neither does American Forests.

By Ian Leahy, *American Forests, Director of Urban Forest Programs*

One of the most frequent questions I receive, as American Forests' Director of Urban Forest Programs, comes from individuals developing tree canopy goals for their jurisdiction or region. They have come across numerous references to American Forests' recommended 40 percent tree canopy goal but cannot find a source citation to include in planning documents.

The reason for that is simple: research no longer supports a universal 40 percent tree canopy recommendation, and neither does American Forests.

Urban Forest Canopy Research – Common Themes

- **Canopy cover estimation**
- **Canopy and regulatory ecosystem services** (e.g. heat/climate, carbon, air pollution removal)
- **Canopy and environmental justice** – and relating canopy to e.g. household income

Also some work on:

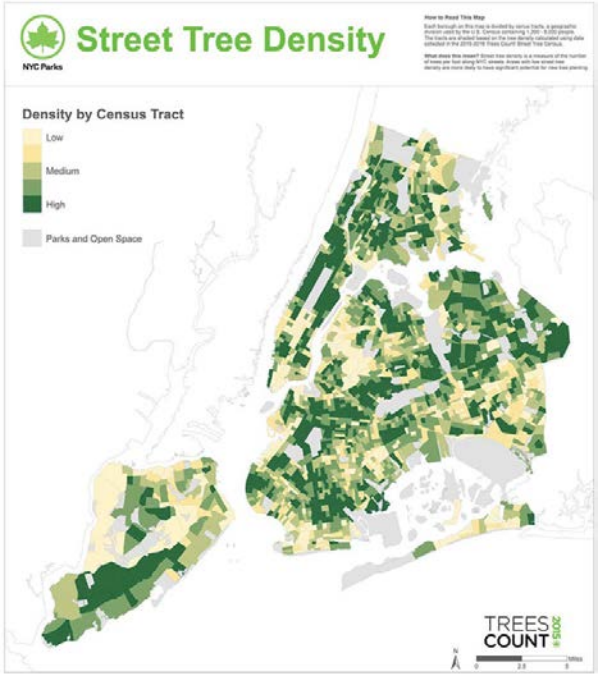
- Health – e.g. general, asthma; education/school performance; crime; retail
- Governance and planning aspects (e.g. zoning), management/program criteria and indicators, public/private
- Tree planting programs, community efforts

Strengths of Using Canopy Targets

- Simple and powerful narrative / discourse – attractive to e.g. politicians
- Easy to communicate and understand
- Provides common narrative and sense of direction in complex governance situation
- Measurable indicator of success
- Assemble public support and generate action and involvement
- Highlighting the urgency of loss
- Linked to several key ecosystem services – see the iTree approach
- Allows for benchmarking

YOU'RE ONE IN A MILLION

We did it! One million trees for New York City!



http://www.smh.com.au/good-weekend/green-power-nycs-parks-commissioner-on-why-parks-are-essential-20160823-gqytqf.html; Photo: Nathaniel Welch

https://www.newwestcity.ca/services/trees/urban-forest-management-strategy#urban-forest-management-strategy-presentation

NEW WESTMINSTER

MANAGING OUR URBAN FOREST

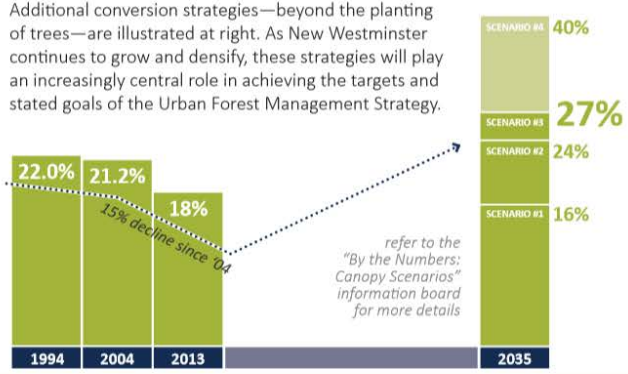
LEADING THE REGION IN URBAN FOREST MANAGEMENT

Recognizing the past decades' decline in New Westminster's urban forest canopy the Urban Forest Management Strategy proposes an aspirational canopy target to bring the City in line with the North American average (27%).

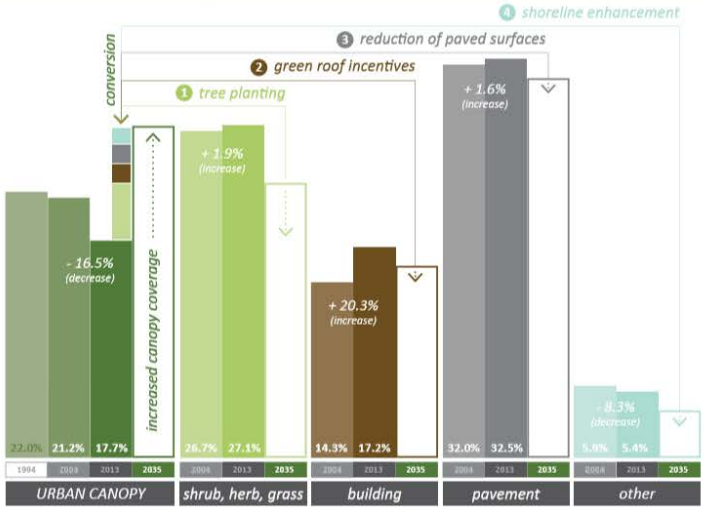
Achieving this goal—with a twenty-year time horizon—requires shared vision and coordinated effort between public and private interests.

In the simplest of terms, the expansion of the urban forest is about planting trees... And as a first step, the identification of "plantable spots" across the diverse matrix of urban land uses, identifies existing opportunities to enhance "shrub, herbs and grass" to include urban canopy.

Additional conversion strategies—beyond the planting of trees—are illustrated at right. As New Westminster continues to grow and densify, these strategies will play an increasingly central role in achieving the targets and stated goals of the Urban Forest Management Strategy.



FOUR CONVERSION STRATEGIES (EXAMPLES) ---> 27% CANOPY TARGET



Strategies beyond tree planting reflect the direct connections between urban forest management and City-wide priorities related to planning and urban design.

SETTING A TARGET: a goal for urban forest management

Actors

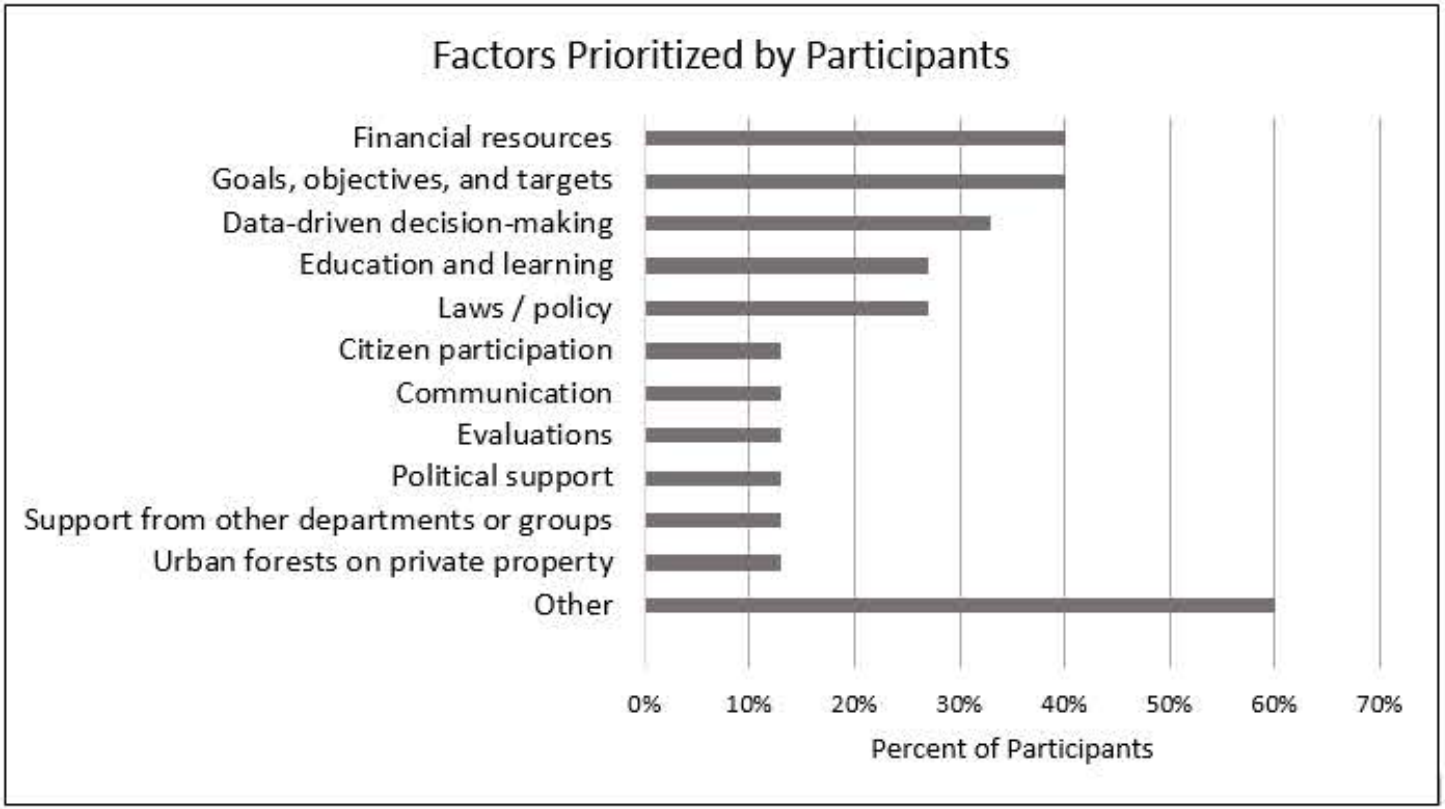
1. Central governmental agency for the project

- **Lateral**

- ***Forestry and Parks Bureau; (Lead)***
- **Finance Bureau; *(Support)***
- **Commission of Development and Reform; *(Support)***
- **Commission of Science and Technology; *(Support)***
- **Land and Resources Bureau; *(Support)***
- **Water Authority; *(Support)***
- **Public Security Bureau; *(Coordinate)***
- **Agriculture Bureau; *(Coordinate)***
- **Environmental Protection Bureau; *(Coordinate)***
- **Commission of City planning;*(Coordinate)***
- **Commission of Rural Affairs;*(Coordinate)***
- **Supervision Bureau; *(Supervise)***
- **Audit Bureau; *(Supervise)***

- **Vertical**
- **Top-down four-layer governmental system**

Slide by Na (Alice) Yao



Source: MSc thesis Zach Wirtz, UBC, 2019

“City-wide tree canopy cover is a useful indicator of the extent of tree presence across a city. Its assessment can be simple, fast and highly reproducibly. Repeat observation could be a cost-effective means of monitoring tree populations, setting targets and tracking effectiveness of planting programmes.”

Doick et al., 2017

WHEN THINGS BECOME REALLY BAD…

- **Calamities**: an event causing great and often sudden **damage** or **distress**; a disaster

- In urban forestry: a **major loss** of urban forest **canopy** over a **short period of time**

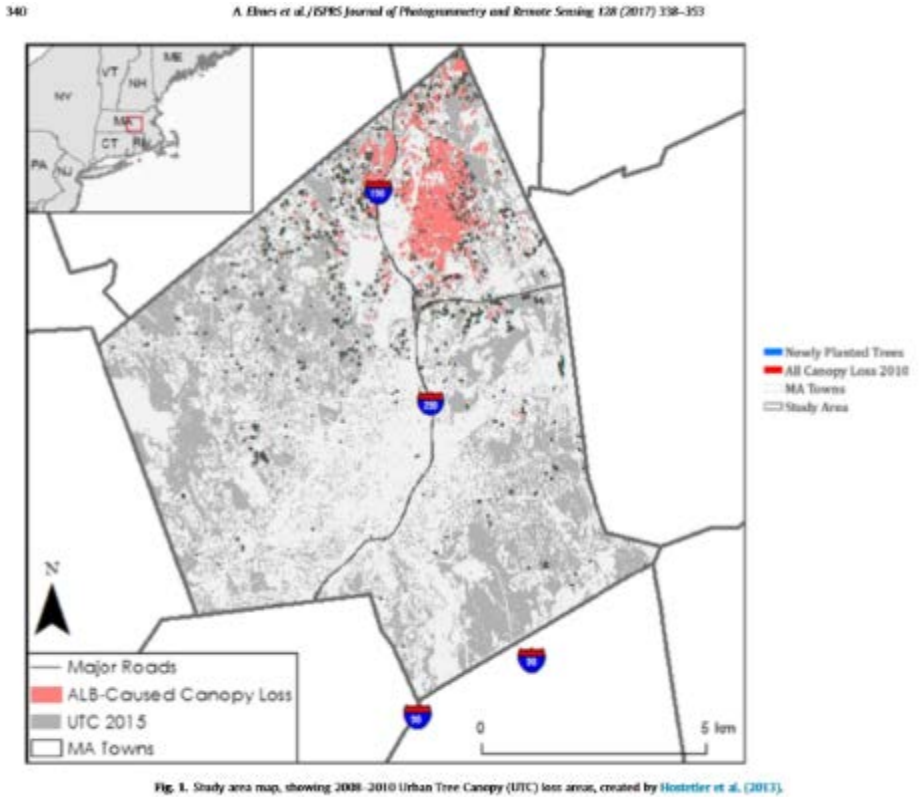


Fig. 1. Study area map, showing 2008–2010 Urban Tree Canopy (UTC) loss areas, created by Hostetler et al. (2013).

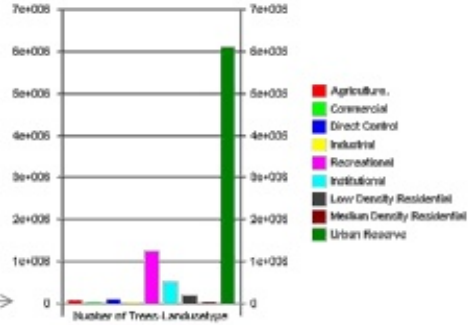
Exhausted worker in Dubai, 2015
photo: Kamran Jebreili

Eco
Streets
Hydro
Vue

STRUCTURE

FUNCTION/BENEFIT

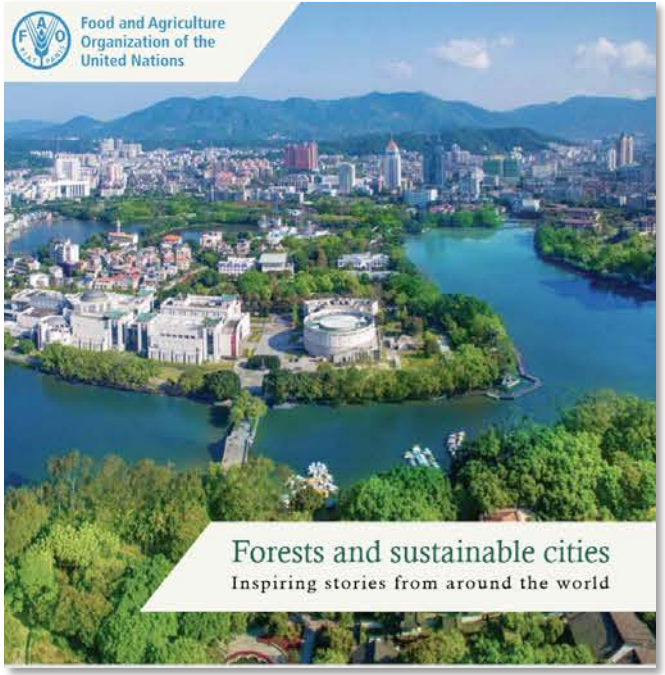
ECONOMIC VALUE



MANAGEMENT

photo credits: Seattle i-Tree Training by Al Zelaya

https://www.itreetools.org/



Trees: the cool approach to city cooling in Phoenix, Arizona

Population	1.6 million
Land area	134 420 hectares
Public green space	16 252 hectares
Green space per person	100.0 m^2

Singapore: the surprisingly green and biodiverse city

Population	5.6 million
Land area	71 920 hectares
Public green space	31 645 hectares
Green space per person	58.0 m^2

STANDARD 1
ESTABLISH RESPONSIBILITY

The city has a written statement by city leaders delegating responsibility for the care of trees within the municipal boundary to a staff member, a city department, or a group of citizens—called a Tree Board.

STANDARD 2
SET THE RULES

The city has in place a law or an official policy that governs the management of forests and trees. These rules describe how work must be performed —often citing best practices or industry standards for tree care and worker safety—where and when they apply, and penalties for noncompliance.

STANDARD 3
KNOW WHAT YOU HAVE

The city has an updated inventory or assessment of the local tree resource so that an effective long-term plan for planting, care, and removal of city trees can be established.

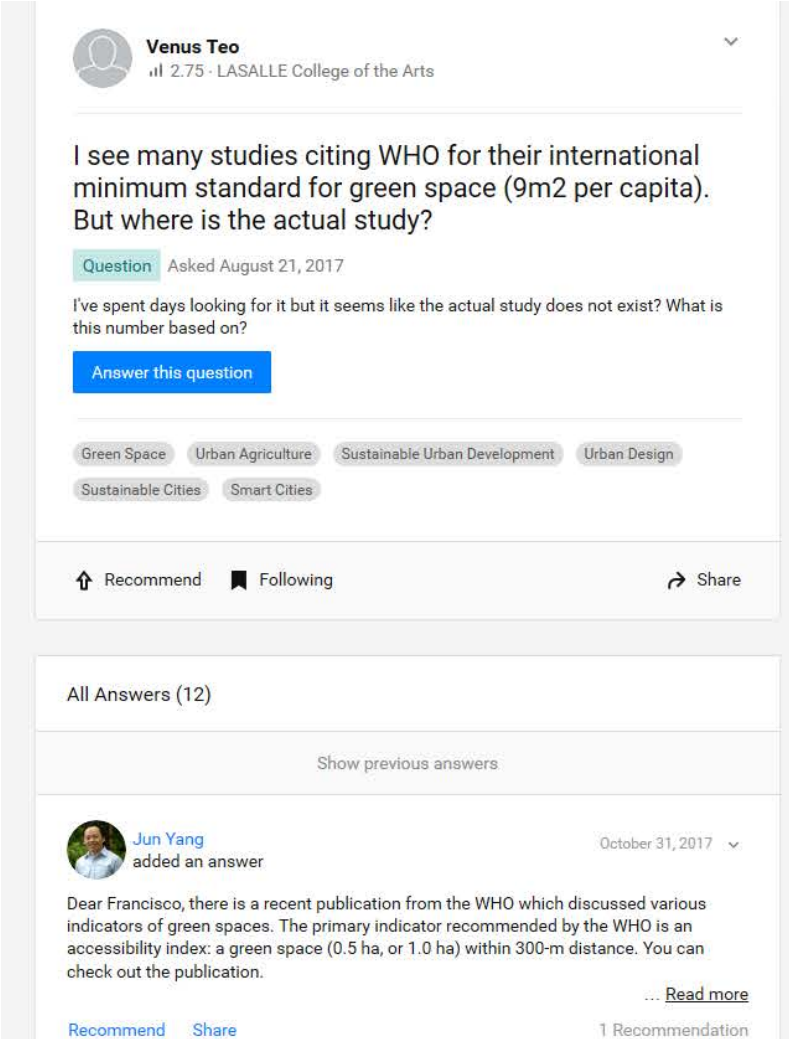
STANDARD 4
ALLOCATE THE RESOURCES

The city has a dedicated annual budget for the routine implementation of the tree management plan.

STANDARD 5
CELEBRATE ACHIEVEMENTS

The city holds an annual celebration of trees to raise awareness among residents and to acknowledge citizens and staff members who carry out the city tree programme.

WHO guideline:
9 m^2 of green space / inhabitant



Venus Teo
2.75 · LASALLE College of the Arts

I see many studies citing WHO for their international minimum standard for green space (9m2 per capita). But where is the actual study?

Question Asked August 21, 2017

I've spent days looking for it but it seems like the actual study does not exist? What is this number based on?

Answer this question

Green Space | Urban Agriculture | Sustainable Urban Development | Urban Design | Sustainable Cities | Smart Cities

Recommend | Following | Share

All Answers (12)

Show previous answers

Jun Yang
added an answer

October 31, 2017

Dear Francisco, there is a recent publication from the WHO which discussed various indicators of green spaces. The primary indicator recommended by the WHO is an accessibility index: a green space (0.5 ha, or 1.0 ha) within 300-m distance. You can check out the publication.

... Read more

Recommend Share

1 Recommendation

Pitfalls when Using Canopy Targets

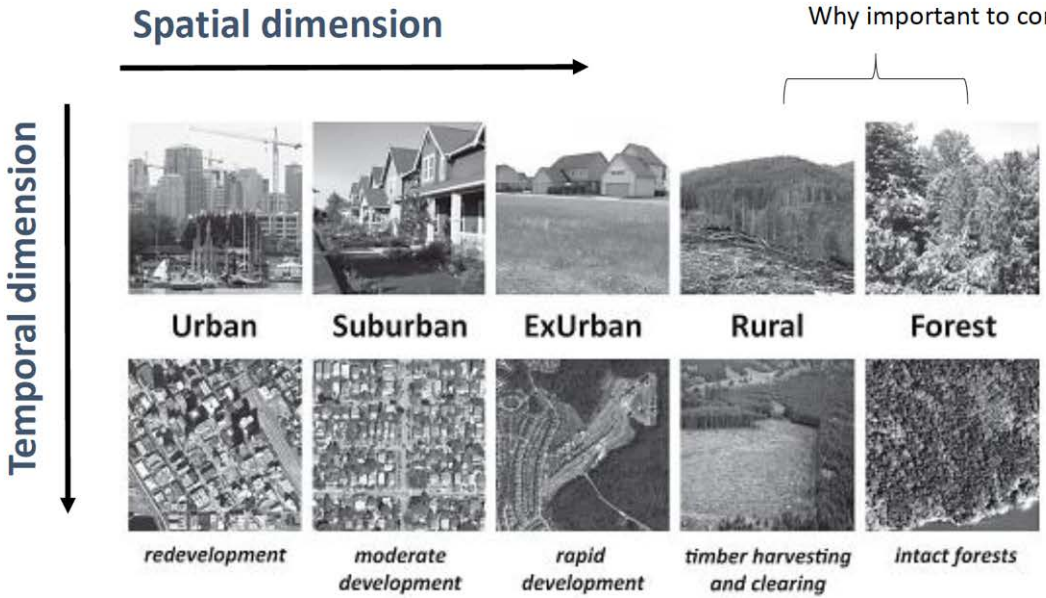
- Cities and local conditions are very different
- Mostly suitable for some ecosystem services (see e.g. i-Tree)
- Public – private; access
- Quite two-dimensional – how about the ‘on the ground’ experience?
- Quantity over quality – resilience, diversity, functionality
- It’s not only about trees
- Issue of uneven distribution of canopy
- Methodology

Dr Greg McPherson: “Targets are best developed for specific cities and should consider **constraints to creating canopy** such as:

- **Development densities** (i.e., dense development patterns with more impervious surfaces have less opportunity for cover);
- **Land use patterns** (i.e., residential areas may have more opportunity for canopy than commercial areas, but canopy cover tends to be less in residential areas of disadvantaged communities versus wealthy ones);
- **Ordinances** (i.e., parking lot shade ordinances promote cover over some impervious areas); and
- **Climate** (i.e., canopy cover in desert cities is often less than tropical cities).”

https://www.americanforests.org/blog/no-longer-recommend-40-percent-urban-tree-canopy-goal/

Urban Forests along the Urbanisation Gradient



Source: Alberti and Hutyra 2012

By CPG1100 - Own work, CC BY-SA 4.0,
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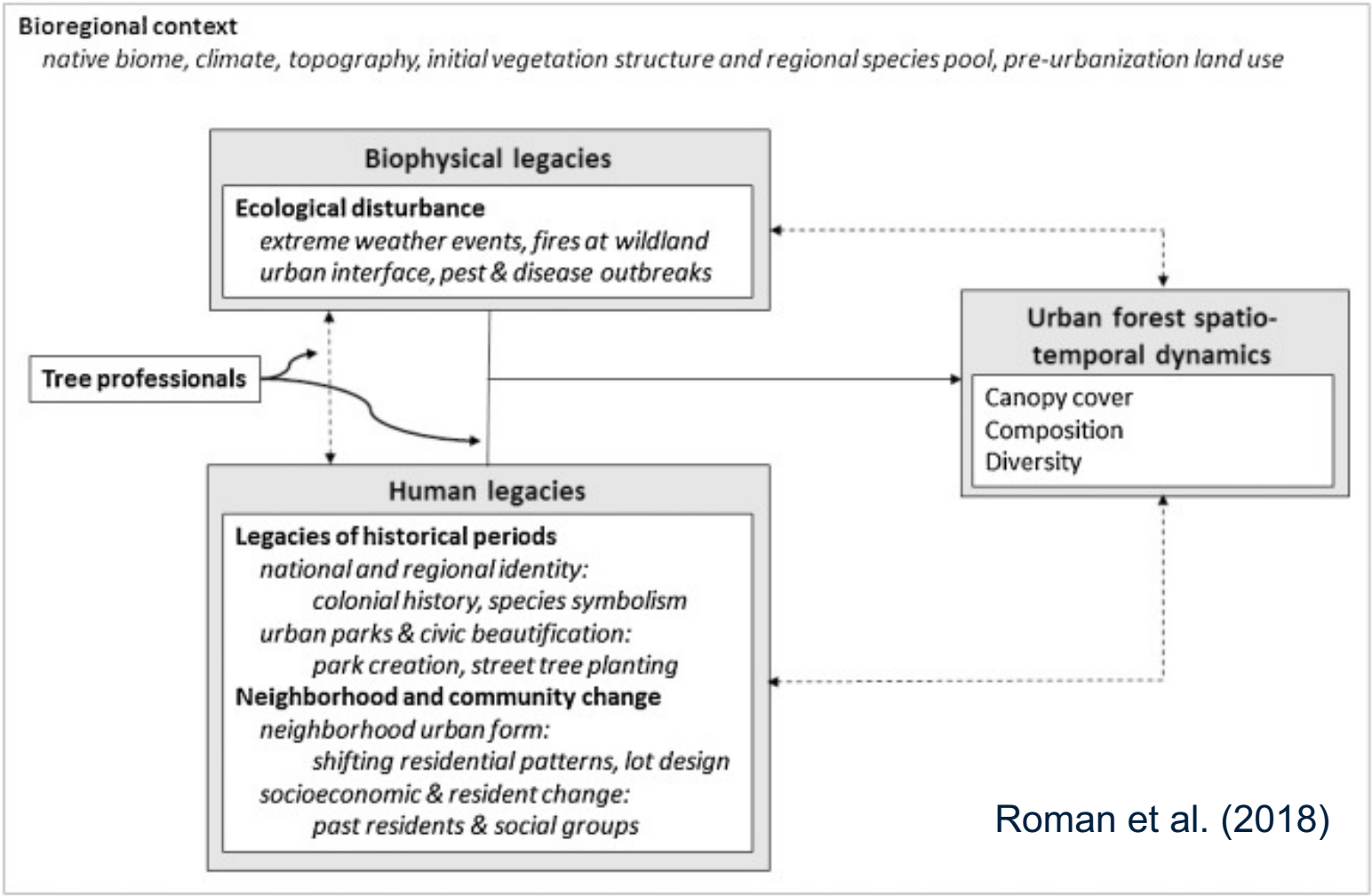
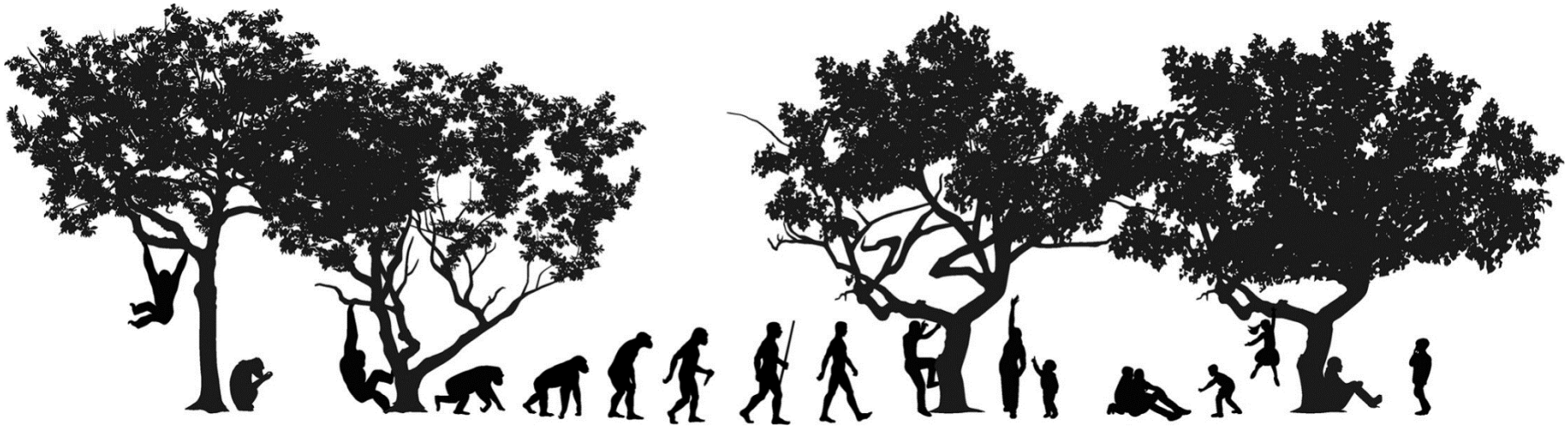


Roman et al. (2018)



Credit: Joseph Townsend and Susan Barton (2018)

(2) **Visible nature:** *Visible Greenspace 100 m* was defined as greenspace percentage in a 100-meter buffer, and *Visible Natural Space 100 m* was defined as greenspace and bluespace percentage within a 100-meter buffer;

(3) **Accessible neighborhood nature:** *Accessible Greenspace 500 m* was defined as publicly accessible greenspace percentage within a 500-meter buffer, and *Accessible Natural Space 500 m* was defined as public greenspace and bluespace percentage within a 500-meter buffer;

ELSEVIER

Environmental Research

Volume 171, April 2019, Pages 365-377

Exposure to natural space, sense of community belonging, and adverse mental health outcomes across an urban region

Emily J. Rugel [a] [*] [✉], Richard M. Carpiano [b] [c] [d], Sarah B. Henderson [a] [c], Michael Brauer [a]

Show more

https://doi.org/10.1016/j.envres.2019.01.034

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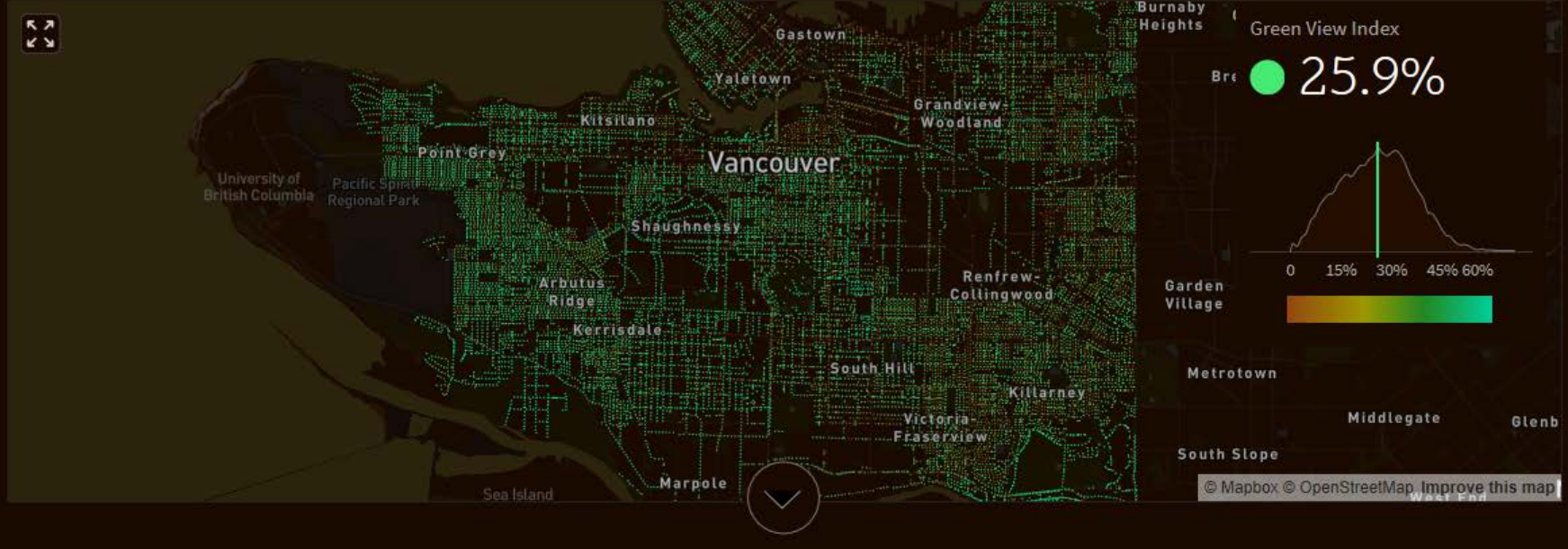
senseable.mit.edu/treepedia/cities/vancouver

Treepedia Compare Cities Description

MIT | SENSEABLE CITY LAB :::: WORLD ECONOMIC FORUM

Exploring the Green Canopy in cities around the world

Vancouver



Google Street View (GSV) → Green View Index (GVI)

Treepedia Lab, MIT

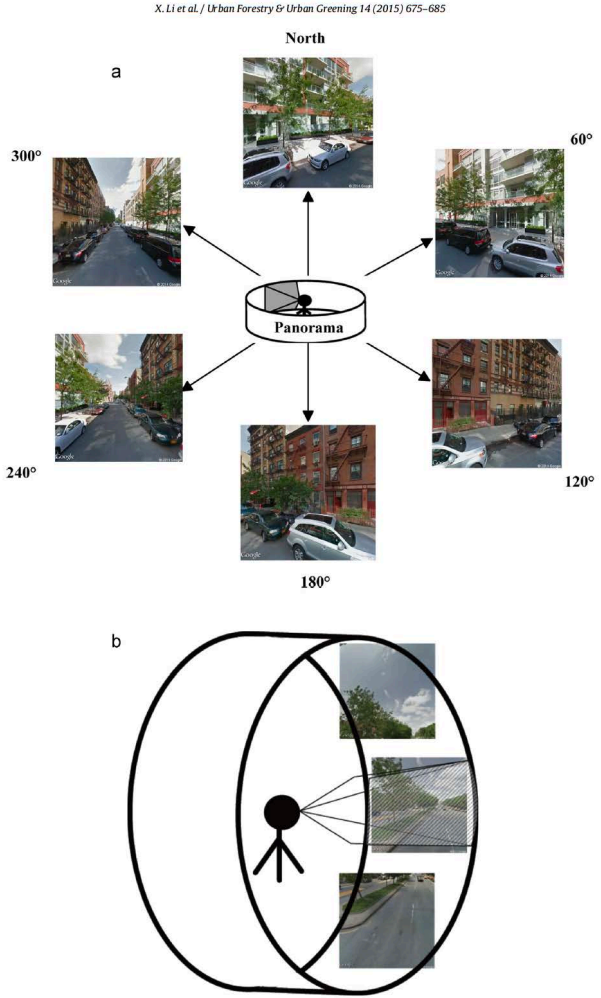
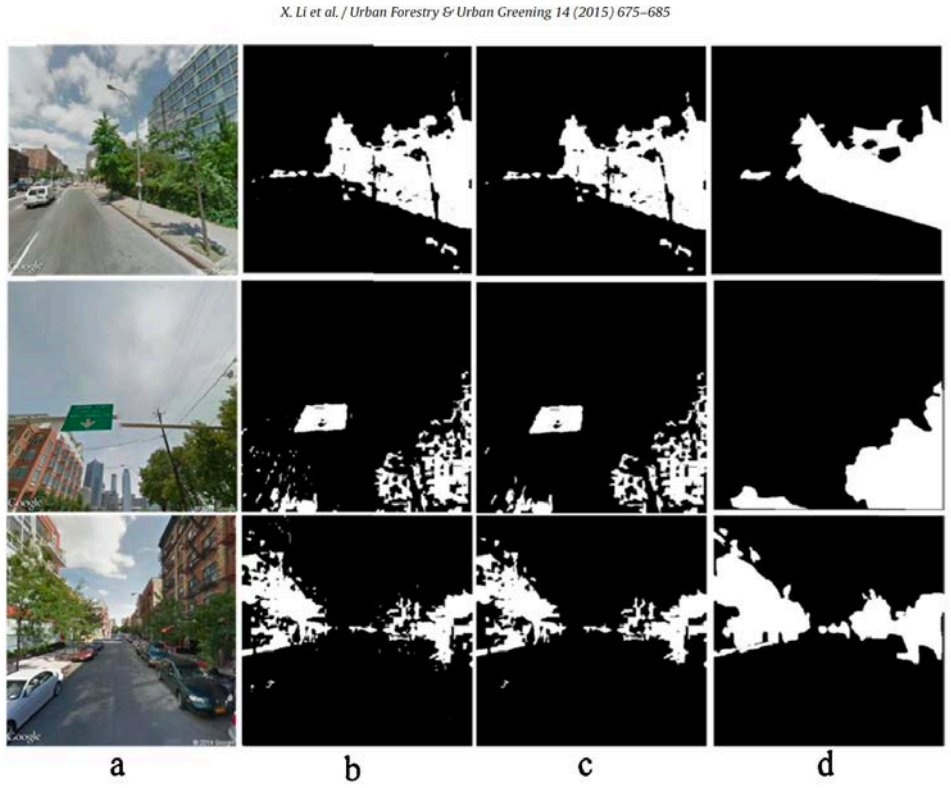


Fig. 5. GSV images captured in six directions at a sample site in the study area (a) and GSV images captured at three vertical view angles at a sample site (b).



Sophie Nitoslawski
PhD Student

All urban forest **data stored** in the "cloud"

In the age of **smart cities**

What should **smart urban forests** look like?

Social media images **continuously tracked** for citizen values on urban public spaces

Researchers use **big data** to **quantify health outcomes** from exposure to forest biodiversity

Concordia University and the City of Montréal **team up** to create **AR game for citizens** to water newly planted trees

Tree "Fitbit®" **sensors monitor** indicators in **real time**

Tree climbing robots scan, identify, and prune in higher risk areas

W 6

Resilience

The capacity to recover quickly from difficulties; toughness

http://www.oxforddictionaries.com/definition/english/resilience

Jehane Samaha
MSc student

Urban Tree Selection Study

- What tree selection criteria do various professional groups prioritize?
- What trees will be excellent to plant in future cities?
- Online **survey**: temperate North America.
- **Case study** interviews: Philadelphia area.

PHILADELPHIA URBAN FOREST.
PHOTO CREDIT: METROPOLIS

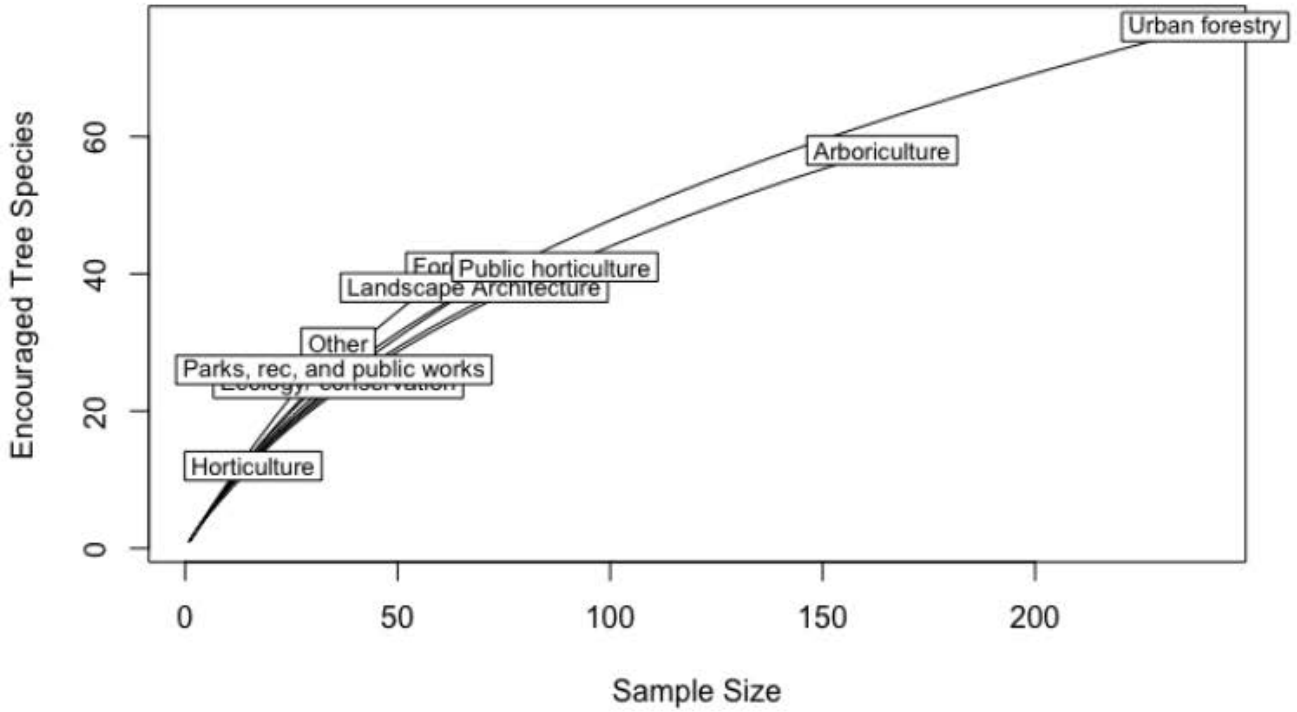


Figure 12: Rarefaction curves for the palettes of encouraged tree species identified by each professional field.

Source: M.Sc. Thesis Jehane Samaha, UBC

Sponge City | Landscape | Planning | Architecture

Building A Greenway: Puyangjia...

Yichang Yunhe Park

Quzhou Lurning Park

A Resilient Landscape: Yanweizh...

Floating Connection: The Harbi...

Qian'an Sanlihe River Ecological...

Minghu Wetland Park

Qunli Stormwater Park: A Green...

Shanghai Houtan Park

Central Landscape of Zhonggua...

Tianjin Qiaoyuan Wetland Park

The Floating Gardens -- Yongni...

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Journal of Environmental Management
Volume 208, 15 February 2018, Pages 24-35

Research article

Canopy of advantage: Who benefits most from city trees?

Christopher S. Greene [a], Pamela J. Robinson [b], Andrew A. Millward [a]

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https://doi.org/10.1016/j.jenvman.2017.12.015

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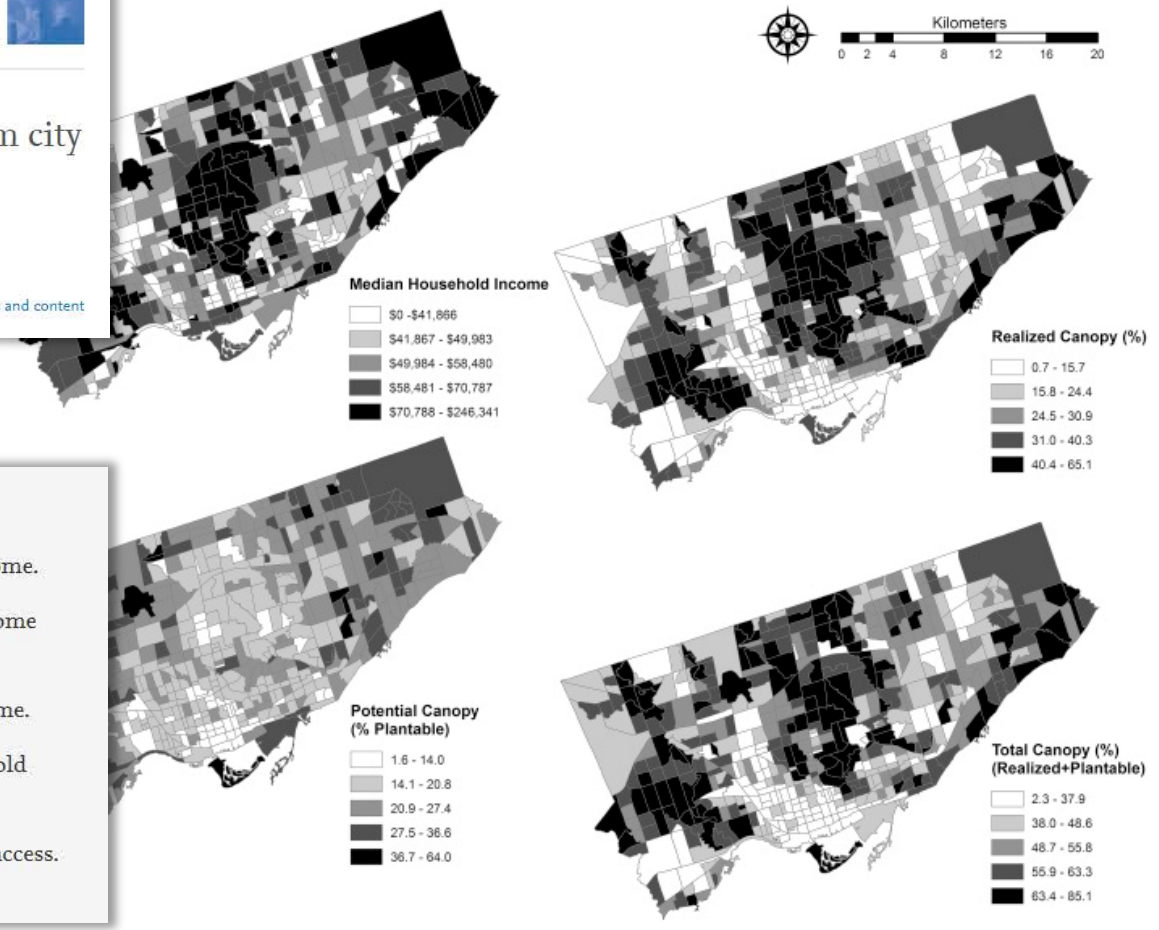
Highlights

- Toronto, Canada is a polarized city from the perspective of income.
- Categorical differences in tree canopy related to household income classes.
- Moderate correlation between tree canopy and household income.
- Significant spatial clusters of high/low tree canopy and household income.
- Distributional inequalities present and related to urban forest access.



PERSPECTIVE

- Canopy targets can be of value – if used with care and together with other criteria and indicators
- Opportunities with technological and research advancement
- What does a specific canopy target represent?
- Linking to the full set of ecosystem services and benefits
- Importance of urban forest legacies