



# Healthy Trees: Healthy City benefits of a robust urban forest

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School of Environmental & Forest Sciences

**Tree Ambassadors**

4 June 2020



So the tree rustles in the  
evening,

Trees have long  
thoughts,

long-breathing and  
restful,

just as they have longer  
lives than ours.

Hermann Hesse,  
*Trees: Reflections and Poems*



# Outline

**1. Trees and Human Health  
the evidence?**

**3. A focus on mental health**

**3. Dosage, equity  
& big trees**

# How are city trees associated with human health?



# Health is...

A state of complete physical, mental, and social well-being and not merely the absence of disease or infirmity

(World Health Organization, 1946)

## Social Determinants of Health



# Urban Trees & Human Health: A Scoping Review



## Purpose:

To carefully collect and synthesize the peer-reviewed evidence concerning urban trees and human health









Health  
Canada

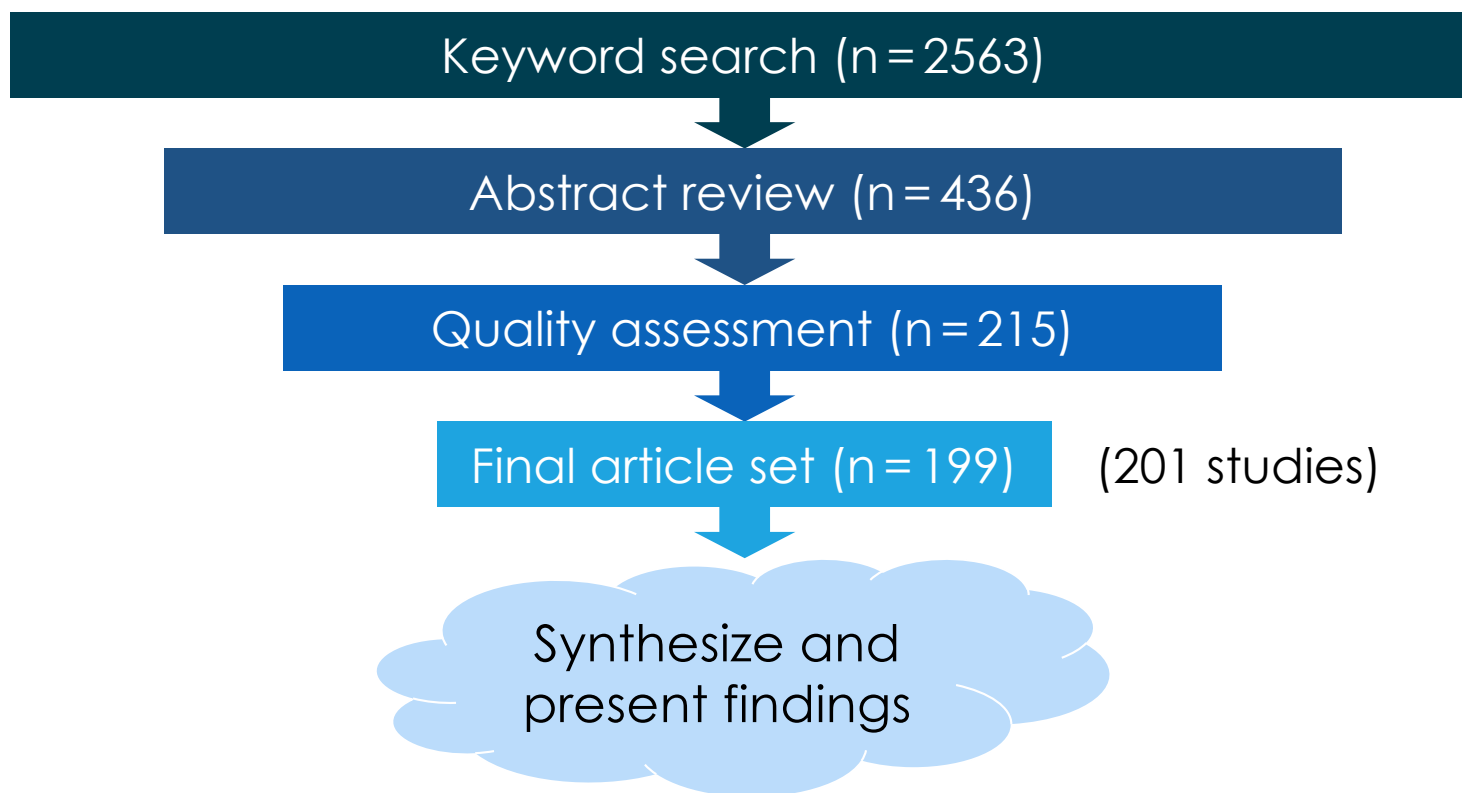
Santé  
Canada

**Canada**  
Natural Resources Canada  
Canadian Forest Service

# Project Team

-  Kathleen Wolf, Ph.D., University of Washington
  -  Sharon Lam, MSc, Ontario Climate Consortium
  -  Jennifer McKeen, MPH, Simon Fraser University
  -  Gregory Richardson, MUP, Health Canada
  -  Matilda Van Den Bosch, M.D, University of British Columbia
  -  Adrina Bardekjian, Ph.D., Tree Canada
-

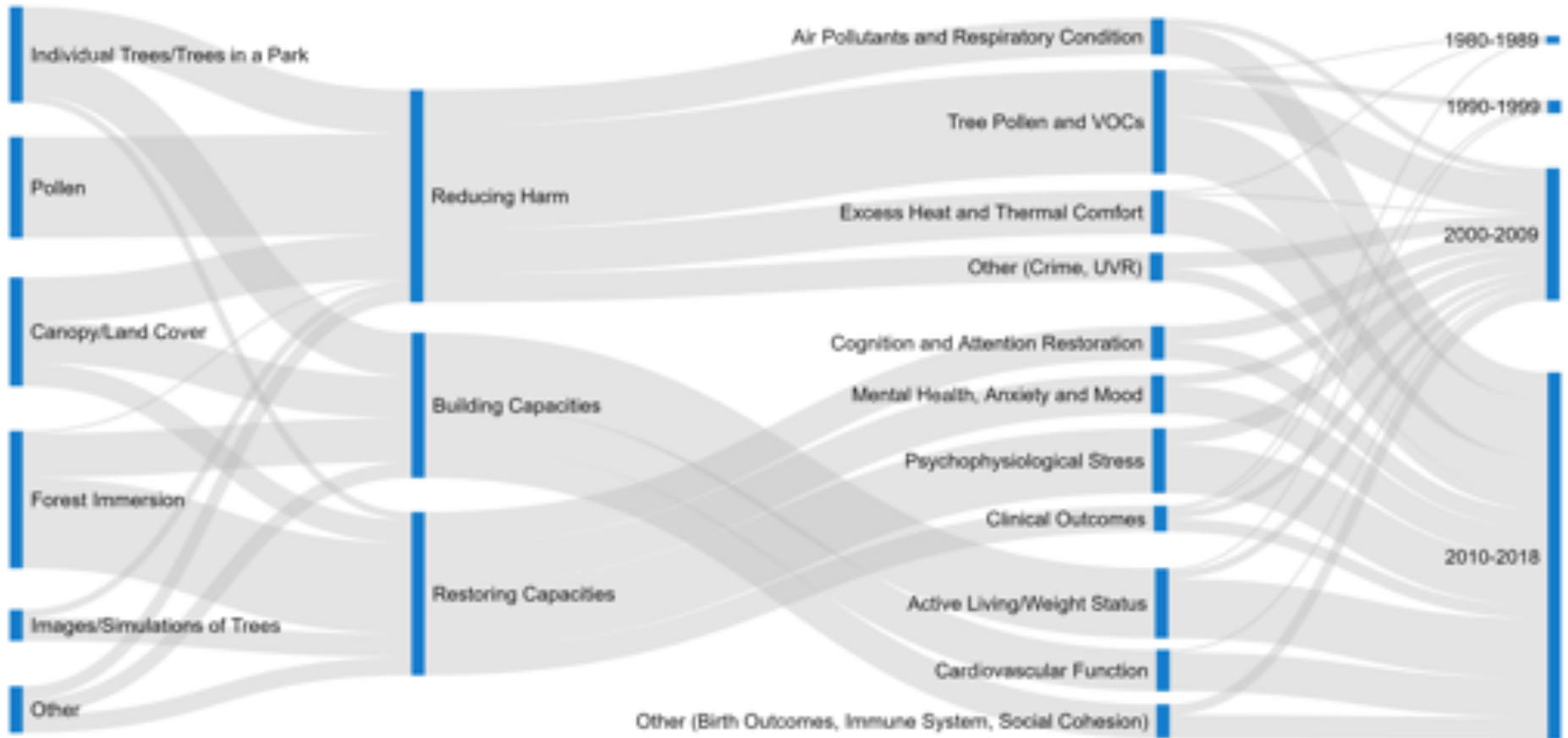
# Method



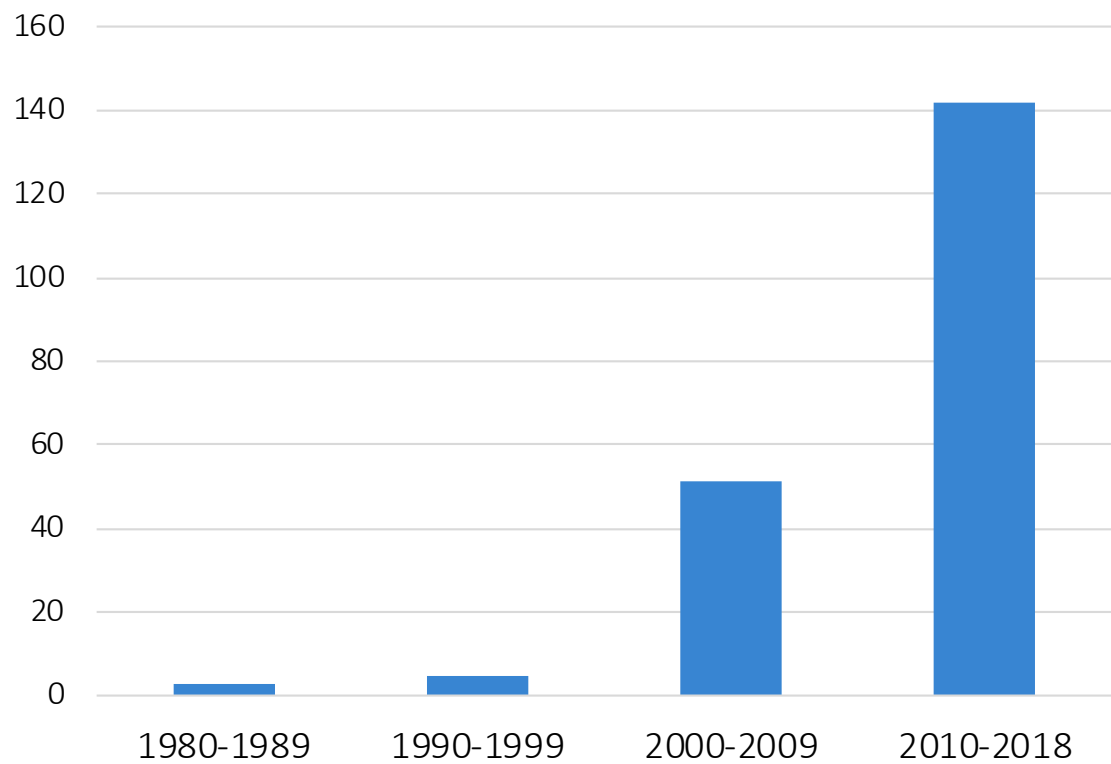


# Associations between urban trees & health

prepared by Sharon Lam



# What did we learn?



**Publication  
Dates  
by Decade**

# What did we learn?



single & park trees



pollen

credit: Univ of Utah



image/simulation



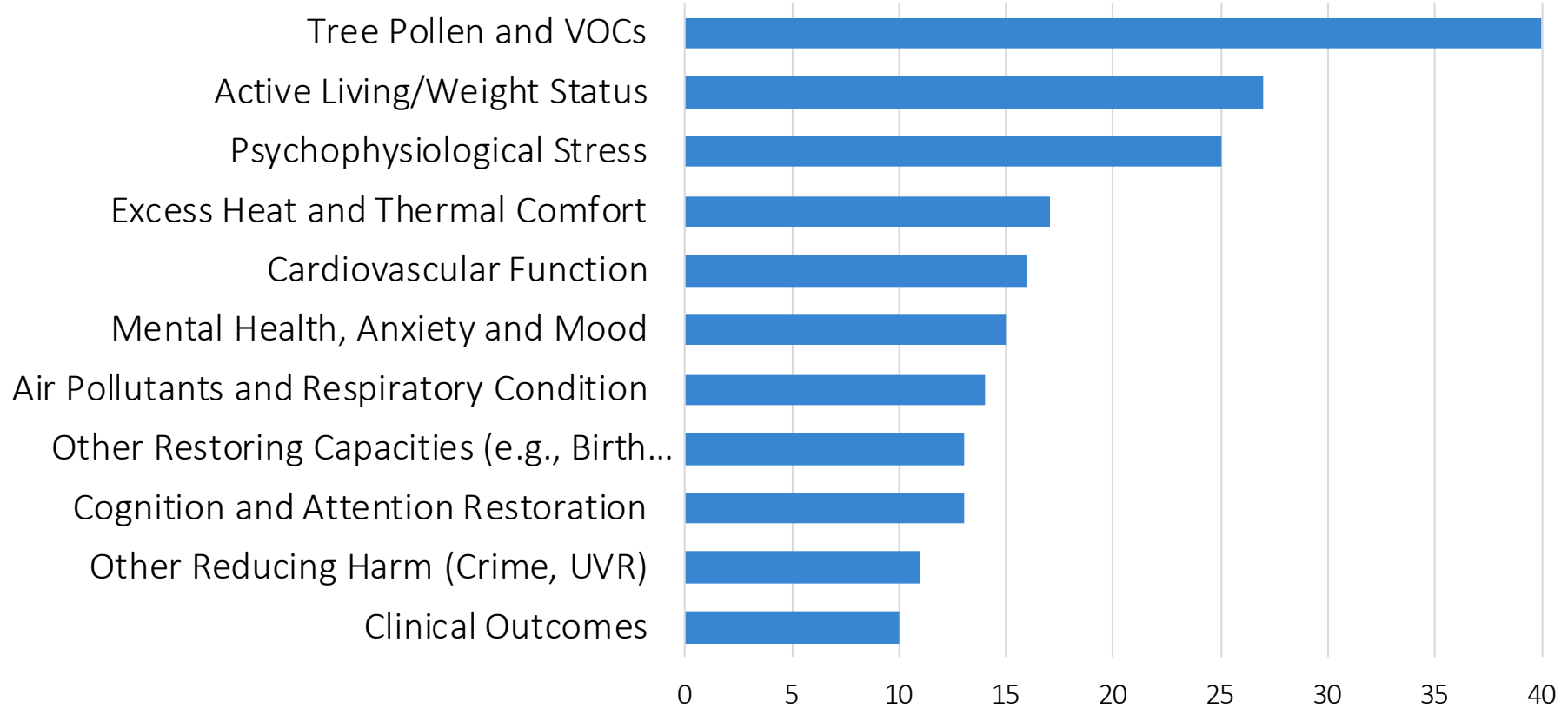
immersion



tree  
canopy/  
NDVI

# What did we learn?

## Health Outcomes Themes:



# Urban Forests & Newborns

the natural environment may affect pregnancy outcomes . . .

10% increase in tree-canopy cover  
within 50m of a house  
= lower number of low weight births  
(1.42 per 1000 births)

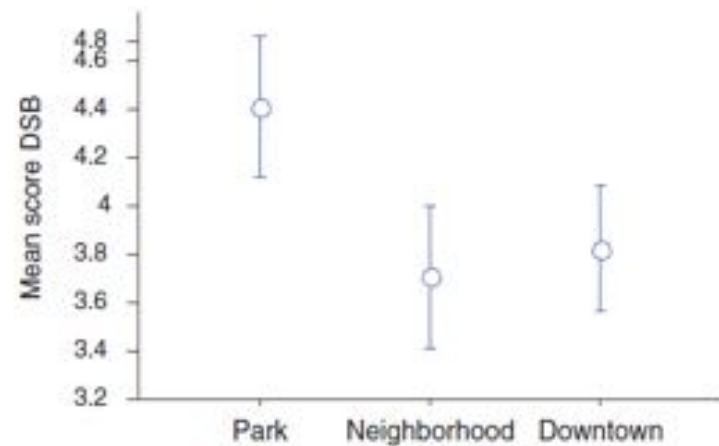


Donovan et al., 2011. *Health & Place* 2011; Hystad et al., 2014. *Env Health Perspectives*

# ADHD and nature contact

- 17 children aged 7-12 with diagnosed ADHD
- 20-minute guided walks
  - Park
  - Neighborhood
  - Downtown
- Pre-walk puzzles
- Post-walk cognitive test

Faber Taylor & Kuo. 2009.  
*Journal of Attention Disorders*



# Green High School Campuses

Matsuoka. 2010. *Landscape & Urban Planning*

- cafeteria & classroom window views with greater quantities of trees and shrubs
- positively associated with:
  - standardized test scores,
  - graduation rates
  - %s of students planning to attend a four-year college
  - fewer occurrences of criminal behavior



credit: NBC News



Children & Nature Network

**THE STATISTICS on CHILDREN & NATURE**



# Encouraging Physical Activity

**Review of studies of adults,  
natural environments vs indoors**

## Results of activity in natural environments:

- greater feelings of revitalization and positive engagement, increased energy
- decreases in tension, confusion, anger, and depression
- greater enjoyment and satisfaction, declared a greater intent to repeat the activity

Coon et al. 2011. *Environmental Science & Technology*



public health officials  
moderate activity  
recommendations



parks, active living, active transit

# Confounders?



Gender



Age



Education



Prior  
Conditions

# Pennsylvania Horticultural Society Clean & Green Program



reduced heart  
rate = less stress

South et al. 2015. *American  
Journal of Public Health*

reduced reports  
of depression &  
worthlessness

South et al. 2018. *JAMA  
Network*



# City Trees & Human Health

**newborn & infant health**

**increased physical activity for kids**

**student therapy**

**overall adult health**

**social cohesion**

**respiratory & cardiovascular health**

**reduced depression**

**elder care improvements**



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Mental health

## 'A high-risk perfect storm': loneliness and financial despair take toll on US mental health

Lockdowns have caused uncertainty, isolation, grief and economic despair, leading to a sharp rise in calls to helplines

By Nina Lakhani

**Nina Lakhani**

Fri 24 Apr 2020  
07:00 EDT



▲ 'In the first wave people were anxious, but now in the second wave people are feeling depressed and isolated, especially very poor people and those in violent situations.' Photograph: Justin Paget/Getty Images

The  
Guardian

Trees, Parks  
Green Space  
more than  
exercise!



Legacy Health, Portland OR

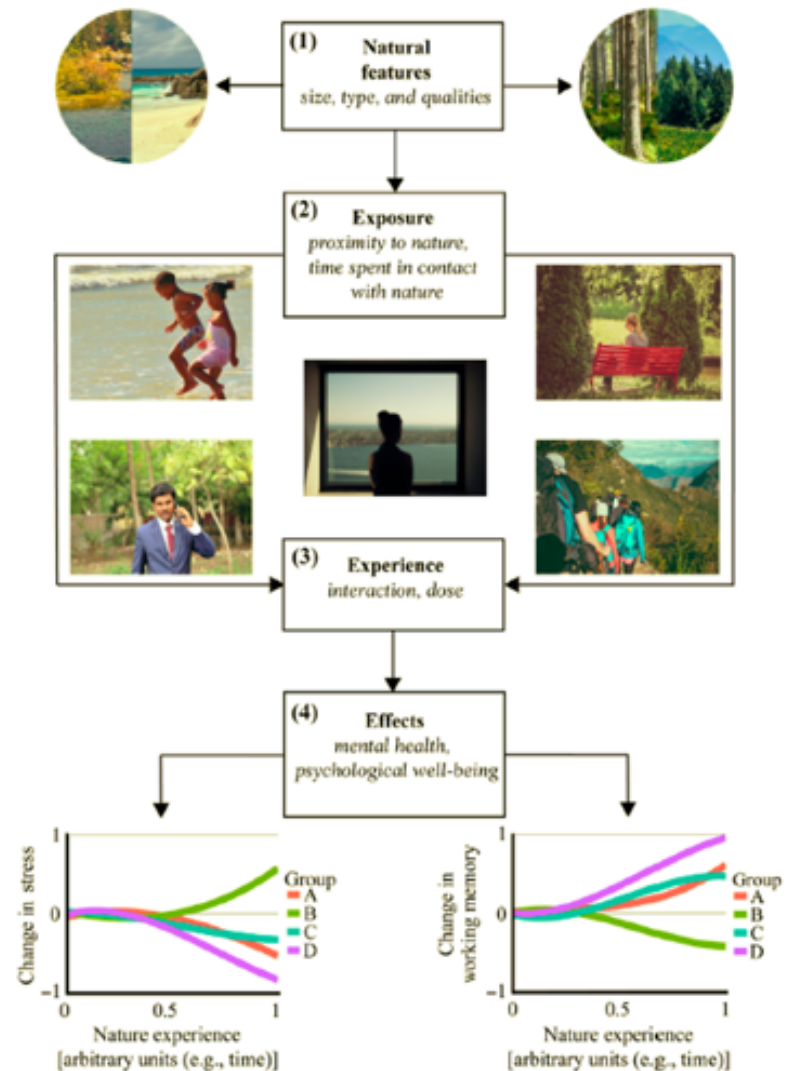




# Nature & Mental Health

experiences & pathways to psychological benefit

Bratman et al. 2019. *Science Advances*



## General Wellness



credit: UK National Health Service

## Therapy & Treatment



# Urban Trees & Green Space for Mental Health

## **general wellness:**

school performance  
stress reduction  
attention restoration  
creativity  
job burnout prevention

## **therapy:**

attention deficit  
emotional therapy  
depression reduction  
dementia & cognitive disorders  
special situations

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# Nature & Stress Response

8 week long experiment, 36 urban adults - chose the time of day, duration, and the place of nature experience based on personal preference and changing daily schedules

## Results:

salivary cortisol – stress biomarker, ~ 21% less  
20-30 minutes nature experience optimal

salivary amylase – stress biomarker, ~ 28% less  
for adults who were least active

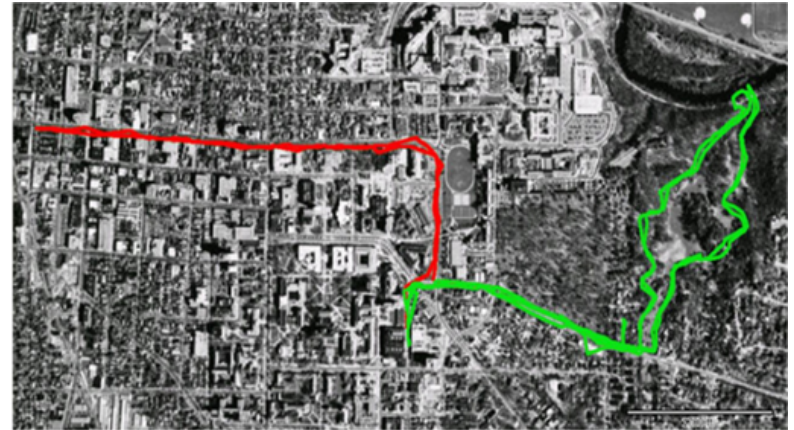


Hunter et al., 2019. *Frontiers in Psychology*

# Improving Depression

20 adults with major depression walk in park setting or built setting

- 50-minute walks one week apart
- before-after testing:
  - Mood: Positive and Negative Affect
  - Cognition: Backward Digit Span



cognitive and affective  
improvements after  
walking in a  
nature setting

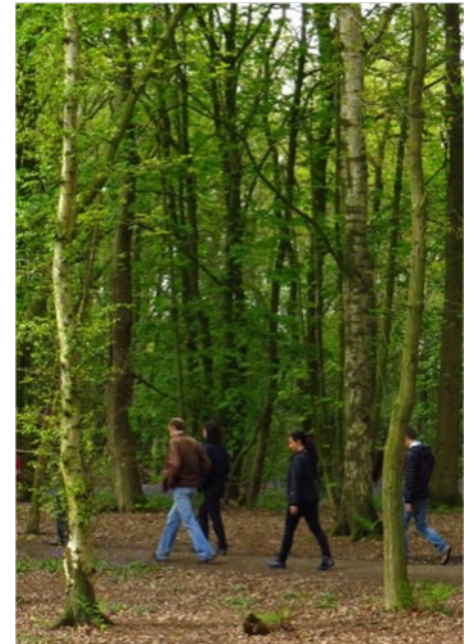
Berman et al. 2012. *Journal of Affective Disorders*

# Group Walks Improve Mental Health

England, Walking for Health national program  
test *Nature Group Walkers vs Non Group Walkers*

## results:

- lower depression, perceived stress, negative affect
- enhanced positive affect and mental well-being
- group walks synergize with physical activity to improve positive affect and mental well-being



David Whittaker

Marselle et al. 2014. *Ecopsychology*

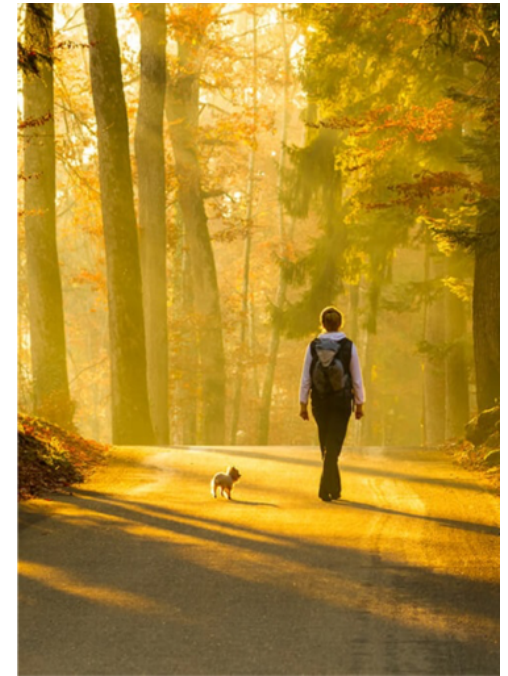
# How Walking in Nature Changes the Brain

**rumination:** Maladaptive self-referential thoughts, heightened risk for depression and other mental illnesses

## 90-min walk in a natural setting *decreased*

- self-reported rumination
- neural activity in the subgenual prefrontal cortex
- no reduced effects from built environment walks

Bratman et al. 2015. *Proceedings of the National Academy of Sciences of the USA*



Look4ward.com

# Attention Restoration Theory

- directed attention
- cognitive fatigue
- outcomes?  
frustration, impulsive,  
aggression

Rachel & Stephen Kaplan, University of MI





# ART Design Elements

- being away
- 'soft' fascination
- extent
- compatibility



Rachel & Stephen Kaplan, University of MI



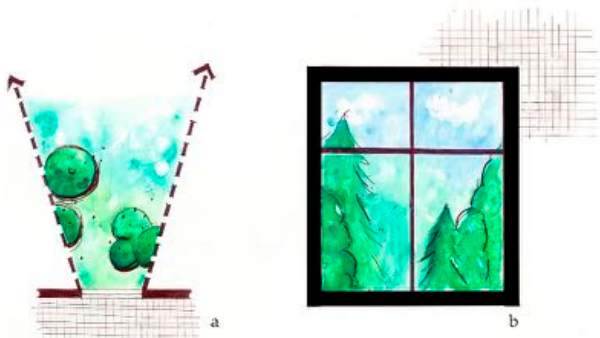
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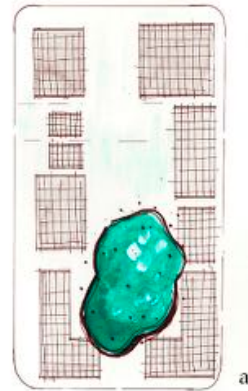
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**3. Dosage, and  
the role of big trees**

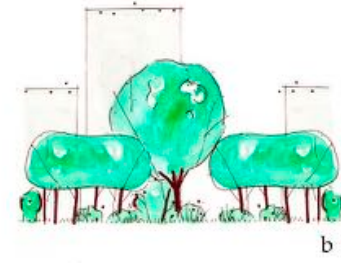
# Tree Planting for Health



**Views from Within**



**Create Refuge**



**Connect Experiences**

Barron, S., Nitoslawski, S., Wolf, K. L., Woo, A., Desautels, E., Sheppard, S. R. J. 2019. **Greening blocks: A conceptual typology of practical design interventions to integrate health and climate resilience co-benefits.** International Journal of Environmental Research and Public Health

# Nearby Nature in Community

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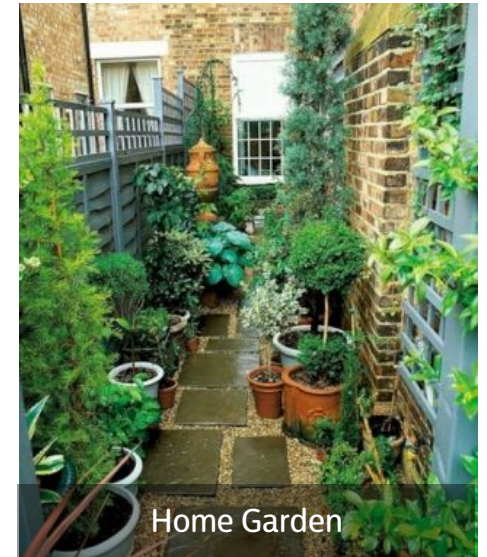
Public Parks & Gardens



Trees & the Urban Forest



Green Infrastructure



Home Garden

Equity and Accessibility :: 10 Minute Walk

# Biodiversity & Mental Health

vegetation cover &  
afternoon bird abundance

## Results:

lower prevalence of depression,  
anxiety & stress:

less depression – more than 20% cover

less anxiety – more than 30% cover

less stress – more than 20% cover

Cox et al. 2017. *BioScience* 67, 147-155.

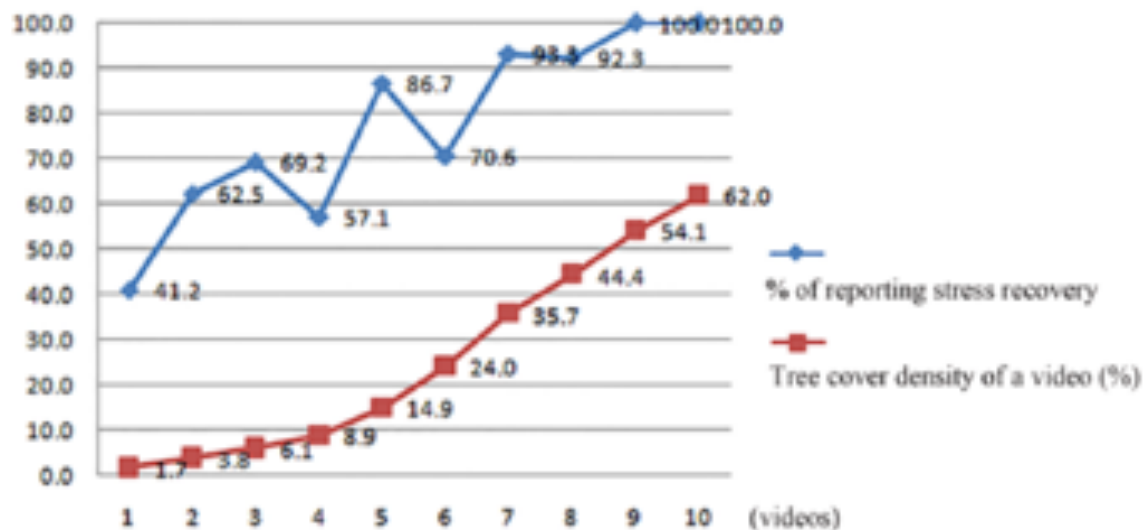


images of canopy cover varied 0-60%



Urban Forest  
Canopy  
Cover  
& Stress  
Response

## lab measures of stress after viewing images



## Urban Forest Canopy Cover & Stress Response

Jiang, et al. 2016. *Environment and Behavior* 48, 607-629.

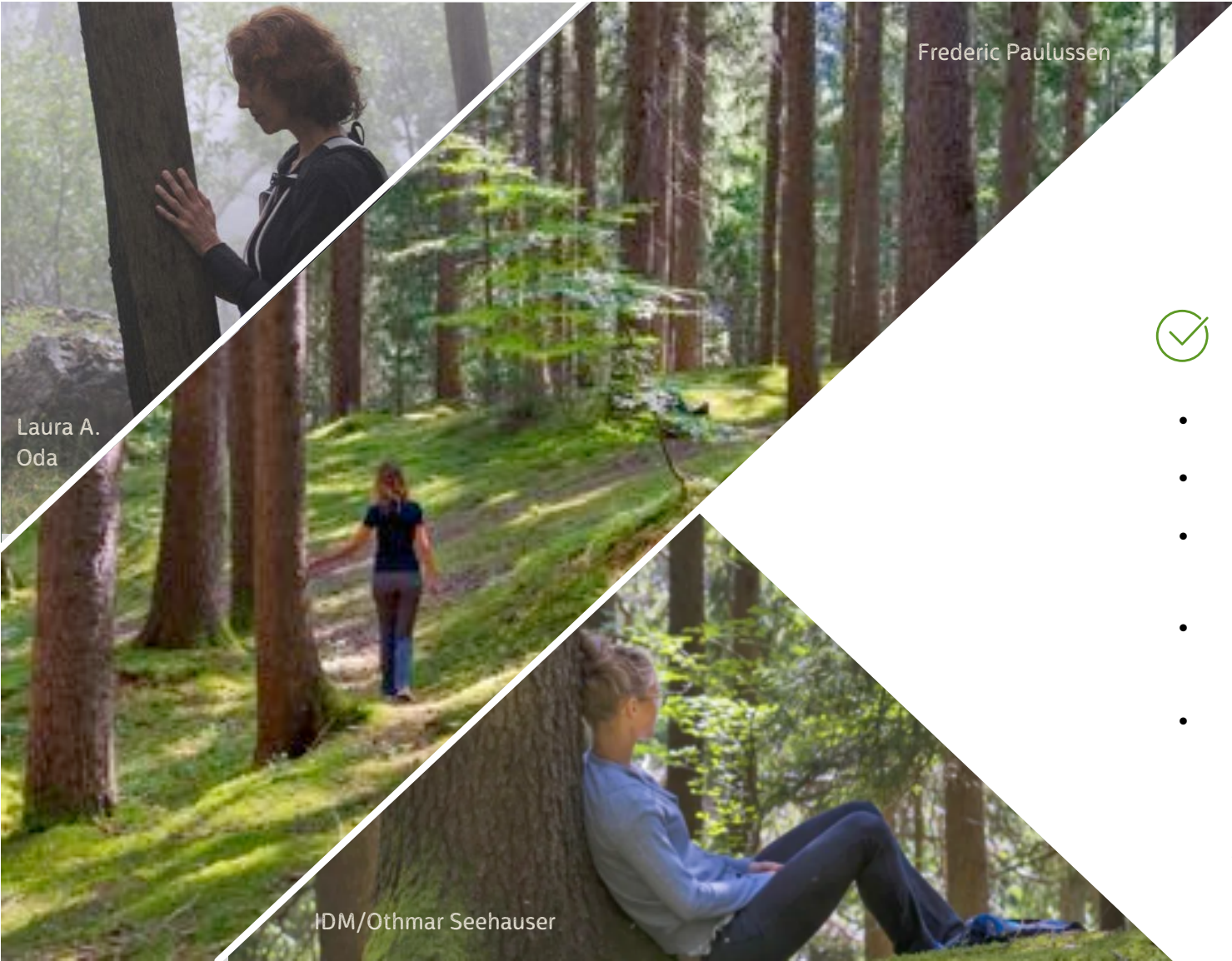
# Forest Bathing & Therapy *Shinrin yoku*



Suzanne Hackenmiller Bartlett

more than a decade of research – Japan, South Korea, northern Europe





Frederic Paulussen

Laura A. Oda

IDM/Othmar Seehauser

# Forest Bathing



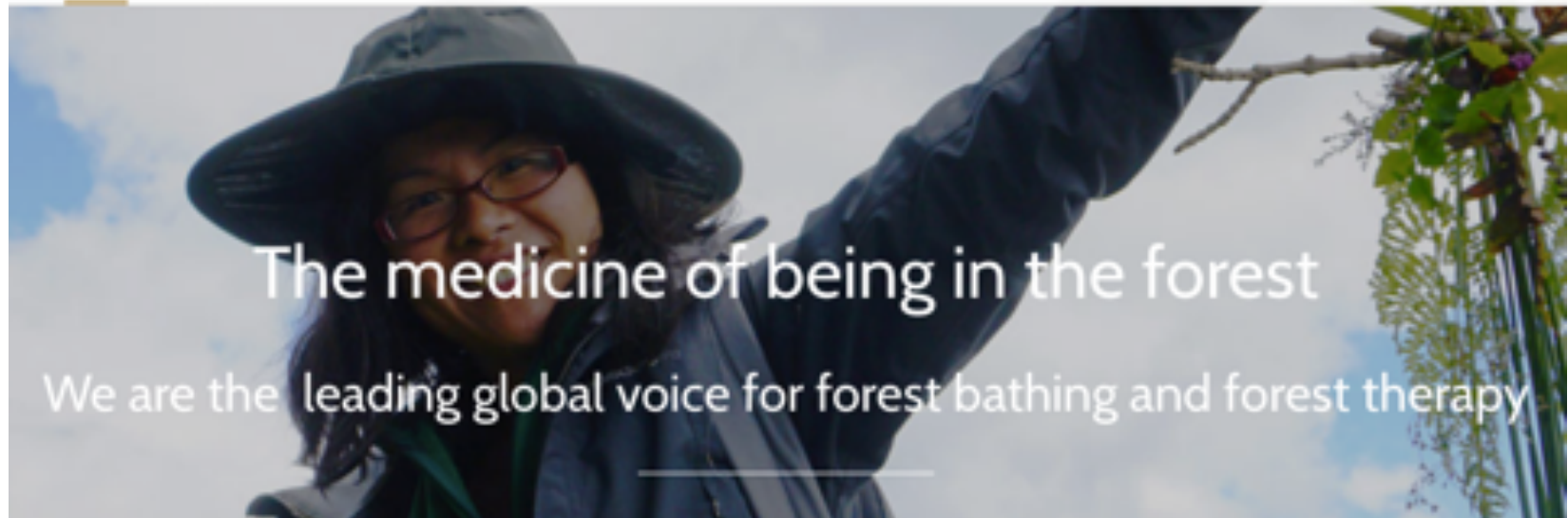
immersion experiences, hours to days, often guided

- improved mood, reduced anxiety
- reduced stress, lower cortisol
- improved nervous system activity, less fight or flight response
- improved diabetes symptoms, reduced blood glucose
- improved pulse rate, blood pressure

Park et al., 2010. *Env Health and Preventive Medicine*  
Li et al. 2006. *Immunopharmacology and Immunotoxicology*



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**Santa Rosa, California**

# How can green space planning protect & promote human health?



# DOSAGE



STRESS  
20-30 min  
session

Hunter et al. 2019.  
*Frontiers in Psychology*



DEPRESSION  
BLOOD PRESSURE  
> 30 min  
per week

Shanahan et al. 2016  
*Scientific Reports*



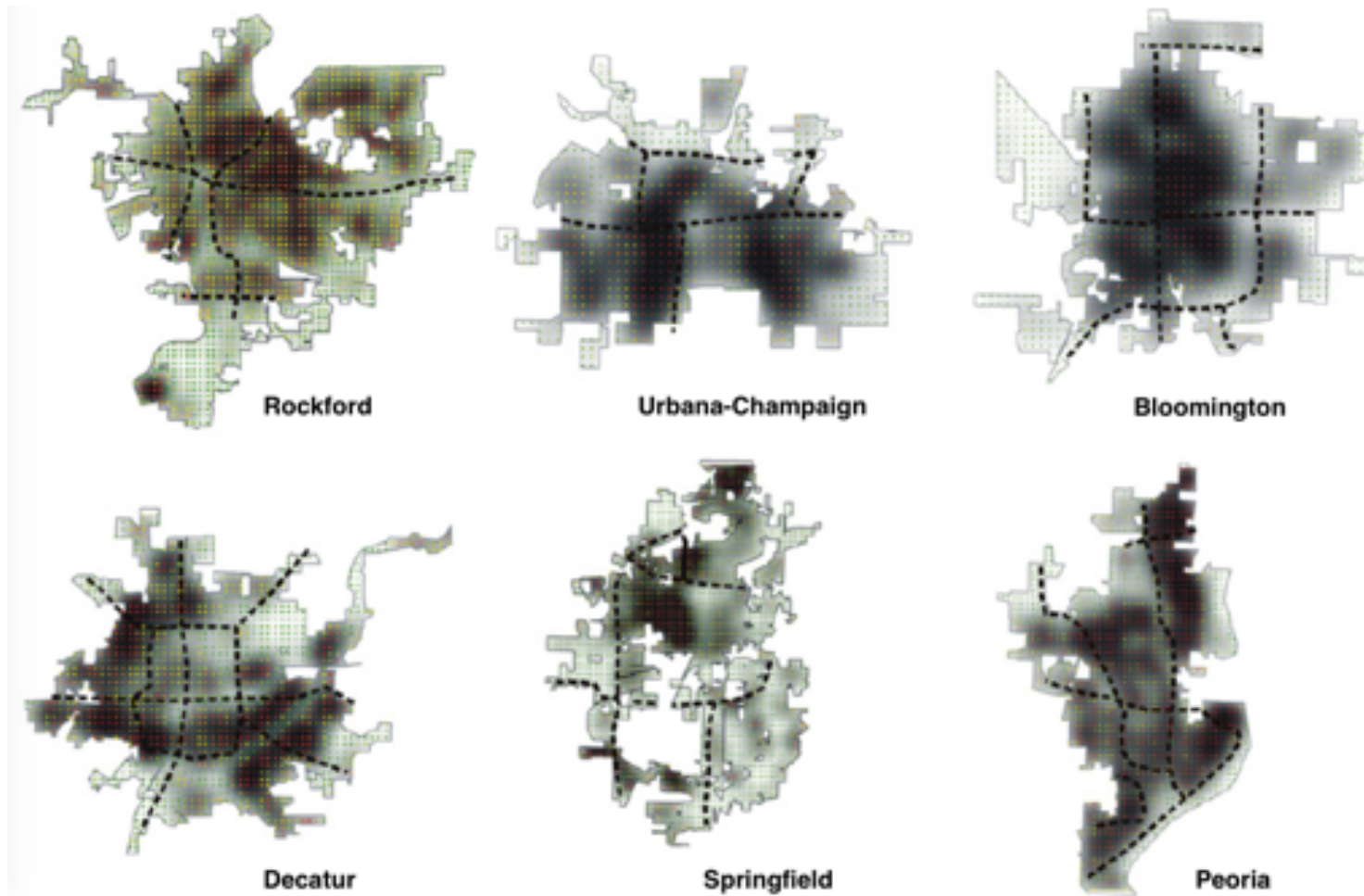
DEPRESSION  
1 garden visit  
per week  
(peak 4-5)

Cox et al. 2017 *Int J of  
Environmental Research  
& Public Health*



HIGH  
WELL BEING  
120 min  
per week  
(peak 200-300)

White et al. 2019 *Scientific  
Reports*



Zhou, X., Kim, J. 2013. Social disparities in tree canopy and park accessibility: A case study of six cities in Illinois using GIS and remote sensing. *Urban Forestry & Urban Greening*



## 2016 Seattle Urban Tree Canopy Analysis

LiDAR imagery

goal 30%,  
now 28%

report at:  
<http://www.seattle.gov/trees/canopycover.htm>

thanks to  
Sandra Pinto de Bader  
City of Seattle



## 2016 Seattle Urban Tree Canopy Analysis

degree of existing  
tree canopy for  
each of Seattle's  
neighborhoods



## 2016 Seattle Urban Tree Canopy Analysis

Map Key  
for each Seattle  
Census tract

% people of color  
(color intensity  
within tract)

% tree canopy  
(size of circle)





*Figure 14. Figure describing percent tree canopy in relation to people of color. Each dot represents an EEA polygon.*

Environmental  
Equity  
trees  
forest canopy  
parks  
natural areas







The tree which moves some to  
tears of joy is, in the eyes of others,  
only a green thing that stands in  
the way.

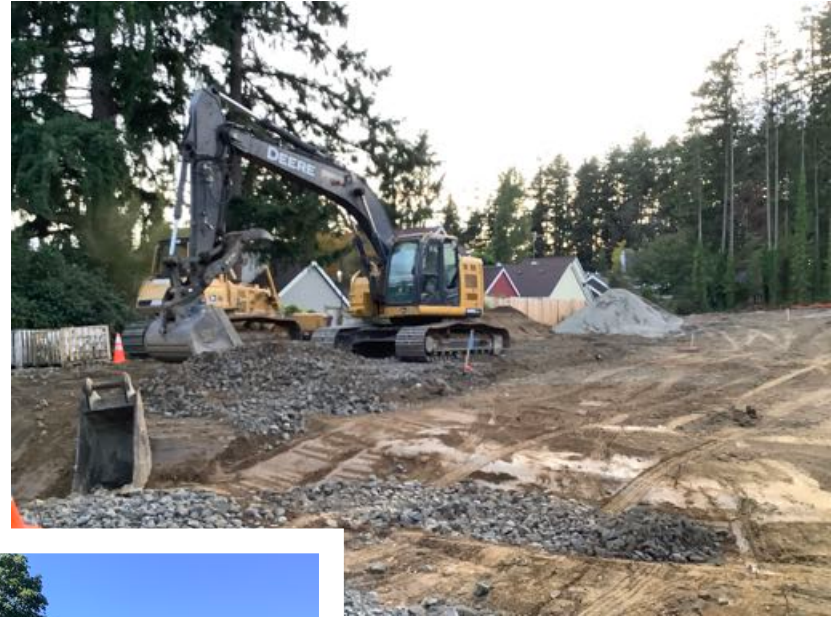
Some see nature all ridicule and  
deformity . . . and some scarce  
see nature at all.

But to the eyes of the man of  
imagination, nature is  
imagination itself.

William Blake



rosalie cushman







# Summary

- City trees & nature provide benefits for human health - protective therapeutic
- More & larger trees provide more benefit – evidence!
- Address equity & health social determinants
- Tree retention & promotion policies?



www.naturewithin.info

College of the Environment University of Washington

## Human Dimensions of Urban Forestry and Urban Greening

featuring research on peoples' perceptions and behaviors regarding nature in cities

**What's New?**

- Nature and Consumer Environments**  
Research about how the urban forest influences business district visitors.
- Trees and Transportation**  
Studies on the value of having quality landscapes in urban roadsides.
- Civic Ecology**  
Studies of human behaviors and benefits when people are active in the environment.
- Policy and Planning**  
Integrating urban greening science with community change.
- Urban Forestry and Human Benefits**  
More resources, studies and links . . .

**Green Cities and Health**  
human health & well-being research

Projects Director  
**Kathleen L. Wolf, Ph.D.**

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