Why are trees important?
human health and economics

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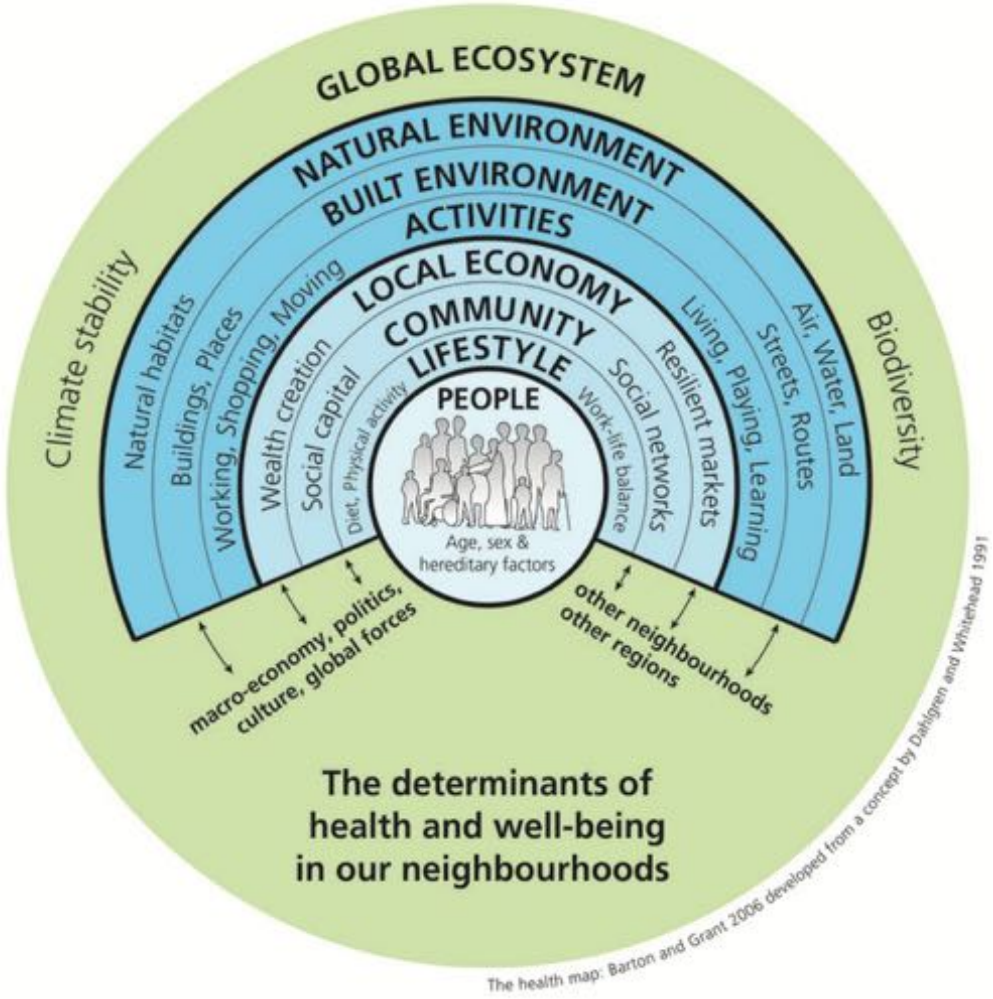
Tree Fund Webinar Series

19 November 2019

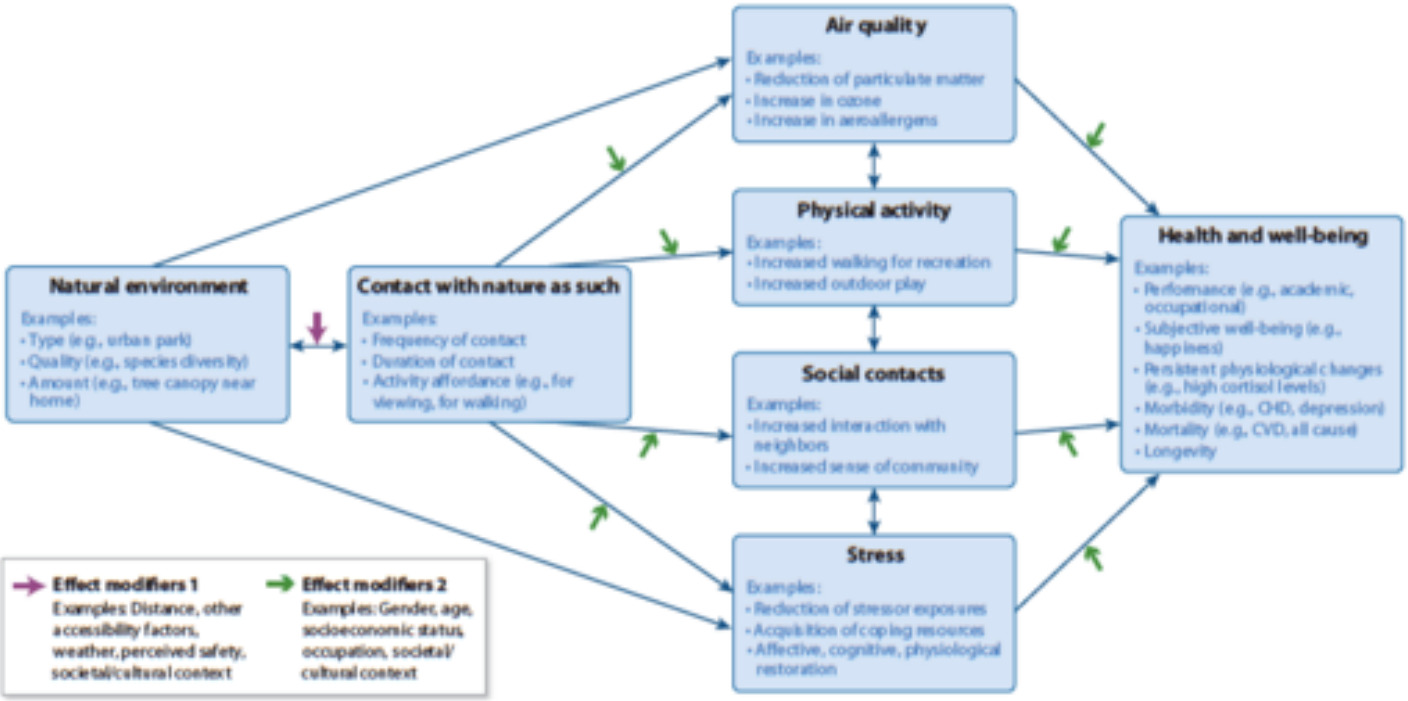
Health is…

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

(World Health Organization, 1946)



Best available science – nature & health?



Hartig, T., R. Mitchell, S. de Vries, and H. Frumkin. 2014. Nature and Health. Annual Review of Public Health 35, 1: 207-228.

Green Cities: Good Health

www.greenhealth.washington.edu

Sponsors:
USDA Forest Service,
(U&CF Program + Pacific NW Research)
University of Washington
NGO partners

Thanks!
to U of WA students:
Katrina Flora
Mary Ann Rozance
Sarah Krueger

Research Reviews & Summaries

Urban Forestry/Urban Greening Research

Green Cities: Good Health

Local Economics

Trees in cities are not grown and managed for products that can be bought and sold on markets, but they do provide many intangible services and functions! This article serves two purposes. First, it introduces valuation methods that are used to convert intangible benefits to dollar sums.[1,2] Then, it shows how nonmarket valuations can support local decision-making.

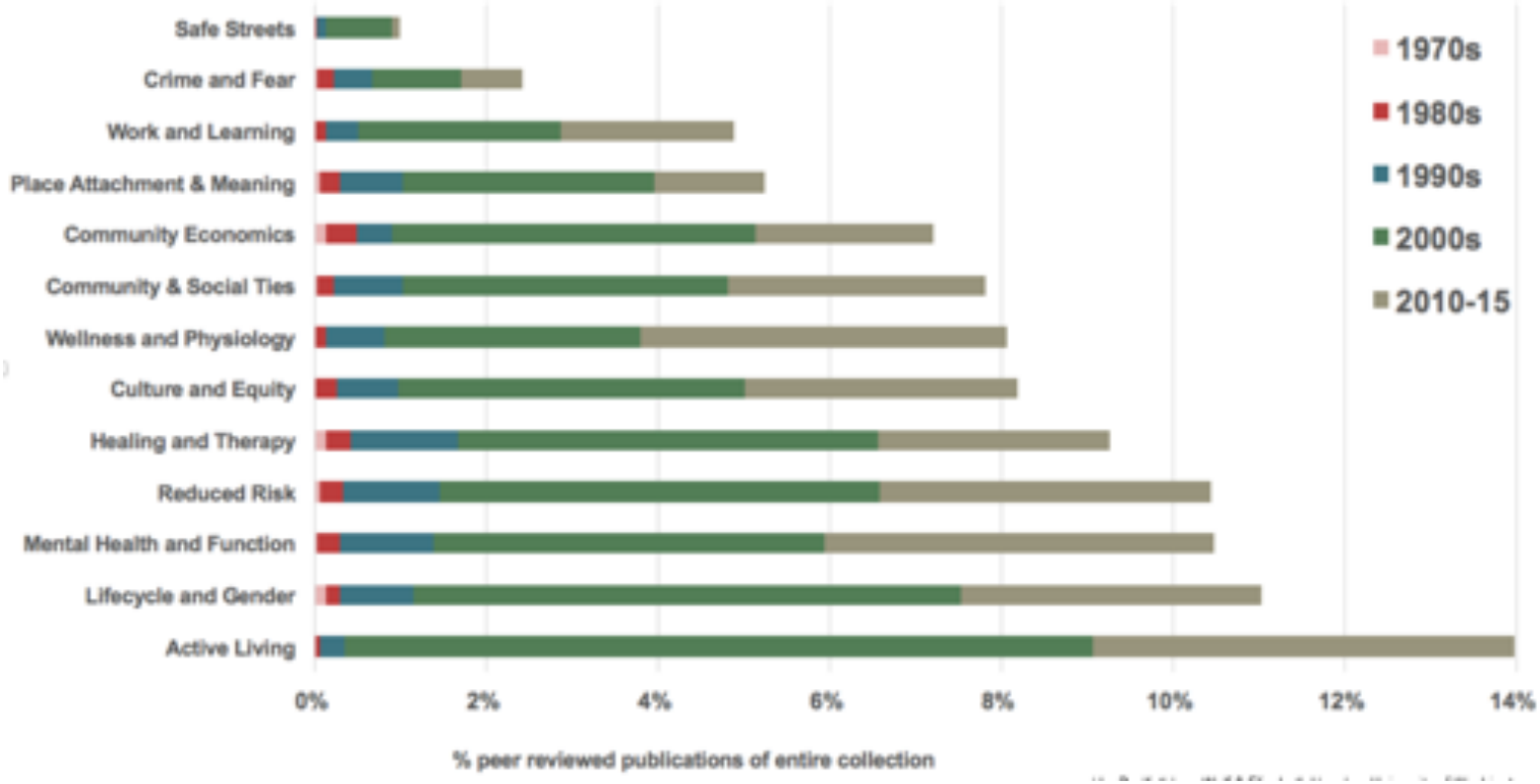
street trees boost market value of houses, providing tax revenue for communities

Fast Facts

- The presence of larger trees in yards and as street trees can add from 3% to 15% to home values throughout neighborhoods.
- Averaging the market effect of street trees on all house values across Portland, Oregon yields a total value of $1.35 billion, potentially increasing annual property tax revenues $15.3 million.[9]
- A study found 7% higher rental rates for commercial offices having high quality landscapes.[14]
- Shoppers claim that they will spend 9% to 12% more for goods and services in central business districts having high quality tree canopy.[34]
- Shoppers indicate that they will travel greater distance and a longer time to visit a district having high quality trees, and spend more time there once they arrive.[34]

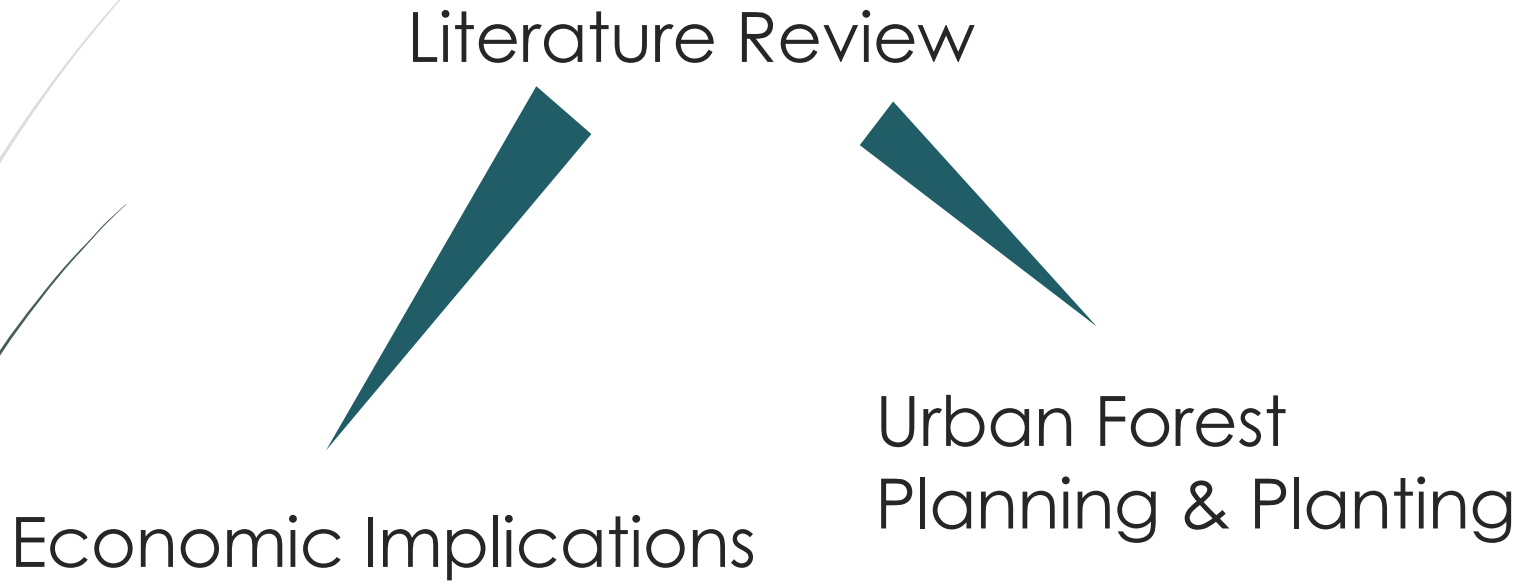
Green Cities: Good Health

database of >4,500 peer reviewed publications

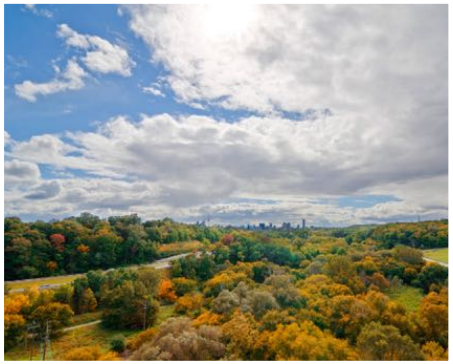


How are urban trees associated with human health?

Urban Trees & Human Health



Urban Trees & Human Health: A Scoping Review




Purpose:

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

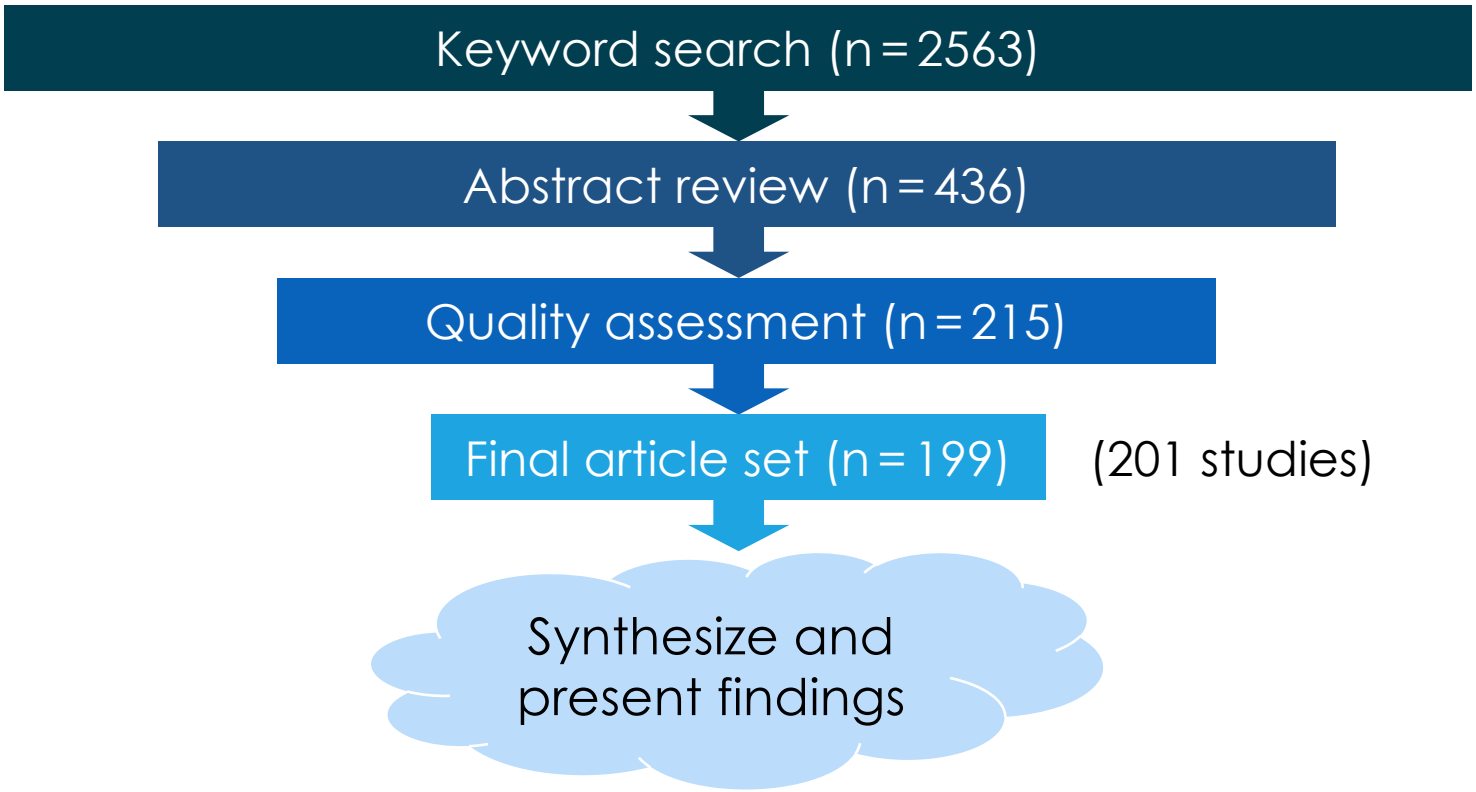
Health Canada Santé Canada

Canada
Natural Resources Canada
Canadian Forest Service

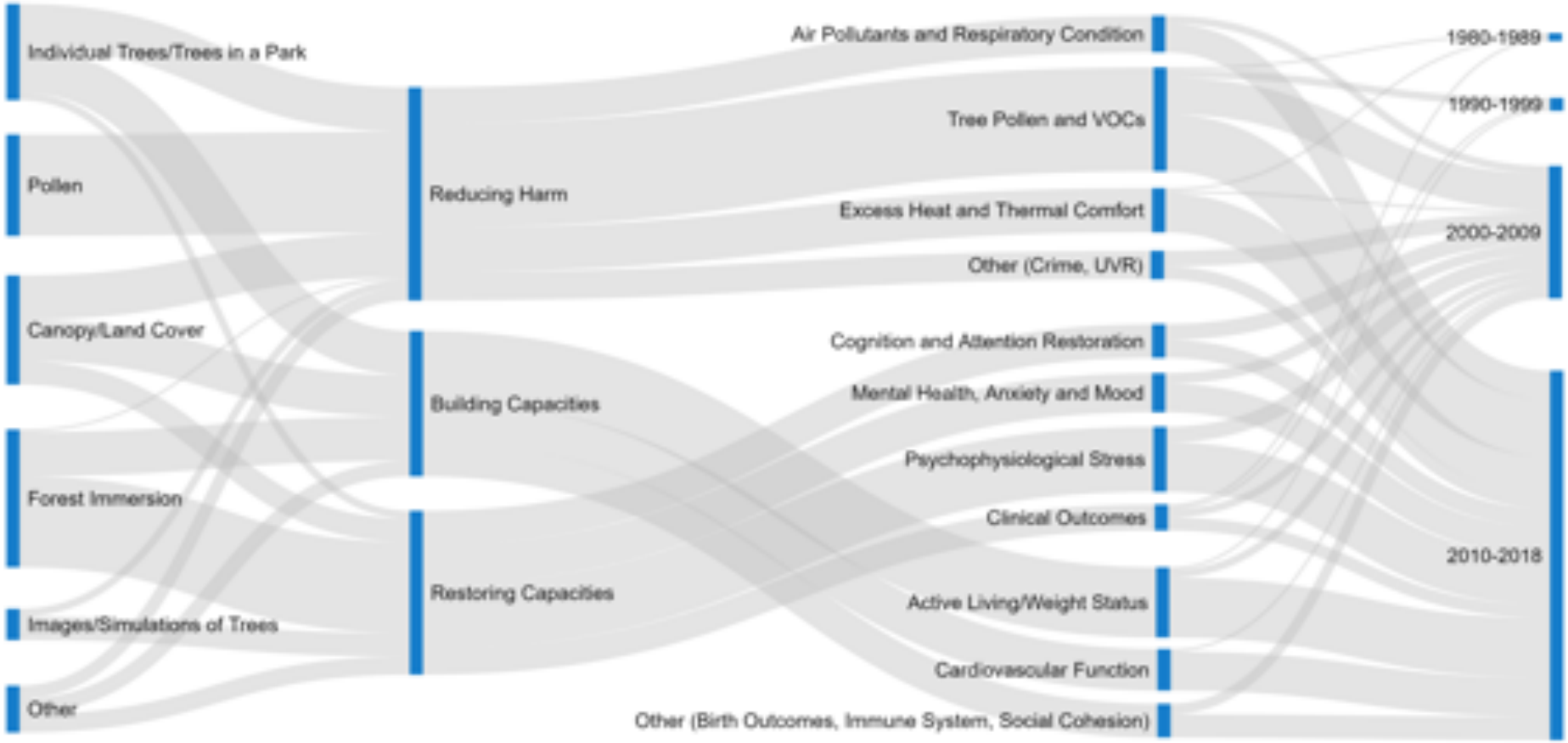
Project Team

- Kathleen Wolf, Ph.D., University of Washington
- Sharon Lam, MSc, University of Toronto
- 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


Keyword search (n = 2563)
Abstract review (n = 436)
Quality assessment (n = 215)
Final article set (n = 199)
(201 studies)
Synthesize and present findings

Associations between urban trees & health



What did we learn?

single & park trees

pollen

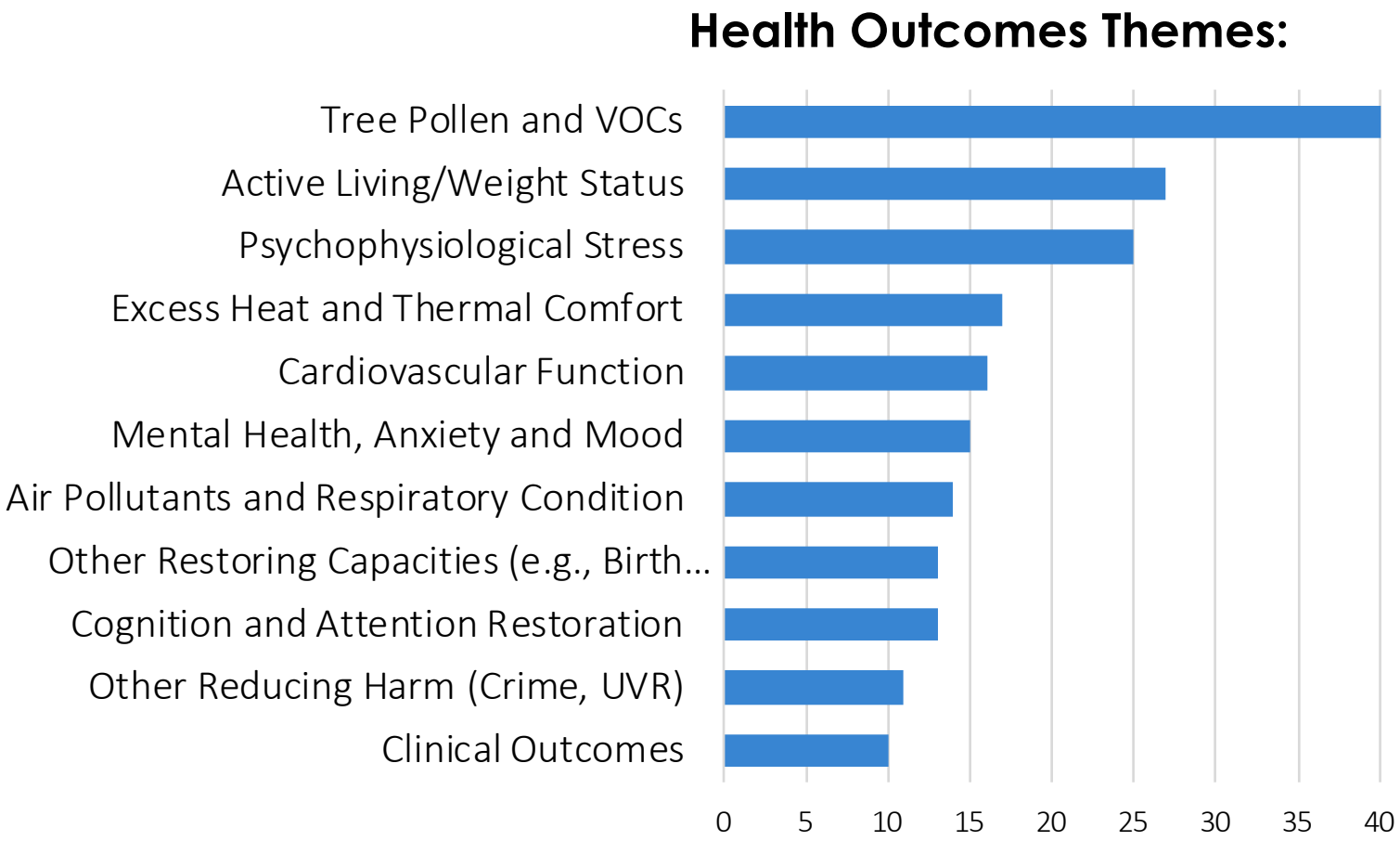
credit: Univ of Utah

image/simulation

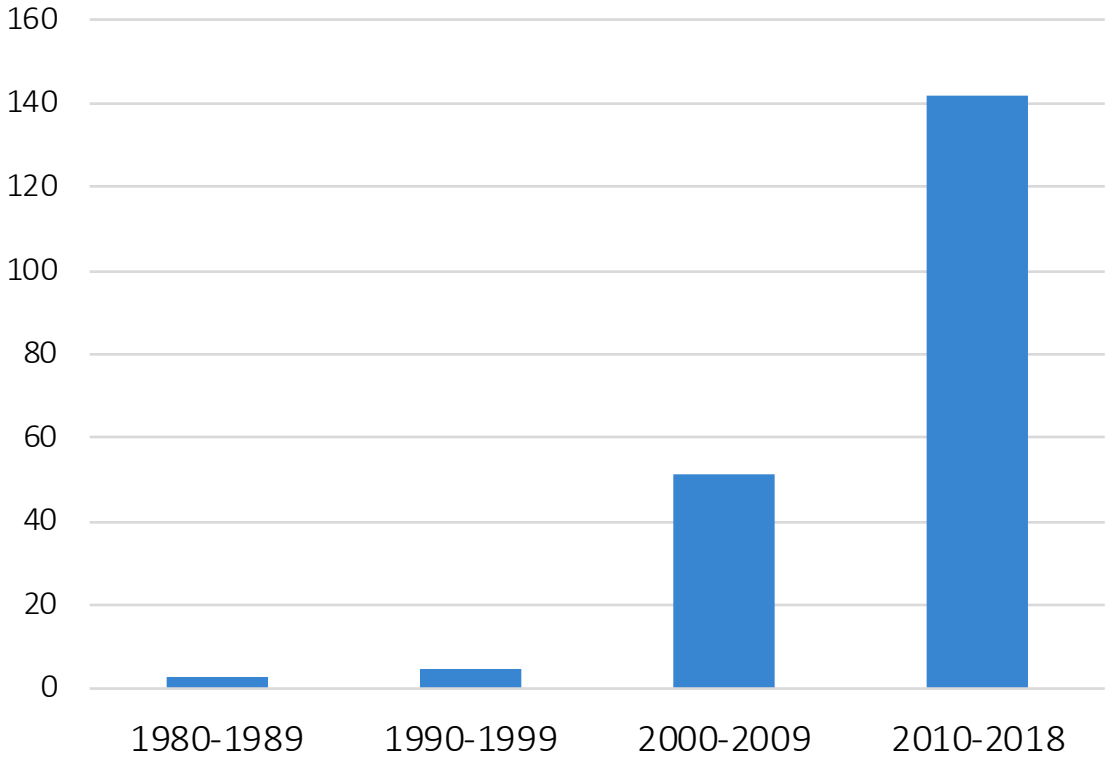
immersion

tree canopy/ NDVI

What did we learn?



What did we learn?



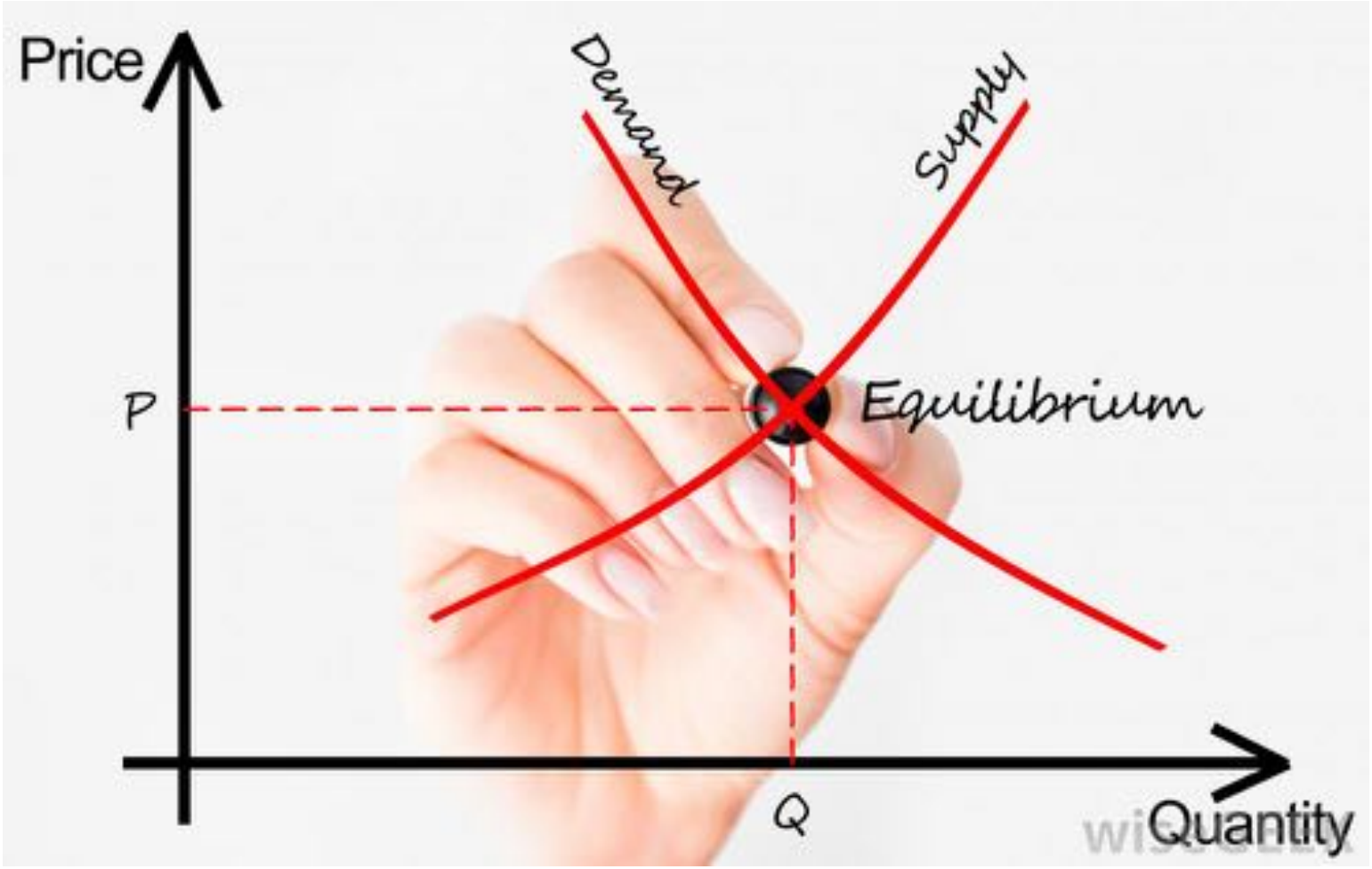
Publication Dates by Decade

Urban Trees & Human Health

Literature Review

Economic Implications

Urban Forest
Planning & Planting

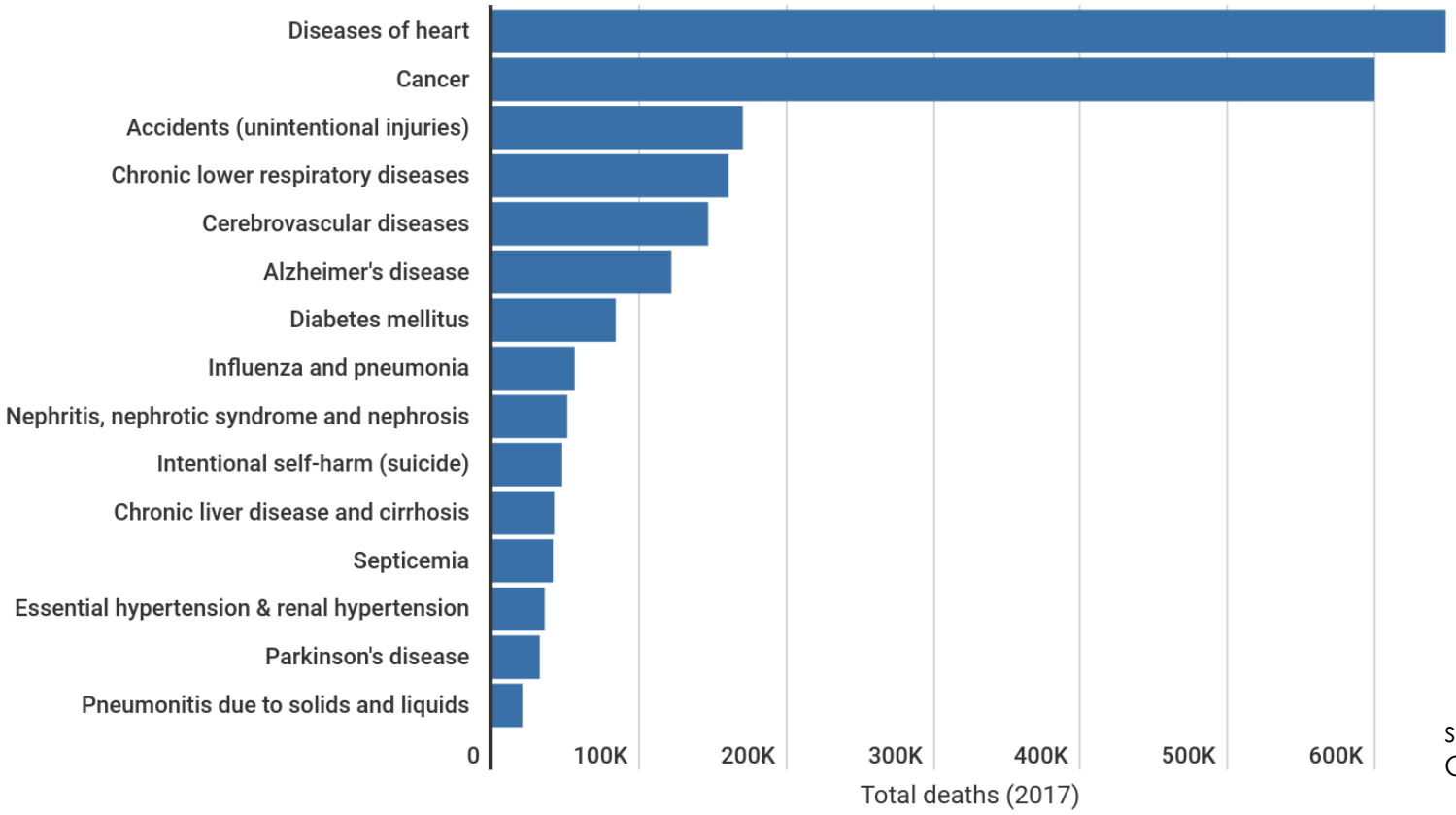


source.wisegeek.com

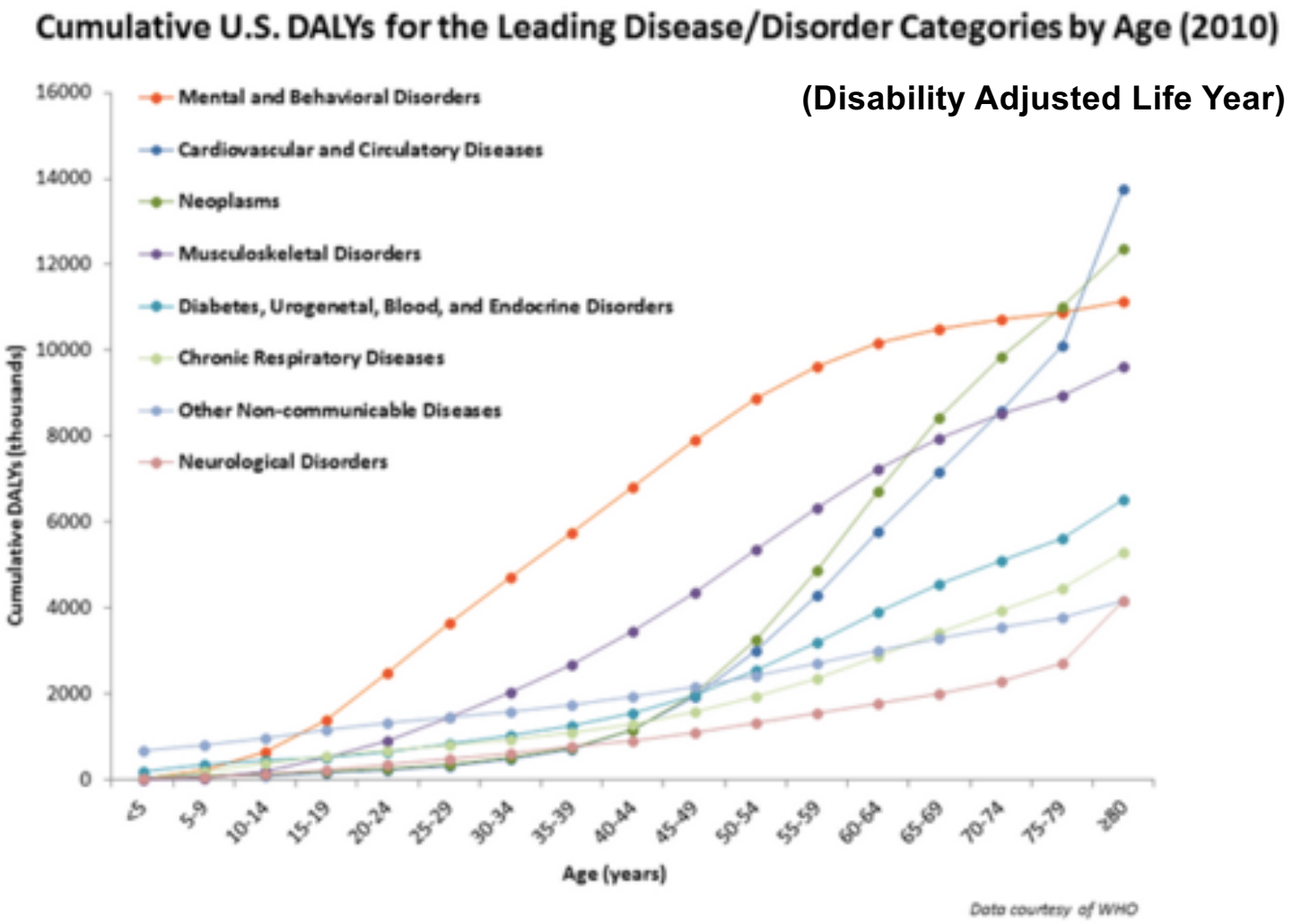
Health Care Spending in U.S.

- $10,348 annual per capita (2016)
- $3.5 trillion total
- 17.9% of Gross Domestic Product

15 Leading Causes of Death in U.S., 2017

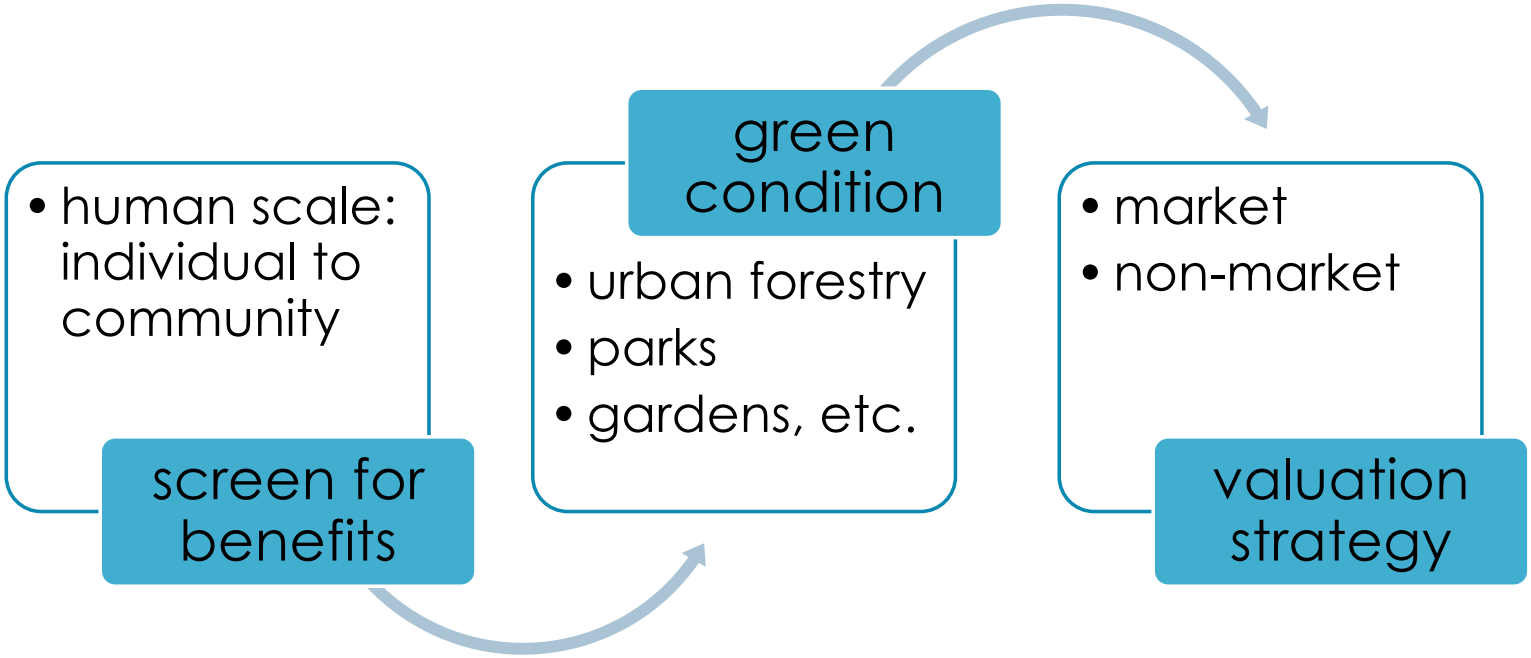


source: U.S. Centers for Disease Control and Prevention



costly chronic diseases

Nature & Health Economics Analysis Process



Nature & Health Annual Savings

Millions of U.S. Dollars (2012)

Benefit (geographic scope)	Minimum ($)	Maximum ($)
Newborn Health (U.S.)	5.3	5.3
Attention Deficit Hyperactivity Disorder (U.S.)	383.5	1,917.7
Schools (U.S.)	20.4	1,262.9
Crime (U.S.)	340.6	899.4
Cardiovascular Disease (U.K., U.S.)	1,220.0	1,220.0
Alzheimer's Disease (U.S.)	724.6	1,449.2
Totals	**2,694.4**	**6,754.5**

Wolf, K.L., M.K. Measells, S.C. Grado, A.S.T. Robbins. 2015. Economic values of metro nature health benefits: A life course approach. Urban Forestry and Urban Greening.

design: milepost

author: USDA Forest Service

printing: The Nature Conservancy

Nearby nature experiences are important across the entire life cycle, from cradle to grave.

Research about nature benefits and economic value is fairly new. Some of the quantified health benefits of nature in cities are easier to convert to economic value than others. Here are some preliminary valuations - estimated for the entire U.S. on an annual basis.

INFANTS

BIRTH WEIGHT

POTENTIAL ECONOMIC VALUE:
$5.6M SAVINGS ON ANNUAL HEALTH CARE COSTS.

Birth weight influences long-term childhood health and development, and has been linked to some adult diseases. Low birth weight is associated with both short- and long-term health care costs, such as longer hospital stays and increased illness. Pregnant women that have more tree canopy and green space near their homes generally have babies with healthier birth weights.

IMMUNE FUNCTION

ECONOMIC IMPLICATION:
STRONGER IMMUNE SYSTEM LEADS TO REDUCED ILLNESS AND CHRONIC DISEASE ACROSS A LIFETIME.

We are most vulnerable in the early months of our lives, when the body and mind are growing and developing at an astonishing rate. The 'hygiene hypothesis' suggests that early contact with outdoor microorganisms stimulates the development of a healthy immune response.

FAMILY DYNAMICS

ECONOMIC IMPLICATION:
IMPROVED FAMILY DYNAMICS, PERHAPS REDUCING MENTAL HEALTH TREATMENT AND COUNSELING SERVICES.

An infant's parents and siblings adjust their lives after a baby arrives, and the changes can bring on stress and anxiety. Nature views and walks help reduce these conditions and improve interactions between people within the household.

Note: All economic values are in 2016 U.S. dollars, and are potential annual savings across the entire U.S.

CHILDREN & TEENS

OVERALL HEALTH AND WELL-BEING

ECONOMIC IMPLICATION:
INCREASED PHYSICAL ACTIVITY, REDUCED ASTHMA (A LEADING CAUSE OF EMERGENCY DEPARTMENT VISITS, HOSPITALIZATIONS AND MISSED SCHOOL DAYS), AND REDUCED RISK OF ADULT SKIN CONDITIONS.

Negative conditions in a child's surroundings can cause both immediate and ongoing health impacts. Nature is a positive influence; playing in nature helps children develop learning, social, and intellectual skills that improve both health and later life achievement. Green spaces clean the air our children and teens breathe, give them space for moderate to vigorous activity, and shade them from too much sun exposure.

ADHD

POTENTIAL ECONOMIC VALUE:
$266.5B-$1.0B ON MEDICATION SAVINGS PER YEAR.

Millions of children ages 3-17 are treated for Attention Deficit Hyperactivity Disorder (ADHD) in the U.S. Nature exposure is a potential alternative treatment; studies show that activity within nature or green spaces, such as play or just 20 minutes of walking, can reduce symptoms.

FUTURE FINANCIAL SUCCESS

POTENTIAL ECONOMIC VALUE:
$1.3B INCREASE IN HIGH SCHOOL GRADUATES' LIFELONG ANNUAL INCOMES.

School performance affects both near-term self-esteem and long-term success. Having green views from classrooms and common spaces in schools can improve students' capacity to direct attention and feel less stressed. Green high school campus landscapes are linked to higher graduation rates.

ADULTS

DEPRESSION AND STRESS

ECONOMIC IMPLICATION:
REDUCES FRUSTRATION, MENTAL DISTRESS AND DEPRESSION DISORDERS, AND IMPROVES BODY IMAGE, SELF-ESTEEM AND LIFE SATISFACTION.

Busy, highly scheduled lifestyles take their toll. Nature experiences reduce stress. Nearly 16 million adults experience major depression each year in the U.S., and mental, behavioral, and neurodevelopmental disorders are a leading cause of disability. Nature experiences support respite and mindfulness for improved mental health, mood, and life function. Improved mental health and function reduces disease treatment costs, and improves worker productivity.

CARDIOVASCULAR DISEASE

POTENTIAL ECONOMIC VALUE:
$1.1-$1.3B ANNUAL SAVINGS, BASED ON A 1-2% REDUCTION IN HISTORIC EXPENDITURES.

Cardiovascular Disease is the leading cause of premature death in the U.S. People show slightly reduced risk of CVD if their neighborhoods have greater nature coverage (particularly tree canopy), however it is worth noting the majority of studies have focused on men.

CRIME & SAFETY

POTENTIAL ECONOMIC VALUE:
$850M IN REDUCED COSTS OF CRIME FOR VICTIMS AND PROPERTY OWNERS PER YEAR.

Personal safety and security are important conditions for quality of life. The presence of nature in neighborhoods – community gardens, forest canopy, and landscaped vacant lots – is associated with reduced personal and property crime.

OLDER ADULTS

MOBILITY & QUALITY OF LIFE

POTENTIAL ECONOMIC VALUE:
$1.7-$2.4B SAVINGS ON HEALTH CARE COSTS FROM FALLS PER YEAR.

One in three older adults falls each year, giving rise to fatal and nonfatal injuries. Residents' falls within older care facilities are particularly expensive medical situations. Being out in nature sustains personal mobility, leading to reduced falls and reduced need for medications. Further, those who are socially isolated are more likely to be unhealthy, so gardening and nature walking activities that promote social interactions support positive lifestyles and quality of life.

HYPERTENSION

POTENTIAL ECONOMIC VALUE:
$1.3-$2.6B SAVINGS ON TREATMENT COSTS ANNUALLY.

Hypertension, or high blood pressure, is one of the five most expensive conditions impacting older adults. Views of nature, particularly forests, and 'forest bathing' (casual walks in naturalistic forest settings) decrease diastolic rates.

COGNITIVE DISORDERS

POTENTIAL ECONOMIC VALUE:
$1.1-$2.5B ANNUAL SAVINGS ON MEDICAL SERVICES, NOT COUNTING THE VALUE OF HOME CAREGIVERS' SERVICES.

About one in five older adults experience mental and cognitive disorders, with age being the greatest risk factor. In 2016, about 13% of people aged 65 or older were afflicted with Alzheimer's disease. Those with dementia have three times as many hospital stays per year as other elders. Encounters with nature improve symptoms related to cognitive disorders, such as agitation, depression, and reduced mobility.

contributing analysts:
Dr. Stephen Grado & Marcus Measells, MSU; Dr. Alicia Robbins, Weyerhaueser

Urban Forests for Human Health:
A Focused Economic Valuation

Healthy trees are rooted in research!

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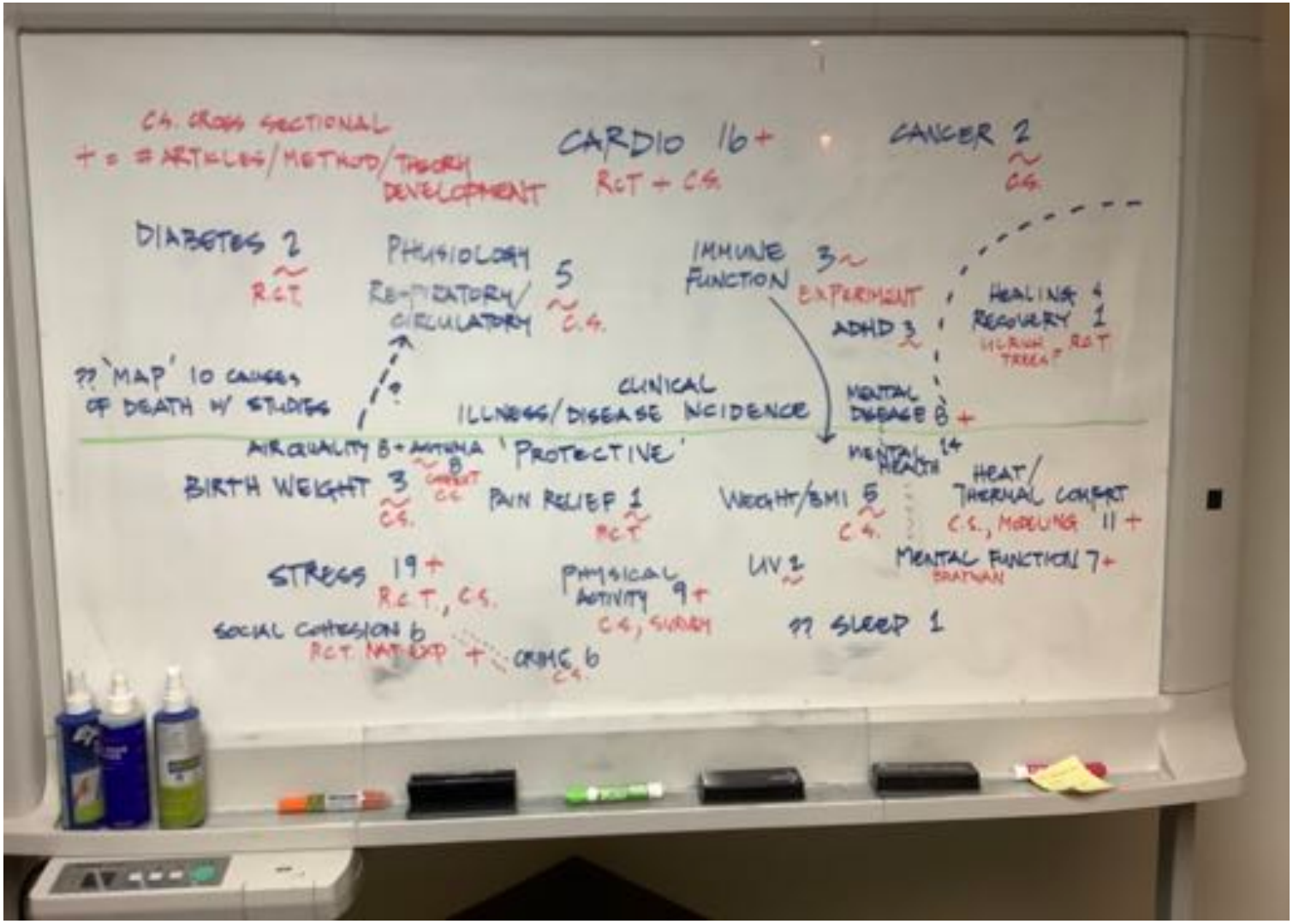
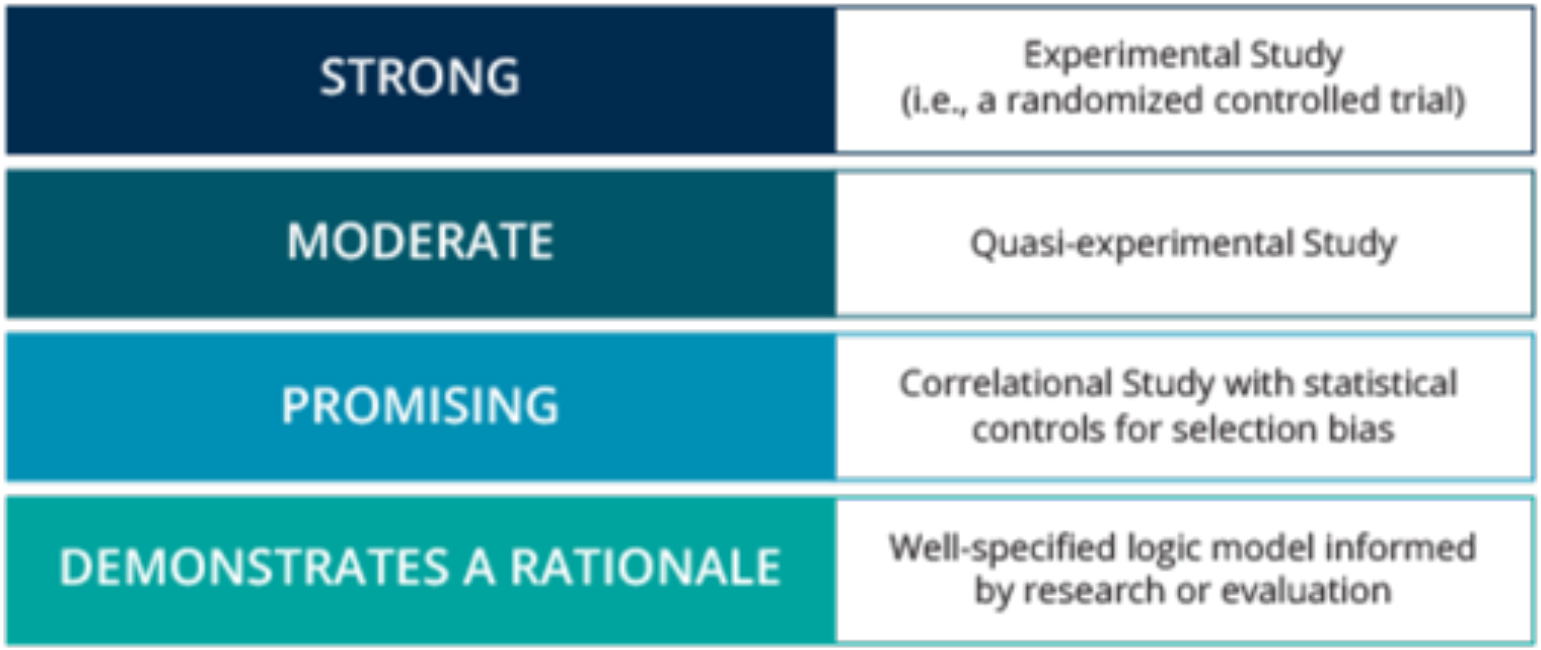

CS. CROSS SECTIONAL
+ = # ARTICLES/METHOD/THEORY DEVELOPMENT
CARDIO 16+
RCT + CS.
CANCER 2
~ CS.
DIABETES 2
~ RCT
PHYSIOLOGY
RESPIRATORY/ CIRCULATORY 5
~ C.S.
IMMUNE FUNCTION 3~
EXPERIMENT
ADHD 3
HEALING RECOVERY 1
RCT
?? 'MAP' 10 CAUSES OF DEATH W/ STUDIES
CLINICAL ILLNESS/DISEASE INCIDENCE
MENTAL DISEASE 8+
AIR QUALITY 8+ ASTHMA 8 'PROTECTIVE'
MENTAL HEALTH 14
BIRTH WEIGHT 3 ~ CS.
PAIN RELIEF 1 ~ RCT
WEIGHT/BMI 5 ~ C.S.
HEAT/ THERMAL COMFRT C.S., MODELING 11+
STRESS 19+ RCT, CS.
PHYSICAL ACTIVITY 9+ CS, SURVEY
UV 2 ~
MENTAL FUNCTION 7+
?? SLEEP 1
SOCIAL COHESION 6 RCT, NAT EXP +
CRIME 6 CS

Strength of Evidence



source: PearsonSchool.com

Trees & Health Valuation Potential

cancer

diabetes, respiratory illness, asthma, healing/recovery

cardiovascular disease, mental disease, ADHD

strength of evidence

clinical illness & disease incidence

Health Care Costs **clinical illness & disease incidence**

illness or disease	annual costs (U.S.)	source
hospital stay/recovery	$1.1 trillion (2017)	debt.org
diabetes	$327 billion (2017)	American Diabetes Association
mental disease	$201 billion (2013)	Health Affairs journal
cardiovascular disease	$200 billion (2015)	Centers for Disease Control & Prevention
ADHD	$143 billion (2013)	American Academy of Child and Adolescent Psychiatry
asthma	$82 billion (2013)	American Thoracic Society
respiratory illness	$36 billion (2010)	American College of Chest Physicians

Trees & Health Valuation Potential

physical activity, weight control, UV screen, better sleep

birth weight, pain relief, crime reduction, thermal comfort

stress reduction, mental function, social cohesion

strength of evidence

health & wellness 'protection'

Avoided Costs = Health Savings

ELSEVIER

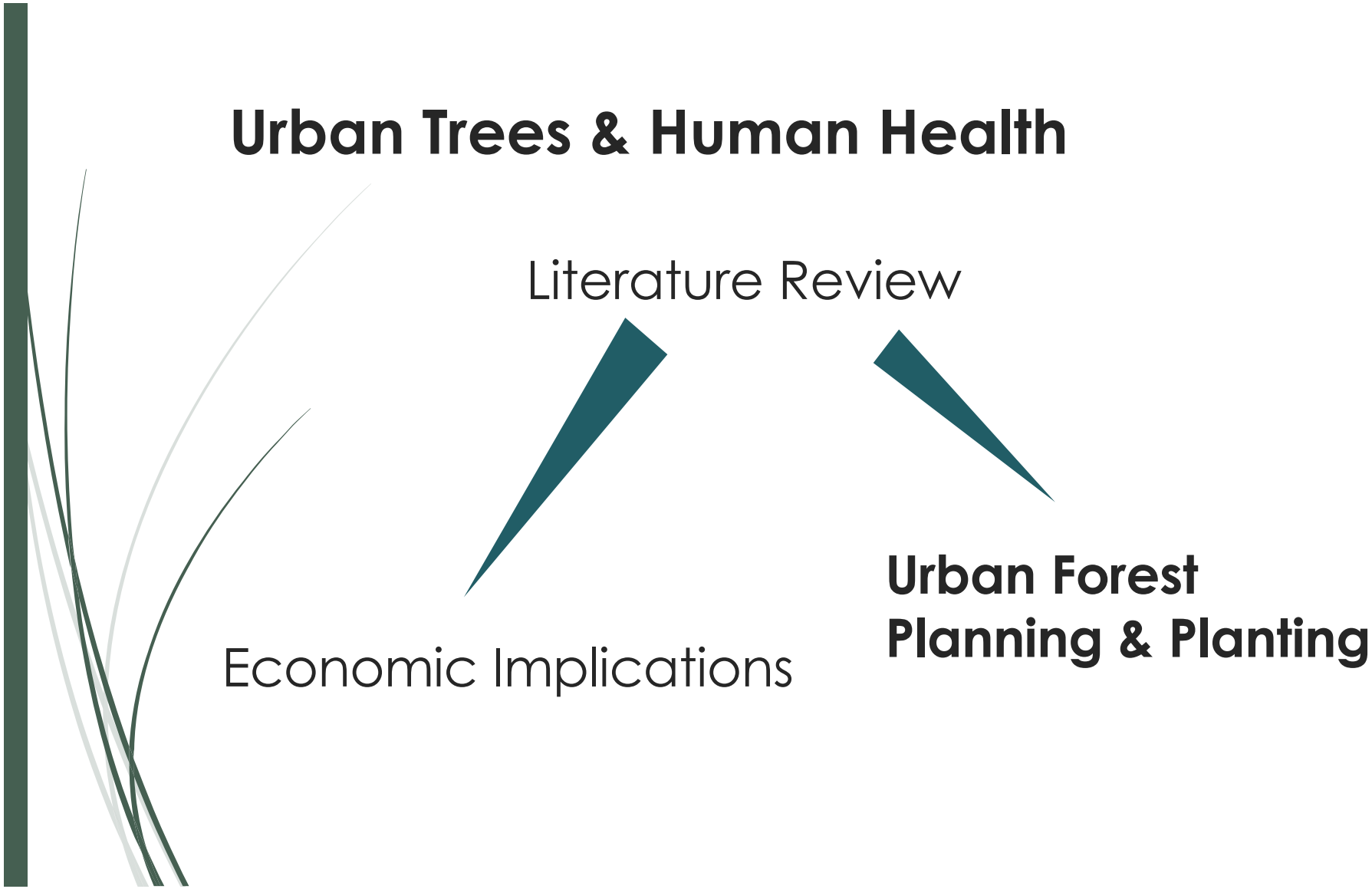
Urban Forestry & Urban Greening

Volume 41, May 2019, Pages 39-47

Is green land cover associated with less health care spending? Promising findings from county-level Medicare spending in the continental United States

Douglas A. Becker [a], Matthew H.E.M. Browning [a, b], Ming Kuo [a], Stephen K. Van Den Eeden [c]

Urban Trees & Human Health



Urban forest management for human health
'Trees are Good' but could they be better?

have evidence re: trees & health

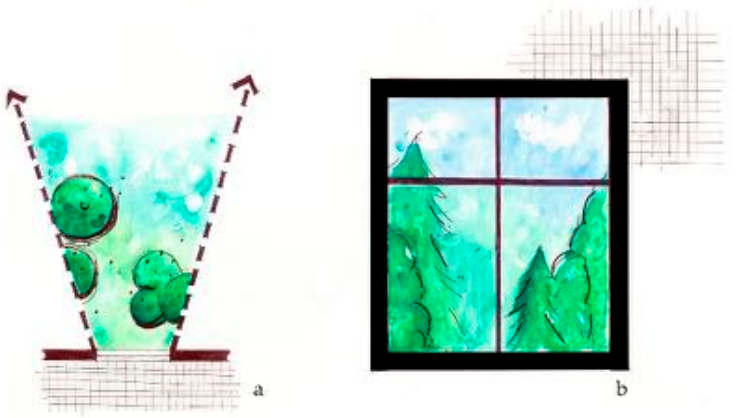
are associated cost reductions & savings

perhaps expand policy and goals?

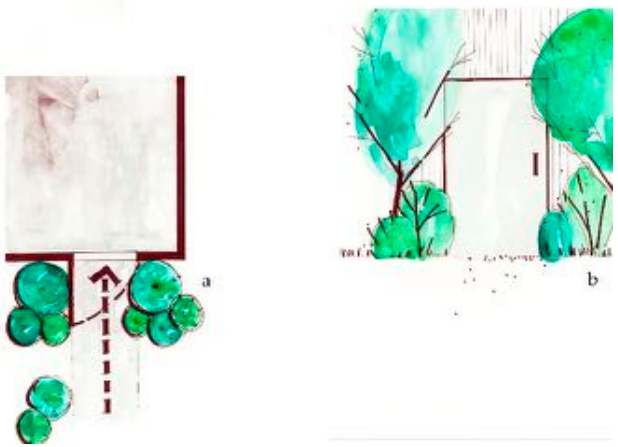
- canopy goals: 35-40%
- connectivity: 20 – 50 minute walks
- address pollen concerns
- enable activity (forest bathing, walking loops)


Landscape
Community
credit: Ignacio Bunster-Ossa
Garden

Tree Planting for Health



The View from Within

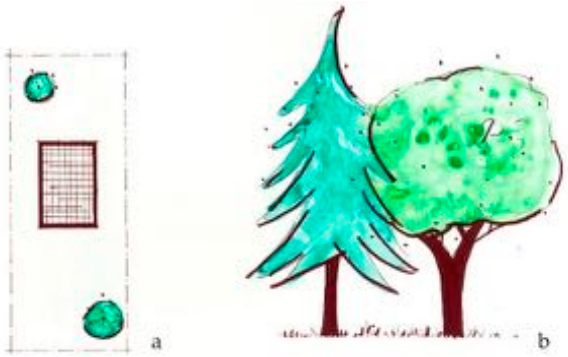


Plant Entrances

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 16, 4241.

Tree Planting for Health

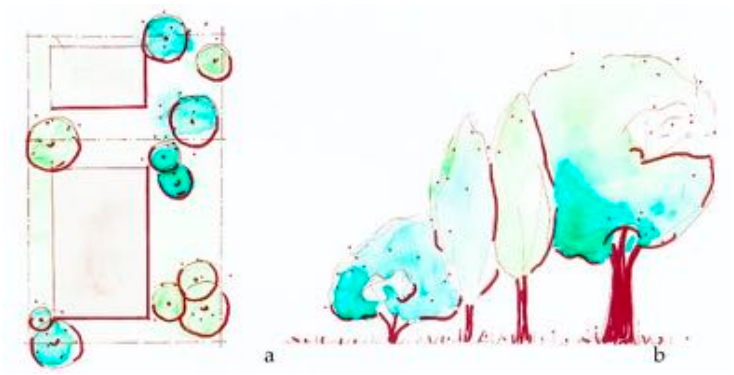
Bring Nature Nearby



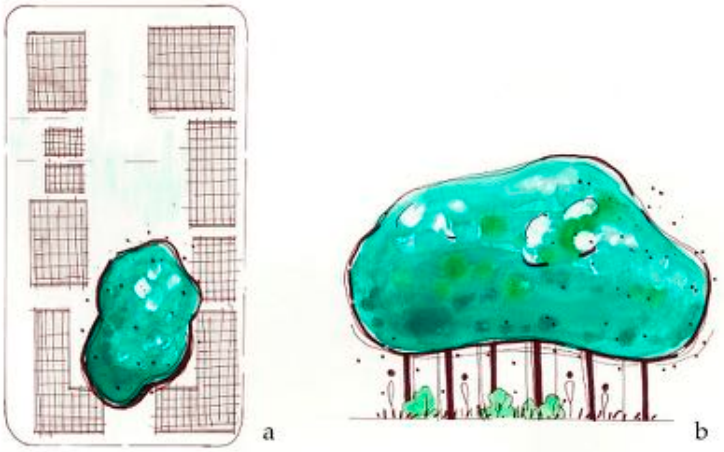
Retain the Mature

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 16, 4241.

Tree Planting for Health



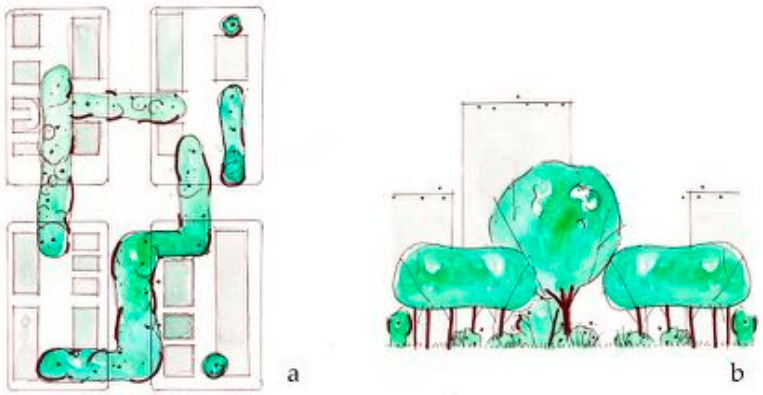
Generate Diversity



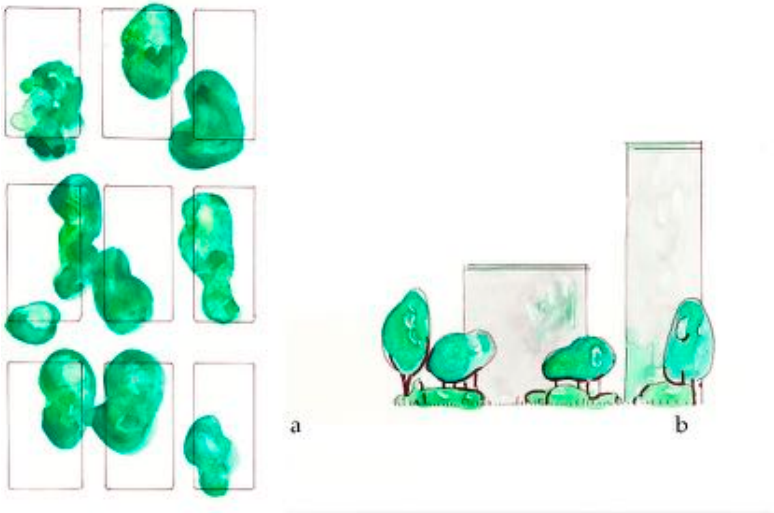
Create Refuge

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 16, 4241.

Tree Planting for Health



Connect Experiences



Optimize Green Infrastructure

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 16, 4241.

www.naturewithin.info