Human Health and Happiness: Benefits of the Urban Forest

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Are Our Urban Forests Ready
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Human Health & Happiness

public & community health
disease prevention
wellness promotion
social determinants

WHO Health Definition

A state of complete
physical, mental, and social well-being
and not merely the absence
of disease or infirmity (1946)

Determinants of Health

Green Cities: Good Health

www.greenhealth.washington.edu

Sponsors:
USDA Forest Service, U&CF Program
University of Washington
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Thanks!
to U of WA students:
Katrina Flora
Mary Ann Rozance
Sarah Krueger

Research Reviews & Summaries

Community Building
Local Economics
Place Attachment & Meaning
Crime & Fear
Safe Streets
Active Living
Reduced Risk
Wellness & Physiology
Healing & Therapy
Mental Health & Function
Work & Learning
Culture & Equity
Lifecycle & Gender

Local Economics

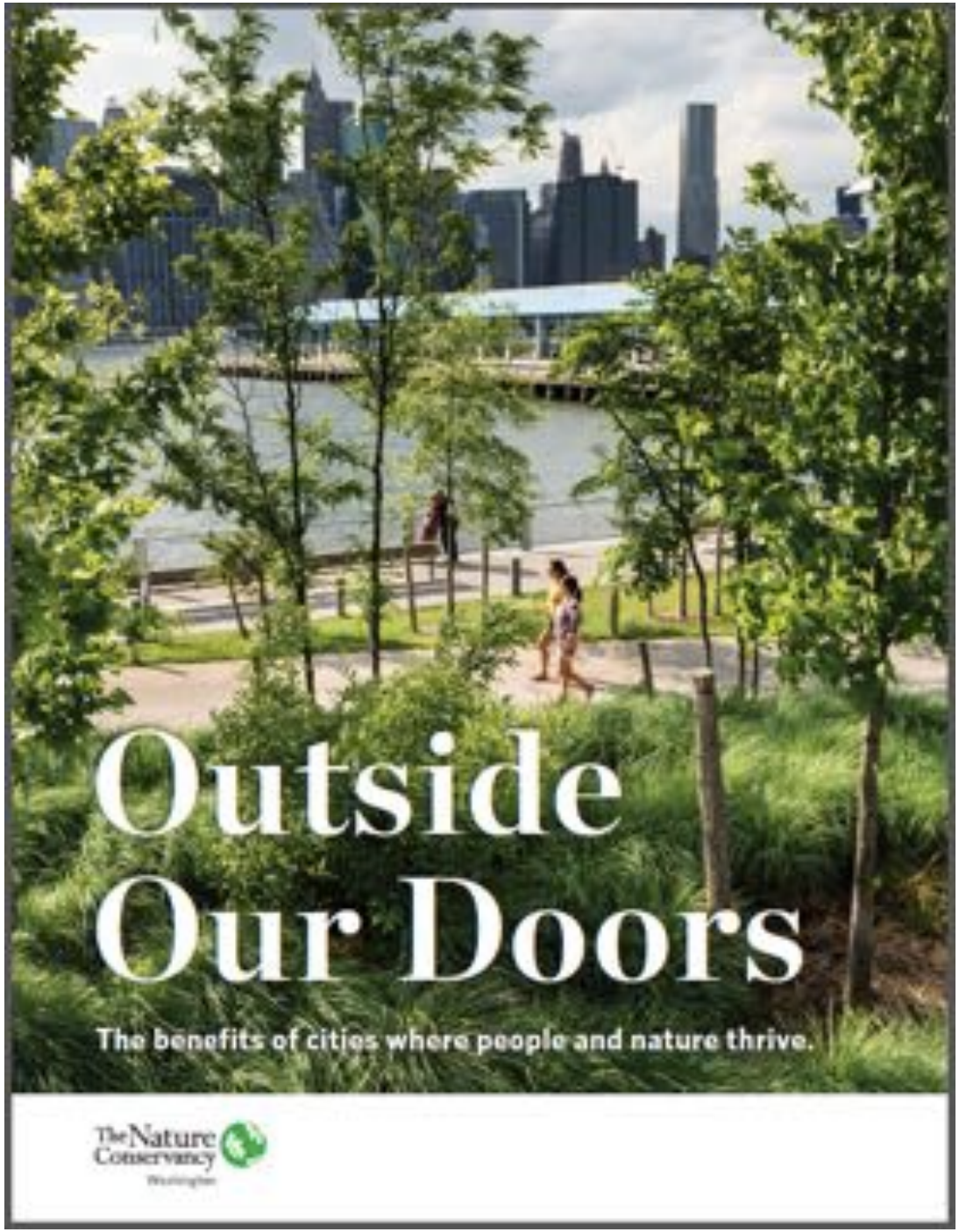
RSS Feed Print

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]



design: milepost

co-author: FOREST SERVICE U.S. DEPARTMENT OF AGRICULTURE

co-author & printing: The Nature Conservancy

Diversity in Metro Nature

NEARBY NATURE INCLUDES A VARIETY OF SPACES AND PLACES

IMAGE BY MIG / SvR

Sacramento Study :: LIDAR x CHIS data

7,900 adults, 250 m buffer, covariates

more tree cover

= better overall health

= better social cohesion

Ulmer et al. 2016. *Health & Place*. Multiple health benefits of urban tree canopy: The mounting evidence for a green prescription.

Prison Inmates :: nature videos

solitary confinement, video room/exercise option

- felt significantly calmer, less irritable, more empathetic
- committed 26% fewer violent infractions

Nadkarni et al. 2017. Impacts of nature imagery on people in severely nature-deprived environments. *Frontiers in Ecology and the Environment.*

Science Review

nearby nature & health evidence

> 40 years

> 4,200 publications

what are the ‘stories’?

Discovery: Human Health Benefits Across the Life Cycle

Urban Forests and Newborns

the natural environment affects 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., Health & Place 2011;
Hystad et al., Env Health Perspectives 2014

Hygiene Hypothesis

- presence of soil bacteria in body, *Mycobacterium vaccae* = increased seratonin
- may alleviate depression
- dirt or Prozac?

Lowry et al. 2007. Neuroscience

Eat Dirt!

Fiddleheads Forest School
Washington Park Arboretum (Seattle)

cognitive
social &
physical
learning

Classroom Views & Stress

School No.1

School No.4

Li & Sullivan. Landscape & Urban Planning, 2016

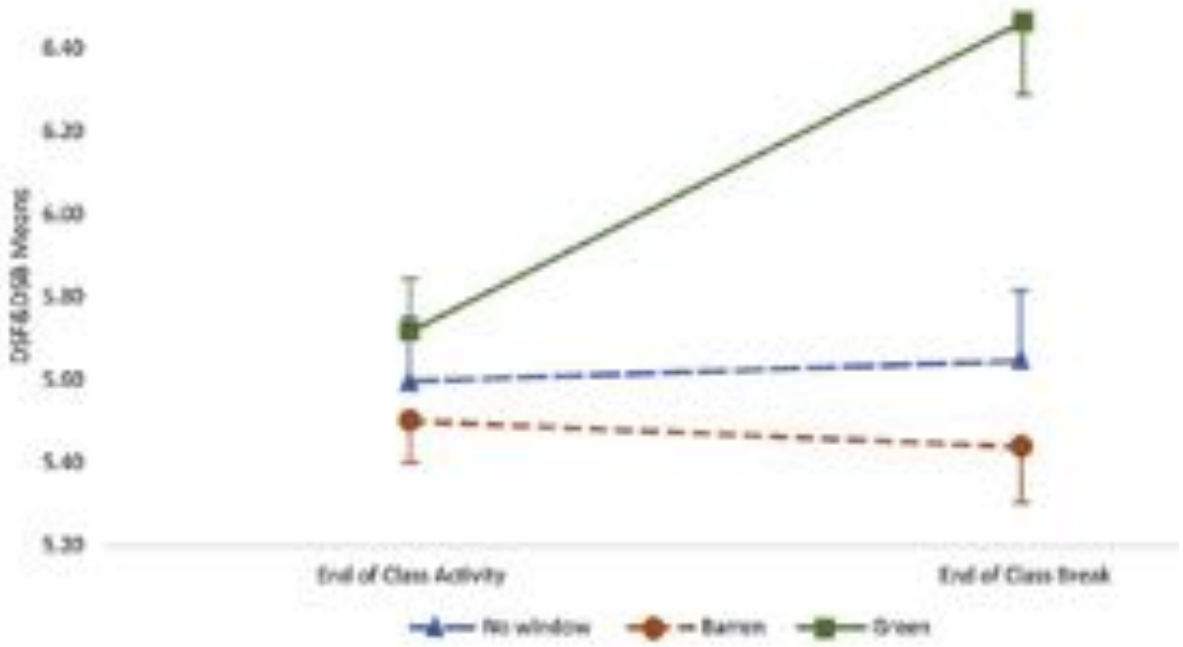


Fig. 2. Attention scores at the end of class activity and break (Means and SE).

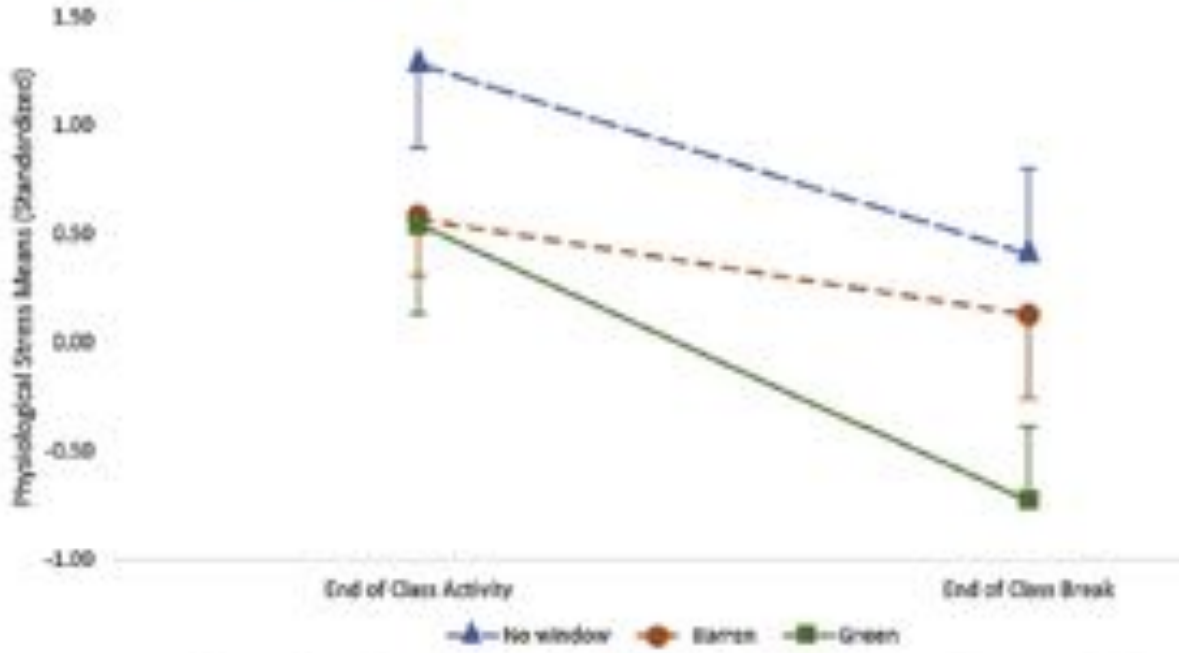


Fig. 3. Physiological stress at the end of class activity and break (Mean and SE).

attention scores

Classroom Views & Stress high school student response

stress scores

CDC moderate activity recommendations
parks, active living, active transit

Shinrin yoku (forest bathing)

- extensive research
- restorative experiences
- workers retirees
- networked system, 52 bases in Japan

Green Streets for Walkability

evidence of lower frustration and higher meditation when moving into the greener streets

Aspinall et al. 2013. The Urban Brain: Analysing Outdoor Physical Activity with Mobile EEG. British Journal of Sports Medicine

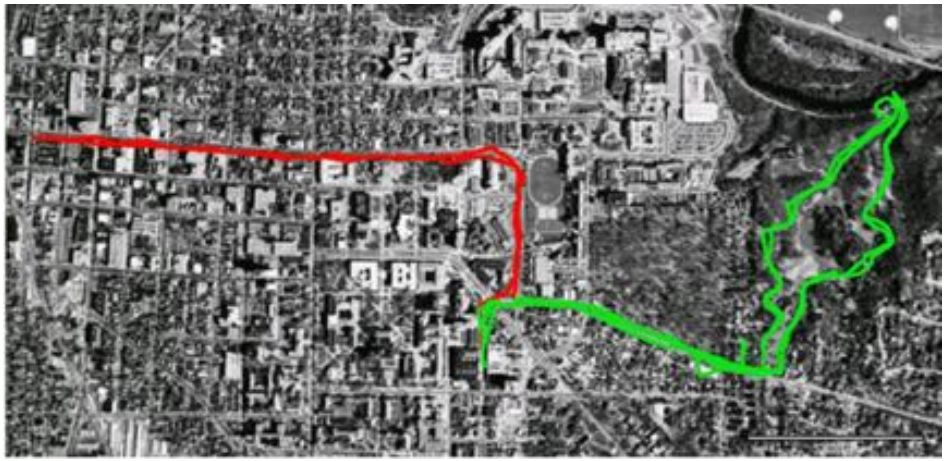
Improving Depression

20 adults with major depression
walk in a park setting and a built setting

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

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

cognitive and affective improvements after walking in a nature setting



Walking Programs

children
elders
families

walking
meetings

Donovan et al. 2013. Journal of Preventive Medicine

EAB Tree Loss & Public Health

1990 to 2007, 1,296 counties in 15 states
infected areas vs. no bugs

15,000 more deaths from cardiovascular disease

6,000 more deaths from lower respiratory disease

controlled for demographic, human mortality, and forest health data at the county level

Toledo, Ohio in 2006, pre EAB

2009, EAB in neighborhood

photo credits: Dan Herms, Ohio State U

Alzheimer's Disease & Dementia

Provide wander gardens & horticulture therapy

- 10.5% reduction in amount of medications used in dementia facility
- 30% fewer falls, accompanied by a reduction in fall severity

Detweiler et al. 2009. *American Journal of Alzheimer's Disease and Other Dementias*

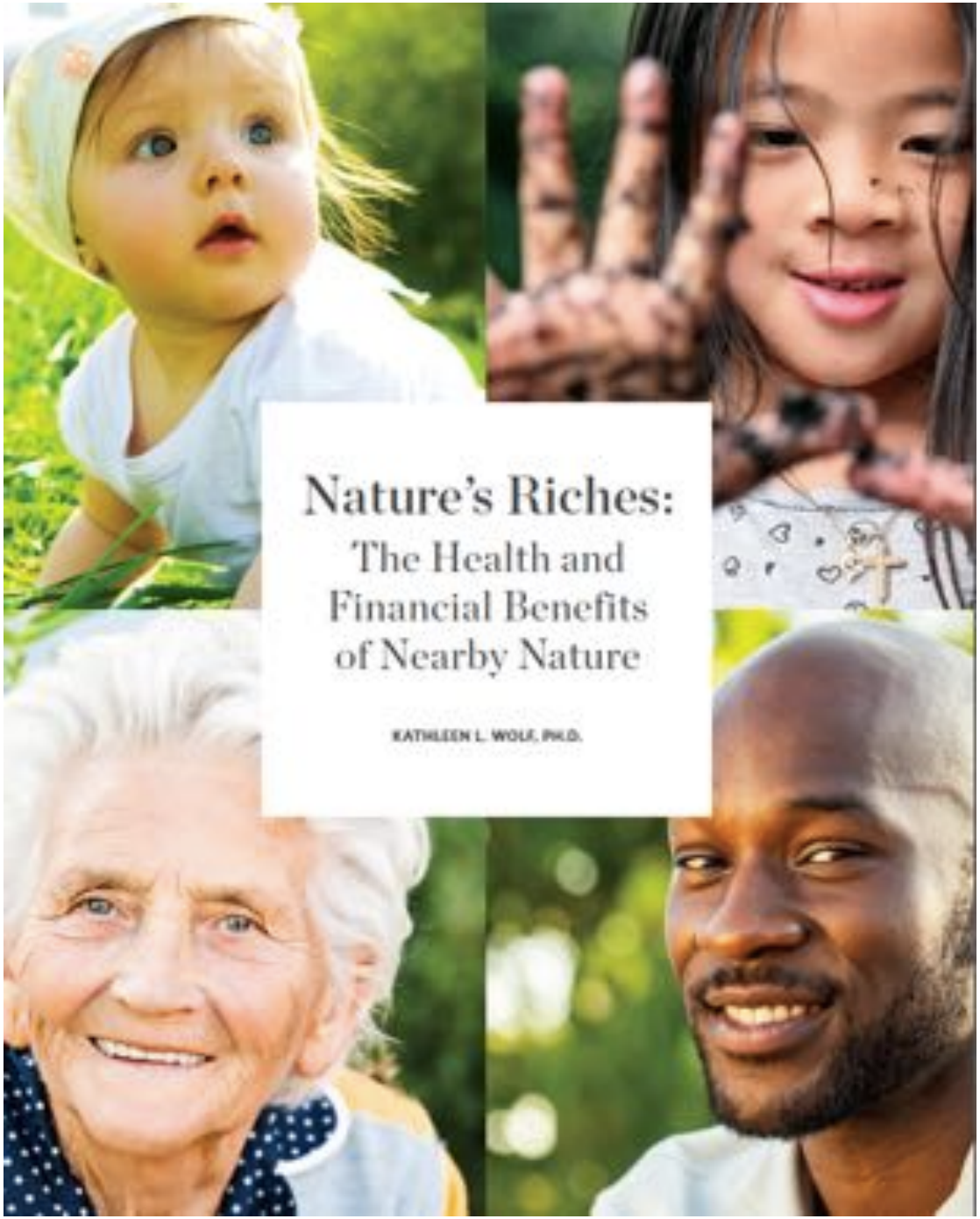
Tim Lynch Associates

www.rph.org/eden.html

economics

wellness
health promotion
disease prevention

U.S. health costs $3 trillion
~ 17% of U.S. GDP



design: milepost

author: FOREST SERVICE U S DEPARTMENT OF AGRICULTURE

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

$144M 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

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

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 2008 U.S. dollars, and are potential annual savings across America (U.S.)

CHILDREN & TEENS

OVERALL HEALTH AND WELL-BEING

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 create 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

$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

$1.2B 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

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 14 million adults experience major depression each year in the U.S., and mental, behavioral, and neuropsychiatric 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

$1.1-$2.2B 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 trees.

CRIME & SAFETY

$900M 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

$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 elder 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

$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

$1.2-$2.3B 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. By 2050, about 11% 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

Neighborhoods with Trees

10 more trees on a city block?

health benefits comparable to $10,000 household income increase OR being 7 years younger

Kardan et al., 2015, Scientific Reports

annual value of $11.7 billion U.S. (2015 dollars)

- cradle to grave human life cycle
- varied expressions of urban greening (metro nature)
- evidence based human health and wellness benefits
- just beginning the analysis!

Celebrating Canada's 150

Are Our Urban Forests Ready for the Next 150?

sanitary city

efficient and hygienic
supply & removal
    of materials and services
natural systems disconnect

Industrial Age – city squalor

credit: BlendSpace

credit: blogs.isb.bj.edu.cn

‘Filthy Cities’

08/04/2005

Baltimore: Public Works Museum
STORM DRAIN

SANITARY
STORM DRAIN

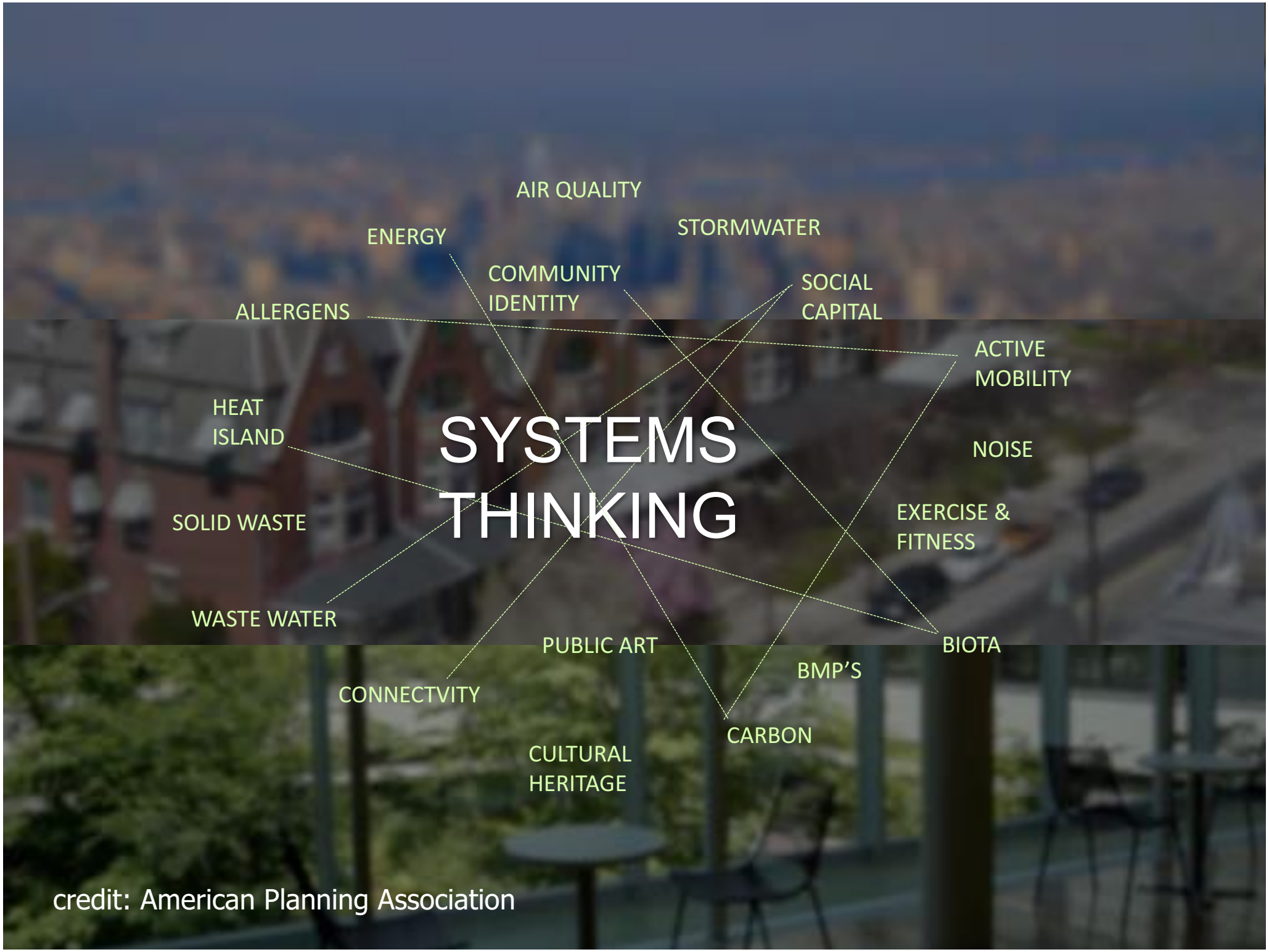
sustainable city

ecological function,
green infrastructure, &
‘revealed’ processes

Pincetl, S. 2010. From the sanitary city to the sustainable city. Local Environment

in the background

trees & forests provide many benefits!



credit: American Planning Association

Landscape
Community
credit: Ignacio Bunster-Ossa
Garden

measure the canopy of a city

i-Tree™

Eco (UFORE)

Streets (STRATUM)

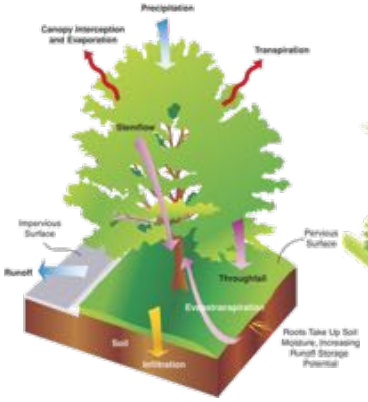
Hydro

Vue

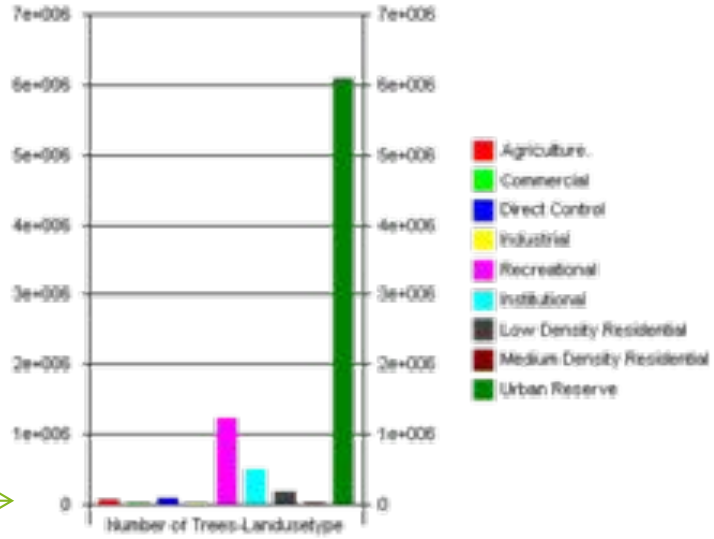
tools provided by USDA Forest Service

STRUCTURE

FUNCTION



VALUE



MANAGEMENT

photo credits: Seattle i-Tree Training by Al Zelaya

Reducing Stormwater Runoff

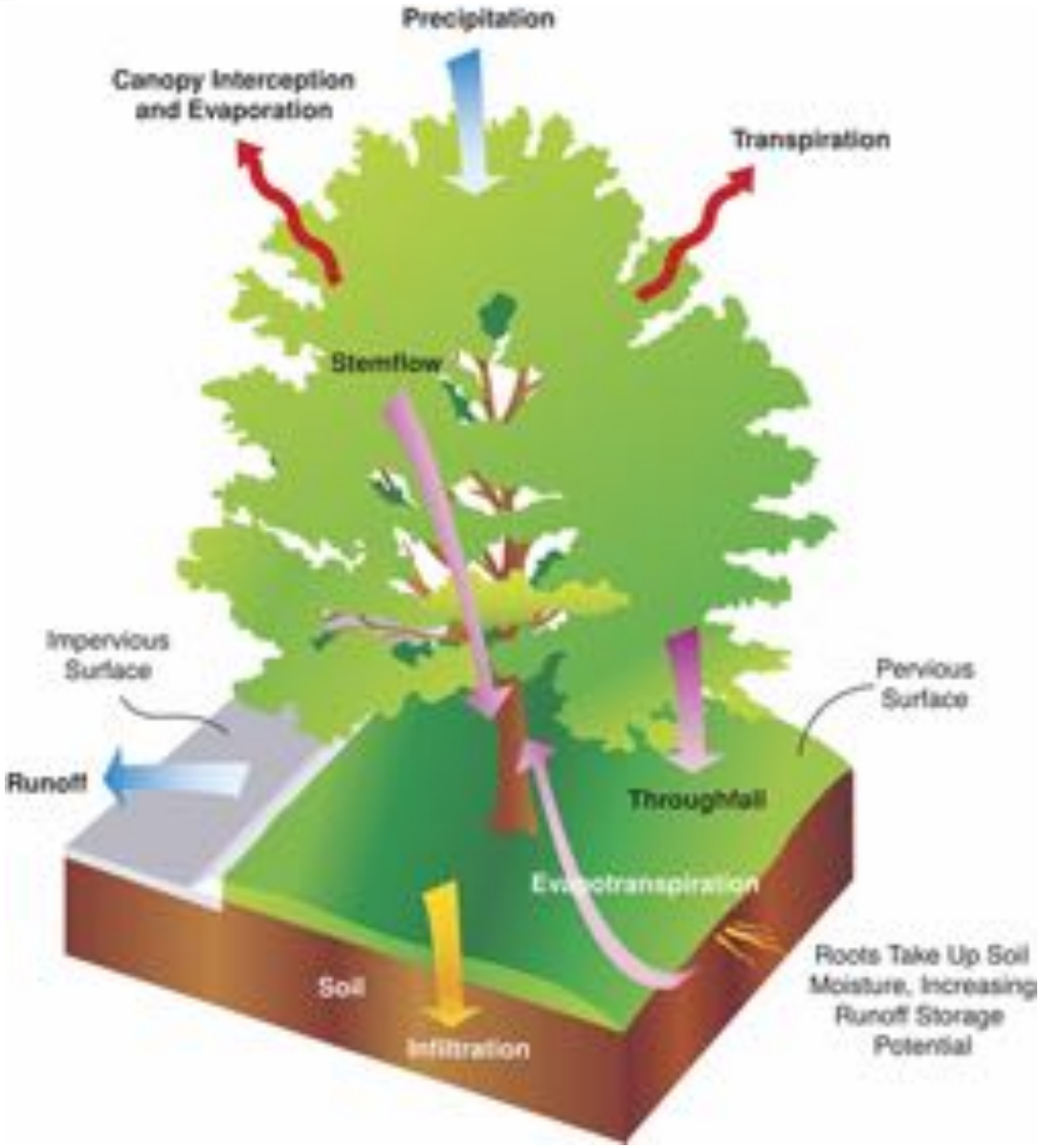
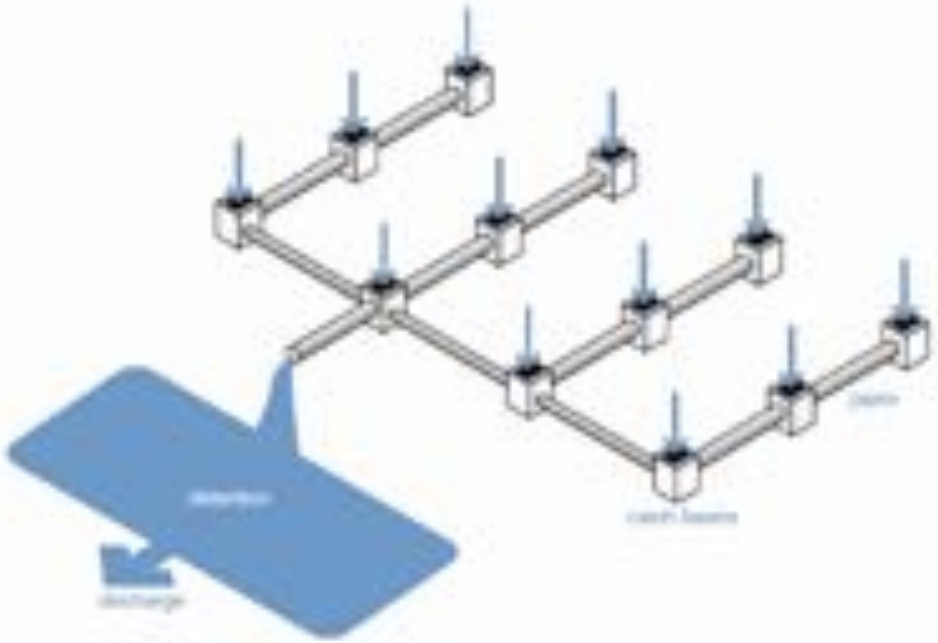


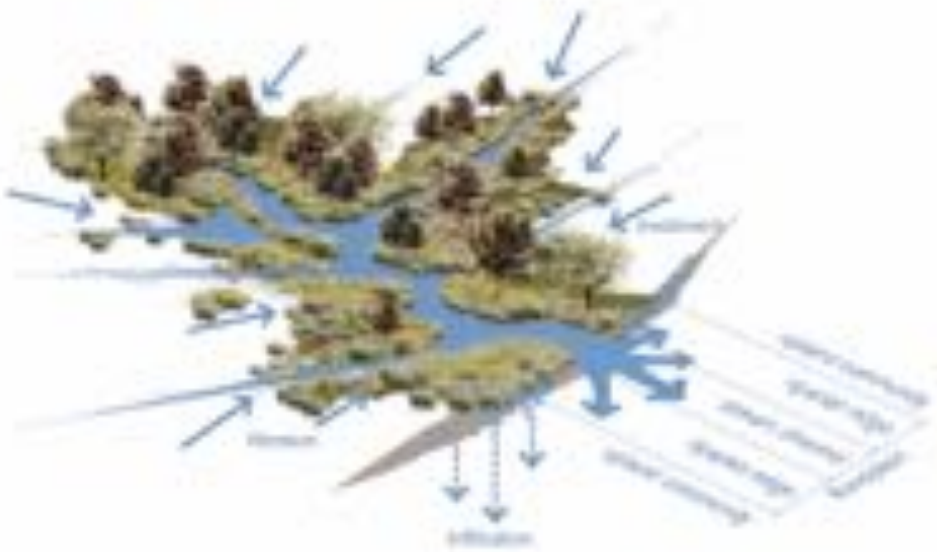
Image courtesy of the Center for Urban Forest Research

Grey Infrastructure



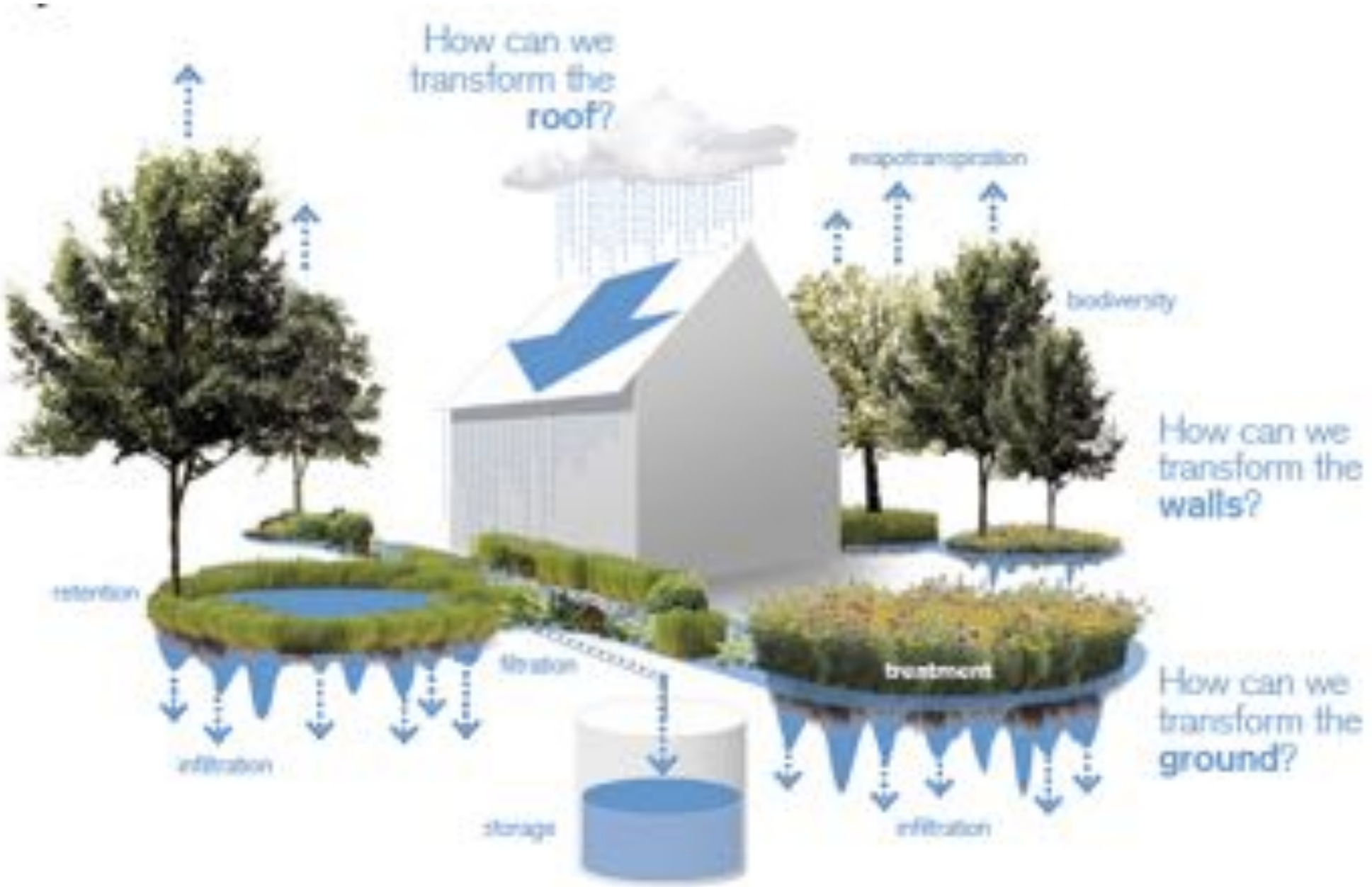
Drain, direct, dispatch

Green Infrastructure



Slow, spread, soak

Source: *Low Impact Development: A Design Manual for Urban Areas*, 2010



Low Impact Development: A Design Manual for Urban Areas, 2010

stormwater retention

Stormwater Management

Thornton Creek Water Quality Channel (Seattle, SvR Design)
1 hectare, treats runoff from 275 hectares (1 hectare = 2.47 acres)

Tanner Springs Park

Portland OR

linked to active living network

neighborhood
social cohesion

environmental
education &
social learning

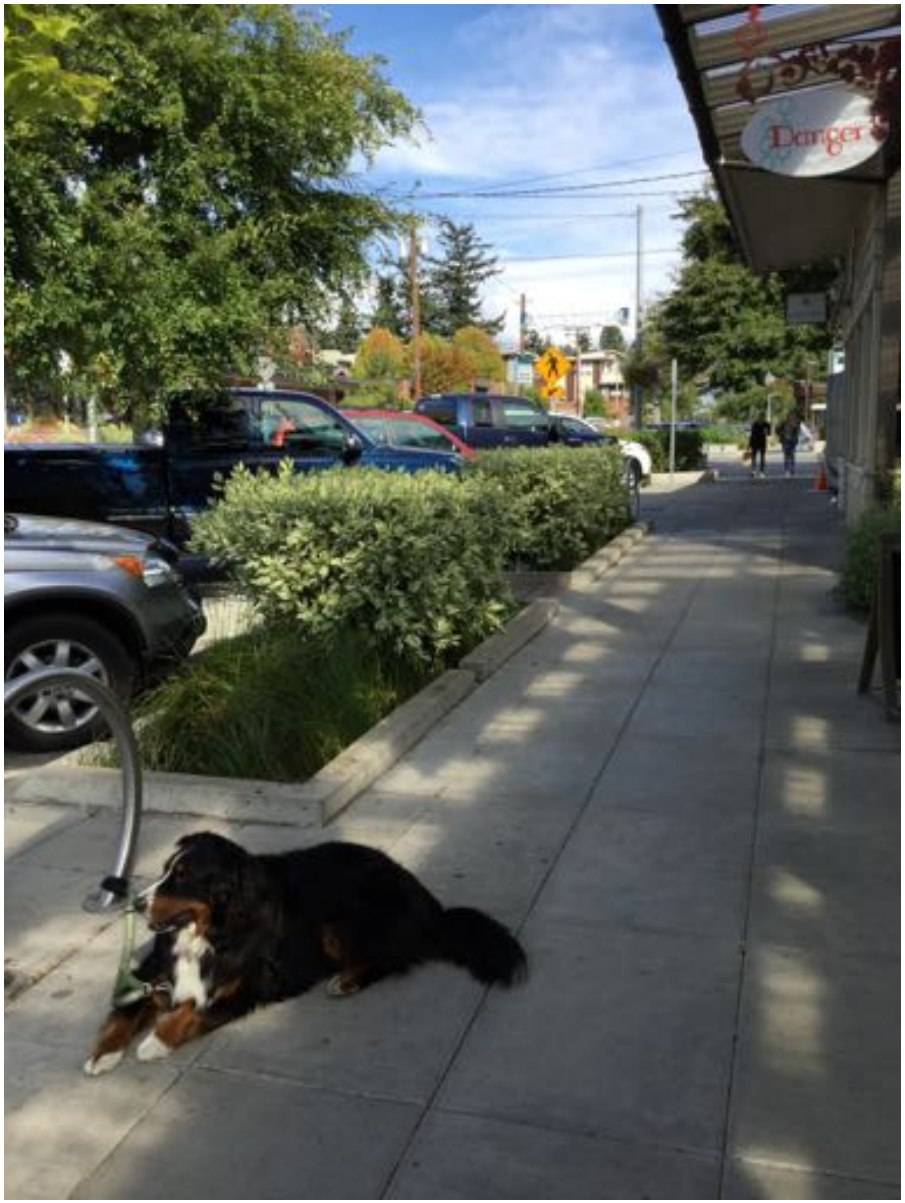
green infrastructure & reduced crime

Philadelphia

reduction in narcotics arrests (18–27 %) for green not gray

vs. 65% increase across city

Kondo et al. 2015.
Journal of Public Health



management for co-benefits - retail

Summary

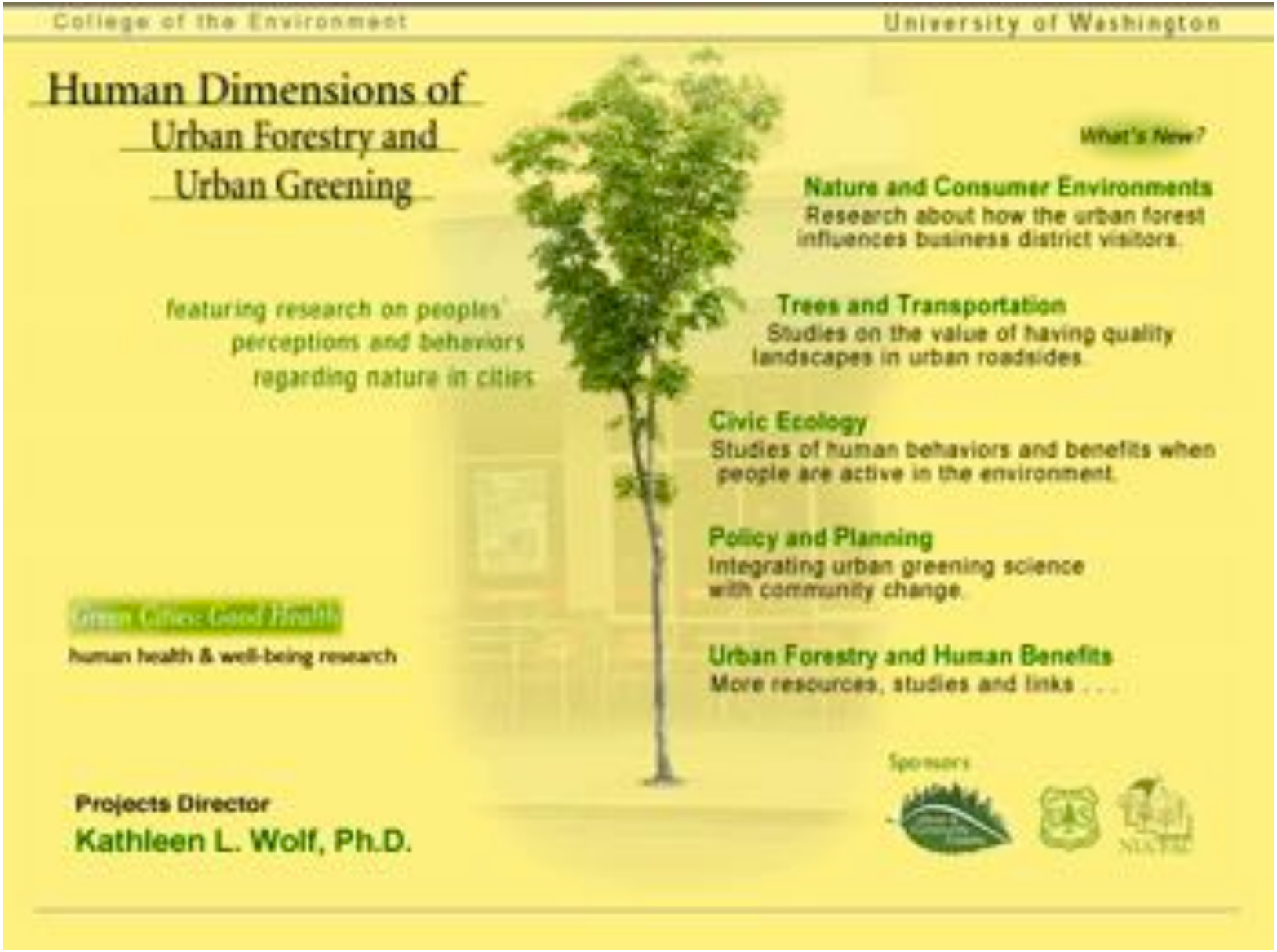
sanitary city (hygiene for health)

sustainable city (ecology and wellness)

urban nature = health & wellness

(40 years of research)

= economic value

= expanded partnerships

www.naturewithin.info