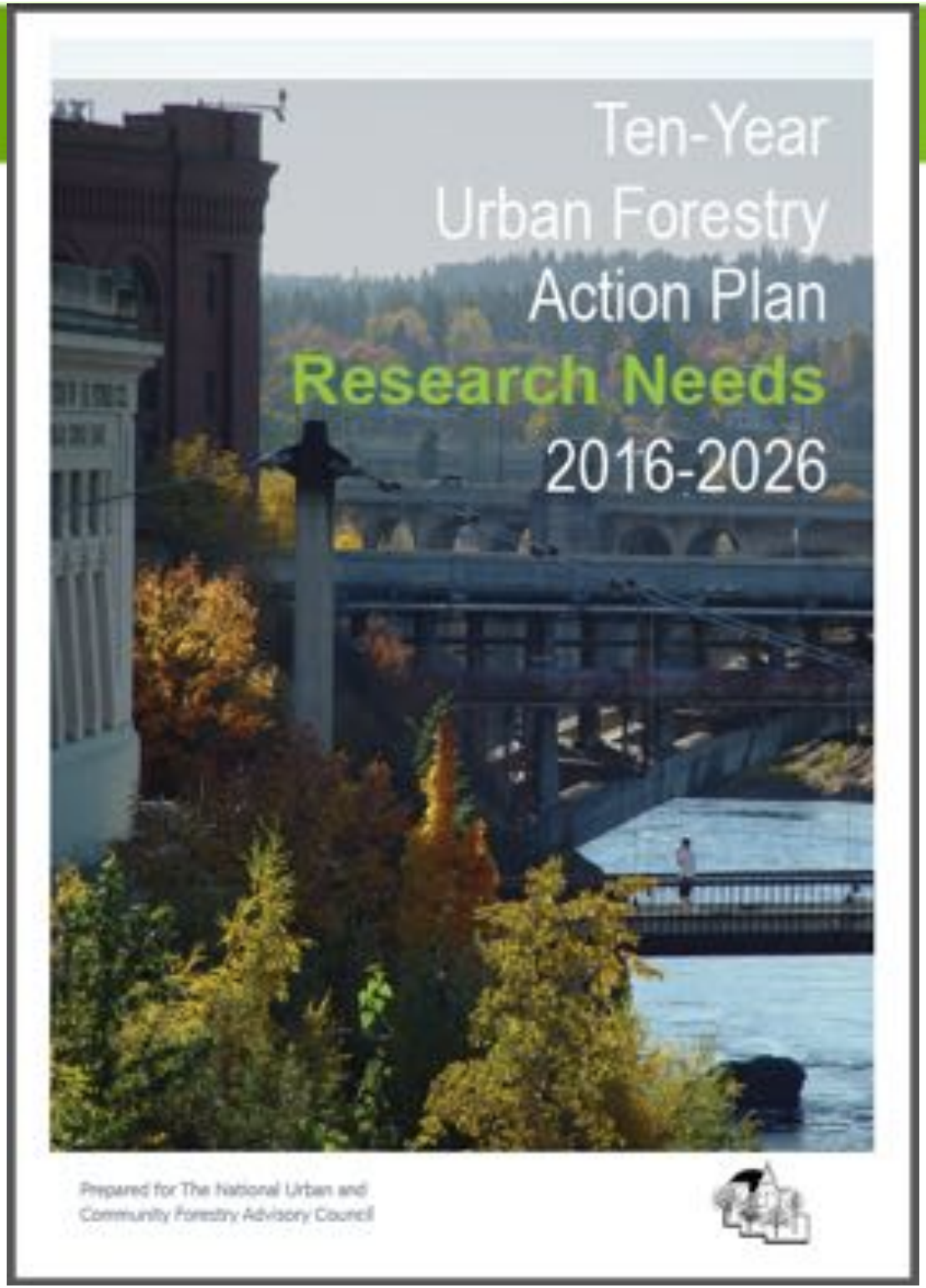
Urban Nearby Nature and Health Care Savings: An Overview

Kathleen Wolf, Ph.D.
Research Social Scientist

University of Washington (Seattle)
School of Environmental and Forest Sciences

USFS Pacific Northwest Research Station

EDRA 48 Madison
3 June 2017



primary action plan

research supplement

---

value of research to U&CF growth

Research Needs Framework

A Understand Ecosystem/ Ecological Services

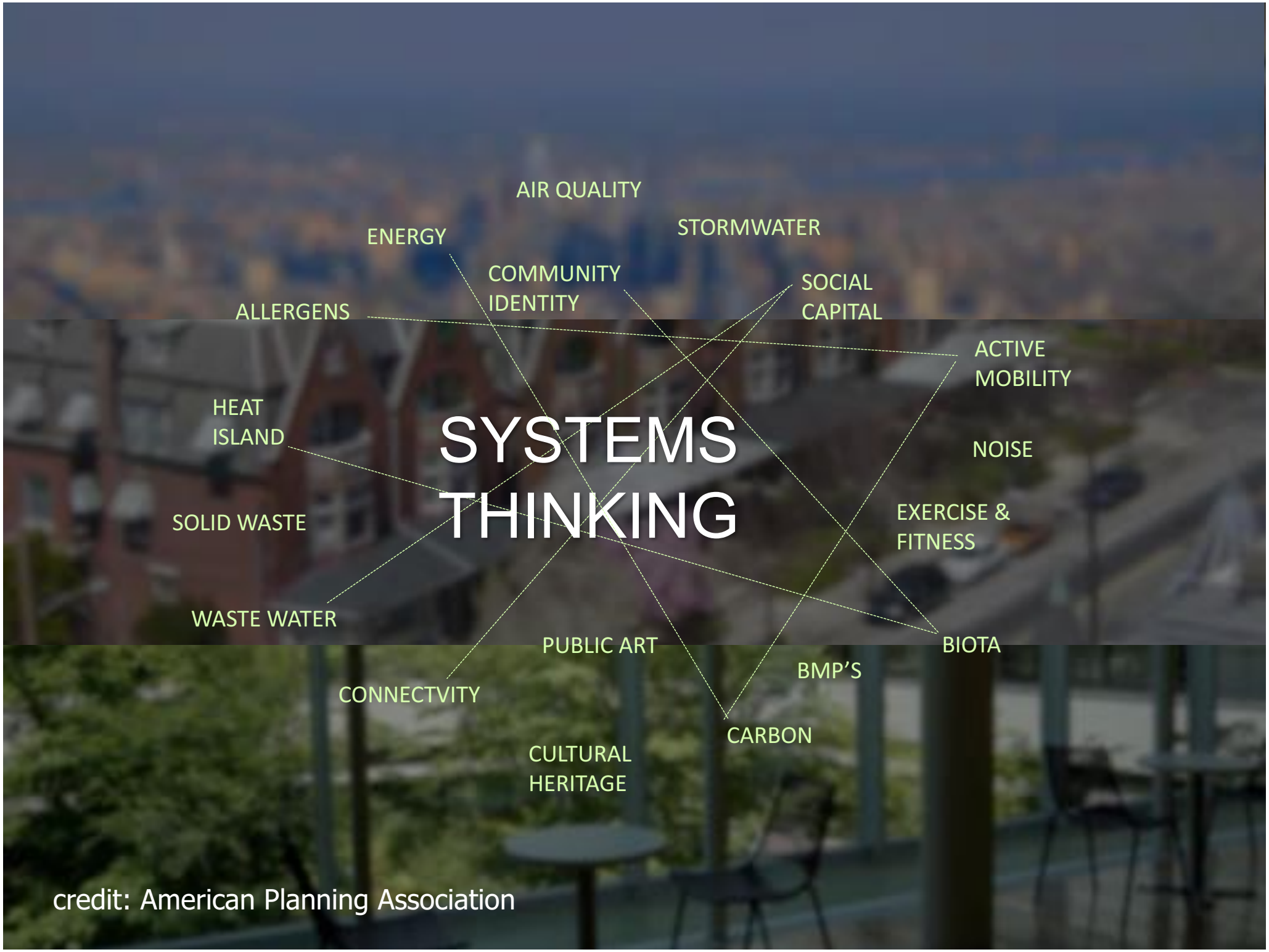
B Promote Human and Community Health

C Planting, Inventory, and Analysis for Forest and Environmental Health

D Prepare for Pests, Threats, Climate and Associated Changes and Risks

E Enable Civic Stewardship and Improved Local Governance

F Integrate Knowledge Networks and Data for Urban Socio-Ecological Systems



credit: American Planning Association

Outline

nearby nature health benefits
economic valuation process
& results
outreach products

WHO Health Definition

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

Social Determinants

Green Cities: Good Health

www.greenhealth.washington.edu

Sponsors:
USDA Forest Service, U&CF Program
University of Washington
NGO partners

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.

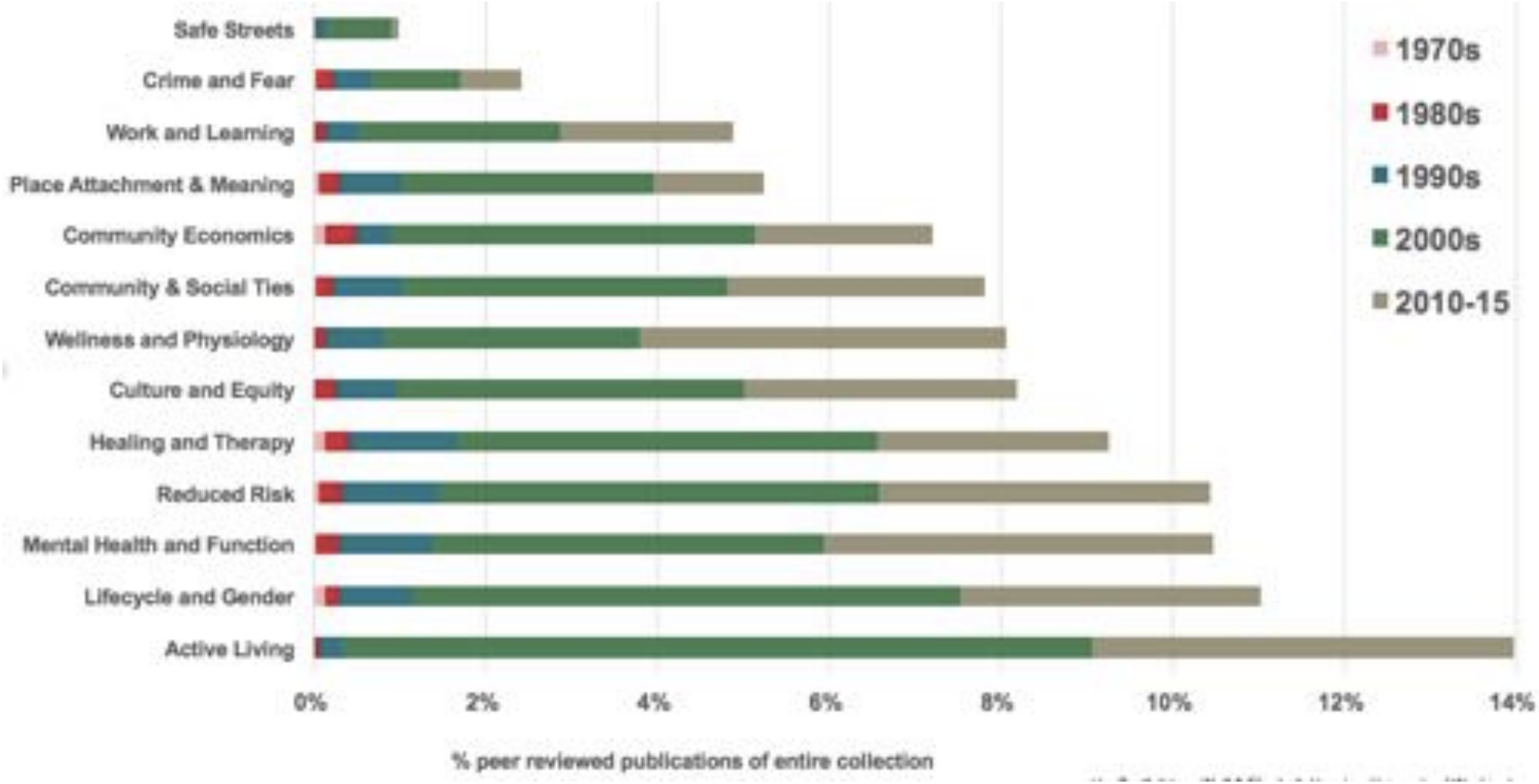
street trees boost market value of houses, providing tax revenue for communities

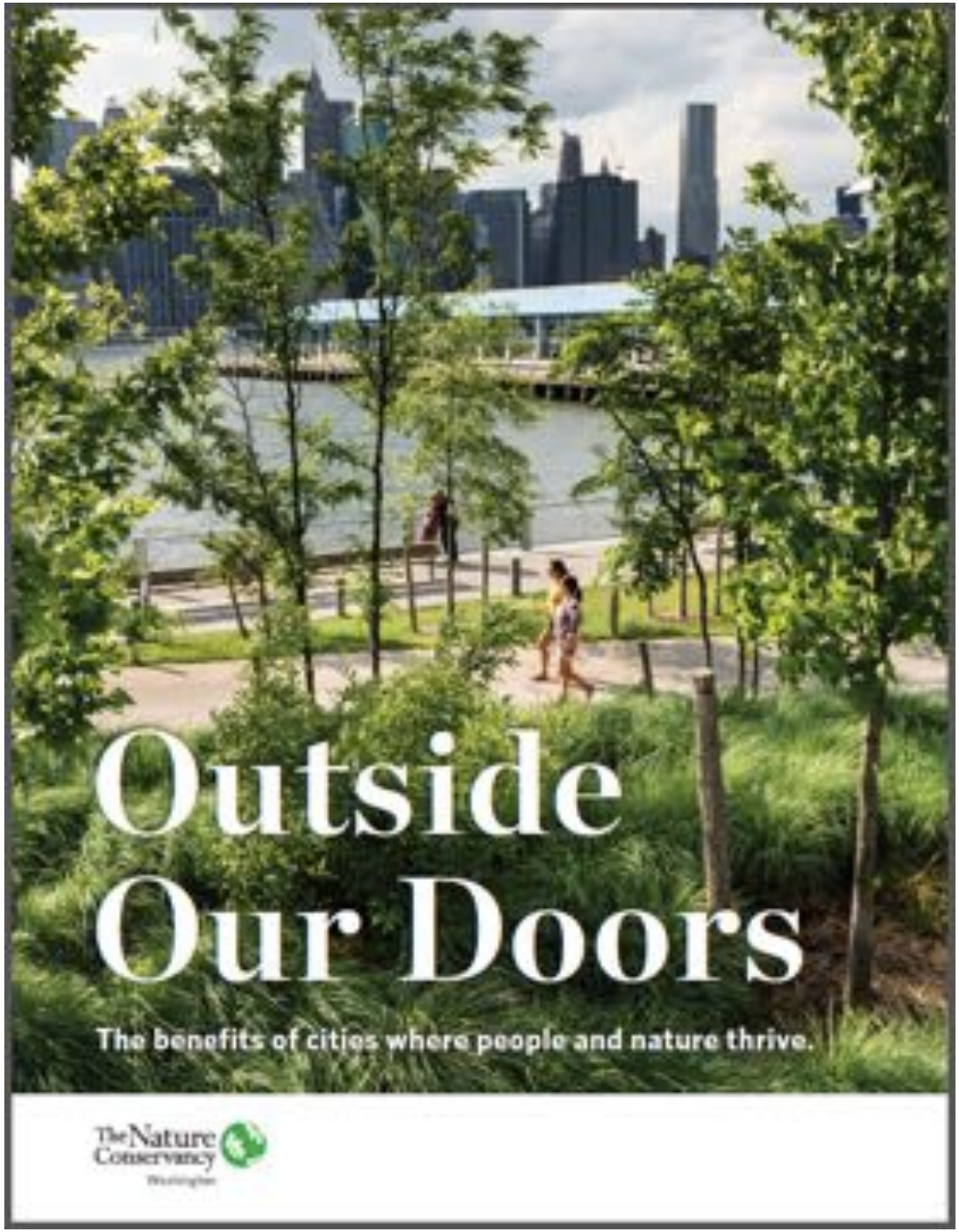
Fast Facts

- 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]

Green Cities: Good Health

database of >4,000 peer reviewed publications





design: milepost

co-author

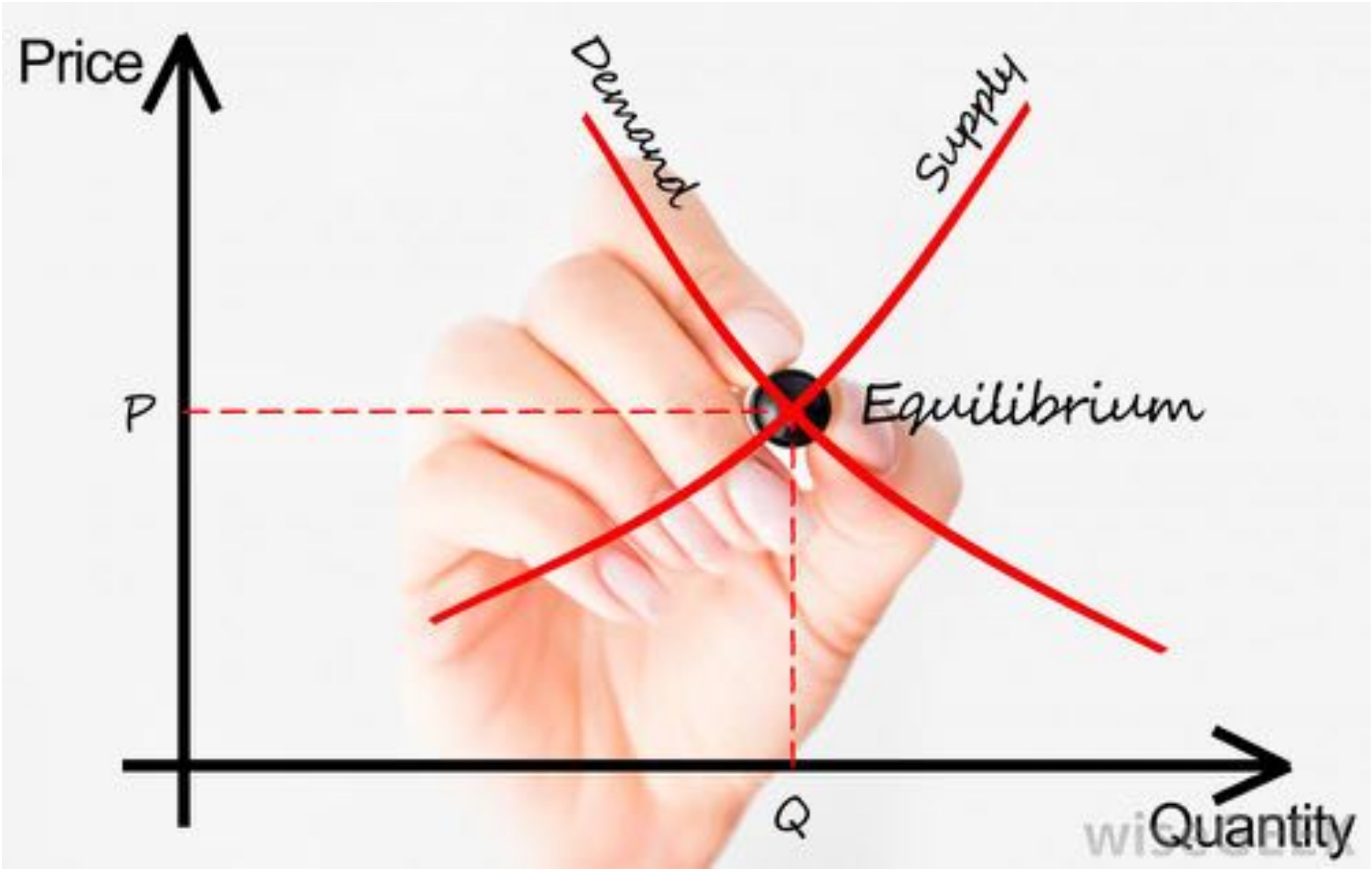
co-author & printing: The Nature Conservancy

Outline

nearby nature health benefits

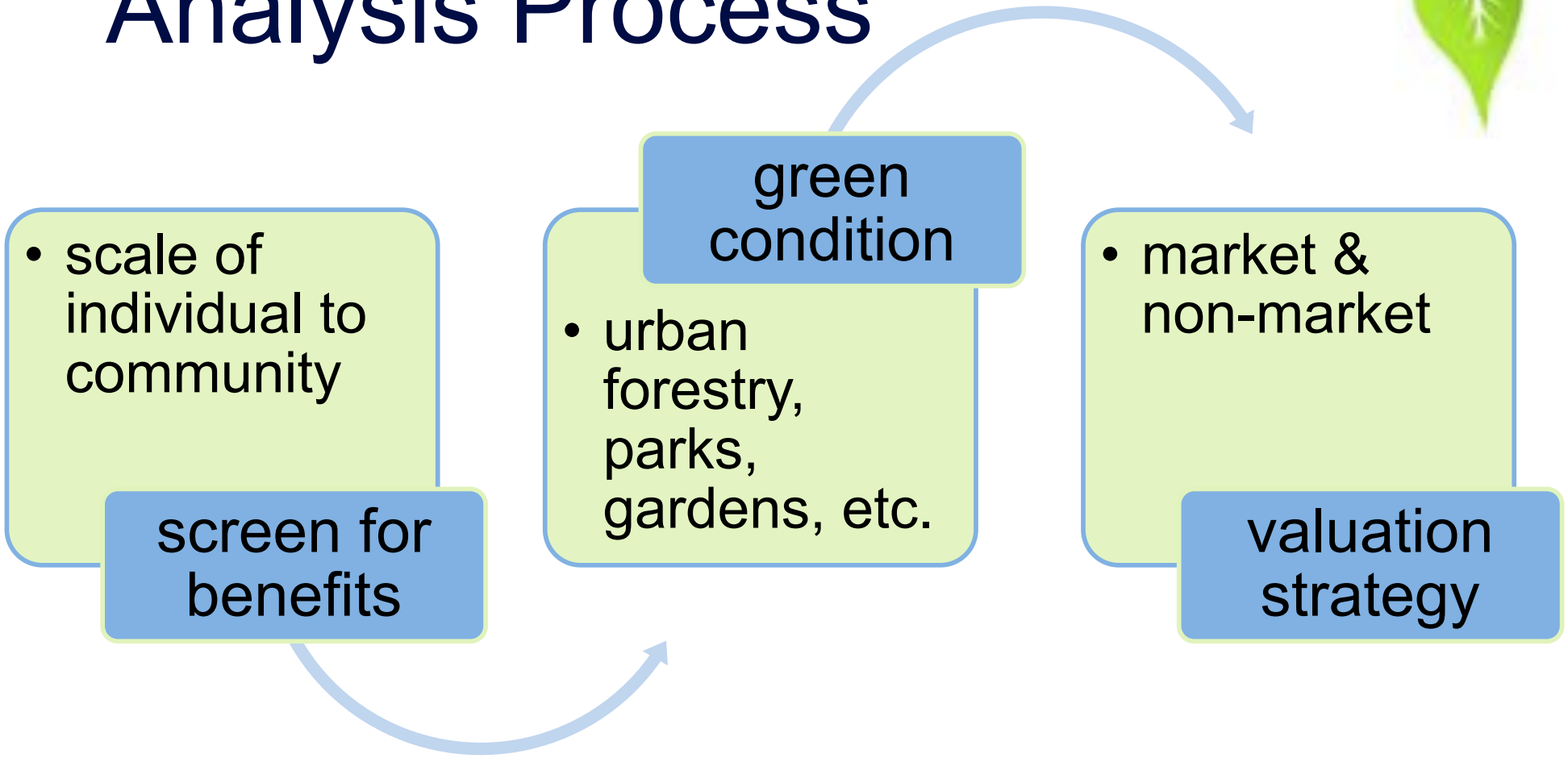
economic valuation process
& results

outreach products



source.wisegeek.com

Analysis Process



process #1: screen for benefits

Metro Nature & Health Evidence Framework

Synthesis of
40 years of
peer-reviewed
literature

Wolf, K.L., A.S.T. Robbins. 2015. Metro nature, environmental health, and economic value. Environmental Health Perspectives 123, 5:390-8.

Discovery: Human Health Benefits Across the Life Cycle

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

process #2: understand green condition

Landscape
Community
credit: Ignacio Bunster-Ossa
Garden

Diversity in Metro Nature

NEARBY NATURE INCLUDES A VARIETY OF SPACES AND PLACES

IMAGE BY MIG / SvR

Stormwater Ecosystem Services

green infrastructure

goal: co-design for co-benefits

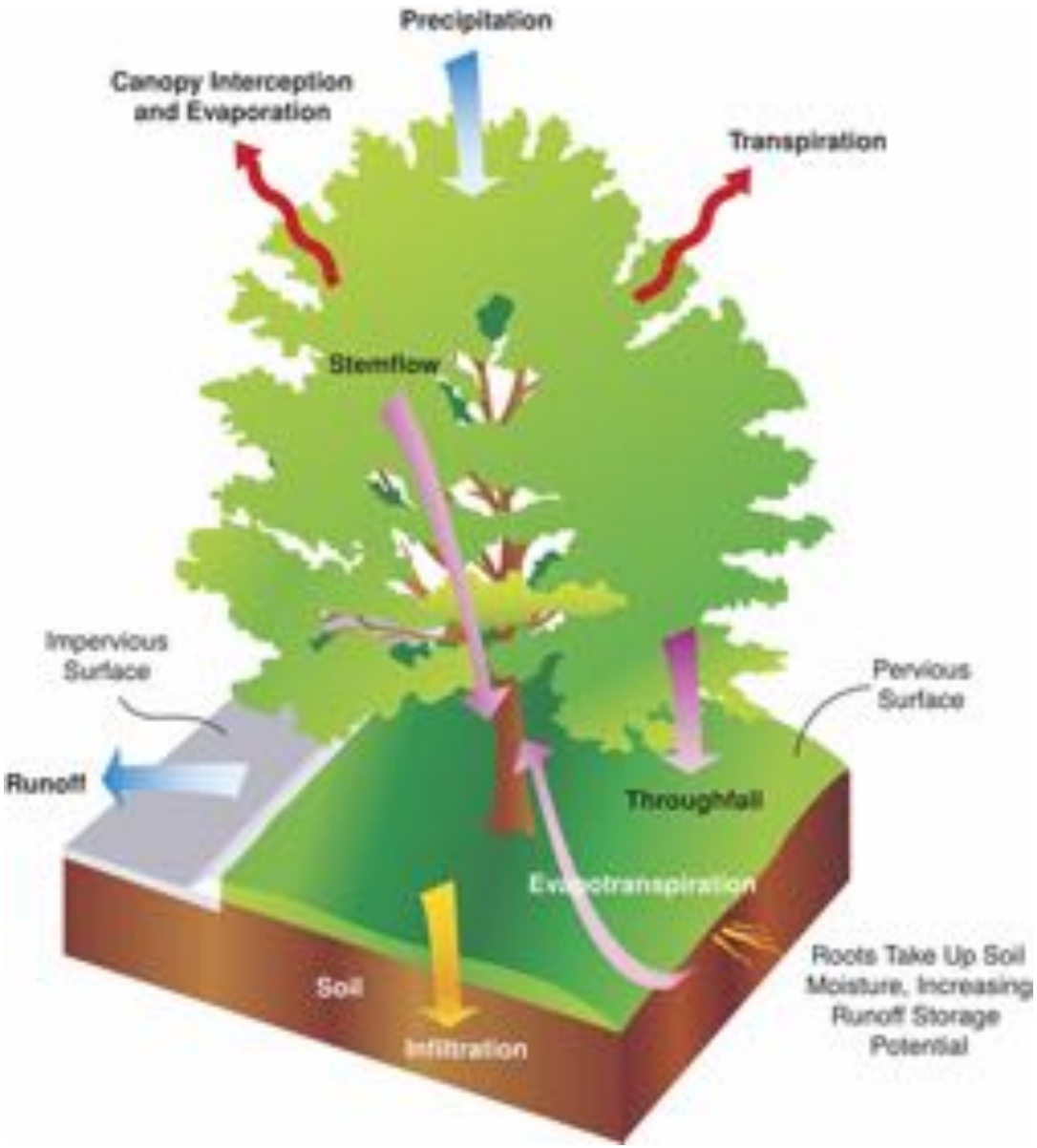


Image courtesy of the Center for Urban Forest Research

stormwater management

Stormwater Engineering

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

economic & health co-benefits

Tanner Springs Park

Portland OR

linked to active living network

process #3: apply valuation strategy

Valuation Sources

Benefit x Nature x Health Outcome

Benefit	Metro Nature	Outcome
Newborn Birth Weight	increased tree canopy cover near mothers' homes	fewer small for gestational age babies
Attention Deficit Hyperactivity Disorder	greener play areas vs built outdoor or indoor settings	reduced symptoms potentially reducing medication
School Performance	green views from classrooms and cafeteria	reduced dropout rate - average annual income
Crime Reduction	trees and lawn in outdoor common areas	reduced violent and non-violent incidence and costs
Cardiovascular Disease	presence of residential tree canopy	reduced incidence or severity of cardiovascular disease
Alzheimer's Disease	wander garden in care facility	reduced medications for patients

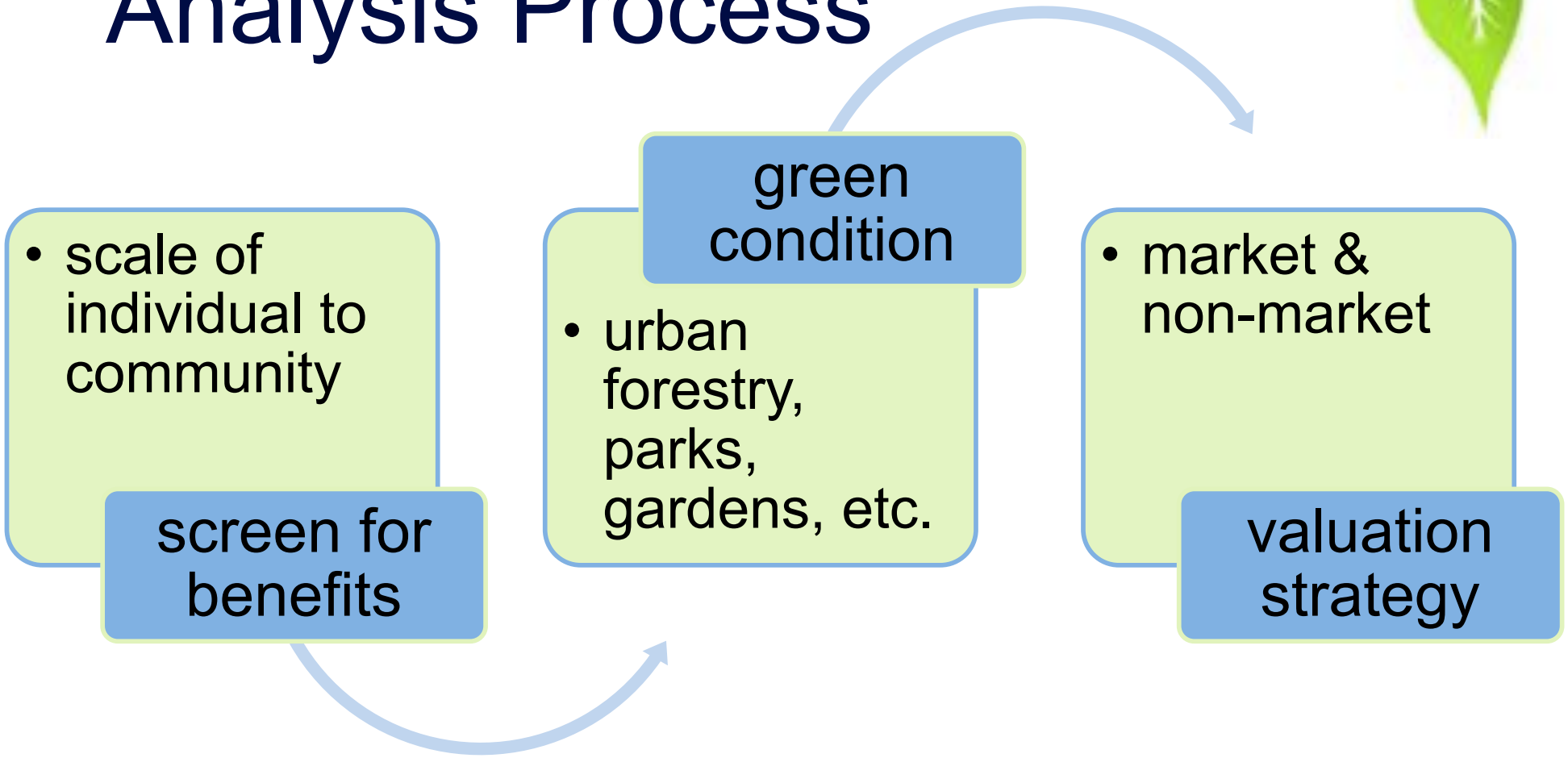
Valuation Strategies

Benefits Transfer approaches

- factor income
- avoided or replacement cost
- burden of illness
- hedonic pricing
- stated preference/contingent valuation
- revealed preference (e.g., travel cost)
- quality adjusted life years
- benefit/cost

What is the Value?

Analysis Process



Summary Table

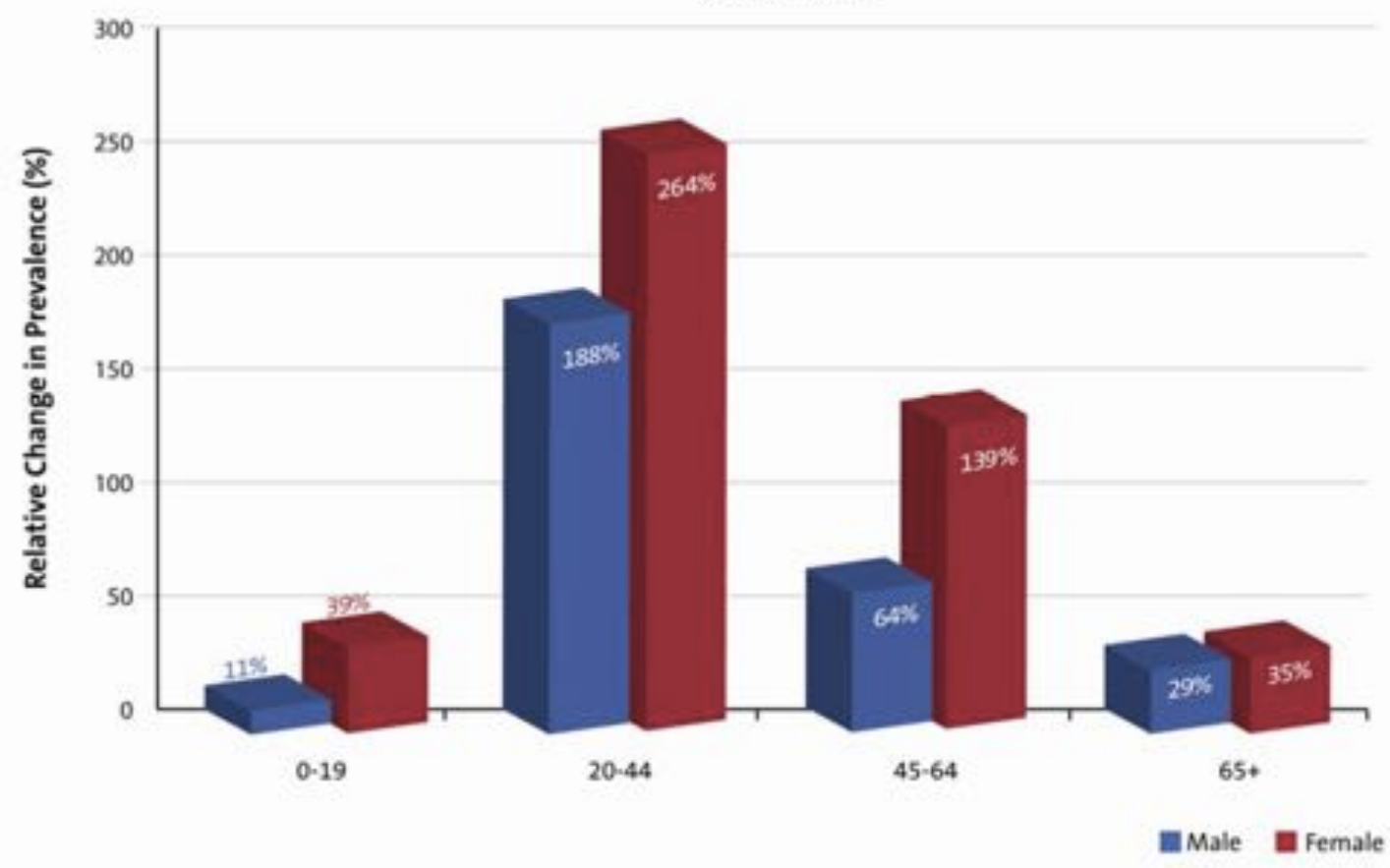
Millions of U.S. Dollars (2012)

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.

Change in % Population on ADHD Treatments

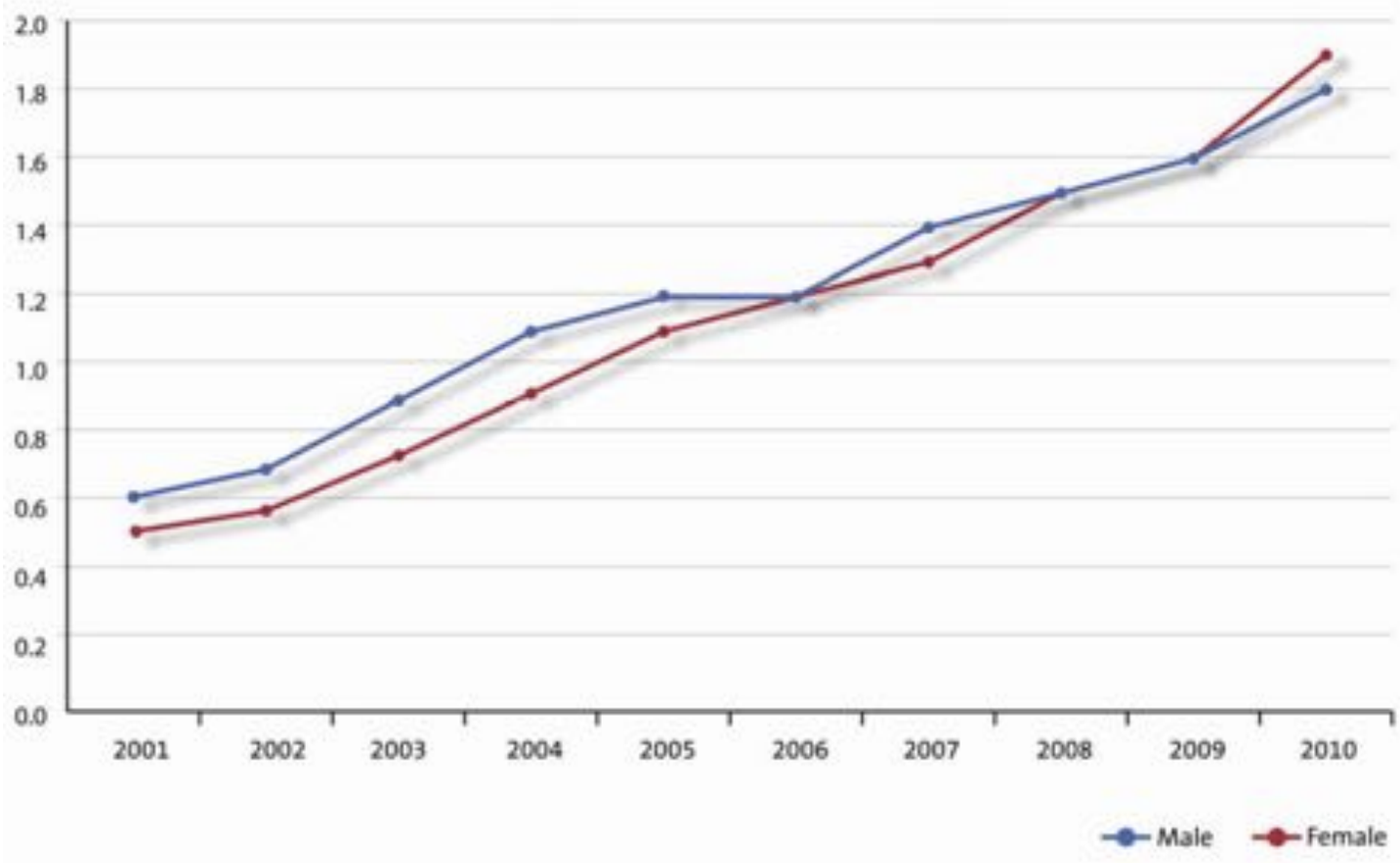
2001 - 2010



America's State of Mind, Medco Health Solutions, Inc

% of Americans Ages 20-44 on ADHD Meds

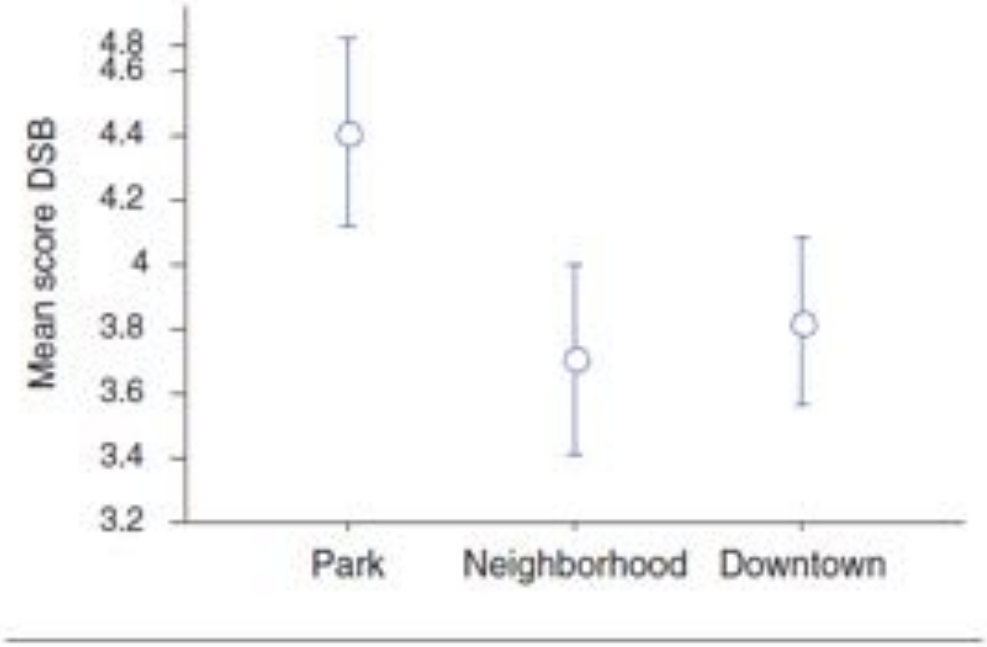
2001 - 2010



America's State of Mind, Medco Health Solutions, Inc

ADHD and nature contact

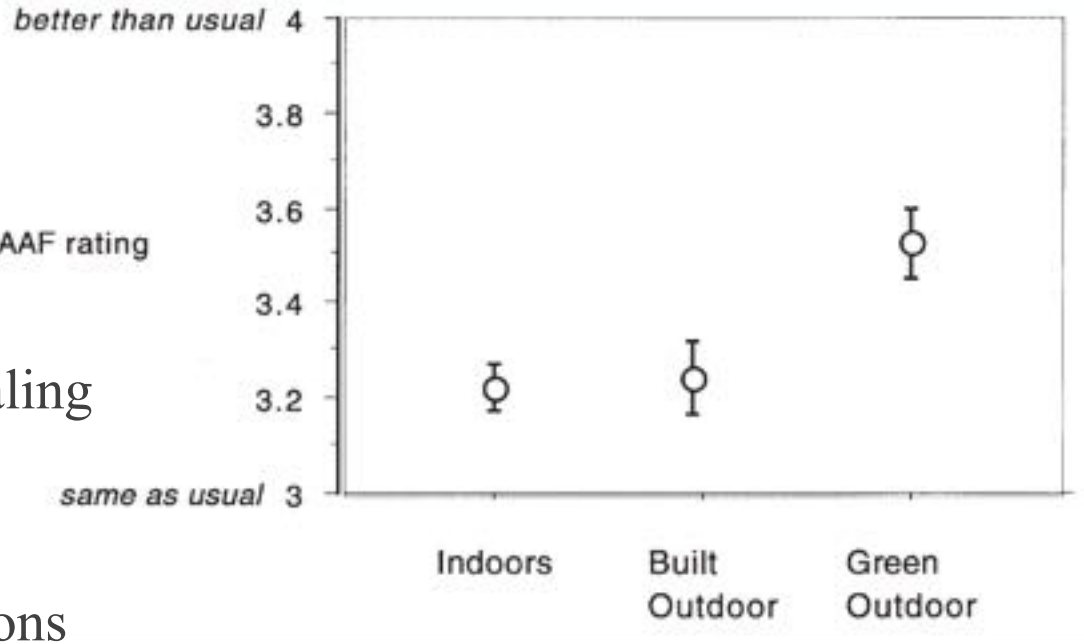
- 17 children aged 7-12 with diagnosed ADHD
- 20-minute guided walks
  - Park
  - Neighborhood
  - Downtown
- Pre-walk puzzles
- Post-walk cognitive test



Faber Taylor & Kuo. 2009.
Journal of Attention Disorders

ADHD and nature contact

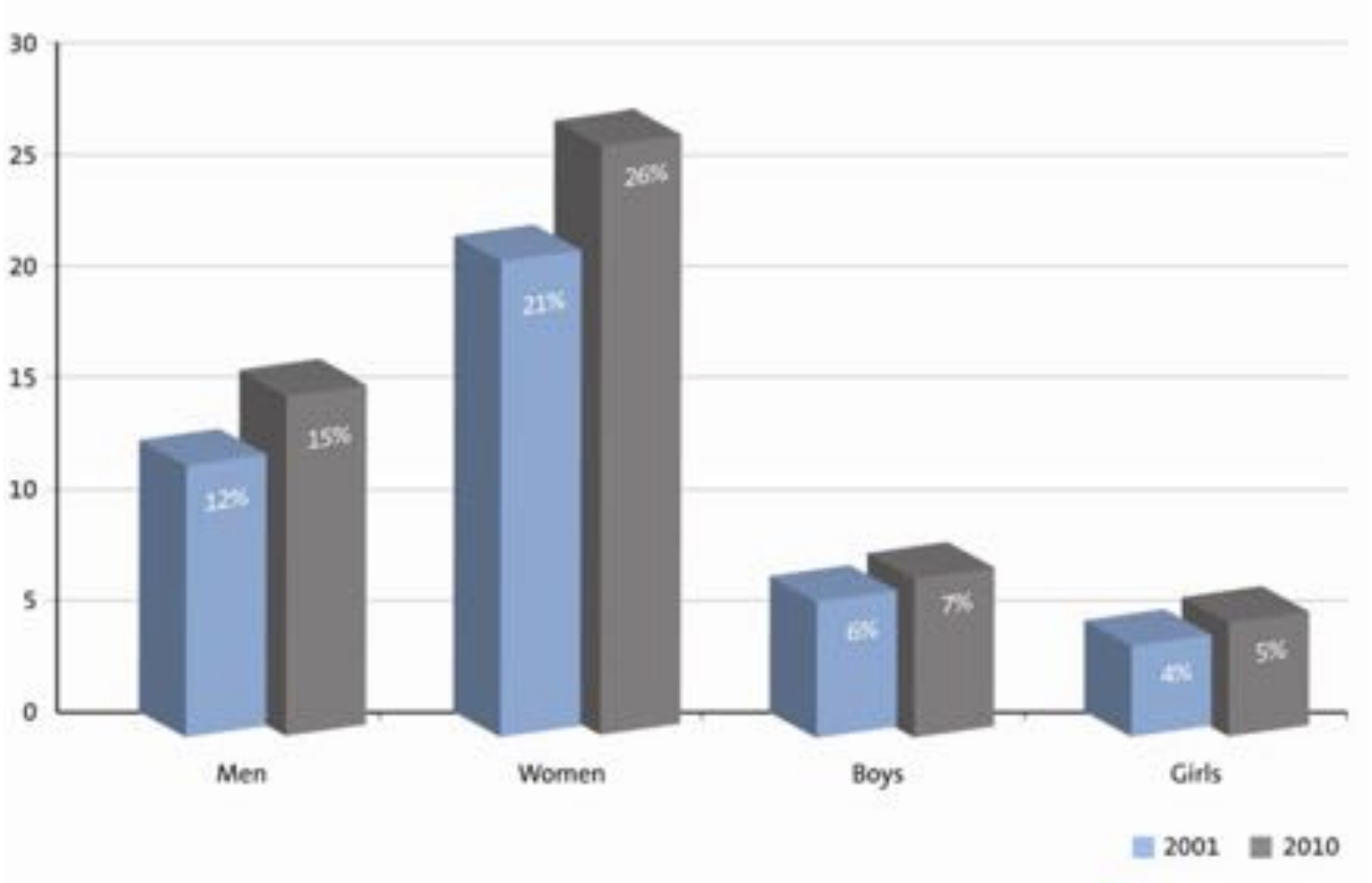
- 96 children aged 7-12 diagnosed ADD or ADHD
- Parents gave *postactivity attentional functioning ratings* (PAAF) – 4 measures:
  - Can't stay focused on unappealing tasks (homework or chores)
  - Can't complete tasks
  - Can't listen and follow directions
  - Easily distracted



Faber Taylor. 2001. *Environment & Behavior*

% of U.S. Population Using Mental Health Medications

2001 vs 2010



America's State of Mind, Medco Health Solutions, Inc

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

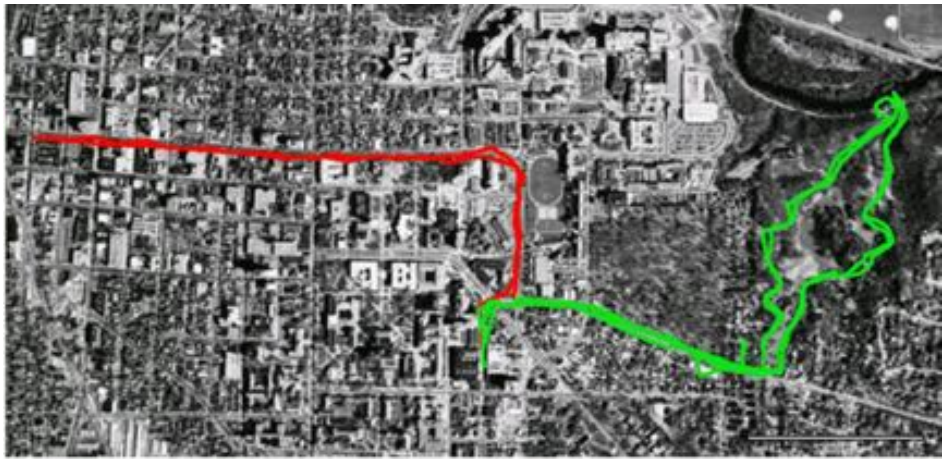
Improving Depression

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

20 adults with major depression
walk in a park setting and an urban setting

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

cognitive and affective improvements after walking in a nature setting



Alzheimer's Disease & Dementia

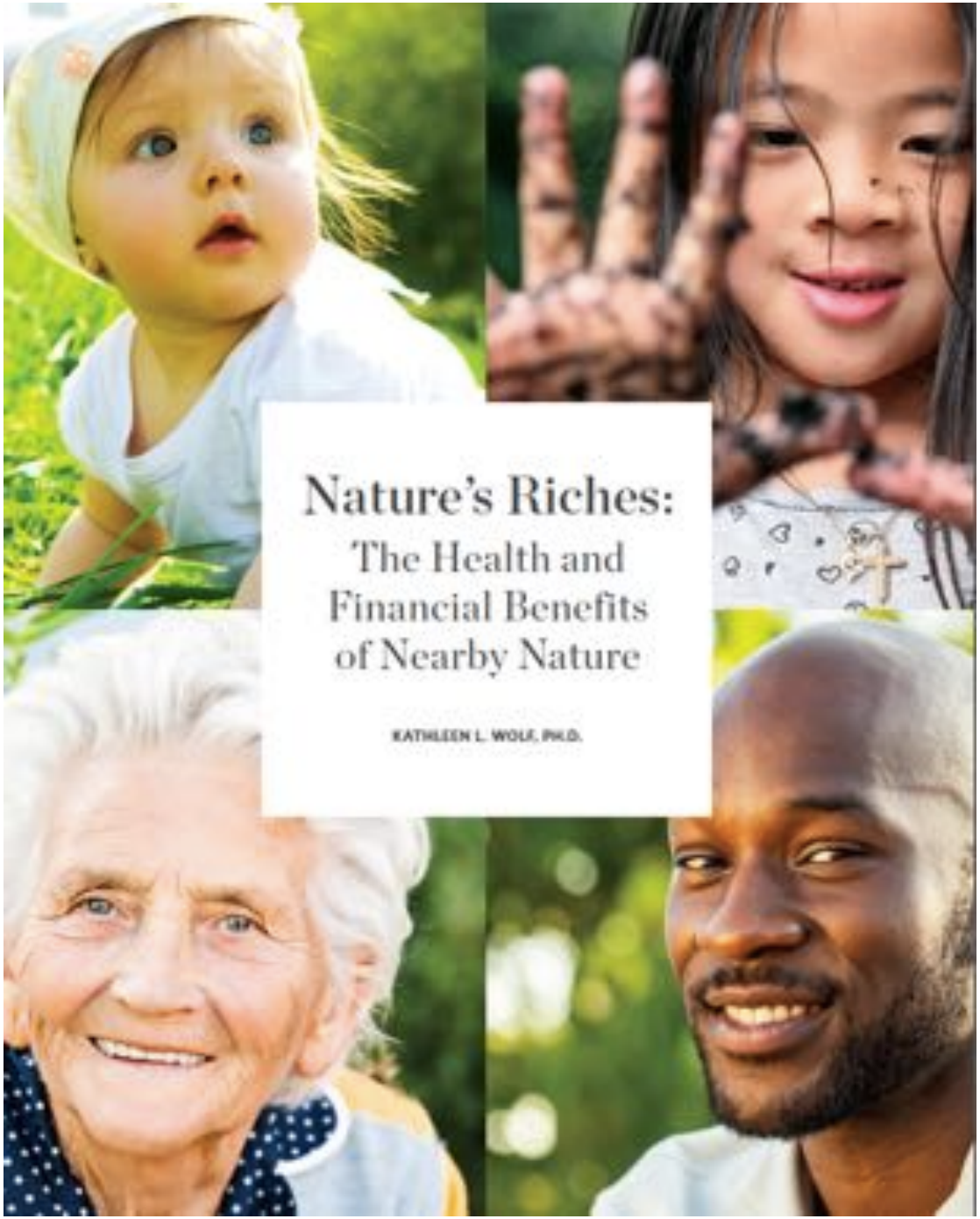
Provide wander gardens & horticulture therapy

- 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



design:

milepost

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

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!

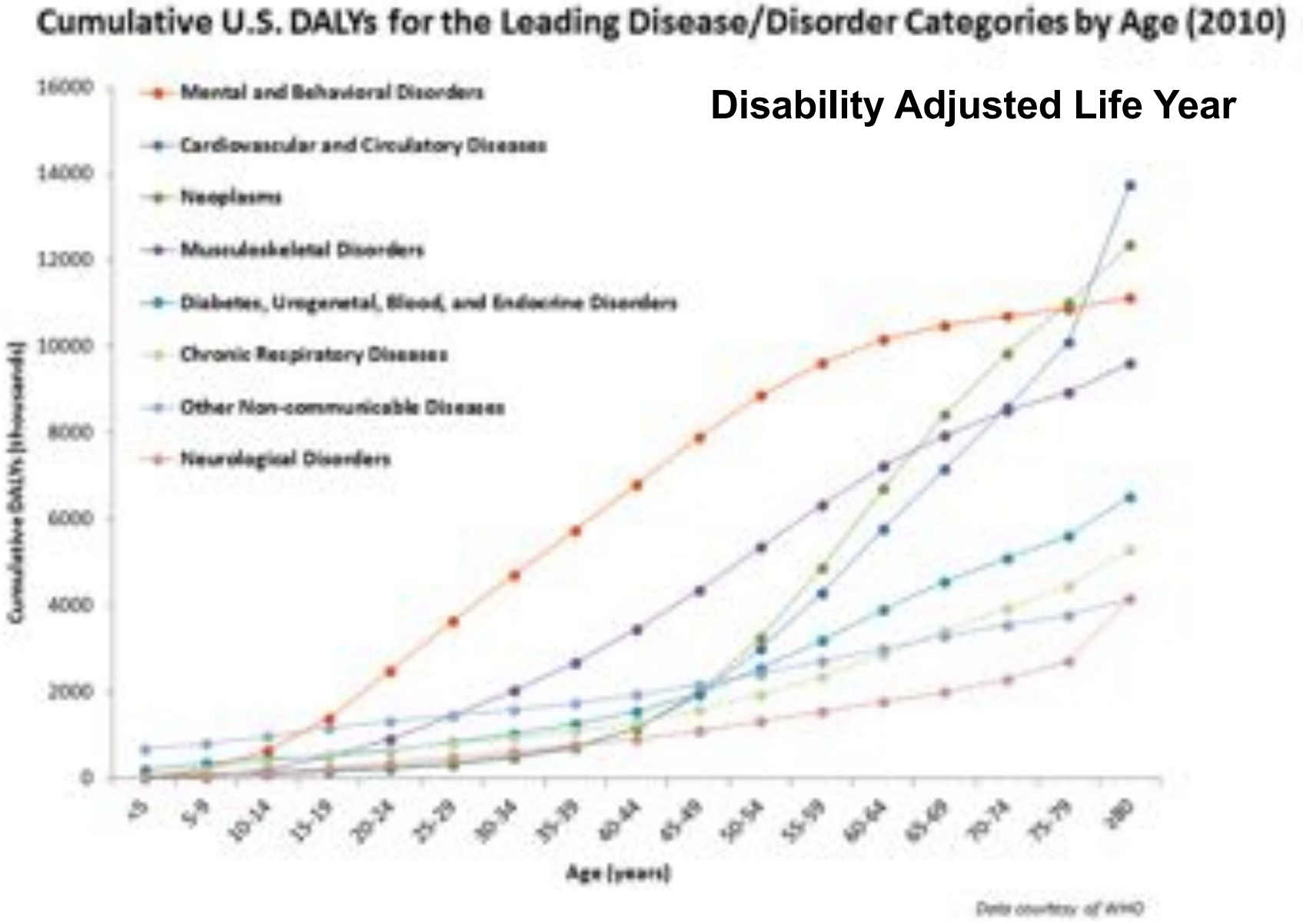
Publications

- Green Cities, Good Health web site. A resource to learn more about nearby nature in cities and human health.
- Wolf, K.L. 2016. Uncovering benefits of the urban forest: A look at how urban forestry investment assists local economies, public health. Properties Magazine 70, 2: 55-57.
- Wolf, K.L., M.K. Measells, and S.C. Grado. (in review). Economics of nearby nature and elder health: A quantitative review. Environmental Health Perspectives.
- Wolf, K.L., M.K. Measells, S.C. Grado, and A.S.T. Robbins. 2015. Economic values of metro nature health benefits: A life course approach. Urban Forestry and Urban Greening 14: 694-701.
- Wolf, K.L., and A.S.T. Robbins. 2015. Metro nature, environmental health, and economic value. Environmental Health Perspectives 123, 5: 390-8.
- Wolf, K.L. 2015. Green strategies to improve public health and save billions. International Innovations 195: 54-55.
- Wolf, K.L. 2013. The urban forest. Communities & Banking 24, 2: 25-27.
- * Research and publications were funded in part by the U.S.D.A. Forest Service, National Urban and Community Forestry program, as recommended by the National Urban and Community Forestry Advisory Council (NUCFAC).

Summary

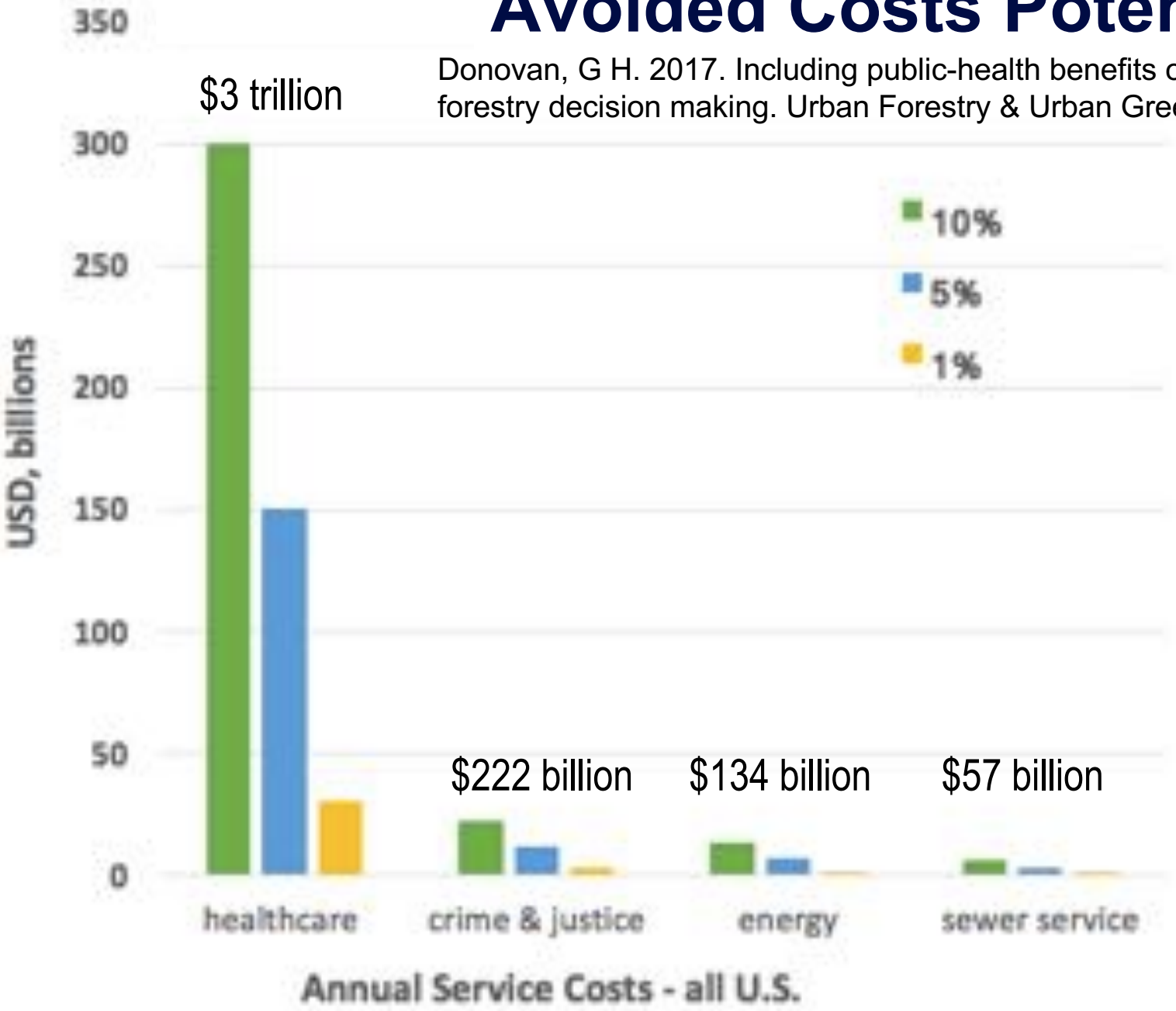
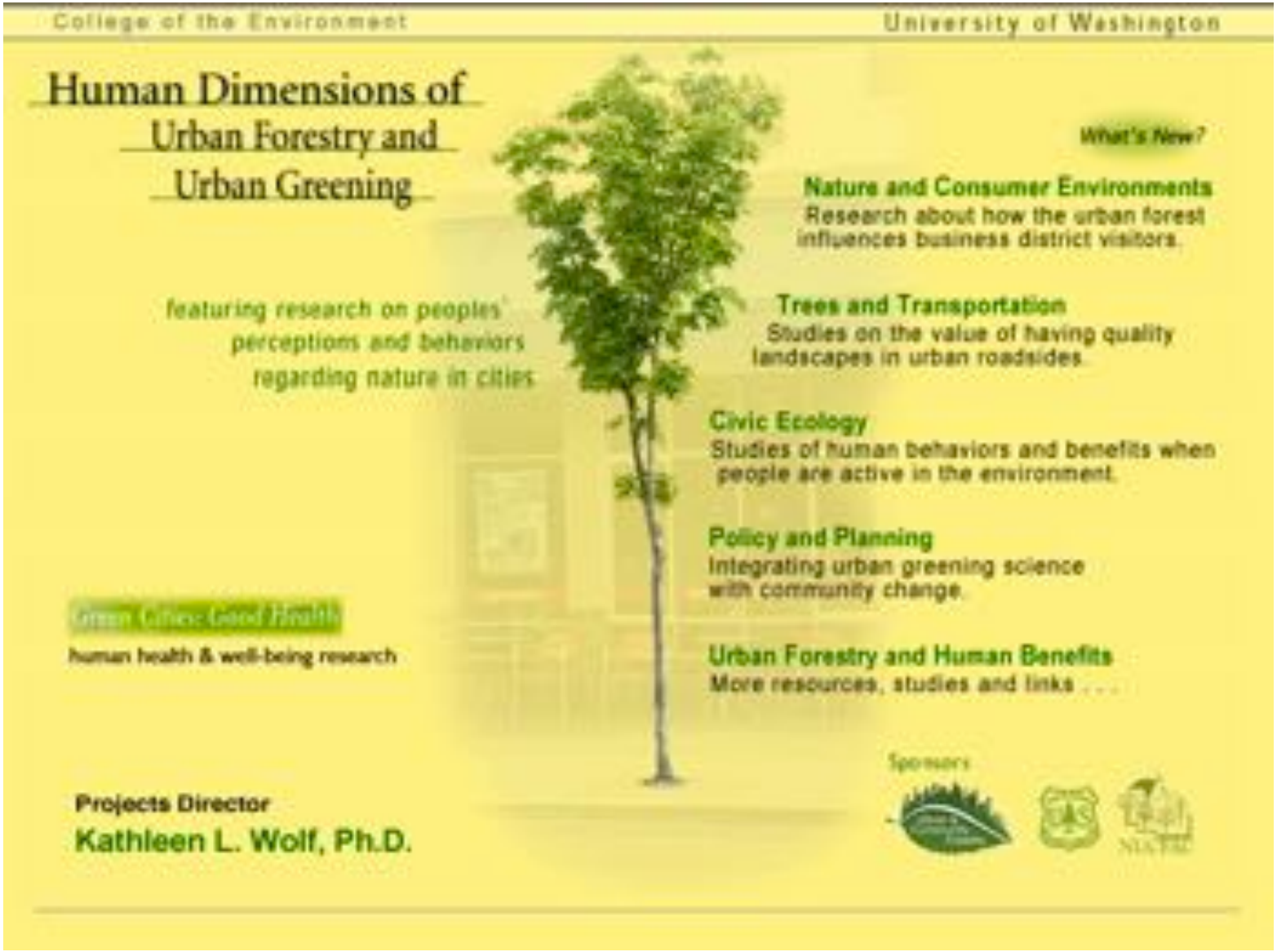
- evidence-based human health & wellness benefits
- economic consequences!
- market & non-market valuations
- first efforts – promising!
- sector messaging about nature & health

Lifecycle :: disease & illness



Avoided Costs Potential?

Donovan, G H. 2017. Including public-health benefits of trees in urban-forestry decision making. Urban Forestry & Urban Greening 22, 120-23.



www.naturewithin.info