The Human Health Benefits of Nature: towards a better understanding of the links and economic benefits

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Clean Air & Urban Landscapes Hub
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SYSTEMS THINKING

- Air Quality
- Stormwater
- Waste Water
- Solid Waste
- Cultural Heritage
- Biota
- Exercise & Fitness
- Active Mobility
- Noise
- Carbon
- BMP's
- Community Identity
- Social Capital
- Public Art
- Connectivity
- Cultural Heritage
- Energy
- Heat Island
- Allergens

credit: American Planning Association
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

- General socio-economic, cultural and environmental conditions
- Social and community networks
- Individual lifestyle factors
  - Age, sex & hereditary factors
  - Living and working conditions
  - Unemployment
  - Work environment
  - Water sanitation
  - Health care services
  - Housing
  - Agriculture and food production
  - Education
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
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. Then, it shows how nonmarket valuations can support local decision-making.

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.

- A study found 7% higher rental rates for commercial offices having high quality landscapes.

- Shoppers claim that they will spend 9% to 12% more for goods and services in central business districts having high quality tree canopy.

- 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.
Green Cities: Good Health
database of >4,000 peer reviewed publications
Discovery: Human Health Benefits Across the Life Cycle
Urban Forests and 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., Health & Place 2011;
Hystad et al., Env Health Perspectives 2014
Hygiene Hypothesis

 présence of soil bacteria in body, *Mycobacterium vaccae* = increased serotonin
 boost immune function
 may alleviate depression (dirt or Prozac?)

Lowry et al. 2007. Neuroscience
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
Civic Stewardship for Resilience

E. Svendsen, L. Campbell; USFS
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

www.rph.org/eden.html
Economic Valuation Process

- What are the benefits?
- Who experiences nature and gets benefits?
- What is the green condition or situation that provides benefits?
- Scale of value question (i.e., community, province/state, nation)
- What are the costs/income gained/lost associated with these benefits?
Analysis Process

- scale of individual to community
- green condition
  - urban forestry, parks, gardens, etc.
- market & non-market valuation strategy

screen for benefits
Publications


* 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). Also the USFS Pacific Northwest Research Station.
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!
process #1: screen for benefits
Lifecycle :: disease & illness

Cumulative U.S. DALYs for the Leading Disease/Disorder Categories by Age (2010)

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

INFANTS

BIRTH WEIGHT
POTENTIAL ECONOMIC VALUE: $6.0B 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 who have more tree canopy and green space near their homes generally have babies with healthier birth weights.

IMMUNE FUNCTION
EVIDENCE INDICATES 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 "nursery 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 visits and walks help reduce these conditions and improve interactions between people within the household.

CHILDREN & TEENS

OVERALL HEALTH AND WELL-BEING
ECONOMIC INDICATOR: INCREASED PHYSICAL ACTIVITY, REDUCED ASTHMA OR LEADING CAUSE OF EMERGENCY DEPARTMENT VISITS, HOSPITALIZATIONS AND MISSED SCHOOL DAYS, AND REDUCED RISK OF ADULT SKIN CONDITIONS.
Nurture is as positive influence, playing in nature helps children develop learning, social, and intellectual skills that improve both health and life achievement. Green spaces close to a child’s home and best friends, give them space for moderate to vigorous activity, and allow them to move around much more easily.

ADHD
POTENTIAL ECONOMIC VALUE: $0.8B SAVINGS ON MEDICATION SAVINGS PER YEAR.
Millions of children ages 2–17 are treated for Attention Deficit Hyperactivity Disorder (ADHD) in the U.S. Nature exposure in 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.

DEPRESSION AND STRESS
ECONOMIC INDICATOR: REDUCES FRUSTRATION, MENTAL DISTRESS AND DEPRESSION DISORDERS, AND IMPROVES BODY IMAGE, SELF-ESTEEM AND LIFE SATISFACTION.
Many highly scheduled lifestyles take their toll. Nature experiences reduce stress. Nearly 1 in 5 adults experience major depression each year in the U.S., and mental, behavioral, and nonpsychiatric disorders are a leading cause of disability. Nature experiences support people and communities for improved mental health, mood, and life function. Improved mental health and function reduces disease treatment costs and improves overall productivity.

CARDIOVASCULAR DISEASE
POTENTIAL ECONOMIC VALUE: $1.3B SAVINGS ON TREATMENT COSTS ANNUALLY.
Cardiovascular Disease is the leading cause of premature deaths 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
POTENTIAL ECONOMIC VALUE: $2.7B SAVINGS ON REDUCED COSTS OF CRIME FOR VICTIMS AND PROPERY OWNERS PER YEAR.
Personal safety and security are important conditions for quality of life. The presence of nature in neighborhoods — community gardens, forest enclosures, and landscaped vacant lots — is associated with reduced personal and property crime.

ADULTS

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MOBILITY & QUALITY OF LIFE
POTENTIAL ECONOMIC VALUE: $1.0B 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’ lives within older care facilities are particularly affected by these situations. Being out in nature maintains personal mobility, leading to reduced falls and reduced need for medications. Further, those who are actually included are more likely to be socially engaged and active in their communities.

HYPERTENSION
POTENTIAL ECONOMIC VALUE: $2.0B SAVINGS ON MEDICATIONS IN THE U.S. ANNUALLY.
Hypertension, or high blood pressure, is one of the five most common conditions impacting older adults. Views of nature, particularly forests and "swell bubbling" (canyon walks in natural forest settings) decrease diastolic rates.

COGNITIVE DISORDERS
POTENTIAL ECONOMIC VALUE: $2.0B SAVINGS ON MEDICAL SERVICES NOT COUNTING THE VALUE OF HOME CAREGIVER SERVICES.
About one in five older adults experience mental and cognitive disorders, with age being the greatest risk factor. In 2010, about 11% of people age 65 or older were affected with Alzheimer’s disease. Those with dementia have three times as many hospital stays per year as other elders. Exposure to nature improves symptoms related to cognitive disorders, such as agitation, depression, and reduced mobility.

OLDER ADULTS

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contributing analysts:
Dr. Stephen Grado & Marcus Measells, MSU; Dr. Alicia Robbins, Weyerhaueser
process #2: understand green condition
Diversity in Metro Nature

NEARBY NATURE INCLUDES A VARIETY OF SPACES AND PLACES

URBAN FOREST CANOPY

BIOPHILIC DESIGN

PARKS AND GARDENS

GREEN STORMWATER INFRASTRUCTURE
Stormwater Ecosystem Services

green infrastructure

goal: co-design for co-benefits

Image courtesy of the Center for Urban Forest Research
Thornton Creek Water Quality Channel (Seattle, SvR Design)
1 hectare, treats runoff from 275 hectares (1 hectare = 2.47 acres)
stormwater & health co-benefits
linked to active living network
process #3: apply valuation strategy
Valuation Sources

Benefit x Nature x Health Outcome

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

What is the Value?
• scale of individual to community
• urban forestry, parks, gardens, etc.
• market & non-market

screen for benefits

green condition

valuation strategy

Thanks to:
Dr. Alicia Robbins, Weyerhauser
Dr. Steve Grado, Mississippi State University
Marc Measells, Mississippi State University
Summary Table  Millions of U.S. Dollars (2012)

<table>
<thead>
<tr>
<th>Benefit (geographic scope)</th>
<th>Minimum ($)</th>
<th>Maximum ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Newborn Health (U.S.)</td>
<td>5.3</td>
<td>5.3</td>
</tr>
<tr>
<td>Attention Deficit Hyperactivity Disorder (U.S.)</td>
<td>383.5</td>
<td>1,917.7</td>
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<tr>
<td>Schools (U.S.)</td>
<td>20.4</td>
<td>1,262.9</td>
</tr>
<tr>
<td>Crime (U.S.)</td>
<td>340.6</td>
<td>899.4</td>
</tr>
<tr>
<td>Cardiovascular Disease (U.K., U.S.)</td>
<td>1,220.0</td>
<td>1,220.0</td>
</tr>
<tr>
<td>Alzheimer’s Disease (U.S.)</td>
<td>724.6</td>
<td>1,449.2</td>
</tr>
<tr>
<td>Totals</td>
<td>2,694.4</td>
<td>6,754.5</td>
</tr>
</tbody>
</table>

Summary

• evidence-based human health & wellness benefits – extensive literature
• economic consequences
• market & non-market valuations
• first efforts – additional opportunities
• = demonstrating return on investment
Future Research?
Local Economics

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Additional Valuation Assessments

- Place – Seattle waterfront
- People - elders
- Nature Element – city trees & forests