Green Infrastructure, Human Health Benefits, & Economic Value: a life course approach

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Grey to Green Conference
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Green Infrastructure for Ecosystem Services

ecology for human benefit
multi-tasking nature & co-benefits

environmental services
health and well-being
economic value
Stormwater Management

Pierce County WA, Chambers Creek Properties
Pierce County WA, Chambers Creek Properties - 4 year growth
stormwater management

Parks & People Foundation, Baltimore
high land values
reduced public funds
community needs
new parks and green space??

SO . . . . . .
multi-tasking nature
creating co-benefits
Tanner Springs Park
Portland OR
linked to active living network
neighborhood social cohesion

environmental education & social learning
Metro Nature for Public Health

scientific evidence
health & well-being benefits
life course concept
‘cradle to grave’
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
School & Learning
Green High School Campuses

- 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

Matsuoka. 2010. Landscape & Urban Planning
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

photos: Dan Herms, Ohio State University
Shinrin-yoku  Forest Bathing

- extended forest walks
- reduced ‘fight or flight’ nervous system activity
- lower cortisol – a stress indicator
- increased immune function
- lower pulse rate & blood pressure
Physical Activity & Depression Reduction

- Review of 13 high quality studies
  - exercise recommended for mild to moderate depression
  - people who are willing & motivated
  - associated meditation and mindfulness are important

Elders & Horticulture Therapy
Effects of nature window view on recovery from surgery (Roger Ulrich, 1984)

- Shorter stays
- Less pain
- Fewer minor complications
- Better emotional well-being
hospital healing gardens:
patients; family and friends; professional staff
What is the Evidence?
Research Reviews

Green Cities: Good Health

Metro nature - including trees, parks, gardens, and natural areas - enhance quality of life in cities and towns. The experience of nature improves human health and well-being in many ways. Nearly 40 years of scientific studies tell us how. Here’s the research...

RESEARCH THEMES
- Livable Cities
- Place Attachment & Meaning
- Community Building
- Community Economics
- Social Ties
- Crime & Fear
- Reduced Risk
- Wellness & Physiology
- Active Living
- Healing & Therapy
- Mental Health & Functioning

www.greenhealth.washington.edu

on-line resource
summaries complete: soon!
Research Review and Summaries

Sponsors:
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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.

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.\(^{34}\)
Metro Nature :: Human Health & Well Being
> 2,900 articles in database

% distribution of entire database
What is the Economic Value?
Economic Valuation

<table>
<thead>
<tr>
<th>Benefit</th>
<th>Metro Nature</th>
<th>Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>Newborn Birth Weight</td>
<td>canopy cover and birth weight</td>
<td>more tree canopy-fewer small for gestational age babies</td>
</tr>
<tr>
<td>Attention Deficit</td>
<td>greener play areas vs built outdoor or indoor settings</td>
<td>reduced symptoms potentially reducing medication</td>
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<tr>
<td>Hyperactivity Disorder</td>
<td></td>
<td></td>
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<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>

\[\text{value} = \text{degree of benefit} \times \text{public/personal costs}\]

Total Value (2012, U.S.) - $1.8 to $5.9 billion
Caveats and Conditions

• shhh! still under peer review for publication

• life course focus
• subset of all metro nature findings
• the best current valuation prospects

• numbers rather small – why?
Valuation Challenges . . . .

- little crossover of natural resources and public health methods
- spotty local health data sources
- equivalent geographic scale of datasets:
  - < 1m for vegetation
  - neighborhood or block for health
- precision of vegetation assessment . . .
  (may need more than canopy)
Vegetation Assessment for Health Benefit?

- Toronto Urban Tree Canopy Assessment 2009
- “represents a ‘top down’ mapping perspective in which tree canopy overhanging other features [such as buildings or paved surfaces] is assigned to the tree canopy class”
Figure 7.—Tree cover (percent) in Toronto neighborhoods, 2009.
Aerial shot of High Park and the southwest end of Toronto.
Top Down Mapping...

adequate vegetation info?

Figure 2: Vegetation is associated with positive response on school campuses. Depicting school sites, these images are an example of the diverse vegetation conditions of metro nature that are associated with potential human health and well-being benefits.
Vegetation & Health Benefits Assessment Explorations

City of Seattle urban forest canopy assessment

vegetation and land use map for Seattle
image credit: UW Remote Sensing and Geospatial Lab
Veg Assessment Using LIDAR

Figure 5: LiDAR response to built versus vegetative surfaces.
credit: Qian-Yi Zhou, Stanford University

fly over(s) by airplane
Veg Assessment Explorations

oblique view
LIDAR point cloud
Veg Assessment Explorations

ground view

LIDAR point cloud
Summary & Conclusions
Summary

• green infrastructure offers co-benefit opportunities
• throughout human life course!
• evidence? environmental services & public health
• economic implications – preliminary
• need to build better data (such as LIDAR)
Human Dimensions of Urban Forestry and Urban Greening

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

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 . . .

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www.naturewithin.info