To Your Good Health: exploring metro nature, remote sensing, and economics

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College of the Environment

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## Ecosystem Services

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The Ancient Tree Forum
Windsor Great Park tour
Ted Green
Ancient Tree Guardian
## Ecosystem Services

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### Supporting Services
- Nutrient cycling
- Soil formation
- Primary production

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**Millennium Ecosystem Assessment**

2005
Nature Benefits
Only Beyond the City?
Health & Well Being
Cultural Ecosystem Services
evidence about the importance of ‘nearby nature’
City Trees, Metro Nature for Health . . . . . Habitat

scientific evidence
health & well being benefits
life course concept
‘cradle to grave’
THE LIFE OF A WOMAN

STAGES OF WOMAN'S LIFE FROM THE CRADLE TO THE GRAVE

1. SMILING INFANT
   - Her gentle manners went for show
   - Her infancy comfortable always
   - Her future days she cannot know

2. YOUNG LADY
   - Her manners are correct
   - Her virtue is supreme
   - Her beauty is incomparable

3. MOTHER
   - She labors and toils
   - She watches night and day
   - She bears the weight of life

4. MATURE WOMAN
   - She has passed her youth
   - She is wise in council
   - She has earned her place in life

5. OLD WOMAN
   - She is old and feeble
   - She is a pillar in the community
   - She is respected for her wisdom

6. DECEASED WOMAN
   - The body sinks
   - The soul departs
   - The spirit rests in peace
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
Nature & Psych Development
children’s play & imagination

Richard Louv - Last Child in the Woods
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
College students with more natural views from their dorm windows
- scored higher on tests of capacity to direct attention
- rated themselves as able to function more effectively

Trees & Crime Reduction

- trees in the public right of way are associated with lower crime rates
  - smaller, viewobstructing trees are associated with increased crime
  - larger trees are associated with reduced crime

Donovan & Prestemon. 2012. *Environment and Behavior*
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
Extensive Evidence?
How Do I Learn More?
Finding that study . . . . . .
Research Review and Summaries

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

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

www.greenhealth.washington.edu
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.
Metro Nature & Health Evidence Framework
Summary

nearly 40 years of health evidence
diverse health benefits
associated with diverse nearby nature

consider a habitat outlook
expand partnership & collaboration

back to life course . . . . .
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

parks, recreation, active transit
A brisk walk in the park keeps Marcy B in shape between dog shows. His owner, Columbus resident Cathy Stenso, got up early to give her 3-year-old Doberman his regular workout. They typically log 18 miles in Berliner Park.
hospital healing gardens: patients; family and friends; professional staff
Effects of nature window view on recovery from surgery (Roger Ulrich, 1984)

- Shorter stays
- Less pain
- Fewer minor complications
- Better emotional well-being
Legacy Good Samaritan Medical Center
Stenzel Healing Garden 1997
Rehabilitation Institute of Oregon
Hospital Staff – Respite and Support
Nature: A stress coping resource for employees 24-7

thanks to Teresia Hazen Legacy, Portland for slides
Elders: mobility & social connections
Evidence about Metro Nature, City Trees, Health, Wellness

new work!
urban forest benefits
i-Tree

Eco Streets Hydro Vue

future? Health/ Anthro

STRUCTURE FUNCTION/BENEFIT

ECONOMIC VALUE MANAGEMENT

photo credits: Seattle i-Tree Training by Al Zelaya
more than trees . . . nature & health evidence
Urban Tree Canopy Assessment

i-Tree analysis

City of Seattle
Top Down Mapping

plus

understory vegetation

for human habitat

school yard landscapes
forest = silviculture
forest = ecosystem
Remote Sensing-LIDAR

Remote Sensing-LIDAR

LiDAR response to built versus vegetative surfaces.
credit: Qian-Yi Zhou, Stanford University
Veg Assessment Explorations
Veg Assessment Explorations

ground view

LIDAR point cloud
What is the Economic Value?
# Economic Value Exploration

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

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<tr>
<th>Benefit</th>
<th>Metro Nature</th>
<th>Outcome</th>
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<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 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>
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Total Value (2012, U.S.) – annual $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)
Summary & Conclusions
in the background
trees & forests for human health & well-being
Summary

- urban forests/metro nature provide habitat for human health
- throughout human life course!
- evidence! Green Cities: Good Health
- vegetation assessment – more ecosystem structure
- economic implications – preliminary
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 . . .

Green Cities: Good Health
human health & well-being research

Projects Director
Kathleen L. Wolf, Ph.D.
our evolution?!
Attention Restoration Theory
Rachel & Stephen Kaplan U of MI
directed attention
fatigue . . . .
Workplace Nature Views

- Well-being
  - desk workers without view of nature reported 23% more ailments in prior 6 months

- Job Satisfaction
  - less frustrated and more patient
  - higher overall job satisfaction and enthusiasm

ART Design Elements

- being away
- ‘soft’ fascination
- extent
- compatibility
the better office cubicle!

bottom line = $$ benefits of trees & nature
Green & Crime Reduction

- vacant lot greening in Philadelphia (4 sections)
- consistent reductions in gun assaults across 4 sections
- consistent reductions in vandalism in 1 section

Branas et al. 2011. *American Journal of Epidemiology*
Oregon Burn Center Garden
Science and the Sacred for Better Human Habitat?

another dimension
public green spaces that please the eye, nourish the soul, and help renew communities
healing gardens
soothing
distracting
calm focus
Design Elements

NatureSacred :: Open Spaces Sacred Places
portal :: path :: surround :: destination
portal :: path :: surround :: destination
science & sacred intersection?
place, design & mindfulness
Nature and Mindfulness

- focus
- soft fascination
- undirected attention
Mindfulness/Meditation Training

- meta analysis; clinical/non situations
- focus on moment-to-moment experience and mental awareness
- more veridical perception (reality check)
- reduce negative affect
- improve vitality and coping
- medical symptoms & sensory pain

Mindfulness/Meditation Training

- healthy workplace employees
- 8 week mindfulness training
- brain electrical activity – positive affect
- brain activation – reduce stress event response
- more antibodies after influenza vaccine = better immune function

Davidson et al. 2003. Alterations in Brain and Immune Function Produced by Mindfulness Meditation. Psychosomatic Medicine