City Trees and Green Space are Health Determinants
a review of evidence & values

Kathleen Wolf, Ph.D.
Research Social Scientist

University of Washington (Seattle)
College of the Environment

UMR Connects Speaker Series
Rochester MN :: May 17, 2016
Evolution of Cities
take-away #1

sanitary
sustainable
sacred
Industrial Age – urban squalor

Filthy Cities documentaries
sanitary city

efficient and hygienic
supply & removal
of materials and services
natural systems disconnect
Baltimore: Public Works Museum
sustainable city

ecological function, green infrastructure, & ‘revealed’ processes

Pincetl, S. 2010. From the sanitary city to the sustainable city. Local Environment
measure the canopy of a city
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

green infrastructure

Image courtesy of the Center for Urban Forest Research
Thornton Creek Water Quality Channel (Seattle, SvR Design)
1 hectare, treats runoff from 275 hectares
linked to active living network
green infrastructure :: co-benefits
City Trees & Nature for Better Health

take-away #2

environments build health more than individual choice possible in the city & towns
evidence about human wellness & ‘nearby nature’
WHO health definition

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

science & evidence re: environment role of ‘metro nature’?
not a panacea, but important!
Determinants of Health
City Trees & Nature for Better Health

take-away #3

scientific evidence – 40 years!
many 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; Hystad et al., Env Health Perspectives 2014
Nature & Psych Development
children’s play & imagination

Richard Louv - Last Child in the Woods
Fiddleheads Forest School
Washington Park Arboretum (Seattle)

cognitive
social &
physical
learning
Hygiene Hypothesis

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

Lowry et al. 2007. Neuroscience
Eat Dirt!
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
Classroom Views & Stress

Li & Sullivan. 2016. Landscape & Urban Planning
Classroom Views & Stress

Attention scores

high school student response

Stress scores
What is the Evidence?

Trees, Urban Greening, Metro Nature Human Health, Welfare & Function
Finding that study . . . . . .
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 review & 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.
Potential Annual Cost Savings and Increased Income Associated with Human Health and Well-being Benefits Derived from Metro Nature

<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>
</tr>
<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>

Millions of U.S. Dollars (2012)

To Your Good Health!

disease prevention!
health promotion!

fine-tuning the tree & nature message
enlisting more partners
back on track
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
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

the better office cubicle!

bottom line = $$ benefits of trees & nature
Biophilic Design :: buildings

integrated nature & architecture

credit: Progressive Times
Mindfulness

Mind Full, or Mindful?
constant busyness

attempted multi-tasking

‘out of balance’

Anna and Elena Balbusso, NY Times
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
Nature and Mindfulness

focus
soft fascination
undirected attention
Attention Restoration Theory

Rachel & Stephen Kaplan

credit: Michael Hellgren
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
combatting obesity
U.S. moderate activity recommendations

parks prescription
Green Streets for Walkability

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

Aspinall et al. 2015. 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 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

Berman et al. 2012. *Journal of Affective Disorders*
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
health care $$ savings
patient preference & return

Ulfelder Healing Garden,
Massachusetts General Hospital

Scripps Encinitas Hospital
Hospital Staff – Respite and Support
Nature: A stress coping resource for employees 24-7

image credit: Teresia Hazen
Elders: mobility & social connections
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
Conclusions

Sanitary to sustainable city . . . .
Salutary benefits of environment
Nearby nature in cities & towns
Evidence? Green Cities: Good Health web site
Benefits across human life cycle
Evolving to the sacred city?

implications for Mayo Clinic & Rochester?
Nature Benefits not only beyond the city!
- 3,800 physicians and scientists
  + 50,900 allied staff
- over $500 million a year on research
- ranked No. 1 on lists of "Best Hospitals"
- about 1,318,300 different patients in 2015
12 Habits of Highly Healthy People
Rochester & Mayo Clinic

nearby nature & trees for . . .

excellence
productivity
livability
Human Dimensions of Urban Forestry and Urban Greening

What’s New?

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.

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

Urban Forestry and Human Benefits
More resources, studies and links

Projects Director
Kathleen L. Wolf, Ph.D.