Urban Ecosystem Services & Their Value

Kathleen Wolf, Ph.D.
Research Social Scientist
University of Washington
May 2011

Urbanization Trends (USFS)

> 80% of US population lives in urbanized areas
• urbanism:
  - efficiencies
  - smaller footprint
  - livable communities
  - conservation of working lands
  - location choice


Green Metropolis: Why Living Smaller, Living Closer, and Driving Less are the Keys to Sustainability. David Owen, 2009

Ecosystem Services Typology

Millennium Ecosystem Assessment 2005

landscape gradient
urban suburban exurban rural wildland
Hilton Head, South Carolina
THE SUSTAINABLE SITES INITIATIVE™

An Integrated Approach
All sites CAN provide ecosystem services.
What are the source landscapes for urban ecosystem services?

parks, trees, open space, and . . . .

Nature & Livable Cities

“multi-tasking” green infrastructure
Open Space Stewardship Volunteers

urban green = livability & human capital

collaborative resource management Elinor Ostrom
Community Gardens
food security :: community cohesion

hospitals: healing gardens
Gardens & Horticulture Therapy

Green Roof - Chicago City Hall

- high-rise nature, preferred views
- energy savings, stormwater management
How are urban ecosystem services assessed or measured?
i-Tree Suite of Software

Urban Environmental Services
USDA Forest Service

i-Tree Eco Seattle sample plots

- Commercial/Mixed Use: 19
- Developed Park or Boulevard: 20
- Downtown: 19
- Major Institutions: 20
- Manufacturing/Industrial: 19
- Multi-family Residential: 0
- Natural Area Parks: 20
- Single-family Residential: 68
- 2010 Completed Plots: 185

USDA Forest Service
Cascade Land Conservancy
King County, City of Seattle
Conserving Energy

Reducing Atmospheric Carbon Dioxide

USDA Forest Service, Center for Urban Forest Research
Reducing Stormwater Runoff

Why are city trees & urban greening important?

human health, functioning, & well-being
human health & well-being . . . . as urban ecosystem services

Ecosystem Services

<table>
<thead>
<tr>
<th>Ecosystem Services</th>
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<tbody>
<tr>
<td><strong>Provisioning Services</strong></td>
</tr>
<tr>
<td>Food (crops, livestock, wild foods, etc...)</td>
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<tr>
<td>Fiber (timber, cotton/hemp/silk, wood fuel)</td>
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<tr>
<td>Genetic resources</td>
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<tr>
<td>Biochemicals, natural medicines, pharmaceuticals</td>
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<tr>
<td>Fresh water</td>
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<tr>
<td><strong>Supporting Services</strong></td>
</tr>
<tr>
<td>Nematodes cycling</td>
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<tr>
<td>Soil formation</td>
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<tr>
<td>Primary production</td>
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<tr>
<td><strong>Regulating Services</strong></td>
</tr>
<tr>
<td>Air quality regulation</td>
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<tr>
<td>Climate regulation (global, regional, and local)</td>
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<tr>
<td>Water regulation</td>
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<tr>
<td>Erosion regulation</td>
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<tr>
<td>Waste purification and waste treatment</td>
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<tr>
<td>Disease regulation</td>
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<tr>
<td>Pest regulation</td>
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<tr>
<td>Pollination</td>
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<tr>
<td>Natural hazard regulation</td>
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<tr>
<td><strong>Cultural Services</strong></td>
</tr>
<tr>
<td>Aesthetic values</td>
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<tr>
<td>Spiritual and religious values</td>
</tr>
<tr>
<td>Recreation and ecotourism</td>
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</tbody>
</table>

cultural services
aesthetic
spiritual
religious
recreation
ecotourism
+ much more!
Finding that study . . . . .

Research Reviews

Green Cities: Good Health

Research Themes:
- Livable Cities
- Parks, Attachment & Healing
- Community Building
- Community Economics
- Social Time
- Crime & Fear
- Resilient Risk
- Wellness & Physiology
- Active Living
- Healing & Therapy
- Mental Health & Resilience

first phase: June 2010
summaries complete: July 2011
additional products June 2012

www.greenhealth.washington.edu

sponsors: Univ of WA; USDA Forest Service, U&CF Program; ARRA

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Obesity Trends* Among U.S. Adults

1985

(*BMI ≥30, or ~30 lbs overweight for 5’ 4” person)

Source: Behavioral Risk Factor Surveillance System, CDC.
Obesity Trends* Among U.S. Adults

1986
(*BMI ≥30, or ~ 30 lbs overweight for 5’ 4” person)

Source: Behavioral Risk Factor Surveillance System, CDC.

Obesity Trends* Among U.S. Adults

1987
(*BMI ≥30, or ~ 30 lbs overweight for 5’ 4” person)

Source: Behavioral Risk Factor Surveillance System, CDC.
Obesity Trends* Among U.S. Adults

1988
(*BMI ≥30, or ~ 30 lbs overweight for 5’ 4” person)

Source: Behavioral Risk Factor Surveillance System, CDC.

Obesity Trends* Among U.S. Adults

1989
(*BMI ≥30, or ~ 30 lbs overweight for 5’ 4” person)

Source: Behavioral Risk Factor Surveillance System, CDC.
Obesity Trends* Among U.S. Adults

1990

(*BMI ≥ 30, or ~ 30 lbs overweight for 5’ 4” person)

No Data           <10%          10%–14%        15%–19%

Source: Behavioral Risk Factor Surveillance System, CDC.

Obesity Trends* Among U.S. Adults

1991

(*BMI ≥ 30, or ~ 30 lbs overweight for 5’ 4” person)

No Data           <10%          10%–14%        15%–19%

Source: Behavioral Risk Factor Surveillance System, CDC.
Obesity Trends* Among U.S. Adults

1992

(*BMI ≥ 30, or ~30 lbs overweight for 5’ 4” person)

Source: Behavioral Risk Factor Surveillance System, CDC.

Obesity Trends* Among U.S. Adults

1993

(*BMI ≥ 30, or ~30 lbs overweight for 5’ 4” person)

Source: Behavioral Risk Factor Surveillance System, CDC.
**Obesity Trends* Among U.S. Adults**

**1994**

(*BMI ≥30, or ~30 lbs overweight for 5’ 4” person*)

![Map of Obesity Trends 1994](chart1.png)

Source: Behavioral Risk Factor Surveillance System, CDC.

**Obesity Trends* Among U.S. Adults**

**1995**

(*BMI ≥30, or ~30 lbs overweight for 5’ 4” person*)

![Map of Obesity Trends 1995](chart2.png)

Source: Behavioral Risk Factor Surveillance System, CDC.
Obesity Trends* Among U.S. Adults

**1996**

(*BMI ≥30, or ~ 30 lbs overweight for 5’ 4” person*)

Source: Behavioral Risk Factor Surveillance System, CDC.

Obesity Trends* Among U.S. Adults

**1997**

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Obesity Trends* Among U.S. Adults

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Source: Behavioral Risk Factor Surveillance System, CDC.

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2001

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Source: Behavioral Risk Factor Surveillance System, CDC.
Obesity Trends* Among U.S. Adults

2002

(*BMI ≥30, or ~ 30 lbs overweight for 5’ 4” person)

Obesity Trends* Among U.S. Adults

2003

(*BMI ≥30, or ~ 30 lbs overweight for 5’ 4” person)

Source: Behavioral Risk Factor Surveillance System, CDC.
Obesity Trends* Among U.S. Adults

2004

(*BMI ≥30, or ~ 30 lbs. overweight for 5’ 4” person)

Source: Behavioral Risk Factor Surveillance System, CDC.

Obesity Trends* Among U.S. Adults

2005

(*BMI ≥30, or ~ 30 lbs. overweight for 5’ 4” person)

Source: Behavioral Risk Factor Surveillance System, CDC.
Obesity Trends* Among U.S. Adults
2006
(*BMI ≥30, or ~ 30 lbs. overweight for 5’ 4” person)

Obesity Trends* Among U.S. Adults
2007
(*BMI ≥30, or ~ 30 lbs. overweight for 5’ 4” person)
Obesity Trends* Among U.S. Adults
2008
(*BMI ≥30, or ~ 30 lbs. overweight for 5’ 4” person)

Source: Behavioral Risk Factor Surveillance System, CDC.

Age-adjusted % of adults aged ≥20 years who are obese, 2007

Source: Behavioral Risk Factor Surveillance System, CDC.
Physical Inactivity & Obesity

The majority of Americans are not active enough. The goal is 30 minutes per day of moderate activity to reduce risk factors for chronic diseases (heart, stroke, cancer, diabetes). Significant costs to national health services:

- $168 billion medical costs
- 17% of all U.S. medical costs

CDC 2010

Urban Forestry & Greening
Active Living

<table>
<thead>
<tr>
<th>Positive Elements</th>
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<tbody>
<tr>
<td>Physical Environment</td>
</tr>
<tr>
<td>higher population density (city core rather than suburbs)</td>
</tr>
<tr>
<td>higher housing density</td>
</tr>
<tr>
<td>mix of land uses (such as residential and retail)</td>
</tr>
<tr>
<td>street design with more connectivity (rather than cul-de-sacs)</td>
</tr>
<tr>
<td>availability of public transit</td>
</tr>
<tr>
<td>walking and biking infrastructure (such as sidewalks and bike lanes)</td>
</tr>
<tr>
<td>Psycho-Social Environment</td>
</tr>
<tr>
<td>safety from crime</td>
</tr>
<tr>
<td>safety from traffic</td>
</tr>
<tr>
<td>absence of social disorder</td>
</tr>
<tr>
<td>aesthetics (including trees and landscape)</td>
</tr>
<tr>
<td>educational campaigns (such as Walk-to-School)</td>
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<tr>
<td>incentive programs (such as work place reimbursement for transit use)</td>
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</tbody>
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Table 1: Determinants of City Walkability
parks, open spaces & trails

make room for pedestrians
Nature, Human Health & Walkable Neighborhoods

- Environments: Neighborhood Streets (Tokyo)
  - tree-lined
  - parks

- Outcomes: Elderly People & Walking
  - less illness
  - lower mortality rate


walkable places = health & happiness
Urban Green :: Public Health & Well Being

> 1,700 articles

Work & Learning
**the nature advantage**

- 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

Tennessen & Cimprich. 1995. *Journal of Environmental Psychology*

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**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*
nature recovery & schools
first phase - reading circle

depaving & nature recovery
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

in closing . . . .
Ecosystem Services

ECOSYSTEM SERVICES

All sites CAN provide ecosystem services

© 2009 Sustainable Sites Initiative
Evidence-based Metrics

HUMAN HEALTH & WELL-BEING
SOILS
MATERIALS
VEGETATION
HYDROLOGY

www.greenhealth.washington.edu

Research Reviews

Green Cities: Good Health

RESEARCH THEMES

- Livable Cities
- Focal Attachment & Healing
- Community Building
- Community Economics
- Social Time
- Crime & Fear
- Resilient Built Environment
- Health & Physiology
- Active Living
- Healing & Therapy
- Mental Health & Functioning

sponsors: Univ of WA; USDA Forest Service, U&CF Program; ARRA
www.naturewithin.info