Ecosystem Services in the City

Urban Greening & Public Health

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Research Social Scientist
University of Washington
ACES :: December 2010
Why are city trees & urban greening important?

human health, functioning, & well-being
Improving Air Quality

Shade on Paved Surfaces and Parked Cars Reduces Evaporative Hydrocarbon Emissions and Ozone Formation

Oxygen and Volatile Organic Compounds Released Through the Leaves

Gaseous Pollutants Absorbed Through Leaf Stomates and Lenticels

Small Particles Adhere to Surfaces

Trees Save Energy for Cooling and Heating, Thereby Reducing Pollutant Emissions from Power Plants

USDA Forest Service, Center for Urban Forest Research
Reducing Atmospheric Carbon Dioxide
Reducing Stormwater Runoff

USDA Forest Service, Center for Urban Forest Research
Conserving Energy

USDA Forest Service, Center for Urban Forest Research
ES . . . a ‘social construction’

**ECOSYSTEM SERVICES**

<table>
<thead>
<tr>
<th>Supporting Services</th>
<th>Provisioning Services</th>
<th>Regulating Services</th>
<th>Cultural Services</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nutrient cycling</td>
<td>Food (crops, livestock, wild foods, etc...)</td>
<td>Air quality regulation</td>
<td>Aesthetic values</td>
</tr>
<tr>
<td>Soil formation</td>
<td>Fiber (timber, cotton/hemp/silk, wood fuel)</td>
<td>Climate regulation (global, regional, and local)</td>
<td>Spiritual and religious values</td>
</tr>
<tr>
<td>Primary production</td>
<td>Genetic resources</td>
<td>Water regulation</td>
<td>Recreation and ecosystem</td>
</tr>
<tr>
<td></td>
<td>Biochemicals, natural medicines, pharmaceuticals</td>
<td>Erosion regulation</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Fresh water</td>
<td>Water purification and waste treatment</td>
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**cultural services in the urban context?**
Urbanization Trends (USFS)

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

“Green Metropolis: Why Living Smaller, Living Closer, and Driving Less are the Keys to Sustainability”
David Owen, 2009
i-Tree Suite of Software

Urban Environmental Services
USDA Forest Service
An Integrated Approach
ECOSYSTEM SERVICES

All sites CAN provide ecosystem services
Evidence-based Metrics

- Soils
- Human Health & Well-being
- Materials
- Vegetation
- Hydrology
2009 REPORT

Guidelines & Performance Benchmarks

- Site Selection
- Pre-Design Assessment
- Site Design – Water
- Site Design – Soil and Vegetation
- Site Design – Materials
- Site Design – Human Health & Well Being
- Construction
- Operations and Maintenance
- Monitoring and Innovation

Sustainability Certification: Outdoor Environments

released November 2009
PROJECT SCHEDULE

Guidelines and Performance Benchmarks Draft 2008
Released November 2008

Guidelines And Performance Benchmarks 2009 with Rating System
Released November 2009

Pilot Projects Phase
From 2010 – 2012

Reference Guide
Target publication – 2012
Community Gardens

food security :: community cohesion
Green Roof - Chicago City Hall

- high-rise nature, preferred views

- energy savings, stormwater management
Stewardship Volunteers

collaborative resource management
Elinor Ostrom
hospitals: healing gardens
Elders & Horticulture Therapy
Nature & Livable Cities

measurable services?
Research Reviews

sponsors:
University of Washington
USDA Forest Service, U&CF Program
NGO partners
Research Reviews

first phase: June 2010
summaries complete: Dec 2010
additional products

www.greenhealth.washington.edu
Urban Green :: Public Health & Well Being
1,584 articles

% distribution
Physical Inactivity & Obesity

majority of Americans not active enough

goal-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
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

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2007

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

2008

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Source: Behavioral Risk Factor Surveillance System, CDC.

doubling of U.S. obesity rate since 1980s
# City Trees & Nature

## Active Living

<table>
<thead>
<tr>
<th>Physical Environment</th>
<th>Positive Elements</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>higher population density (city core rather than suburbs)</td>
</tr>
<tr>
<td></td>
<td>higher housing density</td>
</tr>
<tr>
<td></td>
<td>mix of land uses (such as residential and retail)</td>
</tr>
<tr>
<td></td>
<td>street design with more connectivity (rather than cul-de-sacs)</td>
</tr>
<tr>
<td></td>
<td>availability of public transit</td>
</tr>
<tr>
<td></td>
<td>walking and biking infrastructure (such as sidewalks and bike lanes)</td>
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<th>Psycho-Social Environment</th>
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<tr>
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<td>safety from crime</td>
</tr>
<tr>
<td></td>
<td>safety from traffic</td>
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<tr>
<td></td>
<td>absence of social disorder</td>
</tr>
<tr>
<td></td>
<td>aesthetics (including trees and landscape)</td>
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<tr>
<td></td>
<td>educational campaigns (such as Walk-to-School)</td>
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<tr>
<td></td>
<td>incentive programs (such as work place reimbursement for transit use)</td>
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*Table 1: Determinants of City Walkability*
A brisk walk in the park keeps Harry II in shape between dog shows. His owner, Columbia resident Charlie Strauss, gets up early to give her 2-year-old Oberhuntness his regular exercise. They typically jog 12 miles in Brooklyn Park.
parks, open spaces & trails
make room for pedestrians
walkable places = health & happiness
Nature, Human Health & Walkable Neighborhoods

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

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

Takano, Nakamura, Watanabe. 2002.
Journal of Epidemiology & Community Health
1,584 articles
gap analysis

% distribution
Future Research?
expand ES “Cultural Services”

- benefits
- metrics
- framework
- extract
- geospatial
- “signatures”
- valuation
- units

Figure 1. Comparison between a Landsat 30m pixel resolution image (a) classified using per-pixel method (c), and a National Agricultural Imagery Program (NAIP) 1m pixel resolution image (b) classified using Object Based Image Analysis method (d). Note the higher image detail in the OBIA classification and the greater number of classes possible.
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...

Projects Director
Kathleen L. Wolf, Ph.D.

www.naturewithin.info