City Trees, Nature & Economics :: A Review of Research & Evidence

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Lexington Fayette Tree Board
Lexington :: November 2015
Urban Forest Structure/Metro Nature
Forest Economics
Economic Value of Urban Green Challenges!

Forest Products Industry
= market goods
excludable
identifiable ownership
expenses-revenues-profits

Trees/Green in Cities
= public goods
non-excludable
multiple “owners”
expenses-returns?-profits?
Residential Real Estate Values

place
real estate value
# Yard & Street Trees

<table>
<thead>
<tr>
<th>Value</th>
<th>Increase</th>
<th>Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>2%</td>
<td>2%</td>
<td>mature yard trees (greater than 9-inch dbh)</td>
</tr>
<tr>
<td>3%</td>
<td>3%</td>
<td>larger street trees (up to 100’ away)</td>
</tr>
<tr>
<td>3-5%</td>
<td>3-5%</td>
<td>trees in front yard landscaping</td>
</tr>
<tr>
<td>6-9%</td>
<td>6-9%</td>
<td>good tree cover in a neighborhood</td>
</tr>
<tr>
<td>10-15%</td>
<td>10-15%</td>
<td>mature trees in high-income neighborhoods</td>
</tr>
</tbody>
</table>

multiple studies: Green Cities: Good Health > Local Economics
## Tree Retention In Development

<table>
<thead>
<tr>
<th>Value</th>
<th>Increase</th>
<th>Condition</th>
<th>Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>18%</td>
<td>building lots with substantial mature tree cover</td>
<td></td>
</tr>
<tr>
<td></td>
<td>22%</td>
<td>tree-covered undeveloped acreage</td>
<td></td>
</tr>
<tr>
<td></td>
<td>19-35%</td>
<td>lots bordering suburban wooded preserves</td>
<td></td>
</tr>
<tr>
<td></td>
<td>37%</td>
<td>open land that is two-thirds wooded</td>
<td></td>
</tr>
</tbody>
</table>
Parks & Open Space proximate principle

<table>
<thead>
<tr>
<th>Value</th>
<th>Increase</th>
<th>Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>10%</td>
<td>inner city home located within 1/4 mile of a park</td>
</tr>
<tr>
<td></td>
<td>17%</td>
<td>home near cleaned-up vacant lot</td>
</tr>
<tr>
<td></td>
<td>20%</td>
<td>home adjacent to or fronting a passive park area</td>
</tr>
<tr>
<td></td>
<td>32%</td>
<td>residential development adjacent to greenbelts</td>
</tr>
</tbody>
</table>
Local Government Benefits

Civic Investment – Public Goods like schools, emergency response, roads

- street trees average positive effect on house values
- added up across Portland, Oregon
- yields a total value of $1.35 billion
- potentially increasing annual property tax revenues $15.3 million

Donovan & Butry. 2010
Landscape and Urban Planning
Retail Behavior

preference
perception
patronage
Trees & Retail Environments Research

Awesome!
Trees & Shopper Environments Research

• Research Questions •
  trees and visual quality?
  trees and consumer behavior?
  trees and product pricing?

• Methods:
  mail out/in surveys
  national or local sample
  residents/nearby city residents

partners: U of Washington, NGOs, business organizations
funded by USDA Forest Service
Image Categories (sorted by ratings)

Scale: 1 = not at all, 5 = like very much, 26 images

Pocket Parks mean 3.72 (highest)

Full Canopy mean 3.63
Enclosed Sidewalk 3.32

Intermittent Trees 2.78
No Trees
mean 1.65
(lowest)
(high - 3.72)
1. Place Perceptions
   • Place Character
   • Interaction with Merchants
   • Quality of Products

2. Patronage Behavior
   • travel time, travel distance
   • duration & frequency of visits
   • willingness to pay for parking

3. Product Pricing
   • higher willingness to pay for all types of goods
   • higher in districts with trees – 9-12%
Companies stage an experience when they engage customers in a memorable way.
the Chenoggye freeway in Seoul ~ 1970-2005
Chenoggyeon – 8.4 km, $900 M

initial public criticism!
High Line Railway - W Manhattan
- between 2003 and 2011
- nearby property values increased 103% (despite the deep recession)
- $2 billion was invested in nearby properties development
outdoor rooms
social spaces
sense of welcoming
public xeriscape

shared design & management
identity
affordable materials
message of renewal
Environmental Services

canopy analysis
translation to value
the canopy of a city
Eco (UFORE)
Streets (STRATUM)
Hydro
Vue

tools provided
by USDA
Forest Service

photo credits: Seattle i-Tree Training by Al Zelaya
Improving Air Quality

Image courtesy of the Center for Urban Forest Research
Managing Stormwater Runoff

Image courtesy of the Center for Urban Forest Research
Stormwater Management

Pierce County WA, Chambers Creek Properties
Pierce County WA, Chambers Creek Properties - 4 year growth
Thornton Creek Water Quality Channel (Seattle, SvR Design)
1 hectare, treats runoff from 275 hectares
in cities . . . . .

expensive land values
reduced public funds
increasing community needs
new parks??

SO . . . . . .
multi-tasking nature
creating co-benefits
Stormwater Report, online April 2014 (search health)

co-benefit design opportunities
linked to active living network
neighborhood social cohesion

environmental education & social learning
Public Health Economics

what are the health benefits? economic values?
Determinants of Health
metro nature & health benefits across the life cycle
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
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*

Tim Lynch Associates

www.rph.org/eden.html
What is the Evidence?

Nearby Nature for 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.
Elements of Economic Valuation

Step 1: Screen Benefits Research

- What are the benefits?
- Who experiences nature and gets benefits?
- What is the green condition or situation that provides benefits?
- Scale of value question (i.e., community, province/state, nation)
- What are the costs/income gained/lost associated with these benefits?
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
Valuation Strategies
Step 2: Benefits Transfer and Value

- factor income
- avoided or replacement cost
- burden of illness
- hedonic pricing
- stated preference/contingent valuation
- revealed preference (e.g., travel cost)
- quality adjusted life years
- benefit/cost
## Valuation Sources

### Step 3: Benefits Focus for Valuation

<table>
<thead>
<tr>
<th>Benefit</th>
<th>Metro Nature</th>
<th>Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>Newborn Birth Weight</td>
<td>increased tree canopy cover near mothers' homes</td>
<td>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>
</tr>
</tbody>
</table>
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><strong>Totals</strong></td>
<td><strong>2,694.4</strong></td>
<td><strong>6,754.5</strong></td>
</tr>
</tbody>
</table>

Millions of U.S. Dollars (2012)

Summary

• research & evidence
• diverse & confirmed economic value
• property value, retail behavior, health benefits = $$
• future needs – better comparison of costs & economic value
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 roadways.

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.