Review of Urban Forest Economic Values
Money Does Grow on Trees

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Forest Economics 101
Economic Value of City Nature
Methods Challenges

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

Trees/Green in Cities
- public goods
- non-excludable
- multiple “owners”
- expenses - returns?
  - profits?
Trees & Property Value

hedonic value

street trees

yard landscape

local revenues
## Yard & Street Trees

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

**multiple studies:**

**Green Cities: Good Health > Local Economics**
<table>
<thead>
<tr>
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<th>Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>18%</td>
<td>building lots with substantial mature tree cover</td>
</tr>
<tr>
<td>22%</td>
<td>tree-covered undeveloped acreage</td>
</tr>
<tr>
<td>19-35%</td>
<td>lots bordering suburban wooded preserves</td>
</tr>
<tr>
<td>37%</td>
<td>open land that is two-thirds wooded</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 USD
- potentially increasing annual property tax revenues $15.3 million USD

Donovan & Butry. 2010
*Landscape and Urban Planning*
Community Economics

retail & shopper behavior
indirect economic measures
Trees & Retail Environments Research

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.”
summary

urban forests = human habitat = retail environment

studies of trees in business districts
perception, preference & behavior
design & place messaging/identity
customer relationships
Trees as Place-Makers
the Chenoggye freeway in Seoul
~ 1970-2005
Cheonoggyecheon Stream Restoration

8.4 km, $900 M
ALPHA
Awaji Landscape Planning & Horticulture Academy
retail street
in urban Japan
(and other
Asian cities)
Namba Parks, Osaka

view from nearby hotel
interior retail space

ground level
small plazas
retail entry
up-close nature experiences

place of respite
Namba Parks
retail success & nature experience benefits
lessons learned?

social spaces
small rooms
variety within unity
Austin, TX
South Congress Avenue redevelopment district
public xeriscape

shared design & management
identity
affordable materials
message of renewal
Bainbridge Island, WA
“main street”
outdoor rooms
social spaces
sense of welcoming
Human Health
Evidence & Economic Value

nearby nature experiences
human habitat for wellness
disease prevention
health promotion
What are the economic values of nature and human health benefits?
Elements of Economic Valuation

• 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?
Nearby nature experiences are important across the entire life cycle, from cradle to grave.

Research about nature benefits and economic value is fairly new. Some of the quantified health benefits of nature in cities are easier to convert to economic value than others. Here are some preliminary valuations—estimated for the entire U.S. on an annual basis.

**INFANTS**

**BIRTH WEIGHT**

**ECONOMIC IMPACT:**

- **STRENGTHEN IMMUNE SYSTEM:** LEADS TO REDUCED ILLNESS AND CARDIAC DISEASE ACROSS A LIFETIME.

We are most vulnerable in the early months of our lives, when the body and mind are growing and developing at an astonishing rate. The 'phytotherapy' hypothesis suggests that early contact with outdoor microorganisms facilitates the development of a healthy immune response.

**FAMILY DYNAMICS**

- **IMPROVED FAMILY DYNAMICS:** MAY REDUCE MENTAL HEALTH TREATMENT AND COUNSELING SERVICES.

An infant's parents and siblings adjust their lives after a baby arrives, and the changes can bring on stress and anxiety. Nature walks and activities help reduce these conditions and improve interactions between people within the household.

**CHILDREN & TEENS**

**OVERALL HEALTH AND WELL-BEING**

**INCREASED PHYSICAL ACTIVITY, REDUCED AUTOIMMUNE, AND INCREASED LED TO REDUCED ILLNESS AND CARICAN DISEASE ACROSS A LIFETIME.**

**IMMUNE FUNCTION**

- **STRENGTHENED IMMUNE SYSTEM:** LEADS TO REDUCED ILLNESS AND CARDIAC DISEASE ACROSS A LIFETIME.

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**ADULTS**

**DEPRESSION AND STRESS**

- **REDUCED DEPRESSION AND STRESS:** TO REDUCE ILLNESS AND CARICAN DISEASE ACROSS A LIFETIME.

**MOBILITY & QUALITY OF LIFE**

- **REDUCED DEPRESSION AND STRESS:** TO REDUCE ILLNESS AND CARDIAC DISEASE ACROSS A LIFETIME.

**CARDIOVASCULAR DISEASE**

- **REDUCED DEPRESSION AND STRESS:** TO REDUCE ILLNESS AND CARDIAC DISEASE ACROSS A LIFETIME.

**HYPERTENSION**

- **REDUCED DEPRESSION AND STRESS:** TO REDUCE ILLNESS AND CARDIAC DISEASE ACROSS A LIFETIME.

**COGNITIVE DISORDERS**

- **REDUCED DEPRESSION AND STRESS:** TO REDUCE ILLNESS AND CARDIAC DISEASE ACROSS A LIFETIME.

**CRIME & SAFETY**

- **REDUCED DEPRESSION AND STRESS:** TO REDUCE ILLNESS AND CARDIAC DISEASE ACROSS A LIFETIME.

- **REDUCED DEPRESSION AND STRESS:** TO REDUCE ILLNESS AND CARDIAC DISEASE ACROSS A LIFETIME.

concluding analysts:

Dr. Stephen Grado & Marcus Measells, MSU; Dr. Alicia Robbins, Weyerhaueser
Lifecycle :: disease & illness

Cumulative U.S. DALYs for the Leading Disease/Disorder Categories by Age (2010)

Disability Adjusted Life Year

Data courtesy of WHO
Analysis Process

- **scale of individual to community**

- **green condition**
  - urban forestry, parks, gardens, etc.

- **market & non-market valuation strategy**
process #1: screen for benefits
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.
process #2: understand green condition
Diversity in Metro Nature

Nearby Nature Includes a Variety of Spaces and Places

Urban Forest Canopy

Biophilic Design

Parks and Gardens

Green Stormwater Infrastructure
process #3: apply valuation strategy
Valuation Strategies
Benefits Transfer approaches

- 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
Natural Resources Valuation

- travel cost
- income loss
- hedonic margin
- willingness to pay
Stormwater Ecosystem Services

green infrastructure

goal: co-design for co-benefits

Image courtesy of the Center for Urban Forest Research
Grey Infrastructure

Drain, direct, dispatch

Green Infrastructure

Slow, spread, soak

Source: Low Impact Development: A Design Manual for Urban Areas, 2010
Avoided Costs Potential?

- $3 trillion
- 17% of US GDP


- $222 billion
- $134 billion
- $57 billion
Valuation Sources

Benefit x Nature x Health Outcome

<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</td>
<td>greener play areas vs built outdoor or indoor settings</td>
<td>reduced symptoms potentially reducing medication</td>
</tr>
<tr>
<td>Hyperactivity Disorder</td>
<td></td>
<td></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>

common values: avoided costs & burden of illness
Analysis Process

- scale of individual to community
- screen for benefits
- green condition
  - urban forestry, parks, gardens, etc.
- market & non-market valuation strategy
## Summary Table

<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>

Urban Forests for Human Health:
A Focused Economic Valuation

Support arboriculture research
with a donation to the TREE Fund

Healthy trees are rooted in research!
Donate now at www.treefund.org

Cultivating Innovation in Arboriculture and Urban Forestry
TREE Fund • 552 S. Washington St., Ste. 109, Naperville, IL 60540
Summary

• evidence-based human health & wellness benefits
• economic consequences!
• market & non-market valuations
• first efforts – promising!
• = demonstrating return on investment
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.

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.