Money Does Grow on Trees
Review of Urban Forest Economic Values

Kathleen Wolf, Ph.D.
Research Social Scientist

University of Washington (Seattle)
School of Environmental and Forest Sciences

19th Annual Tree School
Friends of Jefferson the Beautiful
30 April 2019
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?
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
Trees & Property Value

hedonic analysis

street trees
yard landscape

local revenues
## Yard & Street Trees

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

“Companies stage an experience when they engage customers in a memorable way.”
studies of trees in business districts
perception, preference & behavior
design & place messaging/identity
customer relationships

summary
urban forests = human habitat = retail environment

deeproot.com
the Chenoggye freeway in Seoul
~ 1970-2005
Cheonoggyecheon Stream Restoration

8.4 km, $900 M
Austin, TX
South Congress Avenue redevelopment district
public xeriscape

shared design & management
identity
affordable materials
message of renewal
Bainbridge Island, WA
“main street”
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?
Analysis Process

- Scale of individual to community
  - Screen for benefits

- Green condition
  - Urban forestry, parks, gardens, etc.

- Market & non-market valuation strategy
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 Reviews & 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.
City Nature Opportunities

NEARBY NATURE INCLUDES A VARIETY OF SPACES AND PLACES

- URBAN FOREST CANOPY
- BIOPHILIC DESIGN
- PARKS AND GARDENS
- GREEN STORMWATER INFRASTRUCTURE
# Causes of Adult Death in Louisiana?

source: U.S. Centers for Disease Control and Prevention

<table>
<thead>
<tr>
<th>LA Leading Causes of Death, 2014</th>
<th>Deaths</th>
<th>Rate***</th>
<th>State Rank*</th>
<th>U.S. Rate**</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Heart Disease</td>
<td>10647</td>
<td>216.3</td>
<td>5th</td>
<td>167.0</td>
</tr>
<tr>
<td>2. Cancer</td>
<td>9455</td>
<td>186.1</td>
<td>4th</td>
<td>161.2</td>
</tr>
<tr>
<td>3. Accidents</td>
<td>2344</td>
<td>49.8</td>
<td>12th</td>
<td>40.5</td>
</tr>
<tr>
<td>4. Chronic Lower Respiratory Disease</td>
<td>2237</td>
<td>45.5</td>
<td>23rd</td>
<td>40.5</td>
</tr>
<tr>
<td>5. Stroke</td>
<td>2230</td>
<td>45.6</td>
<td>4th</td>
<td>36.5</td>
</tr>
<tr>
<td>6. Alzheimer's disease</td>
<td>1670</td>
<td>36.0</td>
<td>6th</td>
<td>25.4</td>
</tr>
<tr>
<td>7. Diabetes</td>
<td>1238</td>
<td>24.8</td>
<td>7th</td>
<td>20.9</td>
</tr>
<tr>
<td>8. Kidney Disease</td>
<td>1217</td>
<td>24.9</td>
<td>1st</td>
<td>13.2</td>
</tr>
<tr>
<td>9. Septicemia</td>
<td>960</td>
<td>19.4</td>
<td>2nd</td>
<td>10.7</td>
</tr>
<tr>
<td>10. Flu/Pneumonia</td>
<td>854</td>
<td>17.5</td>
<td>14th</td>
<td>15.1</td>
</tr>
</tbody>
</table>
Lifecycle :: disease & illness

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

Disability Adjusted Life Year
<table>
<thead>
<tr>
<th></th>
<th>Louisiana</th>
<th>Ave for States</th>
<th>All U.S</th>
</tr>
</thead>
<tbody>
<tr>
<td>annual per capita spending</td>
<td>$7,815</td>
<td></td>
<td>$8,045</td>
</tr>
<tr>
<td>% of GDP, state &amp; local spending</td>
<td>5.1%</td>
<td>4.0%</td>
<td>17.9%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>N.D. at 2.1%</td>
<td>$3.3 trillion</td>
</tr>
<tr>
<td></td>
<td></td>
<td>to MS at 9.3%</td>
<td></td>
</tr>
<tr>
<td>State ranking</td>
<td>39</td>
<td>1 to 50</td>
<td></td>
</tr>
<tr>
<td>(50 is highest spending)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Nearby nature experiences are important across the entire life cycle, from cradle to grave.

**INFANTS**

**BIRTH WEIGHT**

*Potential Economic Value: 6% LOM SAVINGS ON ANNUAL HEALTH CARE COSTS.*

Birth weight influences long-term childhood health and development, and has been linked to some adult diseases. Low birth weight is associated with both short- and long-term health care costs, such as longer hospital stays and increased illness. Pregnant women that have more tree canopy and green space near their homes generally have babies with heavier birth weights.

**IMMUNE FUNCTION**

*Economic Implication: STRONGER IMMUNE SYSTEM LEADS TO REDUCED ILLNESS AND CHRONIC 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 astounding rate. The ‘hygiene hypothesis’ suggests that early contact with outdoor microorganisms stimulates the development of childhood immune responses.

**FAMILY DYNAMICS**

*Economic Implication: IMPROVED FAMILY DYNAMICS, PERHAPS REDUCING 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. Outdoor walks and play can reduce these conditions and improve interactions between people within the household.

**CHILDREN & TEENS**

**OVERALL HEALTH AND WELL-BEING**

*Economic Implication: INCREASED PHYSICAL ACTIVITY, REDUCED ASTHMA OR LEADING CAUSE OF EMERGENCY DEPARTMENT VISITS, HOSPITALIZATIONS AND MISSED SCHOOL DAYS, AND REDUCED RISK OF ADULT SKIN CONDITIONS.*

Regular physical activity is known to improve health outcomes, reduce the risk of chronic diseases, and improve mental health. Children who spend more time outdoors have been shown to have lower rates of obesity, diabetes, and mental health disorders.

**ADHD**

*Potential Economic Value: GIRL-1.5X ON MEDICATION SAVINGS PER YEAR.*

Millions of children ages 3-17 are treated for Attention-Deficit Hyperactivity Disorder (ADHD). The effects of ADHD are severe and often long-lasting, which makes it a costly disease to treat. Studies suggest that children who spend more time outdoors have fewer ADHD symptoms.

**FUTURE FINANCIAL SUCCESS**

*Potential Economic Value: 1% increase in high school graduates’ lifetime annual income.*

School performance is linked to post-secondary success and future earnings. Children who spend more time outdoors tend to have higher academic achievement, which can lead to higher income in the future.

**ADULTS**

**DEPRESSION AND STRESS**

*Economic Implication: REDUCED FRUSTRATION, MENTAL DISTRESS AND DEPRESSION DISORDERS, AND IMPROVED BODY IMAGE, SELF-ESTEEM, AND LIFE SATISFACTION.*

Exposure to nature can help reduce stress and improve mental health. Activities such as walking in nature, gardening, and spending time outdoors can help reduce symptoms of depression and anxiety.

**CARDIOVASCULAR DISEASE**

*Potential Economic Value: 0.2% reduction in cardiovascular-related heart attack and stroke hospital admissions.*

Cardiovascular diseases are the leading causes of premature death in the U.S. Regular outdoor activities can help reduce the risk of heart disease and stroke by improving cardiovascular health.

**CRIME & SAFETY**

*Potential Economic Value: 0.05% reduction in costs of crime for victims and property owners per year.*

Criminologists have found that communities with more green spaces and higher levels of street lighting tend to have lower crime rates.

**OLDER ADULTS**

**MOBILITY & QUALITY OF LIFE**

*Potential Economic Value: 0.1% reduction in healthcare costs from falls per year.*

As people age, falls become more common and can lead to serious injuries. Regular outdoor activity can help improve balance, strength, and coordination, which can reduce the risk of falls and injuries.

**HYPERTENSION**

*Potential Economic Value: 0.001% reduction in hospitalizations for hypertension annually.*

Hypertension, or high blood pressure, is one of the most expensive conditions impacting older adults. Regular outdoor activities can help reduce blood pressure and lower the risk of hypertension.

**COGNITIVE DISORDERS**

*Potential Economic Value: 0.0001% reduction in costs of care and treatment per year.*

Research has shown that regular outdoor activity can help improve cognitive function and reduce the risk of dementia for older adults.

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Note: All economic values are in 2012 U.S. dollars, and the potential annual savings across the entire life cycle was estimated for the entire U.S. on an annual basis.

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Contributing analysts:
Dr. Stephen Grado & Marcus Measells, MSU; Dr. Alicia Robbins, Weyerhaeuser
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 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>

common values: avoided costs & burden of illness
### 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>

Avoided Costs Potential?


- $3 trillion
- 17% of US GDP
- $222 billion
- $134 billion
- $57 billion
Avoided Costs Potential?

Is green land cover associated with less health care spending? Promising findings from county-level Medicare spending in the continental United States

Douglas A. Becker a, Matthew H.E.M. Browning a, b, c, Ming Kuo a, Stephen K. Van Den Eeden c
Urban Forests for Human Health: A Focused Economic Valuation

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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