Public Perceptions & Values for the urban forest & city trees

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University of Washington
School of Environmental & Forest Sciences

2020 MW-ISA Annual Conference
29 January 2020
Data

Information

Knowledge

Wisdom

meaning

value
Public Perceptions & Values for Trees

Public Perceptions

Health & Economic Values

Nature & Human Health Evidence
“The tree which moves some to tears of joy is in the eyes of others only a green thing that stands in the way. Some see nature all ridicule and deformity . . . and some scarce see nature at all. But to the eyes of the man of imagination, nature is imagination itself.”

WILLIAM BLAKE
trait distinctions:
- conifers & deciduous
- crown shape
- 2D crown size to trunk height ratio
- crown density
higher branching trunk
- dense canopy
- moderate length of leaves (about 4.5 in)
- seasonal differences in response
importance of urban forests, because:

- aesthetics
- air quality
- shade
- naturalness
- older people and women rated higher importance for trees
How do people perceive urban trees? Assessing likes and dislikes in relation to the trees of a city

🌿 benefits: oxygen supply, shade, aesthetics
🌿 annoyances: dropped leaves, tend to fall, infrastructure damage
🌿 preferences: larger trees, trees near houses, increase tree density, more needed in the city
Community Stories: Explaining Resistance to Street Tree-Planting Programs in Detroit, Michigan, USA

community engagement story:
- free trees, ¼ of 7,500 households refused
- why? interviews
- who is included in decisions?
- how were residents approached?
- history of relationship with city! trust?
It’s time to get rid of those nuisance trees!

It’s finally time to get rid of those nuisance trees!
Have some problem trees in your yard? Hire the best pros in Magnolia and have them removed!

Trees are beautiful – but they can also be trouble, shedding seeds, butting up against buildings and fences, and blockering natural light. Whatever your reason, tree removal may be the right move. And it may be more affordable than you think! Here’s what your neighbors spend to remove their nuisance trees:

- Small: $125 to $450
- Medium: $175 to $900
- Large: $400 to $1,000+

Your neighbors in Magnolia trust Angie’s List to connect them with qualified pros for their home projects. Check it out to find their favorites — and get deals on everything from gutter cleaning to kitchen remodels.

Say goodbye to those trouble trees!

assessment, risk & a business model
## Odds Of Death In The United States By Selected Cause Of Injury, 2017 (1)

<table>
<thead>
<tr>
<th>Cause of death</th>
<th>Number of deaths, 2017</th>
<th>One-year odds</th>
<th>Lifetime odds</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accidental poisoning by and exposure to noxious substances</td>
<td>64,795</td>
<td>5,027</td>
<td>64</td>
</tr>
<tr>
<td>Drug poisoning</td>
<td>61,311</td>
<td>5,313</td>
<td>68</td>
</tr>
<tr>
<td>Opioids (including both legal and illegal)</td>
<td>43,036</td>
<td>7,569</td>
<td>96</td>
</tr>
<tr>
<td>All motor vehicle accidents</td>
<td>40,231</td>
<td>8,096</td>
<td>103</td>
</tr>
<tr>
<td>Car occupants</td>
<td>7,248</td>
<td>44,939</td>
<td>572</td>
</tr>
<tr>
<td>Motorcycle riders</td>
<td>4,832</td>
<td>67,409</td>
<td>858</td>
</tr>
<tr>
<td>Pedestrians</td>
<td>7,450</td>
<td>43,721</td>
<td>556</td>
</tr>
<tr>
<td>Assault by firearm</td>
<td>14,542</td>
<td>22,399</td>
<td>285</td>
</tr>
<tr>
<td>Exposure to smoke, fire and flames</td>
<td>2,812</td>
<td>115,832</td>
<td>1,474</td>
</tr>
<tr>
<td>Fall on and from stairs and steps</td>
<td>2,493</td>
<td>130,654</td>
<td>1,662</td>
</tr>
<tr>
<td>Drowning and submersion while in or falling into swimming pool</td>
<td>723</td>
<td>450,511</td>
<td>5,732</td>
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<tr>
<td>Fall on and from ladder or scaffolding</td>
<td>569</td>
<td>572,441</td>
<td>7,283</td>
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<tr>
<td>Air and space transport accidents</td>
<td>385</td>
<td>846,024</td>
<td>10,764</td>
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<tr>
<td>Firearms discharge (accidental)</td>
<td>486</td>
<td>670,204</td>
<td>8,527</td>
</tr>
<tr>
<td>Cataclysmic storm (3)</td>
<td>132</td>
<td>2,467,570</td>
<td>31,394</td>
</tr>
<tr>
<td>Flood</td>
<td>27</td>
<td>12,063,673</td>
<td>153,482</td>
</tr>
<tr>
<td>Lightning</td>
<td>19</td>
<td>171,431,115</td>
<td>218,106</td>
</tr>
<tr>
<td>Earthquake and other earth movements</td>
<td>13</td>
<td>25,055,321</td>
<td>318,770</td>
</tr>
<tr>
<td>Bitten or struck by dog</td>
<td>36</td>
<td>9,047,755</td>
<td>115,111</td>
</tr>
</tbody>
</table>

How are urban trees associated with human health?
Green Cities: Good Health
www.greenhealth.washington.edu

Sponsors:
USDA Forest Service,
(U&CF Program + Pacific NW Research)
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.1,2 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.9
- A study found 7% higher rental rates for commercial offices having high quality landscapes.14
- Shoppers claim that they will spend 9% to 12% more for goods and services in central business districts having high quality tree canopy.34
- 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.34
Literature review of research about nearby nature & human health
Outside Our Doors
The benefits of cities where people and nature thrive.

design: milepost

co-author

co-author &

printing:

The Nature Conservancy
Health is...

A state of complete physical, mental, and social well-being and not merely the absence of disease or infirmity

(World Health Organization, 1946)
Public Perceptions & Values for Trees

Public Perceptions

Health & Economic Values

Nature & Human Health Evidence
Urban Trees & Human Health: A Scoping Review

Purpose:
To carefully collect and synthesize the peer-reviewed evidence concerning urban trees and human health
Project Team

- Kathleen Wolf, Ph.D., University of Washington
- Sharon Lam, MSc, Ontario Climate Consortium
- Jennifer McKeen, MPH, Simon Fraser University
- Gregory Richardson, MUP, Health Canada
- Matilda Van Den Bosch, M.D, University of British Columbia
- Adrina Bardekjian, Ph.D., Tree Canada
Method

Keyword search (n = 2563) →
Abstract review (n = 436) →
Quality assessment (n = 215) →
Final article set (n = 199) →

Synthesize and present findings

(201 studies)
What did we learn?

Publication Dates by Decade
What did we learn?

- single & park trees
- pollen
- immersion
- tree canopy/NDVI

credit: Univ of Utah
What did we learn?

**Health Outcomes Themes:**

- Tree Pollen and VOCs
- Active Living/Weight Status
- Psychophysiological Stress
- Excess Heat and Thermal Comfort
- Cardiovascular Function
- Mental Health, Anxiety and Mood
- Air Pollutants and Respiratory Condition
- Other Restoring Capacities (e.g., Birth...)
- Cognition and Attention Restoration
- Other Reducing Harm (Crime, UVR)
- Clinical Outcomes
Urban Forests & 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., 2011. Health & Place 2011; Hystad et al., 2014. Env Health Perspectives
Healthy Microbiome

- control obesity & asthma
- boost immune function
- improve mental health

Bloomfield et al. 2016 Perspectives in Public Health

put aside the Hygiene Hypothesis

need contact with ‘Old Friends’
~10 to 100 trillion microbes in healthy gastrointestinal (GI) tract

intestinal microbiome development

Arrieta et al. 2014. *Frontiers in Immunology*
GREEN SCHOOLYARDS HELP KIDS FEEL:

- Calmer & Less Stressed: Views of green landscapes from classroom windows helped high school students recover more quickly from stressful events.
- Positive & Restored: Forest school enhanced positive and decreased negative emotions.
- Resilient: Natural areas enhanced feelings of competence and increased supportive social relationships that help build resilience.

GREEN SCHOOLYARDS PROMOTE SOCIAL-EMOTIONAL SKILLS

- Practice Relationship Skills: Children demonstrated more cooperative play, civil behavior and positive social relationships in green schoolyards.
- Develop Self-Awareness & Self-Management: Green schoolyards can reduce aggression and discipline problems. Gardening at school helped students feel proud, responsible & confident.

THE STATISTICS on CHILDREN & NATURE
www.treeclimbing.jp/
physically disabled & tree climbing!
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*

credit: NBC News
public health officials
moderate activity
recommendations

parks, active living, active transit
Encouraging Physical Activity

Review of studies of adults, natural environments vs indoors

Results of activity in natural environments:

- greater feelings of revitalization and positive engagement, increased energy
- decreases in tension, confusion, anger, and depression
- greater enjoyment and satisfaction, declared a greater intent to repeat the activity at a later date

Coon et al. 2011. Environmental Science & Technology
Improving Depression

20 adults with major depression walk in park setting or built setting

• 50-minute walks one week apart

• before-after testing:
  • Mood: Positive and Negative Affect
  • Cognition: Backward Digit Span

Berman et al. 2012. *Journal of Affective Disorders*

cognitive and affective improvements after walking in a nature setting
How Walking in Nature Changes the Brain

**rumination:** Maladaptive self-referential thoughts, heightened risk for depression and other mental illnesses

**90-min walk in a natural setting decreased**
- self-reported rumination
- neural activity in the subgenual prefrontal cortex
- no reduced effects from built environment walks

Bratman et al. 2015. *Proceedings of the National Academy of Sciences of the USA*
Group Walks Improve Mental Health

England, Walking for Health national program test Nature Group Walkers vs Non Group Walkers

results:
- lower depression, perceived stress, negative affect
- enhanced positive affect and mental well-being
- group walks synergize with physical activity to improve positive affect and mental well-being

Marselle et al. 2014. Ecopsychology
Tree cover shows an inverse relationship with depressive symptoms in elderly residents living in U.S. nursing homes

Matthew H.E.M. Browning a, b, 8, Kangjae Lee b, Kathleen L. Wolf c
Forest Bathing & Therapy  *Shinrin yoku*

more than a decade of research – Japan, South Korea, northern Europe
Forest Bathing & Therapy
multiple wellness benefits

results for forest vs built environments:
- reduced stress & diabetes symptoms
- improved pulse rate, blood pressure, mood
- improved nervous system activity – less fight or flight
- one influence? phytoncides (wood essential oils)

Park et al., 2010. *Environmental Health and Preventive Medicine*
Li et al. 2006. *Immunopharmacology and Immunotoxicology*
The medicine of being in the forest

We are the leading global voice for forest bathing and forest therapy.

Santa Rosa, California
City Trees & Human Health

- newborn & infant health
- increased physical activity for kids
- student therapy
- overall adult health
- social cohesion
- respiratory & cardiovascular health
- reduced depression
- elder care improvements
Story: Trees for Human Health Benefits Across the Life Cycle
### Economic Value of City Nature

**Methods Challenges**

<table>
<thead>
<tr>
<th>Forest Products</th>
<th>Trees/Green in Cities</th>
</tr>
</thead>
<tbody>
<tr>
<td>= market goods</td>
<td>= public goods</td>
</tr>
<tr>
<td>excludable</td>
<td>non-excludable</td>
</tr>
<tr>
<td>identifiable ownership</td>
<td>multiple “owners”</td>
</tr>
<tr>
<td>expenses-revenues</td>
<td>expenses-returns?</td>
</tr>
<tr>
<td>= profits</td>
<td>-profits?</td>
</tr>
</tbody>
</table>

- Forest Products are market goods, excludable, with identifiable ownership, where expenses minus revenues equals profits.
- Trees/Green in Cities are public goods, non-excludable, with multiple “owners,” where expenses minus returns equals profits?
Health Care Spending in U.S.

- $10,348 annual per capita (2016)
- $3.5 trillion total
- 17.9% of Gross Domestic Product

Missouri (2009): $6,967 per capita, 17.6% of GSP, (generally higher % than U.S.)
15 Leading Causes of Death in U.S., 2017

- Diseases of heart
- Cancer
- Accidents (unintentional injuries)
- Chronic lower respiratory diseases
- Cerebrovascular diseases
- Alzheimer's disease
- Diabetes mellitus
- Influenza and pneumonia
- Nephritis, nephrotic syndrome and nephrosis
- Intentional self-harm (suicide)
- Chronic liver disease and cirrhosis
- Septicemia
- Essential hypertension & renal hypertension
- Parkinson's disease
- Pneumonitis due to solids and liquids

(source: U.S. Centers for Disease Control and Prevention)
Cumulative U.S. DALYs for the Leading Disease/Disorder Categories by Age (2010)

(Disability Adjusted Life Year)

costly chronic diseases
Nature & Health Economics Analysis Process

- human scale: individual to community
- screen for benefits
  - urban forestry
  - parks
  - gardens, etc.

green condition

valuation strategy
- market
- non-market

Nature & Health Economics
Analysis Process
Nature & Health Annual Savings

<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>Totals</td>
<td>2,694.4</td>
<td>6,754.5</td>
</tr>
</tbody>
</table>

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

**INFANTS**

**BIRTH WEIGHT**
Increased physical activity, reduced asthma, and reduced risk of adult-onset diabetes.

**IMMUNE FUNCTION**
Strengthened immune system leads to reduced illness and chronic disease across a lifetime.

**FAMILY DYNAMICS**
Economic application: Improved family dynamics, perhaps reducing mental health treatment and counseling services.

**FUTURE FINANCIAL SUCCESS**
10.6% increase in high school graduates’ lifetime annual income.

**ADHD**
Potential economic value: $59.9 billion on medication savings per year.

**CARDIOVASCULAR DISEASE**
Potential economic value: $389.8 billion in reduced costs of care.

**HYPERTENSION**
Potential economic value: $31.9 billion in reduced treatment costs annually.

**COGNITIVE DISORDERS**
Potential economic value: $10.2-3.9 billion in annual savings on medical services.

**DEPRESSION AND STRESS**
Reduced risk of depression and mild and major depression disorders, and improved mood and life satisfaction.

**MOBILITY & QUALITY OF LIFE**
Reduced falls and falls-related injuries, increased physical activity, and reduced risk of adult-onset diabetes.

**OLDER ADULTS**

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.

**contributing analysts:**
Dr. Stephen Grado & Marcus Measells, MSU; Dr. Alicia Robbins, Weyerhaeuser
Urban Forests for Human Health: A Focused Economic Valuation

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

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

<table>
<thead>
<tr>
<th>Level</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Demonstrates a Rationale</td>
<td>well-specified logic model or modeling of conditions</td>
</tr>
<tr>
<td>Promising</td>
<td>correlational study with statistical controls for bias</td>
</tr>
<tr>
<td>Moderate</td>
<td>quasi-experimental study a 'natural experiment'</td>
</tr>
<tr>
<td>Strong</td>
<td>experimental study e.g. randomized control trial</td>
</tr>
</tbody>
</table>
Trees & Health Valuation Potential

cancer

clinical illness & disease incidence

diabetes, respiratory illness, asthma, healing/recovery

strength of evidence

cardiovascular disease, mental disease, ADHD
<table>
<thead>
<tr>
<th>illness or disease</th>
<th>annual costs (U.S.)</th>
<th>source</th>
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</thead>
<tbody>
<tr>
<td>hospital stay/recovery</td>
<td>$1.1 trillion (2017)</td>
<td>debt.org</td>
</tr>
<tr>
<td>diabetes</td>
<td>$327 billion (2017)</td>
<td>American Diabetes Association</td>
</tr>
<tr>
<td>mental disease</td>
<td>$201 billion (2013)</td>
<td>Health Affairs journal</td>
</tr>
<tr>
<td>ADHD</td>
<td>$143 billion (2013)</td>
<td>American Academy of Child and Adolescent Psychiatry</td>
</tr>
<tr>
<td>asthma</td>
<td>$82 billion (2013)</td>
<td>American Thoracic Society</td>
</tr>
<tr>
<td>respiratory illness</td>
<td>$36 billion (2010)</td>
<td>American College of Chest Physicians</td>
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</tbody>
</table>
Trees & Health Valuation Potential

**Health & Wellness**
- ‘protection’
- physical activity, weight control, UV screen, better sleep
- birth outcomes, pain relief, crime reduction, thermal comfort, social cohesion
- stress, anxiety, mental function, immune function

**Strength of Evidence**
Avoided Costs = Health Savings

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, Ming Kuo a, Stephen K. Van Den Eeden c
Conclusions!

- Public Perceptions
- Health & Economic Values
- Nature & Human Health Evidence
Build Knowledge Into Practice

• nearly 40 years of research about health: city trees, nearby nature
• evidence to counter negative messages
• knowledge to inform allies & advocates
• possible identity messaging
healthy trees.
happy people.