Why are trees important?  
human health and economics

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Ontario Climate Consortium

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University of Washington

Partners in Community Forestry Conference  
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How are urban trees associated with human health?
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)
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 Bardekkian, Ph.D., Tree Canada
Method

- **Keyword search (n = 2563)**
- **Abstract review (n = 436)**
- **Quality assessment (n = 215)**
- **Final article set (n = 199)** (201 studies)

Synthesize and present findings
Associations between urban trees & health
What did we learn?

- single & park trees
- pollen
- image/simulation
- 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
What did we learn?

Publication Dates by Decade

<table>
<thead>
<tr>
<th>Decade</th>
<th>Count</th>
</tr>
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<tbody>
<tr>
<td>1980-1989</td>
<td>1</td>
</tr>
<tr>
<td>1990-1999</td>
<td>2</td>
</tr>
<tr>
<td>2000-2009</td>
<td>50</td>
</tr>
<tr>
<td>2010-2018</td>
<td>160</td>
</tr>
</tbody>
</table>
Urban Trees & Human Health

- Literature Review
- Economic Implications
- Urban Forest Planning & Planting
Health Care Spending in U.S.

- $10,348 annual per capita (2016)
- $3.5 trillion total
- 17.9% of Gross Domestic Product
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
- Green condition:
  - Urban forestry
  - Parks
  - Gardens, etc.
- Market
- Non-market
- Valuation strategy
Nature & Health Annual Savings

Millions of U.S. Dollars (2012)

<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>

**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>
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</thead>
<tbody>
<tr>
<td>STRONG</td>
<td>Experimental Study (i.e., a randomized controlled trial)</td>
</tr>
<tr>
<td>MODERATE</td>
<td>Quasi-experimental Study</td>
</tr>
<tr>
<td>PROMISING</td>
<td>Correlational Study with statistical controls for selection bias</td>
</tr>
<tr>
<td>DEMONSTRATES A RATIONALE</td>
<td>Well-specified logic model informed by research or evaluation</td>
</tr>
</tbody>
</table>

source: PearsonSchool.com
Trees & Health Valuation Potential

cancer

diabetes, respiratory illness, asthma, healing/recovery

cardiovascular disease, mental disease, ADHD

strength of evidence
clinical illness & disease incidence
## Health Care Costs

### Clinical Illness & Disease Incidence

<table>
<thead>
<tr>
<th>Illness or Disease</th>
<th>Annual Costs (U.S.)</th>
<th>Source</th>
</tr>
</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>Cardiovascular disease</td>
<td>$200 billion (2015)</td>
<td>Centers for Disease Control &amp; Prevention</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>
</tr>
</tbody>
</table>
Trees & Health Valuation Potential

- 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
health & wellness
‘protection’
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, Matthew H.E.M. Browning, Ming Kuo, Stephen K. Van Den Eeden
Urban Trees & Human Health

- Literature Review
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Urban forest management for human health
‘Trees are Good’ but could they be better?

have evidence re: trees & health
are associated cost reductions & savings
perhaps expand policy and goals?

• canopy goals: 35-40%
• connectivity: 20 – 50 minute walks
• address pollen concerns
• enable activity (forest bathing, walking loops)
Tree Planting for Health

Views from Within

Connect Experiences

Create Refuge

Human Dimensions of Urban Forestry and Urban Greening

featuring research on peoples’ perceptions and behaviors regarding nature in cities

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 . . .

Projects Director
Kathleen L. Wolf, Ph.D.

www.naturewithin.info