Urban Forest Human Health Benefits: questions of equity and distribution

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2017 Urban Forest Symposium
Equity and the Urban Forest
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Outline

- Seattle 2016 canopy analysis
- Findings – canopy & equity
- Why is this important?  
  Human health & wellness
- Key questions for discussion?
2016 Seattle Urban Tree Canopy Analysis

LiDAR imagery

goal 30%, now 28%

thanks to Sandra Pinto de Bader

report at: http://www.seattle.gov/trees/canopycover.htm
2016 Seattle Urban Tree Canopy Analysis

degree of existing tree canopy for each of Seattle’s neighborhoods
2016 Seattle Urban Tree Canopy Analysis

Map of % people of color & % tree canopy for each Seattle Census tract
Figure 14. Figure describing percent tree canopy in relation to people of color. Each dot represents an EEA polygon.
TOWARD A HEALTHY, EQUITABLE, AND SUSTAINABLE SEATTLE

The City of Seattle prioritizes actions and initiatives that foster healthy people, healthy communities, and a healthy and flourishing natural environment. Partnerships and collaboration among City departments, community organizations, and residents and businesses have been instrumental in advancing Seattle’s environmental goals. This report provides a high-level overview of our accomplishments to date as well as highlights opportunities for improvement.

OUR COMMITMENT TO RACIAL EQUITY AND ENVIRONMENTAL JUSTICE

While Seattle has long been a pioneer for environmental progress, this success comes with a caveat. People of color, immigrants, refugees, people with low incomes and limited-English proficiency individuals bear a disproportionate burden of environmental health impacts, benefit less directly from our environmental progress, and environmental concerns of these communities often go unaddressed due to systemic racism and lack of data that includes a racial or economic analysis.

OSE’s Equity & Environment Initiative is shifting the City’s approach to those most affected by environmental challenges and racial-socio economic conditions will lead on designing solutions and directly benefit from our programs and policies.

Because of Seattle’s history of land use and segregation, we can utilize a geographic approach to begin to understand racial inequity in Seattle. However, geographic considerations should not substitute for race as many of the concerns of communities would persist even if communities moved to a new location.

Collecting data with a racial lens is a key way for the City to lead by example and understand our residents’ experiences. Having this type of data is an important step in advancing racial and environmental justice in our work ahead.

EQUITY & ENVIRONMENT INITIATIVE (EEI) FOCUS AREAS

These are the geographic areas where communities of color, immigrants, refugees, people with low incomes and limited-English proficiency individuals tend to live. These areas are highly impacted by socio-economic and environmental challenges.

In this report, we analyze, where possible, data as it relates to EEI focus areas or racial demographics of program users.
TREES & GREEN SPACE  
THRIVING & ACCESSIBLE

Trees and green spaces have significant environmental, economic, and social benefits including improving air and water quality, natural stormwater management and soil protection, and attracting people to local business districts and community spaces. The collective impact is significant: Seattle’s urban forest removes 725 metric tons of pollution from the environment and sequesters carbon at a level valued at $11.7 million annually.

Seattle’s reputation for being the “Emerald City” is well known, but residents do not experience those benefits consistently throughout the city. Large parts of Seattle—notably where our communities of color, immigrants, refugees, and residents with low incomes tend to live, learn, work and play—have less tree canopy cover than neighborhoods that are home to a majority of white, upper income residents. Seattle is working to address this disparity to bring the benefits of trees and green spaces to all our communities.

As our city continues to grow, protecting and enhancing our urban forest and green space remains a key priority in order to ensure the benefits of our natural assets are enjoyed by all Seattle residents.

Achieve a 30% canopy cover by 2037

We achieved a 28% canopy cover in Seattle in 2016.

However, our EEI focus areas only had a 20% canopy cover in 2016.

Area of Seattle where people of color and people with low incomes tend to live have less tree canopy than the rest of Seattle.
THRIVING & ACCESSIBLE GREEN SPACE
OUR PATH TO SUCCESS

 Increase Seattle's tree canopy

 Restore 2,500 acres of forested parkland by 2025

 Develop new parks at land-banked sites

 Provide 3 acres of open space per 1,000 people

Seattle Departments Planted
5,298 trees since 2014

Seattle Has Restored
1,374 acres of forested parklands and other designated natural areas since 2005 through the Green Seattle Partnership.

Seattle Currently Holds
14 undeveloped parks

Seattle Currently Has
9.34 acres per 1,000 residents (8.614 acres total)

Tracking, Measuring, and Sharing the Environmental Benefits of Trees

In 2016, Seattle Department of Transportation (SDOT) launched the Street Tree Management Plan—a 9-year targeted approach to improve the condition of Seattle’s street trees. To do this, they organized the city into 27 management units, and will prioritize 3 per year for tree planting, maintaining, and inventorying. Tree maintenance crews worked in South Park/Highland Park neighborhood during 2016, where they inventoried over 6,000 trees, planted 144 trees, and maintained 700 trees. Collectively, these trees provide benefits worth over $375,000 annually through energy savings, carbon sequestration, air quality, and aesthetics.

Photo provided by SDOT
Seattle’s urban heat island hot spots correspond to low tree canopy areas.
study in England (Mitchell & Popham 2008)
mortality stats (40 M population) & green space

lower income, higher mortality
lower income, more green = less mortality
Urban Forestry Justice and the Rights of Medicines, and Materials

Producing edible landscapes in Seattle’s urban forest
Rebecca McLain, Melissa Poe, Patrick T. Hurley, Joyce Lecompte-Mastenbrook, Marla R. Emery

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Urban forestry
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ABSTRACT

Over the next decades, green infrastructure initiatives such as tree planting campaigns, and ecological restoration will dramatically change the species composition, species distribution and structure of urban forests across the United States. These impending changes are accompanied by a demand for urban public spaces where people can engage in practices such as gardening, creating, and livestock production. This article analyzes the institutional framework that undergirds efforts in Seattle, Washington to normalize the production and use of edible landscapes. We focus attention on the role of grassroots fruit tree planting groups and highlight their bridging function between Seattle’s agriculture and forestry policy arenas, expanding the production of edible landscapes. We conclude that a vision of urban forests as providers of goods as well as services may provide a more solid foundation for achieving urban sustainability than the current “hands-off” approach to urban forest management. 

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foraging management on the Burke-Gilman Trail
WHO Health Definition

A state of complete physical, mental, and social well-being and not merely the absence of disease or infirmity (1946)
Determinants of Health
Green Cities: Good Health
www.greenhealth.washington.edu

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University of Washington
NGO partners

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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.
nearby nature & health evidence
> 40 years
~ 4,000 publications

what are the ‘stories’
Discovery: Human Health Benefits Across the Life Cycle
Urban Forests and Newborns

the natural environment affects 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
Hygiene Hypothesis

_presence of soil bacteria in body, 
_Mycobacterium vaccae = increased serotonin

_may alleviate depression

dirt or Prozac?

Lowry et al. 2007. Neuroscience
Nature Contact & Immune Systems

- absence of trees & green space
- less opportunity for ‘inoculation’
Fiddlehead Forest School
Washington Park Arboretum (Seattle)

cognitive
social &
physical
learning
Classroom Views & Stress

Classroom Views & Stress
high school student response

Fig. 2. Attention scores at the end of class activity and break (Means and SE).

Fig. 3. Physiological stress at the end of class activity and break (Mean and SE).
Sacramento Study :: LIDAR x CHIS data
7,900 adults, 250 m buffer, covariates

Ulmer et al. 2016. *Health & Place*. Multiple health benefits of urban tree canopy: The mounting evidence for a green prescription
Shinrin yoku (forest bathing)

- extensive research
- restorative experiences
- workers retirees
- networked system, 52 bases in Japan
Green Streets for Walkability

evidence of lower frustration and higher meditation when moving into the greener streets

Aspinall et al. 2013. The Urban Brain: Analysing Outdoor Physical Activity with Mobile EEG. British Journal of Sports Medicine
Improving Depression

20 adults with major depression walk in a park setting and a built setting

دعو للسير في حديقة أو مكان بناي

50-minute walks one week apart

 путешествوا ظهرة قبل وبعد

before-after testing:

- Mood: Positive and Negative Affect (PANAS)
- Cognition: Backward Digit Span (BDS)

Berman et al. 2012. Journal of Affective Disorders

cognitive and affective improvements after walking in a nature setting
EAB Tree Loss & Public Health

1990 to 2007, 1,296 counties in 15 states infected areas vs. no bugs
15,000 more deaths from cardiovascular disease
6,000 more deaths from lower respiratory disease
controlled for demographic, human mortality, and forest health data at the county level

Toledo, Ohio in 2006, pre EAB

2009, EAB in neighborhood

photo credits: Dan Herms, Ohio State U
Mobile Air Pollutants

High spatial resolution map of summer-time NO2 in Portland Metro

Modeled NO2 (ppb)
- 3.5 - 7.2
- 7.3 - 7.8
- 7.9 - 8.4
- 8.5 - 9.1
- 9.2 - 9.9
- 10 - 10.9
- 11 - 12
- 12.1 - 13
- 13.1 - 14.1
- 14.2 - 21.8

Meenakshi Rao
Itrip, 30th Oct 2013

Dr. Vivek Shandias, Urban Studies and Planning, Portland State University
Health Value of Trees

<table>
<thead>
<tr>
<th>Health Impact</th>
<th>Reduced Incidence due to Trees</th>
<th>Valuation of Benefit (in $1,000,000)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asthma Exacerbation, Missed school days (4-12 years)</td>
<td>6083</td>
<td>0.52</td>
</tr>
<tr>
<td>Asthma Exacerbation, One or More Symptoms (4-12 years)</td>
<td>17,663</td>
<td>2.76</td>
</tr>
<tr>
<td>Emergency Room Visits, Asthma (all ages)</td>
<td>46</td>
<td>0.01</td>
</tr>
<tr>
<td>HA, All Respiratory (65 and older)</td>
<td>49</td>
<td>0.92</td>
</tr>
<tr>
<td>HA, Chronic Lung Disease (less Asthma) (65 and older)</td>
<td>24</td>
<td>0.33</td>
</tr>
</tbody>
</table>

Sum Value: $4.54
Effects of nature window view on recovery from surgery (Roger Ulrich, 1984)

- Shorter stays
- Less pain
- Fewer minor complications
- Better emotional well-being
hospital healing gardens

health care $$ savings
patient preference & return

Ulfelder Healing Garden, Massachusetts General Hospital
Scripps Encinitas Hospital
Massachusetts General Hospital

credit: Frank Oudeman
Outline

• Seattle 2016 canopy analysis
• Findings – canopy & equity
• Why is this important?
  human health & wellness
  value & economics
• Key questions for discussion?

Kathleen L. Wolf, Ph.D.

Design: milepost

Author: US Forest Service

Printing: The Nature Conservancy
**INFANTS**

**BIRTH WEIGHT**

*Potential Economic Value:
5.18% 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 coverage and green space near their homes generally have babies with healthier birth weights.

**IMMUNE FUNCTION**

*Epidemiological Evidence: 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 "hippocampus" suggests that early contact with outdoor microorganisms stimulates the development of a healthy immune response.

**FAMILY DYNAMICS**

*Immunological Evidence: 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. Nature time and walk can help reduce these conditions and improve interactions between people within the household.

*Note: All economic values are in 2018 USD and are presented annual average across the entire US.*

**CHILDREN & TEENS**

**OVERALL HEALTH AND WELL-BEING**

*Potential Economic Value:
Increased physical activity, reduced asthma or leading cause of emergency department visits, hospitalizations and missed school days, and reduced risk of adult skin conditions.*

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 US on an annual basis.

**ADHD**

*Potential Economic Value: 6.96% Savings on Medication Costs.*

Millions of children ages 4-17 are treated for Attention Deficit Hyperactivity Disorder (ADHD) in the U.S. Nature exposure in potential alternative treatments studies show that activity within nature or green spaces, such as play or just 20 minutes of walking can reduce symptoms.

**DEPRESSION AND STRESS**

*Potential Economic Value: Reduced frustration, mental distress and depression disorders, and improved body image, self-esteem and life satisfaction.*


**CARDIOVASCULAR DISEASE**

*Potential Economic Value: 6.96% Savings on Medication Costs.*

Millions of children ages 4-17 are treated for Attention Deficit Hyperactivity Disorder (ADHD) in the U.S. Nature exposure in potential alternative treatments studies show that activity within nature or green spaces, such as play or just 20 minutes of walking can reduce symptoms.

**CRIME & SAFETY**

*Potential Economic Value: 4.8% Savings in Reduced Costs of Crime for Victims and Property Owners.*

Personal safety and security are important conditions for quality of life. The presence of nature in neighborhoods can improve residents' physical and mental health and local social orders.

**ADULTS**

**MOBILITY & QUALITY OF LIFE**

*Potential Economic Value: 6.96% Savings on Medicare Costs.*

One in three older adults falls each year, giving rise to fatal and nonfatal injuries. Residential falls within older care facilities are particularly egregious medical situations. Being out in nature maintains personal mobility, leading to reduced falls and reduced need for medications. Further, those who are actually treated are more likely to be unhealthy, with gardens and nature walking activities that promote social interactions support positive lifestyles and quality of life.

**OLDER ADULTS**

**HYPERTENSION**

*Potential Economic Value: 6.96% Savings on Treatment Costs Annually.*

Hypertension, or high blood pressure, is one of the five most expensive conditions impacting older adults. Views of nature, particularly forests, and "forest bathing" (a walk in nature or forest setting) decreases diastolic rates.

**COGNITIVE DISORDERS**

*Potential Economic Value: 6.96% Savings on Medical Services, Not Counting the Value of Home Caregiver Services.*

About one in five older adults experience mental and cognitive disorders, with age being the greatest risk factor. In 2015, about 15% of people aged 65 or older were affected with Alzheimer's disease. Those with dementia face a loss of memory, communication problems, and reduced mobility.

**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 US on an annual basis.**

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**Contributing Analysts:**

Dr. Stephen Grado & Marcus Measells, MSU; Dr. Alicia Robbins, Weyerhaeuser
annual value of $11.7 billion
U.S. (2015 dollars)

- cradle to grave human life cycle
- varied expressions of urban greening (metro nature)
- evidence based human health and wellness benefits
- just beginning the analysis!
Summary

• UF canopy analysis – irregular, often less in underserved communities

• Why is this important?
  Human health & wellness

• Human health & wellness

• Key questions for discussion . . .
  What to do?
Recent Publications


1. Create an ethic of stewardship
Civic Stewardship for Resilience

E. Svendsen, L. Campbell; USFS
Key Questions!

- Does urban forestry/greening initiate displacement (a.k.a gentrification)?
- How do we address community needs and challenges while also promoting trees?
- What are the processes and programs that best integrate local and community values into an urban forestry/urban greening program?
- Is ‘just green enough’ really equitable enough?
Equity Aspirations

The size of a garden has very little to do with its merit. It is merely an accident relating to the circumstances of the owner. It is the size of his heart and brain and goodwill that make his garden either delightful or dull, as the case may be, and either leave it at the monotonous dead level, or raise it, in whatever degree he may, towards that of a work of art.

Garden as Aspiration, Gertrude Jekyll