



Climate Change and the Urban Canopy

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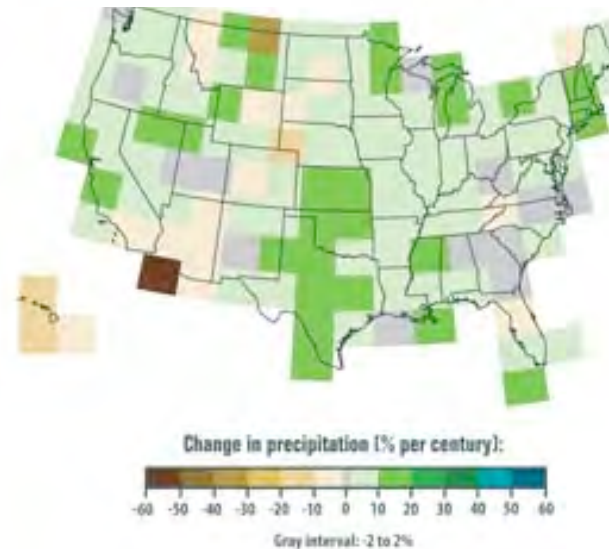
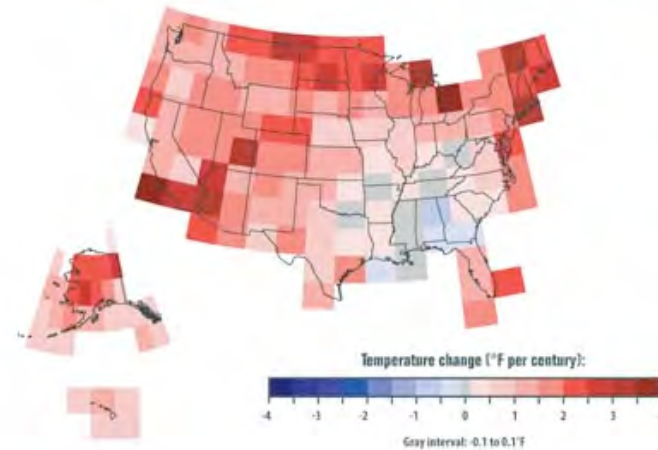
Presentation Overview

- » Climate change & implications for city managers
- » Valuable municipal infrastructure
 - roads, parks, wastewater system, etc.
- » Urban canopy a valuable green infrastructure asset
- » This value will increase with climate change
- » Invest in urban canopy

Impacts of Climate Change

Climate change is expected to:

- » Influence seasonal and average **temperatures**, depending on location
- » Influence the amounts and timing of **precipitation**, depending on location



Source: U.S. EPA: Climate Change Indicators in the United States

Urban Canopy and Climate Change



- » Carbon storage and sequestration
- » Temperature regulation
- » Stormwater control

Carbon Sequestration – Stock Value

The stock value of carbon sequestration is the existing carbon fixed in an urban canopy.

Based on data from 10 U.S. Cities, researchers estimate urban trees in the USA currently store 700 million tones of carbon.

Carbon storage of urban trees within cities ranges from 1.2 million tC in New York, NY to 19,300 tC in Jersey City, NJ (Nowak, 2002).

In Oakland, CA (21% tree cover) urban forest stores carbon at a level of 11.0 metric tons/hectare (Nowak, 1998).

Carbon Sequestration – Flow Value

The flow value is the additional annual amount of carbon sequestered by an urban canopy.

Urban trees in Delaware (18.3% cover) store 1.3 million metric tons of carbon and remove 44,000 metric tons of carbon annually (Kaya 2009)

U.S. national urban forest carbon storage is likely over 700 million metric tons with a gross carbon sequestration rate of 22.8 million tC/year. (Nowak, 2002)

Urban forests in Hangzhou, China sequester an estimated 1.66 tC per hectare, per year. This likely represents an annual offset of 18.6% of the amount of carbon emitted by industrial enterprises in the city (Zhao 2010)

Carbon Sequestration Value

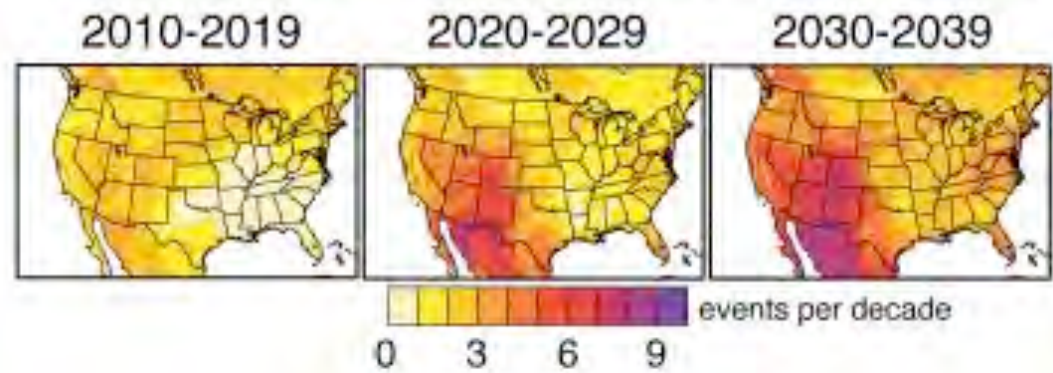
- » Calculate tons of carbon stored in trees
- » California Climate Action Registry's *Urban Forest Project Reporting Protocol*. Measures and Registers Carbon Storage in Urban Trees
- » Value based on market price of trades on carbon markets in U.S. and Europe
- » Market Rates: US \$1/ton; Europe \$40/ton

Urban Canopy and the Heat Island Effect

- » Urban Heat Island Effect + Heat Wave
- » Increase in energy costs
- » Increase in heat-related mortality in urban areas
- » Urban Canopy = Solar Powered Living Air Conditioners



Number of Extremely Hot Seasons Per Decade



Source: Noah Diffenbaugh, Stanford University

Energy Conservation

An urban canopy can reduce energy use through reductions in annual cooling costs of residences and businesses. This, in turn, may help reduce local carbon production.

A single 25-foot tall tree can reduce annual heating and cooling costs of a typical residence by 8 to 12 percent.

Assuming an annual savings of \$10 per household, a nationwide residential tree planting program could eventually save \$1 billion each year (McPherson 1993)

In California existing trees reduce annual air conditioning energy use by 2.5% with a value of \$485.5 million.

Peak load reduction by existing trees saves utilities 10% valued at \$778.5 million annually or \$4.39/tree (McPherson 2003)

Stormwater Control

Trees absorb and filter stormwater runoff, helping to reduce the costs of stormwater management.

- » Avoided stormwater infrastructure costs
- » Reduced CSO control costs
- » Reduced flooding
- » In NYC, avg. tree intercepts 1,400 gal. SW each year, reducing CSO events and providing \$36 million in annual benefits. (City of New York 2009)

Measuring Municipal Asset Values

- » Traditional Financial Accounting (not)
- » Indirect Accounting Measures
- » Compensatory Value



Traditional Accounting Method

- » Account for Trees as a Municipal Asset
- » GASB-34
- » Depreciation guidelines
- » But trees appreciate in value



Compensatory Value

- » Replacement cost of a tree
- » Appraisal method developed by *Council of Tree and Landscape Appraisers*
- » Used to compensate owners for tree loss



Indirect Accounting Measures

- » Avoided costs of stormwater management and flood mitigation
- » Amenity values and property taxes
- » Avoided costs of repaving

Trees and Temperature TMDL

- » Clean Water Services & Temperature TMDL on Tualatin River
- » Cost of chiller = \$104–255 million
- » Streamside forest cost \$50 million less
- » Controlled water temperature and provided other ecosystem services
- » Temperature TMDL combined with riparian restoration or park development

Strategic Planning

McPherson. et al. (2002): *Western WA and OR Community Tree Guide: Benefits, Costs and Strategic Planting*

Helps communities address these questions:

- 1. What is the potential for trees to add value to communities?*
- 2. Where should trees be placed to maximize cost-effectiveness?*
- 3. Which tree species will conflict with existing uses?*

Communicating Asset Values

- » “Trees Pay Us Back” Minnesota Campaign
- » Mayor receives check for \$2.4 million from “the street trees” of Pittsburgh



www.treespayusback.com

Summary

- » An urban canopy is a valuable municipal asset
- » The asset value of an urban canopy will increase with climate change
- » Look beyond accounting methods traditionally used to value municipal assets
- » Protect and manage urban canopy as a valuable green infrastructure asset

More Information

- » American Forest Website: CITYgreen
<http://www.americanforests.org/productsandpubs/citygreen/>
- » U.S. Forest Service: Pacific Southwest Research Station (G. McPherson)
<http://www.fs.fed.us/psw/>
- » U.S. Forest Service: Urban Forests, Environmental Quality, and Human Health
<http://nrs.fs.fed.us/units/urban/>
- » Urban Trees and Shrubs: A guide to the selection of trees in urban areas
<http://www.na.fs.fed.us/spfo/pubs/uf/uts/index.htm>

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