PLANTING THE SEEDS OF SUCCESS.

Trees Pay Us Back -- Benefits of Trees in the Midwest

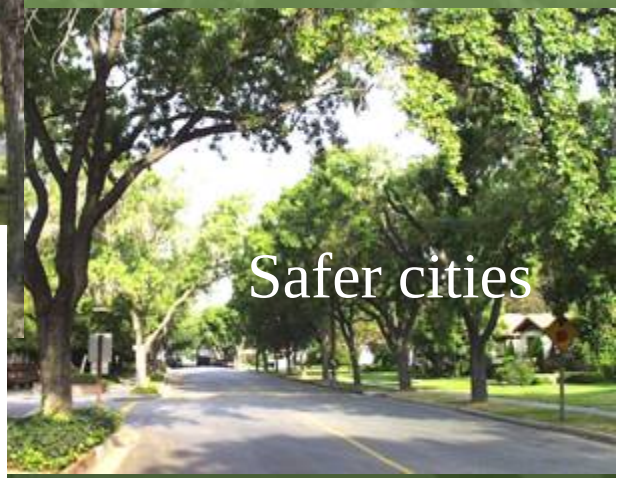
Greg McPherson

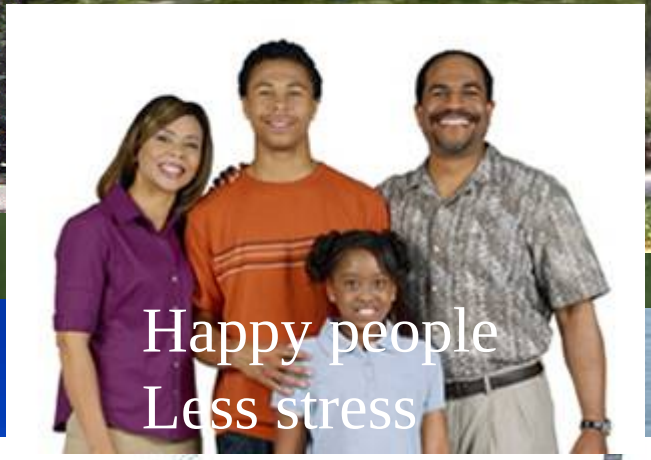
Midwest ISA Annual Conference
Topeka, Kansas
March 1, 2007

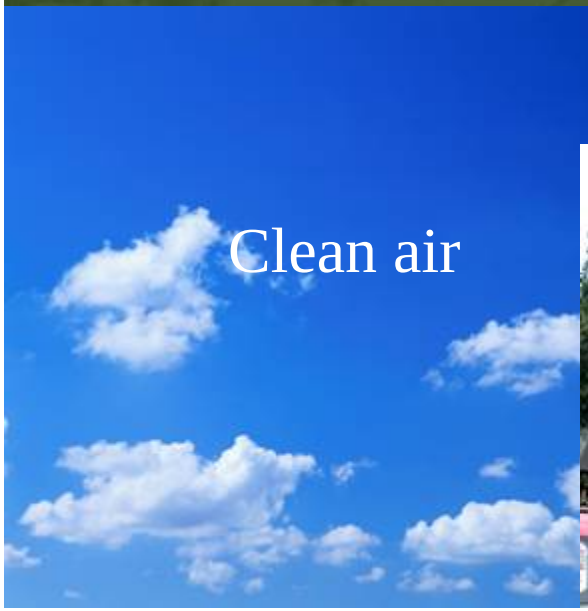
Center for Urban Forest Research

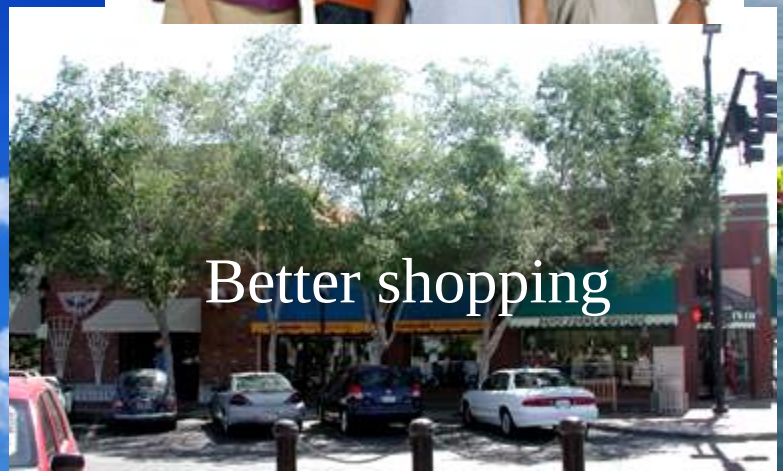
Cities Without Trees

Cities With Trees









Urban
Advantage

Urban
Advantage

Cause for Concern?

Value goes down

Today

- Value of urban trees from a research perspective.
- What you can do.
- i-Tree and STRATUM.

Tree Quiz

- Bradford Pear
- 9 years old
- 9 inch dbh
- 28 ft. tall
- 19 ft. spread

- Number of leaves ?? (#)
- Total leaf area ?? (sq.ft.)
- H_2O retainment capacity ?? (ga

Tree Quiz

- Bradford Pear
- 9 years old
- 9 inch dbh
- 28 ft. tall
- 19 ft. spread

- Number of leaves 88,908
- Total leaf area 3,846 sq ft
- H_2O retainment capacity 55 g

Center for Urban Forest Research

USDA Forest Service
PSW Research Station
Davis, CA

To demonstrate new ways that trees add value - quality of life - to communities.

We convert research results into financial terms to stimulate community investment in trees.

Areas of Research

Investment Value

Benefits *and Costs*

- Energy Conservation
- Air Quality Improvement
- Reducing Runoff
- FireWise Landscapes

Who We Are







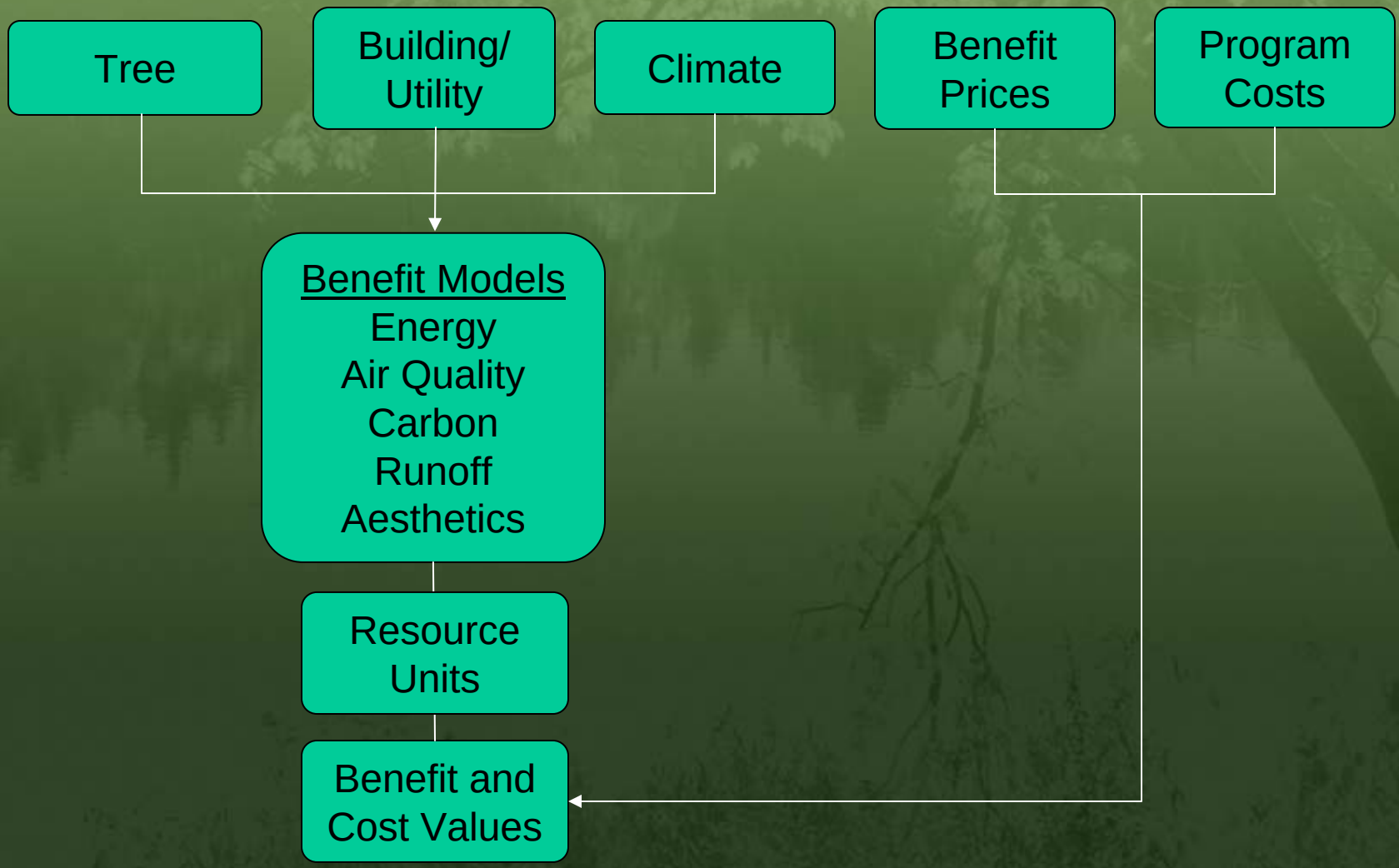


Today

- Value of urban trees from a research perspective.
- What you can do.
- i-Tree and STRATUM.

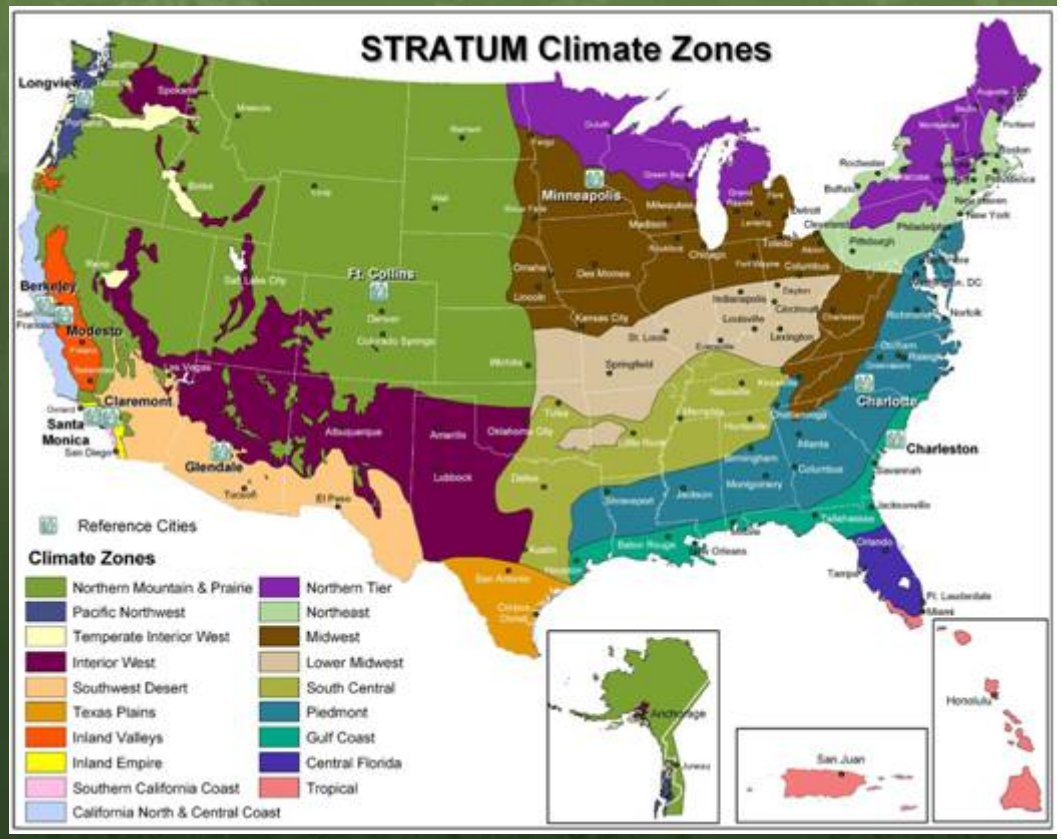
Benefit-Based Approach

Benefit-Cost Modeling

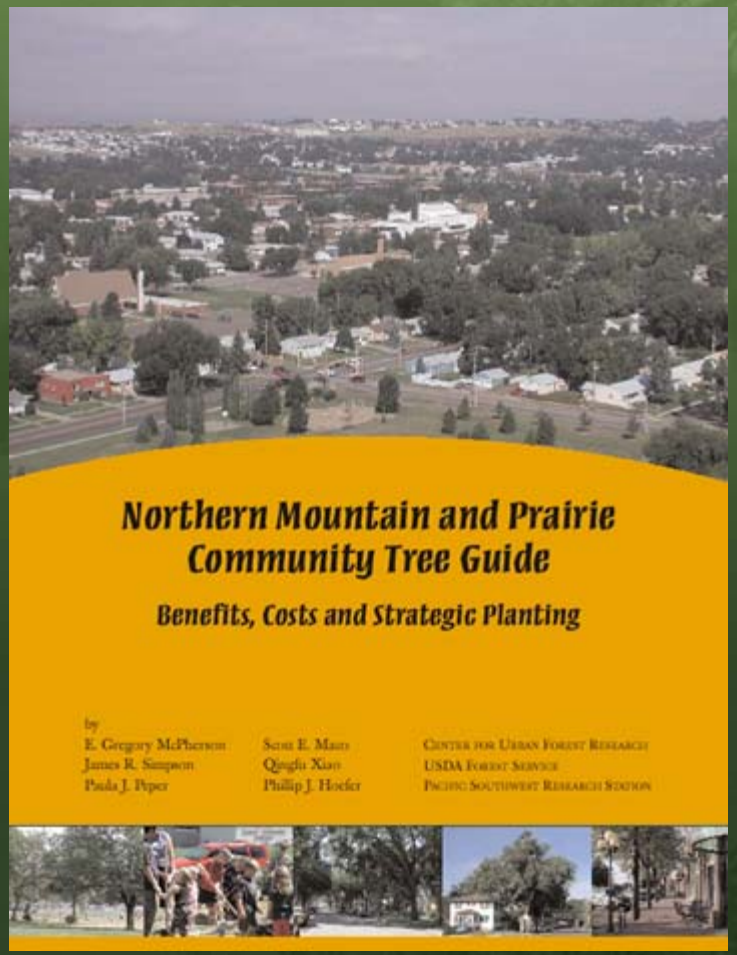


Reference City Research

- Collected data – Minneapolis street trees
- Analyzed growth rates and dimensions
- Estimated magnitude of annual benefits
- Priced benefits
- Priced tree care costs
- Calculated net annual benefits, benefit-cost ratios



Tree Guide for Midwest Communities

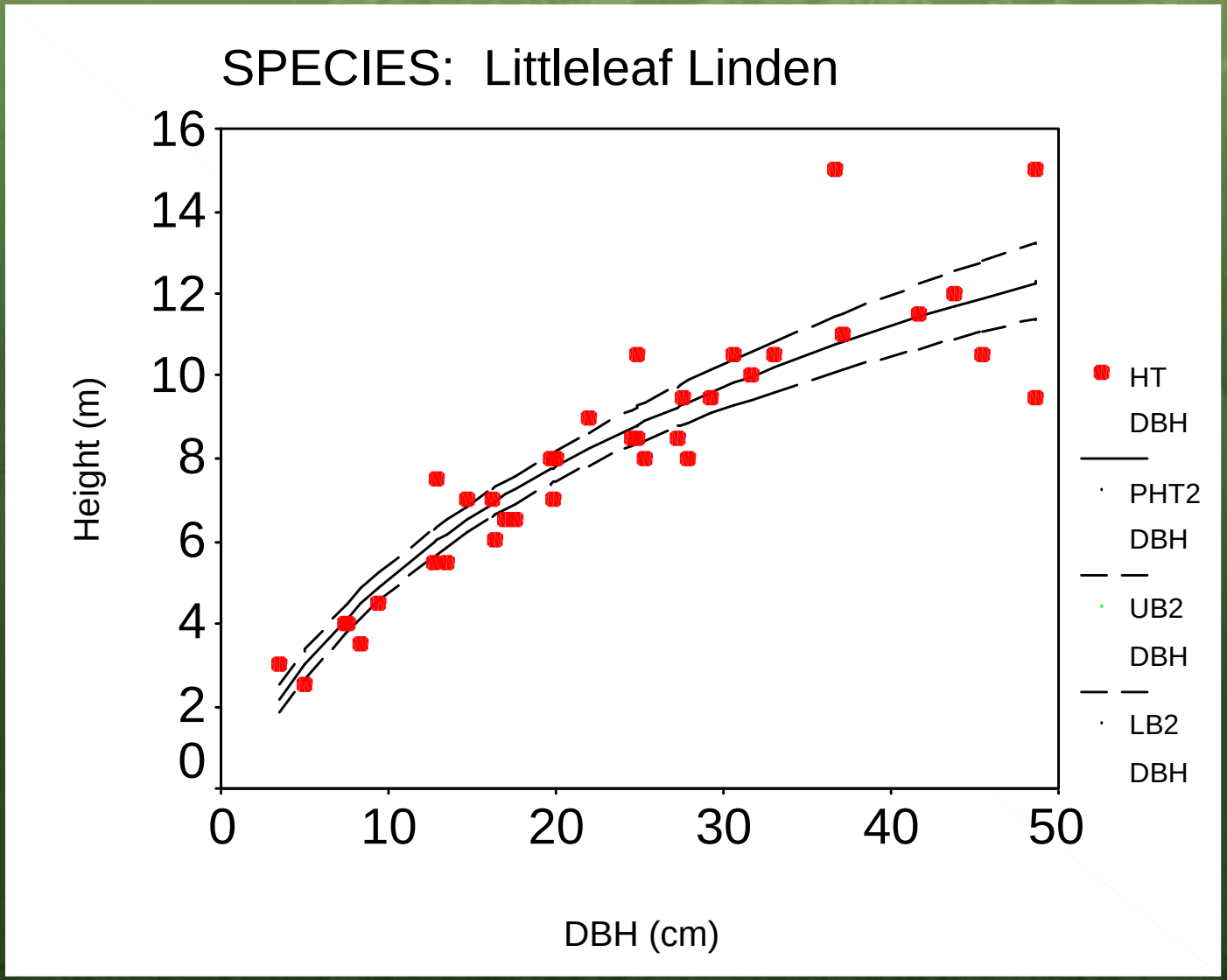


- 1000's of communities
- Contents
  - Regional Benefits And Costs Calculated
  - Examples of Estimating Benefits And Costs Of Tree Planting Projects
  - Guidelines For Selecting And Placing Trees
- Midwest Tree Guide
  - rschneider@fs.fed.us
  - (970) 498-1392
- Northern Mt & Prairie Guide
  - Susan Ford (sbford@fs.fed.us)

City Tree Survey

- Stratified random sample
  - Predominant species
    - » 22 species representing ~75% of forest
  - 35 – 70 trees per species
  - Minimum 40 year age range

Fit Curves for Growth



Reporting Results

- For “typical” large, medium, and small tree.
  - Hackberry
  - Red oak
  - Crabapple
- Dimensions at maturity differentiate tree size.
- For public (street/park) and private property locations (east, south, west).

Typical Tree at 20 yrs

	Small	Medium	Large
Height (ft)	22	40	47
Spread (ft)	21	27	37
LSA (sq ft)	75	343	688

Research Process

Value Analysis

Pricing Benefits

- Minneapolis market prices – ($0.07/kWh, $0.98/therm)
- Carbon trading credits - CO_2 ($15/ton)
- Damage value and control cost of emissions – air pollutants (Wang & Santini)
- Retention/detention costs – stormwater runoff ($0.0048/gal)
- Average resale price - residential property increase (median sales price = $154,403)

Research Process

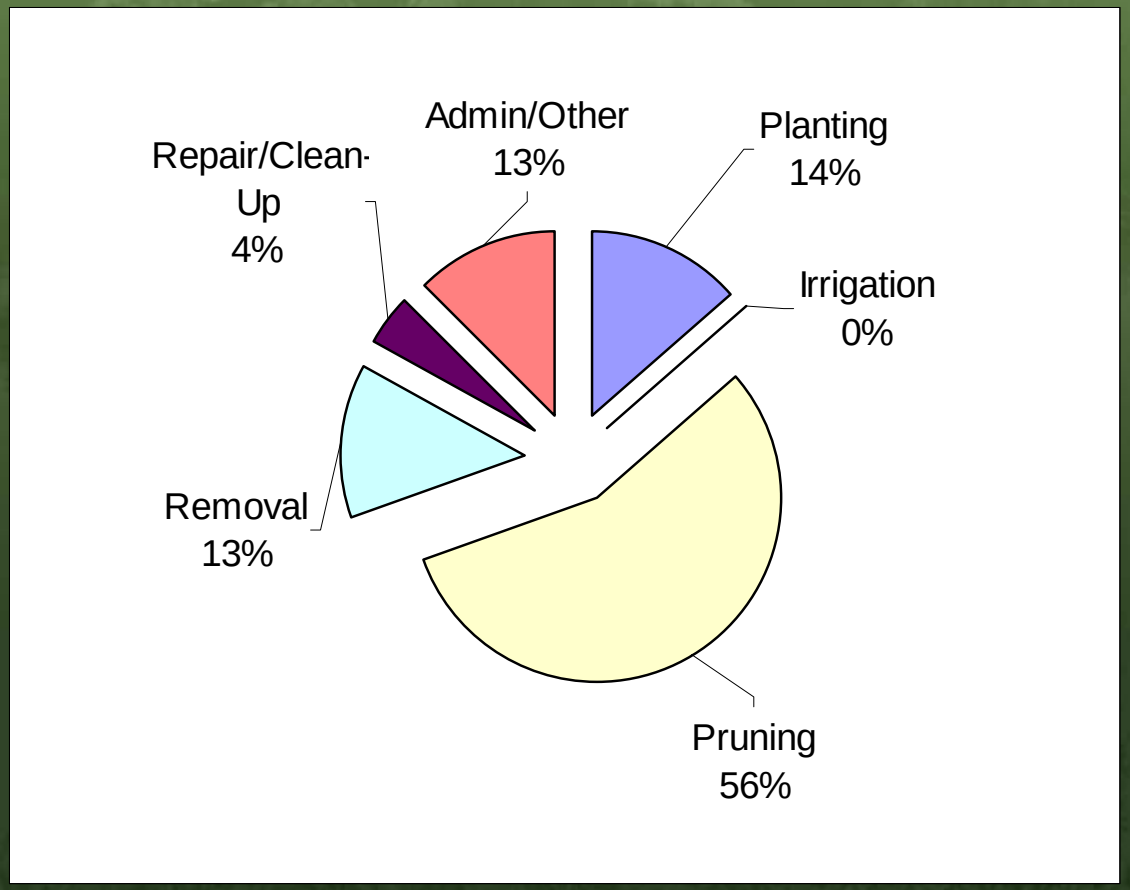
Value Analysis

Calculating Costs

Surveyed 9 commercial and municipal arborists:

- Planting
- Pruning
- Removal and disposal
- Pest and disease control
- Irrigation
- Infrastructure
- Leaf litter cleanup
- Liability
- Administration

Average Annual Street Tree Management Costs ($36/tree)



Research Process

Value Analysis

Calculating Net Benefits

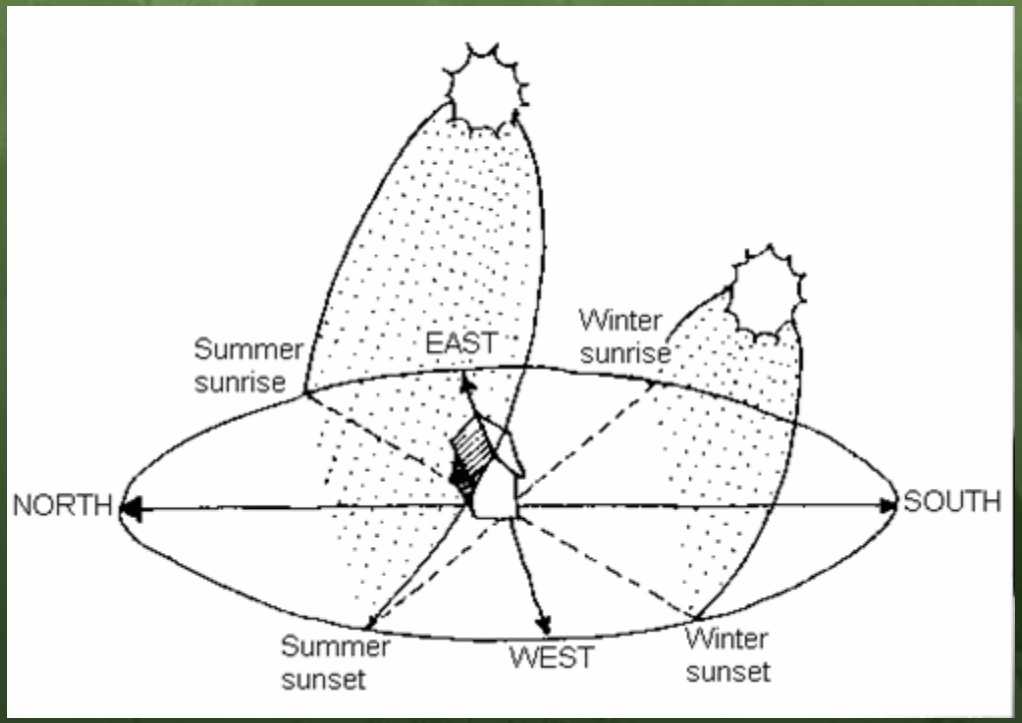
Benefits minus Costs

Trees Improve the Environment

Conserving Energy

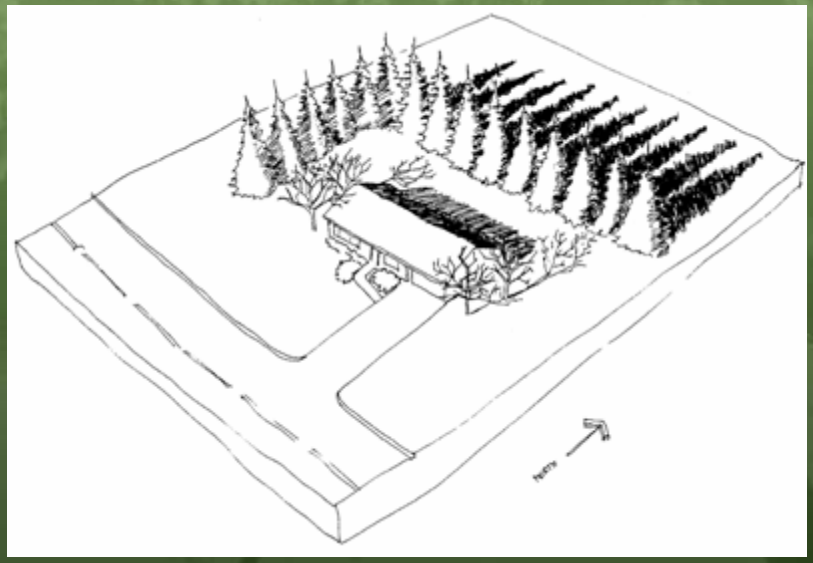
Conserving Cooling Energy

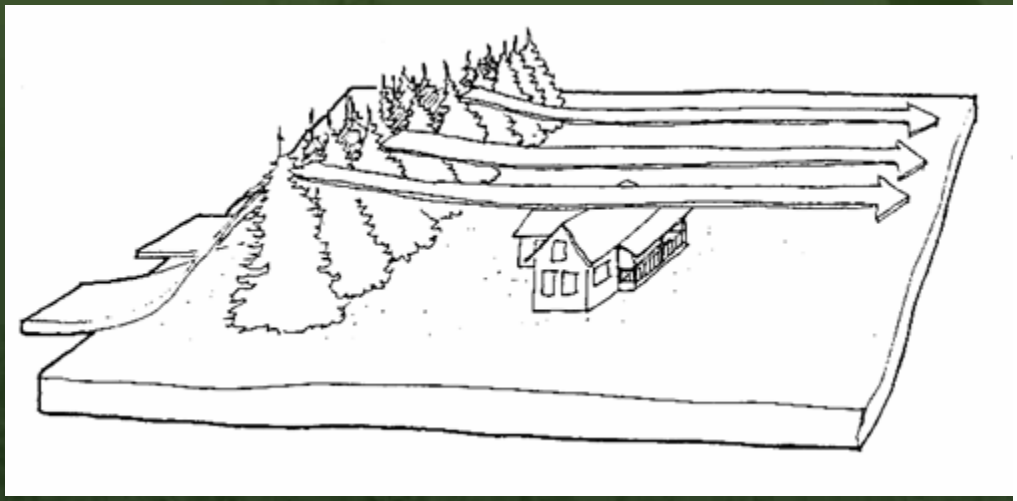
- West is the best
- South solar access
- Shade heat sinks
- Increase canopy citywide to reduce heat island



Conserving Heating Energy

- Windbreaks (25-50 ft from building)
  - Longer than building
  - Perpendicular to wind
  - Multi-row if space

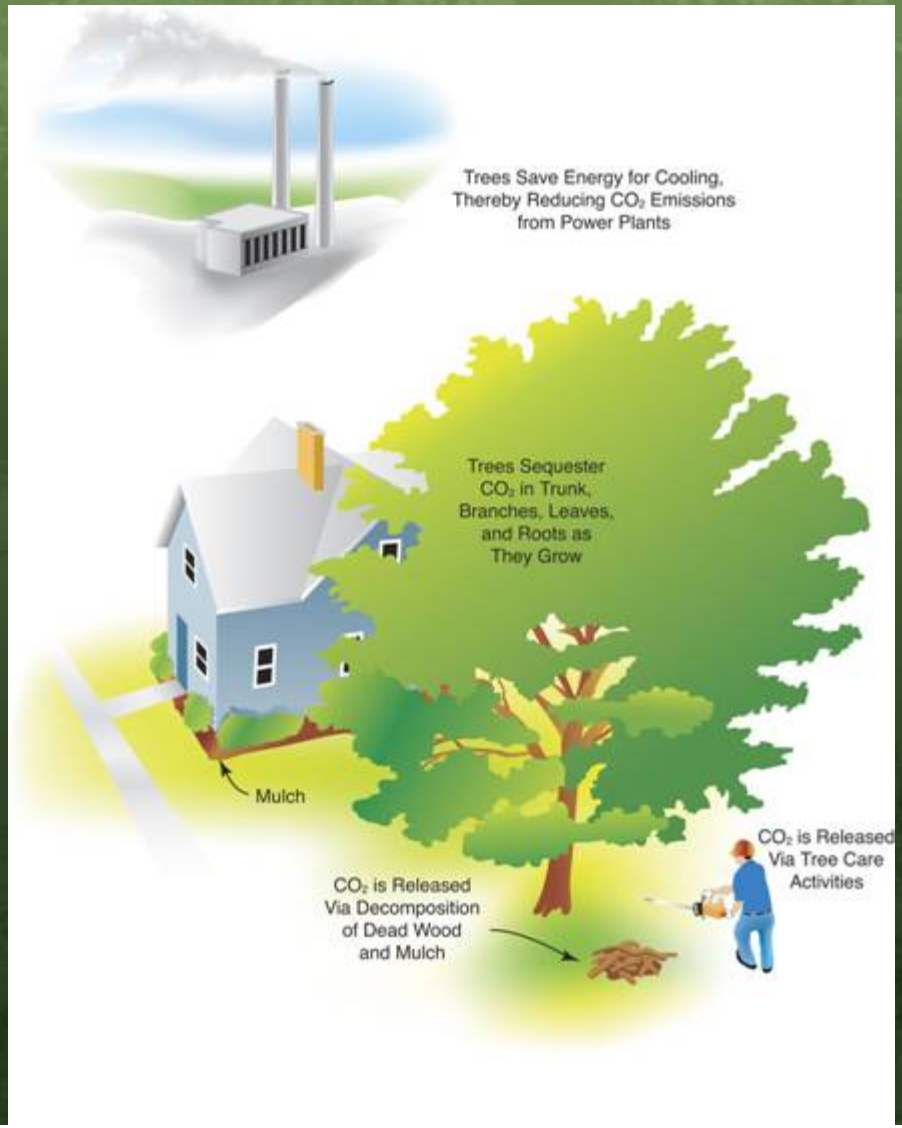




Conserving Energy

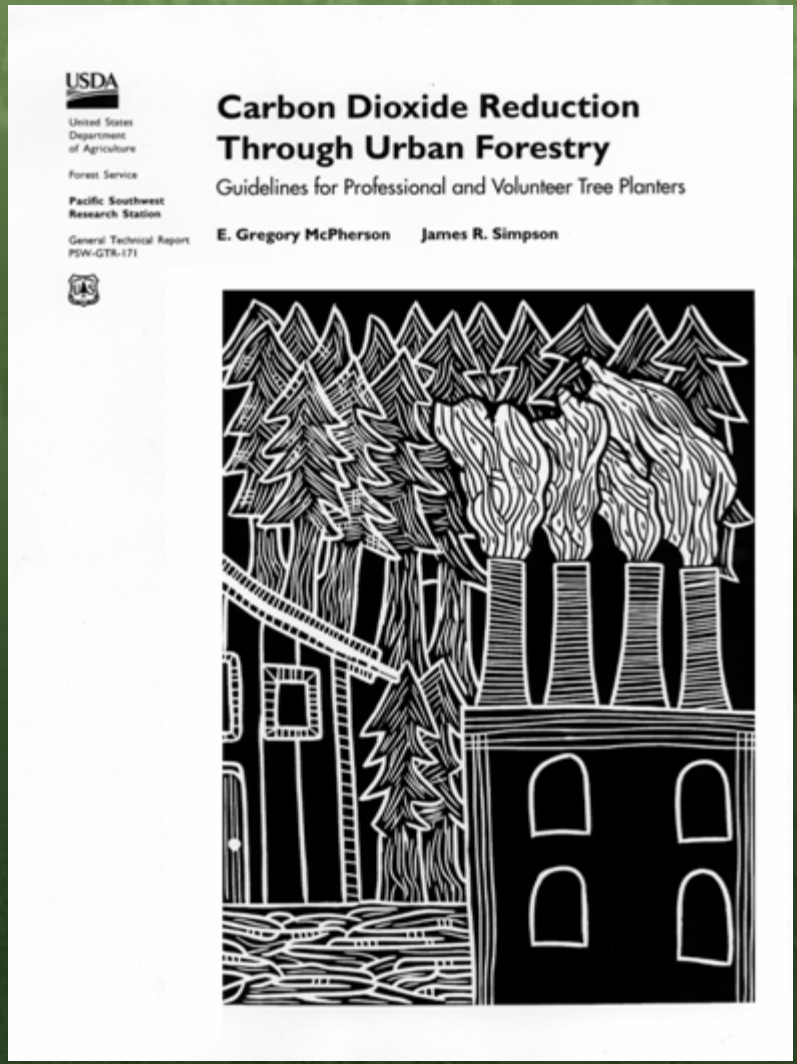
- Hackberry, 20 years (47-ft tall), West
- Save up to 20% of annual AC costs ($23/yr)
- Save 2% of winter heating costs ($33)
- $56/yr total savings

Reducing Atmospheric Carbon Dioxide



Reducing Atmospheric Carbon Dioxide

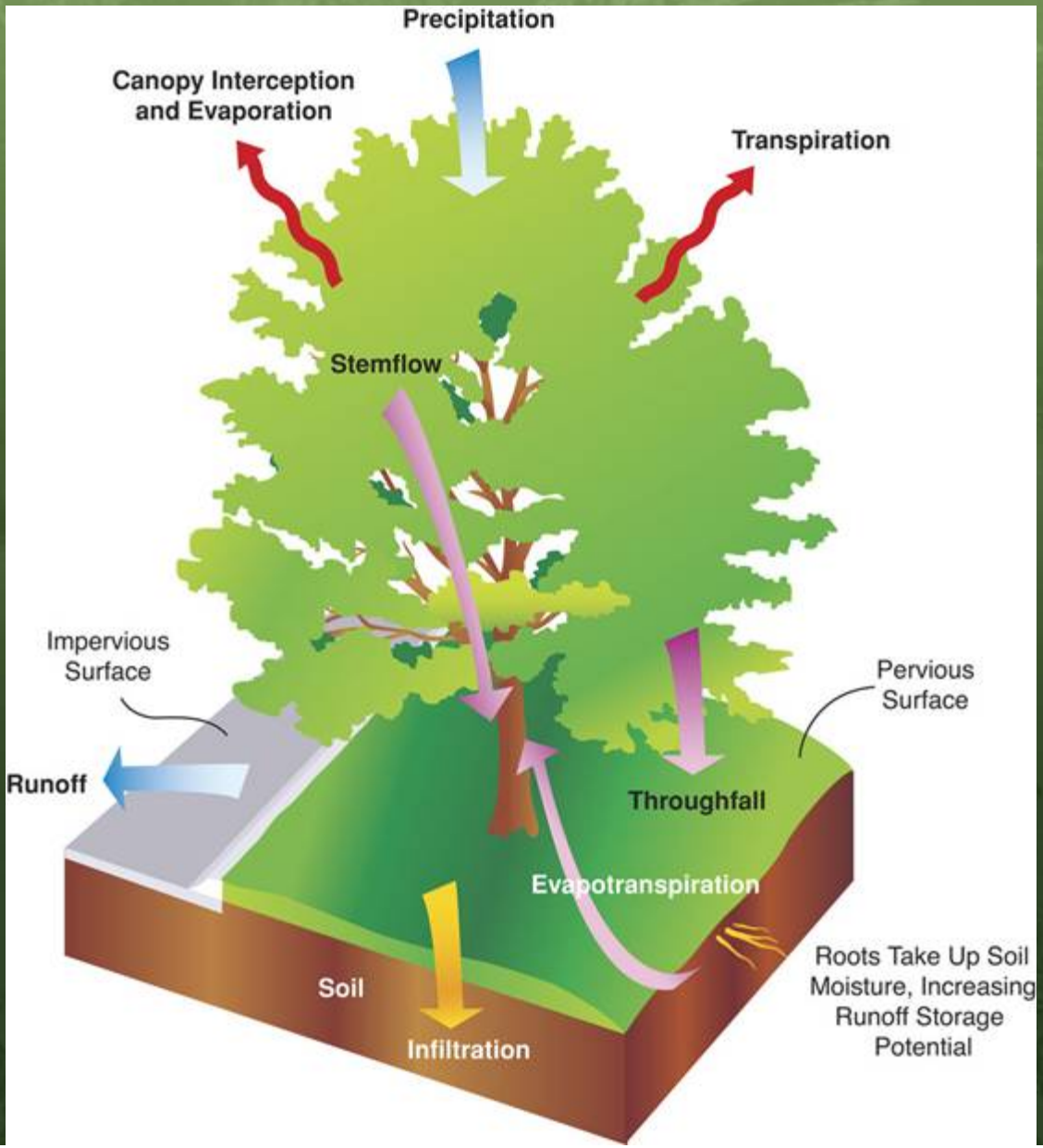
- Increase tree stocking levels
- Create diverse habitats
- Select well-adapted, rapid growing trees
- Locate to maximize energy savings



Reducing CO_2

- Hackberry, 20 years, Opposite west wall
  - Sequestered = 109 lb
  - Avoided = 882 lb
  - Release: Tree care = 4 lb
  - Release: Decomp. = 8 lb
  - Total Net = 979 lb
  - Total Value = $7.34

Reducing Stormwater Runoff

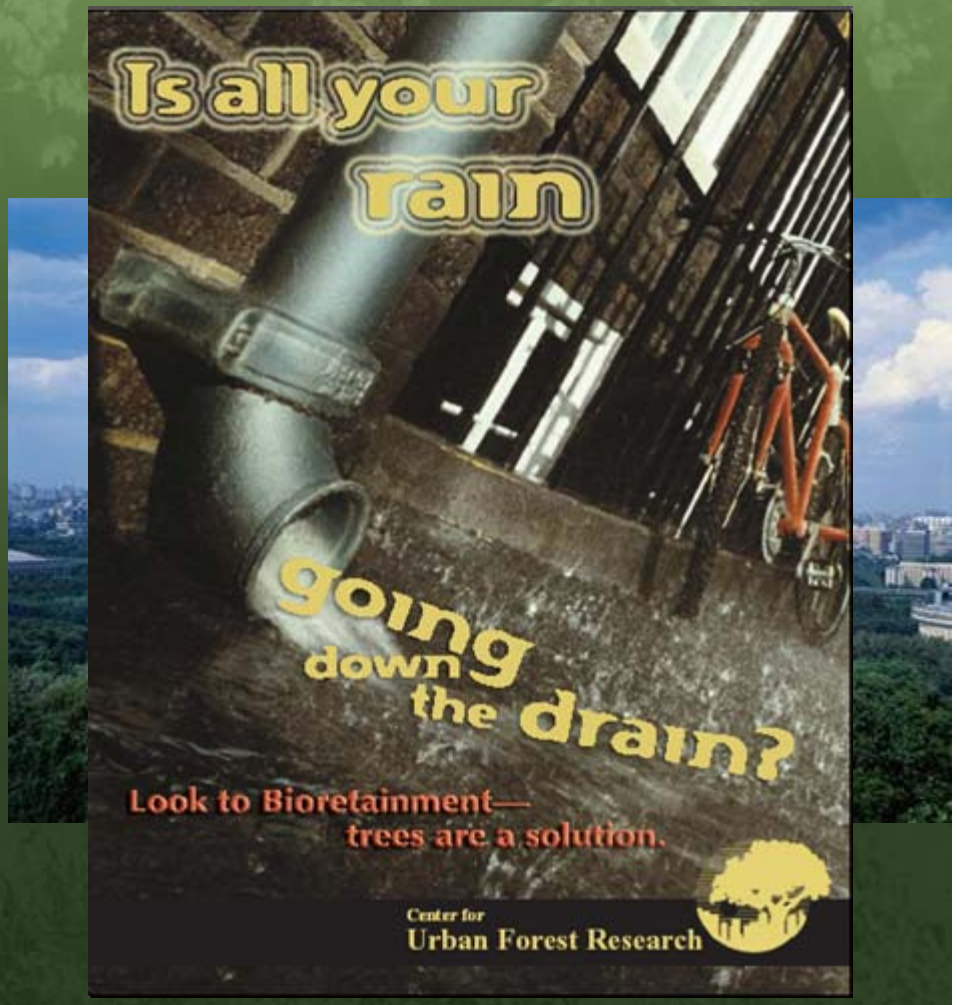


Reducing Stormwater Runoff

- Watershed benefits can exceed irrigation costs
- Water quality benefit can exceed flood control benefit
- To maximize interception:
  - Large leaf and stem surface areas
  - Coarse textured surfaces
  - Match foliation period to rainfall pattern

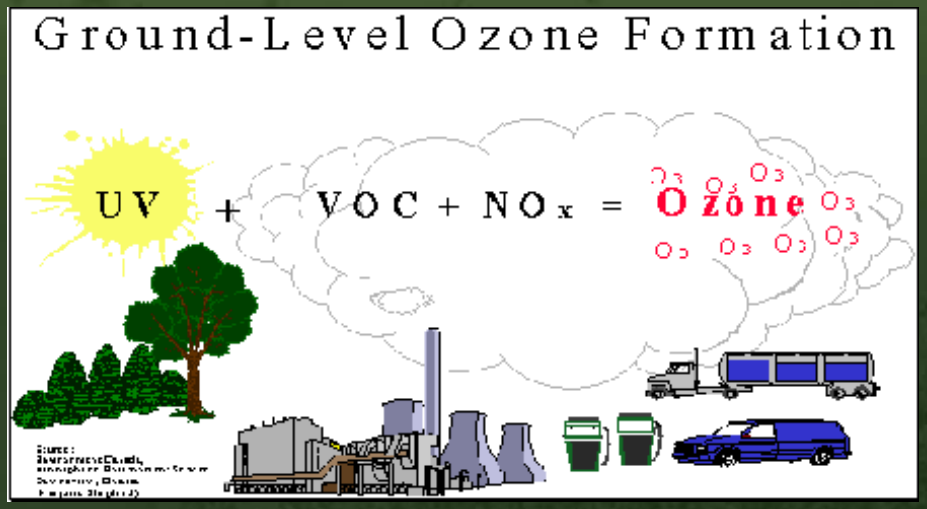
Reducing Runoff

- Hackberry, 20 years
  - Intercepted = 1,394 gal
  - Value = $6

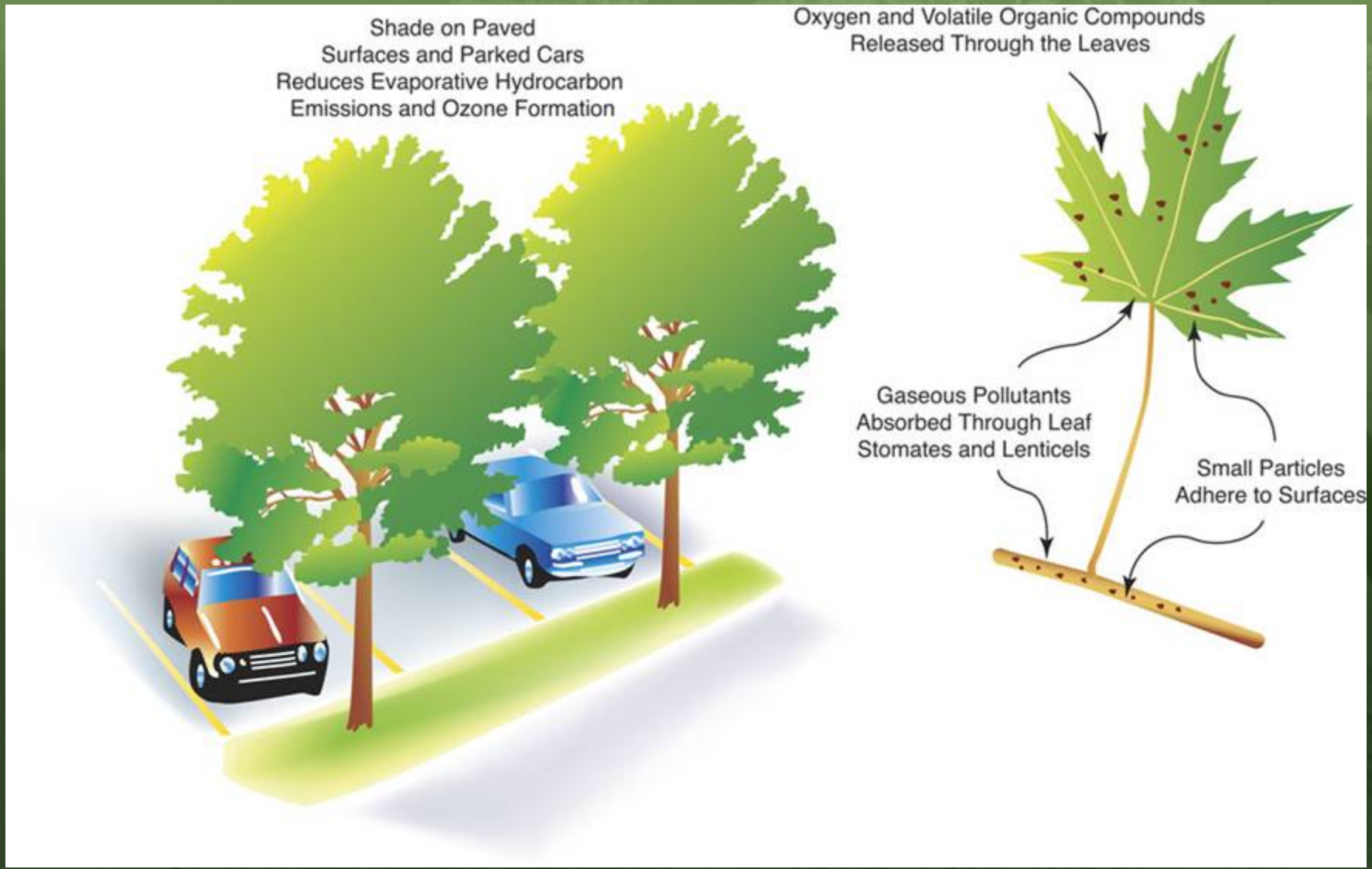


Improving Air Quality

- Ozone: 160 million people
- Particulates: 100 million people



Improving Air Quality



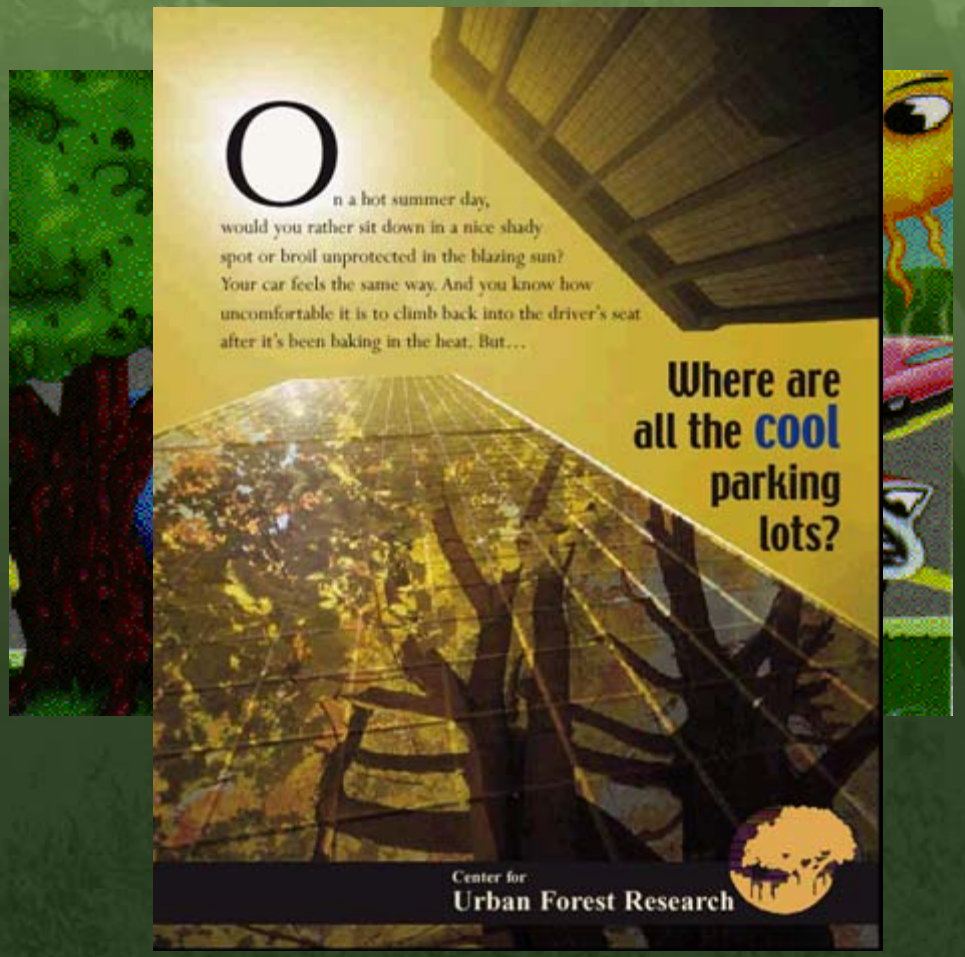
Improving Air Quality

- Plant tolerant species
  - Not ash, tulip tree, Austrian pine
- Conifers
- Hairy plant parts, long petioles
  - Oak, birch, sumac, maple, ash
- Locate close to and downwind of source, plant multiple rows
- Sustain large, healthy trees
- Shade parked cars

Improving Air Quality

Parking Lots

- Lots 3 F degrees cooler
- Cabin 40-50 degrees cooler
- Gas temp 4-8 degrees cooler
- Reduce VOC 1ton/day



Improving Air Quality

- Hackberry, 20 years, Facing West-Wall (lbs)
  - NO2 = 1.16, $3.88
  - SO2 = 0.73, $1.51
  - PM10 = 0.25, $0.71
  - Ozone = 0.18, $0.60
  - VOCs = 0.16, $0.59
  - BVOCs = 0.0, $0
  - Net Value = 2.48, $7.29

Others Things Trees Do

Trees. Vital to Human Health.

- Tree-filled neighborhoods:
  - Lower levels of domestic violence
  - Are safer and more sociable
- Tree-filled landscapes reduce stress
- Trees decrease need for medication and speed recovery times

Trees Sell Houses. (At higher prices.)

- Each large front yard tree adds
  1% to sales price
- Large specimen trees can add
  10%, or more, to property values.

Trees Mean Better Business.

In tree-lined commercial districts…

- More frequent shopping
- Longer shopping trips
- Shoppers spend more for parking
- Shoppers spend 12% more for goods

Trees Improve Pavement Performance.

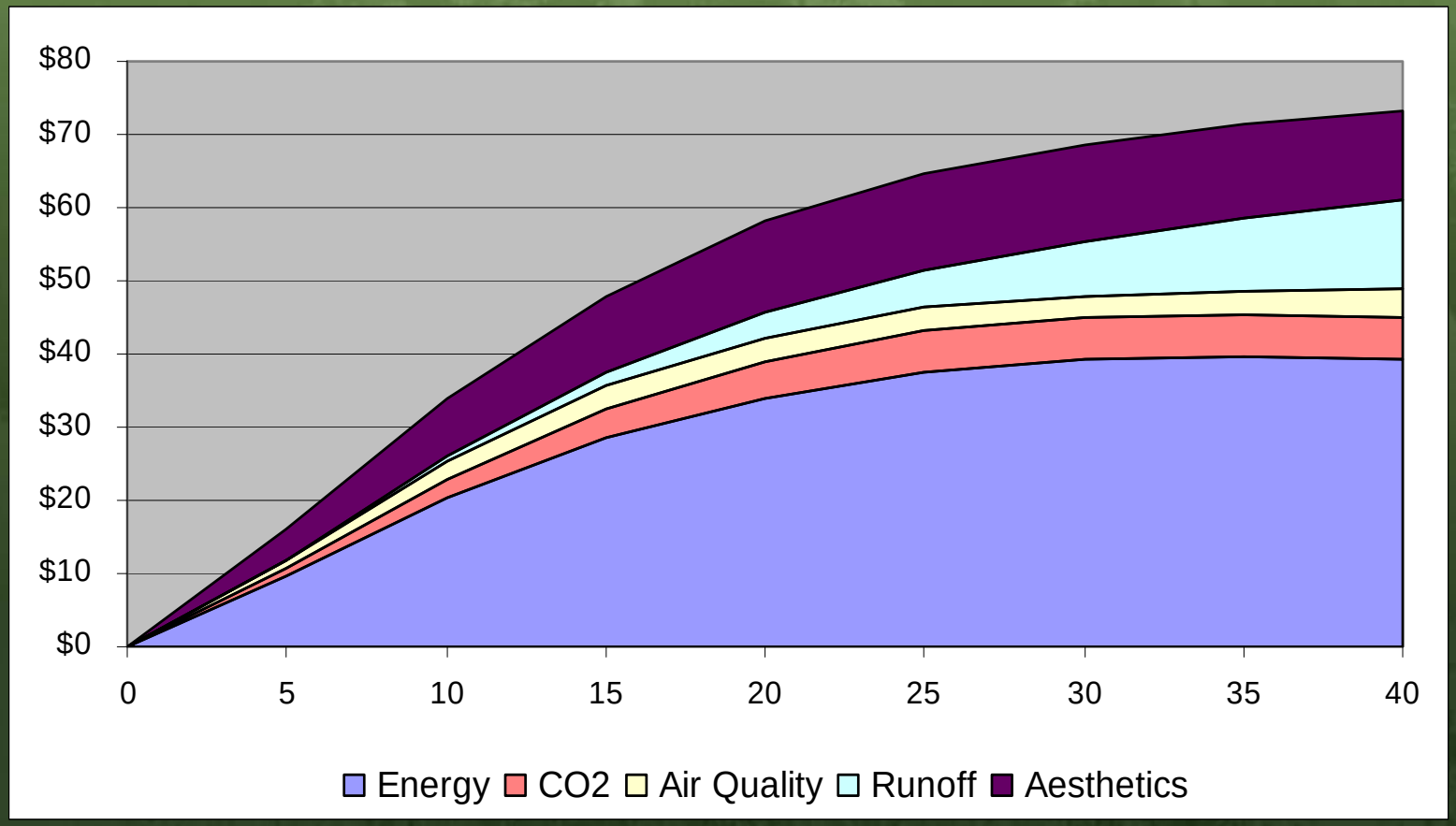
More shade means more time between repaving.

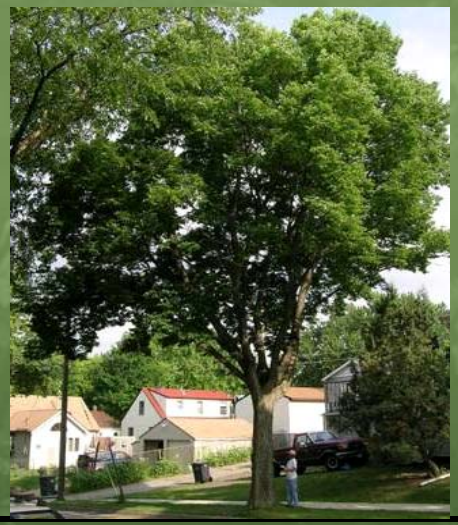
20% shade improves pavement condition by 11%. 60% savings for resurfacing in 30 years

Aesthetic and Other Benefits

- Hackberry, 20 years
  - $25
    - $0.16/sq ft LA x
      155 sq ft LA/year

Benefits in Midwest Red Oak, West Yard



			
Total Costs	$8.47	$13.11	$15.11
Total Benefits	$28.34	$58.05	$102.04
Total Net Benefits	**$19.87**	**$44.94**	**$86.93**

Minneapolis Benefit-Cost Summary

- $2.71 in benefits for every $1 spent
- Net annual benefit = $15.7 million
  - $79/tree, $8/capita

	Ft Collins	Cheyenne	Bismarck	Berkeley	Glendale	Minneapolis	Boulder
Total benefits	2,170,799	686,029	979,094	3,247,545	665,856	24,934,226	2,740,907
Total costs	-997,638	-327,897	-316,640	-2,372,000	-276,436	-9,209,041	-752,606
Net benefits	1,173,161	358,133	662,454	875,545	389,421	15,725,185	1,988,301
Benefit-cost ratio	2.18	2.09	3.09	1.37	2.41	2.71	3.64

Today

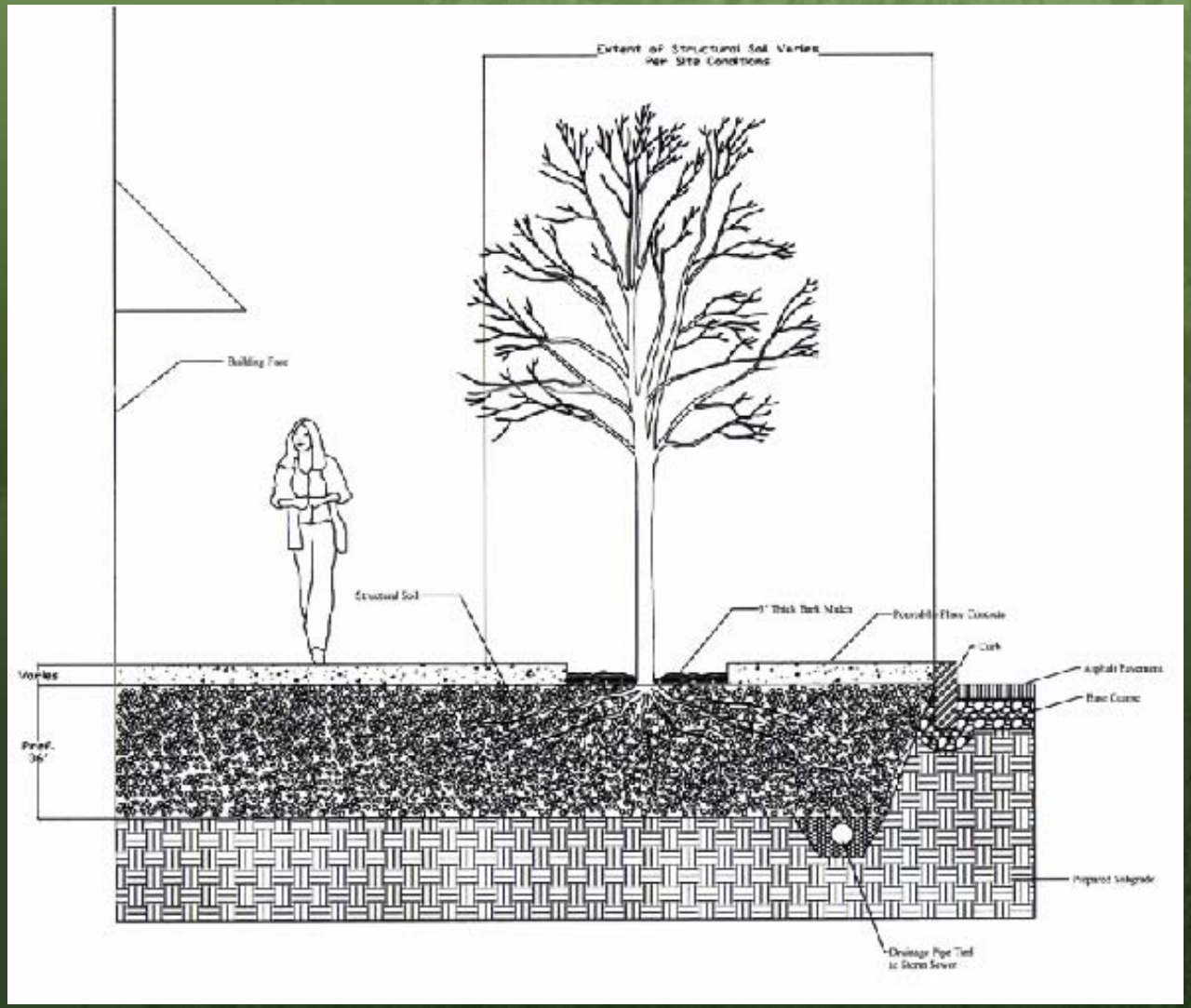
- Value of urban trees from a research perspective.
- What you can do.
- i-Tree and STRATUM.

Maintain Existing Trees

Plant More Trees

Plant Larger Growing Trees

Make More Space For Trees



Today

- Value of urban trees from a research perspective.
- What you can do.
- i-Tree and STRATUM.

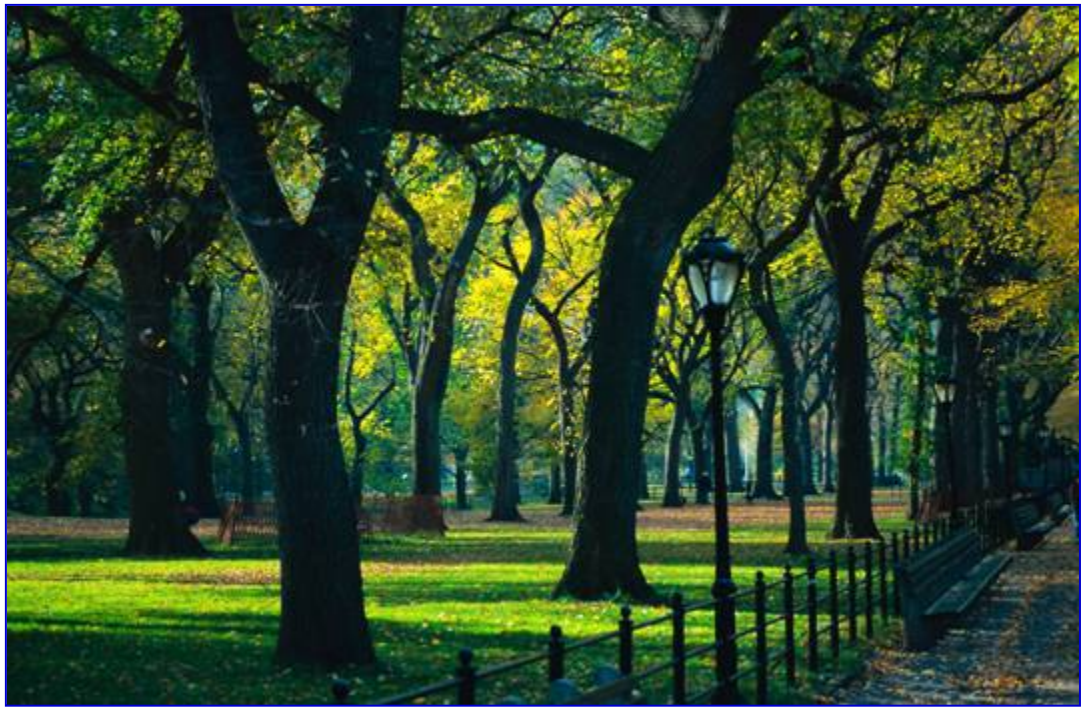
i-Tree & STRATUM

Greg McPherson
USDA Forest Service
Center for Urban Forest Research
Davis, CA

Midwest ISA Annual Conference
Topeka, KS, March 1-2, 2007

Common Goal

"To improve the condition and extent of the urban and community forest"



Public/Private Partnership

- USDA Forest Service
  - ✓Research and Development
  - ✓State and Private Forestry
- Davey Tree Expert Co.
- National Arbor Day Foundation
- Society of Municipal Arborists

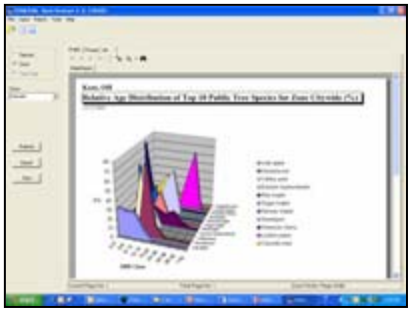
Pulling it Together

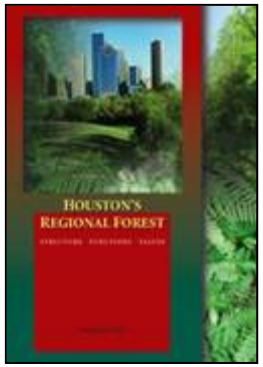
i-Tree Cooperative was formed to deliver all Forest Service applications in a single software suite:

- Credible, USDA FS peer-reviewed tools you can trust
- Public Domain Software
- Accessible
- Technical Support
- Training Workshops

What's Included?

- Two urban forest assessment tools:
  - ✓Assessing street tree populations
  - ✓Assessing urban ecosystems
- Multiple Utilities:
  - ✓Data collection & transfer
  - ✓Inventory management
  - ✓Storm damage assessment





Assessing Street Tree Populations

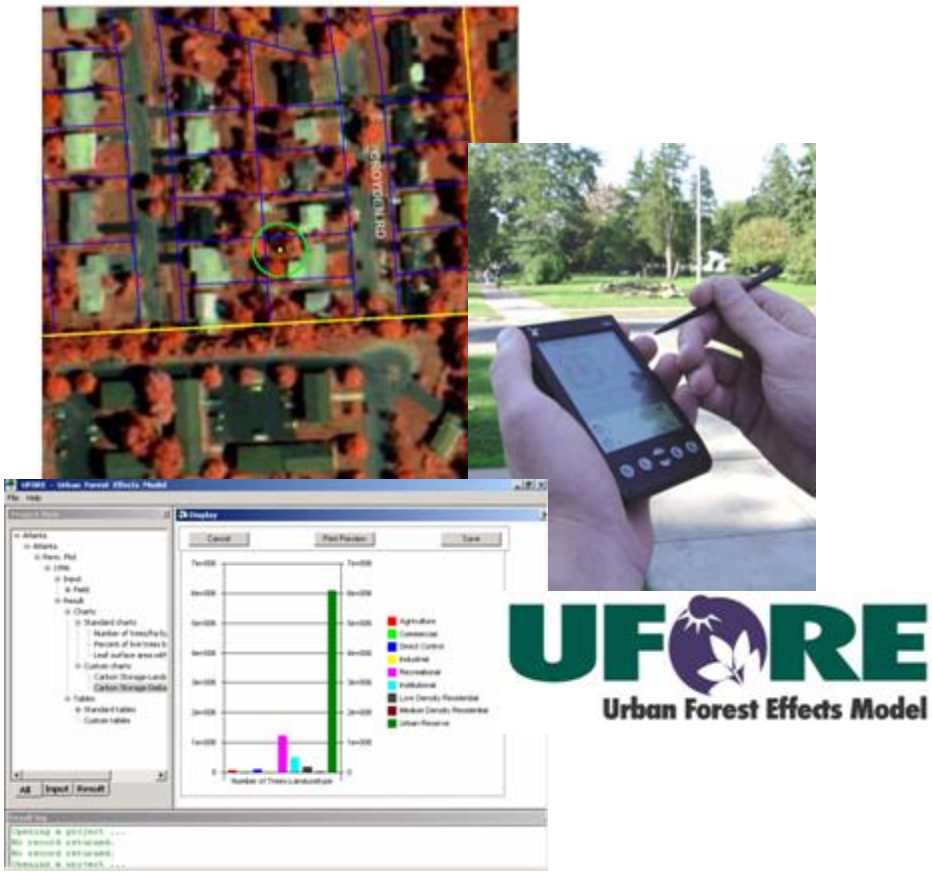
STRATUM assesses:

- ✓ Structure
- ✓ Function
  - Energy
  - Air pollution
  - Stormwater
  - Carbon
  - Property Value
- ✓ Value
- ✓ Management needs

	Total ($)	$/capita	$/tree
Benefit	501,064	11.31	93.64
Cost	94,000	2.12	17.57
Net Benefits	407,064	9.19	76.07
Benefit-Cost Ratio	5.33	5.33	5.33

Assessing Urban Ecosystems

- **UFORE** assesses:
  - ✓Structure
  - ✓Function
    - Energy
    - Air pollution
    - Carbon
  - ✓Value
  - ✓Management
    - Health
    - Pest impacts



i-Tree Management Utilities

- MCTI—Mobile Community Tree Inventory

- SDAP—Storm Damage Assessment Protocol

i-Tree Supports Local U&CF Programs

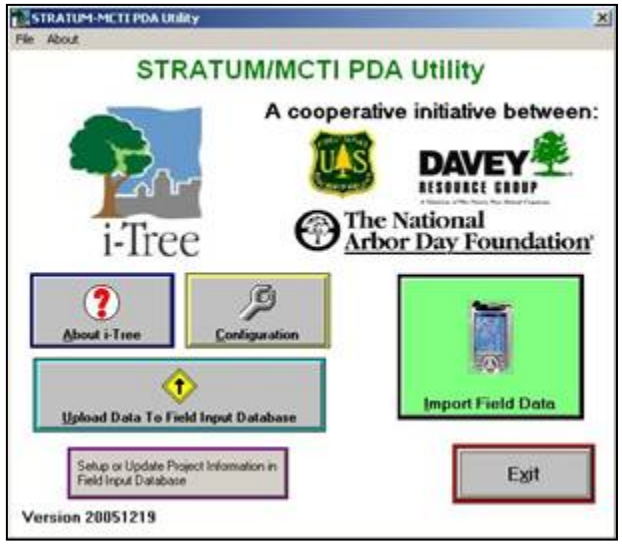
- Highlight value of trees
- Justify investment in tree programs
- Leverage funds from other sources
- Develop management plans
- Manage data
- Baseline for tracking progress

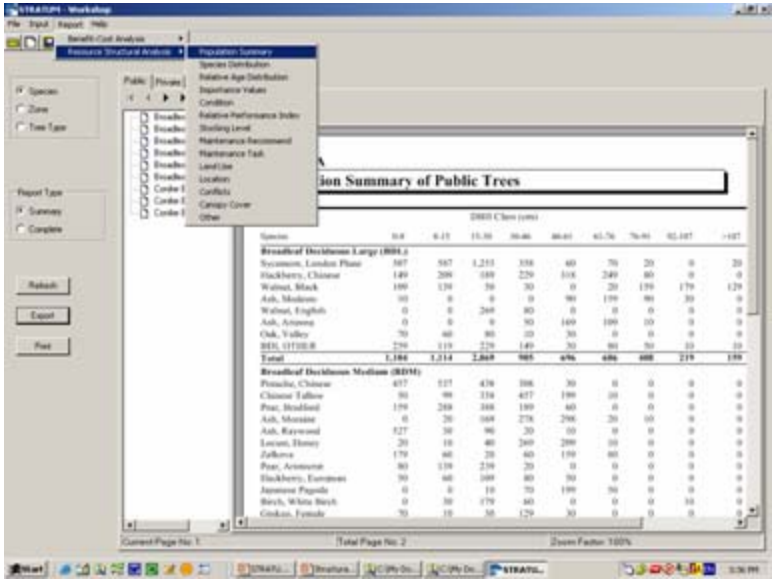
How do I get i-Tree?

- Visit:http://www.itreetools.org
  - ✓Install CD will be mailed
  - ✓Sign up for e-mail newslette
- Telephone & on-line support available.
- Workshops
- User Forum for feedback

PDA to Desktop Data Transfer

STRATUM





STRATUM - Davis_webcast

File Input Report Tools Help

Species
Zone
Tree Type

Zone

Refresh
Export
Print

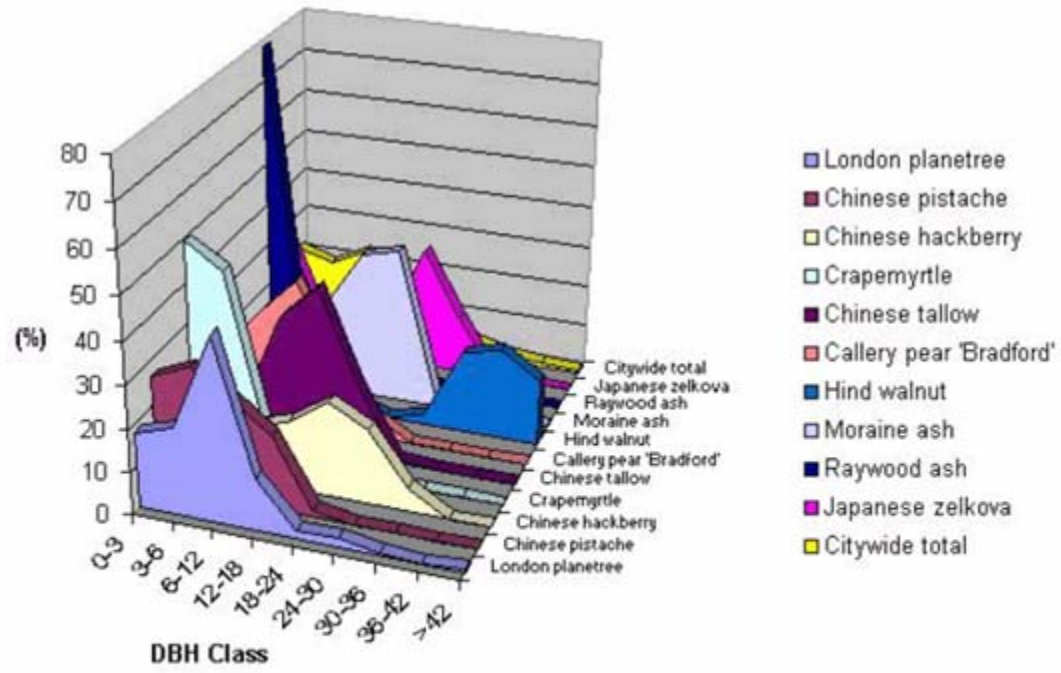
Public | Private | All

MainReport

Davis, CA

Relative Age Distribution of Top 10 Public Tree Species (%)

1/6/2006



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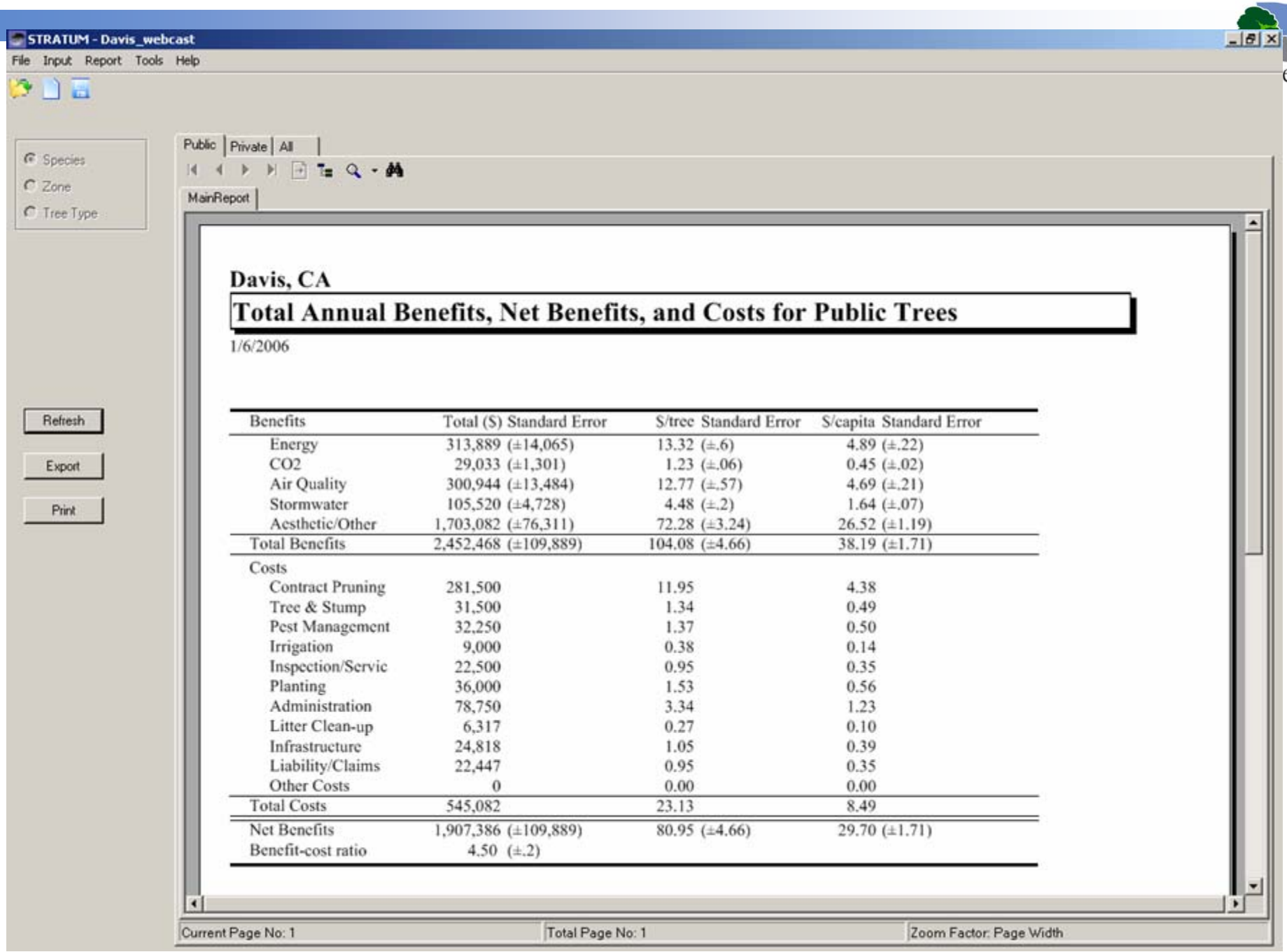


Davis, CA

Total Annual Benefits, Net Benefits, and Costs for Public Trees

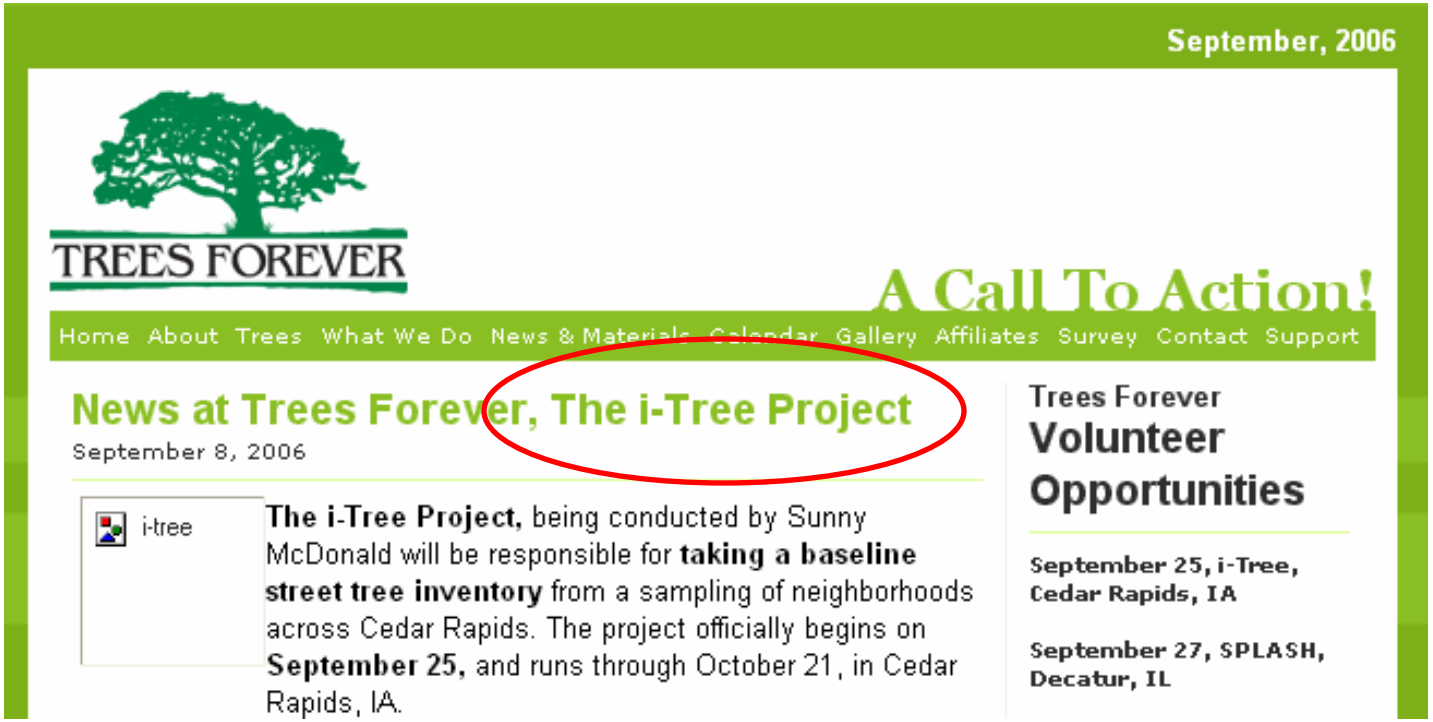
1/6/2006

Benefits	Total ($)	Standard Error	$/tree	Standard Error	$/capita	Standard Error
Energy	313,889	(±14,065)	13.32	(±.6)	4.89	(±.22)
CO2	29,033	(±1,301)	1.23	(±.06)	0.45	(±.02)
Air Quality	300,944	(±13,484)	12.77	(±.57)	4.69	(±.21)
Stormwater	105,520	(±4,728)	4.48	(±.2)	1.64	(±.07)
Aesthetic/Other	1,703,082	(±76,311)	72.28	(±3.24)	26.52	(±1.19)
Total Benefits	2,452,468	(±109,889)	104.08	(±4.66)	38.19	(±1.71)
Costs						
Contract Pruning	281,500		11.95		4.38	
Tree & Stump	31,500		1.34		0.49	
Pest Management	32,250		1.37		0.50	
Irrigation	9,000		0.38		0.14	
Inspection/Servic	22,500		0.95		0.35	
Planting	36,000		1.53		0.56	
Administration	78,750		3.34		1.23	
Litter Clean-up	6,317		0.27		0.10	
Infrastructure	24,818		1.05		0.39	
Liability/Claims	22,447		0.95		0.35	
Other Costs	0		0.00		0.00	
Total Costs	545,082		23.13		8.49	
Net Benefits	1,907,386	(±109,889)	80.95	(±4.66)	29.70	(±1.71)
Benefit-cost ratio	4.50	(±.2)				

Who will use i-Tree?

i-Tree in use:

- State-wide projects (Idaho; Illinois)
- Municipal projects (Portland, OR; Casper, WY)
- Non-profits (Tree People; Trees Forever)



Minneapolis Pilot Project

- Summer of 2004, i-Tree software tested using volunteers
- Professionals collected information along with volunteers

Training Components

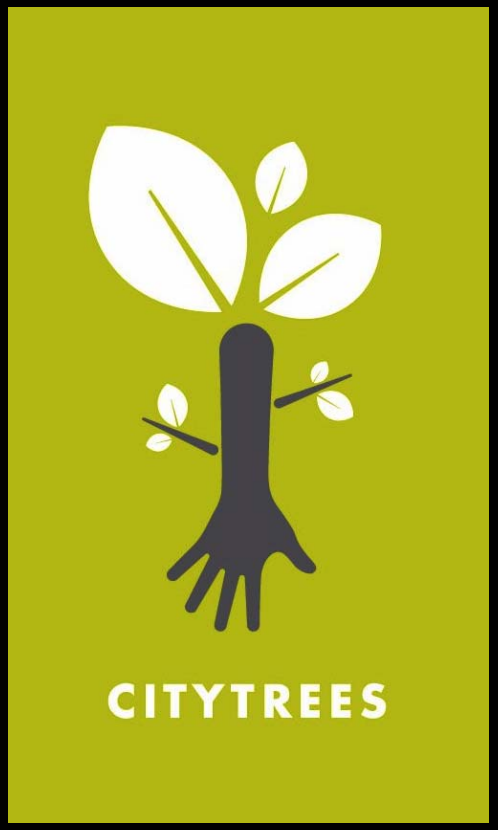
- Classroom Tree ID
- Outdoor Tree ID
- Tree Characteristics
- Measurement
- Software/PDA Operation

Summary

- Using volunteers can be successful, evaluate if it is the right choice for your community.

i-Tree: Demonstrating That Trees Pay Us Back!

- Trees are assets, management adds value by increasing return on investment



Minneapolis Tree Advisory Commission

selected portions of

Annual Report

to the

Minneapolis Park & Recreation Board

Minneapolis City Council & Mayor

January 2006

The Benefits of the Urban Forest

The trees of Minneapolis are THE growing capital asset that benefits everyone in the City.

CITYTREES

The State of the Minneapolis Urban Forest

The **Benefits** of the Urban Forest

Each year Minneapolis street trees provide:

- $6.8 million in energy savings
- $9.1 million in reduced storm water runoff
- $7.1 million increased property value
- Plus improvements to air quality

$24.9 million TOTAL value each year !

i-Tree

CITYTREES

The State of the Minneapolis Urban Forest

To provide Benefits …

Each PUBLIC UTILITY requires
ongoing public investments

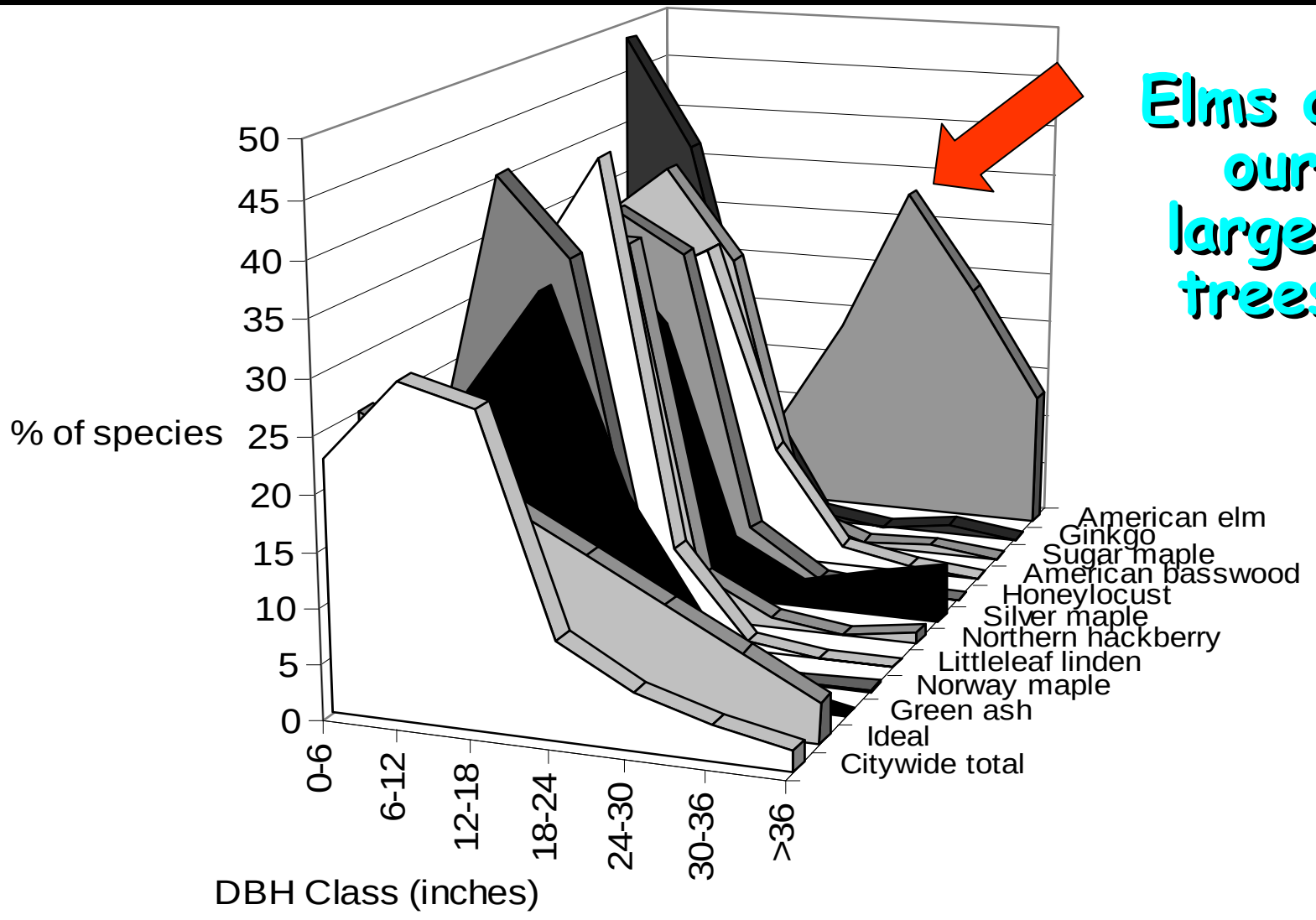
i-Tree

CITYTREES

The State of the
Minneapolis
Urban Forest


The Impacts of Dutch Elm Disease
Only 10% of Minneapolis street trees are elms.
But they generate 30% of tree benefits.
i-Tree
CITYTREES
The State of the
Minneapolis
Urban Forest

The Impacts—why elms matter



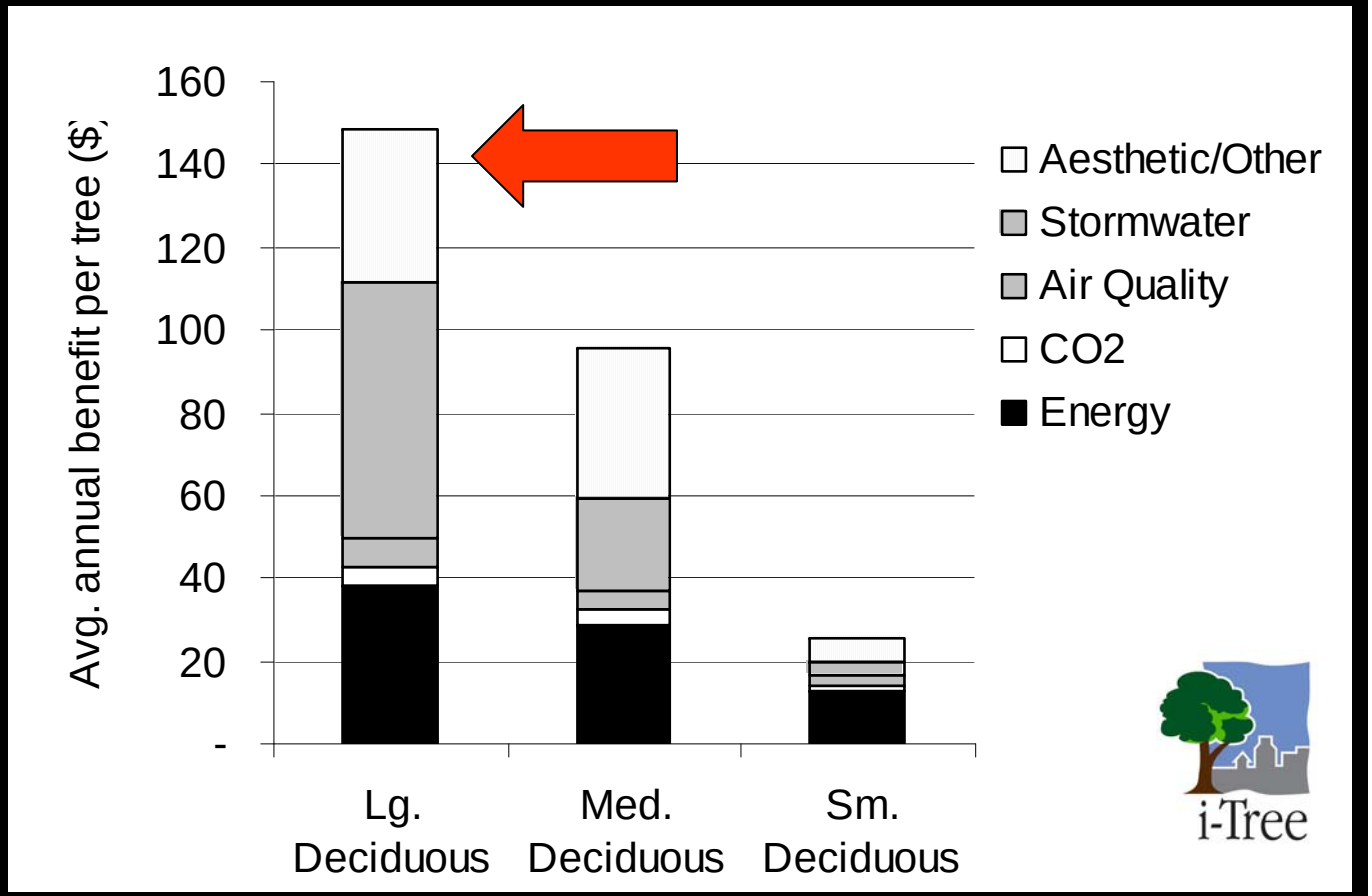
Elms are our largest trees.

i-Tree

The Impacts—why elms matter

LARGE TREES

= MOST BANG FOR BUCK



CITYTREES

The State of the Minneapolis Urban Forest

The Impacts of Dutch Elm Disease

Minneapolis has irretrievably lost:

- In 2004: 10,153 elms
- In 2005: 6,179 elms

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CITYTREES

The State of the Minneapolis Urban Forest

Resources

1. Fund Park Board Forestry to achieve:
   - ✓ Timely removals & pruning
   - ✓ Stump removal
   - ✓ Tree planting
   - ✓ Storm response

Minneapolis Tree Advisory Commission

RECOMMENDATIONS

Policies

1. Adopt urban forestry standards:
   - ✓ Incentives for developers
   - ✓ Streetscape standards & spec's
   - ✓ Private arborist qualifications

Minneapolis Tree Advisory Commission

RECOMMENDATIONS

Outreach

1. Launch Stewardship Campaign.

✓ Inform constituents

✓ Promote participation including **Citizens Tree Academy**

CONCLUSIONS

The State of the Urban Forest

- Benefits
- Impacts
- Threats

Recommendations

- Resources
- Policies
- Outreach

Minneapolis Tree Advisory Commission

How i-Tree makes a difference:

Through i-Tree … elected officials see proof of the economics of trees, e.g.:

- Annual $ benefits of street trees
- Total $ value of urban forest
- Quantity & cost of maintenance
- Economic losses from DED now
- High % & value of trees threatened
- Costs of deferred vigilance

i-Tree

CITYTREES

Minneapolis Tree Advisory Commission

Resulting in funding, leadership & action.

Trees Pay Us Back - Volume 1

i-Tree Results from Minneapolis, MN

i-Tree Overview

Minneapolis Involvement

Map of the Midwest Region

Download Software to View Adobe PDF's

Trees Pay Us Back - VOLUME 2 contains:

- Tools to Communicate Tree Values
- More Tree Benefits Research and Information

Minneapolis:

Minneapolis Municipal Tree Resource Analysis

USDA Forest Service
Center for Urban Forest Research

This report describes the structure and function of Minneapolis' public trees and compares costs and benefits of management.

Assessing Urban Forest Effects and Values: Minneapolis's Urban Forest

USDA Forest Service
Northeastern Research Station

This report describes the structure, health, benefits, and values of Minneapolis's urban forest (both public and private) as determined by the Forest Service's Urban Forest Effects (UFORE) model.

Midwest Region:

Midwest Community Tree Guide: Benefits, Costs, and Strategic Planting

USDA Forest Service
Center for Urban Forest Research

This guide outlines how any Midwest community can use the base data collected in Minneapolis to calculate the costs and benefits of planting trees.

Trees in Our City

USDA Forest Service
Center for Urban Forest Research

This Power Point presentation communicates the benefits of trees to community leaders.

Trees Pay Us Back

USDA Forest Service
Northeastern Area

This brochure summarizes the value of trees and invites communities to use the i-Tree results.

Conclusion

Questions?

- Visit: http://www.fs.fed.us/psw/programs/cufr
- http://www.itreetools.org