

PLANTING THE SEEDS OF SUCCESS.



Trees Pay Us Back

Quantifying Benefits of Trees

Greg McPherson
PNW ISA Annual Conference
Boise, Idaho
September 23, 2008



Center for Urban Forest Research

Today

- Value of urban trees from a research perspective.
- What you can do.



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.



Tree Quiz

- Bradford Pear
- 9 years old
- 9 inch dbh
- 28 ft. tall
- 19 ft. spread
- Number of leaves ?? (#)
- Total leaf area ?? (sq.ft.)
- H₂O retainment capacity ?? (gal)

Tree Quiz



- › Bradford Pear
- › 9 years old
- › 9 inch d.b.h.
- › 28-ft tall
- › 19-ft spread

- › Number of leaves
- › Total leaf area (sq ft)
- › Fresh weight of leaves (lb)
- › Fresh weight of wood (lb)



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
- H₂O retainment capacity 55 g

Tree Quiz

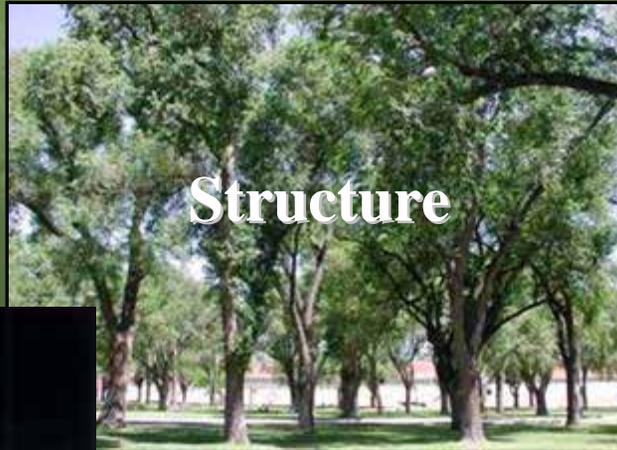


- ▶ Bradford Pear
- ▶ 9 years old
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- ▶ 19-ft spread

- ▶ Number of leaves
- ▶ Total leaf area (sq ft)
- ▶ Fresh weight of leaves (lb)
- ▶ Fresh weight of wood (lb)



Benefit-Based Approach



Structure



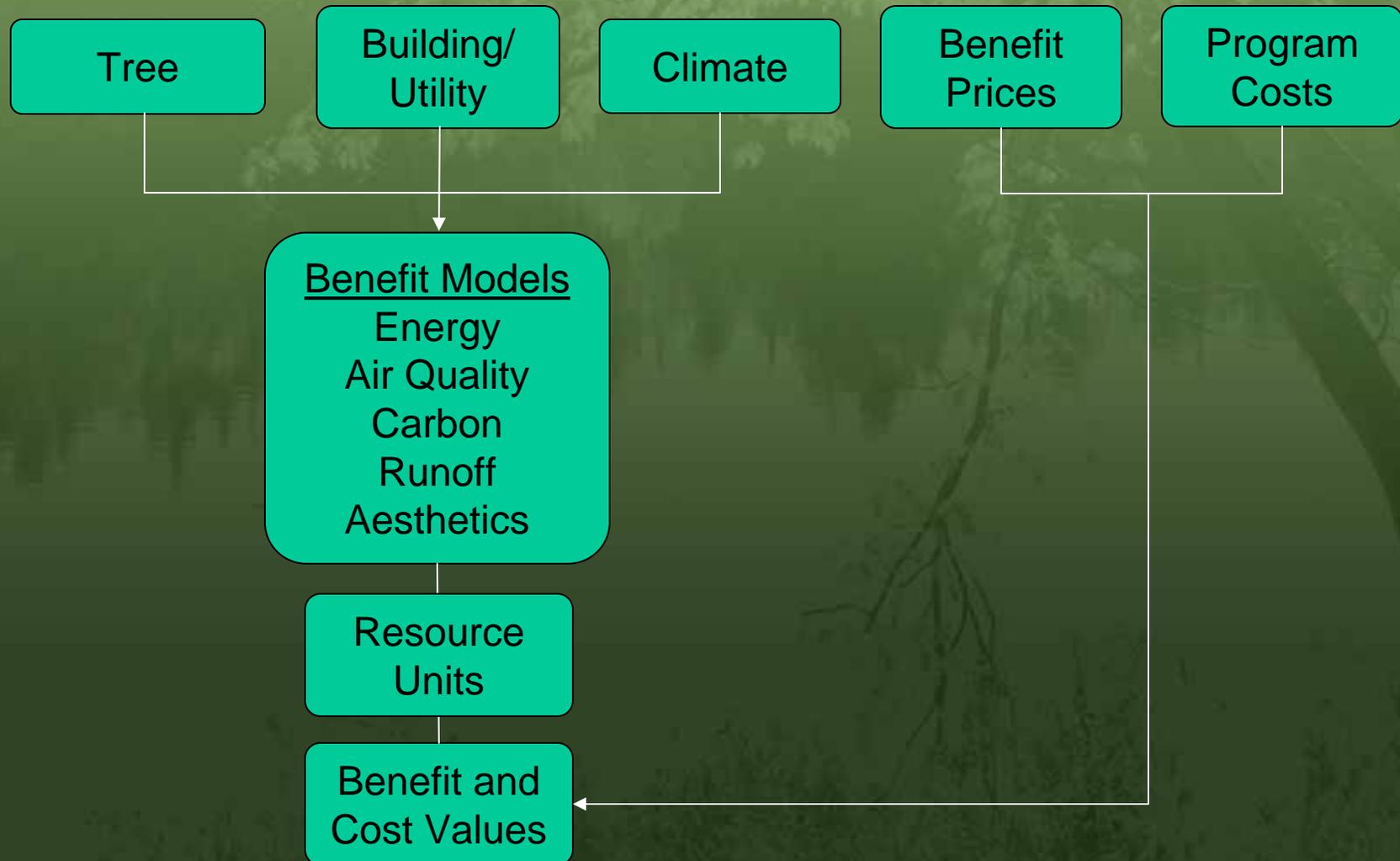
Function



Value



Benefit-Cost Modeling

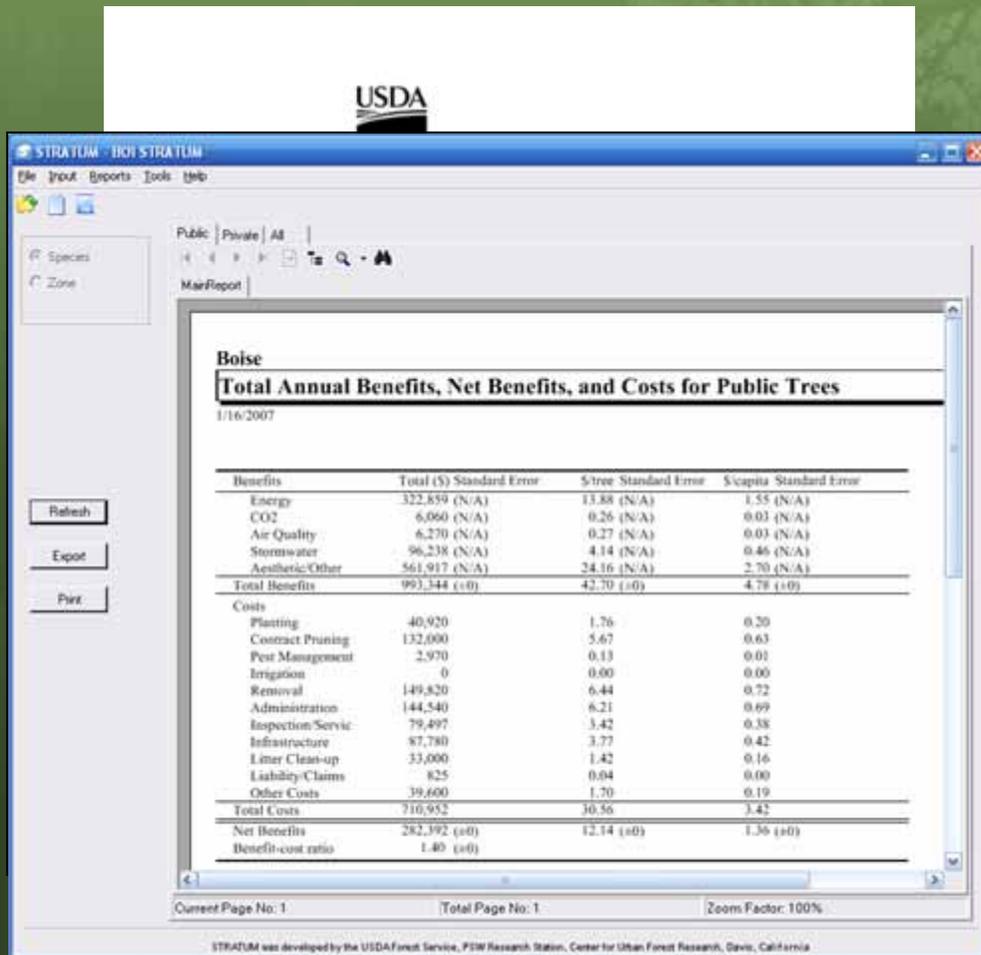


Reference Cities

- Collected data – Boise park/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



Products



- Municipal Forest Resource Assessments
- Community Tree Guides
 - Benefits And Costs for Tree Planting Projects
 - Examples
 - Guidelines For Selecting And Placing Trees
 - rschneider@fs.fed.us
 - (970) 498-1392
- Trees in Our City PPTs
- STRATUM data

Tree Guide Results

- For “typical” large, medium, and small tree.
 - Crabapple
 - Norway Maple
 - White Ash
- For public (street/park) and private property locations (east, south, west).



Size at 20 Years



	Small	Medium	Large
Height (ft)	20	35	39
Spread (ft)	23	29	34
LSA (sq ft)	1,029	2,114	3,376

Trees Improve the Environment



KPVI.com




Where News Comes First

HOME NEWS WEATHER SPORTS ABOUT US HEALTH RECIPES

Email Print Text Size

Reporter: **Andrew Del Greco** will
 Idaho Falls Encourages City-Wide Energy Conservation



We've just installed 2,500 air conditioners.

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It's all part of Mayor Jared Vaniman's and Idaho Falls Power's renewed plan to make energy conservation more attractive.

Van Ashton, Idaho Falls Power: "We've been trying to get the info out for 25 years now."

City Hall has set the example. With new bulbs,

Enforcement

Firefighters Quickly Control Field Fire Near Fort Hall

Fire Burns Historic Buildings in Ketchum

Early Morning Fire Damages Idaho Falls Home

Conserving Energy



Conserving Energy

- White ash, 20 years, Opposite west wall
 - Save AC: 395 kWh, \$32/yr
 - Save Heating costs: \$11/yr
 - Save \$43/yr total



Plant Strategically Summer Shade

- West is the best
- Closer is better
- Large, dense crown



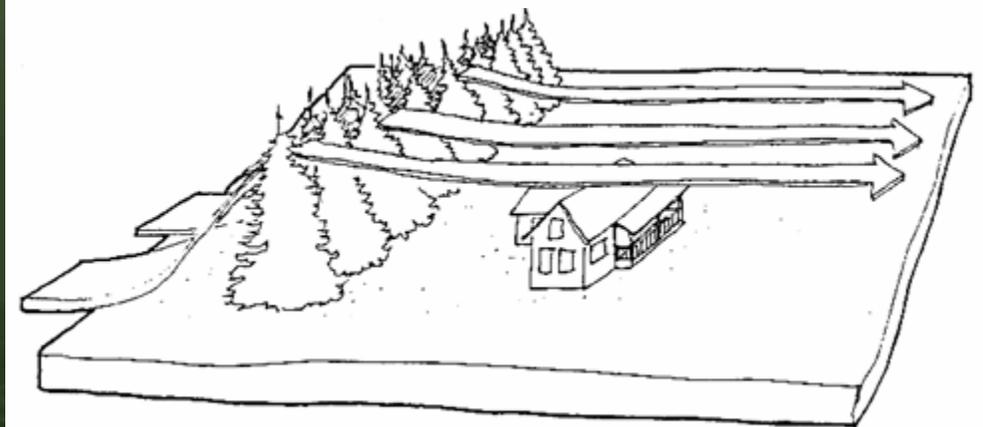
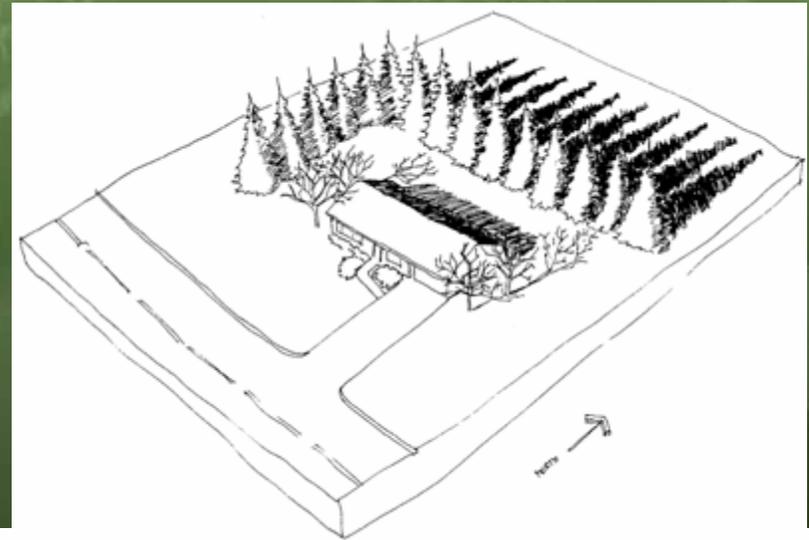
Plant Strategically Solar Friendly to South

- Avoid trees to south
- Open winter crown, dense summer shade
- Foliage early to drop, late to leaf-out
- Examples:
 - Maples, Hackberry, Coffeetree, Honeylocust, Pagodatree, Crabapple



Plant Strategically Windbreaks

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



Choose Species Wisely: Bigger is Better



Plant Lots of Trees



Shade Paved Surfaces



For More Information

Save Dollars With Shade

A Community Tree Planting Solution to Conserve Energy

Just Plant Trees

Imagine a solution to rising energy prices as simple as planting trees. We've all grown up with trees, climbed in them, and probably even planted a few. But how many of us know that they significantly contribute to cooling our homes, businesses and communities?

Millions of Trees Still Needed

Studies in various parts of the West show that many communities have trees that produce shade and summer time cooling. However, Dr. Greg McPherson, Director, Center for Urban Forest Research, Pacific Southwest Research Station in Davis, California, points out that "over 100 million tree-planting sites exist on the east and west side of buildings in the western U.S. with high energy saving potential. These sites need to be filled.

Planting these sites will save billions of energy dollars and should be a high priority for all communities."

Trees Conserve Energy By:

- Shading, which reduces the amount of radiant energy absorbed and stored by built surfaces.
- Evapotranspiration, which converts liquid water in leaves to vapor, thereby cooling the air.
- Reducing the velocity of wind, which slows the infiltration of outside air into inside spaces.

Where would you rather live?



Strategically Placed Trees Save Energy Dollars



Center for Urban Forest Research
Pacific Southwest Research Station
USDA Forest Service
1 Shields Avenue, Suite 1111
Davis, CA 95616-0947

Telephone: 530-752-7638
<http://cuf.rsl.fs.fed.us/>



GREEN PLANTS OR POWER PLANTS?

What is the best solution for California?

Build more power plants or plant more trees?

Researchers at the Center for Urban Forest Research in Davis, California found that planting shade trees can reduce the need for power plants. The study shows that 50 million shade trees planted in strategic, energy-saving locations could eliminate the need for seven 100-megawatt (MW) power plants.

Are Trees Really the Answer?

According to the Center Director, Dr. Greg McPherson, "A tree must grow at least 5 to 15 years before it can fully contribute to the energy conservation process. However, if we don't invest in energy-conserving trees now, they will not be available in 15 years when the demand for energy will be even greater."



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Planting trees
can reduce the need
for power plants



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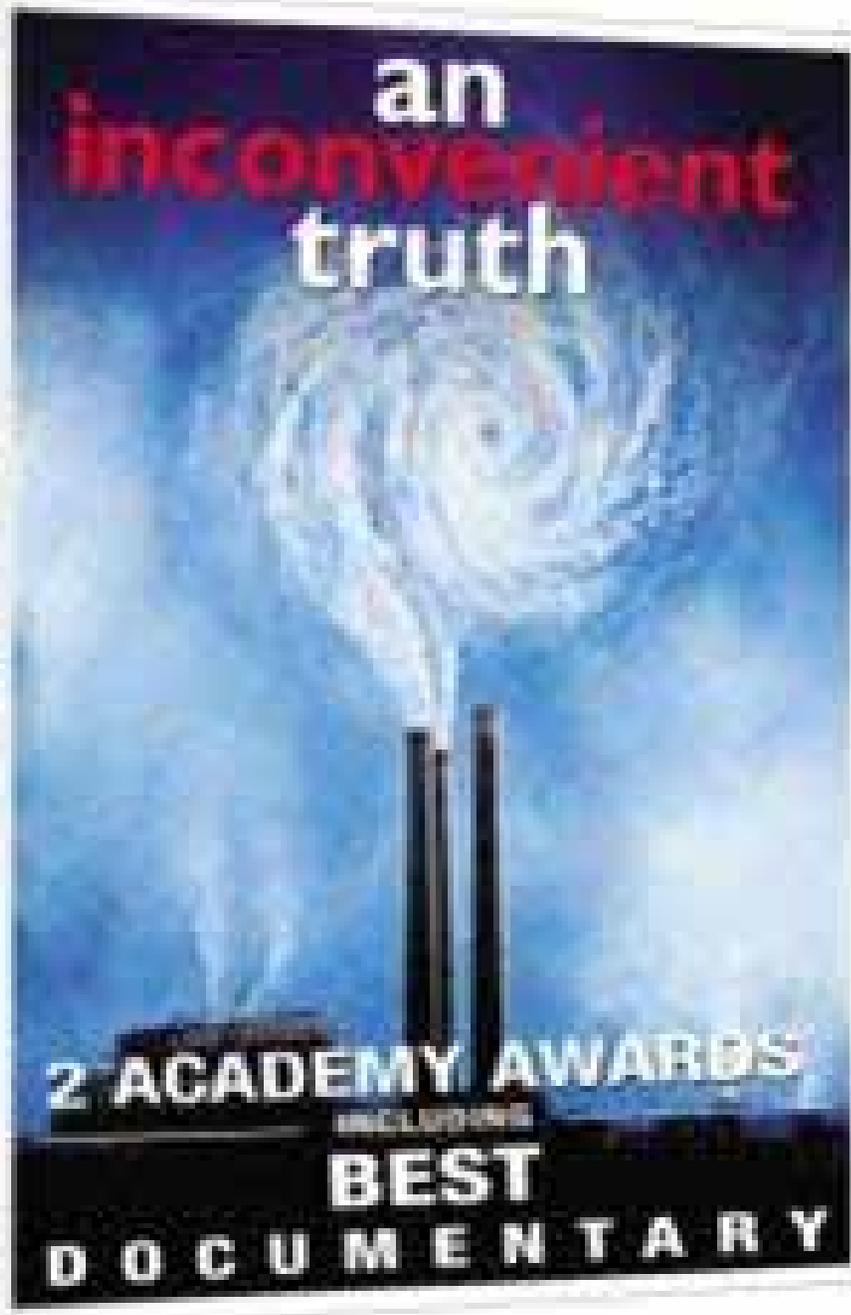
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Market turns

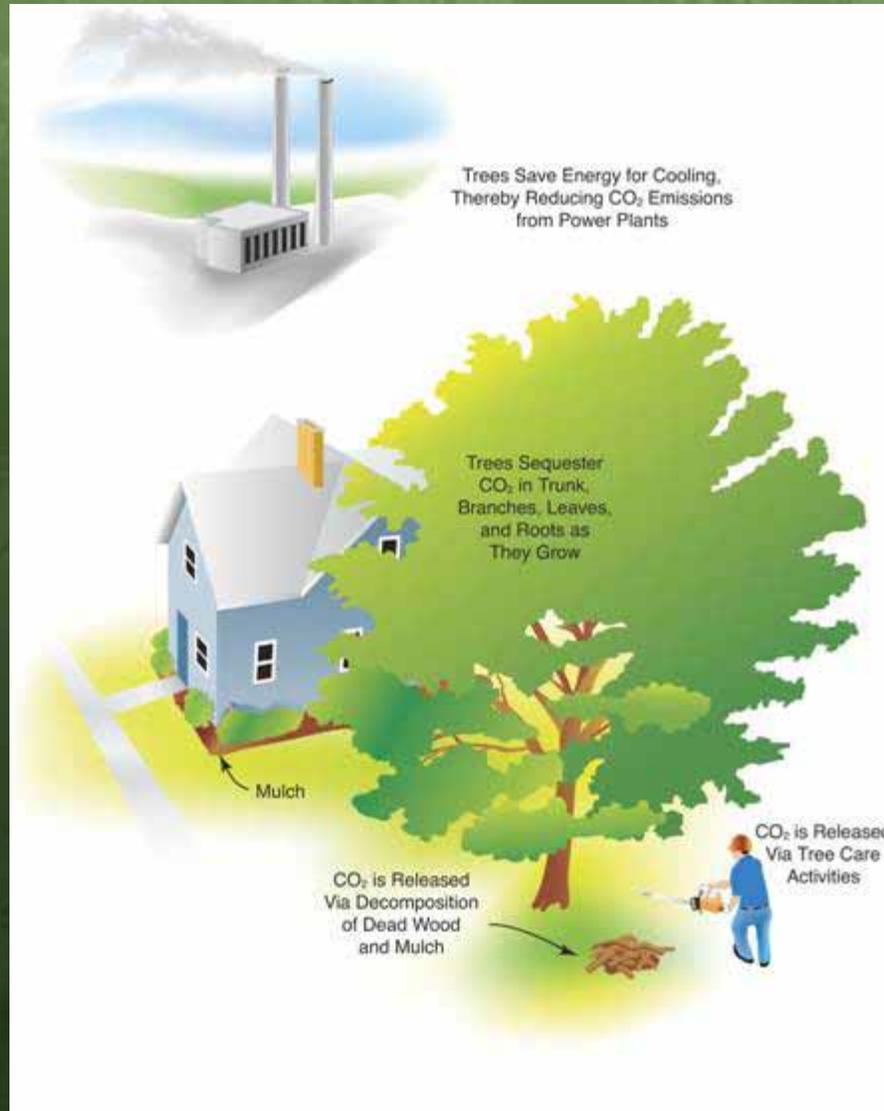


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Reducing Atmospheric Carbon Dioxide



Reducing CO₂

- White ash, 20 years, Opposite west wall
 - Total Net = 466 lb
 - Total Value = \$2



Choose Species Wisely



Small and short-lived



Large and long-lived

Plant and Maintain More Trees



Create Diversity



Make Use of Wood



Municipal Application of Stormwater Tree Credits

GA number of municipalities across the country have established stormwater credit programs that grant flow control credits for existing or newly planted trees. The City of San Jose, California has a program that gives credits for trees planted within 30 feet of impervious surfaces and existing trees that are kept on a site if their canopies are within 20 feet of impervious surfaces. The impervious surface reduction credit for existing trees is the square footage equal to one-half the area of existing tree canopy (credit is equivalent to a reduction in the site's impervious area). **T**The credit for each new deciduous tree is 100 square feet, and the credit for each new evergreen tree is 200 square feet. No more than 25 percent of a site's impervious surface can be credited through the use of trees (San Jose 2007).

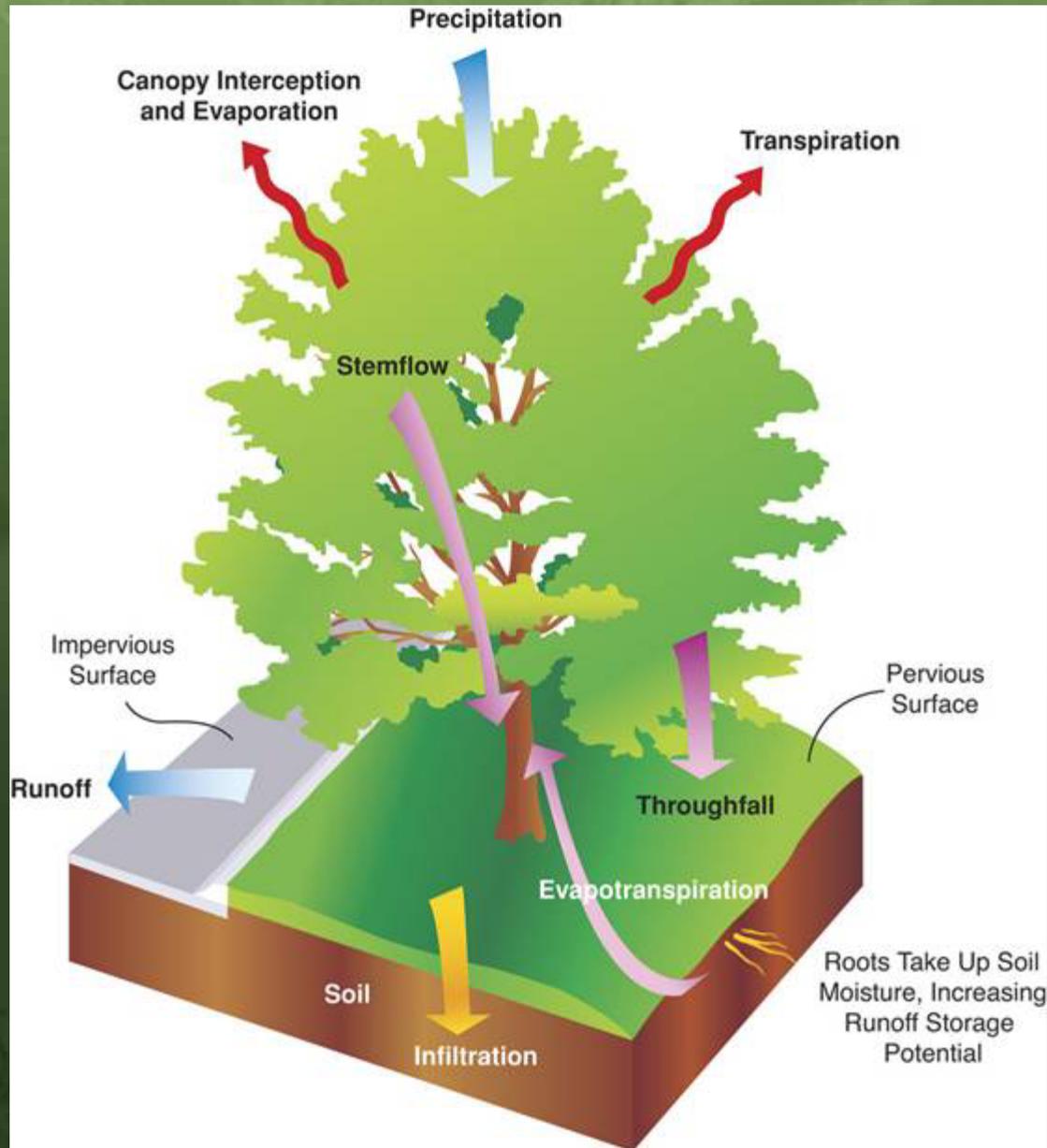
\$Austin, Texas also has a program that provides stormwater credit for both new and existing trees. The program in Austin provides a much more modest tree credit than that of San Jose. For new trees to receive a credit, they must be planted within 25 feet of a ground-level impervious surface and have a minimum diameter of 2 inches at the time of planting. The impervious surface reduction credit for each newly planted tree is 20 square feet. Each existing tree within 25 feet of ground-level impervious surface and with a diameter of 4 inches is credited with an area equal to one quarter the area of the tree canopy (Austin 2007).

Portland, Oregon has a tree credit program equivalent to that of San Jose. The impervious surface reduction credit for new deciduous trees within 25 feet of ground-level impervious surfaces is 100 square feet, and the credit for new evergreen trees is 200 square feet. For existing trees with a diameter of at least 4 inches, the credit is one half of the area of the canopy (BES 2007).

Other municipalities with active stormwater tree credit programs include Tampa, Florida and Sandy, Oregon. These programs are becoming more commonplace, and the list of participating municipalities is growing rapidly. Unfortunately, most of the municipal tree credit programs that

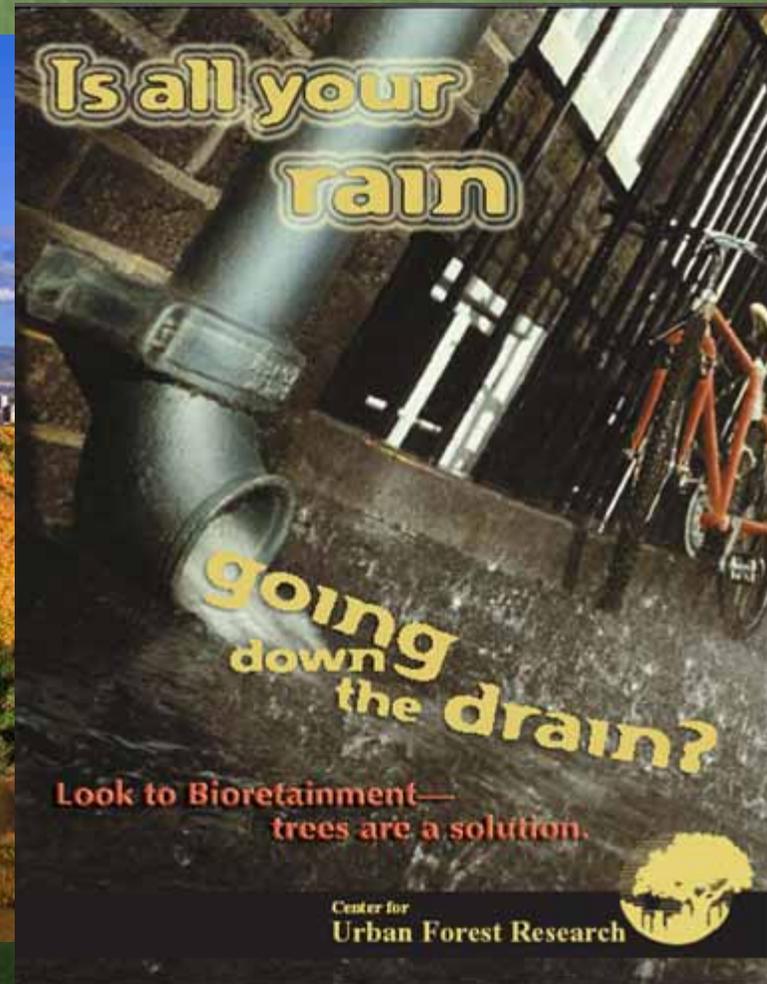


Reducing Stormwater Runoff



Reducing Runoff

- White ash, 20 years
 - Intercepted = 638 gal
 - Value = \$3.19



Choose Trees Wisely



Little leaf & stem surface



Lots of surface area, wide crown

Choose Trees Wisely



Complex structure, rough surface



Evergreen foliage

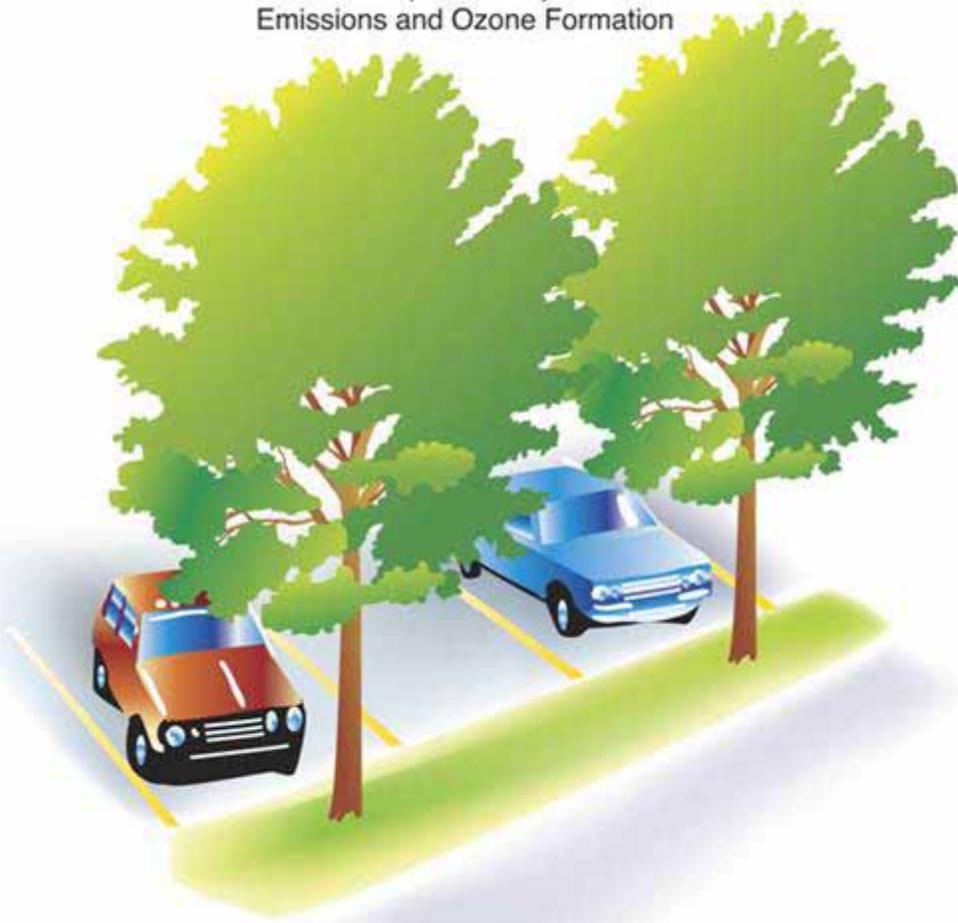
Locate Trees Wisely



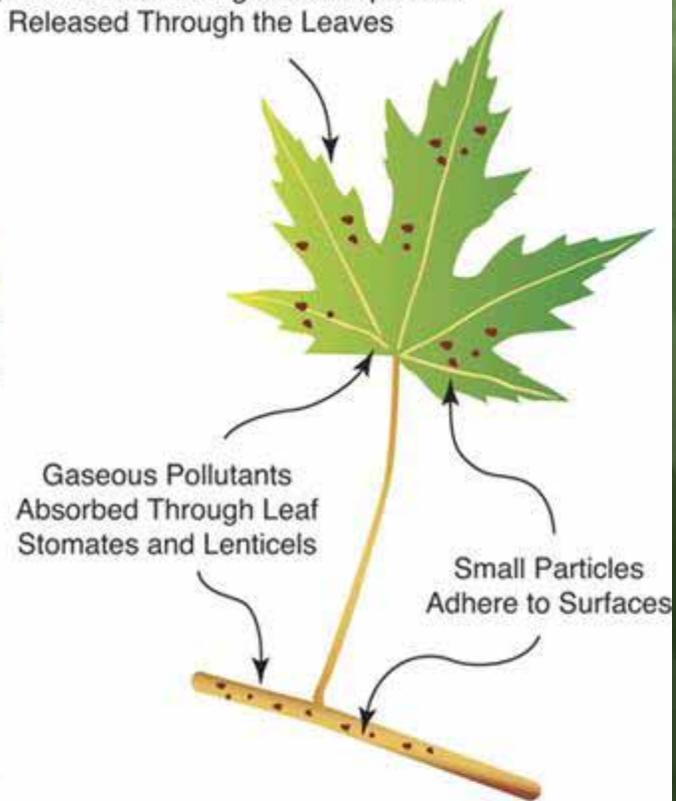


Improving Air Quality

Shade on Paved
Surfaces and Parked Cars
Reduces Evaporative Hydrocarbon
Emissions and Ozone Formation



Oxygen and Volatile Organic Compounds
Released Through the Leaves



Improving Air Quality

- White ash, 20 years, Facing West Wall (lbs)
 - NO₂ = 0.71, \$0.36
 - SO₂ = 1.45, \$0.09
 - PM₁₀ = 0.48, \$0.44
 - Ozone = 0.62, \$0.32
 - VOCs = 0.13, \$0.02
 - BVOCs = 0.0, \$0.00
 - Net Value = 3.39, \$1.23



Choose Trees Wisely



Large and tolerant to pollutants



Evergreens for particulates

Shade Parking Lots

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



On a hot summer day, would you rather sit down in a nice shady spot or broil unprotected in the blazing sun? Your car feels the same way. And you know how uncomfortable it is to climb back into the driver's seat after it's been baking in the heat. But...

Where are all the cool parking lots?

Center for
Urban Forest Research

The graphic features a perspective view of a parking lot with a large tree on the right casting a long, dark shadow over the asphalt. The text is overlaid on the upper and right portions of the image. At the bottom right, there is a circular logo with a stylized tree and the text 'Center for Urban Forest Research'.

Others Things Trees Do



Trees are 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

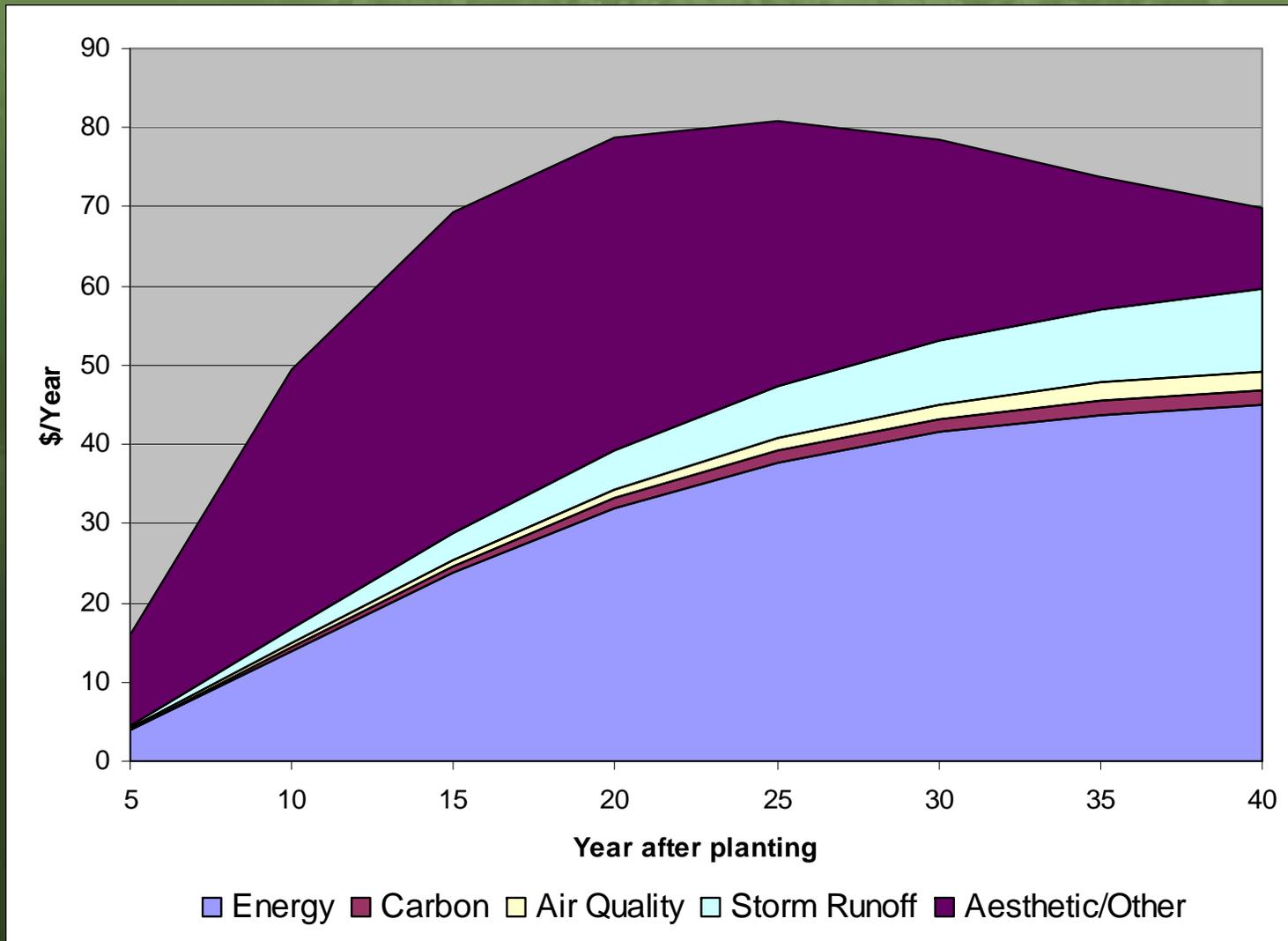


Aesthetic and Other Benefits

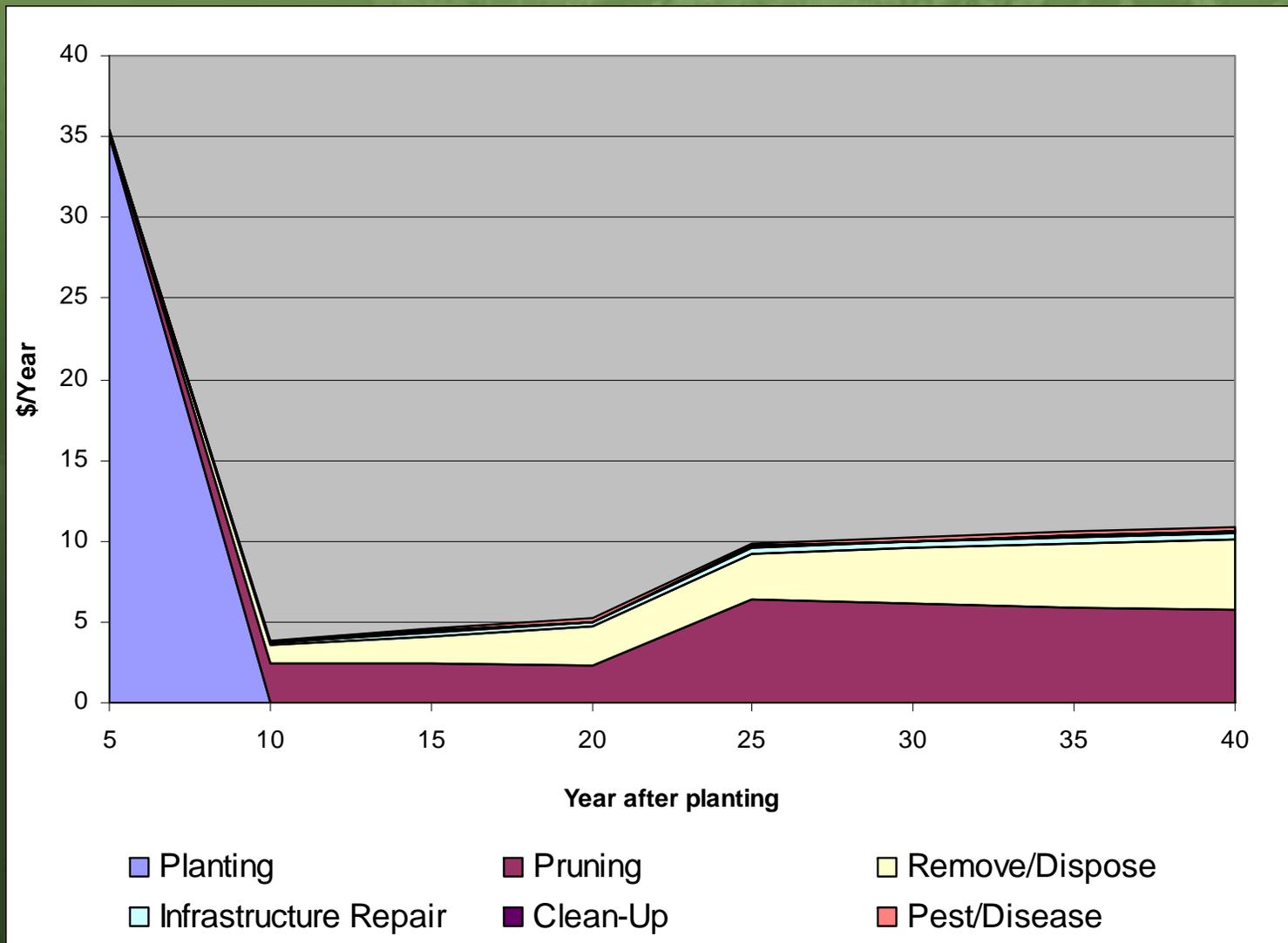
- White ash, 20 years
 - \$39



Benefits in Temperate Interior West White Ash, West Yard



Costs in Temperate Interior West White Ash, Yard





Total Costs	\$4.58	\$5.12	\$5.20
Total Benefits	\$36.63	\$57.87	\$90.24
Total Net Benefits	\$32.05	\$52.74	\$85.04

Boise Benefit-Cost Summary

- \$1.30 in benefits for every \$1 spent
 - 23,262 trees
 - \$771,000 expenditures
 - \$1,002,000 benefits
- Net annual benefit = \$231,479
 - \$10/tree, \$1.11/capita

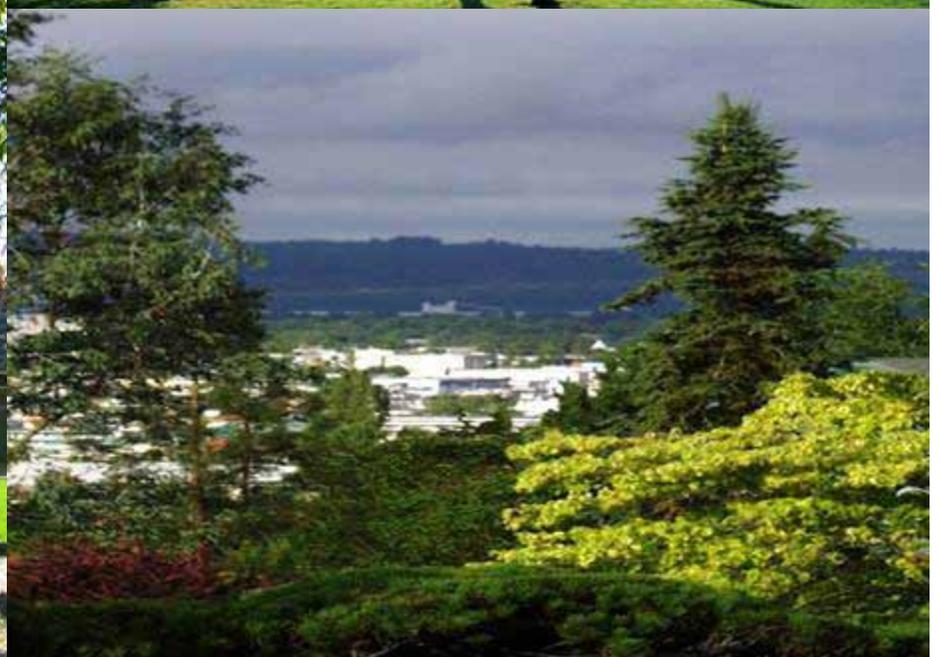
	Ft Collins	Cheyenne	Bismarck	Berkeley	Glendale	Minneapolis	Boulder
Total benefits	2,170,799	686,029	979,094	3,247,545	665,856	24,934,226	2,740,907
Total costs	-997,638	-327,897	-316,640	-2,372,000	-276,436	-9,209,041	-752,606
Net benefits	1,173,161	358,133	662,454	875,545	389,421	15,725,185	1,988,301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



Maintain Existing Trees



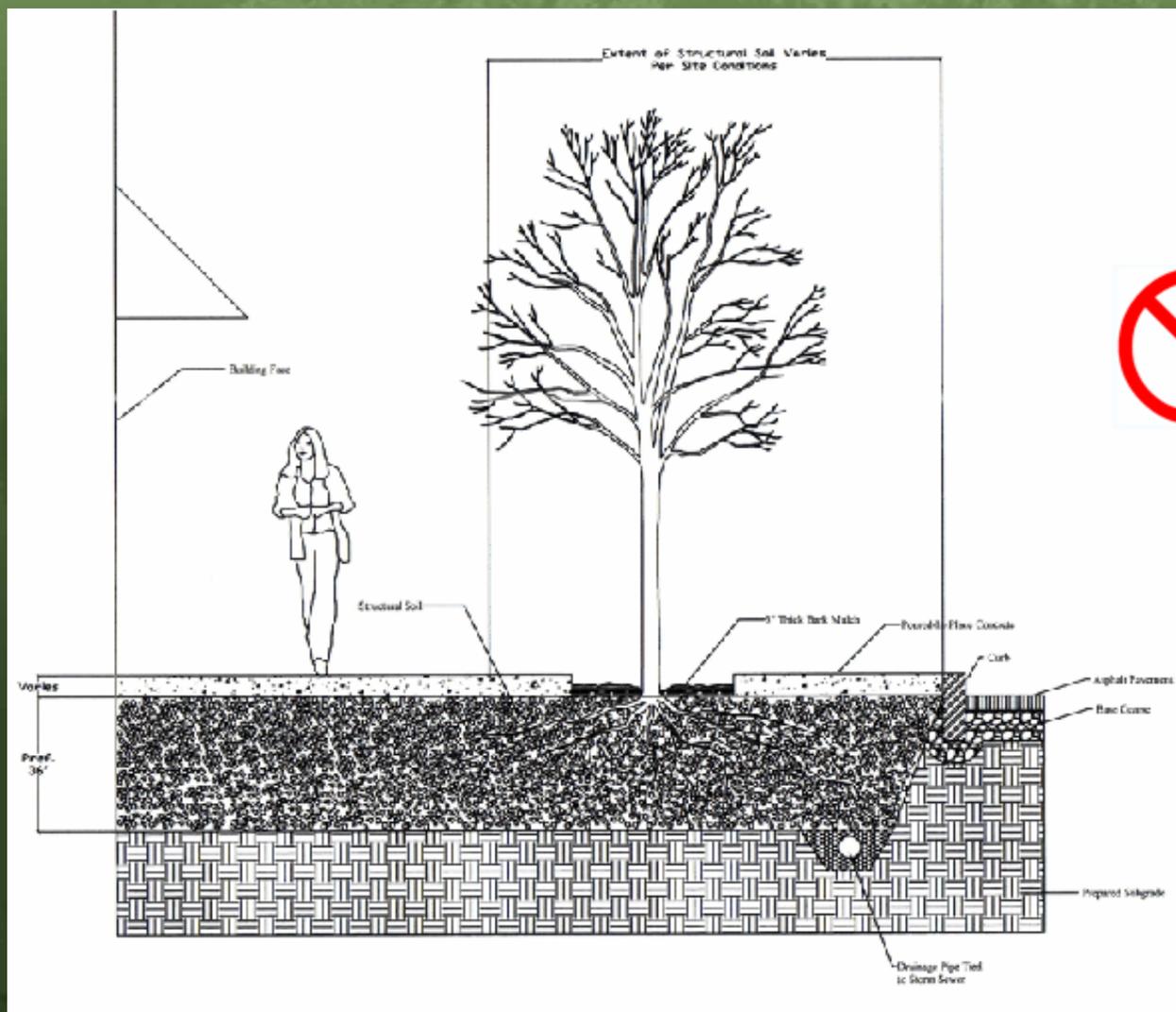
Plant More Trees



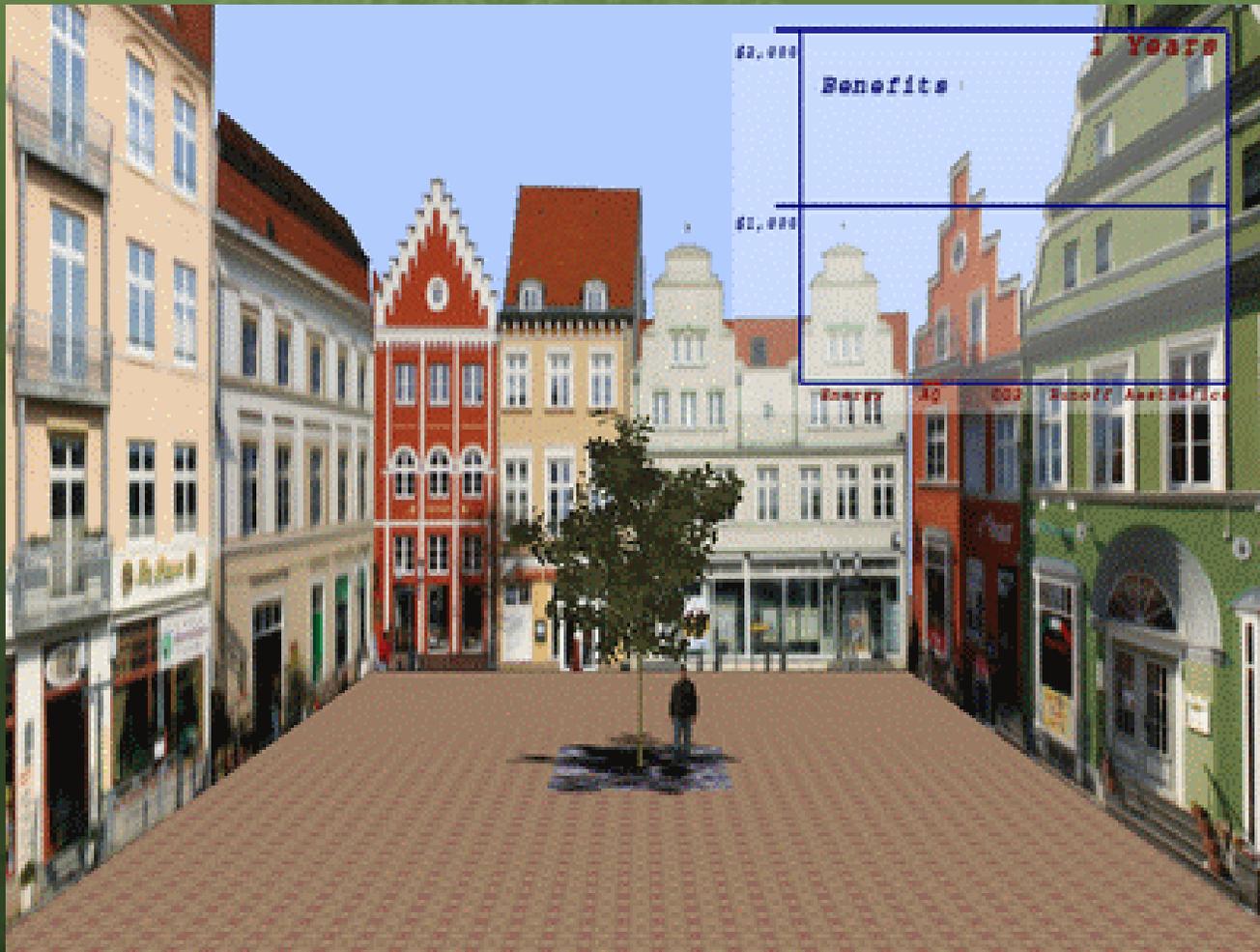
Plant Larger Growing Trees



Make More Space For Trees



Space in Our Minds & Hearts



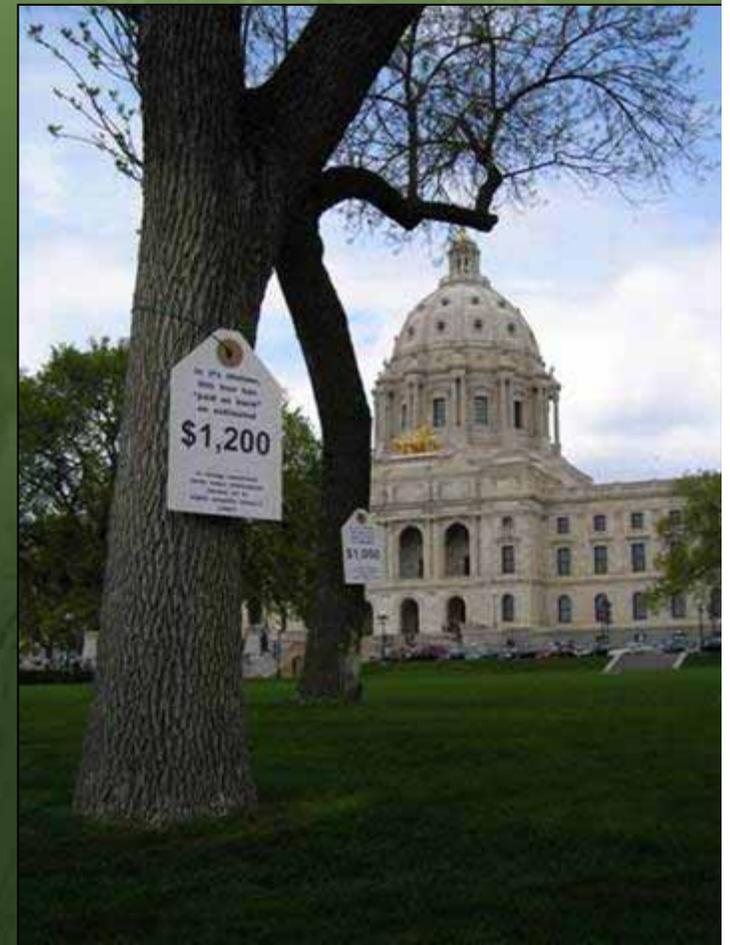
Challenges

- Safety
 - Visibility
 - Lighting
 - Crashes
- Other Infrastructure
 - Roots
 - Leaves and litter
 - Powerlines
 - Irrigation and subbase
 - Crows
- Other Environmental
 - Invasive Species
 - BVOCs, allergens
 - Runoff quality
 - Solar access
 - Water use
 - Tree residue

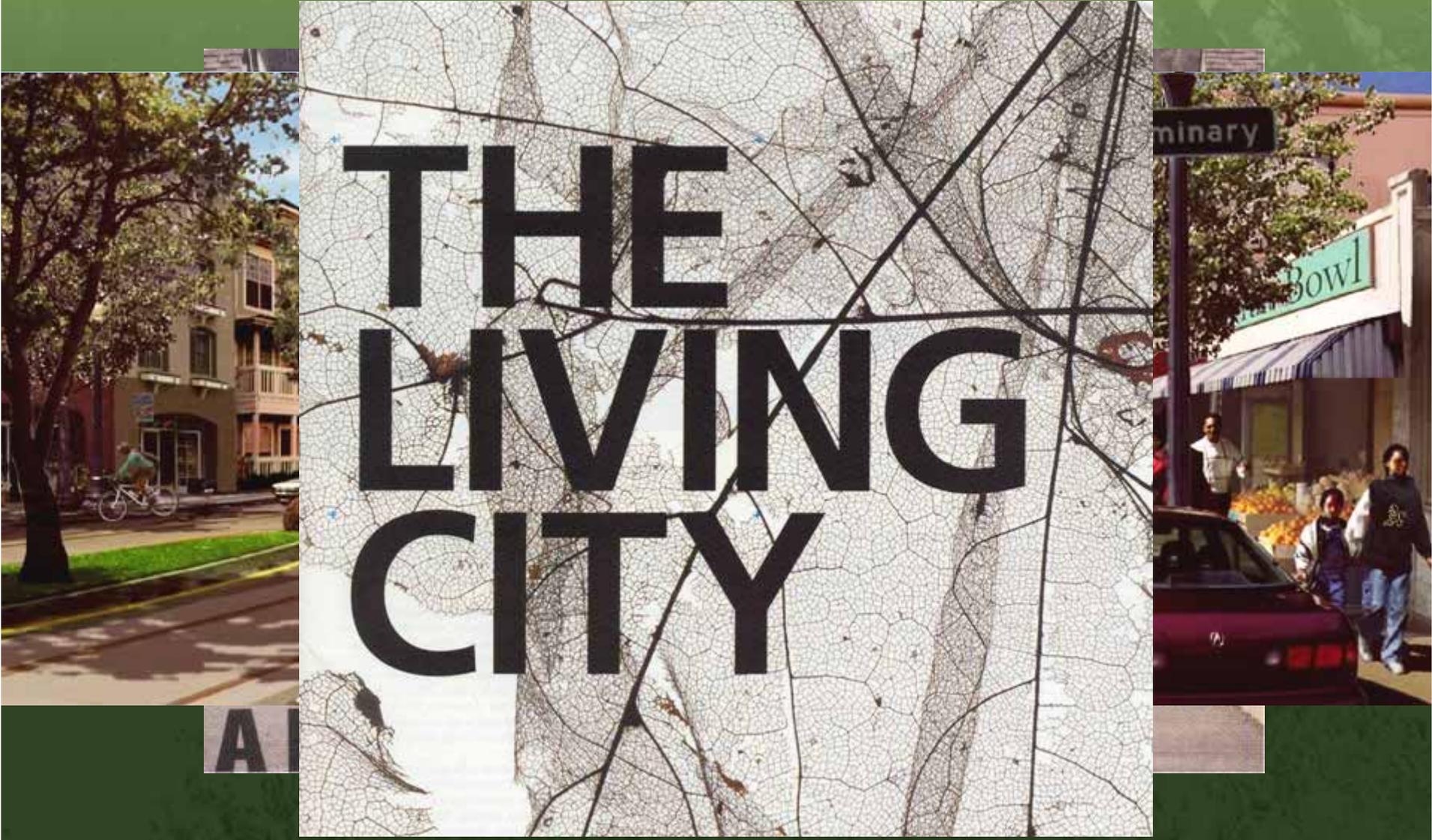


Opportunities

- Urban forestry in spotlight
- Carbon, water, and air quality investments
 - utilities, cities, corporations
- Design plantings to maximize effect & minimize conflicts?
- How best maintain and monitor?
 - high performance
 - 100 years



We Create Our Urban Forest



**THE
LIVING
CITY**

Questions?

www.fs.fed.us/psw/programs/cufr

