Integrated Environmental Improvement with Community Forestry

Peak To Prairie Landscape Symposium

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Ryan Moore

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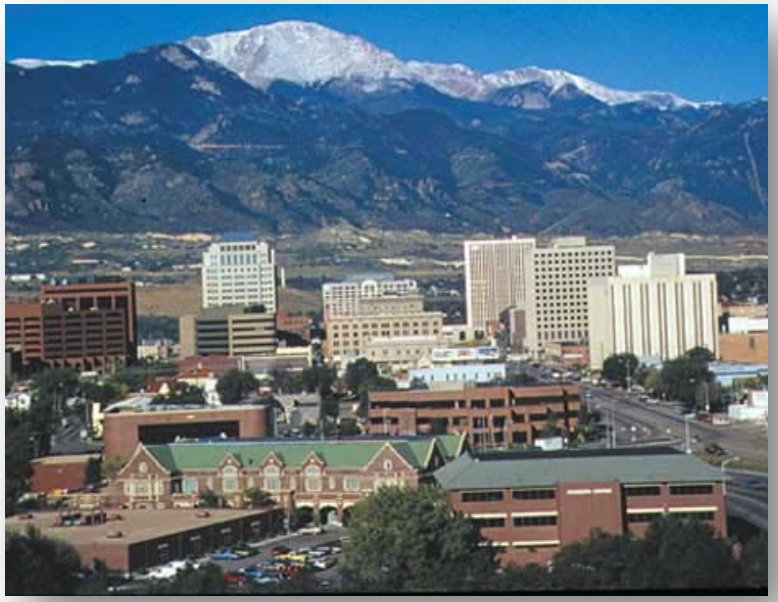
SCIENTIFIC SOLUTIONS FOR A BETTER ENVIRONMENT

PREVIEW



- What we're doing and why
- Environmental impacts of urban forestry and tradeoffs
- Strategies for integrated environmental improvement
- How you can get involved

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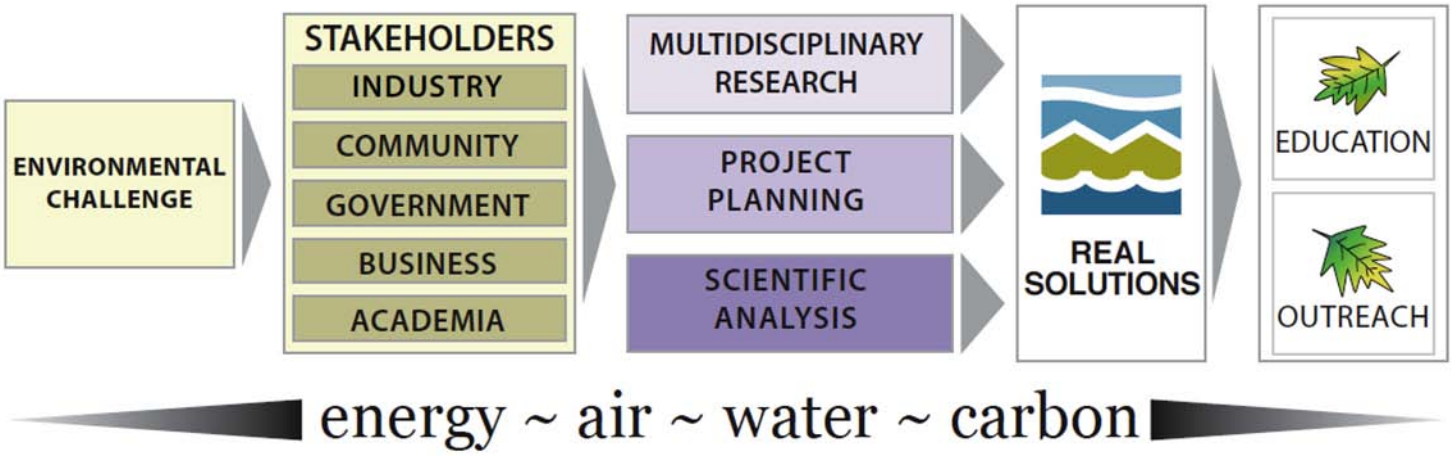
Mission

The Institute for Environmental Solutions is an independent non-profit organization that engages stakeholders to deliver technically sound solutions to complex environmental and health problems -- without unwanted side effects.

Approach



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THE TREE PROJECT

- Identifying how trees can optimize:
  - Air quality
  - Energy conservation
  - Carbon sequestration
  - Water conservation
  - Stormwater management
- Pilot city: Golden

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URBAN FORESTRY ANALYSIS

- Evaluated economic value of environmental services
- 119 sample plots
- Analyzed:
  - Carbon sequestration
  - Air quality impacts
  - Energy impacts
  - Water consumption

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QUANTIFIABLE IMPACTS OF URBAN FORESTRY

Annual values from Golden, CO (10,000 public trees, 100,000 total):

- $50,000 in stormwater management costs avoided
- $23 per house in energy savings
- $43,000 of particulate air pollution removal
- 9 metric tons net ozone air pollution formation

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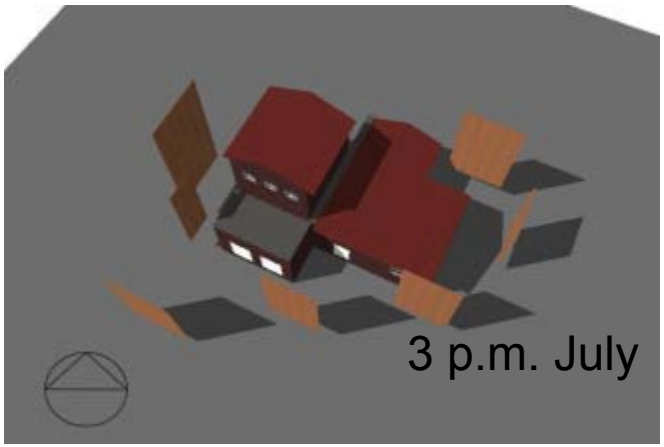
ENERGY TRADEOFFS

- Ambient air temperature moderation
- Summer shading
- Winter wind block
- Winter shading



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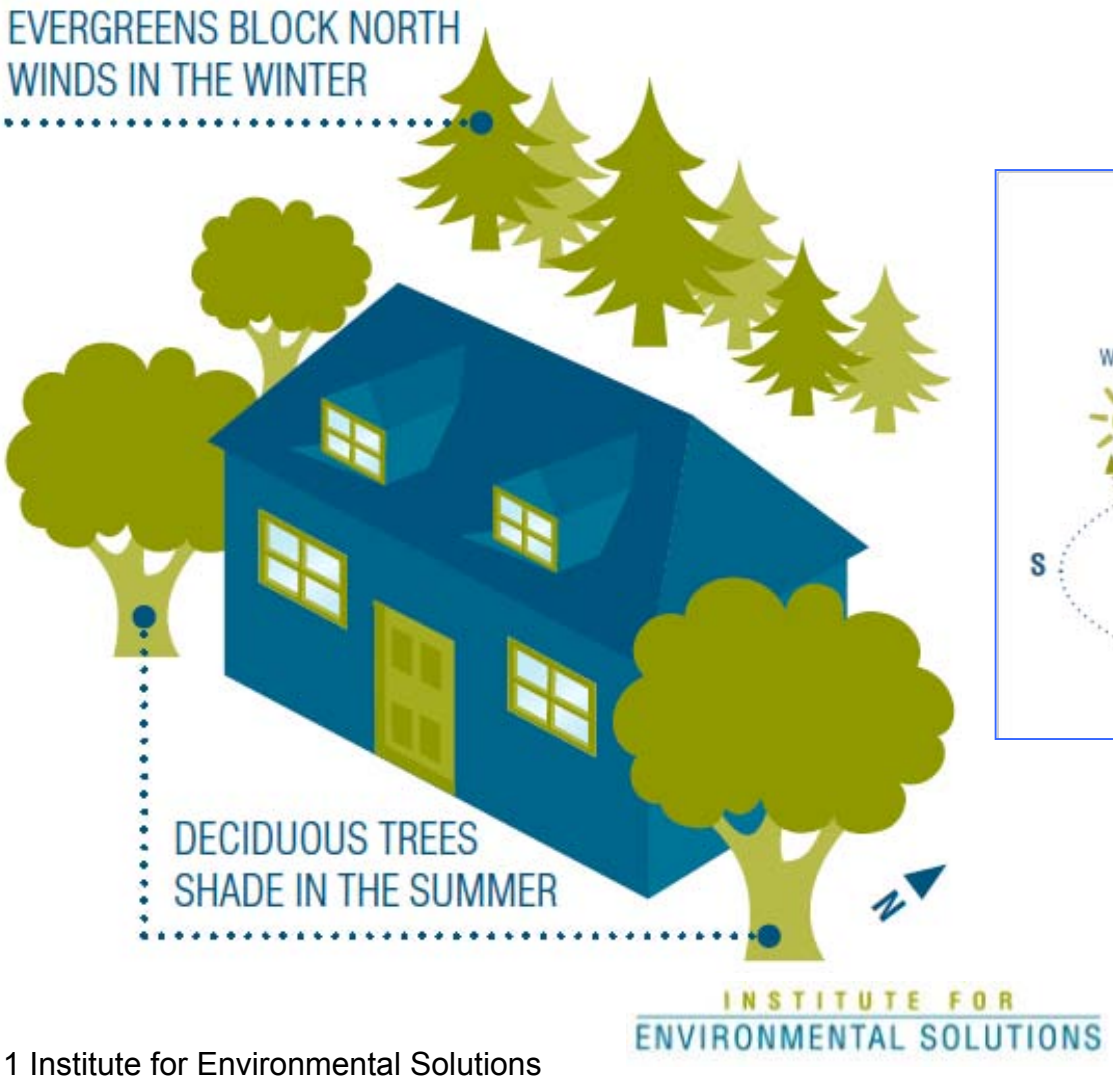
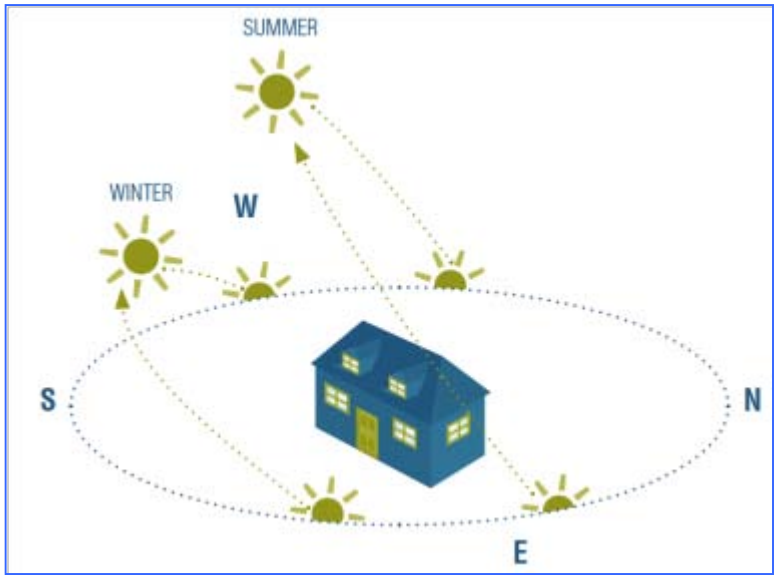
LOCATING TREES





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ANNUAL HOUSEHOLD ENERGY EFFECTS

Existing trees (versus no trees)		
Money saved	Net energy impact	CO_2 emissions avoided
$23	-276 kBtu	196 lb.
Improved trees (versus existing trees)		
Money saved	Net energy impact	CO_2 emissions avoided
$25	-742 kBtu	709 lb.

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WATER CONSERVATION EFFECTS AND TRADEOFFS

- Indirect water conservation
- Tree water use

- Soil beneath trees drier than similar treeless spaces
- Impact varies by species

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STORMWATER MANAGEMENT EFFECTS

- Trees increase infiltration, filtration
- Trap water and slow runoff
- Increase soil porosity

- Average amount of runoff intercepted by a medium-sized tree in a year: **2,300 gallons**
- The value of the runoff volume and pollution reduction function of Golden's street trees: **over $50,000 per year**

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AIR QUALITY TRADEOFFS

- Temperature moderation
- Air pollution removal
- Summer power plant emissions reduction

- Winter heating emissions increase
- Maintenance emissions
- Biogenic volatile organic compounds (BVOC) emissions

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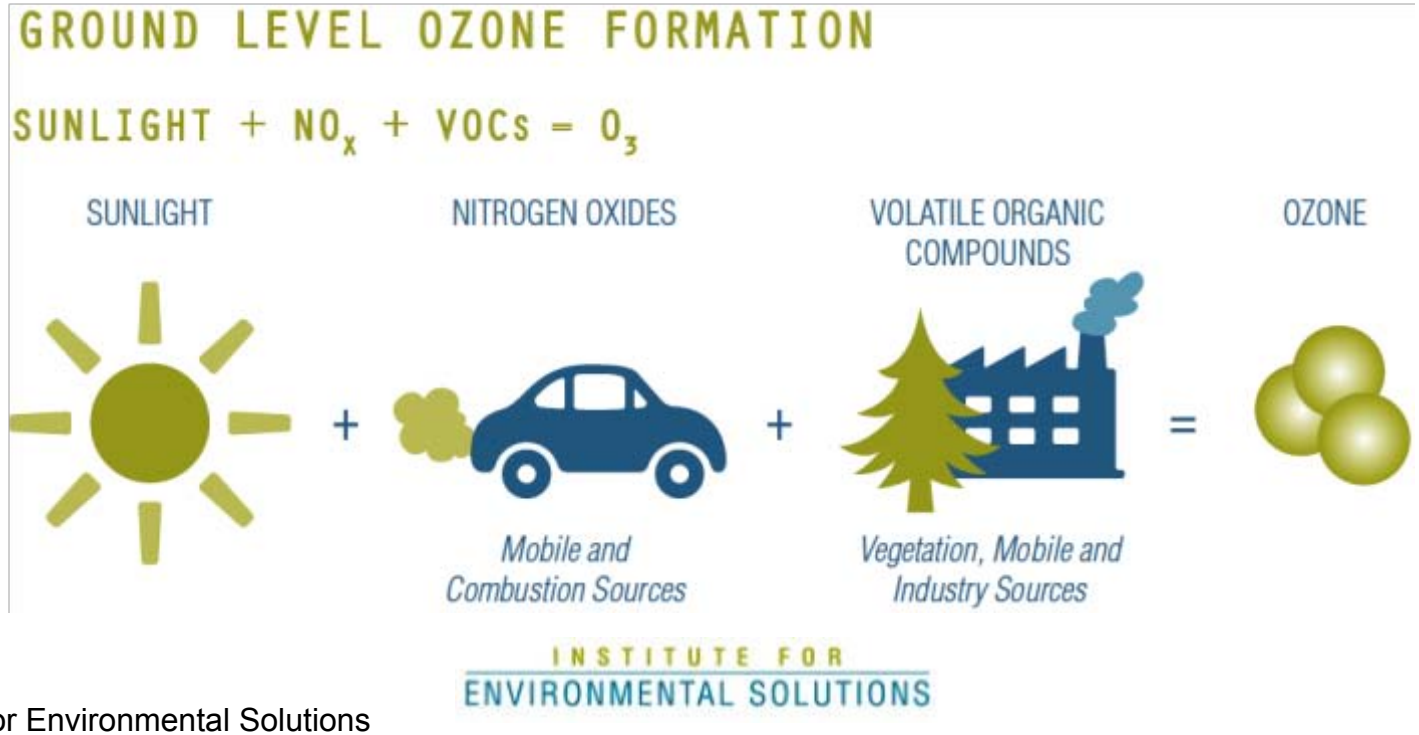
URBAN FORESTS AND OZONE AIR POLLUTION

- BVOC emissions (increased ozone formation)
- Ozone destruction
- Temperature moderation (reduced formation)



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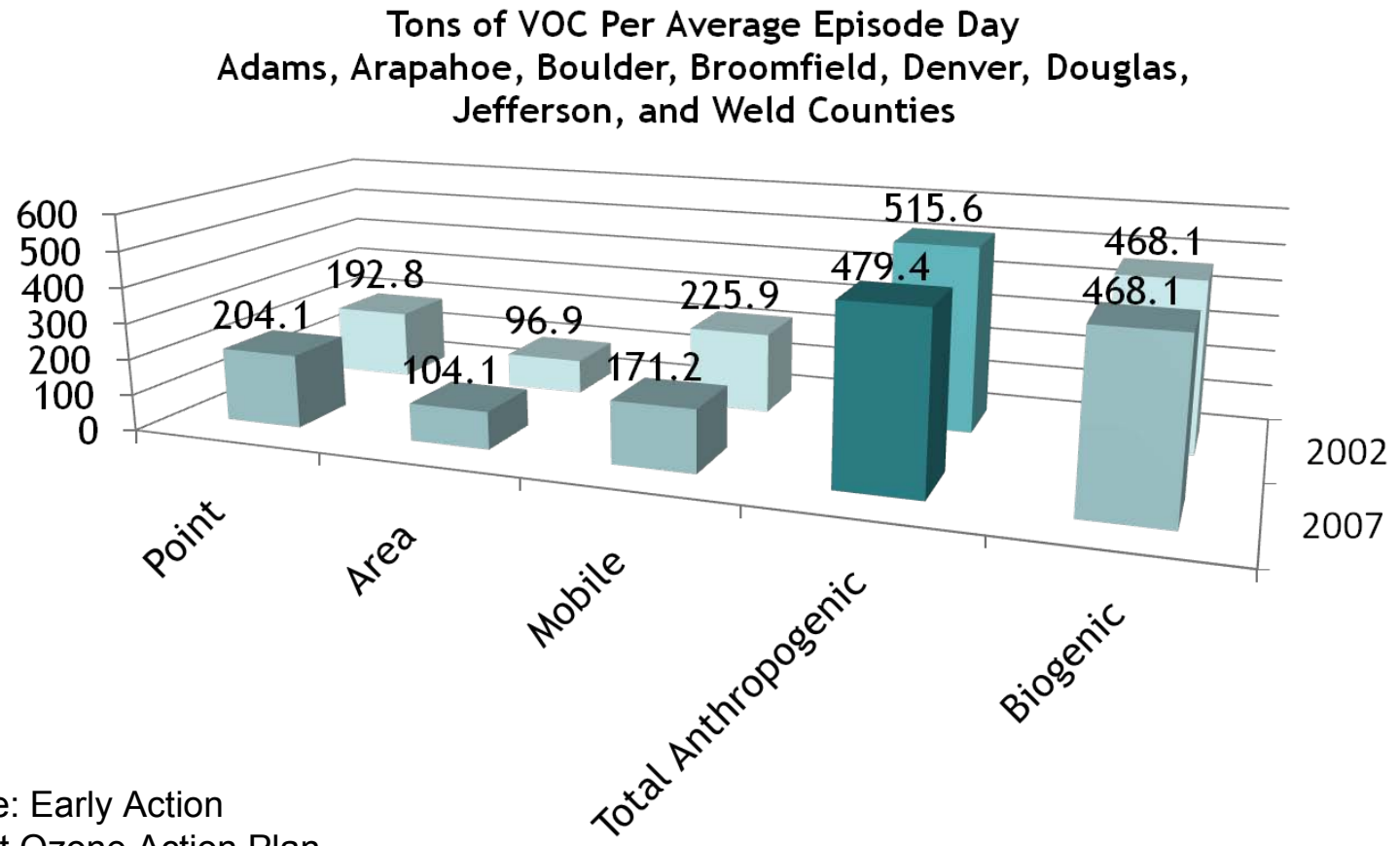
2002 AND 2007
BASE CASE VOC EMISSION INVENTORIES



*Data Source: Early Action Compact Ozone Action Plan, 2004 Revision

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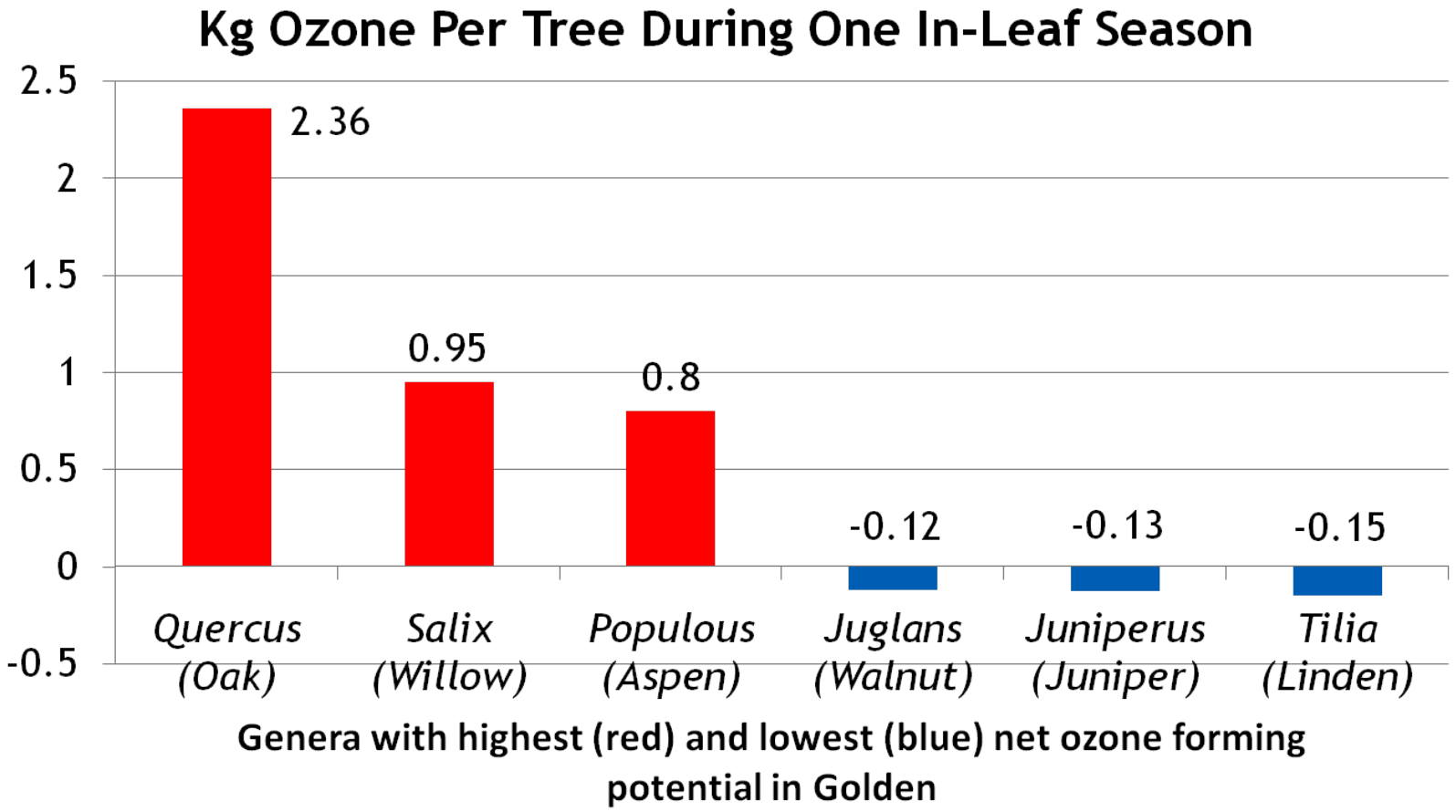
ESTIMATED NET OZONE FORMATION DUE TO URBAN TREES IN GOLDEN, CO



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ECONOMIC IMPROVEMENT POTENTIAL

Additional community forestry can have wide-ranging impacts on the local economy.

•Consumers travel farther and more frequently to shop where tree canopy coverage is high.

•Shoppers pay more for all types of goods in treed areas.

Dr. Kathleen L. Wolf; http://www.naturewithin.info

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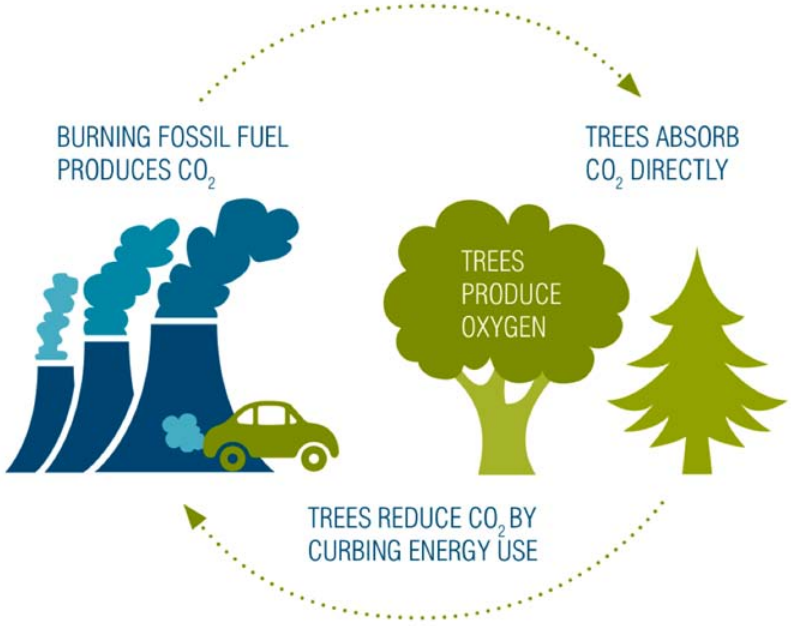
CARBON EFFECTS AND TRADEOFFS

- Sequestration vs. emissions
- Energy offsets vs. indirect emissions
- Carbon storage



Average annual **net** CO_2 sequestration of 10-inch urban tree: 50 to 350 lbs.

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CARBON EFFECTS AND TRADEOFFS

- Sequestration rate depends on tree species, age, and size
- Trees can help reduce CO_2 emissions from power plants by shading buildings and moderating air temperature
- Trees release carbon back into the atmosphere: dead or dying trees naturally emit carbon as they decay and tree maintenance calls for the use of CO_2-emitting machinery such as chippers, chain saws, and trucks

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CARBON EFFECTS AND TRADEOFFS

- To optimize the carbon sequestration function of the urban forest it is important to grow **healthy** and **long-lived** species and to maintain trees strategically
- Planting and maintaining an urban forest over the long-term (with a commitment to replacing dead trees) means more carbon sequestered and stored compared to keeping the space treeless

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COMMUNITY FORESTRY CARBON CREDIT PROJECTS

- Track, report, and potentially sell sequestration of carbon by trees
- Reported sequestration should be additional and “permanent”
- Buyers can find community forestry carbon credits on the Chicago Climate Exchange (CCX) and Climate Action Reserve (each has separate protocols) *OR* locally
- How projects are implemented – size, documentation – is determined by buyer and seller goals

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TREES AND ENVIRONMENTAL TRADEOFFS

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SELECTING TREES

What to consider

- Mature size
- Mature shape
- Local forest diversity
- Whether tree has fruit, nuts, thorns
- Air quality impact (particulates, net ozone)
- Drought tolerance, watering regime
- Maintenance requirements
- **Environmental priorities**

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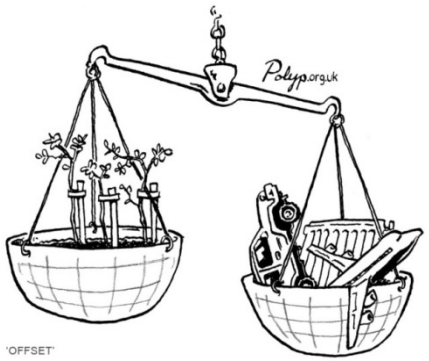
INTEGRATED ENVIRONMENTAL IMPROVEMENT POTENTIAL

Cost-effective results on important local issues, including:

- Ozone air pollution reduction
- Stormwater management
- Energy conservation



Tradeoffs that can be mitigated with strategic planting:

- Water use
- Maintenance emissions
- Biogenic volatile organic compounds (BVOC) emissions
  [Ozone air pollution precursor]

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TREES FOR HEALTHY KIDS AND COMMUNITY

- Lasting, replicable, positive change in environmental health at Mitchell Elementary School in Golden, CO
- Design and implement strategic tree-planting initiative with extensive cooperation among stakeholders, including experts in related technical disciplines, members of the community, and volunteers from surrounding neighborhoods and partner organizations

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TREES FOR HEALTHY COMMUNITY AND ECONOMY

- Improve the environmental and economic health of an emerging downtown business district in Broomfield, through strategic tree selecting, siting, and planting
- Implement collaborative, strategic community forestry pilot program to increase local economic values while reducing pollution and improving health

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OTHER PARTNERSHIP OPPORTUNITIES

- Colorado Urban Forestry Climate Coalition: Local Emission Offsets and Integrated Environmental Improvement
- Urban Trees and Environmental Health Workshop
- Regional Ozone Impacts of Community Forestry: Report to Policy-Makers
- Landscape Energy Optimization Training
- Interactive Environmental Cost-Benefit Tool for Community Planners

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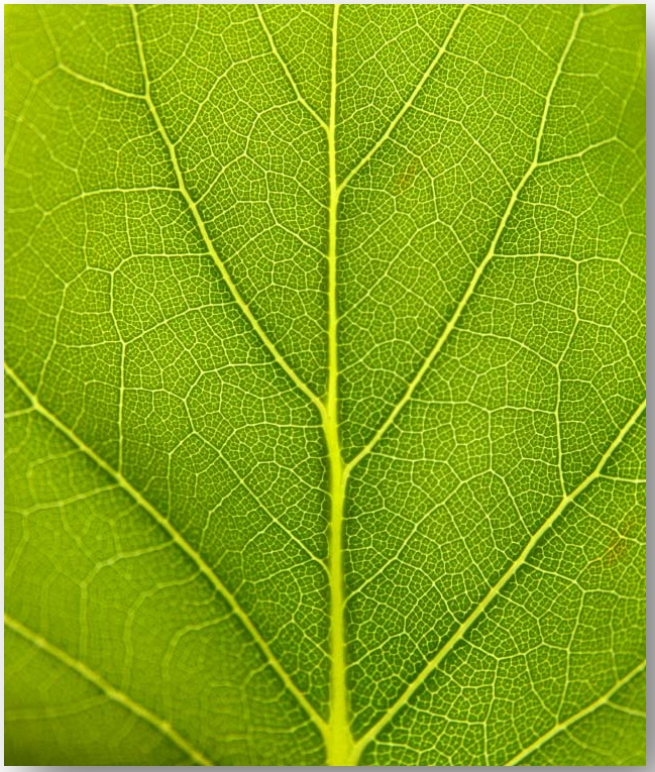
CONCLUSION



- Trees are a highly valuable part of the urban environment
- Environmental tradeoffs are inherent in tree planting
- Strategically select, locate and maintain trees
- Great potential for integrated environmental improvement
- Opportunities for sustaining improving environmental health and economies

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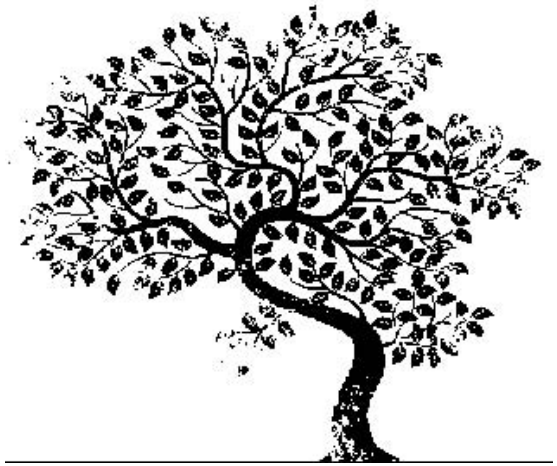

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THE TREE PROJECT
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CONTAMINANTS OF EMERGING CONCERN