The Phoenix Tree and Shade Master Plan

A Program for the Sustainable Management of the Urban Forest Resource
Benefits of Trees: Solution Multipliers
A low risk, high-yield investment for the community

- Air quality, carbon sequestration
- Water quality, storm runoff
- Energy costs
- Property values
- Business
- Community safety and livability

Average ROI of $2.23 in the Phoenix area
Engineered Shade

- Useful in redevelopment projects
- Potential for solar power integration
- Utilize non-heat loading materials
- Utilize recycled components
This 14 inch Blue paloverde provides overall benefits of: $155 every year.

While some functional benefits of trees are well documented, others are difficult to quantify (e.g., human social and communal health). Trees’ specific geography, climate, and interactions with humans and infrastructure is highly variable and makes precise calculations that much more difficult. Given these complexities, the results presented here should be considered initial approximations—a general accounting of the benefits produced by urban street-side plantings.

Benefits of trees do not account for the costs associated with trees’ long-term care and maintenance.

If this tree is cared for and grows to 19 inches, it will provide $217 in annual benefits.
## Benefit-Cost Analysis

### Murphy Bridle Trail - North Central

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

4/7/2009

<table>
<thead>
<tr>
<th>Benefits</th>
<th>Total ($)</th>
<th>Standard Error</th>
<th>$/tree</th>
<th>Standard Error</th>
<th>$/capita</th>
<th>Standard Error</th>
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</thead>
<tbody>
<tr>
<td>Energy</td>
<td>3,171 (N/A)</td>
<td></td>
<td>13.79 (N/A)</td>
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<tr>
<td>CO2</td>
<td>360 (N/A)</td>
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<td>1.57 (N/A)</td>
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<tr>
<td>Air Quality</td>
<td>1,182 (N/A)</td>
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<td>5.14 (N/A)</td>
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<tr>
<td>Stormwater</td>
<td>587 (N/A)</td>
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<td>2.55 (N/A)</td>
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<td>0.00 (N/A)</td>
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<tr>
<td>Aesthetic/Other</td>
<td>11,616 (N/A)</td>
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<td>50.50 (N/A)</td>
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<td>0.01 (N/A)</td>
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<tr>
<td><strong>Total Benefits</strong></td>
<td><strong>16,916 (±0)</strong></td>
<td><strong>73.55 (±0)</strong></td>
<td><strong>0.01 (±0)</strong></td>
<td><strong>0.00 (±0)</strong></td>
<td><strong>0.00 (±0)</strong></td>
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<table>
<thead>
<tr>
<th>Costs</th>
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<tr>
<td>Planting</td>
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<td>Contract Pruning</td>
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<td>Pest Management</td>
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<tr>
<td>Irrigation</td>
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<td></td>
<td>15.22</td>
<td></td>
<td>0.00</td>
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<tr>
<td>Removal</td>
<td>500</td>
<td></td>
<td>2.17</td>
<td></td>
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<td>Administration</td>
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<td>0.00</td>
<td></td>
<td>0.00</td>
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<tr>
<td>Inspection/Servic</td>
<td>500</td>
<td></td>
<td>2.17</td>
<td></td>
<td>0.00</td>
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<tr>
<td>Infrastructure</td>
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<td></td>
<td>0.00</td>
<td></td>
<td>0.00</td>
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<tr>
<td>Litter Clean-up</td>
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<td>6.52</td>
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<td>Liability/Claims</td>
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</tr>
<tr>
<td>Other Costs</td>
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<tr>
<td><strong>Total Costs</strong></td>
<td><strong>12,000</strong></td>
<td></td>
<td><strong>52.17</strong></td>
<td></td>
<td><strong>0.01</strong></td>
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</tbody>
</table>

| Net Benefits     | 4,916 (±0) |               | 21.37 (±0) |               | 0.00 (±0) |               |
| Benefit-cost ratio | 1.41 (±0)  |               |          |               |          |               |

www.itreetools.org
Urban Forest Management Plan

- Formulates, establishes guidelines and documents the strategies and procedures for managing the trees within a jurisdictional area.
- Defines goals and objectives
- Identifies stakeholders
- Many parts/component
Urban Forest Management Plan

Includes the following:

• Planting plan
• Preservation plan
• Maintenance plan
• Removal and replacement plan
• Risk management plan
• Operations plan
• Storm response/emergency plan
• PR/education plan
Tree Resource Inventory

Data

Management Tool

Maintenance Tool

Research Tool
Tree Resource Inventory

- A record of the location, characteristics and assessment of individual trees over a well defined area.
- Most modern inventories use GPS/GIS technology.
- Are dependent on budgets.
- The depth of information collected:
  - Species
  - Diameter
  - Condition
  - Maintenance
  - Notes
Sustainability and Diversity

- Sustainability is the ability to maintain ecological, social and economic benefits over time.

- Urban Forest sustainability requires diversity of tree species as well as diversity of maturity.

Right Tree, Right Place

Age and size

30% Family, 20% Genus, 10 Species
Age Distribution of City of Phoenix Maintained Trees (105,000)

Number of Individual Trees

Diameter at Breast Height (dbh) in inches
# City of Phoenix Tree Inventory

## Top Ten Species in City of Phoenix (104,860)

<table>
<thead>
<tr>
<th>Species</th>
<th>Percentage</th>
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</thead>
<tbody>
<tr>
<td>Vacant space</td>
<td>11.5%</td>
</tr>
<tr>
<td>Prosopis velutina (Mesquite)</td>
<td>8.8%</td>
</tr>
<tr>
<td>Parkinsonia florida (Blue Palo verde)</td>
<td>6.8%</td>
</tr>
<tr>
<td>Pinus halepensis (Aleppo pine)</td>
<td>5.8%</td>
</tr>
<tr>
<td>Parkinsonia praecox (Palo brea)</td>
<td>5.3%</td>
</tr>
<tr>
<td>Ulmus parvifolia (Evergreen elm)</td>
<td>4.3%</td>
</tr>
<tr>
<td>Dalbergia sissoo (Indian rosewood)</td>
<td>4.1%</td>
</tr>
<tr>
<td>Washingtonia filifera (California fan palm)</td>
<td>3.8%</td>
</tr>
<tr>
<td>Acacia stenophylla (Shoestring acacia)</td>
<td>3.1%</td>
</tr>
<tr>
<td>Washingtonia robusta (Mexican fan palm)</td>
<td>3.1%</td>
</tr>
<tr>
<td>Fraxinus velutina (Arizona ash)</td>
<td>3.0%</td>
</tr>
</tbody>
</table>
City of Phoenix Tree Inventory

Top Ten Species in medians and street frontages (13,285)

Vacant space 23.4%
*Parkinsonia florida*  Blue Palo verde 10.6%
*Prosopis velutina*  Mesquite 5.1%
*Acacia stenophylla*  Shoestring acacia 5.1%
*Dalbergia sissoo*  Indian rosewood 5.0%
*Acacia aneura*  Mulga 4.3%
*Parkinsonia praecox*  Palo brea 4.2%
*Washingtonia robusta*  Mexican fan palm 3.7%
*Carnegiea gigantea*  Saguaro 3.6%
*Washingtonia filifera*  California fan palm 3.8%
*Olneya tesota*  Desert ironwood 3.5%
Valuation examples

Encanto Park:
• 1760 trees and palms
• Appraised replacement value @ $6.1 M
• Annual benefit value @ $75.7 K

Trees in street landscape and parks:
• 71,750 trees
• $9.4 M annual benefit to the community.
Encanto Park Tree Resource Structure

Population Composition

Figure 1. Composition of Tree Type at Encanto Park

Canopy Size

The quantifiable benefits produced by trees are primarily related to the amount and distribution of leaf surface area. As a tree canopy increases, so do many of the benefits associated with that tree. For this reason, i-Tree considers mature canopy size when determining species size composition. As an example, a Mexican fan palm (*Washingtonia robusta*), which is a rather substantial tree, is considered by i-Tree to be a small palm, based on the canopy area of a mature palm.

Total Annual Benefits from Encanto Park’s Tree Resource: $75,751
Average Annual Per Tree Benefits: $43.04
Annual Value of Benefits Per Capita: $0.05

Total Annual Investment to Maintain Encanto Park’s Tree Resource: $97,650
Average Annual Per Tree Investment: $55.48
Annual Investment Per Capita: $0.06

Annual Net Loss of Encanto Park’s Tree Resource: $21,899

Net Loss $21,899
Annual Benefits $75,751
Annual Investment $97,650

Encanto Park, Phoenix, Arizona: Urban Forest Resource Data
April 2010
Funding Sources

Phoenix Parks and Preserve Initiative Program (PPPI)
- Renewed in 2008 for 30 years by 83% of voters.
- One cent of sales tax for every $10 of purchases.
- 60% to improvements, renovation and land acquisition.
- 40% to acquisition and development of preserves.
- “Pay as you go program”.

Impact fees
- Four fee areas currently.
- Mostly for trails in preserves.

Memorial Tree Program
- Citizen donation
- New and replacement trees.
Ordinance Review

Departments involved:

- Neighborhood Services, Street Transportation, Parks and Recreation, Public Works, Planning, Zoning and Historic Preservation

23-32  Encroachment of trees, shrubs or bushes prohibited
27-13  Unobstructed passage in streets and alleys
31-10  Removal of debris, rubbish, weeds, overgrown or dead vegetation and other unhealthy or unsafe conditions on streets, alleys and sidewalks.
31-13  Obstructing visibility at intersections
39-7   Exterior premises and vacant land
34     Trees and vegetation
Partnerships

Arizona Community Tree Council
Arizona Public Service
Arizona Landscape Contractors Association
Arizona State Urban and Community Forestry Program
ASU/GIOS Sustainable Cities Network
Audubon Society
Hands-On Greater Phoenix
International Society of Arboriculture Western Chapter
Neighborhood Associations
Phoenix Clean and Beautiful
Salt River Project
US Forest Service, Urban and Community Forestry Program
Valley Forward
Valley Permaculture Alliance
Watershed Management Group
And numerous private companies
Trees and People

Integrating Public Art
Sustainability Partners

City of Phoenix

aps
Establishing a Relationship

• Challenges

• Memorandum of Understanding (MOU) in March 2008.

• Removal, installation and maintenance in city ROW.

• Outlined roles and responsibilities of each party.

• Acceptable species palette.
Citizen Forester Program
• http://www.phoenix.gov/FORESTRY

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