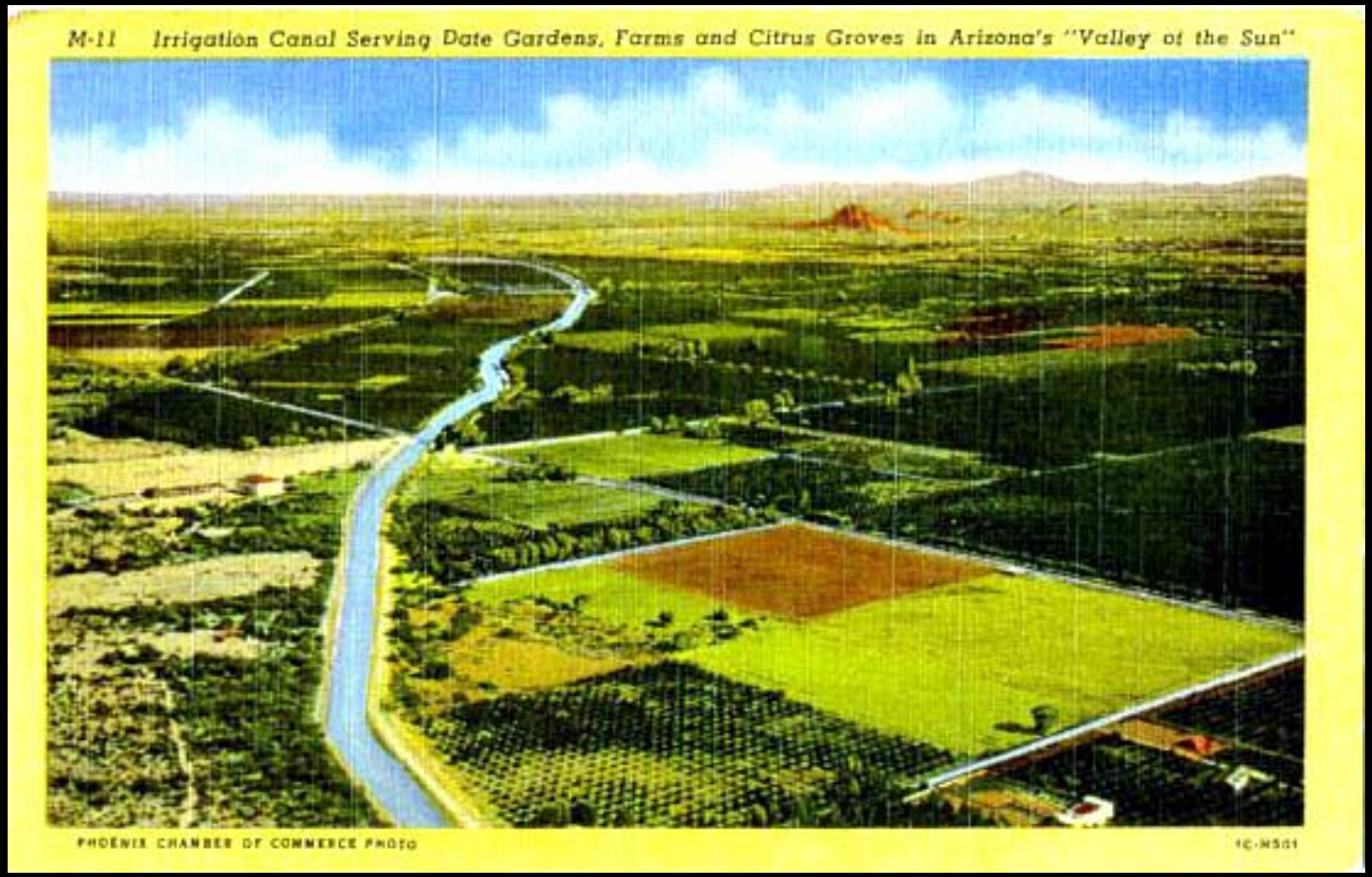
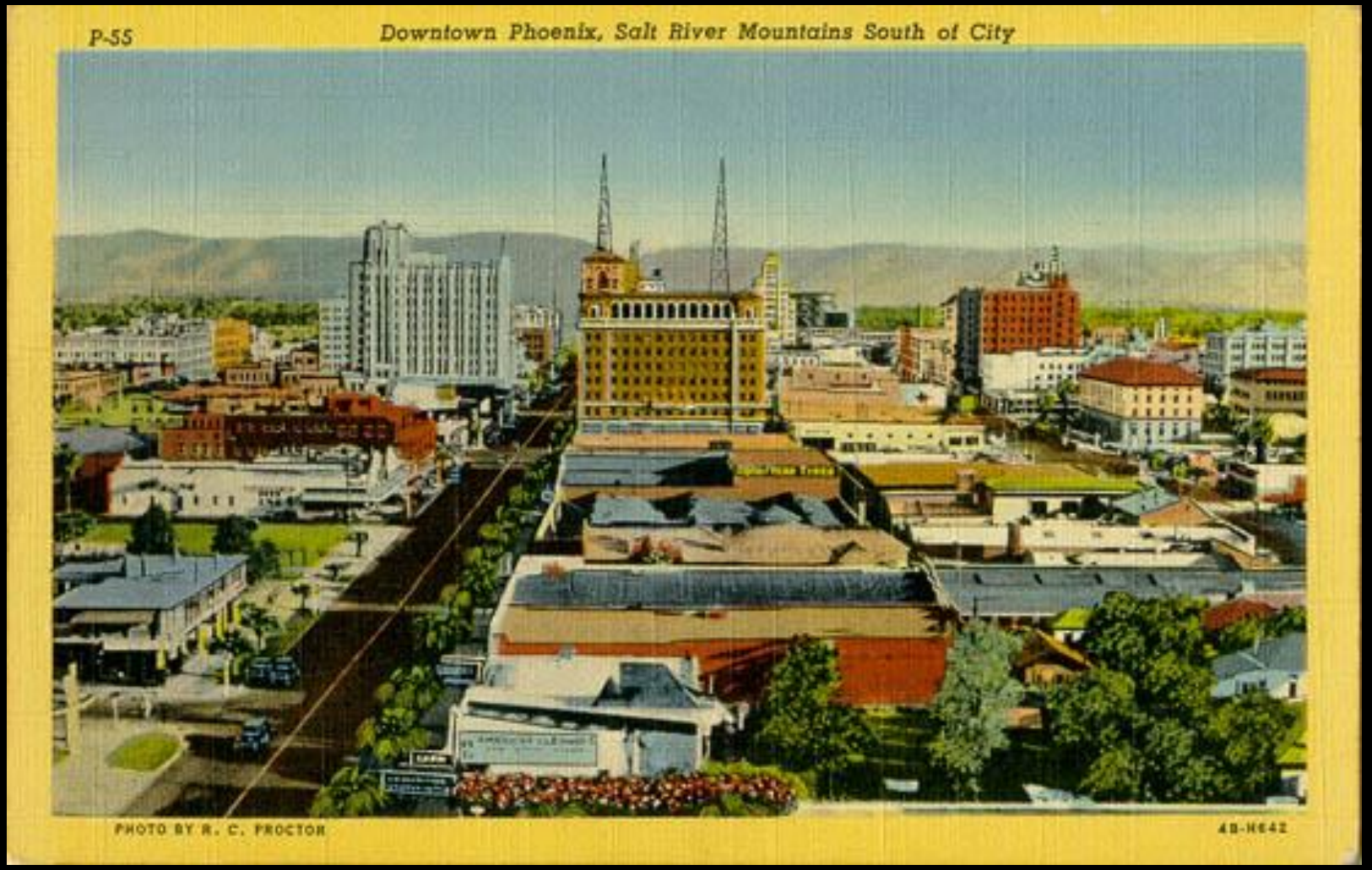

PHOENIX

“Everywhere there is shade and plenty of it.  The entire valley, from Mesa to Phoenix, is one solid mass of green … and the entire distance … can be driven under an almost unbroken arch of shade.” - 1905




**Early 1900s "….a city of gardens and trees."**




**A city of gardens and trees no more.**

**From 1940-60, Phoenix grew from 65K to 439K**

**More houses built in 1959 than in the years 1914 - 46**

# Phoenix's Urban Forest

# Rising Up to Meet Municipal Challenges

Richard Adkins
City of Phoenix

# What is the Urban Forest in the Desert Southwest?

- The collection of trees growing with our city.
- All vegetation, public and private.
- The human - forest interface.
- A keystone for urban living.
- A component of green infrastructure.


PHOENIX


519
1.5
92
1

# The Tree and Shade Master Plan

"An investment strategy for a healthier, more livable and prosperous Phoenix"

http://www.phoenix.gov/parks/parks/urban-forest



# Benefits of Trees

- Environmental improvements
- Economic savings
- Social (health and well-being)
- Aesthetic enhancements
- Provides habitat for wildlife

# 1.5

The City of Phoenix population.

# 519

Phoenix encompasses 519 square miles of land.

These numbers are more than simple statistics; they are contributing factors to the increasing intensity of the city's urban heat island (UHI).

The UHI effect equates to increased energy and water consumption, which leads to increased costs and strained resources.

# 92

Average number of days per year of 100°F or more in Phoenix.

## Air pollution

# $5.76 million/year

Trees within the City of Phoenix intercept 1,770 tons /year of air pollution. Valued at $5.76 million/year.

## Stormwater Runoff

# $6.11 million/year

Trees within the City of Phoenix reduce stormwater runoff by 917 million cubic feet/year valued at $6.11 million/year.

## Carbon Sequestration

# $2.52 million/year

The City of Phoenix urban tree population as a whole stores 305,000 tons of carbon and removes 35,400 tons of carbon from our air each year valued at $2.52 million per year.

# GROWING A HEALTHIER COMMUNITY

## KEY TREES – PHOENIX

LACEBARK ELM
*Ulmus parvifolia*
height: 40'-60'
canopy: 35'-60'

TEXAS HONEY MESQUITE
*Prosopis spp*
height: 12'-20'
canopy: 35'-65'

ARIZONA ASH
*Fraxinus velutina*
height: 35'-65'
canopy: 30'-60'

DESERT IRONWOOD
*Olneya tesota*
height: 20'-60'
canopy: 40'-90'

PALO VERDE
*Parkinsonia spp*
height: 12'-20'
canopy: 30'-50'

DESERT WILLOW
*Chilopsis linearis*
height: 15'-40'
canopy: 30'-50'

CHINESE PISTACHE
*Pistacia chinensis*
height: 45'-65'
canopy: 35'-65'

ALEPPO PINE
*Phus halepensis*
height: 50'-90'
canopy: 75'-95'

LIVE OAK
*Quercus virginiana*
height: 40'-60'
canopy: 50'-90'

EUCALYPTUS / GUM
*Eucalypus spp*
height: 50'-90'
canopy: 40'-65'

**Total Annual Value in Urban Tree Benefits: $40.25 million/year**
*Combined values for annual benefits provided for pollution removal, carbon sequestration, carbon avoidance, energy savings, and storm water avoidance.*

**Total Structural Value in Urban Trees: $3.842 billion**
*Structural Value is the standing value of each tree plus the carbon it stores.*

# SUMMARY OF KEY FINDINGS

## Key Highlights

**AIR QUALITY**
The City of Phoenix urban tree population as a whole scores 305,000 tons of carbon and removes 35,400 tons of carbon from our air each year (valued at $2.52 million/year). Trees remove enough carbon to offset 10,412 cars per year - based on a 25mpg car traveling 12,000 miles/year and producing 14 lbs of $CO_2$ per gallon of gas.

**POLLUTION REMOVAL**
Trees within the City of Phoenix intercept 1,770 tons/year of air pollution (valued at $5.76 million/year).

**STORMWATER RUNOFF**
Trees within the City of Phoenix reduce stormwater runoff by 917 million cubic feet per year. That is enough water to fill approximately 23,000 swimming pools (based on an average pool size of 4,000 cubic feet); valued at $6.11 million/year.

**ENERGY USE**
It is estimated in the City of Phoenix that trees reduce energy-related costs from residential buildings by $22.9 million annually.

**PROVIDE SHADE**
Trees in the City of Phoenix account for 9% shade within the city. That is shade equivalent to 107,186,640 umbrellas or approximately 186,000 football fields.

Project
DESERT CANOPY
ARIZONA
Growing a Healthier Community

Produced in cooperation with the USDA Forest Service, which is an equal opportunity service provider and employer

| DATA | PHOENIX |
|---|---|
| Number of Trees | 3,166,000 |
| Project Study Area | 384.5 sq mi (996 sq km)<br>246,064 acres |
| City Land Area | 519 sq mi (1,344 sq km)<br>332,160 acres |
| Number of Species Sampled | 60 |
| Tree Cover | 9.0% – 12.9 trees/acre |
| Most Common Species | Velvet Mesquite 8.3%<br>California Palm 7.5%<br>Sweet Acacia 6.7% |
| Percentage of Trees less than 6" DBH*<br>DBH is the diameter at 4.5 feet above ground | 44.8% |
| Pollution Removal | 1,770 tons/year<br>($5.76 million/year) |
| Carbon Sequestration | 35,400 tons/year<br>($2.52 million/year) |
| Carbon Storage | 305,000 tons<br>($21.7 million/year) |
| Avoided Carbon Emissions | $2.96 million/year |
| Oxygen Production | 89,200 tons/year |
| Building Energy Savings | $22.9 million/year |
| Avoided Stormwater Runoff | 91,700,000 cu ft<br>($6.11 million/year) |
| Replacement Values | $3.82 billion<br>($1,207/tree) |

# Benefits of Trees: Solution Multipliers

## A low risk, high-yield investment for the community

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

Average ROI of $2.23 in the Phoenix area

McPherson et al, 2004


This tree will give
$ 201 10
worth of
environmental &
aesthetic benefits
over the next year


It pays to plant trees!
Benefits from this tree this year
Stormwater Runoff Reduction 1,544 gal
Carbon Reduction 342 lbs
Electrical Energy Savings 223 kwh
Property Value Impact $155
Help your trees live a long life.
Larger trees provide more benefits.
FUN PLACES
GREAT SPACES
City of Phoenix
Parks and Recreation

# Valuation Examples

Street Landscape medians:

- 10,600 trees, palms, tall cacti
- Appraised replacement value @ $5.4 M

Encanto Park:

- 1760 trees and palms
- Appraised replacement value @ $6.1 M
- Annual benefit value @ $75.7 K

Trees in street landscape/parks/facilities:

- 92,804 trees
- $7.7 M annual benefit to the community.

# Phoenix, Arizona ~ Tree Canopy Cover

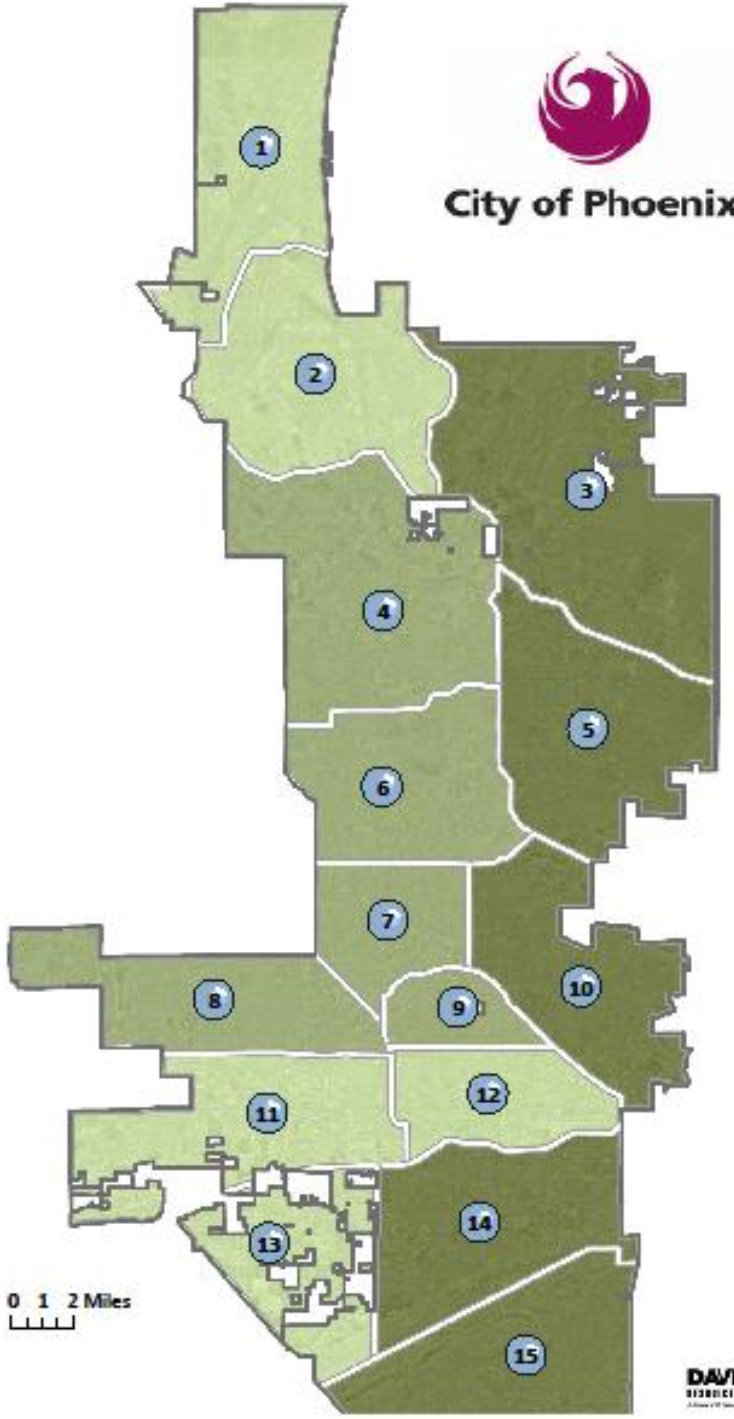
Tree canopy cover is a measure of all public and privately-owned trees and woody shrubs in Phoenix. As trees mature, their canopy increases. Large trees have the greatest canopy. Tree canopy provides vital benefits to the community, including improvements to air quality, reduced energy use, management and reduction of stormwater runoff, increases to property values and improvements to aesthetics, socio-economics, and public health.

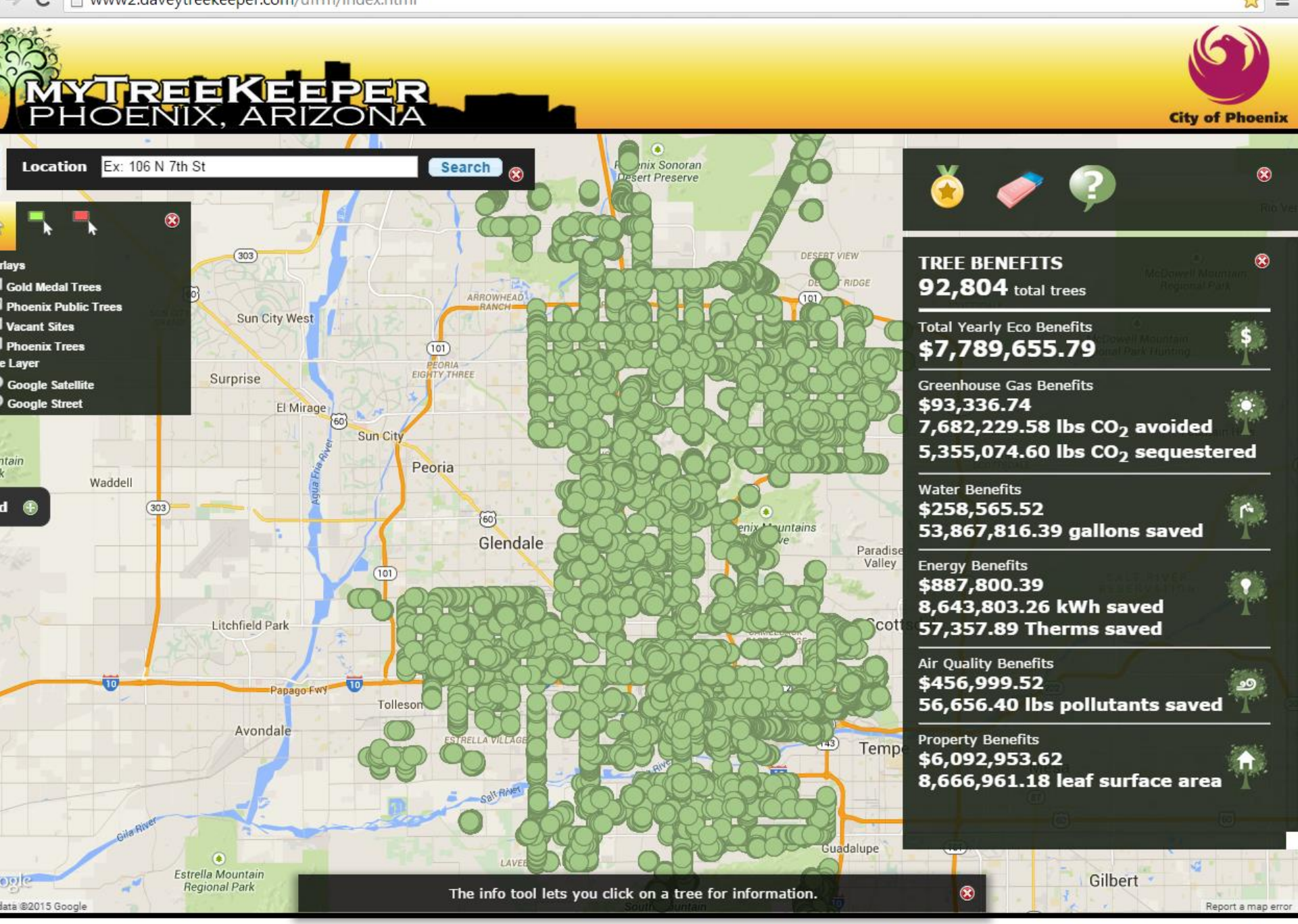
The City of Phoenix recognizes the benefits of trees and the value of urban tree canopy. As a Tree City USA for 29 years and with 19 years of growth awards for new and innovative urban forestry activities, the City has made a commitment to protect and manage the community's tree resource. As a part of this commitment, the City has established a goal of reaching 25% canopy cover by 2030. Currently, the overall average tree canopy cover is 12.4%, approximately 49.6% attainment of the goal. The City is divided into 15 planning villages. This map illustrates the amount of canopy cover in each village. For additional details, use your mouse to hover over a village.

For more information about trees and canopy cover, please see the **2010 Tree and Shade Master Plan.**

## City of Phoenix Planning Villages

1 - Rio Vista
2 - North Gateway
3 - Desert View
4 - Deer Valley
5 - Paradise Valley
6 - North Mountain
7 - Alhambra
8 - Maryvale
9 - Encanto
10 - Camelback East
11 - Estrella
12 - Central City
13 - Laveen
14 - South Mountain
15 - Ahwatukee Foothills






myTreeKeeper was built in cooperation with the City of Phoenix

Tree Benefit information provided by i-Tree

DAVEY RESOURCE GROUP

# Ash, Arizona at 6501 N 7TH ST

Species | Site

## Species

No photos available for this site



| | |
|---|---|
| Species | **Fraxinus velutina ash, Arizona** |
| Multiple Trunks | **Yes** |
| DBH 1 | **15** |
| DBH 2 | **8** |
| DBH 3 | **0** |
| Height | **30** |

### TREE BENEFITS

Total Yearly Eco Benefits

**$192.89**

Greenhouse Gas Benefits

**$3.17**
**448.70 lbs** saved

Water Benefits

**$11.39**
**2,372.71 gallons** saved

Energy Benefits

**$36.58**
**289.04 kWh** saved

Air Quality Benefits

**$17.68**
**2.58 lbs** saved

Property Benefits

**$124.06**
**263.00 leaf surface area**

SHARE

*Tree Benefit descriptions originally published in the USDA Forest Service's Center for Urban Forest Research Tree Guide series.*

# Right Tree Right Place

- Poor planting choices lead to problems and expense years after installation (maintenance/removal/replacement).
- Poorly pruned trees to “fit” the location.
- Select for establishment and natural growth and development.
- Design with mature plant development in mind.
- Remember root development, not just branches.


VALERO


2718

# Tree Anatomy

Cells → Tissues → Organs

Five organs:

- Leaves
- Stems
- Roots
- Flowers
- Fruits

# Roots

- Function
  - Anchor
  - Storage
  - Conduction
  - Absorption

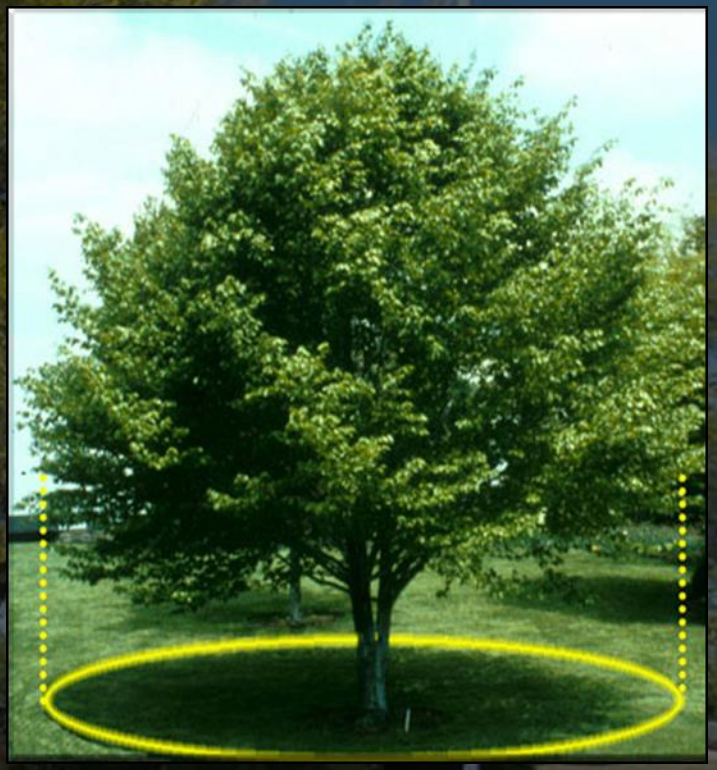
# Roots

- **Absorbing roots –** Small, fibrous, primary tissue that grows at the ends of the main woody roots.

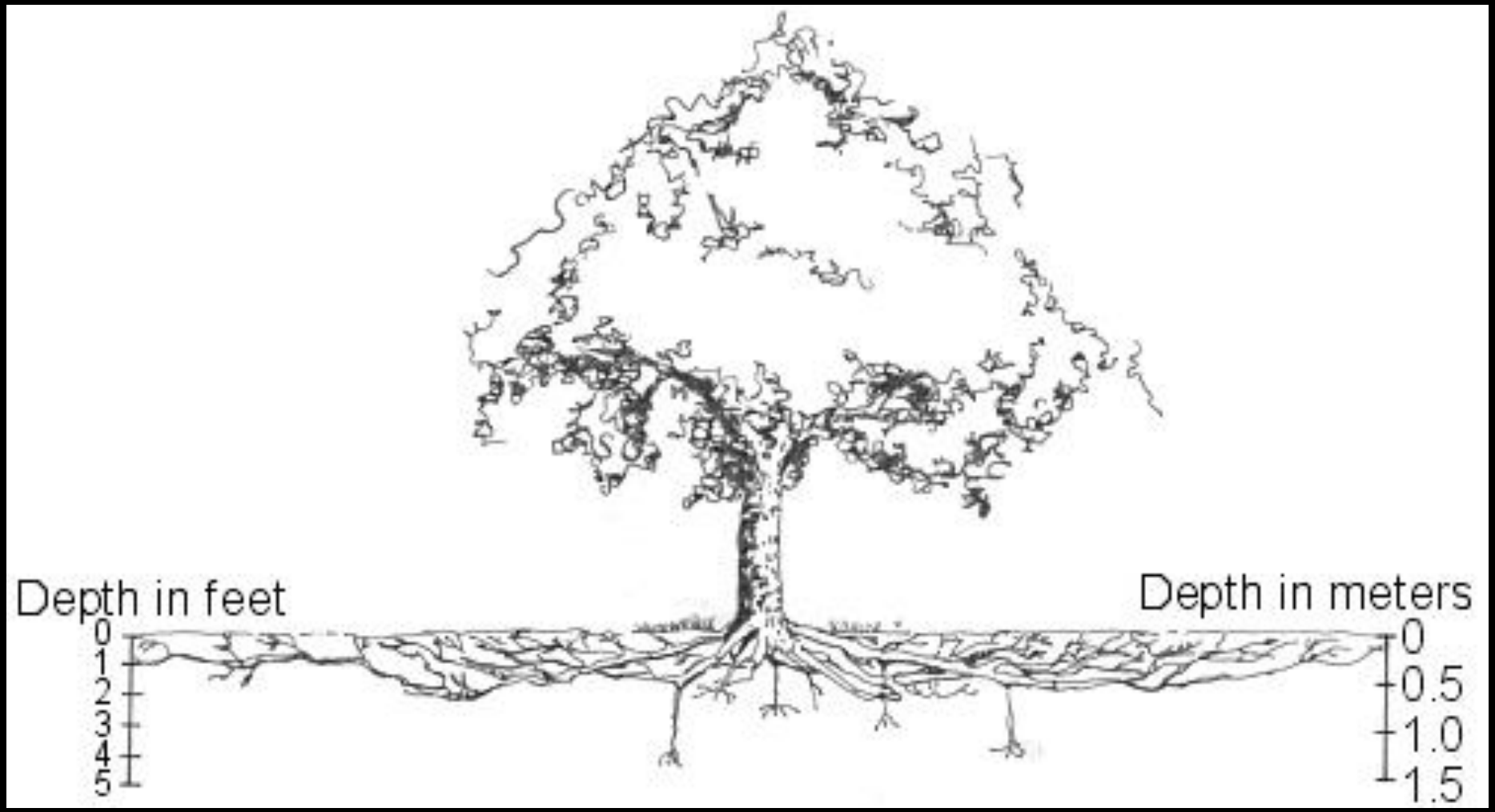
- Have modified epidermal cells that form root hairs which aid in the uptake of water and minerals.

# Roots

- Grow where there is moisture and oxygen. Most absorbing roots are within 12 inches of surface
- Extend laterally considerable distance, well beyond the drip line.
- Extent & direction of root growth is a function of environment/opportunity rather than genetics.

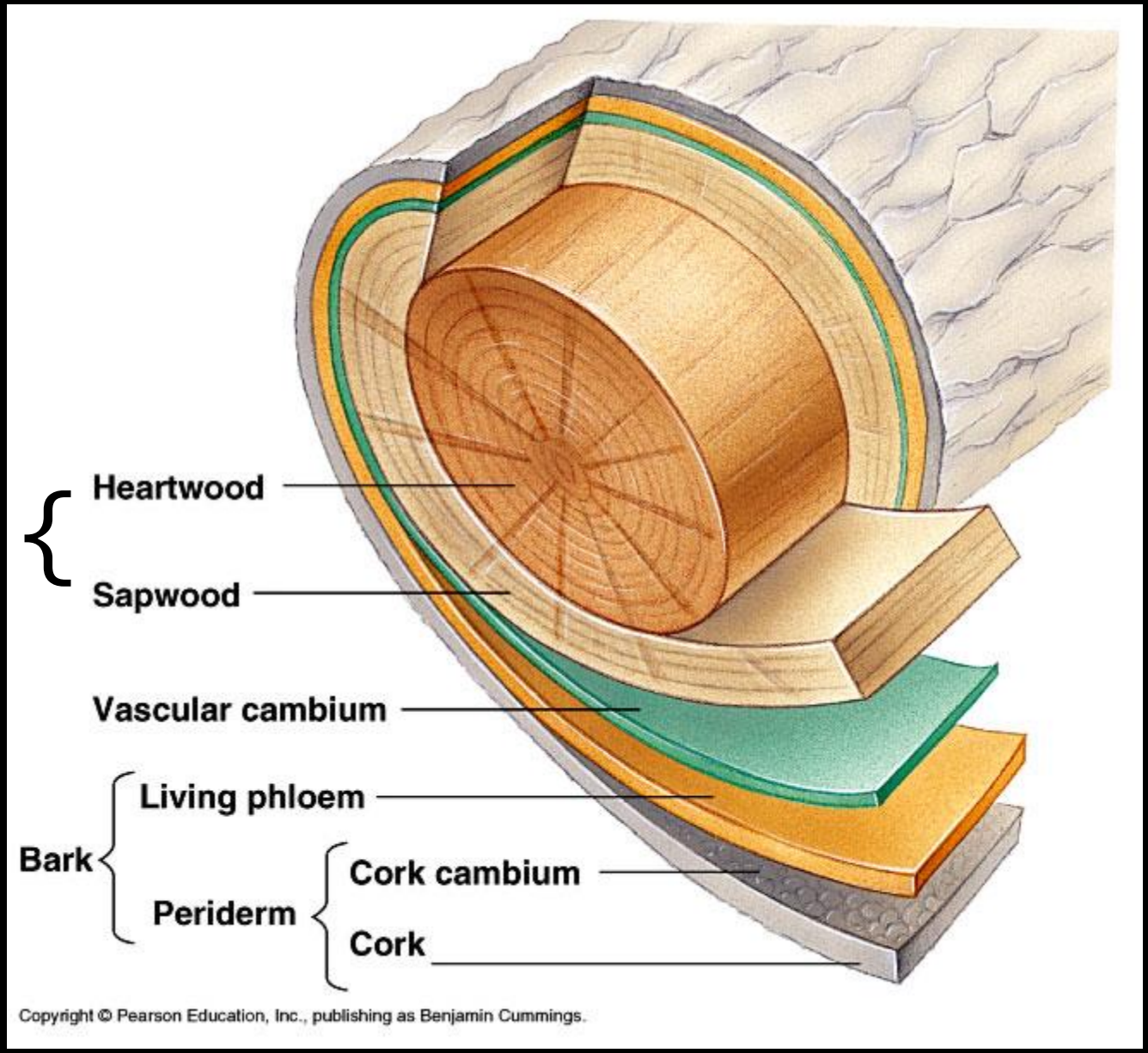


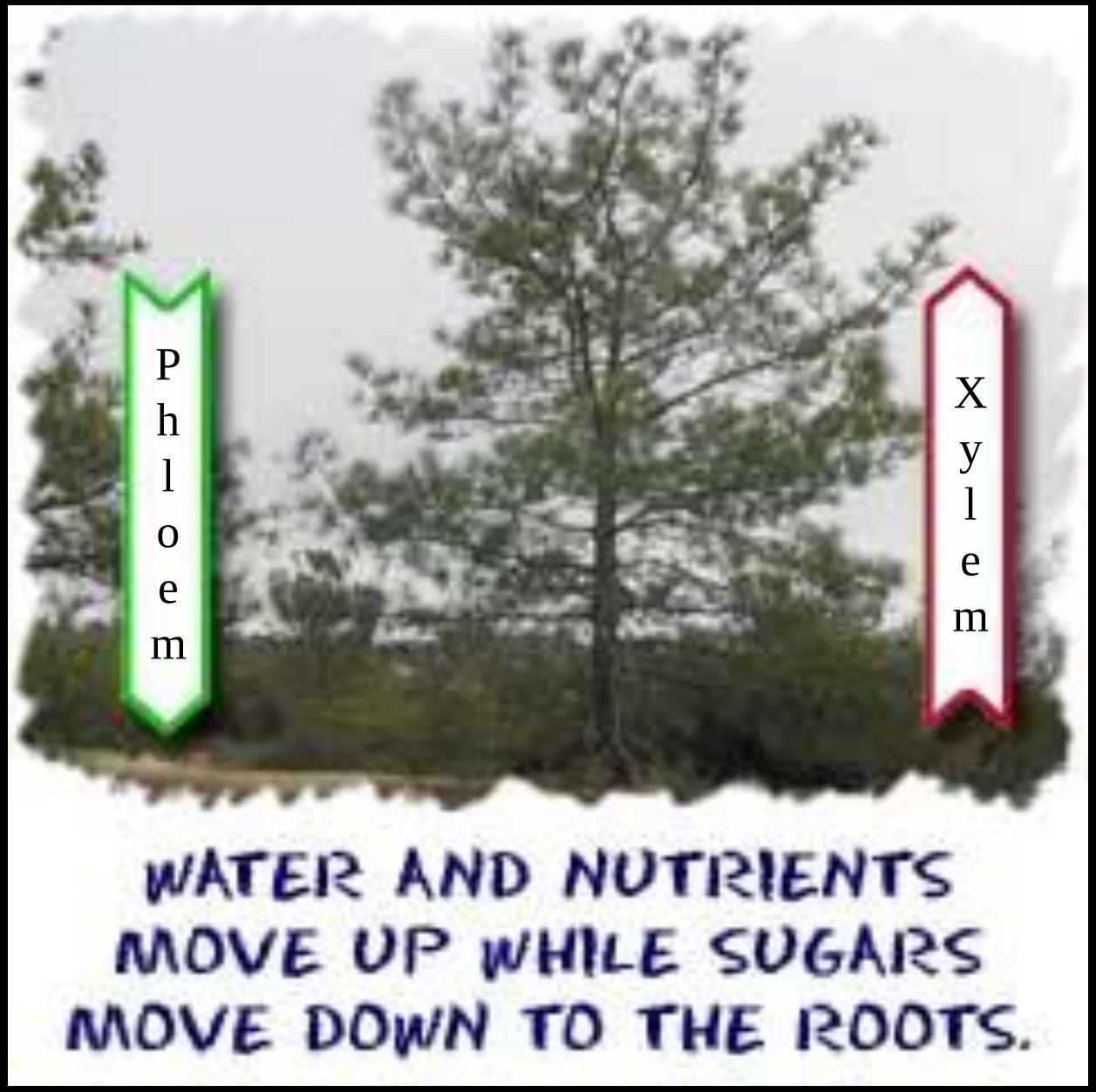
# Tree Root Zone



# Root Myths

- Root system mirrors the top of the tree
- Trees have deep tap roots
- Roots extend to the tips of branches only
- Trees are deep-rooted or shallow-rooted
- Roots seek water


Xylem
Heartwood
Sapwood
Vascular cambium
Bark
Living phloem
Periderm
Cork cambium
Cork
Copyright © Pearson Education, Inc., publishing as Benjamin Cummings.


Phloem
Xylem
WATER AND NUTRIENTS
MOVE UP WHILE SUGARS
MOVE DOWN TO THE ROOTS.

# Tree Physiology

The study of biological and chemical processes within the tree structure.

| | |
|---|---|
| Photosynthesis | (making) |
| Respiration | (using) |
| Translocation | (moving) |
| Transpiration | (losing) |

# Photosynthesis

Most essential.

Transformation of carbon dioxide and water to produce simple sugars and oxygen.

Requires sun energy which is captured by chlorophyll.

**$6CO_2 + 6H_2O + Sun \rightarrow C_6H_{12}O_6 + 6O_2$**

# Respiration

Reverse of photosynthesis:

**$O_2$+ sugar → energy + $H_20$ + $CO_2$**

Chemical energy is released for growth and other life processes.

Requires oxygen to release energy.

Production of carbohydrates (sugars) through photosynthesis must exceed the oxidation of carbohydrates (sugars) through respiration.

**Respiration occurs all the time.**

# Transpiration and Translocation

Allows for photosynthesis and respiration to function properly.

Utilizes the tree's "piping" system.

Allocates carbohydrates to support plant processes.

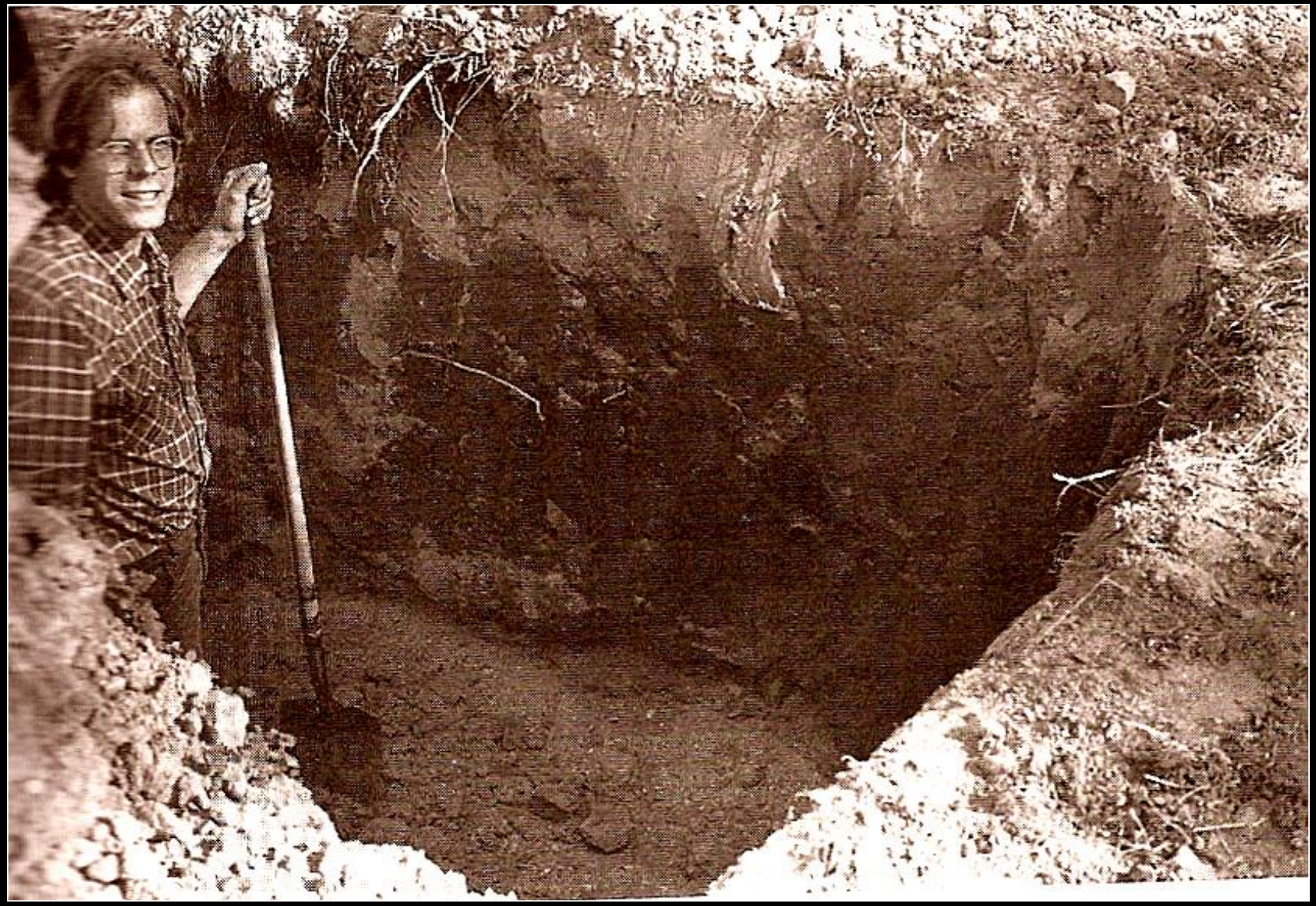
# Plant Processes

Priority of allocation:

- Maintenance of living tissue
- Fine root production
- Flower and seed production
- Primary growth, elongation
- Secondary growth, diameter
- Defensive compounds


People who plant trees are healthier, better looking, richer and have more friends.

Arizona Community Tree Council, 2000



# Steps for Proper Planting

**Look up for wires/lights**

Dig shallow/wide hole

Find the top-most root and treat root defects

Place tree in hole

Position top root 1-2 inches above landscape soil

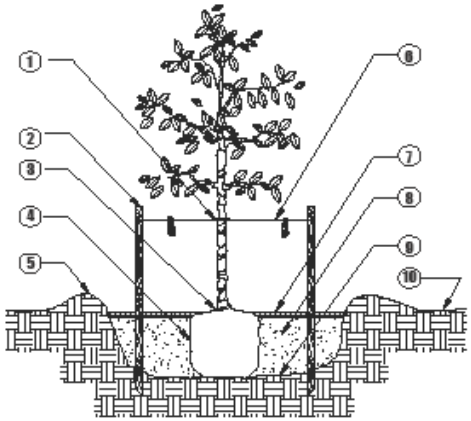
Straighten tree

Add backfill soil and firm the root ball

Add mulch

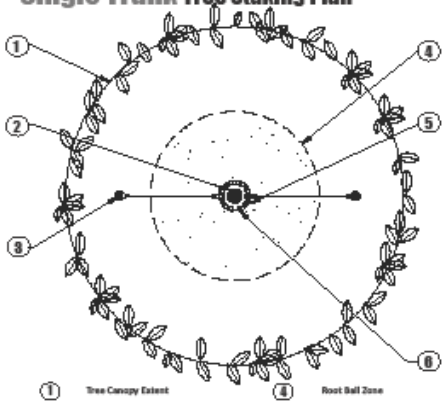
Stake and prune damaged branches if needed

## Single Trunk Tree Planting Detail



1. Rubber Hose, if using Arbor Tape, no hose needed
2. Place Stakes Outside of Root Ball Under Lowest Permanent Branches
3. Root Flare Slightly Above Grade (1-2")
4. Rough Up Edges of Root Ball (Teasing Roots)
5. Soil Berm to Hold Water Flatten Out After 1 Year
6. Arbor Tape (Preferred) Tied to Main Trunk
7. 2-3" Mulch Top Layer, not around base 1" DG Top Layer acceptable for non-turf areas
8. Loose Backfill Soil, Water Settle Only, Do Not Tamp or Compact
9. Hard (Firm) Undisturbed Soil Base
10. Finished Grade

## Single Trunk Tree Staking Plan

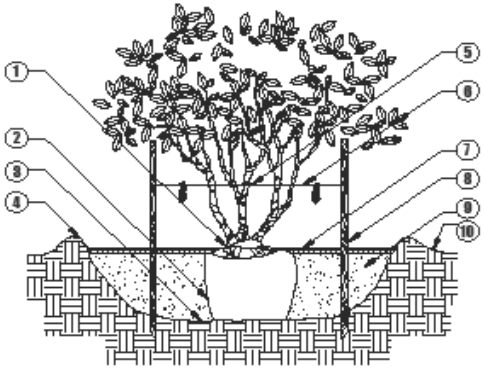


1. Tree Canopy Extent
2. Tree Trunk
3. Tree Stake, Outside of Root Ball
4. Root Ball Zone
5. Arbor Tape or Plastic Coated Wire Tied to Stake
6. Rubber Hose

### REMEMBER TO:

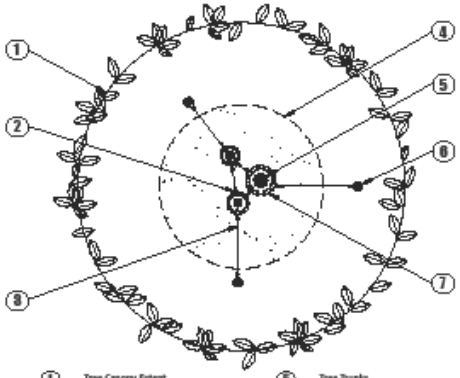
- REMOVE stakes ASAP, within one or two years (two growing seasons)
- WATER thoroughly to settle the soil, adding additional soil as needed then water again
- NOTE: Taller trees may require 2 WIRES: Stakes 10-12' tall NEED 2 WIRES for support

## Multi-Trunk Tree Planting Detail



1. Root Flare Slightly Above Grade (1-2")
2. Rough Up Edges of Root Ball (Teasing Roots)
3. Hard (Firm) Undisturbed Soil Base
4. Soil Berm to Hold Water Flatten Out After 1 Year
5. Rubber Hose, if using Arbor Tape, no rubber hose needed
6. Arbor Tape (Preferred) Tied to Main Trunk(s)
7. 2-3" Mulch Top Layer, not around base 1" DG Top Layer acceptable for non-turf areas
8. Place Stakes Outside of Root Ball Under Lowest Permanent Branches
9. Loose Backfill Soil, Water Settle Only, Do Not Tamp or Compact
10. Finished Grade

## Multi-Trunk Tree Staking Plan



1. Tree Canopy Extent
2. 3 Separate Hoses/Trunks bound to Each Other with Plastic Coated Wire or Arbor Tape
3. Arbor Tape (preferred) or Plastic Coated Wire
4. Root Ball
5. Tree Trunks
6. Tree Stakes Outside Root Zone
7. Rubber Hoses with Wire Ran Through & Tied to Stakes; No Hose needed if using Arbor Tape


09/25/2010


09/25/2010


ADT

You can make a statement with pruning!!

Do not prune unless necessary!

Have a Reason…a Goal…an Objective…

other than:

I gotta prune

I gotta prune

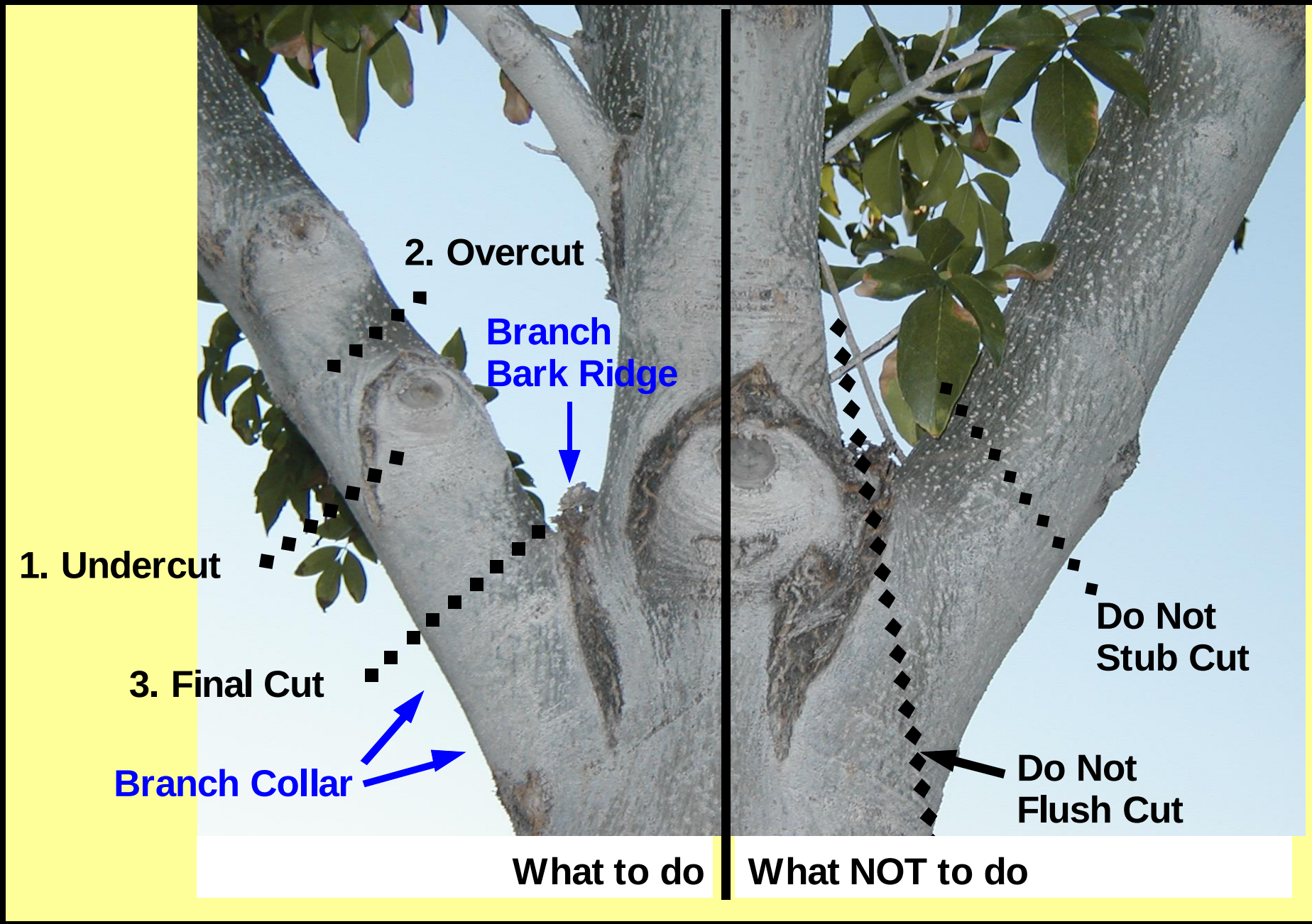
I gotta prune!

# Pruning Priorities (reasons)

- Dead, damaged, diseased (3 D's)
- Broken (1B)
- Crossing, crowded (2 C's)
- Safety; eliminate hazards
- Direct growth, structure, size
- Increase light and air flow
- Elevation/clearance/visibility
- Aesthetics

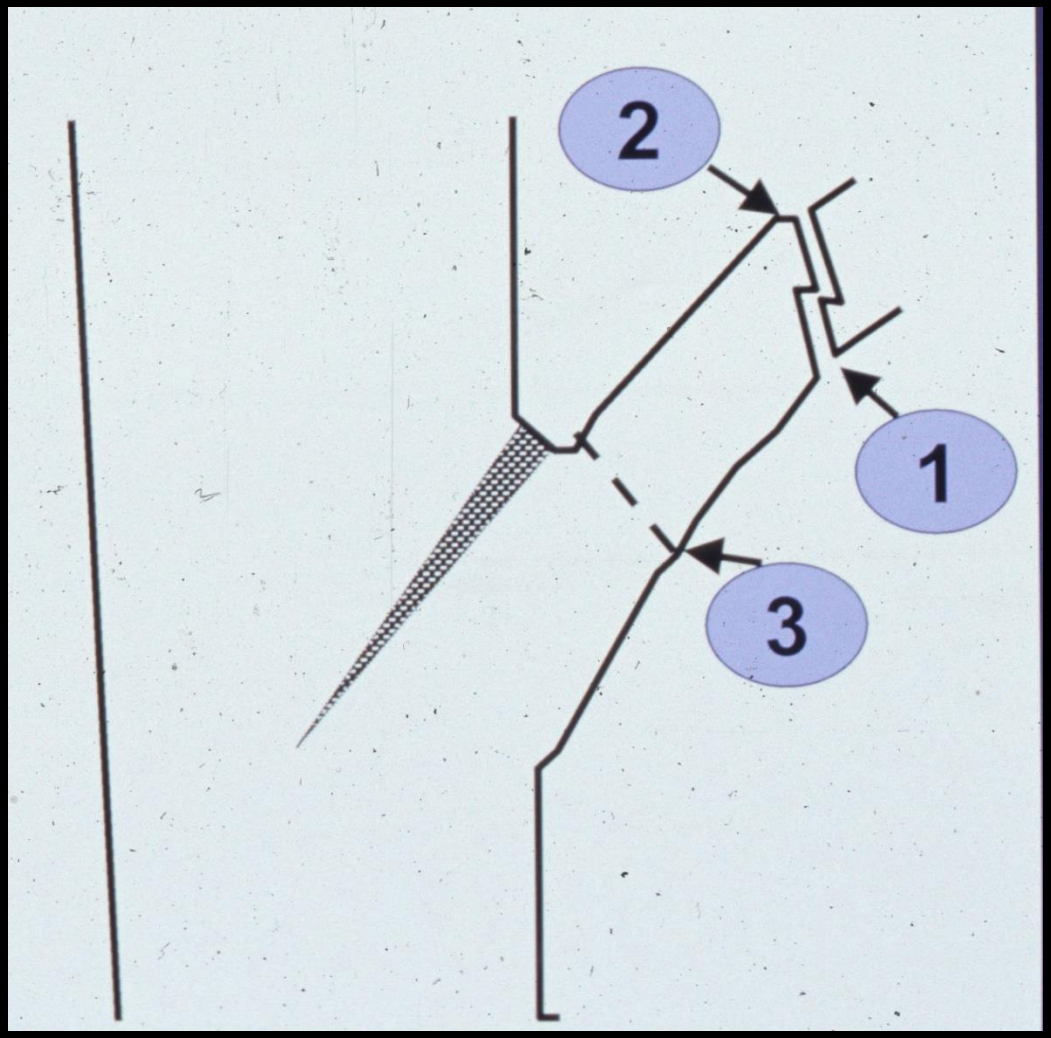
# Pruning Tools

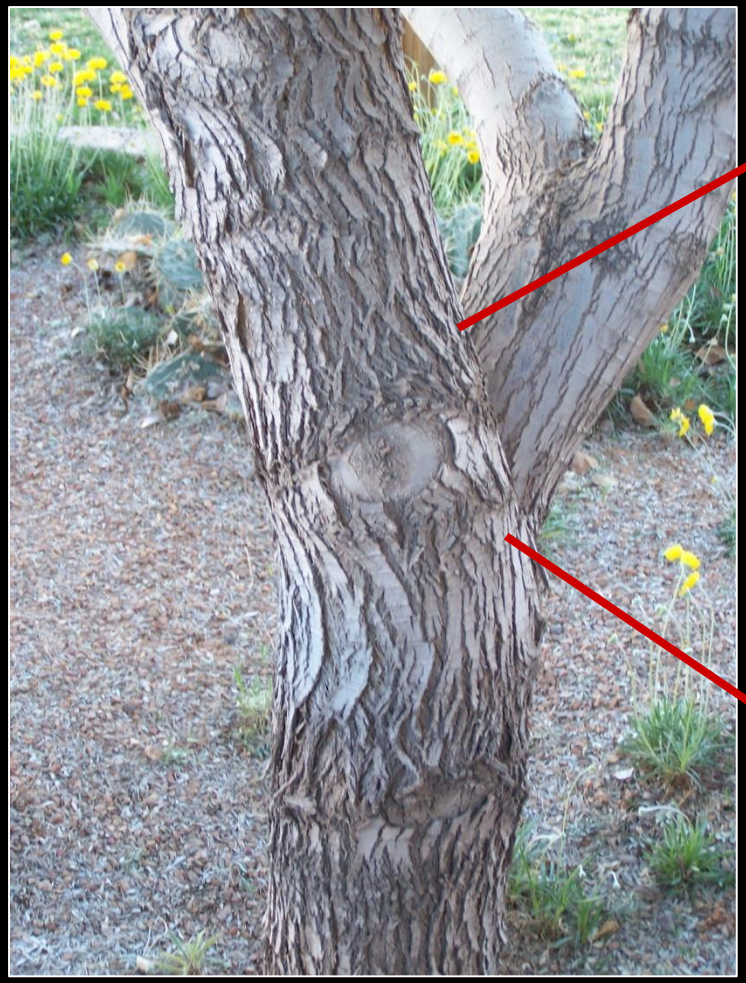
- Hand pruners < ½ inch
- Loppers ½ to 1½ inches
- Hand saws
- Pole pruners ½ to 2 inches
- Pole saws
  - Extensions, 6 -12 foot poles
  - Positioning is important
- Chainsaws


2. Overcut
Branch
Bark Ridge
1. Undercut
3. Final Cut
Branch Collar
Do Not
Stub Cut
Do Not
Flush Cut
What to do
What NOT to do

# Drop Cut (3 cut method)

- Most common
- Helps prevent tearing bark
- Branch falls clear of stub





# Lion Tailing

- Excessive removal of inner lateral branches and foliage
- Weak branch structure/heavy end weight
- Sunburn
- Reduced branch taper
- Excessive watersprouts

# Young Tree Pruning

Create a strong central leader

Create well spaced scaffold branches

Determine the lowest permanent branch height

Allow temporary branches to remain

Remove crossing or rubbing branches

# Personal Protective Equipment

- Safety glasses, gloves, hardhats, chaps, hearing protection, High-Vis clothing or vest.
- Electric and utility lines.
- Ladders
- Vehicular and pedestrian traffic

# Information and Education

Public relations

Communication

Partnerships

Education

Informed citizens
and
policy makers

**http://www.phoenix.gov/parks/parks/urban-forest**

# Questions?

Thanks
for your
Attention!

Richard Adkins

richard.adkins@phoenix.gov

# Tree Inventory

Top Ten Species in City of Phoenix

| | | |
|---|---|---|
| Vacant space | | 11.8% |
| *Prosopis velutina* | Mesquite | 8.9% |
| *Parkinsonia florida* | Palo verde | 7.0% |
| *Pinus halepensis* | Pine | 5.9% |
| *Parkinsonia praecox* | Palo brea | 5.3% |
| *Ulmus parvifolia* | Evergreen elm | 4.3% |
| *Dalbergia sissoo* | Indian rosewood | 4.3% |
| *Washingtonia filifera* | Fan palm | 3.7% |
| *Fraxinus velutina* | AZ ash | 3.1% |
| *Acacia stenophylla* | Shoestring acacia | 3.1% |
| *Washingtonia robusta* | Fan palm | 2.8% |

# Trees for Small Spaces

Vitex or Chaste Tree (*Vitex agnus – castus*)

Little Leaf Ash (*Fraxinus greggii*)

Cascalote (*Caesalpinia cacalaco*)

Texas Mountain Laurel (*Calia secundiflora*)

Feather Tree (*Lysiloma microphylla*)

Texas Olive (*Cordia boissieri*)

Mulga (Acacia aneura)

Leather leaf acacia (Acacia craspedocarpa)

Mastic (Pistacia lentiscus)

Desert Willow (Chilopsis linearis)

# The Urban Forest Resource:

## a Critical Component of Developing Sustainable Infrastructure and Healthy Living

# Benefits of Trees

## Human Health and Well-being

- Livable communities
- Building community attachment and meaning
- Wellness, active living, healing, mental health
- Lowering crime, area safety
- Street safety
- Education and learning


ONE WAY
AIR CONDITIONING SYSTEM
Trees help clean our air and cool the environment.
DesertCanopy.org