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# Urban Desert Landscapes – Creating Climate Resilience One Tree at a Time!

Tanya Quist, PhD  
University of Arizona School of Plant Sciences

# What Would Life Be Like Without Trees?

**Herring Hall**



**Old Main**



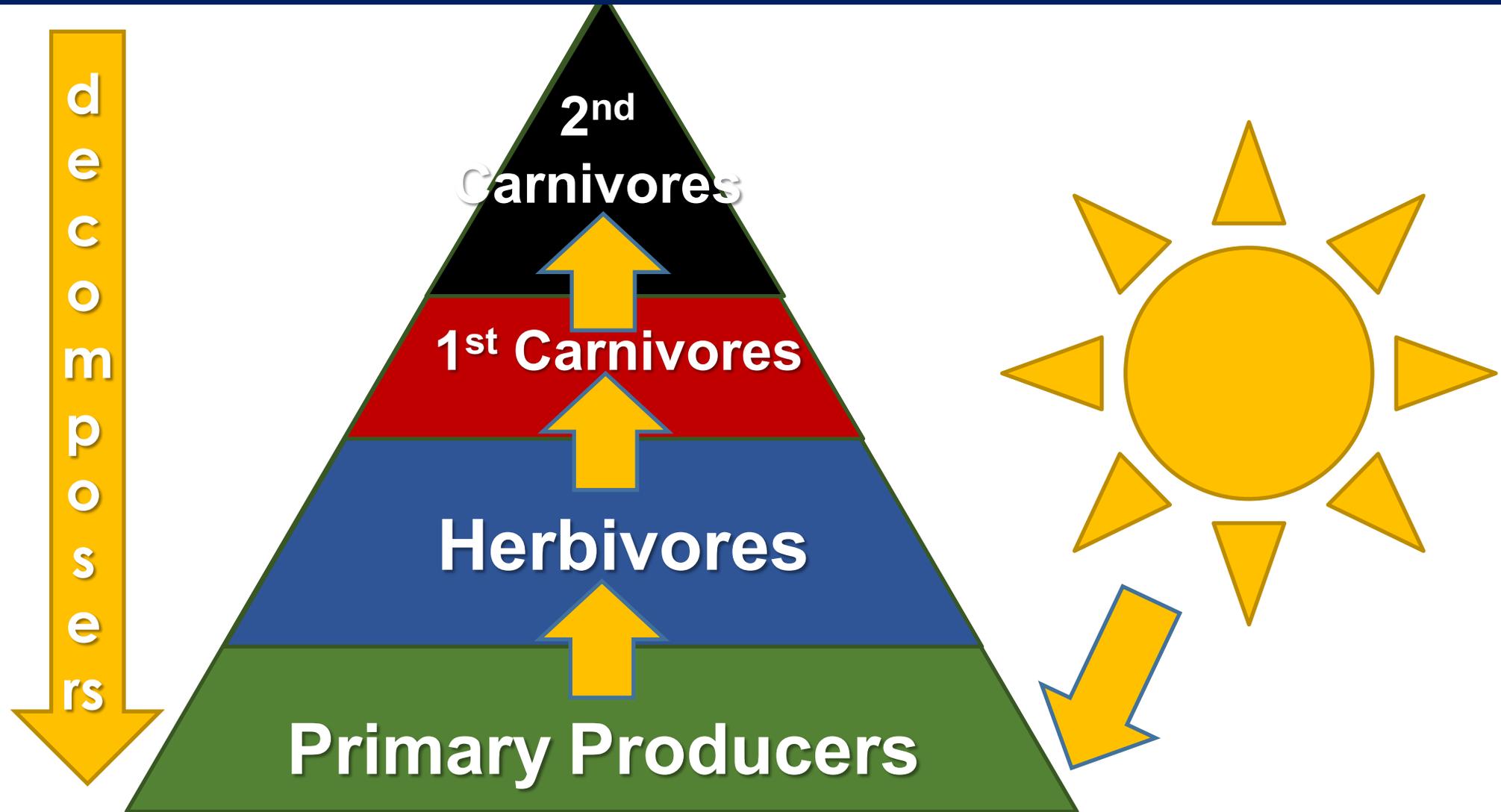
# Outline



- Guiding principles relating to urban landscapes.
  - Ecosystem services plants provide.
- Role and challenges of trees in Arizona cities.
- 3 things you can do to for resilient urban landscapes.
  - Revised Desert Landscape site.



# Plants are Foundational to Life on Earth



# Ecosystem Services

Trees are foundation species in terrestrial ecosystems. Foundation species: tree species that define and structure ecosystems through their influences on associated organisms and modulation of ecosystem processes. (Ellison et. al, 2005)

***Ecosystem:*** an interdependent community of living and non-living things.

## Ecosystem Services:

The goods and services produced natural processes as living and nonliving elements interact.



# Ecosystem Services = Natural Capital

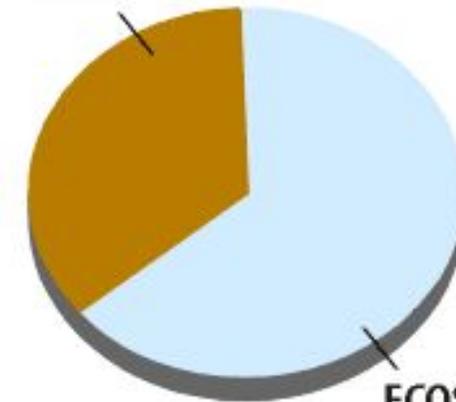


The value of the world's  
natural capital ~ \$33 Trillion/Year  
~ 2x world's combined GNP.

## How much are nature's services worth?

Estimates of human economic activities and ecosystem services

GLOBAL GNP (US\$ 18 trillion)



ECOSYSTEM  
SERVICES (US\$ 33 trillion)

**Source:** Adapted from R. Costanza *et al.*, "The Value of the World's Ecosystem Services and Natural Capital," *Nature* Vol. 387 (1997), p. 256, Table 2.

# Ecosystem Services = Natural Capital

## Urban Ecosystem Services = Green Infrastructure

*Low cost, natural solutions for urban problems.*

ie. water harvesting, green roofs, low impact development



# Trees Benefit Cities

**Economic  
Prosperity**

**Quality of Life**

**Environmental  
Health**

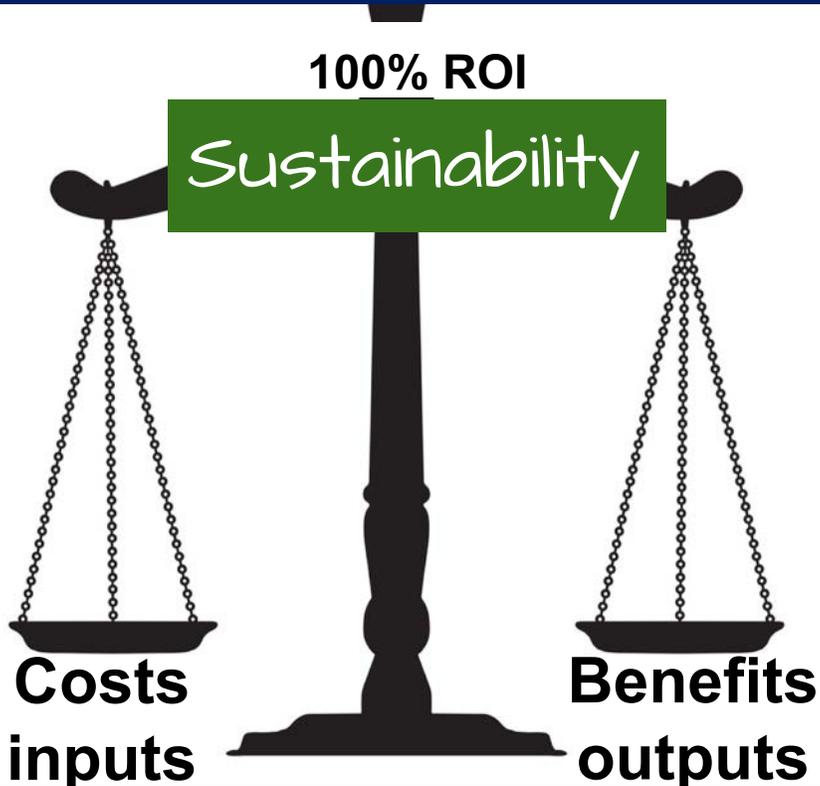
**S U S T A I N A B I L I T Y**

*Increase property values*  
*Increase retail foot traffic*  
*Conserve energy*  
*Reduce utility demands*  
*Mitigate urban flooding*  
*Reduce repaving interval*

*Expand opportunities for  
recreation and community  
gathering*  
*Promote health*  
*Reduce crime*  
*Calm traffic*  
*Support urban wayfinding*  
*Preserve culture/heritage*

*Provide food*  
*Generate oxygen*  
*Capture CO<sub>2</sub> /GHG*  
*Support wildlife*  
*Improve air quality*  
*Protect water quality*  
*Reduce soil erosion*  
*Combat drought.*

# Trees Pay Us Back



*Tree provide benefits with real value and excellent return on investment for humans and the planet in natural and built environments.*

For every \$1 invested in US urban trees, there is an average of \$3.50 of (environmental and economic) goods and services provided to the municipality

# Campus Arboretum Green Infrastructure Value

<b>Replacement.....</b>	<b>\$28,217,339</b>
<b>Services.....</b>	<b>\$272,997 / yr</b> <i>\$44.95/tree</i>
<b>Energy Savings.....</b>	<b>\$55,065 / yr</b>
<b>CO<sub>2</sub> Sequestration...</b>	<b>\$29,180</b> <i>3,890,698lbs of CO<sub>2</sub> stored</i> <i>708,010lbs of CO<sub>2</sub> avoided</i>
<b>Stormwater.....</b>	<b>\$13,766 municipal savings</b> <i>2,867,671 G trapped and filtered</i>
<b>Air quality.....</b>	<b>\$13,675</b> <i>474 lbs of pollutants removed.</i>

# Arizona Needs Trees



# Urbanization Concentrates Environmental Impacts



Urbanization, industrialization, population growth has led to loss of natural environments in urban areas. Lost too are the benefits of green spaces.

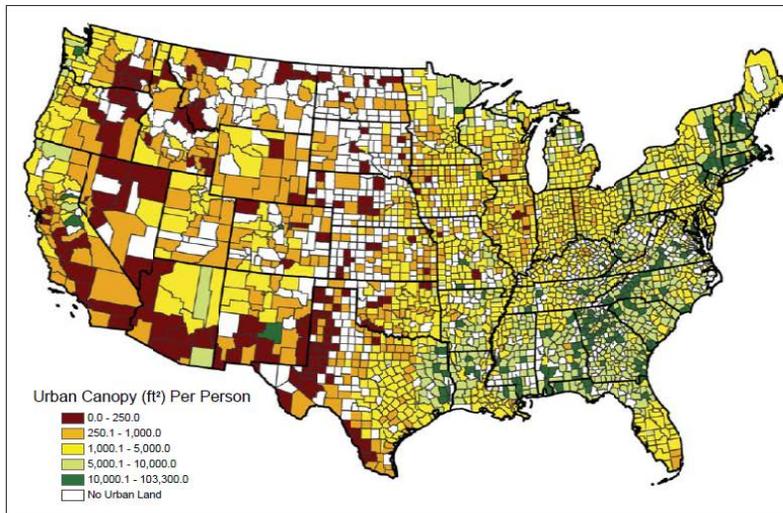
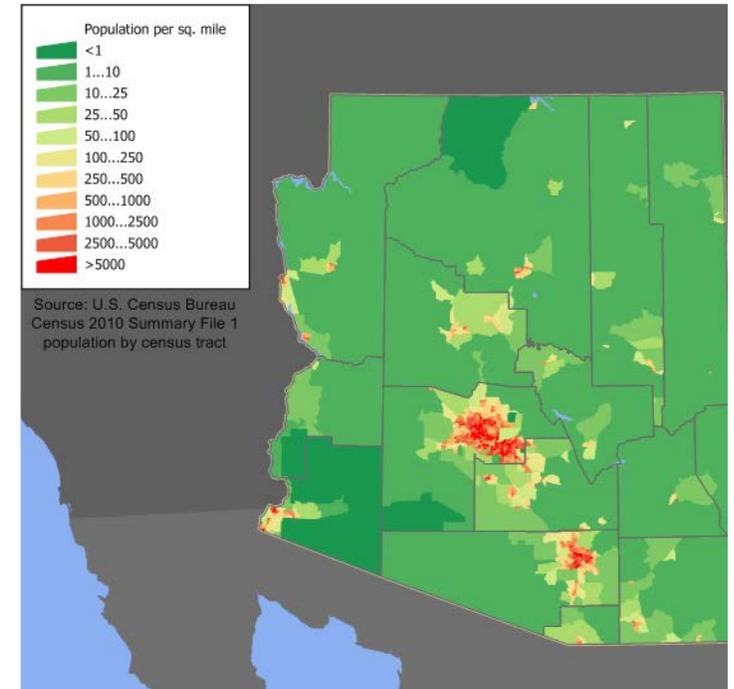


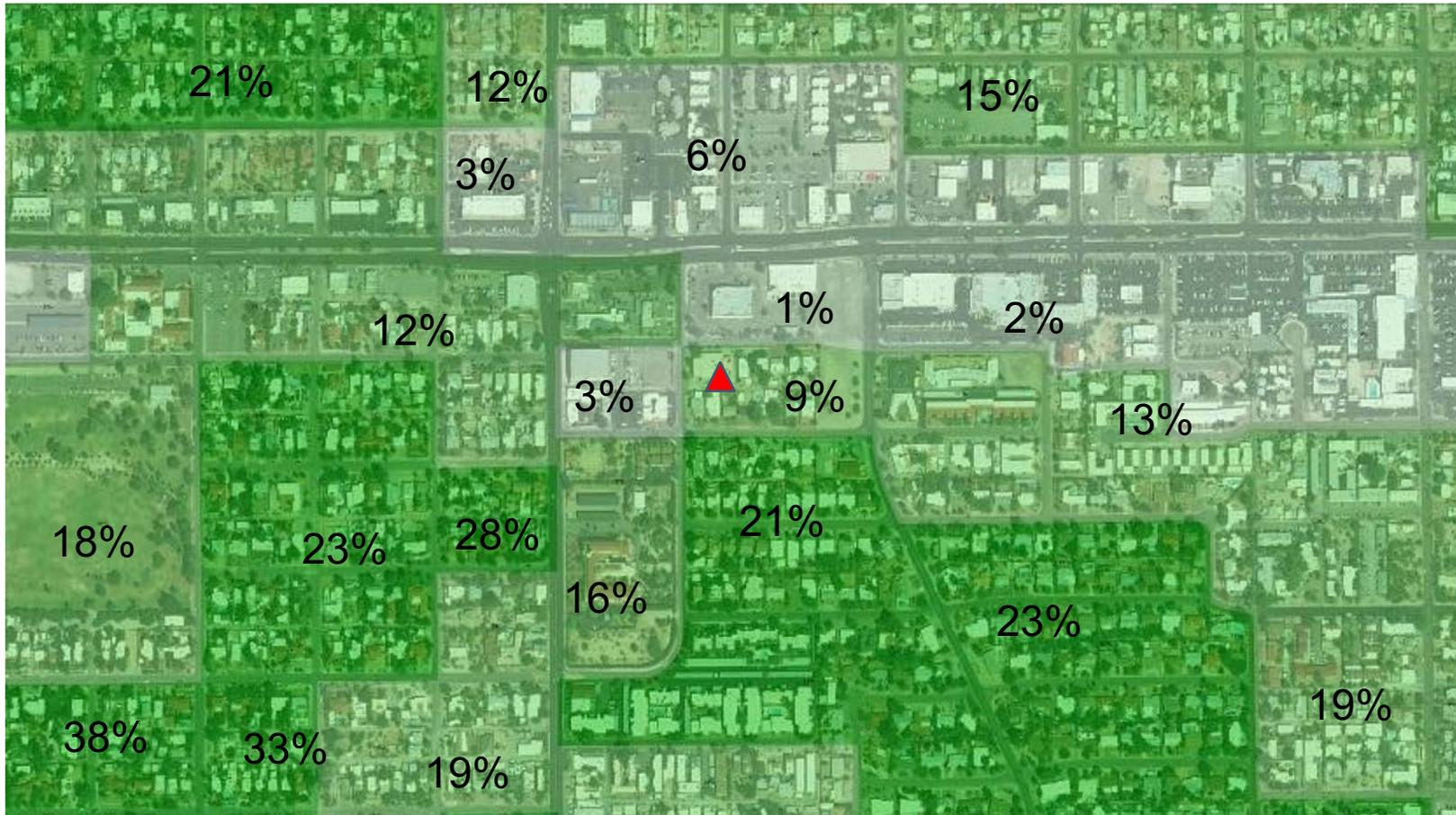
Figure 3—Urban canopy (ft<sup>2</sup>) per person (urban canopy / urban population).



80% of Arizona's population lives in 1 of 3 major metropolitan areas.

The Southwest is one of the most rapidly urbanizing regions in the United States.

# Tucson Canopy Cover



American Forests and the USFS recommends 15-20% baseline target canopy cover for desert cities. The ideal is **26%**

The average canopy cover in Tucson is **~8%**

# Tucson Canopy Cover



Canopy disparity correlates with heat vulnerability

# Conservation in Your Backyard!



AMWUA.ORG

- The largest use of potable water in Arizona is for landscaping.
- As much as 70 percent of residential water use is outdoors.
- Water use in all landscapes can be significantly reduced by using efficient and regionally-appropriate designs, plant selection, and irrigation practices.

# Three Things YOU Can Do.

1. Plan thoughtfully.
2. Plant properly
3. Manage sustainably



# Plan Thoughtfully

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HELPFUL TIPS TO BLOOM INTO ACTION

- ## 1 Desert Garden Basics

The most enduring built landscapes begin with an understanding of the desert environment and the adaptive characteristics of the plants that evolved in deserts.

[MORE](#)
- ## 2 Planning and Preparation

The key to a successful landscape design is careful assessment of the climate, site conditions and the environmental and design functions plants will play. Clarifying these ideas will get you ready to select the right plants for your landscape.

[MORE](#)
- ## 3 Planting

Get your landscape off to a healthy start. Learn when and how to plant trees and the most common challenges faced during the planting process.

[MORE](#)
- ## 4 Sustainable Maintenance

Sustainable landscapes do more with less by minimizing inputs such as irrigation water, chemical fertilizers, pest controls and pruning. Learn how to save time and money while getting the most of your landscape.

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## Alex Peck

**B.S. Plant Sciences, Class of 2021**  
**B.S. Biology, Biomedical, Class of 2021**

- ❖ Desert Biomes
- ❖ Desert Plant Adaptations



## Adam Leon

**B.S. Plant Sciences, Class of 2020**

- ❖ Healthy Ecosystems
- ❖ Urban Landscape Considerations
- ❖ Responsible Design

# Plan Thoughtfully

## Design Gallery

Germinate ideas for your desert landscaping project with this handy plant gallery.



1		Trailing Indigo Bush <i>Dalea greggii</i> TYPE: GROUNDCOVER
2		Bougainvillea <i>Bougainvillea species</i> TYPE: VINE
3		Brittlebush <i>Encelia farinosa</i> TYPE: SHRUB
4		Engelmann's Prickly Pear <i>Opuntia engelmannii</i> TYPE: CACTUS
5		Century Plant <i>Agave americana</i> TYPE: ACCENT
6		Green Desert Spoon <i>Dasyliirion acrotliche</i> TYPE: ACCENT
7		Saguaro <i>Carnegiea gigantea</i> TYPE: CACTUS

# Plan Thoughtfully



**Daniel Harmon**

**B. S. Sustainable Plant Systems, Class of 2019**

- ❖ Plant Selection Criteria
- ❖ Ecologically Sensitive Design

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- 1**  
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- 2**  
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# Plan Thoughtfully

- ✓ **Search for plants.**
- ✓ **Filter** results based on plant characteristics, site conditions or desired landscape function.

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FIND THE RIGHT PLANTS FOR YOUR LANDSCAPING

CHARACTERISTICS GROWING REQUIREMENTS FUNCTION Botanical or Common Name

Plant Type Origin Seasonality  
Height Flower Color Xeriscape Zone  
Width Flower Season

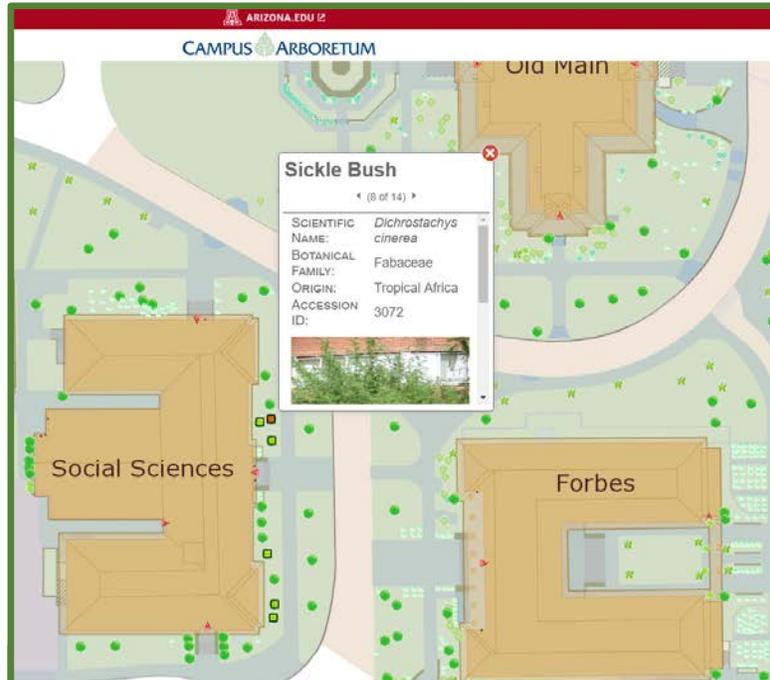
Tree X Southwest U.S. X Deciduous X

COMMON BOTANICAL 1 2 > X Sort A-Z ^ v

12 PLANTS PER PAGE SHOWING 1-12 OF 23

 <p><b>Anacacho Bauhinia</b> <i>Bauhinia lunarioides</i> TYPE: TREE SHRUB</p>	 <p><b>Berlandier Acacia</b> <i>Acacia berlandieri</i> TYPE: TREE SHRUB</p>	 <p><b>Blue Palo Verde</b> <i>Parkinsonia florida</i> TYPE: TREE</p>
 <p><b>Crucifixion Thorn</b> <i>Canotia holacantha</i> TYPE: TREE SHRUB</p>	 <p><b>Desert Museum Palo Verde</b> <i>Parkinsonia 'Desert Museum'</i> TYPE: TREE</p>	 <p><b>Desert Willow</b> <i>Chilopsis linearis</i> TYPE: TREE</p>

# Campus Arboretum Resources



ARIZONA.EDU | CAMPUS ARBORETUM

Old Main

Social Sciences

Forbes

**Sickle Bush**  
(8 of 14)

SCIENTIFIC NAME: *Dichrostachys cinerea*  
BOTANICAL FAMILY: Fabaceae  
ORIGIN: Tropical Africa  
ACCESSION ID: 3072

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**Medicinal Plants Tour**

Plants have been used for centuries to treat and remedy all sorts of ailments; on this tour you will learn about some of the medicinal plants here on campus and their therapeutic properties for human health.

**Tour Resources:**  
PRINT\_Medicinal\_Plants\_Tour\_Booklet.pdf

**Mobile Tour Link:**  
<http://apps.cals.arizona.edu/arboretum/map/#Medicinal-Plants-Tour>




View Species by Botanical Name

**Dichrostachys cinerea** Accession Count: 7  
[Find this plant on campus](#)  
[See this plant in our Tree Tours: Medicinal Plants Tour](#)

**Common Name:** Sickle Bush  
**Family Name:** Fabaceae  
**Botanical Name:** *Dichrostachys cinerea*  
**Sub Species:**  
**Variety:**  
**Forms:**  
**Cultivar:**  
**Characteristics:**  
**Compound:** Dic. pin  
**Geographic Origin:** Tropical Africa  
**Ecozone Origin:** Afrotropic  
**Biome Origin:**

**Natural History:** The Sickle bush was first found in West Africa and is still widespread in its native land. Since then it has been introduced in the West Indies in the 19th Century. It is also found in Sri Lanka, Australia, India, and Madagascar. The Sickle bush is considered an invasive weed and can cause problems to other plants because of its ability to spread fast, grow fast, disperse numerous seeds, and the seed's ability to last in soil up until a year. The sickle bush is also fire resistant and makes it hard to manage the spread and over growth of this plant. Natural enemies exist that act as a biocontrol agent. The fungus *Uredo deformans* found in Sri Lanka, and the insects *Ctenopliusa albostriata* and *Kermis Locca* are some of the currently identified natural enemies (none of which is native in the U.S.). The plant is bat pollinated under normal conditions, but may be insect pollinated on some occasions.

**Cultivation Note:** In order to successfully cultivate the sickle bush one must soak seeds in hot water and then let cool and leave the seeds in the cooled water for 24 hours. The mixture of soil for optimum growth is 1 part soil (course sand or soil) and 3 parts compost. Minimal water and sunlight is needed for this shrub. The early on plants need to be protected from frost, but in their adult years *Dichrostachys cinerea* can tolerate medium amounts of frost. Pruning is needed to keep the sickle bush neat. The sickle bush is mostly found in warm dry savannas, however the sickle bush can grow in more than 3 climate groups. It also has positive affects to the nitrogen levels in the soil.

**Ethnobotany:**  
In some places the dried leaves and flowers of the sickle bush mixed with honey provides cures for stomach ulcers (if taken before food), and pains due to wounds. An alternate form for curing stomach ulcers is mixing leaf extracts and mixing with milk. The leaves and fruits can also be ingredients in animal feed as the sickle pod is nutritious and eaten by animals in nature. The sickle bush has also been used as a snake venom antidiote and well as treatment for some STDs, and also has many astringent qualities.

**Height:** 6 - 10 feet  
**Width:** 0 - 5 feet  
**Growth Rate:** Fast Growing  
**Grow Season:** Summer  
**Flower Season:** Spring  
**Color:** Pink  
**Function:** Shade  
**Spread:** Spreading  
**Allergen:** Non-allergenic  
**Invasive:** Invasive  
**Toxicity:** Benign  
**Hardy:** Hardy  
**Water Use:** Low water Use

**Citations:**

1. [Early Detection and Response-Invasive Alien Plants](#)
2. [Unique Legumes on the U of A Campus](#)
3. [Detailed Coverage of Invasive Species Threatening Livelihood and the Environment Worldwide](#)
4. [Center for Aquatic and Invasive Plants](#)
5. [Ethnobotanical Documentation of Medicinal Plants](#)
6. [Ethnobotanical Study of Plants](#)
7. [Dichrostachys cinerea](#)
8. [Ecology of Dichrostachys cinerea](#)
9. [Profile of Dichrostachys cinerea](#)

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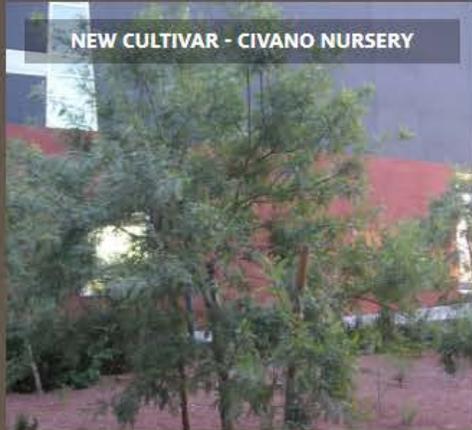
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## PLANTS TO SPROUT IDEAS

Tried and true, virtually fool-proof plants and promising new experimental selections to consider.

### NEW CULTIVAR - CIVANO NURSERY



Libby Davison Ash  
*Fraxinus greggii* 'Libby Davison'  
**TREE**

### PROMISING NEW SPECIES FROM DELEP



Wright's Acacia  
*Senegalia wrightii* var. *wrightii*  
**TREE**

### PROVEN PERFORMER



Ironwood  
*Olneya tesota*  
**TREE**

### PROVEN PERFORMER



Mulga  
*Acacia aneura*  
**TREE**

# Plant Properly



**Daniel Harmon**

**B. S. Sustainable Plant Systems, Class of 2019**

1

## Garden Basics

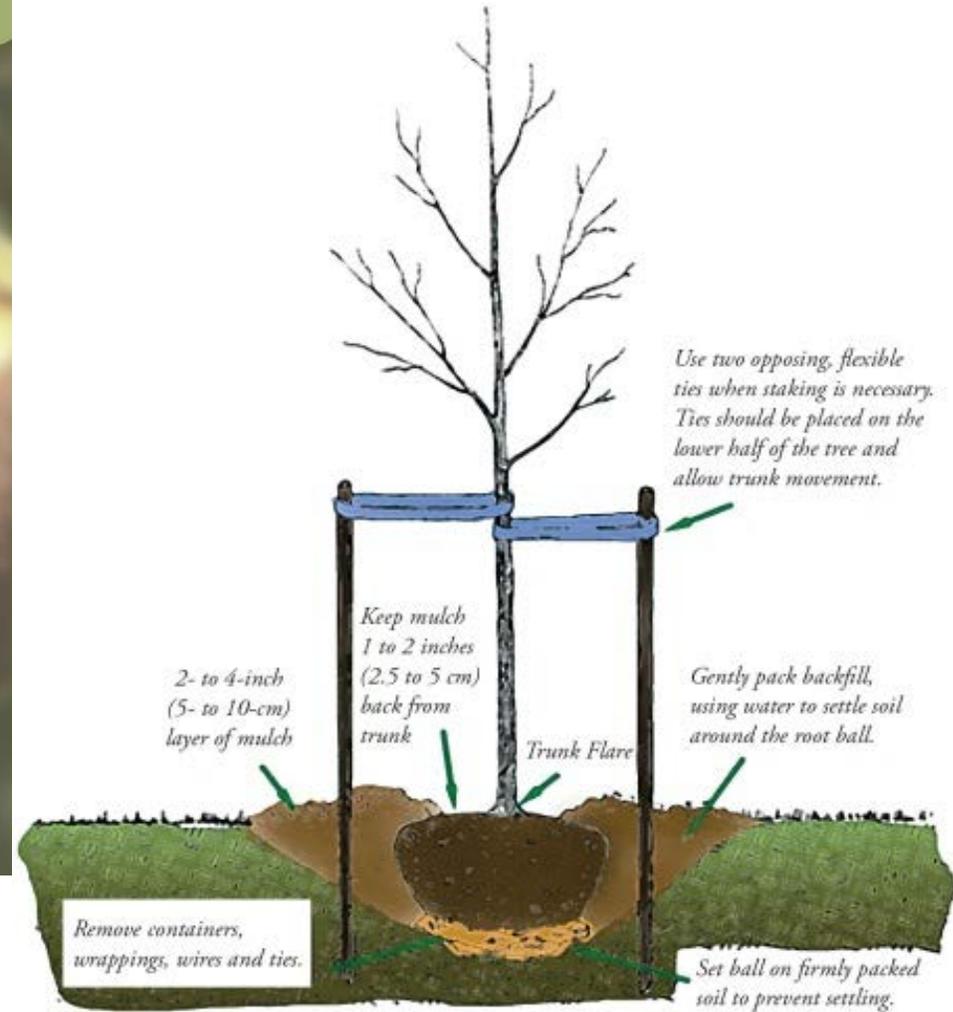
...es begin with an understanding of the  
...tive characteristics of the plants that  
... in deserts.

3

## Planting

Get your landscape off to a healthy start. Learn when and how to plant trees and how to handle the most common challenges faced during the planting process.

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**John Pacheco**

**B. S. Sustainable Plant Systems, Class of 2020**

- ❖ Irrigation
- ❖ Nutrition
- ❖ IPM
- ❖ Pruning
- ❖ Staking



**Cora Ricoy**

**B. S. Sustainable Plant Systems, Class of 2019**

# Manage Sustainably



QTSArizona.com



Horticulture Unlimited



# Manage Sustainably



AZ Plant Lady



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## CULTIVATE DEEPER LEARNING

### Resources

Information-rich websites for local, state and national organizations.

[MORE](#)

### Bibliography

Gain insight into what went into compiling this rich resource.

[MORE](#)

### History

Gain insight into how this expansive website evolved and about the resources behind the content.

[MORE](#)

### Acknowledgements

Recognition for the support from a broad array of people.

[MORE](#)

# Questions?



Tanya M. Quist, PhD  
<https://arboretum.arizona.edu/>

# Key Points

- ✓ Trees play an essential role trees play in our environmental, economic and social well being.
- ✓ Older, mature trees provide the greatest benefits/ROI
- ✓ We are not meeting standards for climate resilience
- ✓ Urban deserts pose particular challenges for plants.
- ✓ Special care must be taken:
  - ✓ Select the right tree for the right place
  - ✓ Learn and employ sustainable maintenance practices

# Plant and Care For Trees

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RESEARCH



EDUCATION



OUTREACH



### DESERT GARDENING TOOLS

Access a wide array of resources to help guide you in creating resilient desert landscapes!



### JOIN US FOR A TREE TOUR!



Visit campus and absorb the beauty of the diverse landscape around you. Learn from an experienced Master Gardener about the many ways trees support our world and enrich our lives. [View the schedule of tours.](#)



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[Past Newsletters / Events](#)

[View Calendar](#)

Next Event:

**URBAN DESERT LANDSCAPES - FREE SEMINAR**  
04/24/2019 - 12:00

Next Scheduled Tour:  
**EDIBLE LANDSCAPES TOUR**  
05/04/2019 - 08:30

## Valuable Resources for Desert Gardening and Restoration

### PLANT SELECTOR

Select plants from our curated list, developed from published information, culled by regional experts and filtered for your specific site needs.

SEARCH PLANTS

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<https://arboretum.arizona.edu/>

