The Drought Survivability Study

Texas A&M Institute of Renewable Natural Resources
Why is landscape water use important?

- Discretionary Usage
- Data driven suggestions
- Drought impact in central Texas
- Potential water savings in urban landscaping
Research Objective

- To analyze urban landscaping for outdoor water conservation efforts for 96 ornamental plants
- Jointly funded by San Antonio Water System (SAWS), San Antonio River Authority (SARA), City of Austin, and City of Georgetown
The Study

The Drought Survivability Study (D.S.S) is a horticultural experiment conducted by the Texas A&M Institute for Renewable Natural Resources that tested the drought tolerances of 96 ornamental species under 4 different irrigation regimes.

Each of the 4 experimental plots contained 96 ornamental plant species and was irrigated at a different percentage of Potential Evapotranspiration (ETO) as follows: 0% ETO, 20% ETO, 40% ETO, and 60% ETO.
Plots 1 and 2, with the lowest irrigation were covered by a movable roof when it rained.
The Drought Simulator is located on the South Side of San Antonio, Texas, and owned by San Antonio Water Systems.
Evapotranspiration

- **Evapotranspiration** – The water a plant loses through evaporation and transpiration.

- **Potential Evapotranspiration (ETO)** - an estimate of evapotranspiration calculated using the Penman-Montieth equation, and climactic data such as temperature, dew point, wind speed, and solar radiation.

- All historic and current ETO values were obtained from the Texas ET network, available at [http://texaset.tamu.edu/pet.php](http://texaset.tamu.edu/pet.php).

### Table 1. Historical Monthly Evapotranspiration Averages in inches for Austin and San Antonio, Texas

<table>
<thead>
<tr>
<th>City</th>
<th>Jan</th>
<th>Feb</th>
<th>Mar</th>
<th>Apr</th>
<th>May</th>
<th>Jun</th>
<th>Jul</th>
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<th>Sep</th>
<th>Oct</th>
<th>Nov</th>
<th>Dec</th>
<th>Total</th>
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<tbody>
<tr>
<td>Austin</td>
<td>2.27</td>
<td>2.72</td>
<td>4.34</td>
<td>5.27</td>
<td>6.39</td>
<td>7.15</td>
<td>7.22</td>
<td>7.25</td>
<td>5.57</td>
<td>4.38</td>
<td>2.74</td>
<td>2.21</td>
<td>57.51</td>
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<tr>
<td>San Antonio</td>
<td>2.42</td>
<td>2.90</td>
<td>4.42</td>
<td>5.47</td>
<td>6.47</td>
<td>6.97</td>
<td>7.31</td>
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Evapotranspiration

After a four month establishment period during which all plots were irrigated at 100% ETO.

Each of the four plots were irrigated at a different percentage of total ETO for that month: 0%, 20%, 40%, and 60%
Irrigation at the Drought Survivability Study

From Mid-July to September each plot was irrigated at a different percentage of ETO

Individual plants received the following irrigation for 12 weeks:

- Plot 1 plants = 0 gallons
- Plot 2 plants ≈ 9 gallons
- Plot 3 plants ≈ 17 gallons
- Plot 4 plants ≈ 25 gallons
DIAGRAM SHOWING SAME SPECIES PLANTED IN THE 4’ x 4’ BLOCKS

BLOCK 1
4 ONE GAL PLANTS OF SAME SPECIES

BLOCK 2
4 ONE GAL PLANTS OF SAME SPECIES
Methods

- 96 Ornamental plants chosen using four horticultural and nursery lists from Texas
  - Perennials, Grasses, Shrubs, and Trees
- Establishment Period – February to May 2016
- Three planting days, three weeding days, twelve data collection weeks with volunteers
- Data collection period (Phase I) July to September 2015; (Phase II) December to March 2016
What are we collecting?

- Appearance monitoring
  - Lush, Stable, Wilt, Leaf Drop, Defoliated, Dead
- Soil Moisture Data
- Infrared Thermometer Data
  - Foliar temperature can indicate stress
Results
Results Phase I: Soil Moisture Over Time + Establishment Period

Figure 1. Soil Moisture Levels of Four Experimental Plots Over Time
Phase I: Soil Moisture Over Time

Figure 2. Soil Moisture Levels of Four Plots From 07/10-08/07
Phase I: Appearance Ratings Over Time

Figure 4. Appearance Rating Average For All Plants in Each Plot
Methods Continued

- **Phase I**
  - Volunteers collect data over 16 data weeks
  - Four months of drought treatment: 0%, 20%, 40%, 60% ET<sub>o</sub>

- **Phase II**
  - Volunteers collect data once every month for four months
  - Four months of no additional irrigation; natural rainfall only
Purple Fountain Grass

0% ETO  

20% ETO

40% ETO  

60% ETO
Red Yucca

0% ETO

20% ETO

40% ETO

60% ETO
Oleander

0% ETO

20% ETO

40% ETO

60% ETO
Sabal Minor Palm

0% ETO

20% ETO

40% ETO

60% ETO
Daylily

0% ETO

20% ETO

40% ETO

60% ETO
Sago Palm

0% ETO

20% ETO

40% ETO

60% ETO
Thyrallis

0% ETO

20% ETO

40% ETO

60% ETO
Asiatic Jasmine

0% ETO

20% ETO

40% ETO

60% ETO
Discussion

- 40% ETo and 60% Eto plots have similar appearance values over the study period
- 0% Eto appearance values have much lower value appearances than 20% Eto
- Correlation between Soil Moisture and Appearance
- Plant Performance Index comparing plants by drought survivability
Implications

- Water conservation education to general public
- Phase II—recovery of plants under no additional irrigation
  - Monitor increase or decrease in appearance values
- Influence of policy decisions related to urban landscaping
Thank you!

Questions?

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