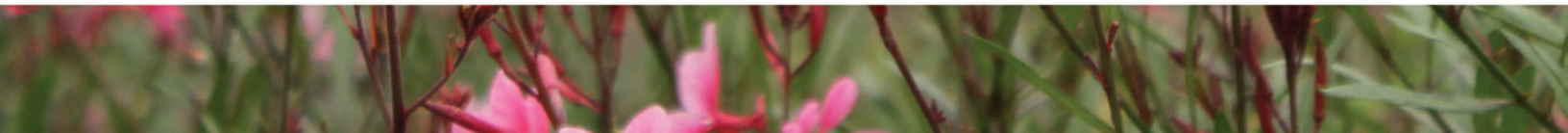
THE DROUGHT SURVIVABILITY STUDY

Amy Uyen Truong, Richard White, Forrest Cobb, and Roel Lopez



The Drought Survivability Study: Report

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The on-site maintenance team, DSS volunteers, and the DSS team.

ABOUT THE AUTHORS

Authors of the report include Amy Uyen Truong, an extension assistant at IRNR and the Texas Water Resources Institute (TWRI). She has experience in water conservation, water resources and drought survivability, and is a candidate of M.S. Water Management and Hydrological Sciences program at Texas A&M University.

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Forrest Cobb, research assistant at Texas A&M IRNR, graduated from Texas A&M San Antonio with a degree in Biology in 2015. He supports projects that seek to quantify and mitigate the environmental impacts of oil and gas production sites in South Texas.

Dr. Roel Lopez is a professor of Wildlife and Fisheries at Texas A&M University and IRNR director.

Jerusalem Sage (*Phlomis fruticose*).

Knock Out Rose (*Rosa Knock Out*).

INTRODUCTION

Water is a major limiting factor for maintaining the aesthetic performance of ornamental plants. The public uses various sources of information to determine the watering needs of Central Texas plants, from use of peer-reviewed articles to qualitative assessments of plant performance. Given the wide-ranging application of water to Central Texas landscapes, establishing the watering needs of native and commercially available plants, especially during drought-prone periods, would be beneficial in an environment such as Central Texas. This study exposed popular ornamental plant species to water-limiting conditions and recorded plant stress under those conditions. This information should allow consumers to choose landscape species that are best suited to their watering preferences and aesthetic needs. Proper plant selection based on watering requirements and consumer preferences or landscaping goals would facilitate greater water savings for the region.

The Drought Survivability Study (DSS), initiated by the Texas A&M Institute of Renewable Natural Resources (IRNR) and Texas Water Resources Institute (TWRI), sought to contribute to an ongoing discussion on the water needs of Central Texas landscapes.

REPORT PURPOSE AND BACKGROUND

Plant performance under drought conditions is a valued topic among scientists, landscape professionals, utilities, and citizens. This interest is driven in Central Texas by variable weather, rainfall, and a history of prolonged periods of drought. Studies such as the DSS are vital to more efficient potable water use for landscape irrigation because of the large variety of species evaluated in the research demonstration, which captures many of the plants typically used in Central Texas residential landscapes. The study's findings should allow utilities to encourage more mindful water use, increase the focus on drought-resistant plants in nurseries, and influence consumer choice for landscapes suitable for Central Texas.

Fall Obedient plant (*Physostegia virginiana*).

High quality landscaping can result in 11% to 17% returns in sales price for residential homes and higher rents for office buildings (Henry, 1999; Laverne et al., 2003; Behe et al., 2005; Stigarll and Elam, 2009). When designed properly, drought-tolerant landscapes can reduce declines in property values that result from drought or watering restriction-induced landscape mortality (Hilaire et al., 2008).

Unfortunately, drought-tolerant landscapes are still perceived as aesthetically unappealing to many consumers, thus representing a large barrier to landscape conversions (Hurd et al., 2006). Adoption of native plants by consumers was observed in Lockett et al. (2002) when selected species both conserved water and were perceived as attractive.

However, there is often an over-application of irrigation water to native ornamentals. Previous studies have reported that in some cases landscape plants receive an excessive amount of water in residential landscapes (Kjelgren et al., 2000; White et al., 2004). A quality aesthetic appearance can commonly be achieved and maintained with very little to no irrigation water with proper establishment periods and plant selection (Sachs, 1991; Shaw and Pittenger, 2004; Smeal et al., 2010). Studies suggest ornamental appearances can remain at an acceptable level over a large range of irrigation levels (Montague et al., 2007; Smeal et al., 2010).

Typically, outdoor irrigation can range from 22% to 67% of total residential water use (Duble, 2014), and landscape irrigation tends to increase substantially during (1) dry periods of the year, such as during summer, and (2) dry years, such as the drought of 2011 (Hermitte et al., 2012). This suggests that outdoor water use is a key area for potential water savings in household and commercial water use and can be realized through adjusted landscape practices.

In drought-related experiments, it is common to use irrigation treatments (Devitt et al., 1994; Costello et al., 2000; Beeson, 2006) and to compare soil volumetric moisture content with plant appearance to establish water requirement or drought tolerance (Chai et al., 2010). Evapotranspiration (ET) is a process that describes the water a plant loses through evaporation

and transpiration. ET, along with potential evapotranspiration (ETo), are used to determine irrigation rates. Potential evapotranspiration (ETo) is an estimate of ET calculated using the Penman-Montieth equation and climatic data such as temperature, dew point, wind speed, and solar radiation (Romero et al., 2010). Monthly evapotranspiration (ETo) values were considered more useful in determining landscape watering needs due to ease of application (Sachs, 1991; Devitt et al., 1994; Jones, 2004).

An investigation of experiments with ET-based irrigation treatments for grasses and ornamentals suggests treatments have used the entire range of possible ET replacement irrigation strategies from zero percent (0.0 ETo) to full evapotranspiration replacement (1.0 ETo). Pittenger et al. (2001) compared the water needs of turfgrass and groundcovers and used treatments of 0.2, 0.3, 0.4, and 0.5 ETo and concluded that four species maintained visually acceptable quality at irrigation equal to or less than warm-season turfgrass. Beeson (2006) used 0.2, 0.4, 0.6, and 0.8 ETo as irrigation treatments and was able to report similar performances between the 0.4, 0.6 and 0.8 ETo treatments. Lastly, Henson et al. (2006) used local weather data from three experimental sites with the Penman-Montieth equation for five irrigation treatments (0, 0.25, 0.50, 0.75, and 1.00 ETo) and found that the majority of species maintained acceptable appearance at 0.50 ETo and some species could perform well at 0.25 ETo. Thus, prior research demonstrates that there are species that can perform similarly between different ETo irrigation treatments and, if realized, can result in substantial water savings. It is also speculated that various plants are being over-irrigated at inefficient ETo levels, and if a sufficient ETo coefficient was identified, major water savings could be achieved while maintaining aesthetic appearances.

As a result of continued horticultural experimentation, ornamental species can be categorized and used to model accurate irrigation recommendations (Costello et al., 2000; Beeson, 2005). Focusing on the results of limited irrigation treatments can then further aid consumers and water utilities in identifying high performance species capable of maintaining aesthetic appearances while reducing outdoor water use. Given the desire for aesthetic water conservation landscaping and the potential savings from reduced outdoor water use, research and data on drought survivability for a large sample set of plants are needed. A large assessment of plants that could be maintained with little or no irrigation would be invaluable for creating a public adoption of water-conserving landscape practices (Costello, 2013).

The study identified six key measures that are important in conducting the plant demonstration study desired by the project sponsors. These measures served to frame how the research demonstration was conducted and what data were collected as part of the field trials.

1. Consumer interest in drought-resilient landscapes.
2. Recommended establishment periods.
3. Irrigation treatments that mimic both drought conditions and consumer management.
4. Establishing a visual assessment scale to document plant stress response to irrigation treatments.
5. Significance of soil moisture as a determinant of irrigation treatment and water content.
6. Use of a plant performance index to convey final results helpful to the consumer.

The Drought Simulator in San Antonio, Texas, in the neutral position prior to initiating the Drought Survivability Study.

RESEARCH MATERIALS AND METHODS

The study tested the drought survivability of 97 ornamental landscape plants (Table 1) using a four-month establishment period, a 12-week drought period, and a four-month recovery period. A review of popular ornamental landscape species in the greater San Antonio and Austin area, excluding large trees, annuals, and turf, was conducted to identify widely used and recommended landscape species for the Central Texas region.

The list was compiled using the September 2006 City of Austin, "Grow Green Native and Adapted Landscape Plants Guide," the 2005 San Antonio Water System "San Antonio Landscape Care Guide," the top sellers lists from Milberger's Landscaping and Nursery in San Antonio and Joss Growers wholesale nursery in Georgetown, TX. The compiled list was subject to the availability of the plant during the study.

Volunteers working diligently during one of the study's planting days.

Table 1. List of species included in the Drought Survivability Study.

1. Agarita (*Mahonia trifoliolata*)	36. Flowering Senna (*Senna corymbosa*)
2. American Beautyberry (*Callicarpa Americana*)	37. Four-nerve Daisy (*Tetraneuris scaposa*)
3. Anacacho Orchid (*Bauhinia lunaroides*)	38. Garden Phlox (*Phlox paniculata*)
4. Asiatic Jasmine (*Trachelospermum asiaticum*)	39. Gaura (*Gaura lindheimeri*)
5. Bat-Faced Cuphea (*Cuphea llavea*)	40. Glossy Abelia (*Abelia x grandiflora*)
6. Belinda's Dream Rose (*Rosa Belinda's Dream*)	41. Grandma's Yellow Rose (*Rosa 'Nacogdoches'*)
7. Bicolor Iris (*Dietes bicolor*)	42. Gregg Salvia (*Salvia greggii*)
8. Blackfoot Daisy (*Melampodium leucantum*)	43. Gulf Muhly-5gal (*Muhlenbergia Capillaris*)
9. Blue Grama Grass (*Bouteloua gracilis*)	44. Gulf Muhly-1 gal (*Muhlenbergia Capillaris*)
10. Blue Liriope (*Liriope muscari 'Big Blue'*)	45. Henry Duelberg Salvia (*Salvia farinacea 'Henry Duelberg'*)
11. Blue Princess Verbena (*Verbena X hybrida 'Blue Princess'*)	46. Indian Grass (*Sorghastrum nutans*)
12. Boxwood (*Buxus*)	47. Jerusalem Sage (*Phlomis fruticosa*)
13. Buford Holly (*Ilex cornuta 'Bufordii'*)	48. Knock Out Rose (*Rosa Knock Out*)
14. Bulbine (*Bulbine frutescens*)	49. Large Daylily (*Hemerocallis sp.*)
15. Butterfly Vine (*Mascagnia macroptera*)	50. Lindheimer Muhly-5gal (*Muhlenbergia lindheimeri*)
16. Carolina Jessamine Vine (*Gelsemium sempervirens*)	51. Lindheimer Muhly-1 gal (*Muhlenbergia lindheimeri*)
17. Cemetary Iris (*Iris albicans*)	52. Little Bluestem (*Schizachyrium scoparium*)
18. Cenizo (*Leucophyllum frutescens*)	53. Martha Gonzales Rose (*Rosa 'Martha Gonzalez'*)
19. Chile Pequin (*Capsicum annuum*)	54. Mexican Bush Sage (*Salvia leucantha*)
20. Compact Nandina (*Nandina domestica 'Compacta'*)	55. Mexican Dwarf Petunia (*Ruellia brittoniana*)
21. Confetti Lantana (*Lantana camara*)	56. Mexican Feathergrass (*Nassella tenuissima*)
22. Coral Honeysuckle (*Lonicera sempervirens*)	57. Mexican Honeysuckle (*Justicia spicigera*)
23. Cotoneaster (*Cotoneaster frigidus*)	58. Mexican Mint Marigold (*Tagetes lucida*)
24. Creeping Juniper (*Juniperus horizontalis*)	59. Mexican Oregano (*Lippia graveolens*)
25. Crepe Myrtle (*Lagerstroemia x. hybrid*)	60. Milkweed (*Asclepias curassavica*)
26. Cross Vine (*Bignonia capreolata*)	61. Mistflower (*Conoclinium greggii*)
27. Daylily (*Hemerocallis sp.*)	62. Monkey Grass (*Liriope sp.*)
28. Dutch Iris (*Iris hollandica*)	63. Moy Grande Hibiscus (*Hibiscus 'Moy Grande'*)
29. Dwarf Chinese Holly (*Ilex cornuta 'Rotunda'*)	64. Mutabilis Rose (*Rosa 'Mutabilis'*)
30. Dwarf Nandina (*Nandina domestica 'Firepower'*)	65. Mystic Spires Salvia (*Salvia Longispicata x farinacea*)
31. Esperanza (*Tecoma stans*)	66. New Gold Lantana (*Lantana x hybrida 'New Gold'*)
32. Evergreen Sumac (*Rhus virens*)	67. Nolina (*Nolina sp.*)
33. Fall Aster (*Symphyotrichum oblongifolium*)	68. Oleander (*Nerium oleander*)
34. Fall Obedient Plant (*Physostegia virginiana*)	69. Photina (*Photinia sp.*)
35. Firebush (*Hamelia patens*)	70. Pittosporum (*Pittosporum sp.*)

Table 1 continued. List of species included in the Drought Survivability Study.

71. Plumbago (*Plumbago auriculata*)	85. Sandankwa Viburnum (*Viburnum suspensum*)
72. Pomegranate (*Punica granatum*)	86. Santolina (*Santolina chamaecyparissus*)
73. Possumhaw Holly (*Ilex decidua*)	87. Skullcap (*Scutellaria suffrutescens*)
74. Pride of Barbados (*Caesalpinia pulcherrima*)	88. Society Garlic (*Tulbaghia violacea*)
75. Primrose Jasmine (*Jasminum mesnyi*)	89. Texas Mountain Laurel (*Sophora secundiflora*)
76. Prostrate Rosemary (*Rosmarinus officinalis 'Prostratus'*)	90. Texas Sotol (*Dasylirion texanum*)
77. Purple Coneflower (*Echinacea purpurea*)	91. Thyrallis (*Galphimia glauca*)
78. Purple Fountaingrass (*Pennisetum setaceum 'Rubrum'*)	92. Turk's Cap (*Malvaviscus arboreus*)
79. Purple Heart (*Tradescantia pallida*)	93. Variegated Liriope (*Liriope muscari 'Variegata'*)
80. Red Yucca (*Hesperaloe parviflora*)	94. Viburnum Tinus (*Vibarnum tinus*)
81. Rock Rose (*Pavonia lasiopetala*)	95. Yaupon Holly (*Ilex vomitoria*)
82. Rosemary (*Rosmarinus officinalis*)	96 Yellow Columbine (*Aquilegia chrysantha*)
83. Sabal Minor Palm (*Sabal minor*)	97. Zexmania (*Wedelia texana*)
84. Sago Palm (*Cycas revoluta*)	

Drought Simulator Operation

Plant studies within greenhouse environments are common; however, an outdoor study to test plant survivability and environmental factors, such as rainfall, sunlight, humidity, and evapotranspiration, will produce conditions relevant to landscapers, home consumers, and water purveyors (Costello, 2013).

The outdoor turfgrass study, "Evaluation of Sixty-Day Drought Survival in San Antonio of Established Turfgrass Species and Cultivars," conducted in 2008 by Texas A&M AgriLife Extension Service (formerly Texas AgriLife Extension Service), used irrigation treatments to test drought survivability of established turfgrass species and cultivars with a visual appearance rating system that tracked leaf firing, turfgrass quality, color, and percent groundcover. The present study expands upon the goals and ambitions of that study by testing a large selection of ornamental plants.

The experiment was conducted in Lewisville silty clay (fine-silty, mixed, thermic Udic Calciustolls). The experimental area was a 5,000-square-foot demonstration site, divided into four even plots and equipped with a drought simulator (i.e. moveable roof).

The soil in all four plots was lightly tilled to reduce compaction and minimize root growth restrictions. Two plots were positioned on each side of a moveable roof with 2-foot rows surrounding each plot. The roof was activated during rain events and moved to completely cover plots 1 and 2 (Figure 1).

Roof Operation

With the help of the San Antonio River Authority (SARA), the roof was programmed to move when activated by a rain sensor. The roof moved to cover treatments 0.0 ETo and 0.2 ETo within two minutes of 0.05 inches of rainfall being detected. After thirty minutes of zero precipitation detection, the roof returned to neutral position. Covering plots 1 and 2 allowed irrigation treatments to remain as close as possible to true drought treatments of 0.0 ETo and 0.2 ETo (Figure 1). The entire demonstration was bordered by concrete barriers on the north and south sides while the west and east sides sloped gently away from plots to reduce runoff entering the plot area.

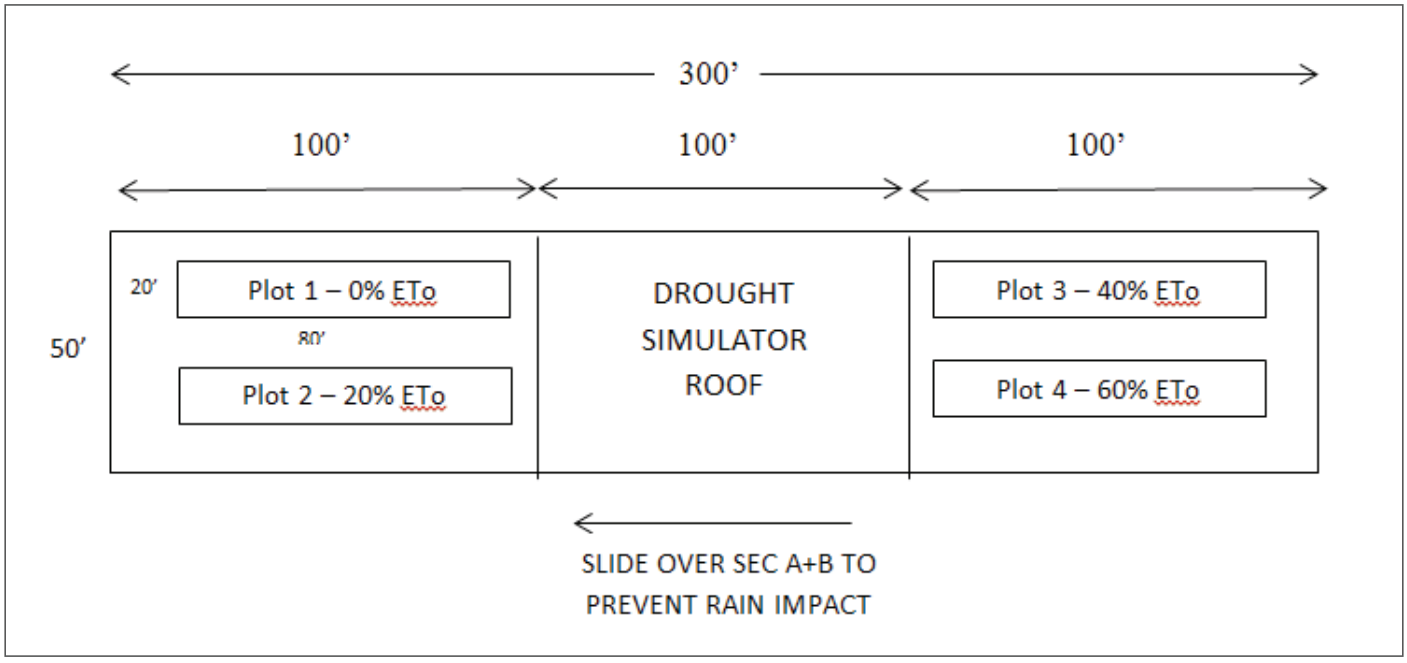

Figure 1. Roof diagram and plot layout.

Irrigation was applied using drip irrigation with 2-gallon emitters installed in each plot. Species were planted at ground level without any restrictions to soil depth. Each species had a 4 foot by 4 foot block (Figure 2) within each plot with four plants spaced evenly within, for a total of 1552 plants. Plants were spaced to mimic crowded residential landscape conditions, with typical root competition. To control for the effects of root competition, placement of plant species blocks was replicated in each plot, so that every species shared the same neighbor in each treatment. Each plot was its own irrigation zone so that runtimes could be adjusted to apply irrigation treatments independently.

Daylily (*Hemerocallis sp.*).

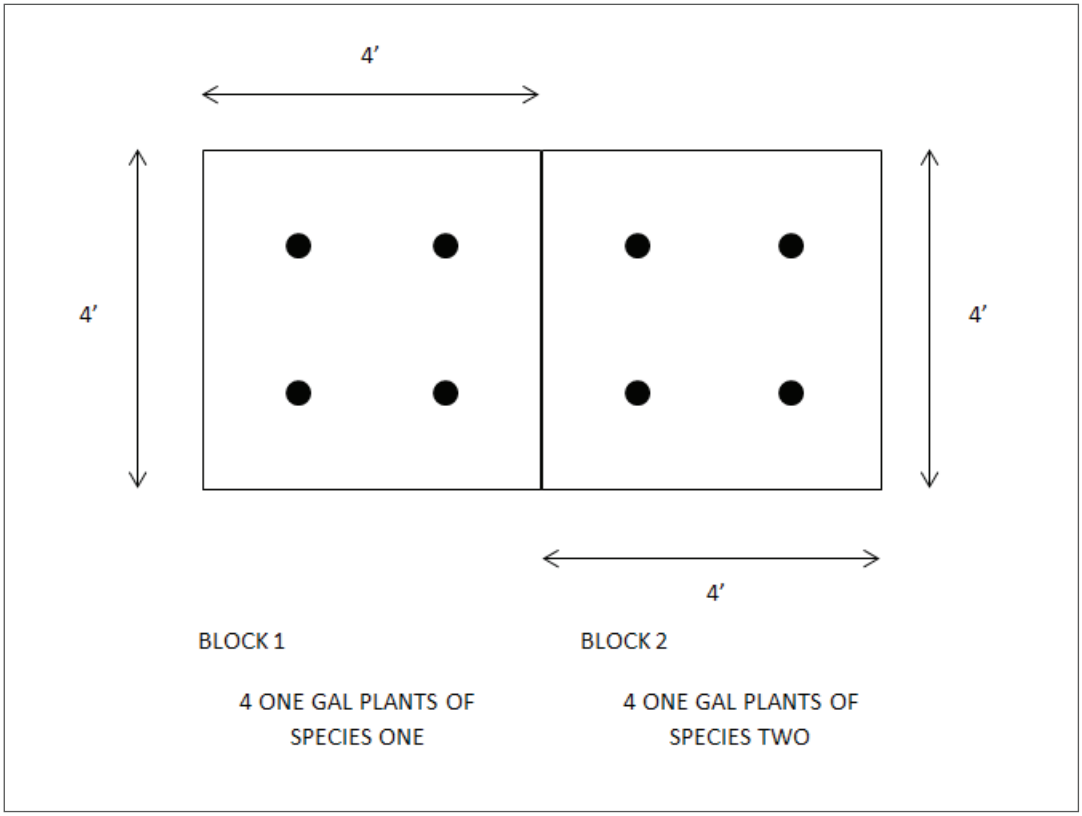

Figure 2. Diagram showing two different species in 4′ x 4′ blocks.

Research Plot Management

Establishment Period

After a plant is moved to a new environment, an establishment period is used to avoid moisture stress and promote plant growth after planting. It is the process of allowing a plant to establish or re-establish a normal, spreading root system to reduce stress and increase survival (Watson, 2000). This period involves supplemental irrigation and effective weed management to allow the shoot and trunk growth rates to match the rates before the plant was transplanted (Gilman, 2007). Maintaining high levels of irrigation and reducing water loss through groundcover such as mulch also encourages root growth and quicker establishment (Montague et al., 2007). Thus, proper establishment will increase planting success.

The establishment period began in February 2015 and continued until July 2015. During the establishment period, glyphosate was applied in each plot using wick applicators and sprayed around the perimeter of the treatment site to control unwanted vegetation. Routine mowing, chemical treatments, and hand weeding along with 2 to 3 inches of mulch in each plot resulted in successful weed management. Based on a soil test result, nitrogen soil treatment was applied to the 0.4 ETo plot to normalize soils at the start of the initial drought treatment in June 2015. Nitrogen was applied at the surface and left to allow irrigation to move it into the soils. The establishment period was initially planned to terminate in June 2015, but because of inclement weather and excessive rainfall with a period of a non-functional roof, the establishment period was extended through July 2015 (Figure 3).

Figure 3. Plots 0.0 ETo and 0.2 ETo at the end of establishment period.

Weather Station Data

Climatological data was obtained from the San Antonio North weather station for ETo estimates using the Penman-Montieth equation (Montieth, 1965) obtained from the Texas ETo network, rainfall, and minimum and maximum temperatures (Figure 4, 5 and 6). The data was used to calculate irrigation times for each ETo treatment.

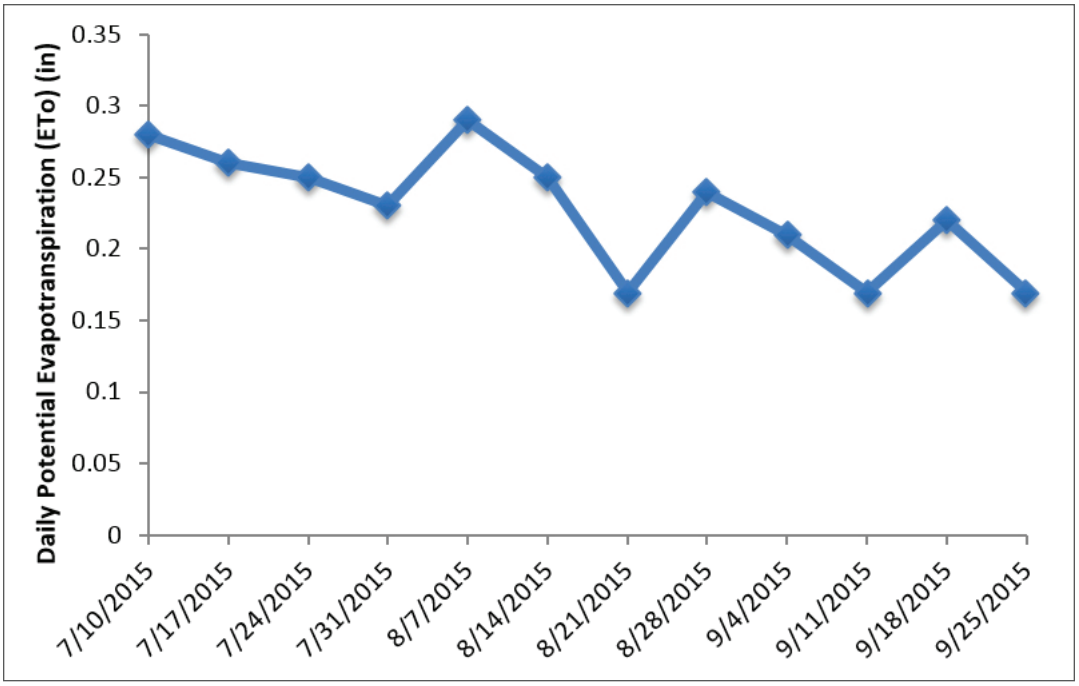

Figure 4. Weekly ETo during the 12-week drought treatment period in 2015.

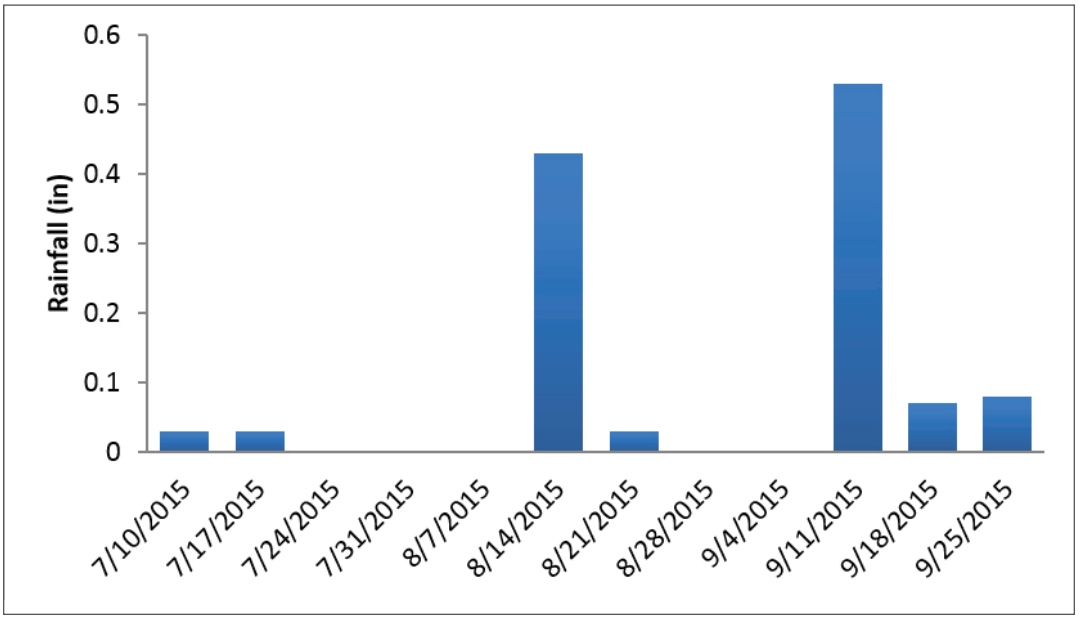

Figure 5. Weekly Rainfall from 10 July 2015 - 29 September 2015.

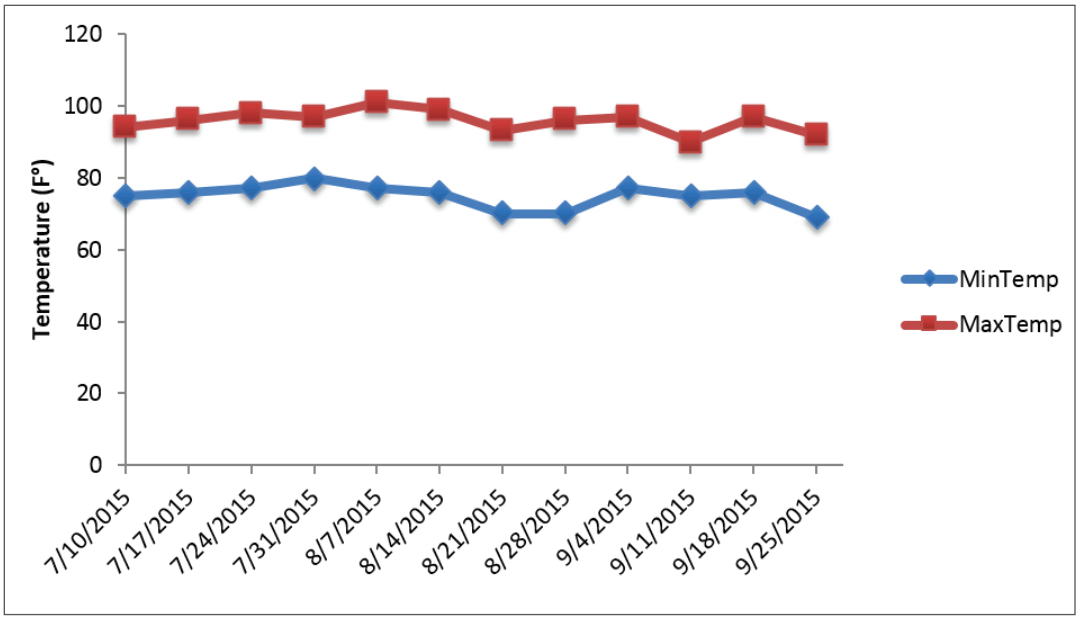

Figure 6. The minimum and maximum temperatures during the 12-week drought treatment period.

Drought Treatment Period

Four irrigation treatments were calculated using ETo data from the Texas ET Network. ETo data from the San Antonio weather station was assumed to represent 100% evapotranspiration for San Antonio, so irrigation was applied as percentages of this ETo.

Based on our literature review, we used treatments of 0.6, 0.4, 0.2, and 0.0 of total ETo. Irrigation was set at the beginning of each month and then adjusted to account for monthly rainfall or higher ETo. Every plant was irrigated using a 2-gallon per hour drip emitter so varying run times in each of the four plots controlled irrigation volume. During the 12-week treatment period, with the exception of the 0.0 ETo plot, all plots were irrigated twice a week at 7:00 AM. Rainfall was also added to the total water received in treatments 0.4 and 0.6 ETo since the roof did not cover these plots during rain events.

Total irrigation over the course of the experiment differed slightly from target treatments due to equipment failures at the Drought Simulator site that occurred in mid-July, which shut down the irrigation system for three irrigation events. The largest volume of irrigation loss was the 0.6 plot. As a result, actual percent ETo received and ETo treatments differed slightly (Table 2). Actual percent ETo irrigated was calculated using total inches irrigated in each plot based on runtimes over total ETo for the treatment period.

Table 2. Total irrigation and ETo irrigated in each plot over treatment period.

	0.6 ETo	0.4 ETo	0.2 ETo
Total Irrigation and precipitation (inches)	10.4	7.2	3.9
Total Irrigation and precipitation (gallons/per plant)	25	17	9
Actual ETo received	0.55	0.38	0.20

Amy Truong at the DSS site.

Recovery Period

The recovery period began in December 2015 and continued until March 2016. Irrigation was turned off for all plots, and the roof remained in a neutral position so that plants only received natural rainfall. Plants were given the opportunity to recover following the drought treatment period under natural conditions.

Data Collection

For the drought treatment period, appearance, soil moisture, and infrared thermometer data were collected weekly. The DSS team as well as Bexar County Master Gardeners, landscaping professionals, and San Antonio residents all with some horticultural experience volunteered throughout the 12-week treatment period. Data was collected every Friday during the treatment period. Plant stress is commonly gauged using physiological or appearance measures (Chaves et al., 2002; Chalmers et al., 2008; Domenghini et al., 2013). Studies typically use a 1-9 scale or a 1-5 scale from low to high aesthetic quality to assess appearances of plants (Pittenger et al., 2001, 2009; Henson et al., 2006; Scheiber et al., 2007, 2008; Domenghini et al., 2013). In this study, appearance ratings were designed so that each plant was rated by three separate evaluators each week on an appearance data collection sheet. Raters looked at plants by row (**Appendix A**). Appearance ratings were assessed based on a scale of 0-5 where (0) dead, (1) defoliated, (2) leaf drop, (3) wilt, (4) stable, and (5) lush (**Appendix B**). All evaluators used their own judgment to ensure an unbiased and objective assessment of the treatments.

Soil moisture data was measured in volumetric water content, which is generally considered an accepted physiological water stress measurement (Jones, 2004, 2007; Chai et al., 2010). Volumetric soil moisture content was measured using a FieldScout TDR (time-domain measurement technology) 100 Soil Moisture Meter with 3-inch probes for 11 indicator-plants every week during the duration of the project (**Appendix C and D**). The indicator plants were randomized within each plot to generate weekly average soil moisture values. The volumetric soil moisture measurements for indicator plants were used to assess the effects of each irrigation treatment during the drought period.

Leaf temperature is an indicator of plant stress. Plant temperature rises as soil moisture decreases to the point that stomatal conductance is limited and evaporative cooling is reduced (Hatfield, 1990; Havaux, 1992; Jones, 1999; Damour et al., 2010). Environmental factors, such as humidity and wind, can skew the relationship between soil water availability and plant temperature. Due to unpredictable outdoor weather, cloud cover, and temperature changes, Infrared (IR) temperature data was not collected on every data collection day. For the purpose of this report, IR data was excluded due to their unreliability.

We collected monthly appearance and soil moisture data for the four-month recovery period. The same appearance guidelines were used to record plant appearances in all plots during the unirrigated period. Using these procedures, we collected data and then compiled results comprehensively to look at plant performance at the end of the drought treatment and then by three-week intervals to monitor plant decline.

RESULTS

Soil Moisture Content during Drought Treatment

Average soil moisture content was measured using soil moisture data collected in each plot every week from 12 June 2015 to 25 September 2015 (Figure 7). The first spike on 19 June 2015 was the result of a rain event that occurred while the roof was nonfunctional, so the period before was considered a part of the establishment period and the study only includes 10 July 2015 onward (Figure 8).

There were two rain events during the drought treatment. The roof malfunctioned during one of the rain events on 14 August 2015 but sheltered the plants during the second major rain event on 11 September 2015 (Figure 5). The rain on 14 August 2015 caused an increase in volumetric moisture content (Figure 8). Precipitation from this event was added equally across irrigation treatments to limit the impact on irrigation treatment effectiveness since volumetric moisture differences continued to be observed after 14 August 2015.

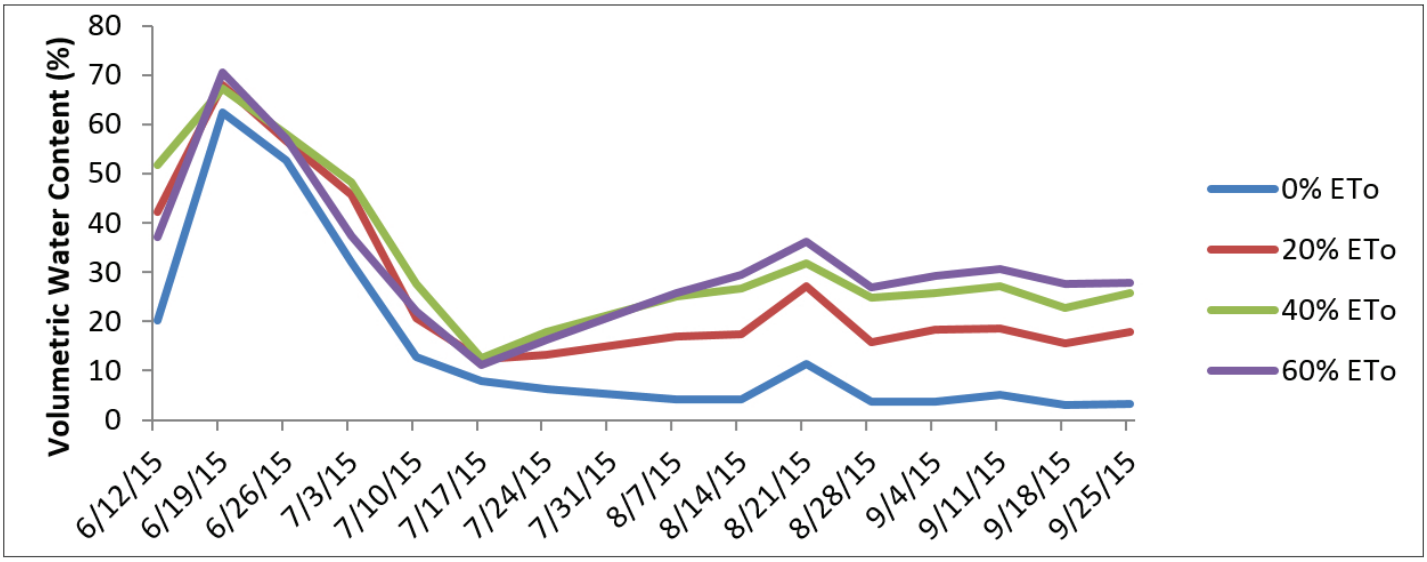

Figure 7. Soil moisture levels by irrigation treatments from 12 June 2015 to 25 September 2015.

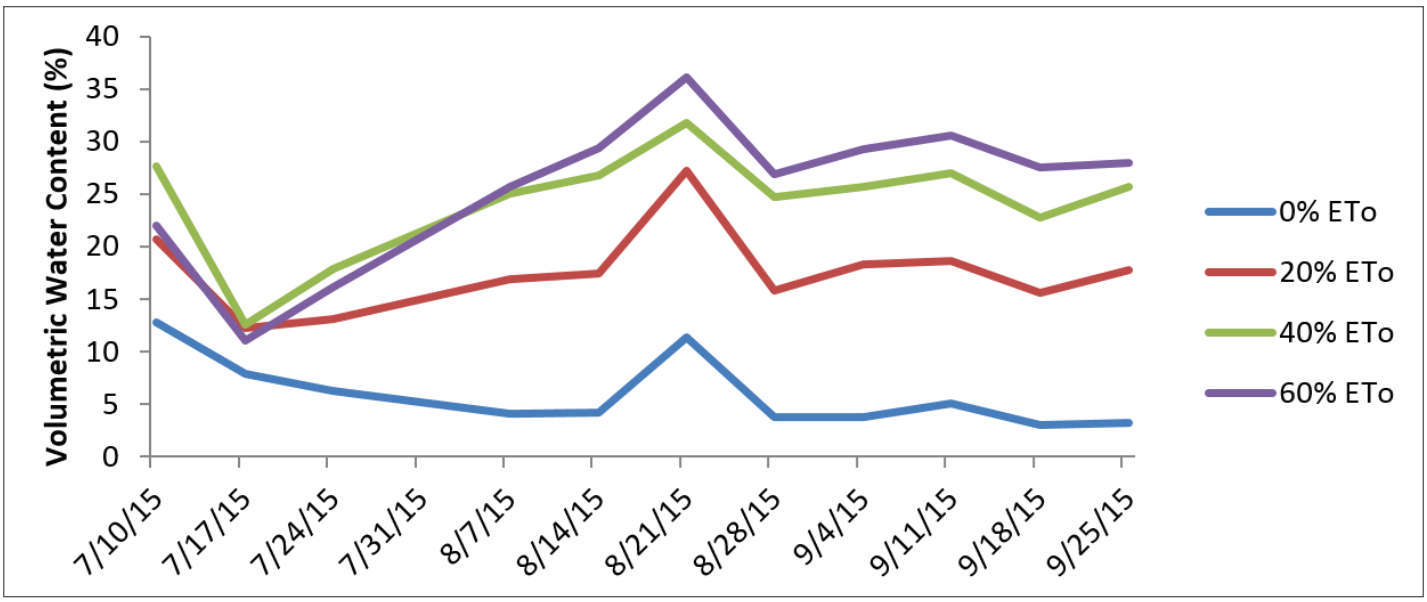

Figure 8. Soil moisture levels by irrigation treatments from 10 July 2015 to 25 September 2015.

Average Appearance during Drought Treatment

Appearance values were used to monitor the effect of different irrigation levels on plant species during the treatment period. The following scale was used to assess appearance, and volunteers were given detailed descriptions to try to standardize rating scale: (5) new growth, (4) stable, (3) wilt, (2) leaf drop, (1) defoliated and (0) dead. This scale was used to approximate consumer reactions to plant appearance. The rating system proved sensitive enough to capture changes in plant performance that occurred following the rain event. A slight increase in the overall appearances was observed during 28 August 2015 but had limited impact on overall performance over time (Figure 9). Patterns in each treatment remained consistent over time.

Overall performance of all species as measured by appearance differed significantly between all treatments except between 0.6 ETo and 0.4 ETo ($p < 0.05$), as shown in Table 3. The study used log-transformed, (Log (x+1)), appearance values due to unequal variances. Mean plant appearance for 0.4 and 0.6 ETo differed only by 0.032. This close relationship is also observed over time in Figure 8. Within the 0.2 ETo treatment, the plants consistently performed between appearance values 3 (wilt) and 4 (stable). Plants in 0.0 ETo treatment, or no irrigation, declined at a rate of 59% during the drought treatment period. The impacts on plots at the end of the drought treatment period were apparent in overall appearances (Figure 10).

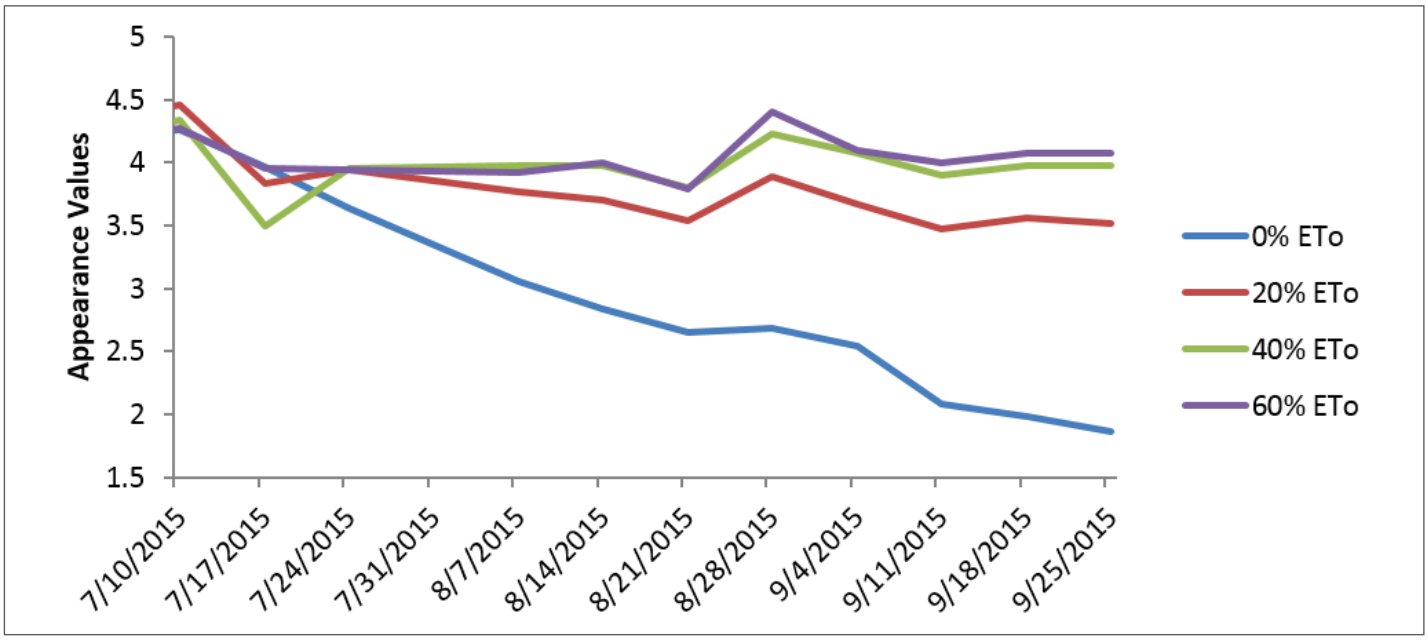

Figure 9. Average appearance rating for all plants within irrigation treatments from 10 July 2015 to 25 September 2015.

Table 3. Mean appearance values for all plants in four irrigation treatments.

Treatment				Mean
0.6 ETo	A			4.064
0.4 ETo	A			4.030
0.2 ETo		B		3.784
0.0 ETo			C	2.916

*Treatments not connected by the same letter are significantly different ($p<0.05$).

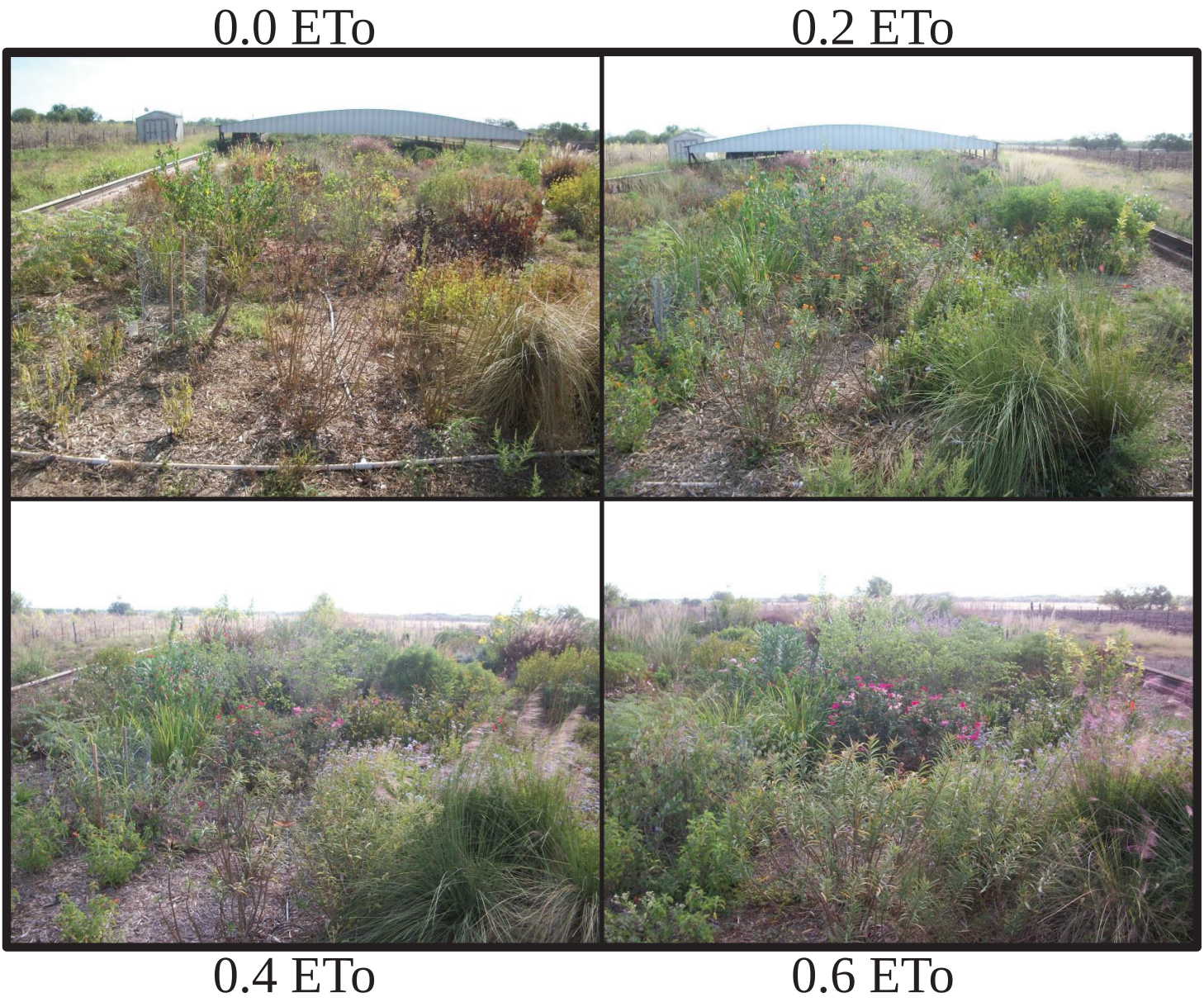

Figure 10. Overview of plant condition at the end of the drought treatment period.

PLANT PERFORMANCE INDEX (PPI)

A Plant Performance Index (PPI) was created to compare highest and lowest performing species for each treatment. A performance index is a useful measure in counting the number of times an entry occurred in the top statistical group across all parameters (Wherley et al., 2011; Zhang et al., 2016). This method is useful to compare the performance of multiple plants and provides a more easily understood visual assessment of various treatments. Similarly performing plants in each respective treatment are grouped together.

Plants that died during the establishment period or did not survive before the treatment period were considered "missing values." Missing values were replaced with the average appearance rating for the remaining plants of that species in its respective treatment for that week. If a species did not have any remaining plants for any individual treatment at the end of the establishment period or before the treatment period started, the species was excluded from the results. For the purpose of the study, appearance values stable (4) and lush (5) represent the highest performing plants. The appearance values dead (0), defoliated (1), leaf drop (2), and wilt (3) were assumed to represent plant performance that would be undesirable in a typical landscape.

Once missing values were addressed, a categorical function was used to create a maximum count value. The maximum count value indicates the highest number of (4) and (5) appearance values for the species in that treatment for that period. For example, a species in the 0.6 ETo treatment has a maximum count value of 144 because within the 12-week period in this treatment, there were a maximum of 144 values of (4) and (5) from three different raters for that species (e.g. 3 separate appearance ratings*4 plants per species*12 weeks = 144 possible values of (4) or (5)).

Next, quartiles of the maximum count value were determined to create four colored tiers of performance (Figure 11). The first tier are plants that performed in the top 25% quartile, the second tier performed in the top 50% quartile, and the third tier performed in the top 75% quartile.

The four treatment columns in the PPI (Figure 12) represent plant performances in each respective treatment over the entire 12-week period. The last column, ALL, lists the highest performing plants across all treatments over the treatment period. The ALL column may be considered representative plant performance in varying water-limiting environments across Central Texas. An index with plant performance listed by plant in alphabetical order can be found in Appendix III.

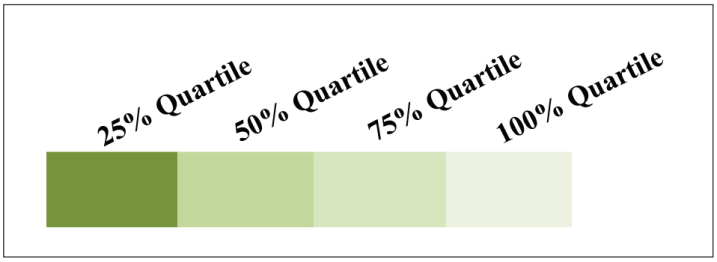

Figure 11. Color legend for performance quartiles.

0% ETo		20% ETo		40% ETo		60% ETo		ALL	
Cenizo	125	Esperanza	144	Boxwood	144	Boxwood	144	Confetti Lantana	564
Chile Pequin	114	Flowering Senna	144	Gaura	144	Confetti Lantana	144	Gaura	558
Confetti Lantana	137	Gulf Muhly One	144	Lindheimer Muhly	144	Cotoneaster	144	Oleander	551
Esperanza	104	Lindheimer Muhly One	144	Mistflower	144	Firebush	144	Lindheimer Muhly One	548
Fall Aster	113	Santolina	144	New Gold Lantana	144	Lindheimer Muhly One	144	Pride of Barbados	545
Flowering Senna	119	Texas Sotol	144	Pomegranate	144	Mistflower	144	Flowering Senna	544
Gaura	135	Mistflower	143	Purple Fountain-grass	144	Pomegranate	144	Gulf Muhly	539
Gulf Muhly	138	Confetti Lantana	141	Cotoneaster	143	Pride of Barba-dos	144	Gulf Muhly One	538
Gulf Muhly One	119	Crepe Myrtle	141	Flowering Senna	143	Turks Cap	144	Cenizo	533
Henry Duelberg Salvia	132	Little Bluestem	141	Lindheimer Muhly One	143	Crepe Myrtle	143	Mistflower	533
Lindheimer Muhly One	117	Cotoneaster	140	Mexican Feather-grass	143	Esperanza	143	Esperanza	531
Mexican Bush Sage	113	Mexican Bush Sage	140	Yaupon Holly	143	Gaura	143	Texas Sotol	530
Mexican Feather-grass	108	Pomegranate	140	Cenizo	142	Gulf Muhly One	143	Rock Rose (x2)	524.5
Mystic Spires Salvia	123	Gulf Muhly	139	Confetti Lantana	142	Lindheimer Muhly	143	Mexican Bush Sage	524
Oleander	134	Indian Grass	139	Mexican Honey-suckle	142	Milkweed	143	Turks Cap	523
Pride of Barbados	130	Pride of Barbados	139	Butterfly Vine	141	Purple Fountain-grass	143	Mexican Feather-grass	521
Red Yucca	113	Bicolor Iris	138	Daylily	141	Bicolor Iris	142	Santolina	519
Rock Rose (x2)	114.5	Chile Pequin	138	Little Bluestem	141	Butterfly Vine	142	Red Yucca	516
Texas Sotol	138	Firebush	138	Rock Rose (x2)	141	Mutabilis Rose	142	Butterfly Vine	512
Turks Cap	120	Mexican Honey-suckle	138	Cross Vine	140	Evergreen Sumac	141	Fall Aster	510
Mistflower	102	Knock Out Rose	137	Esperanza	140	Red Yucca	141	Little Bluestem	510
Indian Grass	99	Oleander	137	Indian Grass	140	Santolina	141	Mystic Spires Salvia	510
Santolina	98	Purple Heart	137	Oleander	140	Mexican Bush Sage	140	Bicolor Iris	508
Zexmania	97	Red Yucca	137	Belindas Dream Rose	139	Oleander	140	Henry Duelberg Salvia	507
Butterfly Vine	96	Gaura	136	Moy Grande Hi-biscus	139	Mystic Spires Salvia	139	Indian Grass	507
New Gold Lantana	96	Mexican Feather-grass	136	Sabal Minor Palm	139	Sabal Minor Palm	139	New Gold Lantana	507
Little Bluestem	94	Belindas Dream Rose	135	Firebush	137	Fall Aster	138	Cotoneaster	500
Bicolor Iris	93	Cenizo	135	Texas Sotol	137	Flowering Senna	138	Purple Fountain-grass	499
Mutabilis Rose	93	Rock Rose (x2)	134.5	Knock Out Rose	136	Purple Heart	138	Chile Pequin	498

Figure 12. Overall Plant Performance Index (PPI) over the 12-week drought treatment period.

Purple Fountain-grass	93	Butterfly Vine	133	Purple Heart	136	Sandankwa Viburnum	138	Purple Heart	495
Texas Mountain Laurel	90	New Gold Lantana	132	Santolina	136	Bulbine	137	Sabal Minor Palm	491
Moy Grande Hibiscus	89	Turks Cap	132	Thyrallis	136	Compact Nandina	137	Mutabilis Rose	476
Sabal Minor Palm	85	Mutabilis Rose	131	Asiatic Jasmine	135	Henry Duelberg Salvia	137	Zexmania	476
Purple Heart	84	Large Daylily	130	Bicolor Iris	135	Knock Out Rose	137	Lindheimer Muhly	473
Cotoneaster	73	Martha Gonzales Rose	129	Fall Aster	135	Mexican Honeysuckle	137	Knock Out Rose	466
Anacacho Orchid	70	Skullcap	129	Henry Duelberg Salvia	134	Daylily	136	Mexican Honeysuckle	465
Mexican Dwarf Petunia	69	Sabal Minor Palm	128	Mexican Dwarf Petunia	134	Skullcap	136	Pomegranate	461
Lindheimer Muhly	62	Compact Nandina	126	Gulf Muhly	133	Agarita	135	Firebush	460
Milkweed	61	Zexmania	126	Martha Gonzales Rose	133	Coral Honeysuckle	135	Mexican Dwarf Petunia	460
Bulbine	56	Boxwood	124	Milkweed	133	Mexican Dwarf Petunia	135	Belindas Dream Rose	455
Knock Out Rose	56	Fall Aster	124	Photina	133	New Gold Lantana	135	Boxwood	448
Skullcap	54	Lindheimer Muhly	124	Gulf Muhly One	132	Rosemary	135	Skullcap	448
Daylily	52	Thyrallis	124	Mystic Spires Salvia	132	Rock Rose (x2)	134.5	Cross Vine	436
Belindas Dream Rose	51	Cross Vine	123	Pride of Barbados	132	Cross Vine	134	Daylily	433
Gregg Salvia	51	Mexican Dwarf Petunia	122	Blackfoot Daisy	131	Little Bluestem	134	Martha Gonzales Rose	432
Evergreen Sumac	50	Evergreen Sumac	119	Mexican Bush Sage	131	Mexican Feathergrass	134	Thyrallis	432
Large Daylily	50	Purple Fountain-grass	119	Chile Pequin	130	Photina	134	Large Daylily	430
Compact Nandina	49	Photina	117	Sandankwa Viburnum	130	Martha Gonzales Rose	133	Anacacho Orchid	427
Plumbago	49	Mystic Spires Salvia	116	Skullcap	129	Cenizo	131	Evergreen Sumac	424
Mexican Honeysuckle	48	Moy Grande Hibiscus	115	Blue Grama Grass	127	Asiatic Jasmine	130	Crepe Myrtle	420
Blackfoot Daisy	46	Yaupon Holly	113	Turks Cap	127	Belindas Dream Rose	130	Photina	420
Mexican Mint Marigold	43	Buford Holly	111	Large Daylily	126	Thyrallis	130	Bulbine	417
Society Garlic	43	Anacacho Orchid	108	Rosemary	126	Gulf Muhly	129	Moy Grande Hibiscus	417
Thyrallis	42	Bulbine	106	Zexmania	126	Indian Grass	129	Compact Nandina	411
Firebush	41	Daylily	104	Red Yucca	125	Yaupon Holly	129	Yaupon Holly	407
Cross Vine	39	Grandmas Yellow Rose	104	Anacacho Orchid	122	Anacacho Orchid	127	Milkweed	406
Martha Gonzales Rose	37	Henry Duelberg Salvia	104	Bulbine	118	Zexmania	127	Texas Mountain Laurel	386

Figure 12 continued. Overall Plant Performance Index (PPI) over the 12-week drought treatment period.

Boxwood	36	American Beauty-berry	101	Jerusalem Sage	118	Large Daylily	124	Asiatic Jasmine	376
Photina	36	Texas Mountain Laurel	96	Plumbago	117	Plumbago	124	Plumbago	374
Blue Grama Grass	35	Jerusalem Sage	95	Primrose Jasmine	115	Bat Faced Cuphea	120	Rosemary	374
Sandankwa Viburnum	35	Rosemary	90	Evergreen Sumac	114	Buford Holly	120	Sandankwa Viburnum	362
Bat Faced Cuphea	34	Blue Grama Grass	88	Four Nerve Daisy	112	Chile Pequin	116	Buford Holly	352
Jerusalem Sage	34	Asiatic Jasmine	85	Mutabilis Rose	110	Blackfoot Daisy	115	Jerusalem Sage	349
Pomegranate	33	Fall Obedient Plant	84	Crepe Myrtle	105	Four Nerve Daisy	115	Blue Grama Grass	327
Monkey Grass	32	Plumbago	84	Grandmas Yellow Rose	104	Carolina Jessamine Vine	111	Primrose Jasmine	326
Crepe Myrtle	31	Cemetary Iris	83	American Beauty-berry	101	Texas Sotol	111	Gregg Salvia	321
Fall Obedient Plant	31	Gregg Salvia	81	Buford Holly	101	Primrose Jasmine	110	Blackfoot Daisy	318
Primrose Jasmine	31	Four Nerve Daisy	74	Dutch Iris	100	Mexican Mint Marigold	107	Four Nerve Daisy	316
Sago Palm	29	Coral Honeysuckle	73	Compact Nandina	99	Blue Princess Verbena	105	Coral Honeysuckle	313
Blue Liriope	28	Blue Liriope	72	Gregg Salvia	98	Texas Mountain Laurel	105	Fall Obedient Plant	311
Blue Princess Verbena	28	Prostrate Rosemary	71	Bat Faced Cuphea	95	Fall Obedient Plant	104	American Beauty-berry	304
Asiatic Jasmine	26	Primrose Jasmine	70	Texas Mountain Laurel	95	Jerusalem Sage	102	Grandmas Yellow Rose	301
Coral Honeysuckle	25	Milkweed	69	Fall Obedient Plant	92	Viburnum Tinus	101	Agarita	292
American Beauty-berry	24	Dutch Iris	66	Agarita	89	Cemetary Iris	91	Bat Faced Cuphea	283
Glossy Abelia	24	Sago Palm	64	Possumhaw Holly	84	Gregg Salvia	91	Mexican Mint Marigold	268
Variegated Liriope	24	Possumhaw Holly	61	Carolina Jessamine Vine	82	Sago Palm	89	Sago Palm	262
Dutch Iris	23	Sandankwa Viburnum	59	Coral Honeysuckle	80	Possumhaw Holly	81	Carolina Jessamine Vine	257
Rosemary	23	Carolina Jessamine Vine	58	Sago Palm	80	Grandmas Yellow Rose	80	Dutch Iris	255
Possumhaw Holly	22	Agarita	57	Cemetary Iris	77	American Beautyberry	78	Cemetary Iris	254
Viburnum Tinus	22	Society Garlic	50	Prostrate Rosemary	76	Blue Grama Grass	77	Possumhaw Holly	248
Yaupon Holly	22	Mexican Mint Marigold	49	Monkey Grass	71	Glossy Abelia	75	Society Garlic	217
Buford Holly	20	Monkey Grass	42	Mexican Mint Marigold	69	Moy Grande Hibiscus	74	Viburnum Tinus	207
Four Nerve Daisy	15	Nolina	41	Glossy Abelia	62	Dutch Iris	66	Blue Princess Verbena	201
Grandmas Yellow Rose	13	Variegated Liriope	40	Society Garlic	59	Society Garlic	65	Monkey Grass	195

Figure 12 continued. Overall Plant Performance Index (PPI) over the 12-week drought treatment period.

Nolina	12	Viburnum Tinus	38	Mexican Oregano	58	Nolina	58	Glossy Abelia	191
Purple Coneflower	12	Bat Faced Cuphea	34	Dwarf Chinese Holly	49	Dwarf Nandina	56	Prostrate Rosemary	176
Agarita	11	Blue Princess Verbena	33	Variegated Liriope	46	Variegated Liriope	50	Blue Liriope	171
Mexican Oregano	9	Glossy Abelia	30	Viburnum Tinus	46	Garden Phlox	48	Variegated Liriope	160
Dwarf Nandina	8	Blackfoot Daisy	26	Purple Coneflower	39	Monkey Grass	48	Nolina	138
Dwarf Chinese Holly	7	Purple Coneflower	24	Blue Princess Verbena	35	Blue Liriope	43	Dwarf Nandina	116
Carolina Jessamine Vine	6	Yellow Columbine	24	Dwarf Nandina	33	Pittosporum	33	Mexican Oregano	106
Cemetary Iris	3	Mexican Oregano	20	Pittosporum	33	Purple Coneflower	30	Purple Coneflower	105
Yellow Columbine	3	Dwarf Nandina	19	Garden Phlox	31	Creeping Juniper	29	Garden Phlox	97
Prostrate Rosemary	2	Garden Phlox	18	Blue Liriope	28	Prostrate Rosemary	27	Dwarf Chinese Holly	81
Creeping Juniper	2	Creeping Juniper	13	Creeping Juniper	28	Mexican Oregano	19	Pittosporum	78
Garden Phlox	0	Dwarf Chinese Holly	12	Nolina	27	Yellow Columbine	19	Creeping Juniper	72
Pittosporum	0	Pittosporum	12	Yellow Columbine	25	Dwarf Chinese Holly	13	Yellow Columbine	71

Figure 12 continued. Overall Plant Performance Index (PPI) over the 12-week drought treatment period.

Plants such as Oleander (*Nerium oleander*) and Anacacho orchid (*Bauhinia lunaroides*) performed in the top 25% quartile across ALL treatments. They maintained drought-resilient performances until the end of the treatment period (Figure 13 and 14). Oleander had 551 counts and is ranked high within the quartile; additionally, Anacacho orchid performed similarly with 427 counts despite being ranked lower in the quartile.

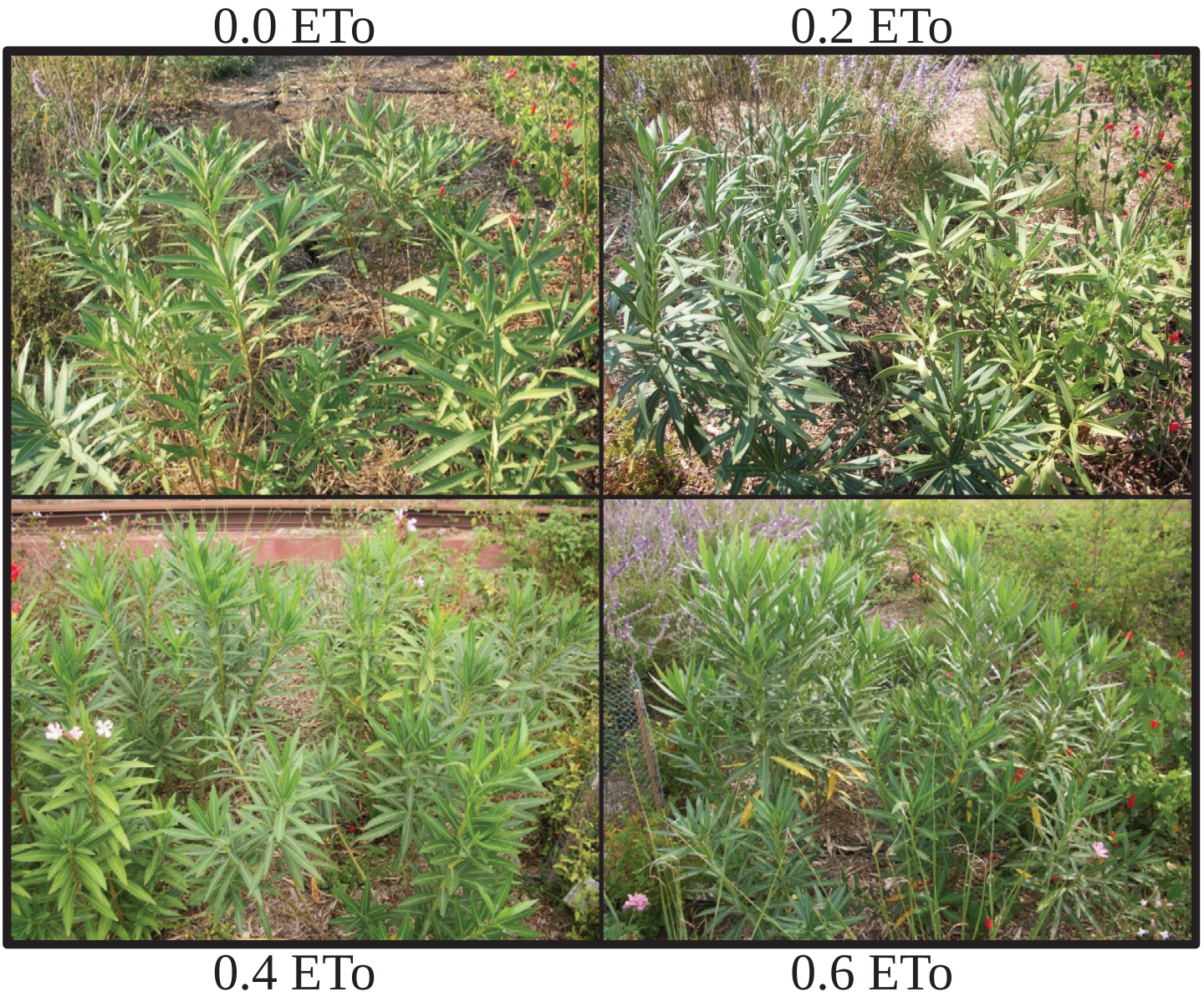

Figure 13. Oleander (*Nerium oleander*) at the end of the drought treatment period.

In the 0.0 ETo treatment, 21% of plants performed in the top quartile, whereas 37% of plants performed in the lowest quartile. As percentage ETo irrigation increased, the percentage of plants in the top quartile increased while the percentage of plants in the last quartile decreased. As more irrigation was applied, most plants such as Bat-faced Cuphea (*Cuphea llavea*) responded with increased performance (Figure 15). Fall Aster (*Symphyotrichum oblongifolium*) remained in the top 25% quartile in all treatments and responded with increased blooms as more irrigation was applied (Figure 16).

These performances indicate some plants can thrive in water-limiting environments whereas some may show signs of wilt and/or have decreased aesthetic appeal such as a reduction in flower production. As a result, plants that performed in the top 25% quartile in the 0.0 ETo treatment can be expected to withstand a 12-week drought period with no supplemental irrigation. These plants are especially valuable during drought periods and can potentially reduce peak water demands for water purveyors.

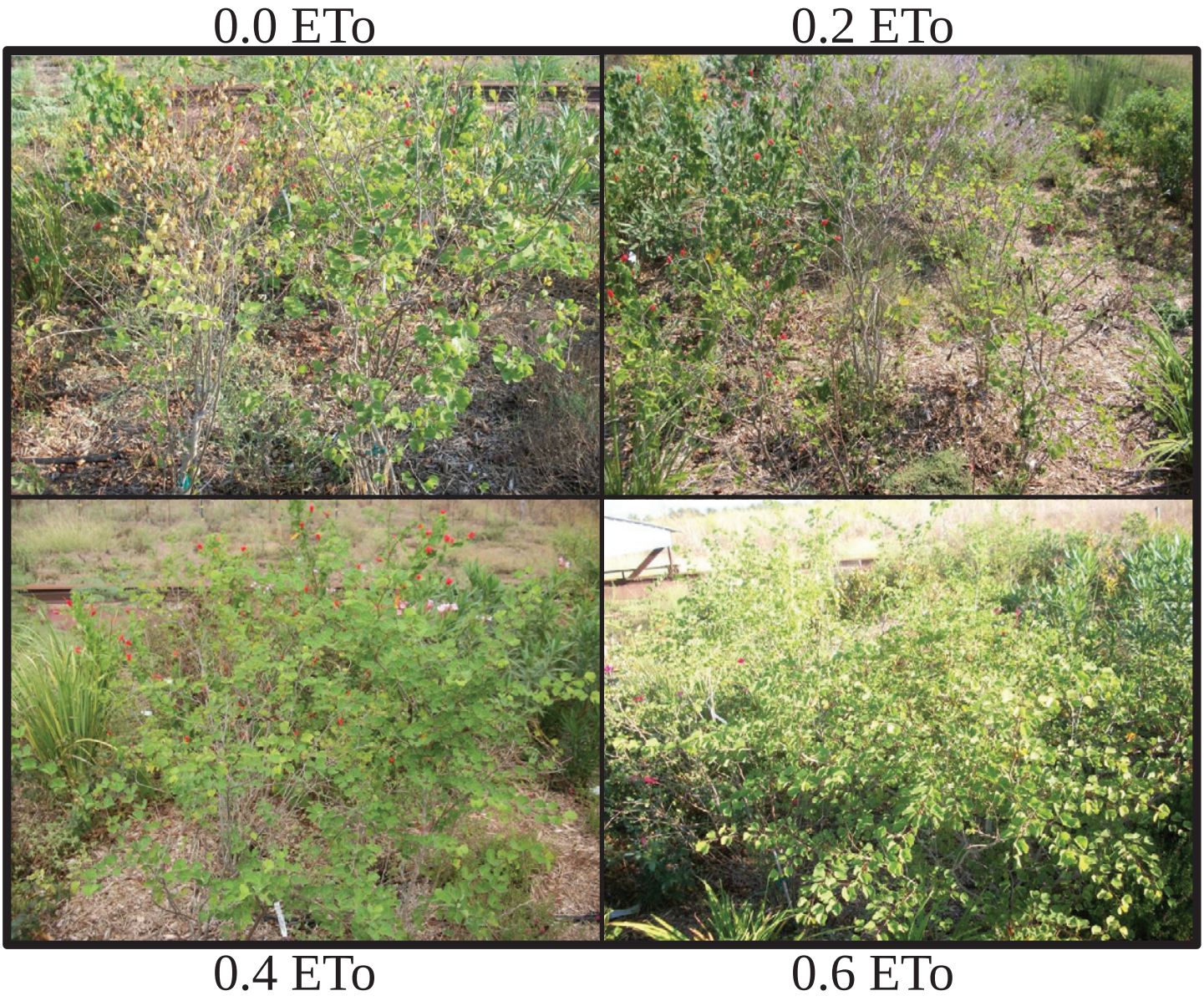

Figure 14. Anacacho Orchid (*Bauhinia lunaroides*) at the end of the drought treatment period.

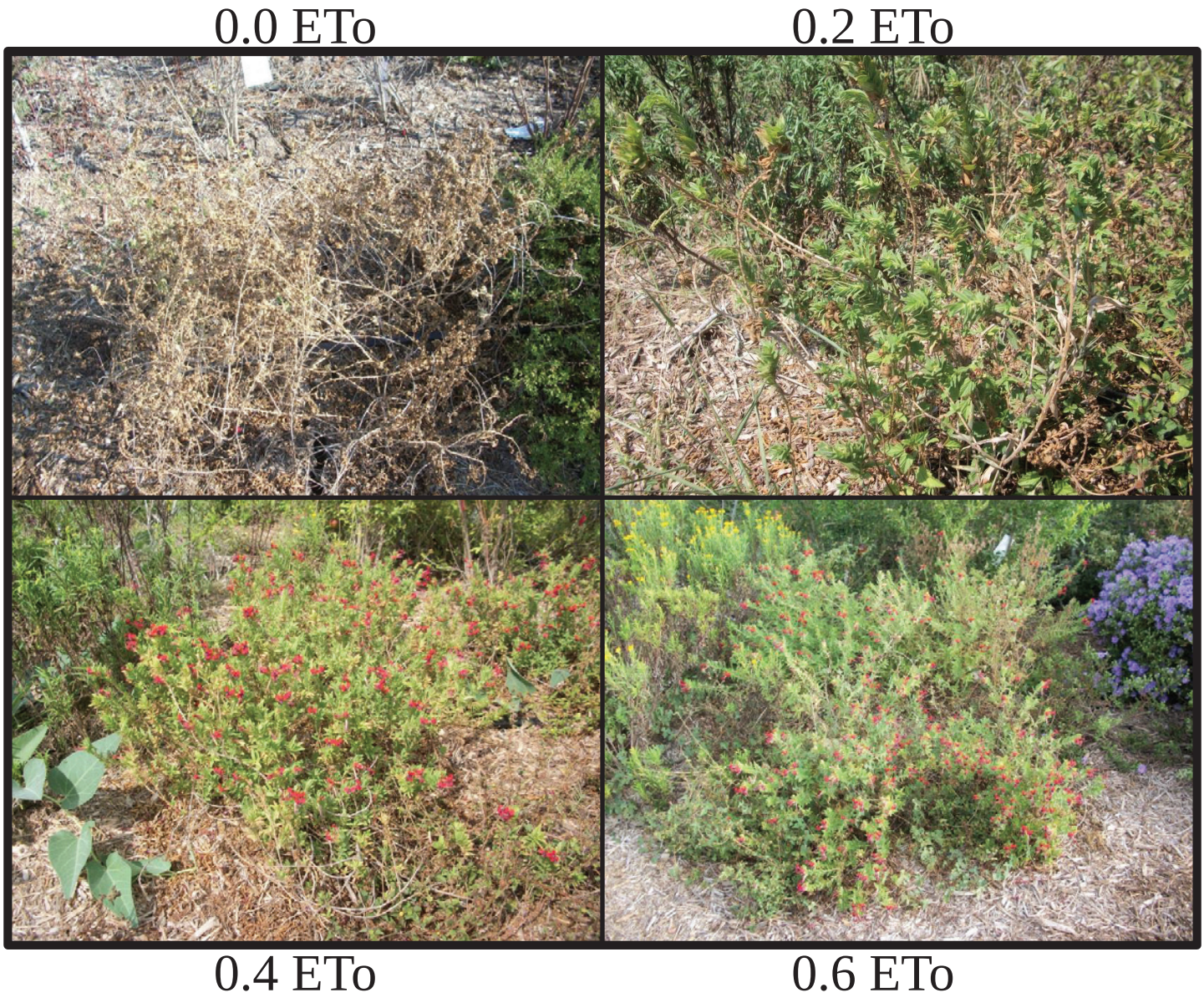

Figure 15. Bat-faced Cuphea (*Cuphea llavea*) at the end of the drought treatment period.

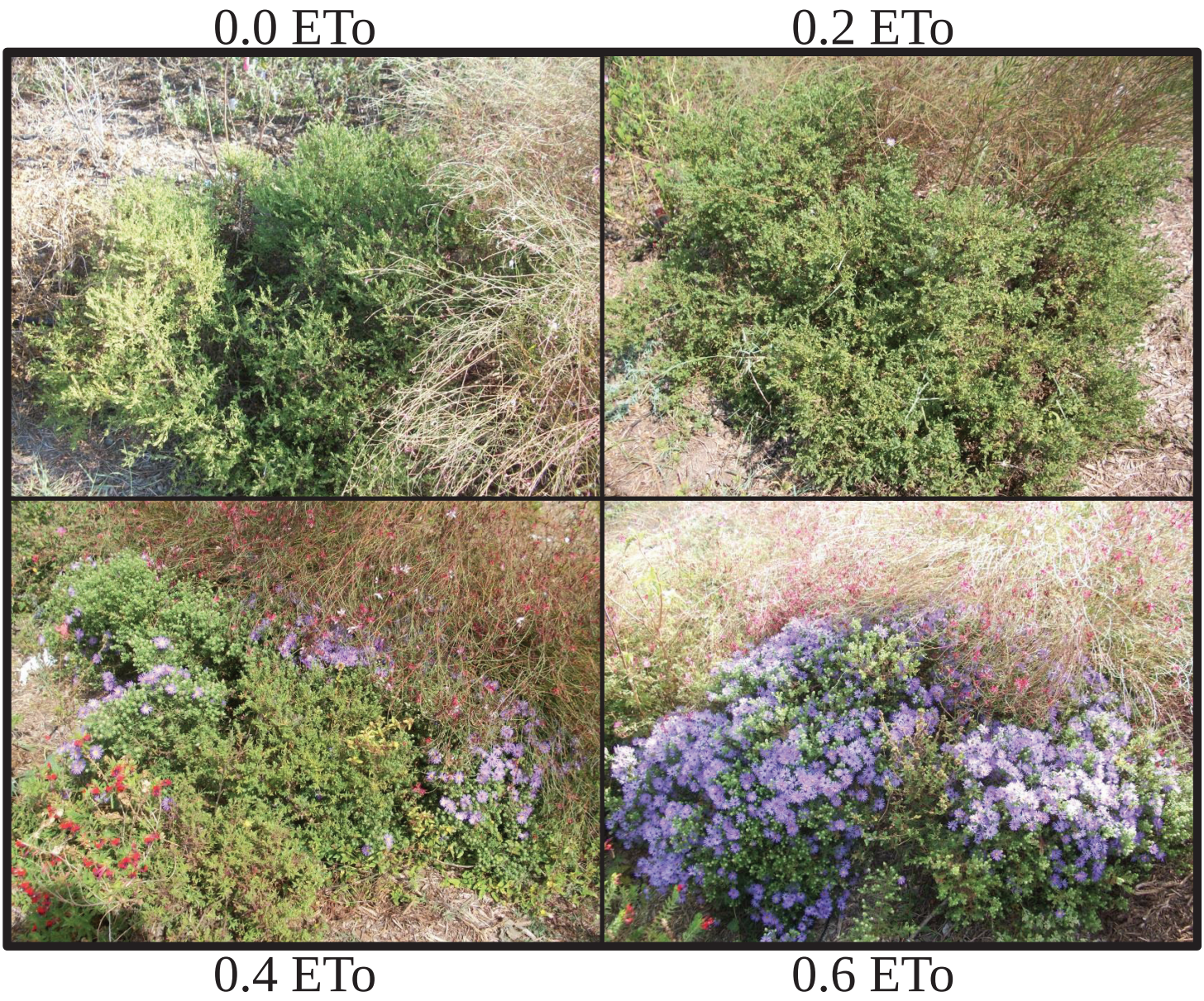

Figure 16. Fall Aster (*Symphyotrichum oblongifolium*) at the end of the drought treatment period.

As referenced in Table 3, overall plant performance assessments among treatments 0.4 ETo and 0.6 ETo are not significantly different ($p<0.05$). The mean appearance ratings for all plants over the 12-week drought treatment period are similar (0.4 ETo = 4.030 and 0.6 ETo = 4.064). In Figure 11, the 0.4 ETo treatment had 65% of plants perform in the top 25% quartile and while the 0.6 ETo treatment had 69% of plants performing in the same quartile. Similarly, 8.2% of plants performed in the last quartile in the 0.4 ETo treatment and in the 0.6 ETo treatment, 7.2% of plants performed in the last quartile. These performances indicate that similar overall plant performances could be achieved with a lower ETo treatment and result in substantial water savings. A 0.4 ETo irrigation regime represented a savings of 8 gallons or 3.2 inches of irrigated water per plant when compared to the 0.6 ETo plot over the 12-week period of this study.

This was observed with species such as Henry Duelberg Salvia (*Salvia farinacea 'Henry Duelberg'*) and Jerusalem Sage (*Phlomis fruticose*), which maintained similar performances in treatments 0.4 ETo and 0.6 ETo (Figure 17 and Figure 18).

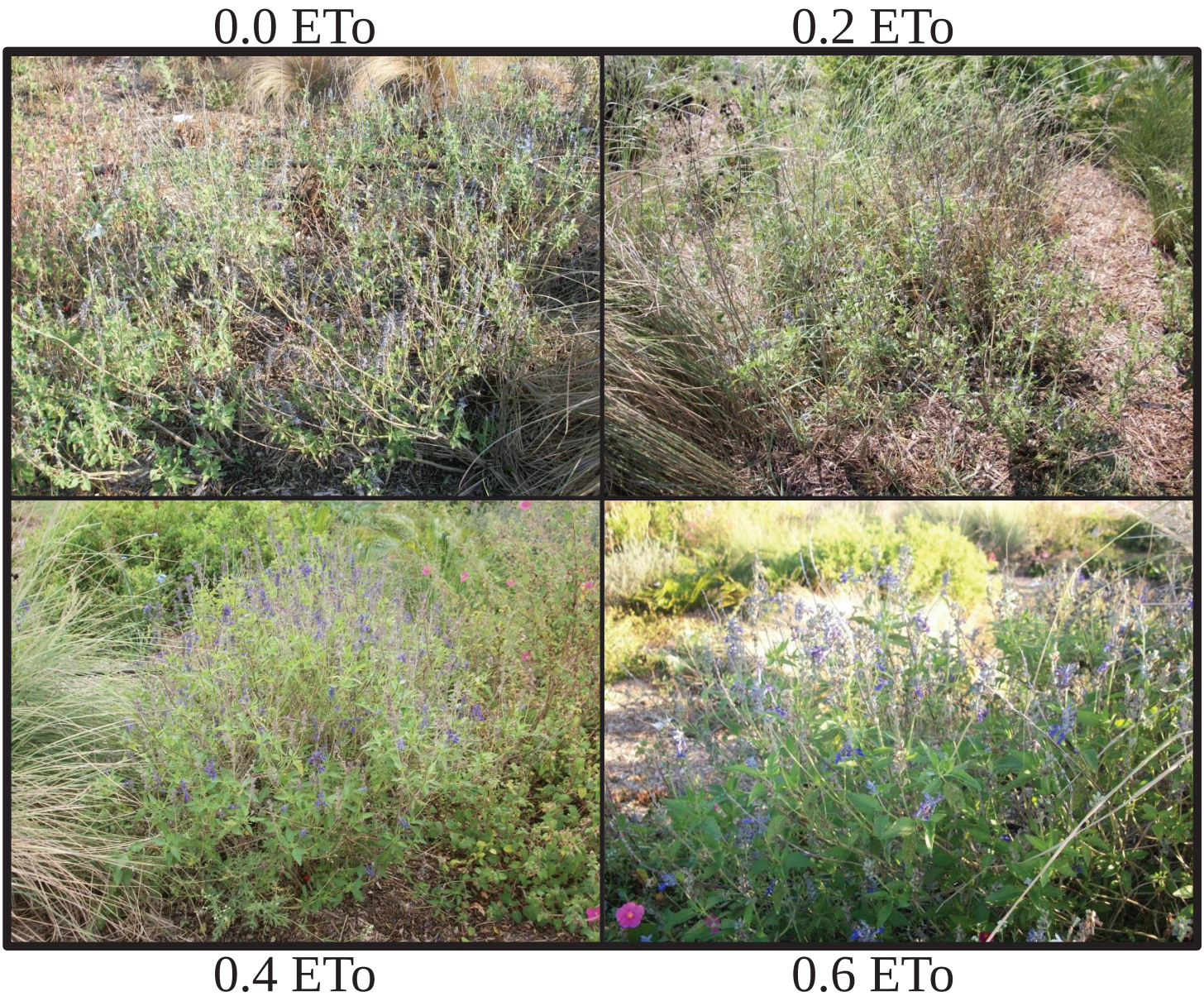

Figure 17. Plant performance of Henry Duelberg Salvia (*Salvia farinacea 'Henry Duelberg'*) at the end of the drought treatment period.

Figure 18. Plant performance of Jerusalem Sage (*Phlomis fruticose*) at the end of the drought treatment period.

Plant Performance Index in Three-Week Intervals

The study also examined plant performance for each treatment in three-week intervals. An advantage of this is the ability to monitor plants that remained in the top quartile or if their performance decreased when they dropped to the next quartile. For the 0.0 ETo treatment, there is a consistent decrease in plants in the top quartile over time. Conversely, the percentage of plants in the last quartile consistently increased over time (Figure 19).

In the 0.2 ETo treatment, a steep decrease of plants in the top quartile was observed after the first three weeks followed by a consistent percentage of plants in the top quartile for the remaining nine weeks (Figure 20). For both the 0.4 ETo and 0.6 ETo treatments, a consistent performance was maintained throughout the treatment period (Figure 21 and 22).

A comprehensive PPI by three-week intervals is listed in alphabetical order in Appendix E, F, H, I, and J.

7/10-7/24		7/31-8/14		8/21-9/4		9/11-9/25	
0% ETo		0% ETo		0% ETo		0% ETo	
Cotoneaster	36	Confetti Nandina	36	Gulf Muhly	36	Four Nerve Daisy	36
Daylily	36	Flowering Senna	36	Henry Duelberg Salvia	36	Gaura	36
Esperanza	36	Gaura	36	Mystic Spires Salvia	36	Oleander	36
Fall Aster	36	Gulf Muhly	36	Oleander	36	Texas Sotol	35
Flowering Senna	36	Mutabilis Rose	36	Cenizo	33	Gulf Muhly	32
Henry Duelberg Salvia	36	Oleander	36	Pride of Barbados	33	Henry Duelberg Salvia	28
Lindheimer Muhly	36	Zexmania	36	Texas Sotol	33	Turks Cap	28
Lindheimer Muhly One	36	Indian Grass	35	Lindheimer Muhly One	32	Cenizo	27
Little Bluestem	36	Little Bluestem	35	Turks Cap	32	Pride of Barbados	27
Mexican Bush Sage	36	Pride of Barbados	35	Confetti Nandina	31	Butterfly Vine	24
Mexican Feathergrass	36	Texas Sotol	35	Gaura	31	Gulf Muhly One	24
Mistflower	36	Fall Aster	34	Gulf Muhly One	31	Mexican Bush Sage	24
Moy Grande Hibiscus	36	Lindheimer Muhly One	34	Mexican Bush Sage	30	Red Yucca	24
Mystic Spires Salvia	36	Rock Rose (x2)	34	Texas Mountain Laurel	30	Chile Pequin	21
Purple Fountaingrass	36	Cenizo	32	Flowering Senna	29	Santolina	21
Rock Rose (x2)	36	Henry Duelberg Salvia	32	Red Yucca	29	Mystic Spires Salvia	20
Skullcap	36	Mistflower	32	Rock Rose (x2)	29	Texas Mountain Laurel	20
Bicolor Iris	35	Mystic Spires Salvia	31	Chile Pequin	28	Flowering Senna	18
Chile Pequin	35	Purple Fountaingrass	31	Fall Aster	27	Mexican Feathergrass	17
Confetti Lantana	35	Chile Pequin	30	Mistflower	27	Fall Aster	16
Pride of Barbados	35	Esperanza	30	Indian Grass	25	Purple Fountaingrass	16
Texas Sotol	35	Gulf Muhly One	30	Mexican Feathergrass	25	Sabal Minor Palm	16
Zexmania	35	Mexican Feathergrass	30	Esperanza	24	Rock Rose (x2)	15.5
Compact Nandina	34	Cotoneaster	29	Santolina	24	Lindheimer Muhly One	15
Gulf Muhly	34	Red Yucca	29	Butterfly Vine	23	New Gold Lantana	15
Gulf Muhly One	34	Turks Cap	28	New Gold Lantana	23	Bicolor Iris	14

Figure 19. PPI for 0% ETo in three-week intervals.

Indian Grass	34	Purple Heart	27	Moy Grande Hibiscus	22	Esperanza	14
Mexican Honeysuckle	34	Santolina	26	Mutabilis Rose	22	Zexmania	12
New Gold Lantana	34	Bicolor Iris	24	Bicolor Iris	20	Little Bluestem	11
Sabal Minor Palm	34	Mexican Dwarf Petunia	24	Purple Heart	16	Moy Grande Hibiscus	11
Cenizo	33	New Gold Lantana	24	Sabal Minor Palm	14	Anacacho Orchid	10
Purple Heart	33	Mexican Bush Sage	23	Zexmania	14	Purple Heart	8
Butterfly Vine	32	Milkweed	23	Anacacho Orchid	12	Mistflower	7
Gaura	32	Bulbine	22	Little Bluestem	12	Dutch Iris	5
Knock Out Rose	32	Sabal Minor Palm	21	Mexican Dwarf Petunia	10	Gregg Salvia	5
Mexican Dwarf Petunia	32	Moy Grande Hibiscus	20	Purple Fountaingrass	10	Indian Grass	5
Mutabilis Rose	32	Anacacho Orchid	19	Evergreen Sumac	9	Blue Grama Grass	4
Photina	32	Large Daylily	19	Blue Grama Grass	8	Knock Out Rose	4
Sandankwa Viburnum	32	Texas Mountain Laurel	19	Cotoneaster	8	Lindheimer Muhly	4
Thyrallis	32	Knock Out Rose	18	Milkweed	8	Blackfoot Daisy	3
Turks Cap	32	Skullcap	18	Plumbago	8	Large Daylily	3
Blackfoot Daisy	31	Butterfly Vine	17	Sago Palm	8	Mexican Dwarf Petunia	3
Crepe Myrtle	31	Gregg Salvia	16	Bulbine	7	Milkweed	3
Red Yucca	31	Mexican Mint Marigold	16	Lindheimer Muhly	7	Mutabilis Rose	3
Belindas Dream Rose	30	Society Garlic	16	Belindas Dream Rose	5	Plumbago	3
Firebush	30	Belindas Dream Rose	15	Compact Nandina	4	Confetti Nandina	2
Anacacho Orchid	29	Lindheimer Muhly	15	Firebush	4	Daylily	2
Cross Vine	29	Evergreen Sumac	14	Photina	4	Belindas Dream Rose	1
Fall Obedient Plant	29	Plumbago	14	Blackfoot Daisy	3	Blue Liriope	1
Gregg Salvia	29	Daylily	12	Blue Liriope	3	Blue Princess Verbena	1
Monkey Grass	29	Mexican Honeysuckle	12	Pomegranate	3	Evergreen Sumac	1
Bat Faced Cuphea	28	Compact Nandina	11	Society Garlic	3	Pomegranate	1
Boxwood	28	Cross Vine	10	Bat Faced Cuphea	2	Agarita	0
Large Daylily	28	Blackfoot Daisy	9	Blue Princess Verbena	2	American Beautyberry	0
Martha Gonzales Rose	28	Blue Liriope	9	Daylily	2	Asiatic Jasmine	0
Primrose Jasmine	28	Blue Princess Verbena	9	Knock Out Rose	2	Bat Faced Cuphea	0
Bulbine	27	Martha Gonzales Rose	9	Mexican Honeysuckle	2	Boxwood	0
Santolina	27	Thyrallis	9	Dutch Iris	1	Buford Holly	0
Asiatic Jasmine	26	Boxwood	8	Gregg Salvia	1	Bulbine	0
Evergreen Sumac	26	Jerusalem Sage	8	Mexican Mint Marigold	1	Carolina Jessamine Vine	0
Jerusalem Sage	26	Blue Grama Grass	7	Thyrallis	1	Cemetary Iris	0
Mexican Mint Marigold	26	Firebush	7	Agarita	0	Compact Nandina	0
Oleander	26	Pomegranate	7	American Beautyberry	0	Coral Honeysuckle	0
Coral Honeysuckle	25	Monkey Grass	5	Asiatic Jasmine	0	Cotoneaster	0
American Beautyberry	24	Bat Faced Cuphea	4	Boxwood	0	Creeping Juniper	0

Figure 19 continued. PPI for 0% ETo in three-week intervals.

Plumbago	24	Buford Holly	4	Buford Holly	0	Crepe Myrtle	0
Society Garlic	24	Dutch Iris	4	Carolina Jessamine Vine	0	Cross Vine	0
Variegated Liriope	24	Glossy Abelia	4	Cemetary Iris	0	Dwarf Chinese Holly	0
Pomegranate	22	Possumhaw Holly	4	Coral Honeysuckle	0	Dwarf Nandina	0
Viburnum Tinus	22	Rosemary	4	Creeping Juniper	0	Fall Obedient Plant	0
Yaupon Holly	22	Sago Palm	4	Crepe Myrtle	0	Firebush	0
Texas Mountain Laurel	21	Primrose Jasmine	3	Cross Vine	0	Garden Phlox	0
Glossy Abelia	20	Sandankwa Viburnum	3	Dwarf Chinese Holly	0	Glossy Abelia	0
Rosemary	19	Fall Obedient Plant	2	Dwarf Nandina	0	Grandmas Yellow Rose	0
Possumhaw Holly	18	Nolina	2	Fall Obedient Plant	0	Jerusalem Sage	0
Sago Palm	17	Four Nerve Daisy	1	Four Nerve Daisy	0	Martha Gonzales Rose	0
Blue Grama Grass	16	Grandmas Yellow Rose	1	Garden Phlox	0	Mexican Honeysuckle	0
Blue Princess Verbena	16	Mexican Oregano	1	Glossy Abelia	0	Mexican Mint Marigold	0
Buford Holly	16	Agarita	0	Grandmas Yellow Rose	0	Mexican Oregano	0
Blue Liriope	15	American Beauty-berry	0	Jerusalem Sage	0	Monkey Grass	0
Four Nerve Daisy	14	Asiatic Jasmine	0	Large Daylily	0	Nolina	0
Dutch Iris	13	Carolina Jessamine Vine	0	Martha Gonzales Rose	0	Photina	0
Grandmas Yellow Rose	12	Cemetary Iris	0	Mexican Oregano	0	Pittosporum	0
Purple Coneflower	12	Coral Honeysuckle	0	Monkey Grass	0	Possumhaw Holly	0
Agarita	11	Creeping Juniper	0	Nolina	0	Primrose Jasmine	0
Nolina	10	Crepe Myrtle	0	Pittosporum	0	Prostrate Rosemary	0
Dwarf Nandina	8	Dwarf Chinese Holly	0	Possumhaw Holly	0	Purple Coneflower	0
Mexican Oregano	8	Dwarf Nandina	0	Primrose Jasmine	0	Rosemary	0
Dwarf Chinese Holly	7	Garden Phlox	0	Prostrate Rosemary	0	Sago Palm	0
Milkweed	7	Photina	0	Purple Coneflower	0	Sandankwa Viburnum	0
Carolina Jessamine Vine	6	Pittosporum	0	Rosemary	0	Skullcap	0
Cemetary Iris	3	Prostrate Rosemary	0	Sandankwa Viburnum	0	Society Garlic	0
Yellow Columbine	3	Purple Coneflower	0	Skullcap	0	Thyrallis	0
Creeping Juniper	2	Variegated Liriope	0	Variegated Liriope	0	Variegated Liriope	0
Prostrate Rosemary	2	Viburnum Tinus	0	Viburnum Tinus	0	Viburnum Tinus	0
Garden Phlox	0	Yaupon Holly	0	Yaupon Holly	0	Yaupon Holly	0
Pittosporum	0	Yellow Columbine	0	Yellow Columbine	0	Yellow Columbine	0

Figure 19 continued. PPI for 0% ETo in three-week intervals.

7/10-7/24		7/31-8/14		8/21-9/4		9/11-9/25	
20% ETo		20% ETo		20% ETo		20% ETo	
Bicolor Iris	36	Bicolor Iris	36	Belindas Dream Rose	36	Butterfly Vine	36
Boxwood	36	Chile Pequin	36	Cenizo	36	Cotoneaster	36
Cotoneaster	36	Cotoneaster	36	Confetti Nandina	36	Esperanza	36
Crepe Myrtle	36	Esperanza	36	Crepe Myrtle	36	Firebush	36
Esperanza	36	Fall Aster	36	Esperanza	36	Flowering Senna	36
Flowering Senna	36	Flowering Senna	36	Flowering Senna	36	Gulf Muhly	36
Gaura	36	Gulf Muhly	36	Gulf Muhly	36	Gulf Muhly One	36
Gulf Muhly One	36	Gulf Muhly One	36	Gulf Muhly One	36	Large Daylily	36
Henry Duelberg Salvia	36	Indian Grass	36	Indian Grass	36	Lindheimer Muhly One	36
Lindheimer Muhly	36	Lindheimer Muhly One	36	Large Daylily	36	Little Bluestem	36
Lindheimer Muhly One	36	Mexican Feather-grass	36	Lindheimer Muhly One	36	Mexican Bush Sage	36
Mexican Bush Sage	36	New Gold Lantana	36	Little Bluestem	36	Mexican Honeysuckle	36
Mexican Feathergrass	36	Oleander	36	Mexican Bush Sage	36	Mistflower	36
Mistflower	36	Pomegranate	36	Mexican Feathergrass	36	Mutabilis Rose	36
Mystic Spires Salvia	36	Pride of Barbados	36	Mexican Honeysuckle	36	Oleander	36
Photina	36	Santolina	36	Mistflower	36	Pomegranate	36
Pride of Barbados	36	Texas Sotol	36	New Gold Lantana	36	Santolina	36
Purple Fountaingrass	36	Belindas Dream Rose	35	Oleander	36	Texas Sotol	36
Purple Heart	36	Confetti Nandina	35	Pomegranate	36	Confetti Nandina	35
Red Yucca	36	Crepe Myrtle	35	Pride of Barbados	36	Martha Gonzales Rose	35
Rock Rose (x2)	36	Firebush	35	Red Yucca	36	Zexmania	35
Sabal Minor Palm	36	Gaura	35	Santolina	36	Cenizo	34
Santolina	36	Little Bluestem	35	Skullcap	36	Crepe Myrtle	34
Texas Sotol	36	Mistflower	35	Texas Sotol	36	Purple Heart	34
Butterfly Vine	35	Purple Fountaingrass	35	Turks Cap	36	Chile Pequin	33
Confetti Nandina	35	Purple Heart	35	Chile Pequin	35	Knock Out Rose	33
Fall Aster	35	Knock Out Rose	34	Knock Out Rose	35	Turks Cap	33
Indian Grass	35	Rock Rose (x2)	34	Bicolor Iris	34	Bicolor Iris	32
Knock Out Rose	35	Cenizo	33	Butterfly Vine	33	Compact Nandina	32
Skullcap	35	Red Yucca	33	Firebush	33	Gaura	32
Yaupon Holly	35	Boxwood	32	Gaura	33	Indian Grass	32
Bulbine	34	Compact Nandina	32	Rock Rose (x2)	32.5	Lindheimer Muhly	32
Chile Pequin	34	Cross Vine	32	Cotoneaster	32	Red Yucca	32
Firebush	34	Lindheimer Muhly	32	Evergreen Sumac	32	Rock Rose (x2)	32
Little Bluestem	34	Mexican Bush Sage	32	Grandmas Yellow Rose	32	Sabal Minor Palm	32
Mexican Honeysuckle	34	Mexican Honey-suckle	32	Moy Grande Hibiscus	32	Thyrallis	32
Asiatic Jasmine	33	Mutabilis Rose	32	Purple Heart	32	Anacacho Orchid	31
Belindas Dream Rose	33	Photina	32	Thyrallis	32	Belindas Dream Rose	31
Blue Grama Grass	33	Sabal Minor Palm	32	Compact Nandina	31	Pride of Barbados	31
Coral Honeysuckle	33	Turks Cap	32	Cross Vine	31	Evergreen Sumac	30
Cross Vine	33	Zexmania	32	Jerusalem Sage	31	Purple Fountaingrass	30

Figure 20. PPI for 20% ETo in three-week intervals.

Daylily	33	Martha Gonzales Rose	31	Mexican Dwarf Petunia	31	Skullcap	30
Gregg Salvia	33	Mexican Dwarf Petunia	31	Mutabilis Rose	31	Buford Holly	29
Jerusalem Sage	33	Blue Grama Grass	30	Martha Gonzales Rose	30	Boxwood	28
Martha Gonzales Rose	33	Large Daylily	30	Zexmania	30	Fall Aster	28
Rosemary	33	Butterfly Vine	29	Boxwood	28	Mexican Dwarf Petunia	28
Buford Holly	32	Moy Grande Hibiscus	29	Mystic Spires Salvia	28	Mexican Feathergrass	28
Cenizo	32	American Beautyberry	28	Sabal Minor Palm	28	New Gold Lantana	28
Mexican Dwarf Petunia	32	Buford Holly	28	Texas Mountain Laurel	28	Cross Vine	27
Mutabilis Rose	32	Mystic Spires Salvia	28	Photina	26	Daylily	27
New Gold Lantana	32	Skullcap	28	Yaupon Holly	26	Texas Mountain Laurel	26
Pomegranate	32	Thyrallis	28	Bulbine	25	Sago Palm	25
Thyrallis	32	Yaupon Holly	27	Fall Aster	25	Yaupon Holly	25
Compact Nandina	31	Anacacho Orchid	26	American Beautyberry	24	Cemetary Iris	24
Evergreen Sumac	31	Bulbine	26	Lindheimer Muhly	24	Dutch Iris	24
Gulf Muhly	31	Evergreen Sumac	26	Prostrate Rosemary	24	Grandmas Yellow Rose	24
Monkey Grass	31	Henry Duelberg Salvia	25	Daylily	23	Mystic Spires Salvia	24
Moy Grande Hibiscus	31	Fall Obedient Plant	24	Rosemary	23	Henry Duelberg Salvia	23
Primrose Jasmine	31	Blue Liriope	23	Buford Holly	22	Moy Grande Hibiscus	23
Turks Cap	31	Cemetary Iris	23	Cemetary Iris	22	Photina	23
Anacacho Orchid	30	Milkweed	23	Four Nerve Daisy	22	American Beautyberry	22
Oleander	29	Grandmas Yellow Rose	22	Anacacho Orchid	21	Bulbine	21
Zexmania	29	Plumbago	22	Henry Duelberg Salvia	20	Plumbago	18
Large Daylily	28	Coral Honeysuckle	21	Primrose Jasmine	20	Asiatic Jasmine	17
Milkweed	28	Daylily	21	Asiatic Jasmine	19	Rosemary	17
Sandankwa Viburnum	28	Gregg Salvia	18	Fall Obedient Plant	19	Agarita	16
American Beautyberry	27	Jerusalem Sage	17	Blue Grama Grass	18	Fall Obedient Plant	14
Bat Faced Cuphea	27	Rosemary	17	Gregg Salvia	18	Four Nerve Daisy	14
Fall Obedient Plant	27	Asiatic Jasmine	16	Possumhaw Holly	18	Jerusalem Sage	14
Plumbago	27	Possumhaw Holly	16	Purple Fountaingrass	18	Prostrate Rosemary	14
Blue Liriope	26	Texas Mountain Laurel	16	Plumbago	17	Carolina Jessamine Vine	13
Grandmas Yellow Rose	26	Carolina Jessamine Vine	15	Blue Liriope	16	Mexican Mint Marigold	13
Texas Mountain Laurel	26	Dutch Iris	15	Carolina Jessamine Vine	15	Gregg Salvia	12
Variegated Liriope	26	Four Nerve Daisy	15	Coral Honeysuckle	12	Possumhaw Holly	11
Prostrate Rosemary	24	Society Garlic	15	Dutch Iris	12	Sandankwa Viburnum	11
Society Garlic	24	Primrose Jasmine	14	Sago Palm	12	Mexican Oregano	10
Blue Princess Verbena	23	Sandankwa Viburnum	13	Nolina	11	Milkweed	10
Four Nerve Daisy	23	Mexican Mint Marigold	12	Agarita	10	Nolina	10

Figure 20 continued. PPI for 20% ETo in three-week intervals.

Mexican Mint Marigold	23	Monkey Grass	10	Milkweed	8	Blue Grama Grass	7
Agarita	22	Viburnum Tinus	10	Sandankwa Viburnum	7	Blue Liriope	7
Viburnum Tinus	21	Agarita	9	Blackfoot Daisy	6	Coral Honeysuckle	7
Glossy Abelia	20	Prostrate Rosemary	9	Society Garlic	5	Purple Coneflower	7
Sago Palm	19	Sago Palm	8	Yellow Columbine	5	Society Garlic	6
Possumhaw Holly	16	Variegated Liriope	8	Dwarf Nandina	4	Glossy Abelia	5
Purple Coneflower	16	Nolina	7	Mexican Oregano	3	Primrose Jasmine	5
Carolina Jessamine Vine	15	Bat Faced Cuphea	6	Viburnum Tinus	3	Blue Princess Verbena	4
Dutch Iris	15	Blue Princess Verbena	5	Variegated Liriope	2	Variegated Liriope	4
Garden Phlox	15	Mexican Oregano	5	Blue Princess Verbena	1	Viburnum Tinus	4
Blackfoot Daisy	14	Yellow Columbine	5	Glossy Abelia	1	Garden Phlox	3
Cemetary Iris	14	Blackfoot Daisy	4	Mexican Mint Marigold	1	Yellow Columbine	3
Dwarf Nandina	14	Glossy Abelia	4	Bat Faced Cuphea	0	Blackfoot Daisy	2
Creeping Juniper	13	Purple Coneflower	1	Creeping Juniper	0	Bat Faced Cuphea	1
Nolina	13	Creeping Juniper	0	Dwarf Chinese Holly	0	Dwarf Nandina	1
Dwarf Chinese Holly	12	Dwarf Chinese Holly	0	Garden Phlox	0	Monkey Grass	1
Pittosporum	12	Dwarf Nandina	0	Monkey Grass	0	Creeping Juniper	0
Yellow Columbine	11	Garden Phlox	0	Pittosporum	0	Dwarf Chinese Holly	0
Mexican Oregano	2	Pittosporum	0	Purple Coneflower	0	Pittosporum	0

Figure 20 continued. PPI for 20% ETo in three-week intervals.

Belinda's Dream (*Rosa Belinda's Dream*).

7/10-7/24		7/31-8/14		8/21-9/4		9/11-9/25	
40% ETo		40% ETo		40% ETo		40% ETo	
Boxwood	36	Belindas Dream Rose	36	Asiatic Jasmine	36	Belindas Dream Rose	36
Cotoneaster	36	Bicolor Iris	36	Blackfoot Daisy	36	Bicolor Iris	36
Crepe Myrtle	36	Blue Grama Grass	36	Blue Grama Grass	36	Boxwood	36
Esperanza	36	Boxwood	36	Boxwood	36	Butterfly Vine	36
Flowering Senna	36	Butterfly Vine	36	Butterfly Vine	36	Cenizo	36
Gaura	36	Confetti Nandina	36	Cenizo	36	Confetti Nandina	36
Henry Duelberg Salvia	36	Cotoneaster	36	Daylily	36	Cotoneaster	36
Lindheimer Muhly	36	Cross Vine	36	Esperanza	36	Cross Vine	36
Lindheimer Muhly One	36	Daylily	36	Firebush	36	Firebush	36
Mexican Bush Sage	36	Esperanza	36	Gaura	36	Flowering Senna	36
Mexican Feathergrass	36	Flowering Senna	36	Gulf Muhly	36	Four Nerve Daisy	36
Milkweed	36	Gaura	36	Knock Out Rose	36	Gaura	36
Mistflower	36	Gulf Muhly	36	Lindheimer Muhly	36	Gulf Muhly	36
Mystic Spires Salvia	36	Indian Grass	36	Lindheimer Muhly One	36	Indian Grass	36
New Gold Lantana	36	Knock Out Rose	36	Little Bluestem	36	Large Daylily	36
Pomegranate	36	Lindheimer Muhly	36	Martha Gonzales Rose	36	Lindheimer Muhly	36
Purple Fountaingrass	36	Little Bluestem	36	Mexican Feathergrass	36	Lindheimer Muhly One	36
Rosemary	36	Mexican Dwarf Petunia	36	Mexican Honeysuckle	36	Little Bluestem	36
Sabal Minor Palm	36	Mistflower	36	Milkweed	36	Martha Gonzales Rose	36
Rock Rose (x2)	35.5	Moy Grande Hibiscus	36	Mistflower	36	Mexican Feathergrass	36
Cenizo	35	New Gold Lantana	36	Mystic Spires Salvia	36	Mexican Honeysuckle	36
Confetti Nandina	35	Oleander	36	New Gold Lantana	36	Mistflower	36
Daylily	35	Photina	36	Oleander	36	New Gold Lantana	36
Mexican Honeysuckle	35	Pomegranate	36	Photina	36	Oleander	36
Purple Heart	35	Pride of Barbados	36	Pomegranate	36	Pomegranate	36
Yaupon Holly	35	Purple Fountaingrass	36	Purple Fountaingrass	36	Purple Fountaingrass	36
Blackfoot Daisy	34	Sabal Minor Palm	36	Purple Heart	36	Santolina	36
Blue Grama Grass	34	Santolina	36	Santolina	36	Texas Sotol	36
Monkey Grass	34	Texas Sotol	36	Thyrallis	36	Yaupon Holly	36
Thyrallis	34	Turks Cap	36	Yaupon Holly	36	Rock Rose (x2)	35.5
Anacacho Orchid	33	Yaupon Holly	36	Rock Rose (x2)	35.5	Blackfoot Daisy	35
Butterfly Vine	33	Zexmania	36	Belindas Dream Rose	35	Gulf Muhly One	35
Chile Pequin	33	Asiatic Jasmine	35	Confetti Nandina	35	Moy Grande Hibiscus	35
Coral Honeysuckle	33	Cenizo	35	Cotoneaster	35	Pride of Barbados	35
Cross Vine	33	Chile Pequin	35	Cross Vine	35	Sabal Minor Palm	35
Fall Aster	33	Fall Aster	35	Flowering Senna	35	Daylily	34
Indian Grass	33	Firebush	35	Gulf Muhly One	35	Fall Aster	34
Little Bluestem	33	Lindheimer Muhly One	35	Henry Duelberg Salvia	35	Knock Out Rose	34
Moy Grande Hibiscus	33	Martha Gonzales Rose	35	Indian Grass	35	Mexican Dwarf Petunia	34
Red Yucca	33	Mexican Feathergrass	35	Mexican Bush Sage	35	Purple Heart	34
Society Garlic	33	Mexican Honeysuckle	35	Moy Grande Hibiscus	35	Skullcap	34

Figure 21. PPI for 40% ETo in three-week intervals.

Belindas Dream Rose	32	Sandankwa Viburnum	35	Pride of Barbados	35	Thyrallis	34
Buford Holly	32	Rock Rose (x2)	34.5	Primrose Jasmine	35	Anacacho Orchid	33
Gulf Muhly One	32	Henry Duelberg Salvia	32	Skullcap	35	Asiatic Jasmine	33
Large Daylily	32	Milkweed	32	Rosemary	34	Mexican Bush Sage	33
Oleander	32	Mystic Spires Salvia	32	Fall Aster	33	Dutch Iris	32
Primrose Jasmine	32	Thyrallis	32	Four Nerve Daisy	33	Esperanza	32
Skullcap	32	Purple Heart	31	Mexican Dwarf Petunia	33	Jerusalem Sage	32
Texas Sotol	32	Rosemary	31	Texas Sotol	33	Photina	32
Asiatic Jasmine	31	Gulf Muhly One	30	Turks Cap	33	Plumbago	32
Bat Faced Cuphea	31	Large Daylily	30	Zexmania	33	Red Yucca	32
Bicolor Iris	31	Bulbine	29	Bicolor Iris	32	Sago Palm	32
Mexican Dwarf Petunia	31	Anacacho Orchid	28	Jerusalem Sage	32	Sandankwa Viburnum	32
Sandankwa Viburnum	31	Evergreen Sumac	28	Red Yucca	32	Bat Faced Cuphea	31
Bulbine	30	Mutabilis Rose	28	Sabal Minor Palm	32	Chile Pequin	31
Firebush	30	Red Yucca	28	Sandankwa Viburnum	32	Henry Duelberg Salvia	31
Jerusalem Sage	30	Skullcap	28	Chile Pequin	31	Turks Cap	31
Knock Out Rose	30	Dutch Iris	27	Plumbago	31	Cemetary Iris	30
Evergreen Sumac	29	Grandmas Yellow Rose	27	Bulbine	30	Bulbine	29
Photina	29	Mexican Bush Sage	27	Compact Nandina	30	Evergreen Sumac	29
Zexmania	29	Blackfoot Daisy	26	Mutabilis Rose	29	Milkweed	29
Mexican Mint Marigold	28	Plumbago	26	Texas Mountain Laurel	29	Grandmas Yellow Rose	28
Plumbago	28	Primrose Jasmine	26	American Beautyberry	28	Mystic Spires Salvia	28
Santolina	28	American Beautyberry	25	Anacacho Orchid	28	Zexmania	28
Viburnum Tinus	28	Crepe Myrtle	24	Evergreen Sumac	28	Mutabilis Rose	27
Carolina Jessamine Vine	27	Jerusalem Sage	24	Gregg Salvia	28	Buford Holly	26
Fall Obedient Plant	27	Fall Obedient Plant	23	Large Daylily	28	Possumhaw Holly	25
Gregg Salvia	27	Compact Nandina	20	Grandmas Yellow Rose	27	Rosemary	25
Turks Cap	27	Coral Honeysuckle	20	Crepe Myrtle	26	Compact Nandina	24
Variegated Liriope	27	Buford Holly	19	Agarita	24	Gregg Salvia	24
Agarita	26	Four Nerve Daisy	19	Buford Holly	24	Texas Mountain Laurel	24
Martha Gonzales Rose	26	Gregg Salvia	19	Prostrate Rosemary	24	Agarita	23
Mutabilis Rose	26	Monkey Grass	18	Carolina Jessamine Vine	23	American Beautyberry	23
Pride of Barbados	26	Society Garlic	18	Dutch Iris	21	Fall Obedient Plant	22
American Beautyberry	25	Mexican Oregano	17	Possumhaw Holly	21	Primrose Jasmine	22
Compact Nandina	25	Possumhaw Holly	17	Fall Obedient Plant	20	Blue Grama Grass	21
Glossy Abelia	25	Texas Mountain Laurel	17	Bat Faced Cuphea	18	Prostrate Rosemary	20
Gulf Muhly	25	Agarita	16	Cemetary Iris	18	Crepe Myrtle	19
Mexican Oregano	25	Carolina Jessamine Vine	16	Coral Honeysuckle	18	Purple Coneflower	18
Prostrate Rosemary	25	Bat Faced Cuphea	15	Sago Palm	17	Glossy Abelia	17
Texas Mountain Laurel	25	Blue Princess Verbena	13	Mexican Mint Marigold	16	Carolina Jessamine Vine	16

Figure 21 continued. PPI for 40% ETo in three-week intervals.

Dwarf Chinese Holly	24	Cemetary Iris	13	Glossy Abelia	12	Mexican Mint Marigold	16
Four Nerve Daisy	24	Sago Palm	12	Mexican Oregano	9	Monkey Grass	12
Pittosporum	24	Viburnum Tinus	11	Blue Liriope	8	Variegated Liriope	12
Grandmas Yellow Rose	22	Blue Liriope	9	Dwarf Chinese Holly	7	Dwarf Nandina	10
Possumhaw Holly	21	Dwarf Chinese Holly	9	Monkey Grass	7	Coral Honeysuckle	9
Dutch Iris	20	Mexican Mint Marigold	9	Purple Coneflower	6	Dwarf Chinese Holly	9
Sago Palm	19	Glossy Abelia	8	Society Garlic	6	Garden Phlox	9
Creeping Juniper	18	Prostrate Rosemary	7	Blue Princess Verbena	5	Mexican Oregano	7
Yellow Columbine	17	Creeping Juniper	6	Garden Phlox	4	Nolina	7
Cemetary Iris	16	Dwarf Nandina	5	Dwarf Nandina	3	Blue Princess Verbena	6
Dwarf Nandina	15	Nolina	5	Nolina	3	Pittosporum	5
Garden Phlox	14	Variegated Liriope	5	Pittosporum	3	Viburnum Tinus	5
Nolina	12	Garden Phlox	4	Creeping Juniper	2	Blue Liriope	4
Blue Princess Verbena	11	Purple Coneflower	4	Variegated Liriope	2	Yellow Columbine	3
Purple Coneflower	11	Yellow Columbine	4	Viburnum Tinus	2	Creeping Juniper	2
Blue Liriope	7	Pittosporum	1	Yellow Columbine	1	Society Garlic	2

Figure 21 continued. PPI for 40% ETo in three-week intervals.

Flowering Senna (*Senna corymbosa*).

7/10-7/24		7/31-8/14		8/21-9/4		9/11-9/25	
60% ETo		60% ETo		60% ETo		60% ETo	
Bicolor Iris	36	Bicolor Iris	36	Agarita	36	Agarita	36
Boxwood	36	Boxwood	36	Boxwood	36	Anacacho Orchid	36
Confetti Nandina	36	Bulbine	36	Bulbine	36	Bat Faced Cuphea	36
Cotoneaster	36	Butterfly Vine	36	Butterfly Vine	36	Bicolor Iris	36
Crepe Myrtle	36	Confetti Nandina	36	Confetti Nandina	36	Blackfoot Daisy	36
Firebush	36	Coral Honeysuckle	36	Cotoneaster	36	Boxwood	36
Flowering Senna	36	Cotoneaster	36	Crepe Myrtle	36	Bulbine	36
Lindheimer Muhly One	36	Crepe Myrtle	36	Esperanza	36	Butterfly Vine	36
Mexican Bush Sage	36	Cross Vine	36	Evergreen Sumac	36	Compact Nandina	36
Mexican Feathergrass	36	Esperanza	36	Fall Aster	36	Confetti Nandina	36
Mistflower	36	Fall Aster	36	Firebush	36	Coral Honeysuckle	36
Mystic Spires Salvia	36	Firebush	36	Flowering Senna	36	Cotoneaster	36
Photina	36	Flowering Senna	36	Gaura	36	Cross Vine	36
Pomegranate	36	Gaura	36	Gulf Muhly	36	Daylily	36
Pride of Barbados	36	Gulf Muhly One	36	Gulf Muhly One	36	Esperanza	36
Purple Fountaingrass	36	Lindheimer Muhly	36	Henry Duelberg Salvia	36	Evergreen Sumac	36
Skullcap	36	Lindheimer Muhly One	36	Knock Out Rose	36	Firebush	36
Turks Cap	36	Little Bluestem	36	Lindheimer Muhly	36	Four Nerve Daisy	36
Viburnum Tinus	36	Mexican Dwarf Petunia	36	Lindheimer Muhly One	36	Gaura	36
Asiatic Jasmine	35	Mexican Feathergrass	36	Little Bluestem	36	Gulf Muhly	36
Daylily	35	Milkweed	36	Martha Gonzales Rose	36	Gulf Muhly One	36
Esperanza	35	Mistflower	36	Mexican Bush Sage	36	Henry Duelberg Salvia	36
Gaura	35	New Gold Lantana	36	Mexican Dwarf Petunia	36	Large Daylily	36
Gulf Muhly One	35	Oleander	36	Milkweed	36	Lindheimer Muhly	36
Lindheimer Muhly	35	Plumbago	36	Mistflower	36	Lindheimer Muhly One	36
Milkweed	35	Pomegranate	36	Mutabilis Rose	36	Little Bluestem	36
Mutabilis Rose	35	Pride of Barbados	36	Mystic Spires Salvia	36	Martha Gonzales Rose	36
New Gold Lantana	35	Red Yucca	36	New Gold Lantana	36	Mexican Bush Sage	36
Rosemary	35	Santolina	36	Oleander	36	Milkweed	36
Sabal Minor Palm	35	Turks Cap	36	Pomegranate	36	Mistflower	36
Sandankwa Viburnum	35	Evergreen Sumac	35	Pride of Barbados	36	Mutabilis Rose	36
Buford Holly	34	Knock Out Rose	35	Purple Fountaingrass	36	Oleander	36
Butterfly Vine	34	Mexican Honeysuckle	35	Red Yucca	36	Photina	36
Compact Nandina	34	Mutabilis Rose	35	Sabal Minor Palm	36	Pomegranate	36
Evergreen Sumac	34	Mystic Spires Salvia	35	Santolina	36	Pride of Barbados	36
Martha Gonzales Rose	34	Purple Fountaingrass	35	Skullcap	36	Purple Fountaingrass	36
Mexican Honeysuckle	34	Purple Heart	35	Thyrallis	36	Purple Heart	36
Mexican Mint Marigold	34	Sandankwa Viburnum	35	Turks Cap	36	Rock Rose (x2)	36
Agarita	33	Belindas Dream Rose	34	Zexmania	36	Sabal Minor Palm	36
Anacacho Orchid	33	Rosemary	34	Cenizo	35	Sandankwa Viburnum	36
Henry Duelberg Salvia	33	Cenizo	33	Indian Grass	35	Santolina	36
Red Yucca	33	Compact Nandina	33	Purple Heart	35	Skullcap	36
Santolina	33	Asiatic Jasmine	32	Bicolor Iris	34	Thyrallis	36

Figure 22. PPI for 60% ETo in three-week intervals.

Yaupon Holly	33	Daylily	32	Compact Nandina	34	Turks Cap	36
Rock Rose (x2)	32.5	Gulf Muhly	32	Coral Honeysuckle	34	Zexmania	36
Blue Princess Verbena	32	Henry Duelberg Salvia	32	Cross Vine	34	Asiatic Jasmine	35
Chile Pequin	32	Mexican Bush Sage	32	Mexican Honeysuckle	34	Crepe Myrtle	35
Oleander	32	Rock Rose (x2)	32	Rock Rose (x2)	34	Fall Aster	35
Purple Heart	32	Sabal Minor Palm	32	Rosemary	34	Knock Out Rose	35
Cenizo	31	Zexmania	32	Daylily	33	Yaupon Holly	35
Fall Aster	31	Chile Pequin	31	Photina	33	Belindas Dream Rose	34
Knock Out Rose	31	Indian Grass	31	Yaupon Holly	33	Mexican Dwarf Petunia	34
Variegated Liriope	31	Texas Sotol	31	Belindas Dream Rose	32	Mexican Honeysuckle	34
Belindas Dream Rose	30	Thyrallis	31	Four Nerve Daisy	32	Buford Holly	33
Indian Grass	30	Agarita	30	Large Daylily	32	Dutch Iris	33
Primrose Jasmine	30	Carolina Jessamine Vine	30	Mexican Feathergrass	32	Indian Grass	33
Bulbine	29	Moy Grande Hibiscus	30	Sandankwa Viburnum	32	Cenizo	32
Coral Honeysuckle	29	Blackfoot Daisy	29	Anacacho Orchid	30	Jerusalem Sage	32
Mexican Dwarf Petunia	29	Photina	29	Bat Faced Cuphea	30	Mystic Spires Salvia	32
Monkey Grass	29	Anacacho Orchid	28	Texas Mountain Laurel	30	Plumbago	32
Plumbago	29	Large Daylily	28	Asiatic Jasmine	28	Primrose Jasmine	32
Bat Faced Cuphea	28	Skullcap	28	Blackfoot Daisy	28	Red Yucca	32
Cross Vine	28	Yaupon Holly	28	Buford Holly	28	Rosemary	32
Fall Obedient Plant	28	Martha Gonzales Rose	27	Carolina Jessamine Vine	28	Sago Palm	32
Four Nerve Daisy	28	Bat Faced Cuphea	26	Chile Pequin	28	Fall Obedient Plant	30
Large Daylily	28	Buford Holly	25	Jerusalem Sage	28	Flowering Senna	30
Glossy Abelia	27	Blue Princess Verbena	23	Primrose Jasmine	28	Mexican Feathergrass	30
Grandmas Yellow Rose	27	Jerusalem Sage	23	Mexican Mint Marigold	27	Carolina Jessamine Vine	29
Gregg Salvia	27	Mexican Mint Marigold	23	Plumbago	27	New Gold Lantana	28
Texas Sotol	27	Cemetary Iris	22	American Beautyberry	26	Possumhaw Holly	28
Thyrallis	27	Viburnum Tinus	22	Texas Sotol	26	Texas Mountain Laurel	28
Little Bluestem	26	Fall Obedient Plant	21	Fall Obedient Plant	25	Texas Sotol	27
Texas Mountain Laurel	26	Texas Mountain Laurel	21	Gregg Salvia	25	Blue Princess Verbena	26
Cemetary Iris	25	Blue Grama Grass	20	Blue Princess Verbena	24	Glossy Abelia	26
Gulf Muhly	25	Primrose Jasmine	20	Moy Grande Hibiscus	24	Cemetary Iris	25
Pittosporum	25	Society Garlic	20	Sago Palm	24	Chile Pequin	25
Blue Grama Grass	24	Four Nerve Daisy	19	Viburnum Tinus	21	Purple Coneflower	24
Carolina Jessamine Vine	24	Gregg Salvia	19	Grandmas Yellow Rose	20	Mexican Mint Marigold	23
Dwarf Nandina	23	American Beautyberry	15	Possumhaw Holly	20	Viburnum Tinus	22
Zexmania	23	Grandmas Yellow Rose	14	Cemetary Iris	19	American Beautyberry	20
Blackfoot Daisy	22	Possumhaw Holly	14	Blue Grama Grass	18	Gregg Salvia	20
Sago Palm	22	Nolina	12	Glossy Abelia	17	Grandmas Yellow Rose	19
Society Garlic	22	Sago Palm	11	Nolina	16	Nolina	16
Jerusalem Sage	19	Dutch Iris	10	Blue Liriope	12	Blue Grama Grass	15
Possumhaw Holly	19	Dwarf Nandina	9	Dutch Iris	12	Garden Phlox	15
Garden Phlox	18	Monkey Grass	9	Dwarf Nandina	12	Society Garlic	15
American Beautyberry	17	Blue Liriope	7	Garden Phlox	11	Dwarf Nandina	12
Prostrate Rosemary	17	Creeping Juniper	7	Society Garlic	8	Moy Grande Hibiscus	11

Figure 22 continued. PPI for 60% ETo in three-week intervals.

Creeping Juniper	16	Variegated Liriope	7	Mexican Oregano	7	Variegated Liriope	10
Yellow Columbine	16	Glossy Abelia	5	Monkey Grass	6	Blue Liriope	9
Blue Liriope	15	Garden Phlox	4	Purple Coneflower	4	Creeping Juniper	4
Nolina	14	Prostrate Rosemary	4	Prostrate Rosemary	3	Monkey Grass	4
Dwarf Chinese Holly	13	Mexican Oregano	2	Creeping Juniper	2	Pittosporum	4
Dutch Iris	11	Pittosporum	2	Pittosporum	2	Mexican Oregano	3
Moy Grande Hibiscus	9	Yellow Columbine	1	Variegated Liriope	2	Prostrate Rosemary	3
Mexican Oregano	7	Dwarf Chinese Holly	0	Dwarf Chinese Holly	0	Yellow Columbine	2
Purple Coneflower	2	Purple Coneflower	0	Yellow Columbine	0	Dwarf Chinese Holly	0

Figure 22 continued. PPI for 60% ETo in three-week intervals.

RECOVERY PERIOD

The recovery period began in December 2015 and continued until March 2016 with normal amounts of rain. All four plots maintained consistent soil moisture levels during the recovery period, so plants were given equal opportunity to recover without any substantial limitations to recovery (Figure 23).

The purpose of this period was to see if any plants from 0.0 ETo and 0.2 ETo plots could make a recovery with only rainfall after a drought period. The roof was disabled and irrigation was turned off for all treatments. Additionally, the unirrigated period was used to identify plant appearance declines when irrigation was turned off. Figure 24 shows the comparison of the top quartile for the last three-week interval in the 0.0 ETo treatment plot from the drought treatment period and the last month of the 0.0 ETo plot from the recovery period. Table 4 lists plants with declined appearances and plants that recovered at the end of the recovery period.

A comprehensive comparison of these two phases with plants in alphabetical order can be found in Appendix J.

Gaura (*Gaura lindheimeri*).

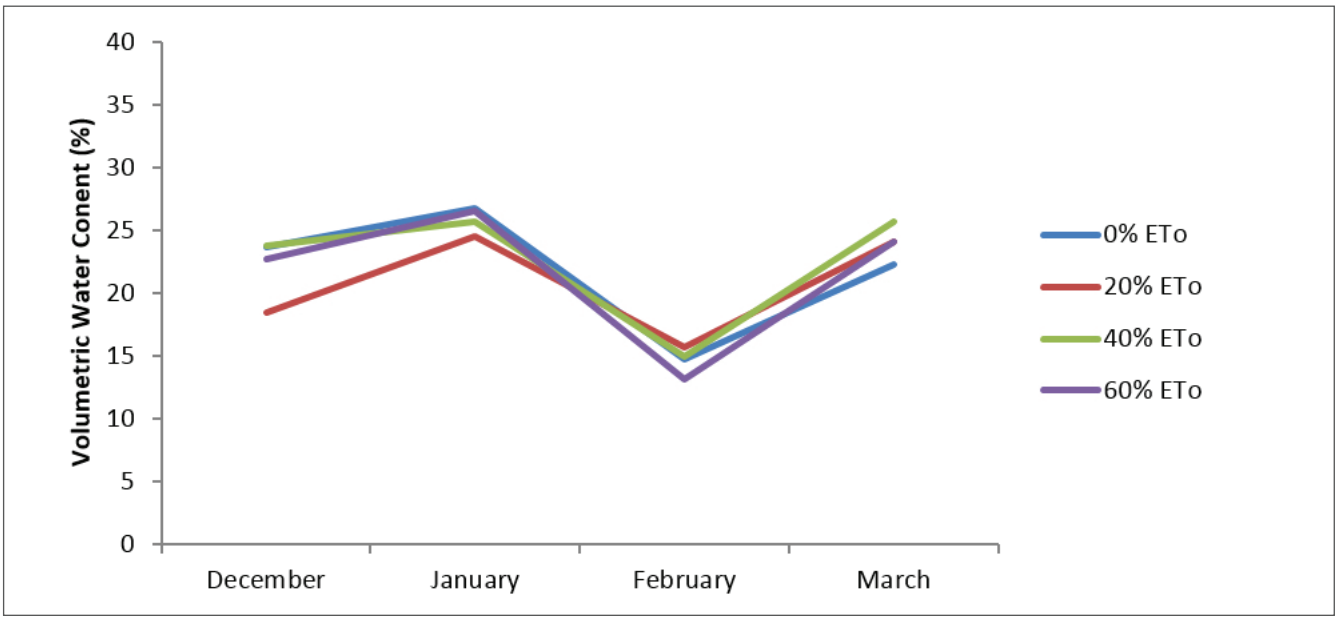

Figure 23. Soil moisture levels by irrigation treatments from December 2015 to March 2016.

Declined Appearance	Recovered Plants
Butterfly vine	Agarita
Chile Pequin	Belindas Dream Rose
Confetti Lantana	Boxwood
Esperanza	Bulbine
Fall Aster	Cemetary Iris
Firebush	Compact Nandina
Gaura	Crepe Myrtle
Mexican Bush Sage	Cross Vine
Pride of Barbados	Daylily
Turks Cap	Dutch Iris
	Evergreen Sumac
	Four Nerve Daisy
	Jerusalem Sage
	Knock Out Rose
	Martha Gonzales Rose
	Mexican Mint Marigold
	Mutabilis Rose
	Mystic Spires Salvia
	Photina
	Possumhaw Holly
	Primrose Jasmine
	Rosemary
	Sandankwa Viburnum
	Texas Mountain Laurel
	Thyrallis

Table 4. List of plants with declined appearances and a list of recovered plants in 0.0 ETo at the end of the recovery period.

Last Three-weeks of Phase I		Last Month of Phase II	
Oleander	144	Daylily	48
Confetti Lantana	142	Dutch Iris	48
Gaura	140	Flowering Senna	48
Gulf Muhly	140	Gulf Muhly	48
Texas Sotol	134	Jerusalem Sage	48
Butterfly Vine	132	Large Daylily	48
Gulf Muhly One	131	Lindheimer Muhly	48
Cenizo	129	Lindheimer Muhly One	48
Mexican Bush Sage	129	Mexican Mint Marigold	48
Pride of Barbados	129	Mistflower	48
Santolina	129	Mystic Spires Salvia	48
Red Yucca	124	Red Yucca	48
Lindheimer Muhly One	123	Texas Mountain Laurel	48
Flowering Senna	120	Zexmania	48
Rock Rose (x2)	119	Bicolor Iris	47
Sabal Minor Palm	119	Cenizo	47
Turks Cap	119	Rock Rose (x2)	46.5
Bicolor Iris	118	Oleander	46
Esperanza	118	Santolina	46
Henry Duelberg Salvia	118	Gulf Muhly One	45
Purple Fountaingrass	118	Henry Duelberg Salvia	45
Mistflower	115	Pomegranate	45
Purple Heart	112	Anacacho Orchid	44
Large Daylily	111	Sabal Minor Palm	44
Mexican Feathergrass	111	Texas Sotol	43
Zexmania	111	Knock Out Rose	42
Anacacho Orchid	110	Mexican Feathergrass	41
Chile Pequin	110	Cross Vine	39
Fall Aster	110	Evergreen Sumac	39
Pomegranate	109	Four Nerve Daisy	39
Cotoneaster	108	Martha Gonzales Rose	39
Firebush	108	Mutabilis Rose	39
Lindheimer Muhly	108	Belindas Dream Rose	38
Martha Gonzales Rose	107	Bulbine	38
New Gold Lantana	107	Cemetary Iris	38
Knock Out Rose	106	Purple Fountaingrass	38
Mexican Honeysuckle	106	Purple Heart	38
Mystic Spires Salvia	104	Primrose Jasmine	37
Belindas Dream Rose	102	Thyrallis	37
Mutabilis Rose	102	Agarita	36
Thyrallis	102	Boxwood	36
Boxwood	100	Compact Nandina	36

Figure 24. A comparative PPI of 0.0 ETo treatment using the last three-week interval from the drought treatment period and the last month of the recovery period.

Skullcap	100	Cotoneaster	36
Cross Vine	99	Crepe Myrtle	36
Daylily	99	Photina	36
Texas Mountain Laurel	98	Possumhaw Holly	36
Indian Grass	97	Rosemary	36
Evergreen Sumac	96	Sandankwa Viburnum	36
Yaupon Holly	96	Fall Aster	35
Dutch Iris	94	Gregg Salvia	34
Mexican Dwarf Petunia	93	Bat Faced Cuphea	33
Compact Nandina	92	Blue Princess Verbena	33
Photina	91	Coral Honeysuckle	33
Sago Palm	89	Glossy Abelia	33
Buford Holly	88	Yaupon Holly	33
Crepe Myrtle	88	Mexican Honeysuckle	32
Moy Grande Hibiscus	88	Skullcap	32
Bulbine	86	Blue Liriope	30
Asiatic Jasmine	85	Butterfly Vine	30
Plumbago	85	Gaura	30
Four Nerve Daisy	80	Fall Obedient Plant	28
Sandankwa Viburnum	79	Society Garlic	28
Jerusalem Sage	78	Dwarf Nandina	27
Milkweed	78	Plumbago	27
Blackfoot Daisy	76	Indian Grass	26
Agarita	75	Mexican Dwarf Petunia	26
Rosemary	74	Purple Coneflower	24
Grandmas Yellow Rose	71	Blackfoot Daisy	23
Cemetary Iris	70	Firebush	21
Bat Faced Cuphea	68	Mexican Oregano	21
Little Bluestem	68	Prostrate Rosemary	21
Fall Obedient Plant	66	Turks Cap	19
American Beautyberry	65	Chile Pequin	18
Possumhaw Holly	64	Viburnum Tinus	18
Gregg Salvia	61	Grandmas Yellow Rose	16
Primrose Jasmine	59	Carolina Jessamine Vine	15
Carolina Jessamine Vine	58	Nolina	15
Coral Honeysuckle	52	Little Bluestem	12
Mexican Mint Marigold	52	Mexican Bush Sage	12
Purple Coneflower	49	Asiatic Jasmine	11
Glossy Abelia	48	Buford Holly	8
Blue Grama Grass	47	Esperanza	8
Nolina	44	Pittosporum	7
Blue Princess Verbena	37	Garden Phlox	6
Prostrate Rosemary	37	Sago Palm	6
Mexican Oregano	35	Dwarf Chinese Holly	4

Figure 24 continued. A comparative PPI of 0.0 ETo treatment using the last three-week interval from the drought treatment period and the last month of the recovery period.

Variegated Liriope	35	Pride of Barbados	4
Viburnum Tinus	31	Blue Grama Grass	2
Garden Phlox	27	Creeping Juniper	2
Dwarf Nandina	23	Variegated Liriope	1
Society Garlic	23	American Beautyberry	0
Blue Liriope	21	Confetti Lantana	0
Monkey Grass	17	Milkweed	0
Dwarf Chinese Holly	9	Monkey Grass	0
Pittosporum	9	Moy Grande Hibiscus	0
Yellow Columbine	8	New Gold Lantana	0
Creeping Juniper	6	Yellow Columbine	0

Figure 24 continued. A comparative PPI of 0.0 ETo treatment using the last three-week interval from the drought treatment period and the last month of the recovery period.

Katie Behrends at the DSS site.

SUMMARY AND CONCLUSIONS

This ambitious study is one of the first to attempt to quantify the performance of a large number of Central Texas landscape plants at various volumetric soil moisture levels created by irrigation water supplied at various fractions of estimated evapotranspiration (ETo). The data generated by the DSS provides a basis for a water-conserving plant selection approach for Texas landscapes. By using study results, substantial water savings can be realized through reduced landscape irrigation in times of drought without sacrificing landscape aesthetics.

As part of the process for long-term water conservation and plant health, an appropriate establishment period to ensure root health and stability is required. A three- to four-month establishment period is suggested before exposing plants to water-limited conditions based on a review of published literature. Immediate exposure of plants to limitations in soil plant available water, while contributing to water savings, will not contribute to landscape plant establishment success.

Consumers can determine an ETo irrigation level that fits their needs and populate their landscapes with similar plants to achieve the same aesthetic performance over time. When planted together, plants that performed within the same PPI quartile should perform similarly in landscapes. Plants that fall in the top quartile can be planted together under the same irrigation treatment and expected to remain either "stable" or "lush." As a result, water efficiency can be achieved because groupings of plants are not being overwatered or underwatered. This would allow more efficient irrigation management, particularly if ETo is used as a basis of plant irrigation. For ETo-based irrigation to be effective, however, a more robust network of weather stations is needed to support efficient irrigation efforts in Central Texas.

Treatments 0.6 ETo and 0.4 ETo were not significantly different for mean appearance values. In general, a maximum coefficient of 0.4 ETo for landscape plant irrigation would result in substantial water savings in landscapes with drought resilient plants based on performance in this study and could result in minimal irrigation required following appropriate establishment and proper placement in the landscape. Additionally, a landscape with no irrigation or 0.2 ETo irrigation with a selection of robust plants can be expected to withstand a period of drought while maintaining aesthetic appearances. Recovery of drought-stressed plants also occurred within the recovery period of this study.

Additional evaluation of plants included in this study as well as others would strengthen the results demonstrated and may provide additional choices for use in water-conserving landscapes in Central Texas. The DSS assessed plant appearance but did not account for other plant performance indexes such as plant height or overall biomass. As a result, plants in other plots may have performed similarly but with stunted growth, or reduced biomass. A considerable amount of research remains, such as a standardized method to assess the water needs of landscape species and a discussion on experimental design and methods with proper randomization. The study included 97 species common to a Central Texas landscape; however, research can be extended to include species in other environments or Ecoregions.

Pride of Barbados (*Caesalpinia pulcherrima*).

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Chile Pequin (*Capsicum annuum*).

APPENDIX A. Appearance Rating Sheet

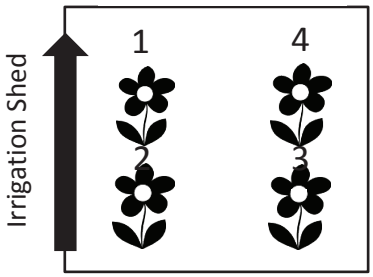
Appearance Rating Sheet

Row A

Rater_____

Date_____

Block Guide



Rating guide

5-Lush
4-Stable
3-Wilt
2-Leaf Drop
1-Defoliation
0-Death

	Chile Pequin	Daylily	Pride of Barbados	Glossy Abelia	Texas Sotol	Belinda's Dream Rose	Thyrallis	Little Bluestem	Mexican Dwarf Petunia	Pittosporum	Cenizo	Yellow Columbine	Mexican Feathergrass	Monkey Grass	Moy Grande' Hibiscus	Bulbine	Purple Heart	Prostrate Rosemary	Cross Vine	Sabal Minor Palm
Plot 1																				
Plant #1																				
Rating																				
Plant #2																				
Rating																				
Plant#3																				
Rating																				
Plant #4																				
Rating																				
Plot 2																				
Plant #1																				
Rating																				
Plant #2																				
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Plant #1																				
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Plant #2																				
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Plant#3																				
Rating																				
Plant #4																				
Rating																				

APPENDIX B. Appearance Ratings Procedure

Start at 9:00 AM Duration: 2 hours

Team of three for the same row in every plot. Write your name and the date. Write a number for each plant between 5 and 0 on appearance monitoring sheet.

Please note the order of plants in each block to keep consistency.

The appearance characteristics are: **Lush, Stable, Wilt, Leaf Drop, Defoliated, Dead.**

Definitions

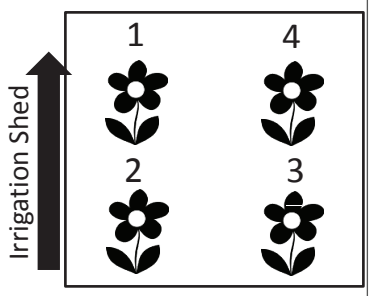
- Lush: The plant has the look of adequate moisture and new growth is occurring.
- Stable: The plant does not have the look of high amounts of moisture but there is no wilting or new growth.
- Wilt: New growth or mature foliage is showing symptoms of flaccidity but no leaf drop has occurred temporary leaf color change may be visible.
- Leaf Drop: Leaves have started to drop and/or permanent color change appears on stems or leaves. Stems are still alive.
- Defoliated: Over 90% of the leaves have dropped but the stems are alive.
- Dead: Denotes the plant has died and will not have the capability to refoliate from existing stems.

APPENDIX C. Soil Moisture Data Sheet

Soil Moisture Data Sheet

Rater_____

Date_____



	Gulf Muhly	Mistflower	Knock Out Rose	Anacacho Orchid	Oleander	Firebush	Purple Fountaingrass	Yaupon Holly	Cross Vine	Asiatic Jasmine
Plot 1										
Plant #1										
Reading										
Plant #2										
Reading										
Plant #3										
Reading										
Plant #4										
Reading										
Plot 2										
Plant #1										
Reading										
Plant #2										
Reading										
Plant #3										
Reading										
Plant #4										
Reading										
Plot 3										
Plant #1										
Reading										
Plant #2										
Reading										
Plant #3										
Reading										
Plant #4										
Reading										
Plot 4										
Plant #1										
Reading										
Plant #2										
Reading										
Plant #3										
Reading										
Plant #4										
Reading										

APPENDIX D. Soil Data Procedure

Start time: 11:00 AM Duration: 1 hour

Soil should be measured at a depth of 3 inches for every plant of the indicator species in every plot. Write your name and the date. Measure on the southern side near the base of the plant. Record volumetric water content (%).

Please note the order of plants in each block to keep consistency.

APPENDIX E. Overall PPI in alphabetical order.

0% ETo		20% ETo		40% ETo		60% ETo		ALL*	
Agarita	11	Agarita	57	Agarita	89	Agarita	135	Agarita	292
American Beauty-berry	24	American Beauty-berry	101	American Beauty-berry	101	American Beauty-berry	78	American Beauty-berry	304
Anacacho Orchid	70	Anacacho Orchid	108	Anacacho Orchid	122	Anacacho Orchid	127	Anacacho Orchid	427
Asiatic Jasmine	26	Asiatic Jasmine	85	Asiatic Jasmine	135	Asiatic Jasmine	130	Asiatic Jasmine	376
Bat Faced Cuphea	34	Bat Faced Cuphea	34	Bat Faced Cuphea	95	Bat Faced Cuphea	120	Bat Faced Cuphea	283
Belindas Dream Rose	51	Belindas Dream Rose	135	Belindas Dream Rose	139	Belindas Dream Rose	130	Belindas Dream Rose	455
Bicolor Iris	93	Bicolor Iris	138	Bicolor Iris	135	Bicolor Iris	142	Bicolor Iris	508
Blackfoot Daisy	46	Blackfoot Daisy	26	Blackfoot Daisy	131	Blackfoot Daisy	115	Blackfoot Daisy	318
Blue Grama Grass	35	Blue Grama Grass	88	Blue Grama Grass	127	Blue Grama Grass	77	Blue Grama Grass	327
Blue Liriope	28	Blue Liriope	72	Blue Liriope	28	Blue Liriope	43	Blue Liriope	171
Blue Princess Verbena	28	Blue Princess Verbena	33	Blue Princess Verbena	35	Blue Princess Verbena	105	Blue Princess Verbena	201
Boxwood	36	Boxwood	124	Boxwood	144	Boxwood	144	Boxwood	448
Buford Holly	20	Buford Holly	111	Buford Holly	101	Buford Holly	120	Buford Holly	352
Bulbine	56	Bulbine	106	Bulbine	118	Bulbine	137	Bulbine	417
Butterfly Vine	96	Butterfly Vine	133	Butterfly Vine	141	Butterfly Vine	142	Butterfly Vine	512
Carolina Jessamine Vine	6	Carolina Jessamine Vine	58	Carolina Jessamine Vine	82	Carolina Jessamine Vine	111	Carolina Jessamine Vine	257
Cemetary Iris	3	Cemetary Iris	83	Cemetary Iris	77	Cemetary Iris	91	Cemetary Iris	254
Cenizo	125	Cenizo	135	Cenizo	142	Cenizo	131	Cenizo	533
Chile Pequin	114	Chile Pequin	138	Chile Pequin	130	Chile Pequin	116	Chile Pequin	498
Compact Nandina	49	Compact Nandina	126	Compact Nandina	99	Compact Nandina	137	Compact Nandina	411
Confetti Lantana	137	Confetti Lantana	141	Confetti Lantana	142	Confetti Lantana	144	Confetti Lantana	564
Coral Honeysuckle	25	Coral Honeysuckle	73	Coral Honeysuckle	80	Coral Honeysuckle	135	Coral Honeysuckle	313
Cotoneaster	73	Cotoneaster	140	Cotoneaster	143	Cotoneaster	144	Cotoneaster	500
Creeping Juniper	2	Creeping Juniper	13	Creeping Juniper	28	Creeping Juniper	29	Creeping Juniper	72
Crepe Myrtle	31	Crepe Myrtle	141	Crepe Myrtle	105	Crepe Myrtle	143	Crepe Myrtle	420
Cross Vine	39	Cross Vine	123	Cross Vine	140	Cross Vine	134	Cross Vine	436
Daylily	52	Daylily	104	Daylily	141	Daylily	136	Daylily	433
Dutch Iris	23	Dutch Iris	66	Dutch Iris	100	Dutch Iris	66	Dutch Iris	255
Dwarf Chinese Holly	7	Dwarf Chinese Holly	12	Dwarf Chinese Holly	49	Dwarf Chinese Holly	13	Dwarf Chinese Holly	81
Dwarf Nandina	8	Dwarf Nandina	19	Dwarf Nandina	33	Dwarf Nandina	56	Dwarf Nandina	116
Esperanza	104	Esperanza	144	Esperanza	140	Esperanza	143	Esperanza	531
Evergreen Sumac	50	Evergreen Sumac	119	Evergreen Sumac	114	Evergreen Sumac	141	Evergreen Sumac	424
Fall Aster	113	Fall Aster	124	Fall Aster	135	Fall Aster	138	Fall Aster	510
Fall Obedient Plant	31	Fall Obedient Plant	84	Fall Obedient Plant	92	Fall Obedient Plant	104	Fall Obedient Plant	311
Firebush	41	Firebush	138	Firebush	137	Firebush	144	Firebush	460
Flowering Senna	119	Flowering Senna	144	Flowering Senna	143	Flowering Senna	138	Flowering Senna	544
Four Nerve Daisy	15	Four Nerve Daisy	74	Four Nerve Daisy	112	Four Nerve Daisy	115	Four Nerve Daisy	316
Garden Phlox	0	Garden Phlox	18	Garden Phlox	31	Garden Phlox	48	Garden Phlox	97
Gaura	135	Gaura	136	Gaura	144	Gaura	143	Gaura	558

Glossy Abelia	24	Glossy Abelia	30	Glossy Abelia	62	Glossy Abelia	75	Glossy Abelia	191
Grandmas Yellow Rose	13	Grandmas Yellow Rose	104	Grandmas Yellow Rose	104	Grandmas Yellow Rose	80	Grandmas Yellow Rose	301
Gregg Salvia	51	Gregg Salvia	81	Gregg Salvia	98	Gregg Salvia	91	Gregg Salvia	321
Gulf Muhly	138	Gulf Muhly	139	Gulf Muhly	133	Gulf Muhly	129	Gulf Muhly	539
Gulf Muhly One	119	Gulf Muhly One	144	Gulf Muhly One	132	Gulf Muhly One	143	Gulf Muhly One	538
Henry Duelberg Salvia	132	Henry Duelberg Salvia	104	Henry Duelberg Salvia	134	Henry Duelberg Salvia	137	Henry Duelberg Salvia	507
Indian Grass	99	Indian Grass	139	Indian Grass	140	Indian Grass	129	Indian Grass	507
Jerusalem Sage	34	Jerusalem Sage	95	Jerusalem Sage	118	Jerusalem Sage	102	Jerusalem Sage	349
Knock Out Rose	56	Knock Out Rose	137	Knock Out Rose	136	Knock Out Rose	137	Knock Out Rose	466
Large Daylily	50	Large Daylily	130	Large Daylily	126	Large Daylily	124	Large Daylily	430
Lindheimer Muhly	62	Lindheimer Muhly	124	Lindheimer Muhly	144	Lindheimer Muhly	143	Lindheimer Muhly	473
Lindheimer Muhly One	117	Lindheimer Muhly One	144	Lindheimer Muhly One	143	Lindheimer Muhly One	144	Lindheimer Muhly One	548
Little Bluestem	94	Little Bluestem	141	Little Bluestem	141	Little Bluestem	134	Little Bluestem	510
Martha Gonzales Rose	37	Martha Gonzales Rose	129	Martha Gonzales Rose	133	Martha Gonzales Rose	133	Martha Gonzales Rose	432
Mexican Bush Sage	113	Mexican Bush Sage	140	Mexican Bush Sage	131	Mexican Bush Sage	140	Mexican Bush Sage	524
Mexican Dwarf Petunia	69	Mexican Dwarf Petunia	122	Mexican Dwarf Petunia	134	Mexican Dwarf Petunia	135	Mexican Dwarf Petunia	460
Mexican Feather-grass	108	Mexican Feather-grass	136	Mexican Feather-grass	143	Mexican Feather-grass	134	Mexican Feather-grass	521
Mexican Honey-suckle	48	Mexican Honey-suckle	138	Mexican Honey-suckle	142	Mexican Honey-suckle	137	Mexican Honey-suckle	465
Mexican Mint Marigold	43	Mexican Mint Marigold	49	Mexican Mint Marigold	69	Mexican Mint Marigold	107	Mexican Mint Marigold	268
Mexican Oregano	9	Mexican Oregano	20	Mexican Oregano	58	Mexican Oregano	19	Mexican Oregano	106
Milkweed	61	Milkweed	69	Milkweed	133	Milkweed	143	Milkweed	406
Mistflower	102	Mistflower	143	Mistflower	144	Mistflower	144	Mistflower	533
Monkey Grass	32	Monkey Grass	42	Monkey Grass	71	Monkey Grass	48	Monkey Grass	195
Moy Grande Hi-biscus	89	Moy Grande Hi-biscus	115	Moy Grande Hi-biscus	139	Moy Grande Hi-biscus	74	Moy Grande Hi-biscus	417
Mutabilis Rose	93	Mutabilis Rose	131	Mutabilis Rose	110	Mutabilis Rose	142	Mutabilis Rose	476
Mystic Spires Salvia	123	Mystic Spires Salvia	116	Mystic Spires Salvia	132	Mystic Spires Salvia	139	Mystic Spires Salvia	510
New Gold Lantana	96	New Gold Lantana	132	New Gold Lantana	144	New Gold Lantana	135	New Gold Lantana	507
Nolina	12	Nolina	41	Nolina	27	Nolina	58	Nolina	138
Oleander	134	Oleander	137	Oleander	140	Oleander	140	Oleander	551
Photina	36	Photina	117	Photina	133	Photina	134	Photina	420
Pittosporum	0	Pittosporum	12	Pittosporum	33	Pittosporum	33	Pittosporum	78
Plumbago	49	Plumbago	84	Plumbago	117	Plumbago	124	Plumbago	374
Pomegranate	33	Pomegranate	140	Pomegranate	144	Pomegranate	144	Pomegranate	461
Possumhaw Holly	22	Possumhaw Holly	61	Possumhaw Holly	84	Possumhaw Holly	81	Possumhaw Holly	248
Pride of Barbados	130	Pride of Barbados	139	Pride of Barbados	132	Pride of Barbados	144	Pride of Barbados	545
Primrose Jasmine	31	Primrose Jasmine	70	Primrose Jasmine	115	Primrose Jasmine	110	Primrose Jasmine	326
Prostrate Rose-mary	2	Prostrate Rose-mary	71	Prostrate Rose-mary	76	Prostrate Rose-mary	27	Prostrate Rose-mary	176

Purple Coneflower	12	Purple Coneflower	24	Purple Coneflower	39	Purple Coneflower	30	Purple Coneflower	105
Purple Fountain-grass	93	Purple Fountain-grass	119	Purple Fountain-grass	144	Purple Fountain-grass	143	Purple Fountain-grass	499
Purple Heart	84	Purple Heart	137	Purple Heart	136	Purple Heart	138	Purple Heart	495
Red Yucca	113	Red Yucca	137	Red Yucca	125	Red Yucca	141	Red Yucca	516
Rock Rose (x2)	114.5	Rock Rose (x2)	134.5	Rock Rose (x2)	141	Rock Rose (x2)	134.5	Rock Rose (x2)	524.5
Rosemary	23	Rosemary	90	Rosemary	126	Rosemary	135	Rosemary	374
Sabal Minor Palm	85	Sabal Minor Palm	128	Sabal Minor Palm	139	Sabal Minor Palm	139	Sabal Minor Palm	491
Sago Palm	29	Sago Palm	64	Sago Palm	80	Sago Palm	89	Sago Palm	262
Sandankwa Viburnum	35	Sandankwa Viburnum	59	Sandankwa Viburnum	130	Sandankwa Viburnum	138	Sandankwa Viburnum	362
Santolina	98	Santolina	144	Santolina	136	Santolina	141	Santolina	519
Skullcap	54	Skullcap	129	Skullcap	129	Skullcap	136	Skullcap	448
Society Garlic	43	Society Garlic	50	Society Garlic	59	Society Garlic	65	Society Garlic	217
Texas Mountain Laurel	90	Texas Mountain Laurel	96	Texas Mountain Laurel	95	Texas Mountain Laurel	105	Texas Mountain Laurel	386
Texas Sotol	138	Texas Sotol	144	Texas Sotol	137	Texas Sotol	111	Texas Sotol	530
Thyrallis	42	Thyrallis	124	Thyrallis	136	Thyrallis	130	Thyrallis	432
Turks Cap	120	Turks Cap	132	Turks Cap	127	Turks Cap	144	Turks Cap	523
Variegated Liriope	24	Variegated Liriope	40	Variegated Liriope	46	Variegated Liriope	50	Variegated Liriope	160
Viburnum Tinus	22	Viburnum Tinus	38	Viburnum Tinus	46	Viburnum Tinus	101	Viburnum Tinus	207
Yaupon Holly	22	Yaupon Holly	113	Yaupon Holly	143	Yaupon Holly	129	Yaupon Holly	407
Yellow Columbine	3	Yellow Columbine	24	Yellow Columbine	25	Yellow Columbine	19	Yellow Columbine	71
Zexmania	97	Zexmania	126	Zexmania	126	Zexmania	127	Zexmania	476

APPENDIX F. PPI for 0% ETo in three-week intervals by alphabetical order.

7/10-7/24		7/31-8/14		8/21-9/4		9/11-9/25	
0% ETo		0% ETo		0% ETo		0% ETo	
Agarita	11	Agarita	0	Agarita	0	Agarita	0
American Beautyberry	24	American Beautyberry	0	American Beautyberry	0	American Beautyberry	0
Anacacho Orchid	29	Anacacho Orchid	19	Anacacho Orchid	12	Anacacho Orchid	10
Asiatic Jasmine	26	Asiatic Jasmine	0	Asiatic Jasmine	0	Asiatic Jasmine	0
Bat Faced Cuphea	28	Bat Faced Cuphea	4	Bat Faced Cuphea	2	Bat Faced Cuphea	0
Belindas Dream Rose	30	Belindas Dream Rose	15	Belindas Dream Rose	5	Belindas Dream Rose	1
Bicolor Iris	35	Bicolor Iris	24	Bicolor Iris	20	Bicolor Iris	14
Blackfoot Daisy	31	Blackfoot Daisy	9	Blackfoot Daisy	3	Blackfoot Daisy	3
Blue Grama Grass	16	Blue Grama Grass	7	Blue Grama Grass	8	Blue Grama Grass	4
Blue Liriope	15	Blue Liriope	9	Blue Liriope	3	Blue Liriope	1
Blue Princess Verbena	16	Blue Princess Verbena	9	Blue Princess Verbena	2	Blue Princess Verbena	1
Boxwood	28	Boxwood	8	Boxwood	0	Boxwood	0
Buford Holly	16	Buford Holly	4	Buford Holly	0	Buford Holly	0
Bulbine	27	Bulbine	22	Bulbine	7	Bulbine	0
Butterfly Vine	32	Butterfly Vine	17	Butterfly Vine	23	Butterfly Vine	24
Carolina Jessamine Vine	6	Carolina Jessamine Vine	0	Carolina Jessamine Vine	0	Carolina Jessamine Vine	0
Cemetary Iris	3	Cemetary Iris	0	Cemetary Iris	0	Cemetary Iris	0
Cenizo	33	Cenizo	32	Cenizo	33	Cenizo	27
Chile Pequin	35	Chile Pequin	30	Chile Pequin	28	Chile Pequin	21
Compact Nandina	34	Compact Nandina	11	Compact Nandina	4	Compact Nandina	0
Confetti Lantana	35	Confetti Nandina	36	Confetti Nandina	31	Confetti Nandina	2
Coral Honeysuckle	25	Coral Honeysuckle	0	Coral Honeysuckle	0	Coral Honeysuckle	0
Cotoneaster	36	Cotoneaster	29	Cotoneaster	8	Cotoneaster	0
Creeping Juniper	2	Creeping Juniper	0	Creeping Juniper	0	Creeping Juniper	0
Crepe Myrtle	31	Crepe Myrtle	0	Crepe Myrtle	0	Crepe Myrtle	0
Cross Vine	29	Cross Vine	10	Cross Vine	0	Cross Vine	0
Daylily	36	Daylily	12	Daylily	2	Daylily	2
Dutch Iris	13	Dutch Iris	4	Dutch Iris	1	Dutch Iris	5
Dwarf Chinese Holly	7	Dwarf Chinese Holly	0	Dwarf Chinese Holly	0	Dwarf Chinese Holly	0
Dwarf Nandina	8	Dwarf Nandina	0	Dwarf Nandina	0	Dwarf Nandina	0
Esperanza	36	Esperanza	30	Esperanza	24	Esperanza	14
Evergreen Sumac	26	Evergreen Sumac	14	Evergreen Sumac	9	Evergreen Sumac	1
Fall Aster	36	Fall Aster	34	Fall Aster	27	Fall Aster	16
Fall Obedient Plant	29	Fall Obedient Plant	2	Fall Obedient Plant	0	Fall Obedient Plant	0
Firebush	30	Firebush	7	Firebush	4	Firebush	0
Flowering Senna	36	Flowering Senna	36	Flowering Senna	29	Flowering Senna	18
Four Nerve Daisy	14	Four Nerve Daisy	1	Four Nerve Daisy	0	Four Nerve Daisy	36
Garden Phlox	0	Garden Phlox	0	Garden Phlox	0	Garden Phlox	0
Gaura	32	Gaura	36	Gaura	31	Gaura	36
Glossy Abelia	20	Glossy Abelia	4	Glossy Abelia	0	Glossy Abelia	0
Grandmas Yellow Rose	12	Grandmas Yellow Rose	1	Grandmas Yellow Rose	0	Grandmas Yellow Rose	0

Gregg Salvia	29	Gregg Salvia	16	Gregg Salvia	1	Gregg Salvia	5
Gulf Muhly	34	Gulf Muhly	36	Gulf Muhly	36	Gulf Muhly	32
Gulf Muhly One	34	Gulf Muhly One	30	Gulf Muhly One	31	Gulf Muhly One	24
Henry Duelberg Salvia	36	Henry Duelberg Salvia	32	Henry Duelberg Salvia	36	Henry Duelberg Salvia	28
Indian Grass	34	Indian Grass	35	Indian Grass	25	Indian Grass	5
Jerusalem Sage	26	Jerusalem Sage	8	Jerusalem Sage	0	Jerusalem Sage	0
Knock Out Rose	32	Knock Out Rose	18	Knock Out Rose	2	Knock Out Rose	4
Large Daylily	28	Large Daylily	19	Large Daylily	0	Large Daylily	3
Lindheimer Muhly	36	Lindheimer Muhly	15	Lindheimer Muhly	7	Lindheimer Muhly	4
Lindheimer Muhly One	36	Lindheimer Muhly One	34	Lindheimer Muhly One	32	Lindheimer Muhly One	15
Little Bluestem	36	Little Bluestem	35	Little Bluestem	12	Little Bluestem	11
Martha Gonzales Rose	28	Martha Gonzales Rose	9	Martha Gonzales Rose	0	Martha Gonzales Rose	0
Mexican Bush Sage	36	Mexican Bush Sage	23	Mexican Bush Sage	30	Mexican Bush Sage	24
Mexican Dwarf Petunia	32	Mexican Dwarf Petunia	24	Mexican Dwarf Petunia	10	Mexican Dwarf Petunia	3
Mexican Feathergrass	36	Mexican Feathergrass	30	Mexican Feathergrass	25	Mexican Feathergrass	17
Mexican Honeysuckle	34	Mexican Honeysuckle	12	Mexican Honeysuckle	2	Mexican Honeysuckle	0
Mexican Mint Marigold	26	Mexican Mint Marigold	16	Mexican Mint Marigold	1	Mexican Mint Marigold	0
Mexican Oregano	8	Mexican Oregano	1	Mexican Oregano	0	Mexican Oregano	0
Milkweed	7	Milkweed	23	Milkweed	8	Milkweed	3
Mistflower	36	Mistflower	32	Mistflower	27	Mistflower	7
Monkey Grass	29	Monkey Grass	5	Monkey Grass	0	Monkey Grass	0
Moy Grande Hibiscus	36	Moy Grande Hibiscus	20	Moy Grande Hibiscus	22	Moy Grande Hibiscus	11
Mutabilis Rose	32	Mutabilis Rose	36	Mutabilis Rose	22	Mutabilis Rose	3
Mystic Spires Salvia	36	Mystic Spires Salvia	31	Mystic Spires Salvia	36	Mystic Spires Salvia	20
New Gold Lantana	34	New Gold Lantana	24	New Gold Lantana	23	New Gold Lantana	15
Nolina	10	Nolina	2	Nolina	0	Nolina	0
Oleander	26	Oleander	36	Oleander	36	Oleander	36
Photina	32	Photina	0	Photina	4	Photina	0
Pittosporum	0	Pittosporum	0	Pittosporum	0	Pittosporum	0
Plumbago	24	Plumbago	14	Plumbago	8	Plumbago	3
Pomegranate	22	Pomegranate	7	Pomegranate	3	Pomegranate	1
Possumhaw Holly	18	Possumhaw Holly	4	Possumhaw Holly	0	Possumhaw Holly	0
Pride of Barbados	35	Pride of Barbados	35	Pride of Barbados	33	Pride of Barbados	27
Primrose Jasmine	28	Primrose Jasmine	3	Primrose Jasmine	0	Primrose Jasmine	0
Prostrate Rosemary	2	Prostrate Rosemary	0	Prostrate Rosemary	0	Prostrate Rosemary	0
Purple Coneflower	12	Purple Coneflower	0	Purple Coneflower	0	Purple Coneflower	0
Purple Fountaingrass	36	Purple Fountaingrass	31	Purple Fountaingrass	10	Purple Fountaingrass	16
Purple Heart	33	Purple Heart	27	Purple Heart	16	Purple Heart	8
Red Yucca	31	Red Yucca	29	Red Yucca	29	Red Yucca	24
Rock Rose (x2)	36	Rock Rose (x2)	34	Rock Rose (x2)	29	Rock Rose (x2)	16
Rosemary	19	Rosemary	4	Rosemary	0	Rosemary	0
Sabal Minor Palm	34	Sabal Minor Palm	21	Sabal Minor Palm	14	Sabal Minor Palm	16
Sago Palm	17	Sago Palm	4	Sago Palm	8	Sago Palm	0
Sandankwa Viburnum	32	Sandankwa Viburnum	3	Sandankwa Viburnum	0	Sandankwa Viburnum	0
Santolina	27	Santolina	26	Santolina	24	Santolina	21
Skullcap	36	Skullcap	18	Skullcap	0	Skullcap	0
Society Garlic	24	Society Garlic	16	Society Garlic	3	Society Garlic	0

Texas Mountain Laurel	21	Texas Mountain Laurel	19	Texas Mountain Laurel	30	Texas Mountain Laurel	20
Texas Sotol	35	Texas Sotol	35	Texas Sotol	33	Texas Sotol	35
Thyrallis	32	Thyrallis	9	Thyrallis	1	Thyrallis	0
Turks Cap	32	Turks Cap	28	Turks Cap	32	Turks Cap	28
Variegated Liriope	24	Variegated Liriope	0	Variegated Liriope	0	Variegated Liriope	0
Viburnum Tinus	22	Viburnum Tinus	0	Viburnum Tinus	0	Viburnum Tinus	0
Yaupon Holly	22	Yaupon Holly	0	Yaupon Holly	0	Yaupon Holly	0
Yellow Columbine	3	Yellow Columbine	0	Yellow Columbine	0	Yellow Columbine	0
Zexmania	35	Zexmania	36	Zexmania	14	Zexmania	12

APPENDIX G. PPI for 20% ETo in three-week intervals by alphabetical order.

7/10-7/24		7/31-8/14		8/21-9/4		9/11-9/25	
20% ETo		20% ETo		20% ETo		20% ETo	
Agarita	22	Agarita	9	Agarita	10	Agarita	16
American Beautyberry	27	American Beautyberry	28	American Beautyberry	24	American Beautyberry	22
Anacacho Orchid	30	Anacacho Orchid	26	Anacacho Orchid	21	Anacacho Orchid	31
Asiatic Jasmine	33	Asiatic Jasmine	16	Asiatic Jasmine	19	Asiatic Jasmine	17
Bat Faced Cuphea	27	Bat Faced Cuphea	6	Bat Faced Cuphea	0	Bat Faced Cuphea	1
Belindas Dream Rose	33	Belindas Dream Rose	35	Belindas Dream Rose	36	Belindas Dream Rose	31
Bicolor Iris	36	Bicolor Iris	36	Bicolor Iris	34	Bicolor Iris	32
Blackfoot Daisy	14	Blackfoot Daisy	4	Blackfoot Daisy	6	Blackfoot Daisy	2
Blue Grama Grass	33	Blue Grama Grass	30	Blue Grama Grass	18	Blue Grama Grass	7
Blue Liriope	26	Blue Liriope	23	Blue Liriope	16	Blue Liriope	7
Blue Princess Verbena	23	Blue Princess Verbena	5	Blue Princess Verbena	1	Blue Princess Verbena	4
Boxwood	36	Boxwood	32	Boxwood	28	Boxwood	28
Buford Holly	32	Buford Holly	28	Buford Holly	22	Buford Holly	29
Bulbine	34	Bulbine	26	Bulbine	25	Bulbine	21
Butterfly Vine	35	Butterfly Vine	29	Butterfly Vine	33	Butterfly Vine	36
Carolina Jessamine Vine	15	Carolina Jessamine Vine	15	Carolina Jessamine Vine	15	Carolina Jessamine Vine	13
Cemetary Iris	14	Cemetary Iris	23	Cemetary Iris	22	Cemetary Iris	24
Cenizo	32	Cenizo	33	Cenizo	36	Cenizo	34
Chile Pequin	34	Chile Pequin	36	Chile Pequin	35	Chile Pequin	33
Compact Nandina	31	Compact Nandina	32	Compact Nandina	31	Compact Nandina	32
Confetti Nandina	35	Confetti Nandina	35	Confetti Nandina	36	Confetti Nandina	35
Coral Honeysuckle	33	Coral Honeysuckle	21	Coral Honeysuckle	12	Coral Honeysuckle	7
Cotoneaster	36	Cotoneaster	36	Cotoneaster	32	Cotoneaster	36
Creeping Juniper	13	Creeping Juniper	0	Creeping Juniper	0	Creeping Juniper	0
Crepe Myrtle	36	Crepe Myrtle	35	Crepe Myrtle	36	Crepe Myrtle	34
Cross Vine	33	Cross Vine	32	Cross Vine	31	Cross Vine	27
Daylily	33	Daylily	21	Daylily	23	Daylily	27
Dutch Iris	15	Dutch Iris	15	Dutch Iris	12	Dutch Iris	24
Dwarf Chinese Holly	12	Dwarf Chinese Holly	0	Dwarf Chinese Holly	0	Dwarf Chinese Holly	0
Dwarf Nandina	14	Dwarf Nandina	0	Dwarf Nandina	4	Dwarf Nandina	1
Esperanza	36	Esperanza	36	Esperanza	36	Esperanza	36
Evergreen Sumac	31	Evergreen Sumac	26	Evergreen Sumac	32	Evergreen Sumac	30
Fall Aster	35	Fall Aster	36	Fall Aster	25	Fall Aster	28
Fall Obedient Plant	27	Fall Obedient Plant	24	Fall Obedient Plant	19	Fall Obedient Plant	14
Firebush	34	Firebush	35	Firebush	33	Firebush	36
Flowering Senna	36	Flowering Senna	36	Flowering Senna	36	Flowering Senna	36
Four Nerve Daisy	23	Four Nerve Daisy	15	Four Nerve Daisy	22	Four Nerve Daisy	14
Garden Phlox	15	Garden Phlox	0	Garden Phlox	0	Garden Phlox	3
Gaura	36	Gaura	35	Gaura	33	Gaura	32
Glossy Abelia	20	Glossy Abelia	4	Glossy Abelia	1	Glossy Abelia	5
Grandmas Yellow Rose	26	Grandmas Yellow Rose	22	Grandmas Yellow Rose	32	Grandmas Yellow Rose	24

Gregg Salvia	33	Gregg Salvia	18	Gregg Salvia	18	Gregg Salvia	12
Gulf Muhly	31	Gulf Muhly	36	Gulf Muhly	36	Gulf Muhly	36
Gulf Muhly One	36	Gulf Muhly One	36	Gulf Muhly One	36	Gulf Muhly One	36
Henry Duelberg Salvia	36	Henry Duelberg Salvia	25	Henry Duelberg Salvia	20	Henry Duelberg Salvia	23
Indian Grass	35	Indian Grass	36	Indian Grass	36	Indian Grass	32
Jerusalem Sage	33	Jerusalem Sage	17	Jerusalem Sage	31	Jerusalem Sage	14
Knock Out Rose	35	Knock Out Rose	34	Knock Out Rose	35	Knock Out Rose	33
Large Daylily	28	Large Daylily	30	Large Daylily	36	Large Daylily	36
Lindheimer Muhly	36	Lindheimer Muhly	32	Lindheimer Muhly	24	Lindheimer Muhly	32
Lindheimer Muhly One	36	Lindheimer Muhly One	36	Lindheimer Muhly One	36	Lindheimer Muhly One	36
Little Bluestem	34	Little Bluestem	35	Little Bluestem	36	Little Bluestem	36
Martha Gonzales Rose	33	Martha Gonzales Rose	31	Martha Gonzales Rose	30	Martha Gonzales Rose	35
Mexican Bush Sage	36	Mexican Bush Sage	32	Mexican Bush Sage	36	Mexican Bush Sage	36
Mexican Dwarf Petunia	32	Mexican Dwarf Petunia	31	Mexican Dwarf Petunia	31	Mexican Dwarf Petunia	28
Mexican Feathergrass	36	Mexican Feathergrass	36	Mexican Feathergrass	36	Mexican Feathergrass	28
Mexican Honeysuckle	34	Mexican Honeysuckle	32	Mexican Honeysuckle	36	Mexican Honeysuckle	36
Mexican Mint Marigold	23	Mexican Mint Marigold	12	Mexican Mint Marigold	1	Mexican Mint Marigold	13
Mexican Oregano	2	Mexican Oregano	5	Mexican Oregano	3	Mexican Oregano	10
Milkweed	28	Milkweed	23	Milkweed	8	Milkweed	10
Mistflower	36	Mistflower	35	Mistflower	36	Mistflower	36
Monkey Grass	31	Monkey Grass	10	Monkey Grass	0	Monkey Grass	1
Moy Grande Hibiscus	31	Moy Grande Hibiscus	29	Moy Grande Hibiscus	32	Moy Grande Hibiscus	23
Mutabilis Rose	32	Mutabilis Rose	32	Mutabilis Rose	31	Mutabilis Rose	36
Mystic Spires Salvia	36	Mystic Spires Salvia	28	Mystic Spires Salvia	28	Mystic Spires Salvia	24
New Gold Lantana	32	New Gold Lantana	36	New Gold Lantana	36	New Gold Lantana	28
Nolina	13	Nolina	7	Nolina	11	Nolina	10
Oleander	29	Oleander	36	Oleander	36	Oleander	36
Photina	36	Photina	32	Photina	26	Photina	23
Pittosporum	12	Pittosporum	0	Pittosporum	0	Pittosporum	0
Plumbago	27	Plumbago	22	Plumbago	17	Plumbago	18
Pomegranate	32	Pomegranate	36	Pomegranate	36	Pomegranate	36
Possumhaw Holly	16	Possumhaw Holly	16	Possumhaw Holly	18	Possumhaw Holly	11
Pride of Barbados	36	Pride of Barbados	36	Pride of Barbados	36	Pride of Barbados	31
Primrose Jasmine	31	Primrose Jasmine	14	Primrose Jasmine	20	Primrose Jasmine	5
Prostrate Rosemary	24	Prostrate Rosemary	9	Prostrate Rosemary	24	Prostrate Rosemary	14
Purple Coneflower	16	Purple Coneflower	1	Purple Coneflower	0	Purple Coneflower	7
Purple Fountaingrass	36	Purple Fountaingrass	35	Purple Fountaingrass	18	Purple Fountaingrass	30
Purple Heart	36	Purple Heart	35	Purple Heart	32	Purple Heart	34
Red Yucca	36	Red Yucca	33	Red Yucca	36	Red Yucca	32
Rock Rose (x2)	36	Rock Rose (x2)	34	Rock Rose (x2)	33	Rock Rose (x2)	32
Rosemary	33	Rosemary	17	Rosemary	23	Rosemary	17
Sabal Minor Palm	36	Sabal Minor Palm	32	Sabal Minor Palm	28	Sabal Minor Palm	32
Sago Palm	19	Sago Palm	8	Sago Palm	12	Sago Palm	25
Sandankwa Viburnum	28	Sandankwa Viburnum	13	Sandankwa Viburnum	7	Sandankwa Viburnum	11
Santolina	36	Santolina	36	Santolina	36	Santolina	36
Skullcap	35	Skullcap	28	Skullcap	36	Skullcap	30
Society Garlic	24	Society Garlic	15	Society Garlic	5	Society Garlic	6

Texas Mountain Laurel	26	Texas Mountain Laurel	16	Texas Mountain Laurel	28	Texas Mountain Laurel	26
Texas Sotol	36	Texas Sotol	36	Texas Sotol	36	Texas Sotol	36
Thyrallis	32	Thyrallis	28	Thyrallis	32	Thyrallis	32
Turks Cap	31	Turks Cap	32	Turks Cap	36	Turks Cap	33
Variegated Liriope	26	Variegated Liriope	8	Variegated Liriope	2	Variegated Liriope	4
Viburnum Tinus	21	Viburnum Tinus	10	Viburnum Tinus	3	Viburnum Tinus	4
Yaupon Holly	35	Yaupon Holly	27	Yaupon Holly	26	Yaupon Holly	25
Yellow Columbine	11	Yellow Columbine	5	Yellow Columbine	5	Yellow Columbine	3
Zexmania	29	Zexmania	32	Zexmania	30	Zexmania	35

APPENDIX H. PPI for 40% ETo three-week intervals by alphabetical order.

7/10-7/24		7/31-8/14		8/21-9/4		9/11-9/25	
40% ETo		40% ETo		40% ETo		40% ETo	
Agarita	26	Agarita	16	Agarita	24	Agarita	23
American Beautyberry	25	American Beautyberry	25	American Beautyberry	28	American Beautyberry	23
Anacacho Orchid	33	Anacacho Orchid	28	Anacacho Orchid	28	Anacacho Orchid	33
Asiatic Jasmine	31	Asiatic Jasmine	35	Asiatic Jasmine	36	Asiatic Jasmine	33
Bat Faced Cuphea	31	Bat Faced Cuphea	15	Bat Faced Cuphea	18	Bat Faced Cuphea	31
Belindas Dream Rose	32	Belindas Dream Rose	36	Belindas Dream Rose	35	Belindas Dream Rose	36
Bicolor Iris	31	Bicolor Iris	36	Bicolor Iris	32	Bicolor Iris	36
Blackfoot Daisy	34	Blackfoot Daisy	26	Blackfoot Daisy	36	Blackfoot Daisy	35
Blue Grama Grass	34	Blue Grama Grass	36	Blue Grama Grass	36	Blue Grama Grass	21
Blue Liriope	7	Blue Liriope	9	Blue Liriope	8	Blue Liriope	4
Blue Princess Verbena	11	Blue Princess Verbena	13	Blue Princess Verbena	5	Blue Princess Verbena	6
Boxwood	36	Boxwood	36	Boxwood	36	Boxwood	36
Buford Holly	32	Buford Holly	19	Buford Holly	24	Buford Holly	26
Bulbine	30	Bulbine	29	Bulbine	30	Bulbine	29
Butterfly Vine	33	Butterfly Vine	36	Butterfly Vine	36	Butterfly Vine	36
Carolina Jessamine Vine	27	Carolina Jessamine Vine	16	Carolina Jessamine Vine	23	Carolina Jessamine Vine	16
Cemetary Iris	16	Cemetary Iris	13	Cemetary Iris	18	Cemetary Iris	30
Cenizo	35	Cenizo	35	Cenizo	36	Cenizo	36
Chile Pequin	33	Chile Pequin	35	Chile Pequin	31	Chile Pequin	31
Compact Nandina	25	Compact Nandina	20	Compact Nandina	30	Compact Nandina	24
Confetti Nandina	35	Confetti Nandina	36	Confetti Nandina	35	Confetti Nandina	36
Coral Honeysuckle	33	Coral Honeysuckle	20	Coral Honeysuckle	18	Coral Honeysuckle	9
Cotoneaster	36	Cotoneaster	36	Cotoneaster	35	Cotoneaster	36
Creeping Juniper	18	Creeping Juniper	6	Creeping Juniper	2	Creeping Juniper	2
Crepe Myrtle	36	Crepe Myrtle	24	Crepe Myrtle	26	Crepe Myrtle	19
Cross Vine	33	Cross Vine	36	Cross Vine	35	Cross Vine	36
Daylily	35	Daylily	36	Daylily	36	Daylily	34
Dutch Iris	20	Dutch Iris	27	Dutch Iris	21	Dutch Iris	32
Dwarf Chinese Holly	24	Dwarf Chinese Holly	9	Dwarf Chinese Holly	7	Dwarf Chinese Holly	9
Dwarf Nandina	15	Dwarf Nandina	5	Dwarf Nandina	3	Dwarf Nandina	10
Esperanza	36	Esperanza	36	Esperanza	36	Esperanza	32
Evergreen Sumac	29	Evergreen Sumac	28	Evergreen Sumac	28	Evergreen Sumac	29
Fall Aster	33	Fall Aster	35	Fall Aster	33	Fall Aster	34
Fall Obedient Plant	27	Fall Obedient Plant	23	Fall Obedient Plant	20	Fall Obedient Plant	22
Firebush	30	Firebush	35	Firebush	36	Firebush	36
Flowering Senna	36	Flowering Senna	36	Flowering Senna	35	Flowering Senna	36
Four Nerve Daisy	24	Four Nerve Daisy	19	Four Nerve Daisy	33	Four Nerve Daisy	36
Garden Phlox	14	Garden Phlox	4	Garden Phlox	4	Garden Phlox	9
Gaura	36	Gaura	36	Gaura	36	Gaura	36
Glossy Abelia	25	Glossy Abelia	8	Glossy Abelia	12	Glossy Abelia	17
Grandmas Yellow Rose	22	Grandmas Yellow Rose	27	Grandmas Yellow Rose	27	Grandmas Yellow Rose	28

Gregg Salvia	27	Gregg Salvia	19	Gregg Salvia	28	Gregg Salvia	24
Gulf Muhly	25	Gulf Muhly	36	Gulf Muhly	36	Gulf Muhly	36
Gulf Muhly One	32	Gulf Muhly One	30	Gulf Muhly One	35	Gulf Muhly One	35
Henry Duelberg Salvia	36	Henry Duelberg Salvia	32	Henry Duelberg Salvia	35	Henry Duelberg Salvia	31
Indian Grass	33	Indian Grass	36	Indian Grass	35	Indian Grass	36
Jerusalem Sage	30	Jerusalem Sage	24	Jerusalem Sage	32	Jerusalem Sage	32
Knock Out Rose	30	Knock Out Rose	36	Knock Out Rose	36	Knock Out Rose	34
Large Daylily	32	Large Daylily	30	Large Daylily	28	Large Daylily	36
Lindheimer Muhly	36	Lindheimer Muhly	36	Lindheimer Muhly	36	Lindheimer Muhly	36
Lindheimer Muhly One	36	Lindheimer Muhly One	35	Lindheimer Muhly One	36	Lindheimer Muhly One	36
Little Bluestem	33	Little Bluestem	36	Little Bluestem	36	Little Bluestem	36
Martha Gonzales Rose	26	Martha Gonzales Rose	35	Martha Gonzales Rose	36	Martha Gonzales Rose	36
Mexican Bush Sage	36	Mexican Bush Sage	27	Mexican Bush Sage	35	Mexican Bush Sage	33
Mexican Dwarf Petunia	31	Mexican Dwarf Petunia	36	Mexican Dwarf Petunia	33	Mexican Dwarf Petunia	34
Mexican Feathergrass	36	Mexican Feathergrass	35	Mexican Feathergrass	36	Mexican Feathergrass	36
Mexican Honeysuckle	35	Mexican Honeysuckle	35	Mexican Honeysuckle	36	Mexican Honeysuckle	36
Mexican Mint Marigold	28	Mexican Mint Marigold	9	Mexican Mint Marigold	16	Mexican Mint Marigold	16
Mexican Oregano	25	Mexican Oregano	17	Mexican Oregano	9	Mexican Oregano	7
Milkweed	36	Milkweed	32	Milkweed	36	Milkweed	29
Mistflower	36	Mistflower	36	Mistflower	36	Mistflower	36
Monkey Grass	34	Monkey Grass	18	Monkey Grass	7	Monkey Grass	12
Moy Grande Hibiscus	33	Moy Grande Hibiscus	36	Moy Grande Hibiscus	35	Moy Grande Hibiscus	35
Mutabilis Rose	26	Mutabilis Rose	28	Mutabilis Rose	29	Mutabilis Rose	27
Mystic Spires Salvia	36	Mystic Spires Salvia	32	Mystic Spires Salvia	36	Mystic Spires Salvia	28
New Gold Lantana	36	New Gold Lantana	36	New Gold Lantana	36	New Gold Lantana	36
Nolina	12	Nolina	5	Nolina	3	Nolina	7
Oleander	32	Oleander	36	Oleander	36	Oleander	36
Photina	29	Photina	36	Photina	36	Photina	32
Pittosporum	24	Pittosporum	1	Pittosporum	3	Pittosporum	5
Plumbago	28	Plumbago	26	Plumbago	31	Plumbago	32
Pomegranate	36	Pomegranate	36	Pomegranate	36	Pomegranate	36
Possumhaw Holly	21	Possumhaw Holly	17	Possumhaw Holly	21	Possumhaw Holly	25
Pride of Barbados	26	Pride of Barbados	36	Pride of Barbados	35	Pride of Barbados	35
Primrose Jasmine	32	Primrose Jasmine	26	Primrose Jasmine	35	Primrose Jasmine	22
Prostrate Rosemary	25	Prostrate Rosemary	7	Prostrate Rosemary	24	Prostrate Rosemary	20
Purple Coneflower	11	Purple Coneflower	4	Purple Coneflower	6	Purple Coneflower	18
Purple Fountaingrass	36	Purple Fountaingrass	36	Purple Fountaingrass	36	Purple Fountaingrass	36
Purple Heart	35	Purple Heart	31	Purple Heart	36	Purple Heart	34
Red Yucca	33	Red Yucca	28	Red Yucca	32	Red Yucca	32
Rock Rose (x2)	36	Rock Rose (x2)	35	Rock Rose (x2)	36	Rock Rose (x2)	36
Rosemary	36	Rosemary	31	Rosemary	34	Rosemary	25
Sabal Minor Palm	36	Sabal Minor Palm	36	Sabal Minor Palm	32	Sabal Minor Palm	35
Sago Palm	19	Sago Palm	12	Sago Palm	17	Sago Palm	32
Sandankwa Viburnum	31	Sandankwa Viburnum	35	Sandankwa Viburnum	32	Sandankwa Viburnum	32
Santolina	28	Santolina	36	Santolina	36	Santolina	36
Skullcap	32	Skullcap	28	Skullcap	35	Skullcap	34
Society Garlic	33	Society Garlic	18	Society Garlic	6	Society Garlic	2

Texas Mountain Laurel	25	Texas Mountain Laurel	17	Texas Mountain Laurel	29	Texas Mountain Laurel	24
Texas Sotol	32	Texas Sotol	36	Texas Sotol	33	Texas Sotol	36
Thyrallis	34	Thyrallis	32	Thyrallis	36	Thyrallis	34
Turks Cap	27	Turks Cap	36	Turks Cap	33	Turks Cap	31
Variegated Liriope	27	Variegated Liriope	5	Variegated Liriope	2	Variegated Liriope	12
Viburnum Tinus	28	Viburnum Tinus	11	Viburnum Tinus	2	Viburnum Tinus	5
Yaupon Holly	35	Yaupon Holly	36	Yaupon Holly	36	Yaupon Holly	36
Yellow Columbine	17	Yellow Columbine	4	Yellow Columbine	1	Yellow Columbine	3
Zexmania	29	Zexmania	36	Zexmania	33	Zexmania	28

APPENDIX I. PPI for 60% ETo in three-week intervals by alphabetical order.

7/10-7/24		7/31-8/14		8/21-9/4		9/11-9/25	
60% ETo		60% ETo		60% ETo		60% ETo	
Agarita	33	Agarita	30	Agarita	36	Agarita	36
American Beautyberry	17	American Beautyberry	15	American Beautyberry	26	American Beautyberry	20
Anacacho Orchid	33	Anacacho Orchid	28	Anacacho Orchid	30	Anacacho Orchid	36
Asiatic Jasmine	35	Asiatic Jasmine	32	Asiatic Jasmine	28	Asiatic Jasmine	35
Bat Faced Cuphea	28	Bat Faced Cuphea	26	Bat Faced Cuphea	30	Bat Faced Cuphea	36
Belindas Dream Rose	30	Belindas Dream Rose	34	Belindas Dream Rose	32	Belindas Dream Rose	34
Bicolor Iris	36	Bicolor Iris	36	Bicolor Iris	34	Bicolor Iris	36
Blackfoot Daisy	22	Blackfoot Daisy	29	Blackfoot Daisy	28	Blackfoot Daisy	36
Blue Grama Grass	24	Blue Grama Grass	20	Blue Grama Grass	18	Blue Grama Grass	15
Blue Liriope	15	Blue Liriope	7	Blue Liriope	12	Blue Liriope	9
Blue Princess Verbena	32	Blue Princess Verbena	23	Blue Princess Verbena	24	Blue Princess Verbena	26
Boxwood	36	Boxwood	36	Boxwood	36	Boxwood	36
Buford Holly	34	Buford Holly	25	Buford Holly	28	Buford Holly	33
Bulbine	29	Bulbine	36	Bulbine	36	Bulbine	36
Butterfly Vine	34	Butterfly Vine	36	Butterfly Vine	36	Butterfly Vine	36
Carolina Jessamine Vine	24	Carolina Jessamine Vine	30	Carolina Jessamine Vine	28	Carolina Jessamine Vine	29
Cemetary Iris	25	Cemetary Iris	22	Cemetary Iris	19	Cemetary Iris	25
Cenizo	31	Cenizo	33	Cenizo	35	Cenizo	32
Chile Pequin	32	Chile Pequin	31	Chile Pequin	28	Chile Pequin	25
Compact Nandina	34	Compact Nandina	33	Compact Nandina	34	Compact Nandina	36
Confetti Nandina	36	Confetti Nandina	36	Confetti Nandina	36	Confetti Nandina	36
Coral Honeysuckle	29	Coral Honeysuckle	36	Coral Honeysuckle	34	Coral Honeysuckle	36
Cotoneaster	36	Cotoneaster	36	Cotoneaster	36	Cotoneaster	36
Creeping Juniper	16	Creeping Juniper	7	Creeping Juniper	2	Creeping Juniper	4
Crepe Myrtle	36	Crepe Myrtle	36	Crepe Myrtle	36	Crepe Myrtle	35
Cross Vine	28	Cross Vine	36	Cross Vine	34	Cross Vine	36
Daylily	35	Daylily	32	Daylily	33	Daylily	36
Dutch Iris	11	Dutch Iris	10	Dutch Iris	12	Dutch Iris	33
Dwarf Chinese Holly	13	Dwarf Chinese Holly	0	Dwarf Chinese Holly	0	Dwarf Chinese Holly	0
Dwarf Nandina	23	Dwarf Nandina	9	Dwarf Nandina	12	Dwarf Nandina	12
Esperanza	35	Esperanza	36	Esperanza	36	Esperanza	36
Evergreen Sumac	34	Evergreen Sumac	35	Evergreen Sumac	36	Evergreen Sumac	36
Fall Aster	31	Fall Aster	36	Fall Aster	36	Fall Aster	35
Fall Obedient Plant	28	Fall Obedient Plant	21	Fall Obedient Plant	25	Fall Obedient Plant	30
Firebush	36	Firebush	36	Firebush	36	Firebush	36
Flowering Senna	36	Flowering Senna	36	Flowering Senna	36	Flowering Senna	30
Four Nerve Daisy	28	Four Nerve Daisy	19	Four Nerve Daisy	32	Four Nerve Daisy	36
Garden Phlox	18	Garden Phlox	4	Garden Phlox	11	Garden Phlox	15
Gaura	35	Gaura	36	Gaura	36	Gaura	36
Glossy Abelia	27	Glossy Abelia	5	Glossy Abelia	17	Glossy Abelia	26
Grandmas Yellow Rose	27	Grandmas Yellow Rose	14	Grandmas Yellow Rose	20	Grandmas Yellow Rose	19

Gregg Salvia	27	Gregg Salvia	19	Gregg Salvia	25	Gregg Salvia	20
Gulf Muhly	25	Gulf Muhly	32	Gulf Muhly	36	Gulf Muhly	36
Gulf Muhly One	35	Gulf Muhly One	36	Gulf Muhly One	36	Gulf Muhly One	36
Henry Duelberg Salvia	33	Henry Duelberg Salvia	32	Henry Duelberg Salvia	36	Henry Duelberg Salvia	36
Indian Grass	30	Indian Grass	31	Indian Grass	35	Indian Grass	33
Jerusalem Sage	19	Jerusalem Sage	23	Jerusalem Sage	28	Jerusalem Sage	32
Knock Out Rose	31	Knock Out Rose	35	Knock Out Rose	36	Knock Out Rose	35
Large Daylily	28	Large Daylily	28	Large Daylily	32	Large Daylily	36
Lindheimer Muhly	35	Lindheimer Muhly	36	Lindheimer Muhly	36	Lindheimer Muhly	36
Lindheimer Muhly One	36	Lindheimer Muhly One	36	Lindheimer Muhly One	36	Lindheimer Muhly One	36
Little Bluestem	26	Little Bluestem	36	Little Bluestem	36	Little Bluestem	36
Martha Gonzales Rose	34	Martha Gonzales Rose	27	Martha Gonzales Rose	36	Martha Gonzales Rose	36
Mexican Bush Sage	36	Mexican Bush Sage	32	Mexican Bush Sage	36	Mexican Bush Sage	36
Mexican Dwarf Petunia	29	Mexican Dwarf Petunia	36	Mexican Dwarf Petunia	36	Mexican Dwarf Petunia	34
Mexican Feathergrass	36	Mexican Feathergrass	36	Mexican Feathergrass	32	Mexican Feathergrass	30
Mexican Honeysuckle	34	Mexican Honeysuckle	35	Mexican Honeysuckle	34	Mexican Honeysuckle	34
Mexican Mint Marigold	34	Mexican Mint Marigold	23	Mexican Mint Marigold	27	Mexican Mint Marigold	23
Mexican Oregano	7	Mexican Oregano	2	Mexican Oregano	7	Mexican Oregano	3
Milkweed	35	Milkweed	36	Milkweed	36	Milkweed	36
Mistflower	36	Mistflower	36	Mistflower	36	Mistflower	36
Monkey Grass	29	Monkey Grass	9	Monkey Grass	6	Monkey Grass	4
Moy Grande Hibiscus	9	Moy Grande Hibiscus	30	Moy Grande Hibiscus	24	Moy Grande Hibiscus	11
Mutabilis Rose	35	Mutabilis Rose	35	Mutabilis Rose	36	Mutabilis Rose	36
Mystic Spires Salvia	36	Mystic Spires Salvia	35	Mystic Spires Salvia	36	Mystic Spires Salvia	32
New Gold Lantana	35	New Gold Lantana	36	New Gold Lantana	36	New Gold Lantana	28
Nolina	14	Nolina	12	Nolina	16	Nolina	16
Oleander	32	Oleander	36	Oleander	36	Oleander	36
Photina	36	Photina	29	Photina	33	Photina	36
Pittosporum	25	Pittosporum	2	Pittosporum	2	Pittosporum	4
Plumbago	29	Plumbago	36	Plumbago	27	Plumbago	32
Pomegranate	36	Pomegranate	36	Pomegranate	36	Pomegranate	36
Possumhaw Holly	19	Possumhaw Holly	14	Possumhaw Holly	20	Possumhaw Holly	28
Pride of Barbados	36	Pride of Barbados	36	Pride of Barbados	36	Pride of Barbados	36
Primrose Jasmine	30	Primrose Jasmine	20	Primrose Jasmine	28	Primrose Jasmine	32
Prostrate Rosemary	17	Prostrate Rosemary	4	Prostrate Rosemary	3	Prostrate Rosemary	3
Purple Coneflower	2	Purple Coneflower	0	Purple Coneflower	4	Purple Coneflower	24
Purple Fountaingrass	36	Purple Fountaingrass	35	Purple Fountaingrass	36	Purple Fountaingrass	36
Purple Heart	32	Purple Heart	35	Purple Heart	35	Purple Heart	36
Red Yucca	33	Red Yucca	36	Red Yucca	36	Red Yucca	32
Rock Rose (x2)	33	Rock Rose (x2)	32	Rock Rose (x2)	34	Rock Rose (x2)	36
Rosemary	35	Rosemary	34	Rosemary	34	Rosemary	32
Sabal Minor Palm	35	Sabal Minor Palm	32	Sabal Minor Palm	36	Sabal Minor Palm	36
Sago Palm	22	Sago Palm	11	Sago Palm	24	Sago Palm	32
Sandankwa Viburnum	35	Sandankwa Viburnum	35	Sandankwa Viburnum	32	Sandankwa Viburnum	36
Santolina	33	Santolina	36	Santolina	36	Santolina	36
Skullcap	36	Skullcap	28	Skullcap	36	Skullcap	36
Society Garlic	22	Society Garlic	20	Society Garlic	8	Society Garlic	15

Texas Mountain Laurel	26	Texas Mountain Laurel	21	Texas Mountain Laurel	30	Texas Mountain Laurel	28
Texas Sotol	27	Texas Sotol	31	Texas Sotol	26	Texas Sotol	27
Thyrallis	27	Thyrallis	31	Thyrallis	36	Thyrallis	36
Turks Cap	36	Turks Cap	36	Turks Cap	36	Turks Cap	36
Variegated Liriope	31	Variegated Liriope	7	Variegated Liriope	2	Variegated Liriope	10
Viburnum Tinus	36	Viburnum Tinus	22	Viburnum Tinus	21	Viburnum Tinus	22
Yaupon Holly	33	Yaupon Holly	28	Yaupon Holly	33	Yaupon Holly	35
Yellow Columbine	16	Yellow Columbine	1	Yellow Columbine	0	Yellow Columbine	2
Zexmania	23	Zexmania	32	Zexmania	36	Zexmania	36

APPENDIX J. A comparative PPI of 0.0 ETo treatment using the last three-week interval from the drought treatment period and the last month of the recovery period in alphabetical order.

Last three weeks of Phase 1		Last month of Phase 2	
Agarita	75	Agarita	36
American Beautyberry	65	American Beautyberry	0
Anacacho Orchid	110	Anacacho Orchid	44
Asiatic Jasmine	85	Asiatic Jasmine	11
Bat Faced Cuphea	68	Bat Faced Cuphea	33
Belindas Dream Rose	102	Belindas Dream Rose	38
Bicolor Iris	118	Bicolor Iris	47
Blackfoot Daisy	76	Blackfoot Daisy	23
Blue Grama Grass	47	Blue Grama Grass	2
Blue Liriope	21	Blue Liriope	30
Blue Princess Verbena	37	Blue Princess Verbena	33
Boxwood	100	Boxwood	36
Buford Holly	88	Buford Holly	8
Bulbine	86	Bulbine	38
Butterfly Vine	132	Butterfly Vine	30
Carolina Jessamine Vine	58	Carolina Jessamine Vine	15
Cemetary Iris	70	Cemetary Iris	38
Cenizo	129	Cenizo	47
Chile Pequin	110	Chile Pequin	18
Compact Nandina	92	Compact Nandina	36
Confetti Lantana	142	Confetti Lantana	0
Coral Honeysuckle	52	Coral Honeysuckle	33
Cotoneaster	108	Cotoneaster	36
Creeping Juniper	6	Creeping Juniper	2
Crepe Myrtle	88	Crepe Myrtle	36
Cross Vine	99	Cross Vine	39
Daylily	99	Daylily	48
Dutch Iris	94	Dutch Iris	48
Dwarf Chinese Holly	9	Dwarf Chinese Holly	4
Dwarf Nandina	23	Dwarf Nandina	27
Esperanza	118	Esperanza	8
Evergreen Sumac	96	Evergreen Sumac	39
Fall Aster	110	Fall Aster	35
Fall Obedient Plant	66	Fall Obedient Plant	28
Firebush	108	Firebush	21
Flowering Senna	120	Flowering Senna	48
Four Nerve Daisy	80	Four Nerve Daisy	39
Garden Phlox	27	Garden Phlox	6
Gaura	140	Gaura	30
Glossy Abelia	48	Glossy Abelia	33

Grandmas Yellow Rose	71	Grandmas Yellow Rose	16
Gregg Salvia	61	Gregg Salvia	34
Gulf Muhly	140	Gulf Muhly	48
Gulf Muhly One	131	Gulf Muhly One	45
Henry Duelberg Salvia	118	Henry Duelberg Salvia	45
Indian Grass	97	Indian Grass	26
Jerusalem Sage	78	Jerusalem Sage	48
Knock Out Rose	106	Knock Out Rose	42
Large Daylily	111	Large Daylily	48
Lindheimer Muhly	108	Lindheimer Muhly	48
Lindheimer Muhly One	123	Lindheimer Muhly One	48
Little Bluestem	68	Little Bluestem	12
Martha Gonzales Rose	107	Martha Gonzales Rose	39
Mexican Bush Sage	129	Mexican Bush Sage	12
Mexican Dwarf Petunia	93	Mexican Dwarf Petunia	26
Mexican Feathergrass	111	Mexican Feathergrass	41
Mexican Honeysuckle	106	Mexican Honeysuckle	32
Mexican Mint Marigold	52	Mexican Mint Marigold	48
Mexican Oregano	35	Mexican Oregano	21
Milkweed	78	Milkweed	0
Mistflower	115	Mistflower	48
Monkey Grass	17	Monkey Grass	0
Moy Grande Hibiscus	88	Moy Grande Hibiscus	0
Mutabilis Rose	102	Mutabilis Rose	39
Mystic Spires Salvia	104	Mystic Spires Salvia	48
New Gold Lantana	107	New Gold Lantana	0
Nolina	44	Nolina	15
Oleander	144	Oleander	46
Photina	91	Photina	36
Pittosporum	9	Pittosporum	7
Plumbago	85	Plumbago	27
Pomegranate	109	Pomegranate	45
Possumhaw Holly	64	Possumhaw Holly	36
Pride of Barbados	129	Pride of Barbados	4
Primrose Jasmine	59	Primrose Jasmine	37
Prostrate Rosemary	37	Prostrate Rosemary	21
Purple Coneflower	49	Purple Coneflower	24
Purple Fountaingrass	118	Purple Fountaingrass	38
Purple Heart	112	Purple Heart	38
Red Yucca	124	Red Yucca	48
Rock Rose (x2)	119	Rock Rose (x2)	47
Rosemary	74	Rosemary	36
Sabal Minor Palm	119	Sabal Minor Palm	44
Sago Palm	89	Sago Palm	6
Sandankwa Viburnum	79	Sandankwa Viburnum	36
Santolina	129	Santolina	46
Skullcap	100	Skullcap	32

Society Garlic	23	Society Garlic	28
Texas Mountain Laurel	98	Texas Mountain Laurel	48
Texas Sotol	134	Texas Sotol	43
Thyrallis	102	Thyrallis	37
Turks Cap	119	Turks Cap	19
Variegated Liriope	35	Variegated Liriope	1
Viburnum Tinus	31	Viburnum Tinus	18
Yaupon Holly	96	Yaupon Holly	33
Yellow Columbine	8	Yellow Columbine	0
Zexmania	111	Zexmania	48

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