2016-08-558

Project Title: Assessing tree to grass water use ratios; Significance to the golf course industry

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Objectives of the project:

Research was undertaken to assess the water use rate of ten different mature landscape trees species relative to hybrid bermudagrass (C4 grass), bentgrass, perennial ryegrass and tall fescue (C3 grasses). The research was designed to address the following questions; 1)What are the water use rates of mature landscape trees growing in an arid environment? 2) What are the water use rates of these trees relative to morphological parameters that will allow such data to be scaled to other locations? 3)What are the water use trade-offs between tree species and turfgrass on an area basis?

Start Date: 2016

Project Duration: 3 years

Total Funding: $90,000

Summary Text

Water is a precious resource in the southwestern United States where population growth is placing greater demand on this finite resource. Water use in all sectors is being heavily scrutinized, with water users expected to maintain tight water budgets and implement as many water saving techniques as possible. It is estimated that 60 percent of all the water used in the Las Vegas valley is used in the residential sector, with 70% of that water used outdoors to irrigate urban landscapes. These landscapes are dominated by trees and turf grass and although much is known about the water use of turf grass species, little is known about the water use of landscape trees and therefore little is known about the tradeoffs between grasses and trees in urban landscapes. We are conducting a tree to grass water use ratio study focusing on ten common landscape tree species grown in the valley (mesquite, ash (Modesto and Arizona), desert willow, oak, Palo Verde, vitex, locust, elm and crepe myrtle) and four turf grass species (bermudagrass, bent grass, tall fescue and ryegrass). We are estimating water use by closing hydrologic balances on the trees (basins) and turf grass (lysimeters). We are also estimating transpiration of trees using Granier probes and estimating conductive tissue with a novel dye injection system. We will compare water use of all ten tree species with the four turf grass species and develop models that incorporate reference ET and morphological characteristics such as tree height, canopy volume, basal canopy area, LAI and leaf area. Observations are ongoing.

Hypotheses

1) In Southern Nevada, Mature landscape trees use more water than landscape grasses, based on tree basal canopy area. As such, tree to grass water use ratios will favor greater

removal of turfgrass to be equivalent to the water use of trees. Ratios will vary based on turfgrass species with cool season grasses such as tall fescue using significantly more water than warm season grasses such as bermudagrass.

2) Landscape tree morphological characteristics, such as height, basal canopy area, canopy volume, leaf area density and trunk diameter along with estimates of reference evapotranspiration (environmental demand) can be used to accurately estimate monthly and yearly actual evapotranspiration totals of tree species. However, the accuracy of these equations will be species dependent.

Results

Reference ET 12 month total = 156.6 cm
Tall Fescue ET 12 month total= 185.3 cm
Low fertility Bermuda grass ET 12 month total =106 cm (literature, Devitt et al.1992)
(Refer to Figure 1).

ET on a basal canopy area basis typically peaked during summer months and declined in fall and winter months with distinct separation on a species basis. (Refer to Figure 2).

When comparing tree and Bermuda grass ratios generated for Mesquite, Modesto Ash, and Crepe Myrtle ratios above one occurred for all species but the highest values were primarily confined to the fall and winter period. (Refer to Figure 3).

When similar ratios were generated for tall fescue fewer months had ratios above 1.0 with the highest ratio during January and February.

With the exception of Crepe Myrtle, tree grass water use ratios on a yearly basis always reflected lower water use for trees compared to grasses. This response indicated that smaller areas of turf grass would need to be removed to be equivalent to tree water use on a basal canopy area basis.

Research is ongoing including the analysis of the Thermal Dissipation Probe data and core dye analysis. Because of high mortality with bent grass and ryegrass during summer months, tree grass ratios will be confined to fall, winter, and spring periods for these grasses.

Summary Points

Water use of trees and grasses followed the basic bell shaped curve of reference ET for the Las Vegas area but variation occurred on a species basis.

On a basal canopy area basis all trees except Crepe Myrtle used less water than all 4 turfgrass species with greater differences occurring when the comparison was made with high water using tall fescue compared to low water using low fertility bermudagrass.

Variation in ET on a monthly basis could be described for some trees based on morphological parameters and reference ET but for some species the correlation was not significant.

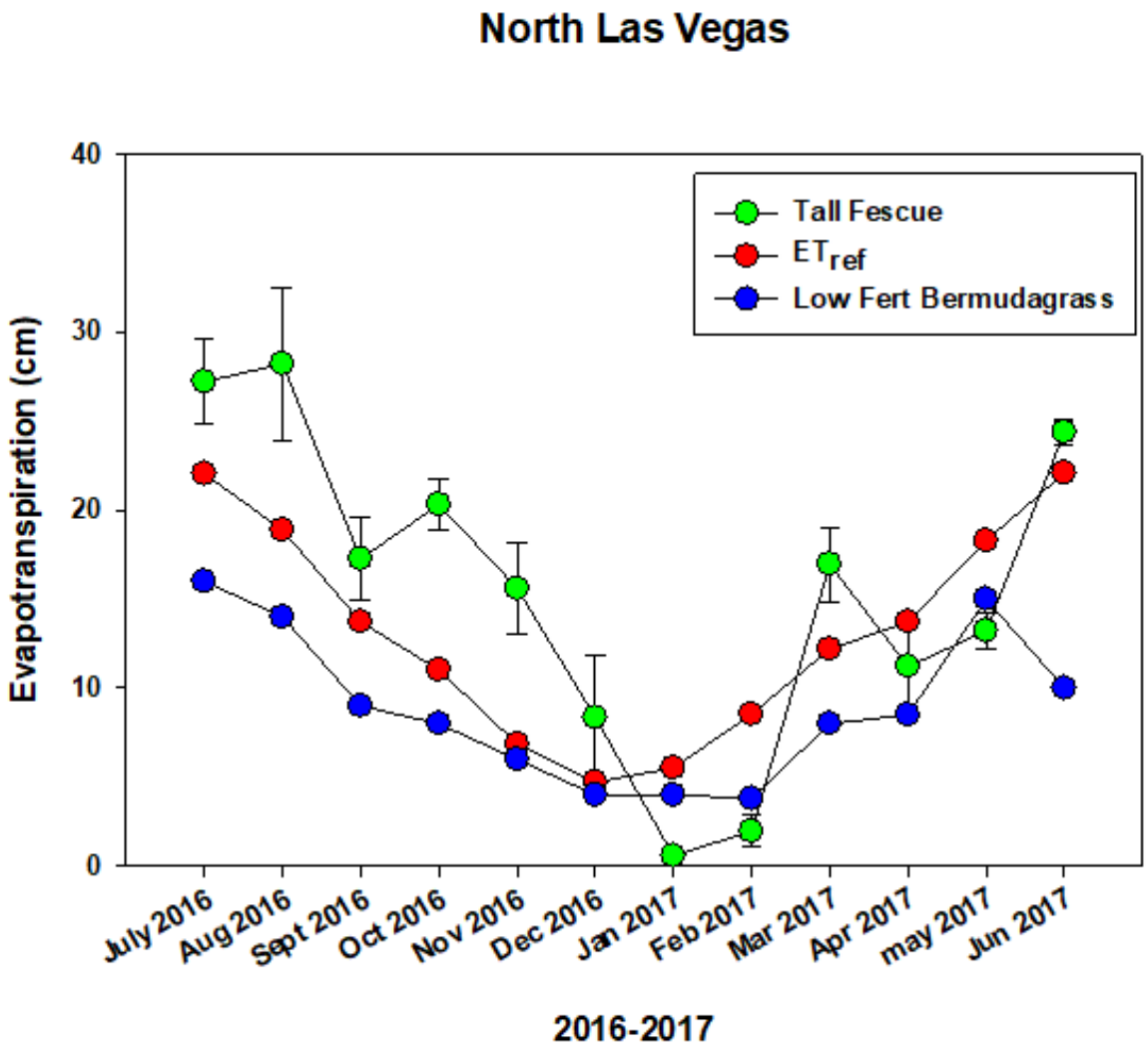

Figure 1. Evapotranspiration of tall fescue and bermudagrass, along with reference evapotranspiration over the 2016-2017 period.

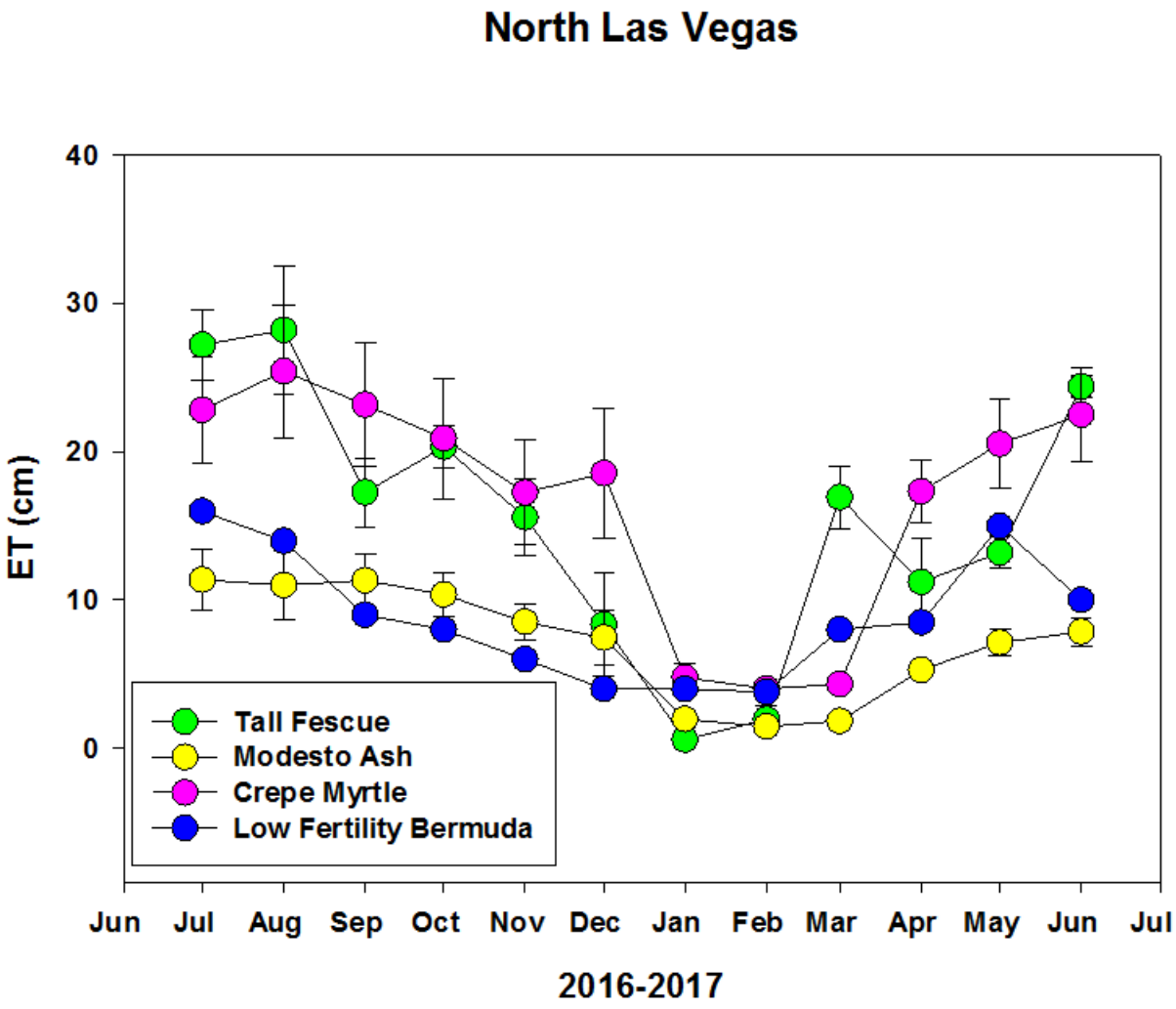

Figure 2. Evapotranspiration of tall fescue and bermudagrass with modesto ash and Crepe myrtle over the 2016-2017 period..

North Las Vegas

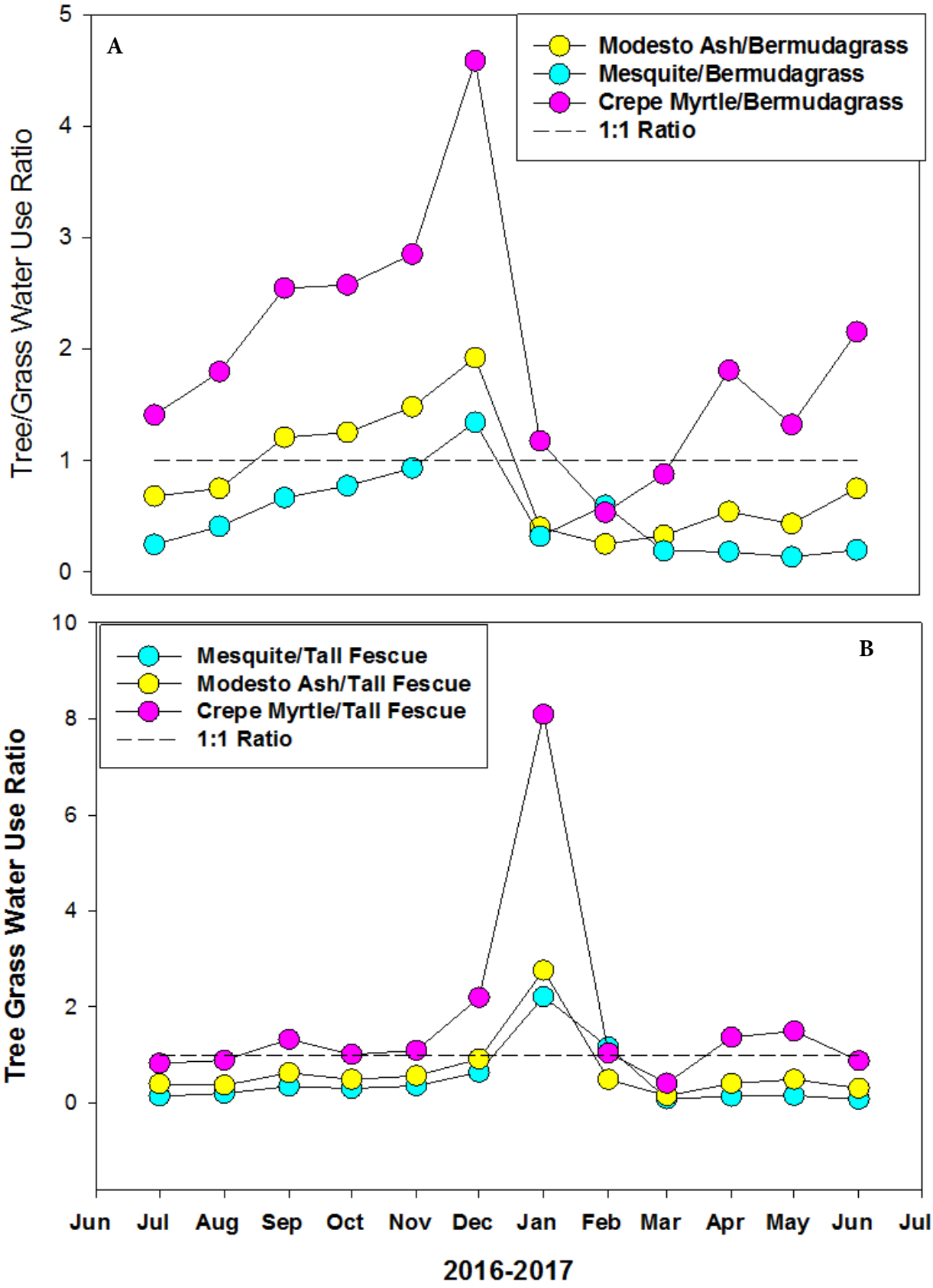

Figure 3. Tree/Turfgrass water use ratios comparing several tree species with bermudagrass (A) or tall fescue (B).