



## Introduction

Species such as creosotebush (*Larrea tridentata*), mesquite (*Prosopis sp.*), and juniper (*Juniperus sp.*) have been locally dominant in the semi-arid southwestern United States for at least 4,000 years; however, in the last 100 years, these species have encroached upon native grasslands, expanding in range and land cover density as the result of a combination of changes in land use such as fewer, less intense wildfires, heavy grazing, and elimination of native herbivores, as well as changes in atmospheric conditions including precipitation, temperature, and CO<sub>2</sub>. These changes in the semiarid landscape have led to the alteration of both ecological and hydrological processes.

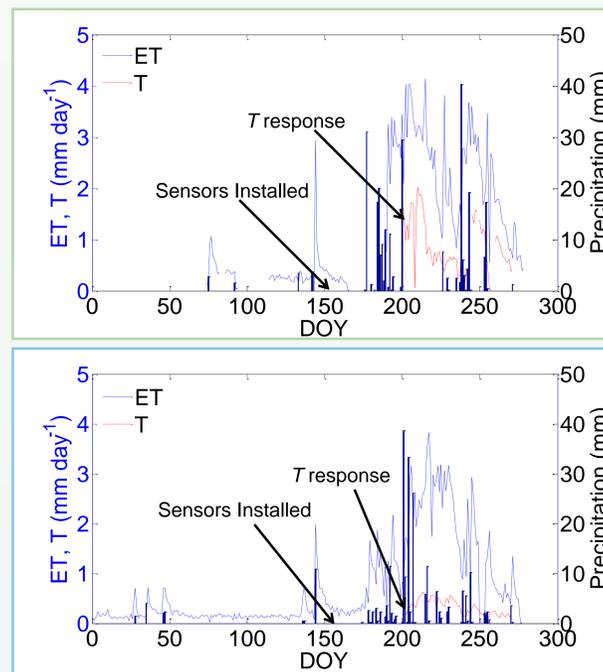
The objective of this study is to compare transpiration losses by creosotebush at two study sites in southeastern Arizona, Santa Rita Experimental Range (SRER) and Walnut Gulch Experimental Watershed (WGEW). We used sap flow measurement in order to understand the unique water use of these woody plants under different environmental conditions.

## Methods



- 1) A greenhouse experiment was conducted to test the effectiveness of the sap flow sensors compared to a gravimetric method of measuring water loss.
- 2) 15 sensors were deployed at both sites during the first week of June and monitored from 8 June 2008 to present.

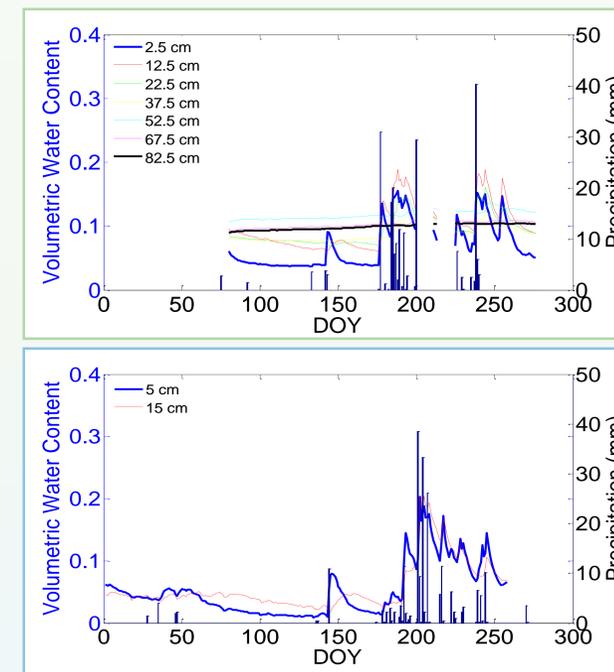
## Preliminary Results



Figures 3 and 4. *ET*, *T*, and precipitation at SRER and WGEW.

Transpiration is greater at SRER most likely due to the shrubs being larger at this field site. It took approximately 3 weeks following the start of monsoon storms for the plants to respond with increases in *T*.

## Soil Moisture



Figures 7 and 8. Daily volumetric water content and precipitation at SRER and WGEW.

Volumetric water content is directly correlated to precipitation events and can be used to determine *E* at each field site.

The relationship between *T* and *E* can also be examined by looking at the correlation between *T* from sap flow and *E* from soil moisture measurements at different depths.



SRER

WGEW

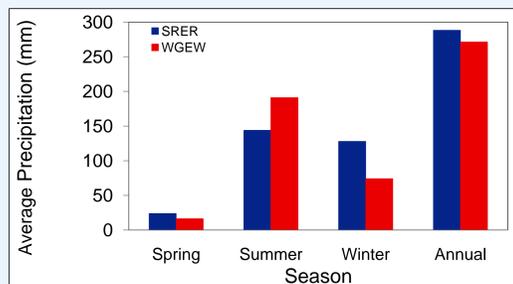


Figure 1. Seasonal precipitation at SRER (1971-2007) and WGEW (1964-2003).

SRER receives more annual precipitation more evenly distributed throughout the year while WGEW receives the majority of yearly precipitation during the summer monsoon season.

Additional measurements at both sites include:

- Precipitation
- *ET*
- Soil Moisture
- Leaf Area Index



SRER Eddy Tower

WGEW Eddy Tower

## Methods Testing

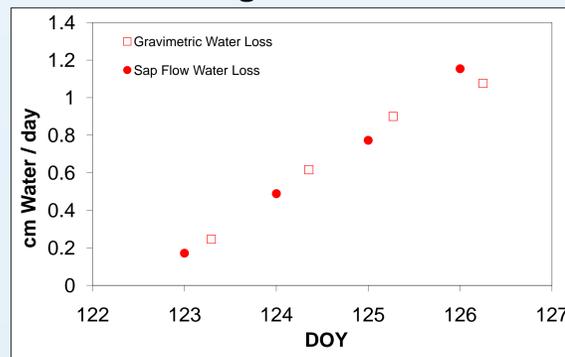
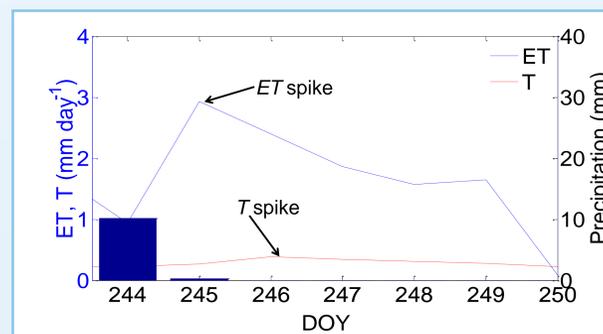
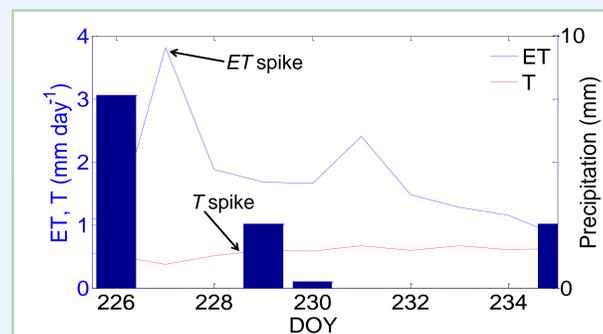


Figure 2. Water loss by creosotebush measured by sap flow and gravimetrically.



Figures 5 and 6. *ET*, *T*, and precipitation for one event at SRER and WGEW.

When a precipitation event occurs, there is a spike in *ET* within one day after the event while *T* is lagged, peaking 2 to 3 days later.

## Conclusions

- Creosotebush *T* is lower at WGEW than at SRER
- At both sites, the peak in *T* is lagged in comparison to the peak in *ET*

## Future Work

Work will continue at both SRER and WGEW with regular data collection and analysis in order to better understand the water use of creosotebush and address the three proposed hypotheses. Evaporation (*E*) is being measured using lysimeters and will be used to compare *ET* to *E* and *T*.

## Acknowledgements

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## Hypotheses

- There will be no transpiration (*T*) responses for storms less than 5 mm at both sites.
- There will be a lagged response of *T* to large precipitation events, with evaporation being the dominate component in the partitioning of *ET* for the first two days.
- The ratio of plant transpiration to total evapotranspiration (*T/ET*) will be less at SRER due to the larger amount of bare soil exposed at this site.