Feb 2nd, 9:30 AM - 3:30 PM

Research poster: Water source partitioning for shrubland transpiration using innovative field methods

Amanda Wagner
University of Nevada, Las Vegas

Dale A. Devitt
University of Nevada, Las Vegas, dadevitt@unlv.nevada.edu

Michael Young
Desert Research Institute

Matthew S. Lachniet
University of Nevada, Las Vegas, matthew.lachniet@unlv.edu

Jeremy Koonce
University of Nevada, Las Vegas

See next page for additional authors

Presenters
Amanda Wagner, Dale A. Devitt, Michael Young, Matthew S. Lachniet, Jeremy Koonce, and Brian M. Bird

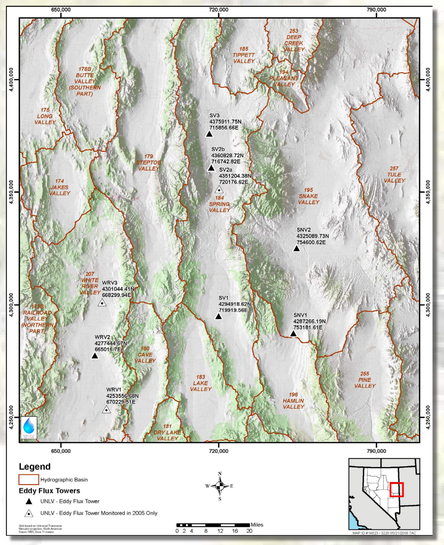
Water source partitioning for shrubland transpiration using innovative field methods

Amanda Wagner – Graduate Assistant, Water Resources Management, UNLV
Dale Devitt – Professor of Soil and Water, School of Life Sciences, UNLV
Michael Young – Associate Professor of Soil Physics, Desert Research Institute
Matt Lachniet – Assistant Professor, Geosciences, UNLV
Jeremy Koonce – Graduate Assistant, Geosciences, UNLV
Brian Bird – Staff Research Associate, School of Life Sciences, UNLV

INTRODUCTION

Groundwater recharge reduction in the Great Basin Desert, NV due to a decline in annual precipitation and groundwater pumping could intensify the reliance of phreatophytes on groundwater. A reduction in groundwater due to climate variability and pumping could lead to a stronger coupling of phreatophytes to groundwater resources. Some climate models predict a reduction in annual precipitation over the next 20-30 years throughout much of the western United States (Barnett and Pierce, 2007). Therefore, extensive research is needed to gain a stronger understanding of the coupling of phreatophytes to groundwater prior to pumping and climate change.

Beginning in March 2010, we will initiate field research to gain a better understanding of the relationship between phreatophytes and their environment. In order to gain a comprehensive understanding of the coupling and decoupling of phreatophytes with groundwater resources, we will measure the fractional evapotranspiration (ET) associated with the phreatophyte Greasewood (Sarcobatus vermiculatus). We will utilize eddy covariance (EC) data, which integrates ET from an entire canopy, groundwater oscillations patterns, and Granier's thermal dissipations probes (TDP) to measure transpiration as a fractional component of ET.



LOCATION

SV6 coordinates:
Northing: 4324555.44
Easting: 717823.99

Elevation: 1,755.71 meters
UTM Zone 11, Map datum WGS84


SV6 September 2009 during plant assessment


SV6 weather station and eddy flux equipment

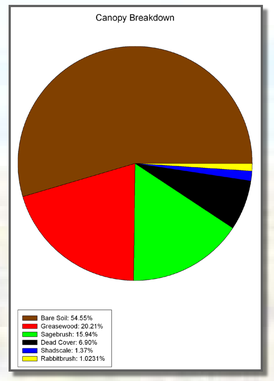

Amanda Wagner and Dr. Dale Devitt conducting the SV6 plant assessment


***Sarcobatus vermiculatus*: Greasewood**


Chrysothamnus viscidiflorus: Rabbitbrush

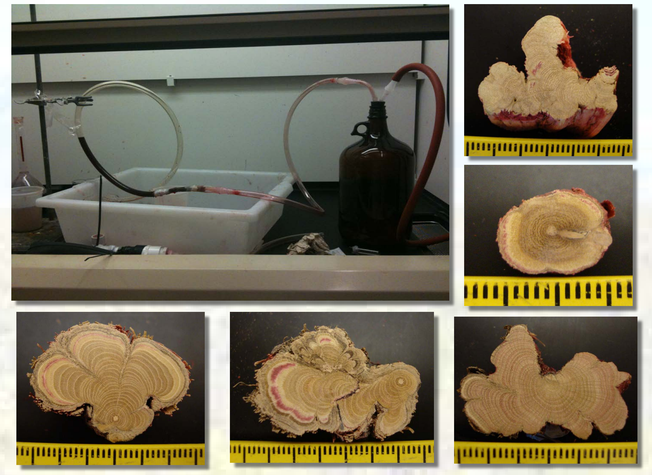

Atriplex confertifolia: Shadscale


Artemisia tridentate: Big Sagebrush



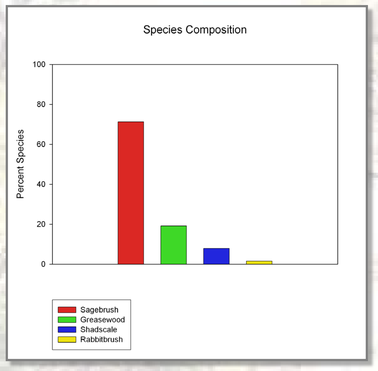
Plant Study

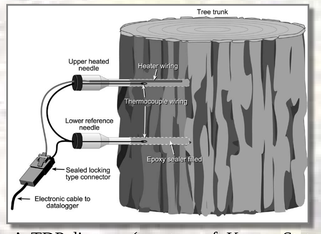
A plant assessment of SV6 was conducted in September 2009 on four 25 m by 25 m plots. All plants within each plot were counted and the height and canopy diameters measured. From the measurements collected during the plant assessment, we were able to calculate the percentage of each species and the canopy cover at the site. This data will be compared to remote sensing data to gain a greater insight into the species composition of the surrounding area.



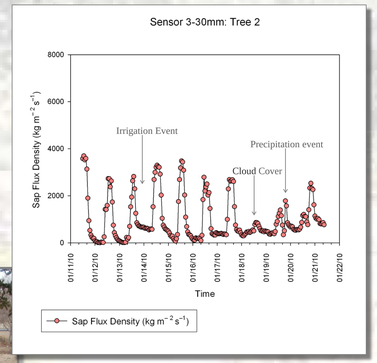
Dye Study

In order to stain the conductive vascular tissue of the stems we dissolved 1g of safranin in 40mL ETOH then added water to a volume of 1000mL. We affixed airtight tubing to each end of the stem and pulled dye through the bottom of the stem using suction. This resulted in staining of only the conductive tissue, as can be seen in the above photos. We performed this technique on four stems of each species. All stems were cut in a 4°C cold room, however two were cut on a bench and two were cut underwater to prevent cavitation. We will use this data to derive an average percent of conductive tissue for each species and to guide the sensor installation in the field.





Granier's TDP diagram (courtesy of Kansas State Univ.)

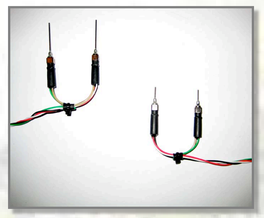


MATERIAL AND METHODS

Sapflow

Sap flow measurements will be conducted using Granier's thermal dissipation probes (TDP). A sensor which consists of two cylindrical probes either 10mm or 30 mm in length are inserted radially into the sapwood of the trunk (Granier 1985). The top probe consists of a heating element and both probes contain a copper-constantan thermocouple which allows the system to measure the difference in temperature between the two probes. A datalogger will collect data in thirty minute intervals. During pre-study trials, we installed six 10mm and six 30mm sensors in three oak trees. Each oak contained two 30mm and two 10mm sensors. Initial data showed well defined peaks and troughs throughout the 10 day trial period with clear responses to an irrigation event, precipitation event and cloud cover.


Datalogger and TDP probes installed in an Oak tree during pre-study trials


30mm and 10mm TDP