Comparison of Groundwater Depth in a Heterogeneous Riparian Buffer under separate Hydrologic Regimes

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Introduction

**Overall:** We seek to understand the effects of riparian vegetation on the irrigation-influenced water balance in the Lower Arkansas River Valley (LARV). I helped with this project by working on the following action items:

1. **Comparing water balances in streamside study areas with and without riparian buffers, abutted by agricultural or by naturally-vegetated (or fallow) areas.**
   a. Collect groundwater and surface water head data.
   b. Assimilate three years of 15-minute data collected from 12 groundwater wells and 3 surface water wells.
   c. Use GPS-survey data and the hydraulic head data to compute groundwater depth.

2. **Early estimation of the relative magnitude of riparian evapotranspiration (ET).**
   a. Compute the White Method.
   b. Use in-situ meteorological data to compute ET.
Background

- LARV is economically important!
  - River Balances
  - Amount of use
  - Irrigation
- Supreme Court - Kansas v. Colorado
  - Seven cases, six regarding the Arkansas River and use/rights
- Sustainability: Economic, Social, Environmental
- Ultimately, we’re engineers, we serve people!
  - Agriculture
  - Right by land
  - Safe/Clean Practices
Location
Methods & Experimental Setup

- Field Work
  - Arkansas Valley Research Center at Rocky Ford, Otero County, CO
  - ArcGIS and GPS Mapping
  - Twelve Groundwater wells
  - Three River wells
  - One Groundwater well - Barometric
  - Measurements
    - Elevation in meters above sea level (msal)
    - Depth to Groundwater (DTGW) Measurements

- Computational Analysis
  - Excel & R-Script
  - Wells Equipped with Sensors, measured:
    - Absolute Pressure
    - Temperature
    - Barometric Pressure & Temperature
    - 15-minute time-intervals

- Weather Stations
- Timeline: 2017 - 2020
Results (Hypothesis)

Source: USDA Natural Resource Conservation Service (NRCS) - Colorado Basin-Wide Interactive SNOTEL Graphs.
Link: https://www.nrcs.usda.gov/wps/portal/nrcs/detail/co/snow/products/?cid=nrceprd1432263

Note: The snow water equivalent values are the average from all sites within and adjacent to the watershed!
Results

Well A1
Field, Flooded
Very Pronounced Results
Good connection w/ atm.
Upstream

Well A4
Field, Unflooded

Well B3
River
Thick Riparian Corridor

Well C2
River
Thin Riparian Corridor
Big Sandy Beaches
Little to no vegetation
Downstream

Note:
Depth to Groundwater - DTGW
Next Steps...

- Compute ET using the White Method
- Compute ET using local meteorological data and compare to the White Method
- Incorporate satellite imagery
- Continue graphical/statistical analysis
- Correlate data between other factors: Temperature, Pressure, Elevation, etc.

$$q = S_y (24r \pm s)$$

$q \ [L/T]$ is the Volume of Withdrawn Water (Water Consumption), also known as $ET_s$

$S_y \ [L^3/L^3]$ is the Specific Yield

$r \ [L/T]$ is the recharge rate calculated as the hourly rise of the water table between midnight and 4 A.M. (i.e., the slope of a fitted linear model)

$s \ [L/T]$ is the net fall/rise of water table in the 24 hr period
What benefits did you get from your SURE experience?

Being involved in the SURE program has given me exposure to undergrad research, a concept I knew nothing about nor thought I would have the opportunity to pursue. SURE has made me contemplate on my own career path, and has allowed me to explore different ways I can take my degree once I graduate, which is something I cherish as first-generation student. Insight into the graduate school process has been wonderful, and I now I have people to aid me if I pursue that path. Finally, the SURE experience has aided in my growth in becoming a better academic learning and contributor. Becoming a good student has been a rocky road for me, and SURE has pushed me into becoming a better learner and student. Overall, I am grateful for this experience. To me this was not just a resume booster, but a valuable teaching experience and a fun experience overall.

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References


Go Rams!! #WSCOESURE2021
Thank you