The Groundwater Dependent Ecosystem (GDE) Identification, Assessment, and Monitoring Program

February 26, 2026
TAC / EWG Meeting

Responses to issues raised on our report

Responses to issues raised by TAC/EWG review have been provided through the 2/11 document provided to the Watermaster

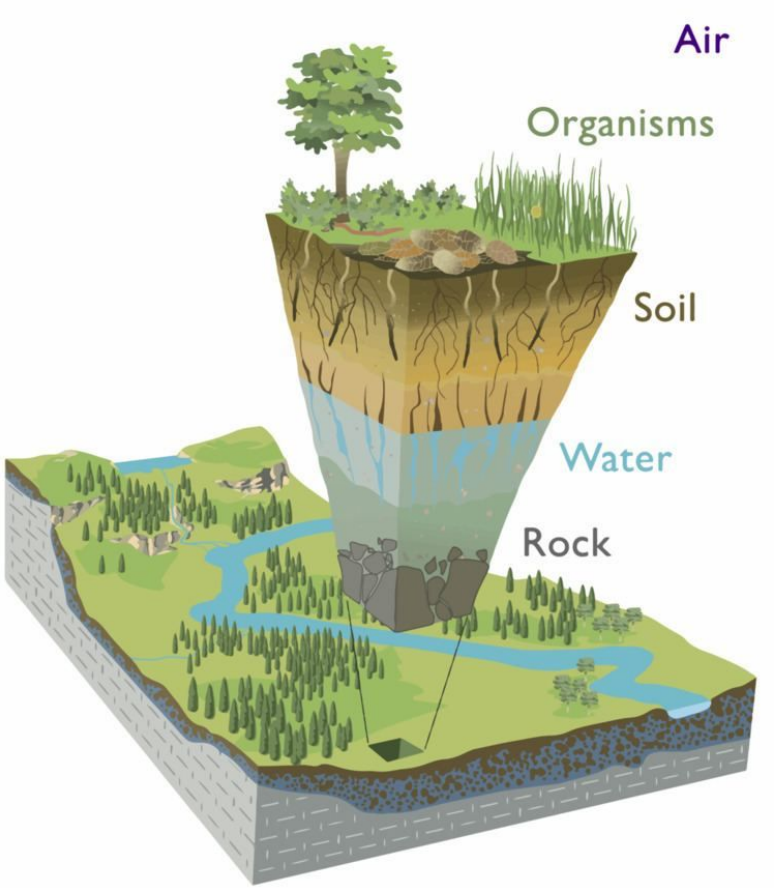
- Some of our responses additionally address issues raised by West Yost's review
- We appreciate the evaluation of our work

We maintain that we have provided you documentation of:

- Significant acreage of groundwater-dependent species distributed near the Sink
- Patterns of water use and composition that are consistent with GDE activity
- Logical consistency among the independent lines of investigation

The multidisciplinary nature of this activity

- Critical Zone Science (Waldron 2020)
  - Complex set of interactions occurring from the top of the canopy through the soil column, interfacing with groundwater
  - Field still integrating language, perspectives, and approaches across disciplines (Lohse et al., 2009)



Desert water balance research

- Extreme rainfall can result in percolation (Schreiner-McGraw & Vivoni 2017), but **meaningful movement beyond 1 - 2 m is rare due to vegetation uptake** (e.g., Gee et al. 1994, Smith et al. 1995, Scott and Biederman 2019)
- Over annual cycle, nearly all soil moisture is used by ET (Scott & Biederman 2019; Rungee et al., 2019)
- Runoff to the Sink would have to provide water supporting plants km's away

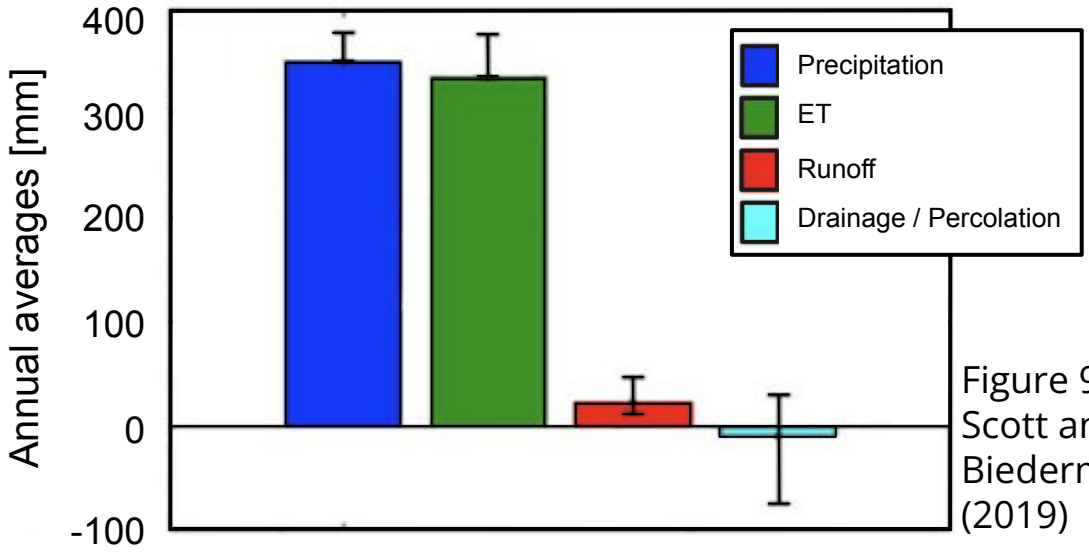
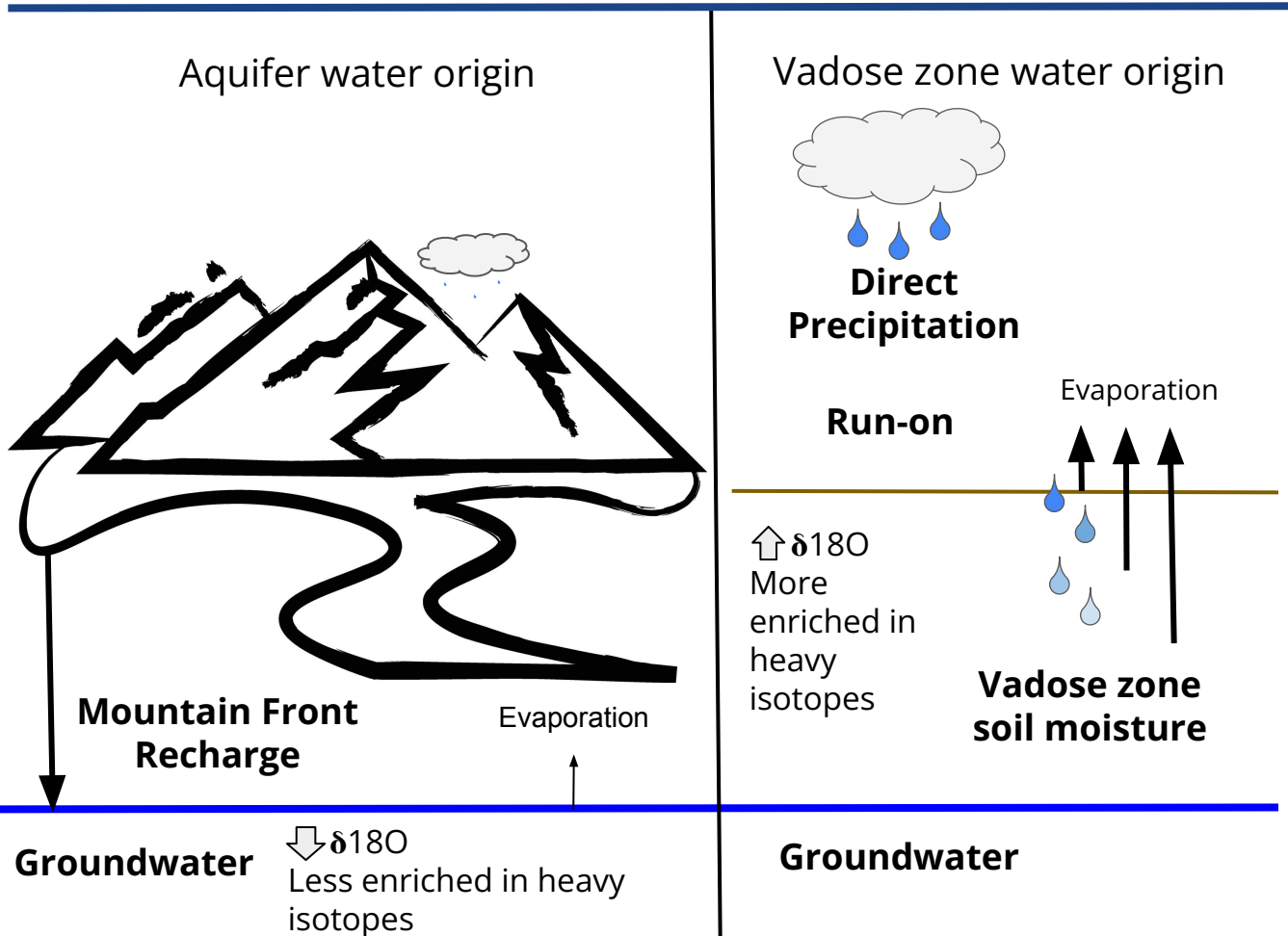


Figure 9 from Scott and Biederman (2019)

Flowpaths determine isotopic composition



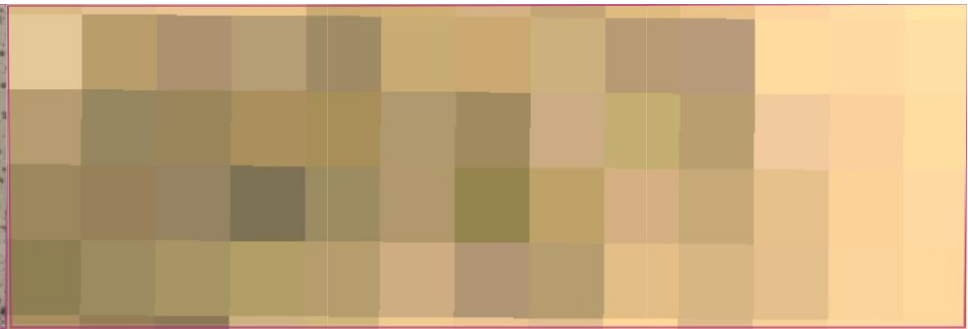
- Different climatic conditions and flowpaths → different impacts of evaporation
- Evaporation → Enrichment in heavy isotopes (e.g., δ18O)
- Isotopic signature evolve different mean and distribution by origin

Remote monitoring of the mesquite bosque

- Mesquite canopies typically 5–20 m in diameter or smaller and can be widely spaced
- Landsat pixels are 30 × 30 m (900 m^2)
  - Mix tree canopy + bare soil reflectance, and ephemeral plants in the subcanopy
  - Mixed signal reduces accuracy in assessing mesquite health
- Groundwater dynamics occur at the individual tree scale → **30 m resolution is too coarse** to detect mesquite-level responses
- **Higher-resolution imagery (1–10 m)** better captures canopy-scale variation and true bosque condition

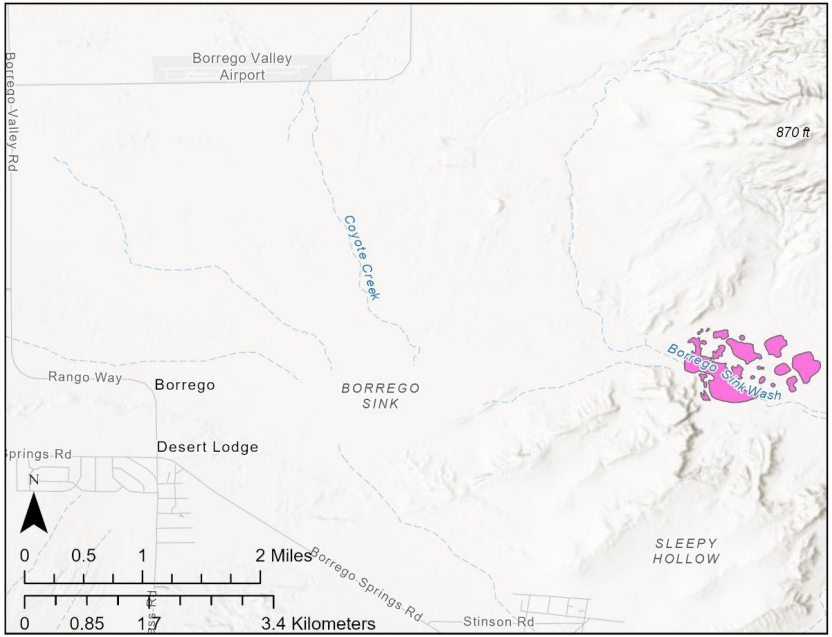
1 m NAIP imagery of Site 1

30 m Landsat imagery of exact same area

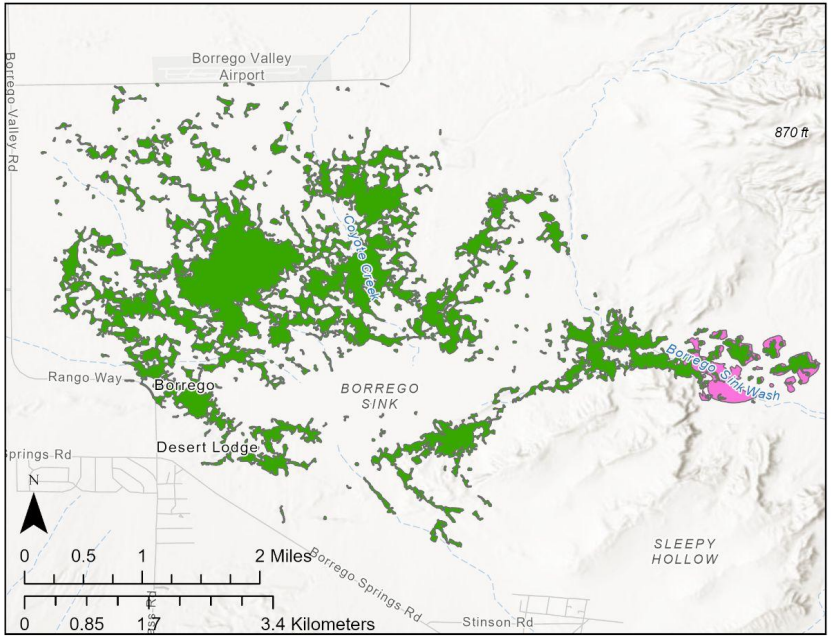


State of the science before the GDE Project and now

In the GMP, only 142.2 acres of mesquite bosque habitat was identified and analyzed, with roots restricted to 15.3 ft bgs.



Mesquite mapped in the GMP (142.2 acres)



Mesquite mapped in the GMP (142.2 acres)

Live mesquite bosque habitat (mapped by UCI; 1,800 acres)

References

Gee, G. W., Wierenga, P. J., Andraski, B. J., Young, M. H., Fayer, M. J., & Rockhold, M. L. (1994). Variations in water balance and recharge potential at three western desert sites. *Soil Science Society of America Journal*, 58(1), 63–72.

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