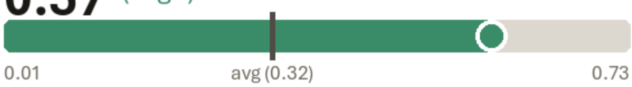
Lake Mohave Groundwater Basin Profile

ARIZONA TRI-UNIVERSITY
RECHARGE AND WATER RELIABILITY PROJECT

Basin Summary Statistics

Size[1]: 980 square miles
Elevation[2]: Range: 454-5,455 ft; Median: 1,524 ft
Top 3 land cover types by area[3]: Shrub/Scrub (87%), Open Water (3.7%), Cultivated Crops (2.4%)
Major surface watershed(s)[4]: Colorado River
Groundwater subbasins[1]: None
Groundwater-derived streamflow fraction[5]:
0.57 (High)



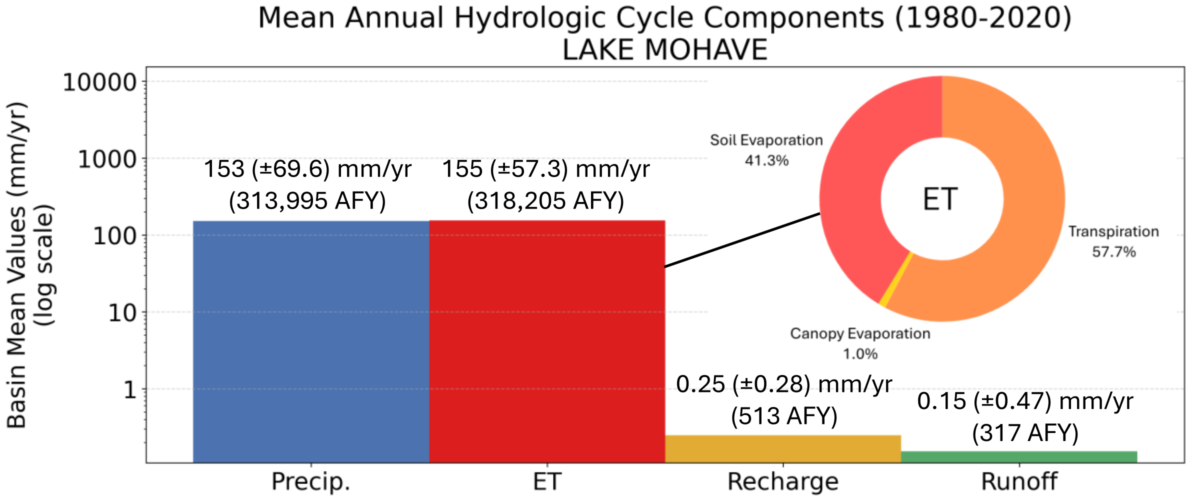


Figure 1 (above). Bar chart showing Noah-MP modeling results of the historical mean annual hydrologic cycle components (precipitation [P], evapotranspiration [ET], natural recharge, and runoff) in the basin from 1980-2020.[6] ET is partitioned into soil evaporation, canopy evaporation, and transpiration. It is possible for ET to be greater than P when there are other sources such as groundwater, surface water, or water in storage.

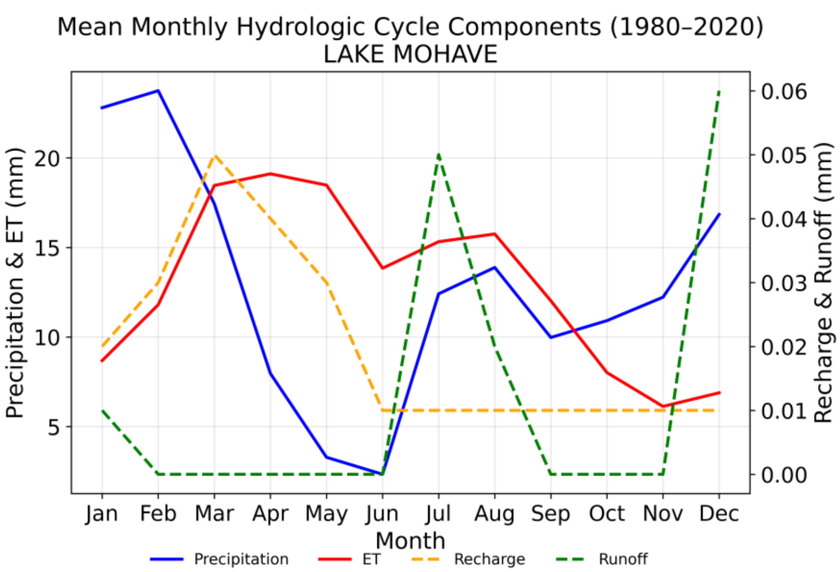
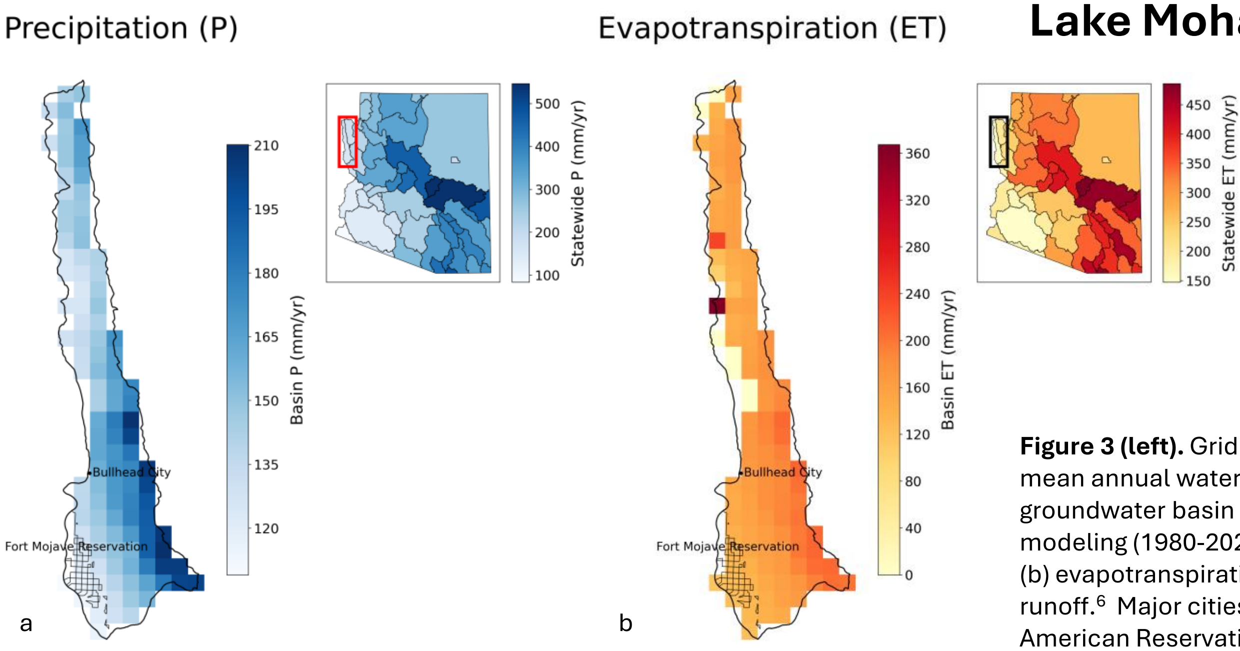


Figure 2. Graph showing monthly mean precipitation, ET, recharge, and runoff for the groundwater basin (1980-2020) from Noah-MP modeling results.[6]

On annual timescales, evapotranspiration (ET) is approximately equal to precipitation (P) on average in the Lake Mohave basin, resulting in basin-wide averages near zero for natural recharge (0.25 mm) and runoff (0.15 mm). ET is greater than P from mid-March through mid-September. Soil evaporation makes up 41.3% of total ET in the basin, while transpiration comprises 57.7% and canopy evaporation accounts for the remainder (1.0%). P exceeds ET during the late fall and winter months when there is lower atmospheric demand.

Lake Mohave



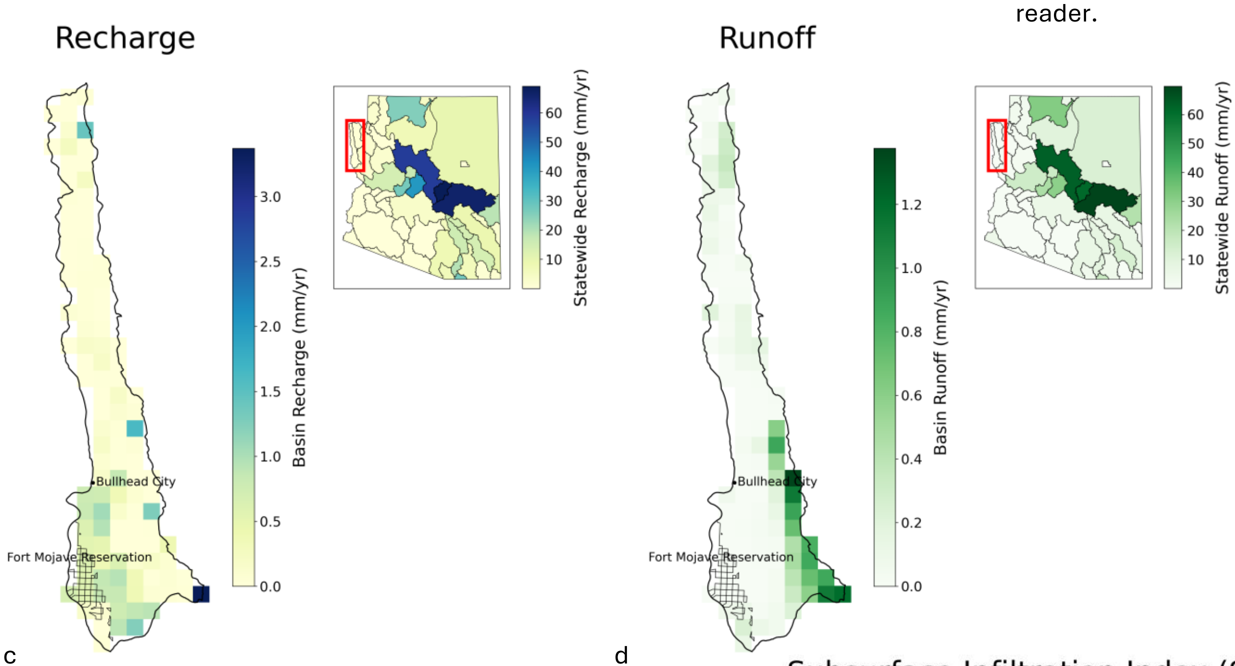


Figure 3 (left). Gridded depiction of mean annual water fluxes across the groundwater basin from Noah-MP modeling (1980-2020): (a) precipitation, (b) evapotranspiration, (c) recharge, (d) runoff.[6] Major cities/towns[7] and Native American Reservation boundaries[8] are shown (as applicable) to help orient the reader.

P in the Lake Mohave basin is greatest in the Black Mountains in the southeast portion of the basin. ET is highest over the open water of Lake Mohave. Runoff and natural recharge are minimal across the basin, with the highest values (1 mm/yr and 3 mm/yr, respectively) occurring at the mountain fronts of the Black Mountains. Infiltration potential varies across the basin, but is generally greater in the alluvial deposits in the northern regions of the basin and in the alluvial fans east of the Mohave Valley in the southern portion.

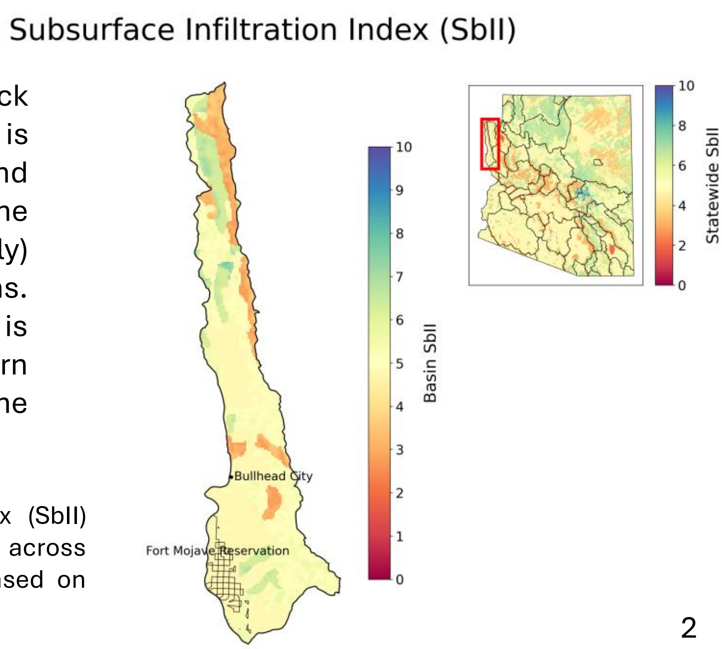


Figure 4 (right). Subsurface infiltration index (SbII) showing infiltration potential of the subsurface across the groundwater basin on a scale of 1-10 based on geologic features.[9]

Lake Mohave

Climate Change Projections:
Changes in Temperature, Precipitation, ET, Recharge, and Runoff
(2060-2099 vs. 1981-2020)

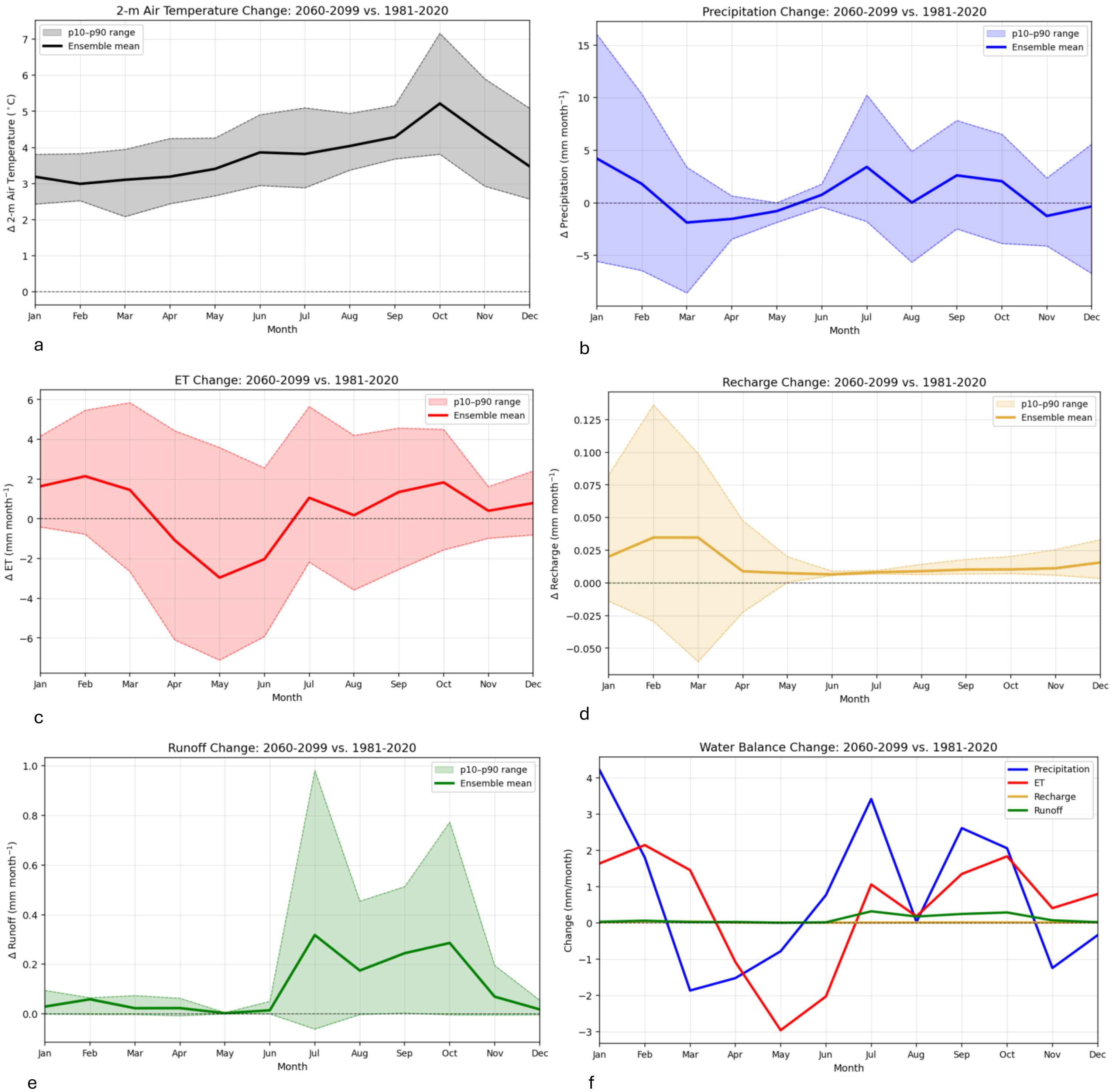


Figure 5. Plots (a)-(e) show projected changes in (a) temperature, (b) precipitation, (c) evapotranspiration (ET), (d) natural recharge, and (e) runoff statewide, comparing end of the 21st century to the historical record from 1981-2020 under the IPCC Scenario SSP3-7.0.[10] Plot (f) shows the change in the water balance components (P, ET, recharge, and runoff) on a single graph for direct comparison. The analysis uses 14 dynamically downscaled global climate models (GCM) at 9-km resolution and the Noah-MP land surface model. The ensemble mean of the 14 GCMs is shown in bold for each component of the hydrologic cycle, with the 10-90th percentile shaded to show model projection uncertainty.

Lake Mohave

Climate change projections across the Lake Mohave basin show drier springs (10-22% drier March through May) and a drier November (10%) and December (1%). September and October are projected to be 18-25% (2.1-2.6 mm/month) wetter on average, which is consistent with a projected increase in extreme events associated with hurricane and tropical cyclone activity by the end of the century. Natural recharge remains near zero throughout the year and is projected to be slightly negative (approximately -0.01 mm/month) from May-November.* While remaining below 0.5 mm/month, runoff is projected to increase by 0.18-0.30 mm/month from July to October. Projected increases in temperature range from approximately 3.0 °C in February to 5.3 °C in October. Higher temperatures and greater water availability from precipitation lead to a projected 18% increase in evapotranspiration (ET) in January and a 21% increase in October compared to the baseline period.

*Projected negative recharge values are attributed to increased capillary rise from the aquifer through the vadose zone due to climate factors, resulting in water loss from the system. Because the Noah-MP model does not include groundwater pumping, this indicates that climate-driven factors play a significant role in groundwater storage decline in Arizona.

References

1. ADWR Groundwater Basin and Subbasin shapefiles. Retrieved from: https://gisdata2016-11-18t150447874z-azwater.opendata.arcgis.com/
2. USGS Digital Elevation Model data. Retrieved from: https://apps.nationalmap.gov/downloader/
3. Annual National Land Cover Database – Land Cover (2024). Retrieved from the Multi-Resolution Land Characteristics Consortium: https://www.mrlc.gov/data
4. USGS HUC8 Watersheds. Retrieved from: https://hydro.nationalmap.gov/arcgis/rest/services/wbd/MapServer
5. Mroczek, C., Springer, A. E., Gupta, N., Sankey, T., & Lucas, B. (2025). Regional base-flow index in arid landscapes using machine learning and instrumented records. *Journal of Hydrology: Regional Studies*, *62*, 102778. https://doi.org/10.1016/j.ejrh.2025.102778
6. Gupta, A., Qiu, Y., Behrangi, A., & Niu, G. (2026). Noah-MP 40-Years Climatology for Water Balance over Ground Water Basins in Arizona, HydroShare, http://www.hydroshare.org/resource/a3cc182071124849a463b6132213af23. (Figures by Hinkley, M. & Mohsenzadeh Karimi, S.)
7. AZGeo City Points shapefile. Retrieved from AZGeo Data Hub: https://azgeo-open-data-agic.hub.arcgis.com/datasets/azgeo::city-points/about
8. Federal American Indian Reservation boundaries shapefile. Retrieved from: https://services2.arcgis.com/FiaPA4ga0iQKduv3/arcgis/rest/services/Federal_American_Indian_Reservations_v1/FeatureServer
9. Lima, R., Springer, A., Sankey, T. (2026). Arizona Subsurface Infiltration Index v.2, HydroShare, https://doi.org/10.4211/hs.abcd8aa1a793463ab33677ce9d46db58
10. Qiu, Y. (2026). Future Projection of Hydroclimate over Arizona Version 2, HydroShare, https://doi.org/10.4211/hs.a5751f0af305483682501f79d9af0bd7