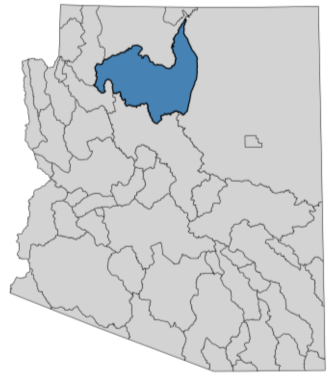
Coconino Plateau Groundwater Basin Profile

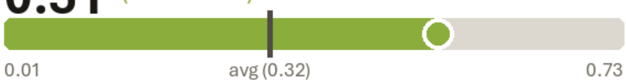
ARIZONA TRI-UNIVERSITY RECHARGE AND WATER RELIABILITY PROJECT



Basin Summary Statistics

Size[1]: 5,810 square miles
Elevation[2]: Range: 1,341-12,621 ft; Median: 5,933 ft
Top 3 land cover types by area[3]: Shrub/Scrub (77%), Evergreen Forest (21%), Barren Land (1.2%)
Major surface watershed(s)[4]: Havasu Canyon, Lower Little Colorado
Groundwater subbasins[1]: None
Groundwater-derived streamflow fraction[5]:

0.51 (Moderate)



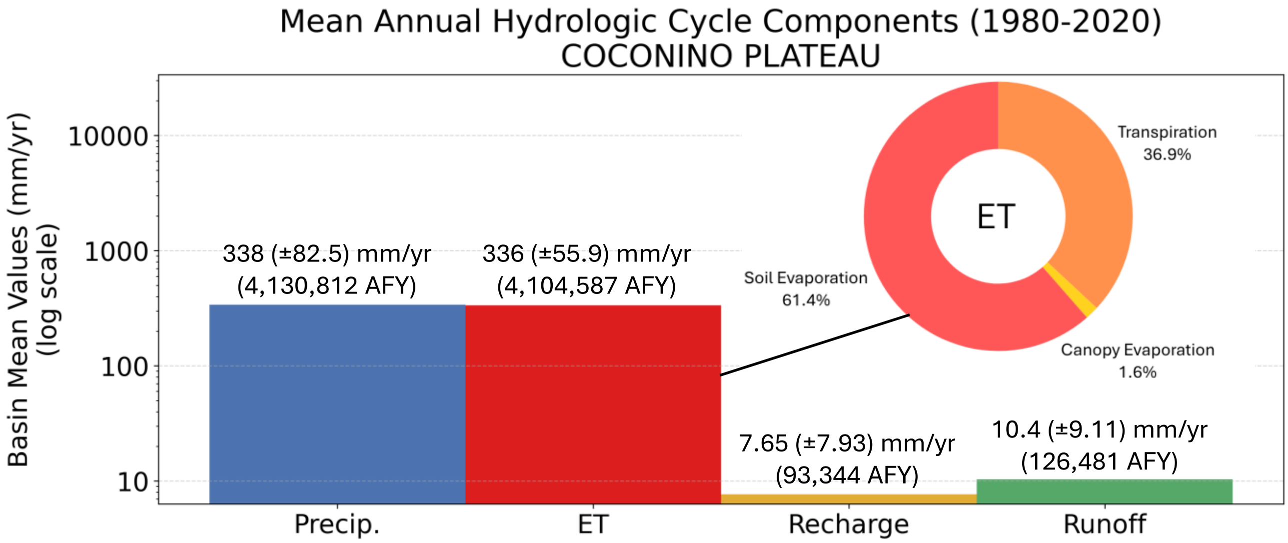


Figure 1 (above). Bar chart showing Noah-MP modeling results of the historical mean annual hydrologic cycle components (precipitation [P], evapotranspiration [ET], natural recharge, and runoff) in the basin from 1980-2020.[6] ET is partitioned into soil evaporation, canopy evaporation, and transpiration.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

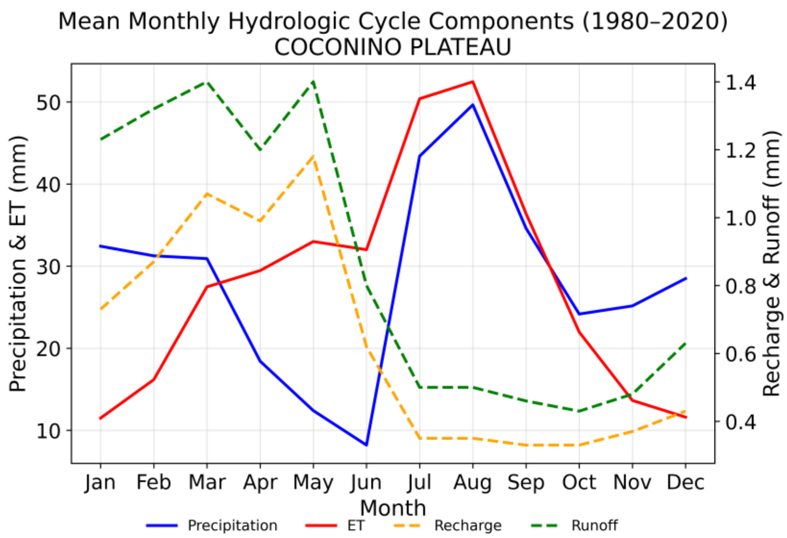


Figure 2. Graph showing monthly mean precipitation, ET, recharge, and runoff for the groundwater basin (1980-2020) from Noah-MP modeling results.[6]

On average, annual evapotranspiration (ET) is approximately equal to annual precipitation (P) across the basin, resulting in low basin-wide annual averages for natural recharge (7.65 mm) and runoff (10.4 mm). Seasonally, the Coconino Plateau is affected by the North American Monsoon during the summer months, and large frontal systems during the winter. ET exceeds P from March through September while P exceeds ET in the winter months. Soil evaporation makes up 61.4% of total ET in the basin, while transpiration comprises 36.9% and canopy evaporation accounts for the remainder (1.6%). Natural recharge and runoff peak in May as a result of springtime snowmelt.

Coconino Plateau

Figure 3 (below). 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.

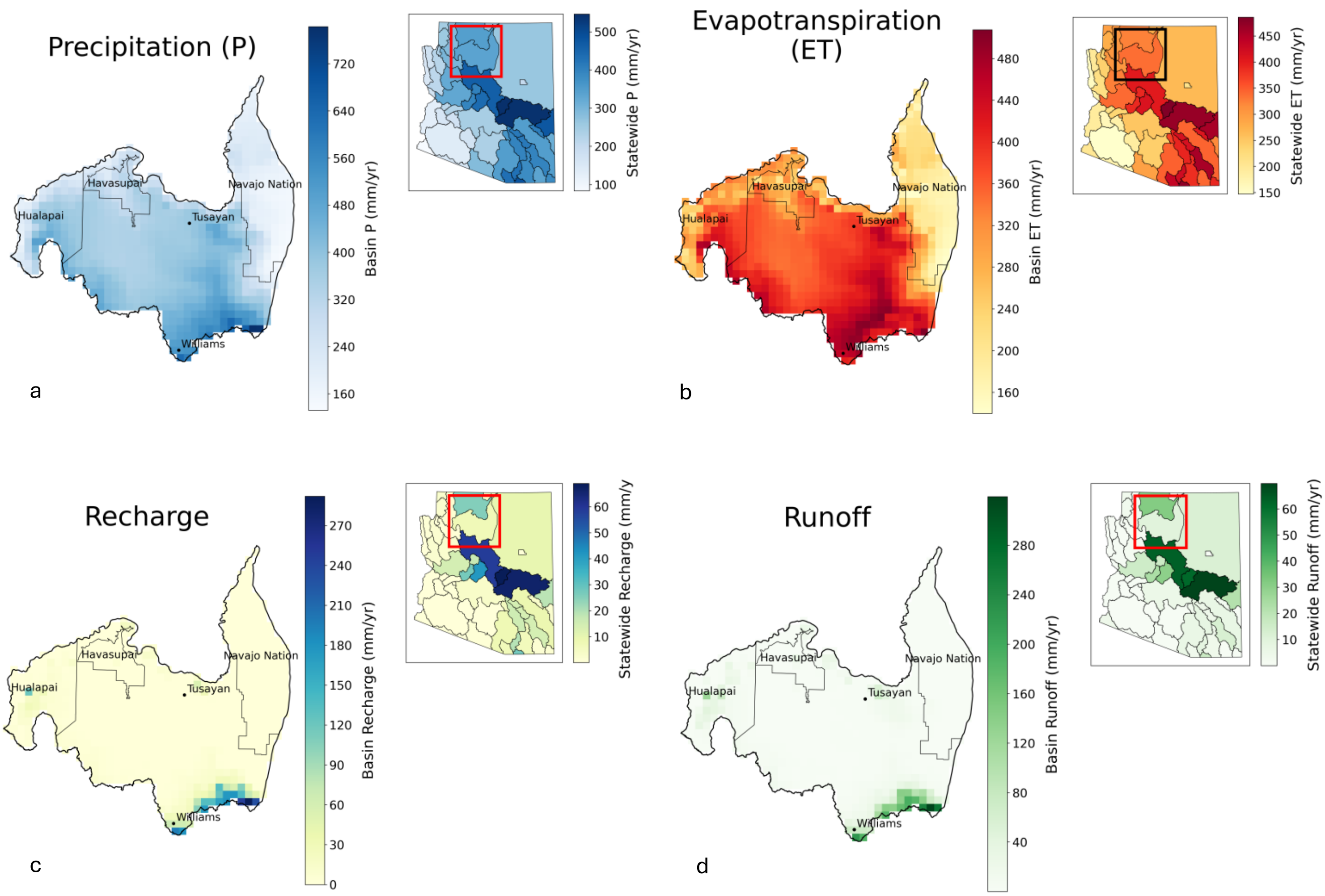
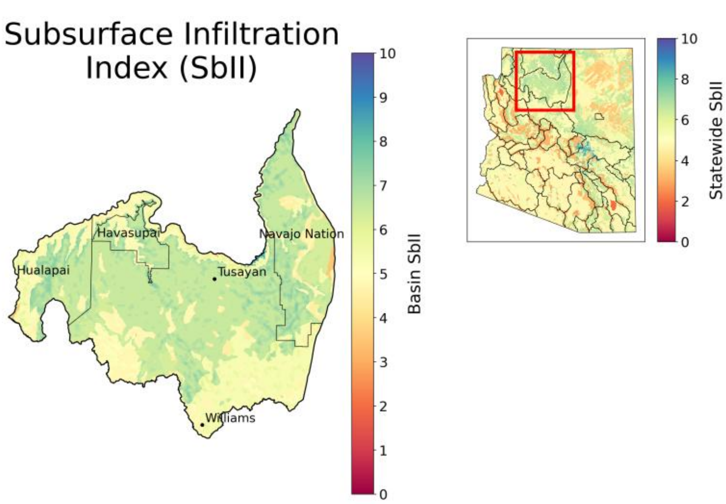


Figure 4 (below). Subsurface infiltration index (SbII) showing infiltration potential of the subsurface across the groundwater basin on a scale of 1-10 based on geologic features.[9]



Natural recharge is greatest in the southeast portion of the Coconino Plateau basin, exceeding 200 mm/year in this region. Similarly, most of the runoff is generated near the San Francisco Peaks to the southeast. The majority of the basin has moderately high subsurface infiltration potential due to large regions with karst-type geology.

Coconino Plateau

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

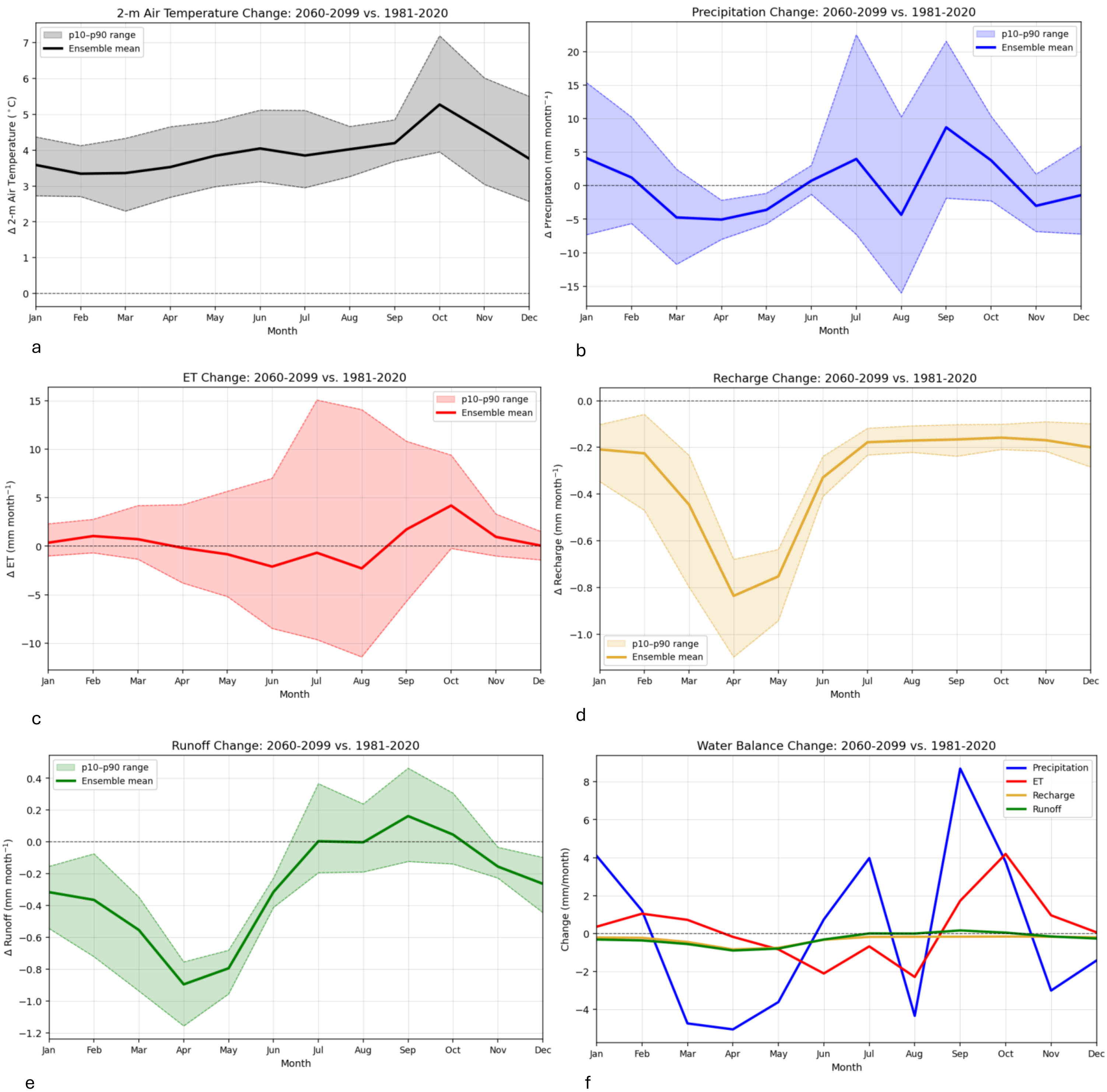


Figure 5. Plots (a)-(e) show projected changes in (a) temperature, (b) precipitation, (c) evapotranspiration (ET), (d) natural recharge, and (e) runoff statewide, comparing end of the 21st century to the historical record from 1981-2020 under the IPCC Scenario SSP3-7.0.[10] Plot (f) shows the change 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.

Coconino Plateau

Climate change projections across the Coconino Plateau show drier springs (15-28% drier March through May), and a drier August (8%), November (13%), and December (4%). September and October are projected to be 14-25% (3.8-8.8 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. Declines in natural recharge are projected for all months of the year, with projections in the highest recharge months (March-May) showing declines of 57-85% (-0.45 to -0.84 mm/month). Recharge projections are slightly negative (-0.01 mm) in July and August.* Runoff is projected to decrease throughout most months of the year, with 56-83% (-0.55 to -0.90 mm/month) declines in the highest runoff months (March-May) and slight increases of 0.05-0.17 mm/month in September-October. Projected increases in temperature range from approximately 3.4 °C in February to 5.3 °C in October. Higher temperatures and greater water availability from precipitation lead to a projected 19% (4.2 mm) increase in evapotranspiration (ET) 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

Arizona State University | The University of Arizona | NAU Northern Arizona University

Version: June 2026. Please visit our website for additional information: ccass.arizona.edu/atur