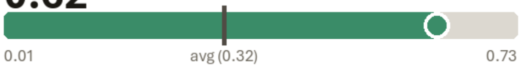
ARIZONA TRI-UNIVERSITY
RECHARGE AND WATER RELIABILITY PROJECT

# Peach Springs Groundwater Basin Profile

## Basin Summary Statistics

**Size[1]:** 1,409 square miles
**Elevation[2]:** Range: 1,135-7,085 ft; Median: 5,157 ft
**Top 3 land cover types by area[3]:** Shrub/Scrub (83%), Evergreen Forest (14%), Barren Land (1.1%)
**Major surface watershed(s)[4]:** Colorado River/Lake Mead, Truxton Wash/Red Lake
**Groundwater subbasins[1]:** None
**Groundwater-derived streamflow fraction[5]:**

**0.62** (High)



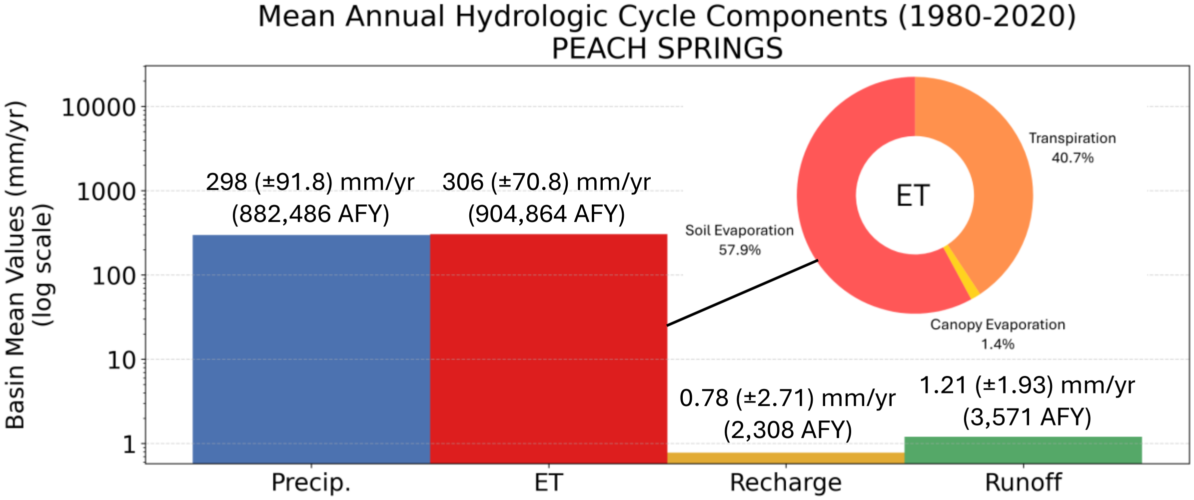


**Figure 1 (above).** Bar chart showing Noah-MP modeling results of the historical mean annual hydrologic cycle components (precipitation [P], evapotranspiration [ET], natural recharge, and runoff) in the basin from 1980-2020.[6] ET is partitioned into soil evaporation, canopy evaporation, and transpiration.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

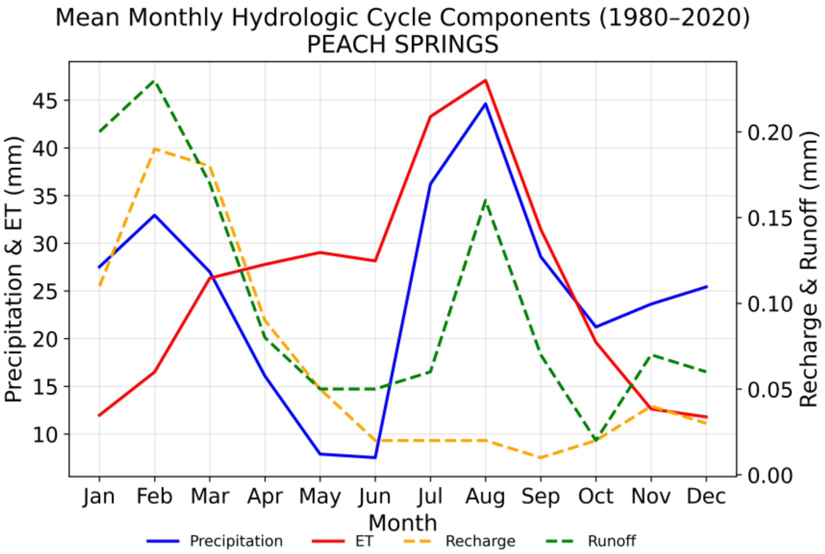


**Figure 2.** Graph showing monthly mean precipitation, ET, recharge, and runoff for the groundwater basin (1980-2020) from Noah-MP modeling results.[6]

Precipitation (P) in the Peach Springs basin is affected by the North American Monsoon during the summer months and large frontal systems during the winter. On annual timescales, evapotranspiration (ET) is approximately equal to P, with the greatest atmospheric losses occurring during the summer months. ET exceeds P from March through mid-September. Soil evaporation makes up 57.9% of total ET in the basin, while transpiration comprises 40.7% and canopy evaporation accounts for the remainder (1.4%). Natural recharge (0.78 mm/yr) and runoff (1.21 mm/yr) are near zero on average across the basin. Groundwater is estimated to supply 62% of total streamflow in the Peach Springs basin.

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**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.

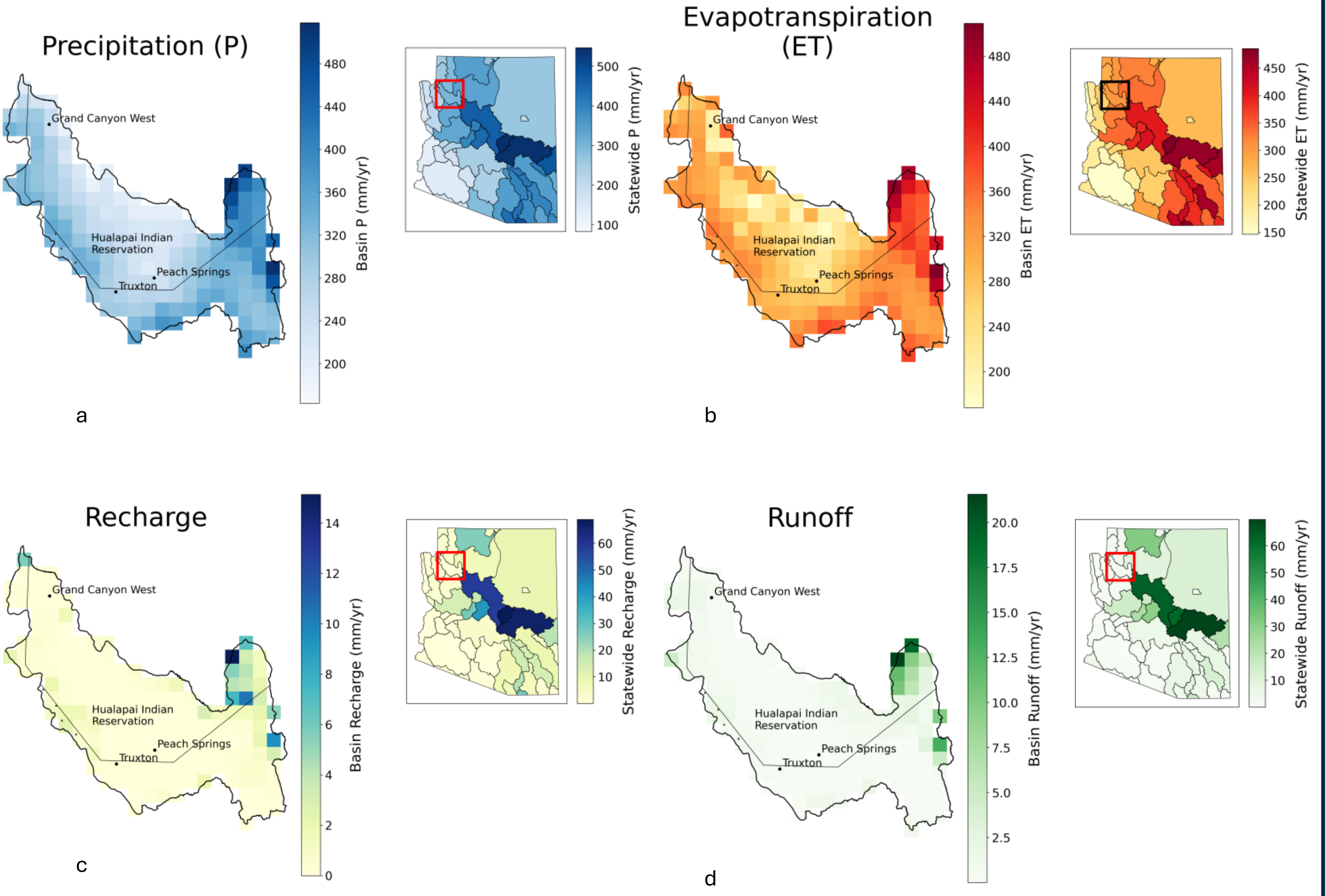
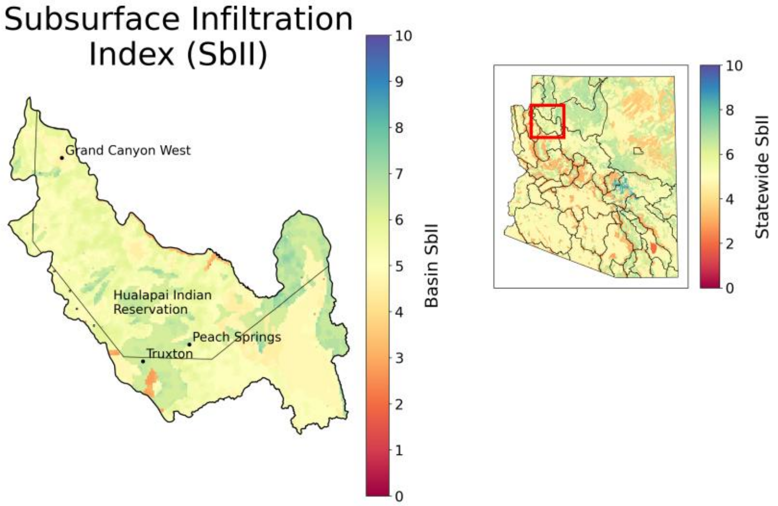


**Figure 4 (below).** Subsurface infiltration index (SbII) showing infiltration potential of the subsurface across the groundwater basin on a scale of 1-10 based on geologic features.[9]



Precipitation (P) in the Peach Springs basin is greatest at the higher elevations to the east, where P exceeds 450 mm/yr on average. ET (450 mm/yr), natural recharge (10 mm/yr), and runoff (15 mm/yr) are also highest in this region. Overall, the basin has moderate infiltration potential with pockets of higher potential that result from faulting in higher elevation areas and karst-type geology.

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

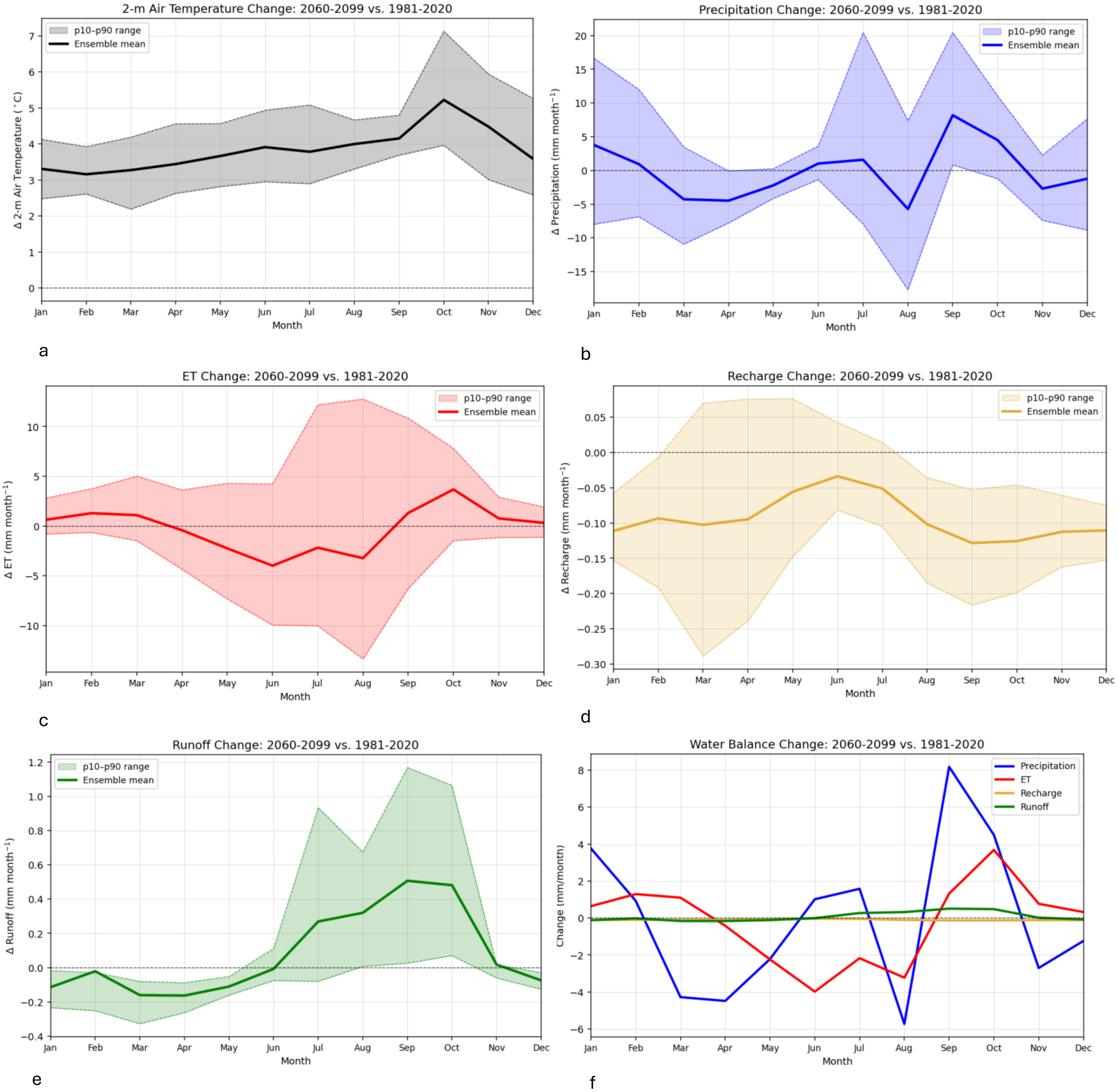

**Figure 5.** Plots (a)-(e) show projected changes in (a) temperature, (b) precipitation, (c) evapotranspiration (ET), (d) natural recharge, and (e) runoff statewide, comparing end of the 21st century to the historical record from 1981-2020 under the IPCC Scenario SSP3-7.0.[10] Plot (f) shows the change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

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Climate change projections across the Peach Springs basin show drier springs (15-29% drier March through May), and a drier August (11%) and November (13%). September and October are projected to be 20-30% (4.4-8.2 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 is projected to remain near zero throughout the year, and slightly negative (-0.01 to -0.13 mm/month) from June though February. While runoff is projected to remain below 0.7 mm/month, minor increases of 0.28-0.52 mm/month are projected for July-October. Projected increases in temperature range from approximately 3.2 °C in February to 5.3 °C in October. Higher temperatures and greater water availability from precipitation lead to a projected 19% (3.7 mm) increase in evapotranspiration (ET) in October compared to the baseline period while less water availability in August leads to a projected decline in ET (6% or -3.1 mm)).

*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.

**<u>References</u>**

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