

A wide-angle photograph of a desert valley. In the foreground, there is dry, scrubby vegetation on a sandy slope. The middle ground shows a vast, flat valley floor. In the background, there are rugged, brown mountains under a bright blue sky filled with large, white, fluffy clouds. The text is overlaid on the upper half of the image.

Estimating Natural Recharge in Indian Wells Valley Progress Report, Nov. 16, 2017

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Objectives

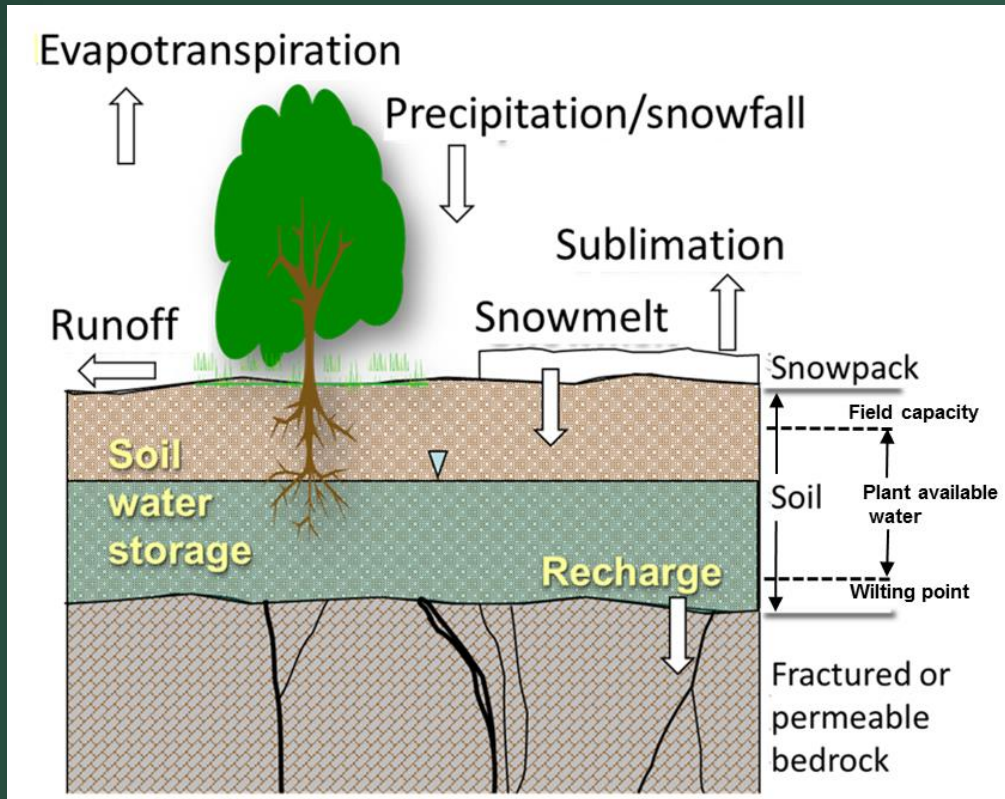
- Locally calculate the water balance with the newly revised Basin Characterization Model in the Indian Wells Valley to estimate natural recharge by constraining all components of the water balance
- Provide validation from multiple sources to increase confidence in estimates
- Evaluate historical and future patterns of natural recharge and evaporative demand in the valley

Progress to date

- Data we have
 - Lots of literature
 - Regional climate data
 - Regional and local streamgage data
 - Actual evapotranspiration from remote sensing
 - Mapped vegetation types
 - Evidence of ponding on playa
- Literature review for estimates of natural recharge
- Development of sub-basins
- Estimates of sub-basin recharge from statewide calibrations
- Preliminary results of actual ET comparisons for 18 vegetation types in basin
- Preliminary results of model comparisons to streamflow
- Ponding playa comparison



Solving the Water Balance

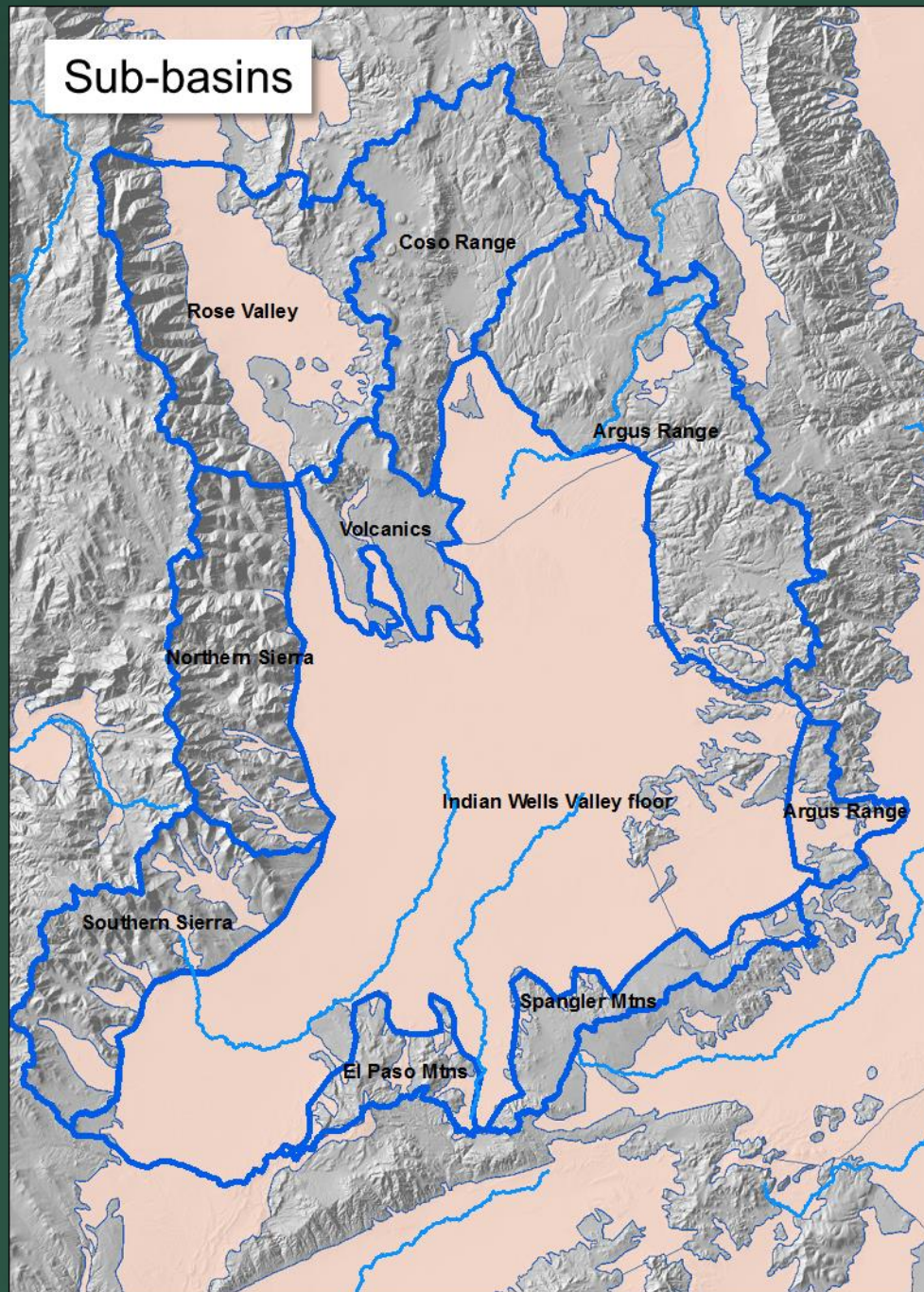


Basin Characterization Model

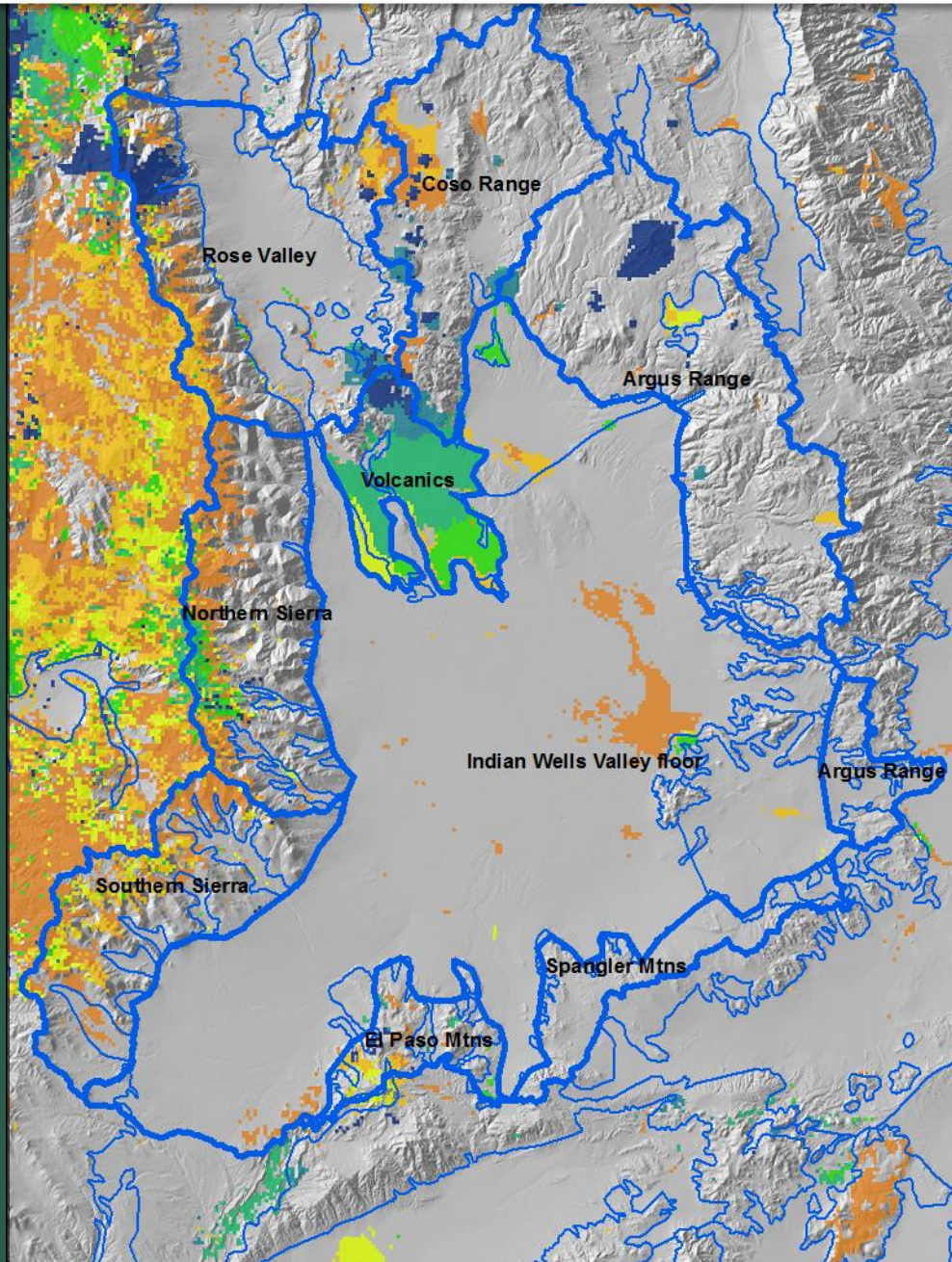
A grid based regional water balance model

Precipitation – evapotranspiration – sublimation – runoff – recharge – change in soil storage = 0

Sub-basins



Recharge + runoff based on statewide calibrations



Rch+Run 1981-2010
(mm/year)



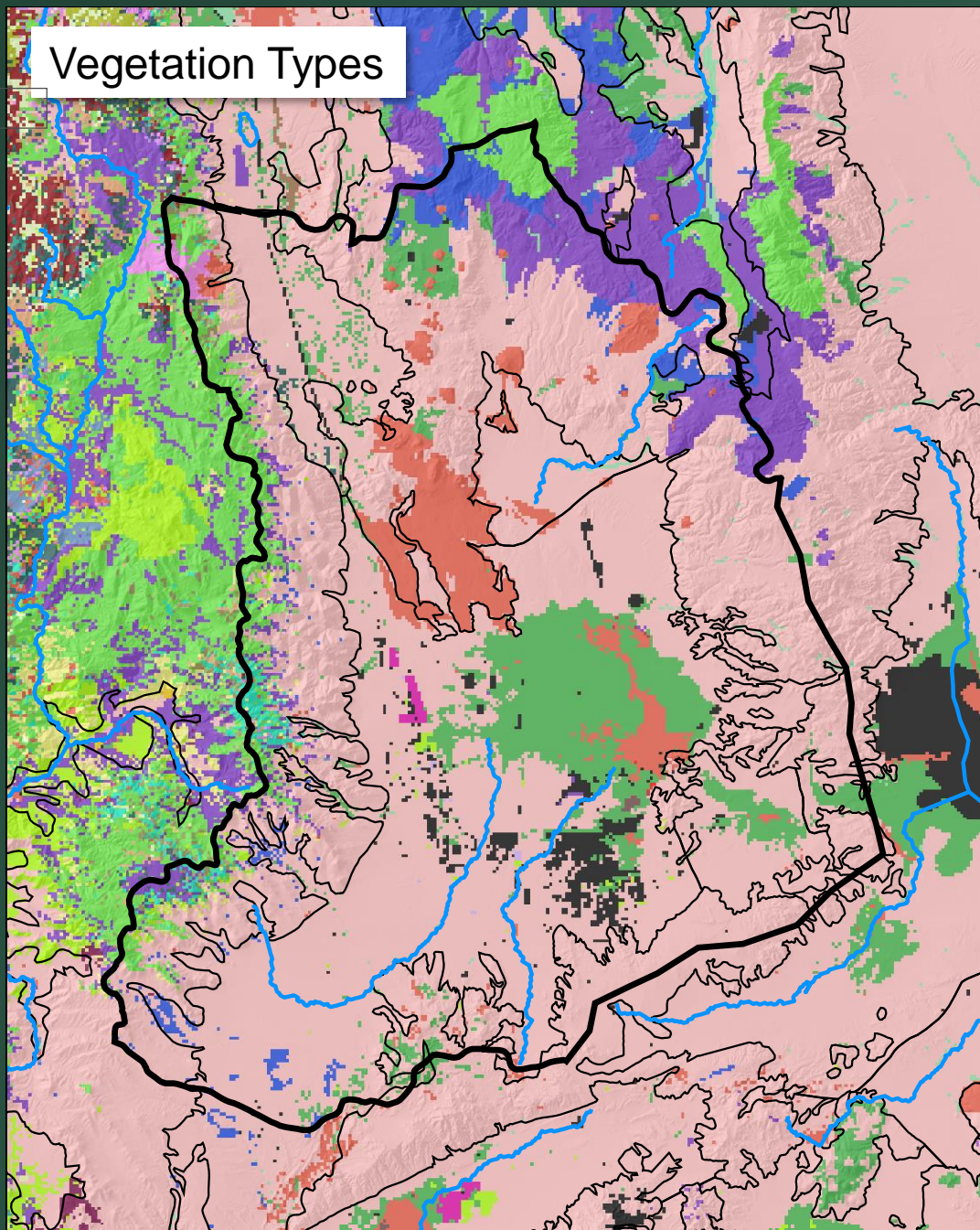
Recharge and runoff from statewide calibration

	Area (km2)	Mean Recharge (mm)	Mean Recharge (acre- feet)
Southern Sierra	249	1.5	299
Northern Sierra	256	3.1	644
Coso Range	289	2.8	655
Volcanics	129	19.6	2,048
Argus Range	511	2.1	877
Spangler Mtns	105	0.0	-
El Paso Mtns	80	3.1	203
Indian Wells Valley floor	1,583	0.3	324
Rose Valley	414	6.5	2,173
Total w/o Rose Valley			5,050

Recharge estimates for Indian Wells Valley

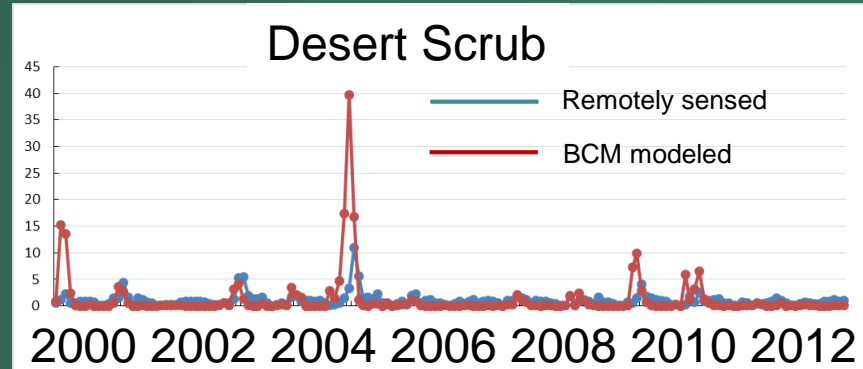
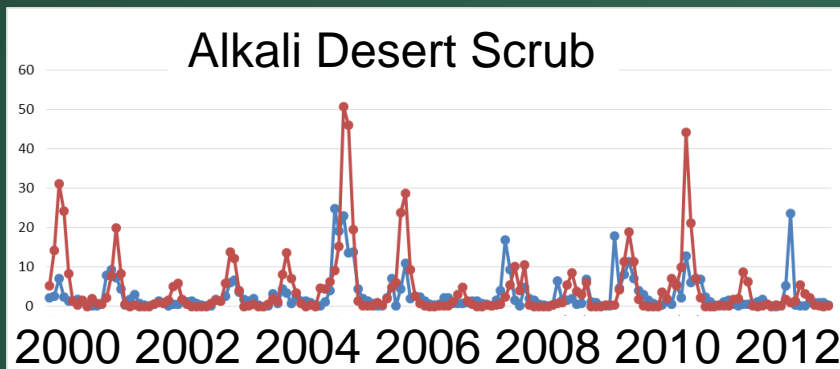
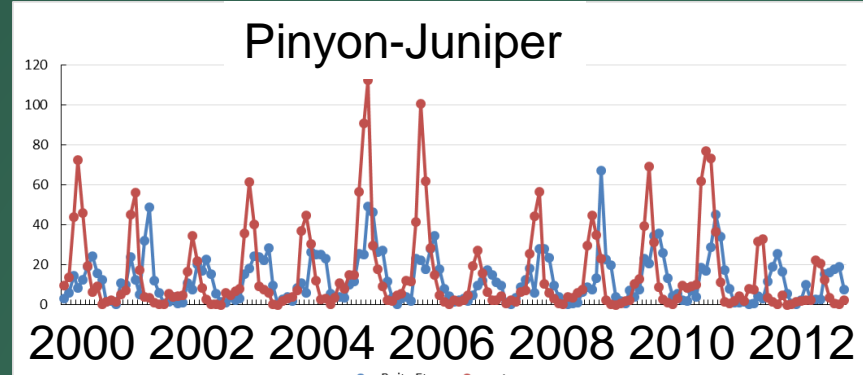
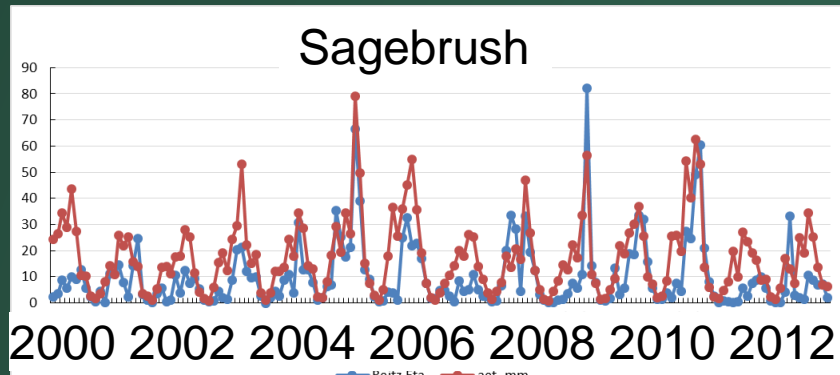
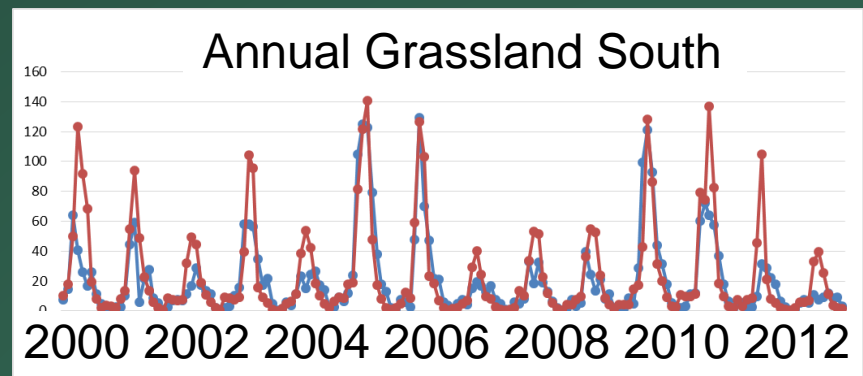
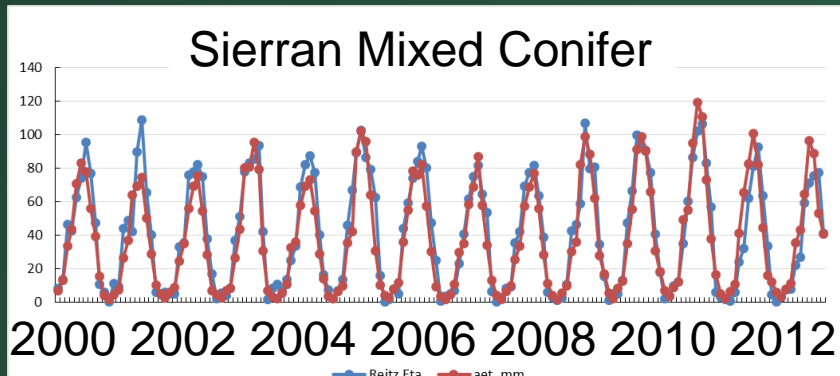
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Vegetation Types



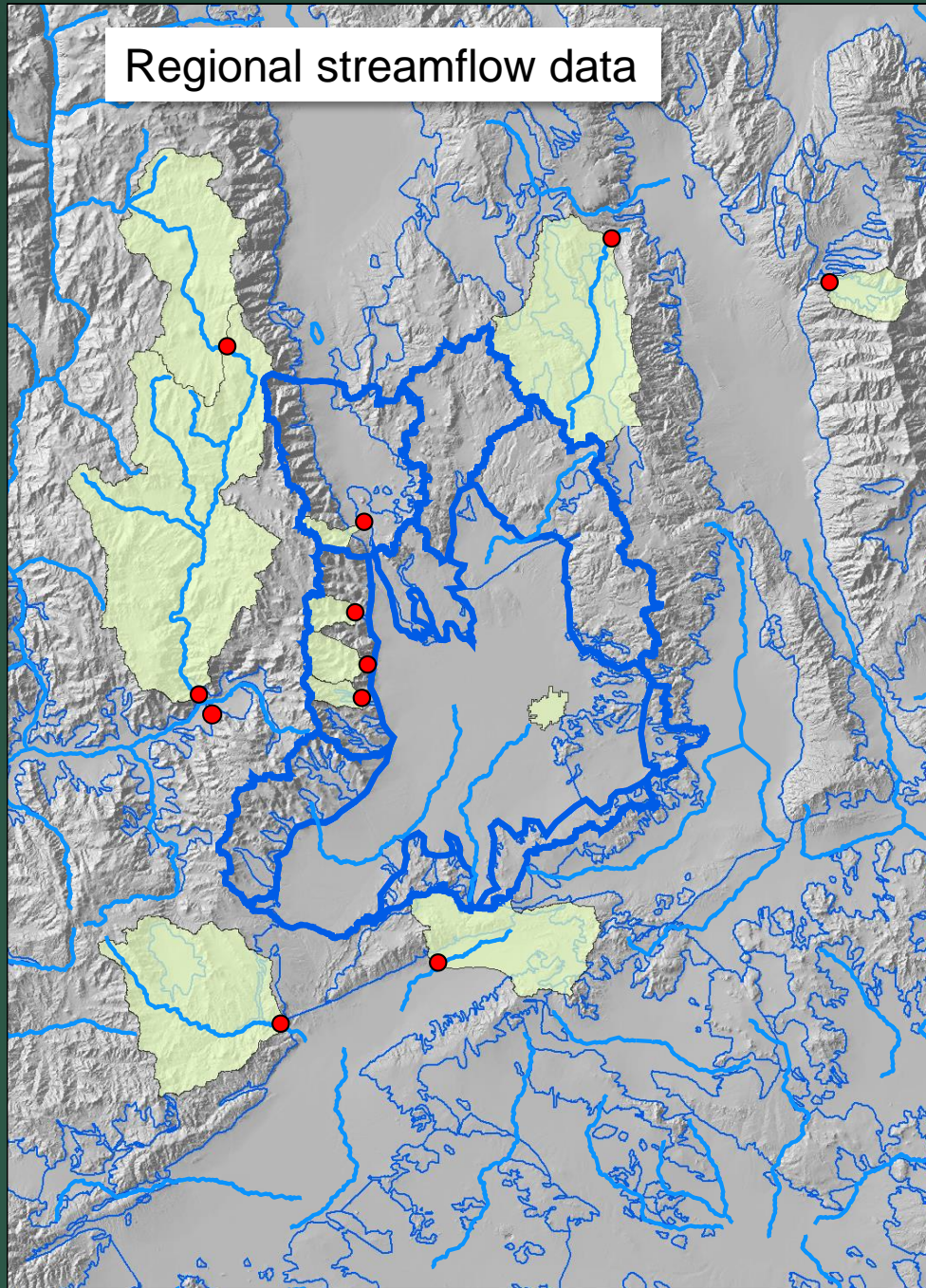
- Annual grasslands
- Alkali desert scrub
- Barren
- Desert scrub
- Desert wash
- Eastside pine
- Joshua tree
- Juniper
- Mixed chaparral
- Montane chaparral
- Montane hardwood conifer
- Montane hardwood
- Pinyon-juniper
- Sagebrush
- Urban
- Water
- Wet meadow
- Irrigated row and field crops

Comparison of Actual Evapotranspiration Estimates

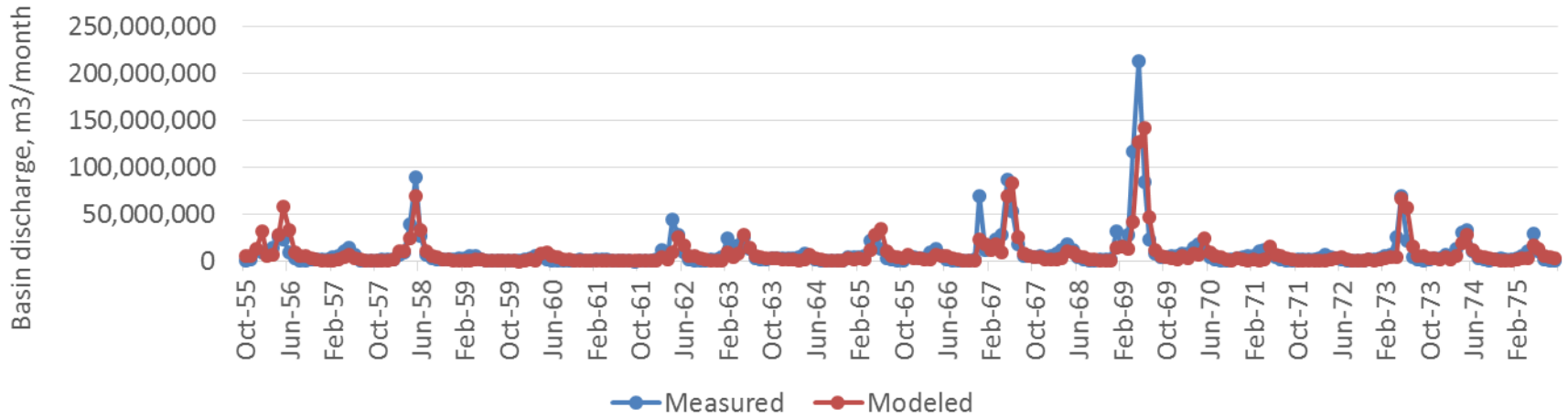


Preliminary calibration results

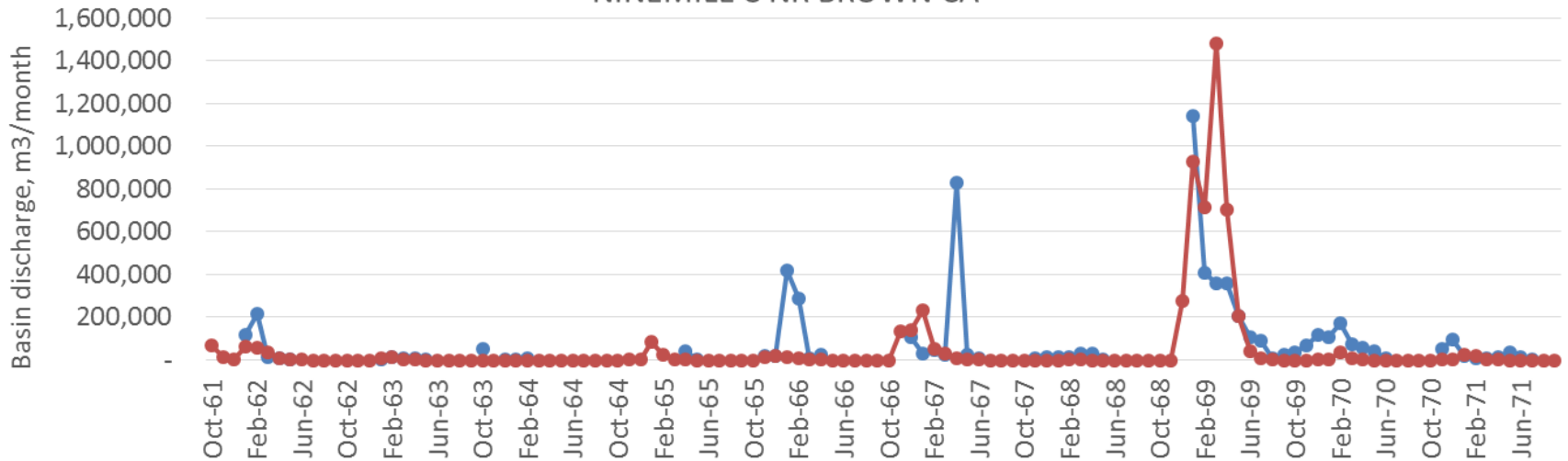
Regional streamflow data



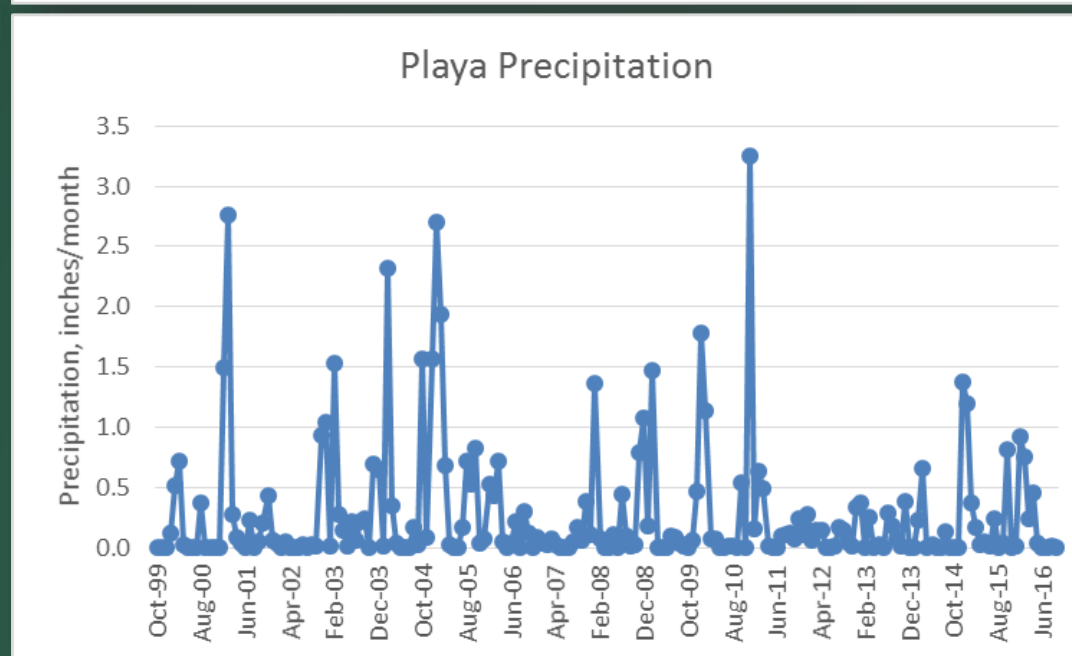
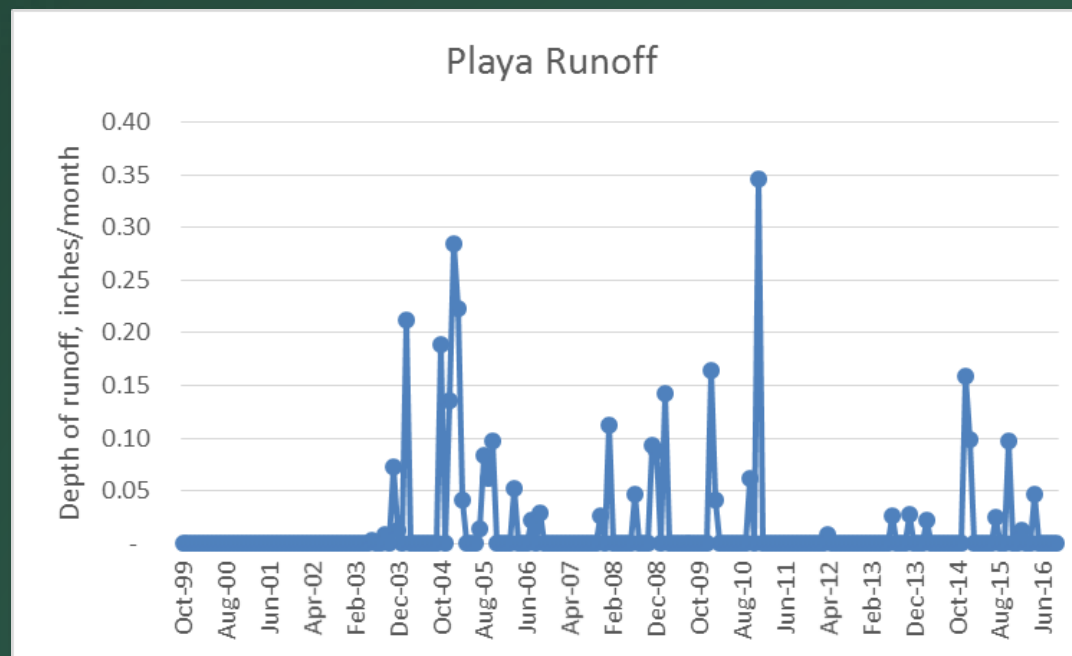
SF Kern R nr Onyx, CA



NINEMILE C NR BROWN CA



Preliminary calibration results



Preliminary calibration results



Results and Discussion

- Sub-basin boundaries for reporting: are there more useful boundaries for land and water resource management?
- Statewide calibration has lower recharge values than other studies, although averaging over dissimilar time periods
 - Requires additional local calibration, including matching local vegetation evapotranspiration
 - Matching streamflows helps to discern the proportion of runoff that becomes recharge in this arid basin
- Spatial distribution of recharge is a function of climate, geology, soil storage, and vegetation type



Take Home Message

- Recharge is the most elusive component of the water balance to quantify
- Water balance closure helps to constrain and define recharge spatially and temporally over basins on the basis of
 - spatially distributed climate
 - soil storage and energy balance properties
 - deterministic processes such as evapotranspiration, changes in soil water content and drainage, and seasonality of water availability and demand
- Layers of evidence are being compiled to help validate and support the estimate of recharge
- Once calibration is complete analysis of historical and future trends will be done

A wide-angle photograph of a vast field of orange poppies in full bloom. The flowers are densely packed, creating a sea of orange that stretches towards the horizon. In the background, there are rolling hills and mountains under a sky filled with large, dramatic, grey and white clouds. The overall mood is serene yet powerful due to the scale of the flower field and the intensity of the sky.

Thank you!