Watershed Connections Workshop: enhancing regional collaboration on water resource management issues across the Tulare Basin

Progression of California Drought in 2014

Southern California Edison
Energy Education Center Sustainability Building – June 10, 2014
The Tulare Basin … a distinct place with unique
• geology,
• soils,
• climate,
• hydrology,
• ecology,
• human history,
• economy, and
• culture.
In terms of its geological history, the Tulare Basin is very young.

As the Sierra Nevada (uplifted during the Mesozoic Era) was eroded during the Cenozoic Era (66 MYA to 2 MYA), fine-grained sediments (sand, silt, and clay) flowed west into the deep ocean trench west of the Sierra Nevada. About 50 MYA, parts of what is now the Central Valley (especially north of Coalinga) were above sea level for the first time! Most of those marine sediments fill what is now the Tulare Basin to depths of as much as 25,000 feet.
Glaciers (see the stippled area on the map) once extended south to the upper watershed of what is now the Kaweah River. When these glaciers melted, they helped raise global sea level and they provided fresh melt water that replaced the saltwater that once filled the marine embayment between the Sierra Nevada and the Coast Ranges.
Starting 2 million years ago, a series of glacial episodes periodically caused much of the area now known as the Central Valley to become a fresh water lake. Lake Corcoran (aka Lake Clyde) was the last widespread lake to fill the Valley about 1 million years ago. Lake Corcoran was connected to Salinas River, which drained into Monterey Bay. 560,000 years ago, tectonic shifting caused 1) land at the southern end of Corcoran Lake (the Tehachapi mountains) to rise while 2) land sank where San Francisco Bay is now located. Water from the Lake spilled over its western ridge and completely drained the Lake. As a result, Carquinez Strait was carved out and the basin that would become San Francisco Bay began to form.
EXPLANATION

- Continental deposits
- Marine sediments
- Crystalline rock

Fault — Arrows show relative direction of movement
### Stratigraphic Divisions

<table>
<thead>
<tr>
<th>ERA</th>
<th>Period</th>
<th>Epochs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quaternary</td>
<td>2 Million Years</td>
<td>Holocene, Pleistocene</td>
</tr>
<tr>
<td>CENOZOIC</td>
<td>Tertiary</td>
<td>Pliocene, Miocene, Oligocene, Eocene, Paleocene</td>
</tr>
<tr>
<td>Cretaceous</td>
<td>135 Million Years</td>
<td>Jurassic</td>
</tr>
<tr>
<td>MESOZOIC</td>
<td>Jurassic</td>
<td>195 Million Years</td>
</tr>
</tbody>
</table>

**Water Table**
- 1905-1908
- approx. 10 feet

**Sedimentary Units**
- Corcoran Clay
- Confined Aquifer
- Semiconfined Aquifer
- Alluvium: Mostly Sand and Clay
- Continental Deposits of Quaternary Age
- Base of Fresh Water
- Brackish water
- Saline Water
- Deposits from the Sierra Nevada
- Top of Marine Deposits
- Upper Cretaceous
- Jurassic
- Cretaceous
- Tertiary
- Quaternary
- Cenozoic
- Mesozoic
- Tertiary
- Cretaceous
- Quaternary

**Vertical exaggeration x55**
STATE OF CALIFORNIA

PRECIPITATION

Annual average precipitation polygons represent areas described by isohyetal lines of precipitation, measured in inches, averaged over the period 1961-1980.
Tulare Basin Watershed Map
(from the crests of the Sierra Nevada, Coast Range, and Transverse Ranges to the Fresno Slough)
Watershed Map: Kings, Kaweah, Tule, and Kern Rivers (and Deer Creek, White River and Poso Creek)
Tulare Lake fan dam was formed by the outflow of glacial melt water along the ancient Kings River at the close of the last ice age (the Wisconsin) about 10,000 years ago. Tulare Lake formed behind (south of) the fan dam ... the “dam” held back water that was flowing from south (higher elevation near the Tehachapi mountains at the “head” of the Tulare Valley) to north (toward sea level at the San Joaquin River Delta).
Floods and Droughts in the Tulare Lake Basin

Figure 1. Flood on the Kaweah River, January 2, 1997. Photograph by Tony Caprio

John Austin

Three Rivers, CA 93271
MAP OF THE WESTERN PORTION OF TULARE COUNTY
SHOWING THEIR IRRIGATION DISTRICTS, RAILROADS, TOWNS, TOWNSHIPS, CREEKS, DITCHES, WELLS, LAKE AND THE
Artesian Fruit Belt, Tract of Measure, Pilot & Morton.

PUBLISHED BY PACIFIC COAST LAND BUREAU,
24 Market Street, San Francisco.

Walter Turnbull, Manager of Tulare, Tulare County, Calif.
In this compelling book about our geologically young state, artist and paleo-ecologist Laura Cunningham captures in words and thoroughly researched narrative, a sense of how much our state has changed (in a very long time frame) and how much change our habitats and wildlife are continuing to experience since European eyes first looked upon this varied landscape that draws us to the Golden State.
Figure 1. The area receiving an average of 229–279 mm (9–11 in) of precipitation per year, and the occurrence of aridic soils, in the San Joaquin Valley and surrounding central California. The precipitation polygon completely overlays the aridic soil distribution.
By the time acorns became the staff of life in the Tulare Valley (during the Archaic Period), ancient Californians had become extremely skillful at basket making. Grasses, sedges, fern, and other plant materials were used to fashion baskets of all sizes and shapes to serve many needs.
During the Archaic Period, indigenous peoples who spent part of their year living on the shores of Tulare Lake and Buena Vista Lake, began to construct buoyant boats … balsas … out of bundles of tules.
As the lakes shrank, the alkalinity rose. The ecosystem started to go into a tailspin. 1888 seems to have been the pivotal year. The fishing (or seining) was apparently terrific that year as the ecosystem crashed. Over 133,600 pounds of fish from Tulare Lake were shipped to San Francisco in one ten-week period in the fall of 1888. By the end of that year, the catfish, lake trout, pond turtles, mussels, and clams had reportedly died out of all three lakes (Tulare, Kern, and Buena Vista) due to the increasing alkalinity.

Horse-drawn cart beside artesian well west of Bakersfield. Carleton Watkins – photographer 1888.
The New York Times reported in August 1898 when Tulare Lake dried up completely. This was the first time that had happened in historic times. It had gone from full-pool to bone-dry in just 20 years (1878–98). Austin, J.T. 2012. Floods and Droughts in the Tulare Lake Basin. Sequoia Natural History Association, Three Rivers, California.
CONDITIONS IN THE TULARE LAKE AREA
SINCE COMPLETION OF PINE FLAT DAM

1954 - 1959
As a result of floodwaters occurring in December 1958

1960 - 1967
As a result of floodwaters occurring in December 1966

1968 - 1972

1973 - 1976

1977 - 1980

1981 - 1985

1986 - 1990

1991 - 1994

1995 - 1999

TULARE LAKE BASIN WSD
STAFF ENGINEER
CORCORAN, CALIFORNIA
SEPTEMBER 1999

Residual 1998 Floodwater
No Flooding in 1999
Publicly Accessible Nature Preserves, Ecological Reserves
(and other wildlife habitat)
Managed by State and Federal Agencies:

- Stone Corral Ecological Reserve (3 sub-units – 30 min. drive)
- Yaudanchi Ecological Reserve (SE of Porterville – 50 min. drive)
- Allensworth Ecological Reserve (dozens of sub-units – 30 min. drive)
- Semitropic Ecological Reserve (dozens of sub-units – 70 min. drive)
- Buttonwillow Ecological Reserve (3 sub-units – 85 min. drive)
- Lokern Ecological Reserve (over a dozen sub-units – 95 min. drive)

- Pixley National Wildlife Refuge (6,939 acres: 5,350 ac. of upland habitat ... grassland, alkali playa, and vernal pools, 755 acres of seasonal wetlands, & 15 acres of riparian habitat. – 50 min. drive)
- Kern NWR (11,249-acres of natural desert uplands, a relict riparian corridor, and developed marsh – 75 min. drive)

- Atwell Island Land Retirement Demonstration Project Wetland & Nature Trail (8,500 acres – 60 min. drive)

- Hiking Trail between Cobble Knoll and Slick Rock Rec. Areas (one mile trail – 40 min. drive)
There are also Publicly Accessible Nature Preserves (and other wildlife habitat) Managed by City and County Agencies:

SCICON (including the 620-acre Circle J Ranch)

City of Bakersfield’s Kern River Parkway (extends 35 miles; comprises 6,000 acres)

City of Visalia owns and manages Mooney’s Grove Park
Nature Preserves Managed by Local NGOs:

- Kaweah Oaks Preserve (324 ac. – 15 min. drive)
- Herbert Wetland Prairie Preserve (725 ac. – 25 min. drive)
- Dry Creek & Homer Ranch Preserves (1,917 ac. – 30 min. drive)
- Blue Oak Ranch (1,147 ac. – 60 min. drive)
- Lewis Hill Preserve (110 ac. – 45 min. drive)
- Lokern Preserve (3,900 ac. – )
- Pixley Vernal Pools Preserve (40 ac. – 35 min. drive)
- Sand Ridge Preserve (270 ac. – 75 min. drive)
- Semitropic Ridge Preserve (3,700 ac. – 70 min. drive)
- Wind Wolves Preserve (95,000 ac. – 90 min. drive)

Note: River Ridge Ranch partners with Wild Places on a number of conservation, habitat restoration, and environmental education projects.
Blue Oak Ranch (near SCICON)
Lewis Hill Preserve near Porterville
The San Joaquin Valley, which includes the San Joaquin and Tulare Basins, has experienced large changes in groundwater storage. In the early 1960s, groundwater pumping caused water levels to decline to historic lows on the west side of the San Joaquin Valley, which resulted in large amounts of surface subsidence. In the late 1960s, the surface-water delivery system began to route water from the wetter Sacramento Valley and Delta regions to the drier, more heavily pumped San Joaquin Valley. The surface-water delivery system was fully functional by the early 1970s, resulting in groundwater-level recovery in the northern and western parts of the San Joaquin Valley. Overall, the Tulare Basin portion of the San Joaquin Valley, the hottest and driest part of the Central Valley, is still showing declines in groundwater levels and accompanying depletion of groundwater storage. Faunt, C.C. ed., 2009, Groundwater Availability of the Central Valley Aquifer: U.S. Geological Survey Professional Paper 1766, 225 p. Available at http://pubs.usgs.gov/pp/1766/
In the 66-month period analyzed, the water stored in the combined Sacramento and San Joaquin Basin decreased by more than 31 cubic kilometers, or nearly the volume of Lake Mead. Nearly two-thirds of this came from changes in groundwater storage, primarily from the Central Valley.
As President of Tulare Basin Wildlife Partners and as a Board member of Sequoia Riverlands Trust, my role this morning is to invite all of you to consider how each of us can take steps to enhance regional collaboration.
We recognize that there are many leaders in the room. Our role today is not to be a leader ... Our role is to be a ...
"Quick, Ted, get that one down on paper before you forget it."

...facilitator!
I was told that participants were invited to the workshop today because most of you are “deciders” … so I’m looking forward to rejoining you at about lunch time to see what you’ve mulled over!