Tulare Basin Watershed Overview

Presented at Climate Change Workshop
John Austin
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Central Valley Basins
Floods and Droughts in the Tulare Lake Basin
Snowmelt floods – large runoff years
1853 – Theft of a Whaleboat in SF Bay
Hoist the Sail – Take Advantage of NW Winds
The San Joaquin Valley
Summit Lake
North end of Tulare Lake
Tulare Lake Basin natural communities
Historic wetland connections
5 Documented Trips between Tulare Lake and SF Bay

• 1853 — Whaleboat from San Francisco Bay to Tejon Ranch

• 1868 — 16-foot scow with a one-ton cargo of honey to SF Bay

• 1938 — Bakersfield to Treasure Island to see the Worlds Fair

• 1969 — 2 farmers & their 3 teenage sons from Bakersfield to SF Bay

• 1983 — 2 guys kayaked from Bakersfield to SF Bay
A Water Hole 40 Miles Long
A feeding ground for condors and vultures
Hydrologic connection of Tulare Lake Basin
Tulare Lake Basin natural communities
Historic wetland connections - South
How big was Tulare Lake?

- It was the largest freshwater lake west of the Mississippi
- When it was full, it was 4 times larger than Lake Tahoe.
Tulare Lake in 1970
Sample of fishes in the Tulare Lakebed

Terminus of North America’s southernmost (chinook) salmon run
Sample of fish eaters in the Tulare Lakebed

Marine mammals: sea otters, harbor seals, and sea lions
Tulare Lake Ecosystem — 1850
Yokuts tribesmen built tule balsa (rafts) Reminiscent of the reed boats on Lake Titicaca in Bolivia
Navy Seaplane Landing Base during WWII
PBY Catalina taking off
What happened to Tulare Lake?
Known floods and multi-year droughts for past 168 years: 1849–2016
Mules doomed Tulare Lake
Fresno Scraper invented in 1883
The coming of the canals
Tulare Lake Basin natural communities
The San Joaquin Valley Desert — 1850
Tulare Lake Basin
Landuse — 1912
Kings River Delta Fan
Tulare Lake Basin
Landuse — 2000
Elevation of water in the Tulare Lakebed for 120 years: 1850–1969. Tulare Lake Basin has functioned as a closed basin since 1878.
How does your typical plants view drought?
Current drought from perspective of plants

Topics to be addressed

1. Increase in temperature, potential evapotranspiration, and frequency of severe droughts since the mid-1980s.

2. Apparent decrease in frequency of rain-producing weather types and precipitation since the mid-1980s.

3. Decrease in average runoff since the mid-1980s.
Variation in runoff over past 123 years: 1894–2016
The change that occurred 30 years ago
Drought terminology
From perspective of plants

1. Decrease in precipitation and runoff

2. Increase in temperature

3. Increase in actual evapotranspiration (ET)

4. Increase in potential evapotranspiration (PET)

5. Palmer Drought Severity Index (PDSI)
Valley oak mortality
Mooney Grove
Drought in Blue Oak woodland
Conifer mortality
Rough Fire
September 1, 2015
Variation in runoff over 1113 years: 900–2012
Upper San Joaquin River — Millerton Lake
Change in global temperature for 11,000 years
Melting of Sierra glaciers
Lyell Glacier 1883 - 2015
Accounts of conditions in California in Little Ice Age
1542, 1579, 1602, 1769, and 1831
Changes in California average temperature for 120 years: 1895–2015
Water stored in Sierra snowpack at Donner Pass for 120 years: 1896–2015
Variation in runoff over past 123 years: 1894–2016
How to view the dry spell that began in 2000
California Drought Monitor
October 2014
2012

2002
Changes in California drought severity for 120 years: 1896–2015
Changes in California precipitation and PET for 115 years: 1901–2015
California drought severity for past 119 years: 1896–2014
Changes in California PET
1901–2080
Changes in California precipitation for 120 years: 1896–2015
Variation in runoff over past 123 years: 1894–2016
Atmospheric patterns have caused our major droughts
High pressure ridge
The cause of our biggest droughts
Change in frequency of rain-producing weather types (1980-2010)
Change in frequency of rain-producing weather types
Pacific Southwest Subregion (1980-2010)
Decrease in runoff — last three decades

<table>
<thead>
<tr>
<th>Basin</th>
<th>1894-1986</th>
<th>1987-2016</th>
<th>Decrease</th>
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<tbody>
<tr>
<td>Upper San Joaquin</td>
<td>1,849,987</td>
<td>1,575,063</td>
<td>-15%</td>
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<tr>
<td>Kings</td>
<td>1,702,431</td>
<td>1,473,552</td>
<td>-13%</td>
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<tr>
<td>Kaweah</td>
<td>434,906</td>
<td>378,027</td>
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<tr>
<td>Tule</td>
<td>142,671</td>
<td>114,820</td>
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<tr>
<td>Kern</td>
<td>746,250</td>
<td>601,763</td>
<td>-19%</td>
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2016 flows are based on May 1 DWR estimates. Flows for Upper San Joaquin River only available for 1901–2016.
Changes in California precipitation and PET for 115 years: 1901–2015
Take-away messages
Current drought from the perspective of plants

1. Plants have required more water to avoid stress since the mid-1980s. Increase in PET driving increase in significant droughts. Trend seems bad.

2. Apparent decrease in frequency of rain-producing weather types and precipitation since the mid-1980s. Trend seems bad.

3. Runoff has been reduced since the mid-1980s. Three plausible explanations.
