Kern River Snow and Water Report – March 1, 2022

"The earth, the air, the land, and the water are not an inheritance from our forefathers but on loan from our children. So, we have to handover to them at least as it was handed over to us."

Mahatma Gandhi

Published Monthly from November 1, 2021, to June 1, 2022

Hope for a Miracle March, April, and May!

Current Conditions: *October was good. November was a bust. December was great. January and February not good!*

La Niña conditions are ongoing[1]. As of ***March 1***, in the Kern River basin there are eight snow pillow sensor stations reporting an average of 6.6" of snow water content[2]. The current snowpack is 39% of the California annual April 1 benchmark of 21.5" snow water content. To date precipitation in the Upper Kern River basin is 68% of average and in the South Fork Kern River basin it is 71% of average[3]. Observed Kern River basin water flow is 43% of average – 64,300-acre feet (af)[4]

Outlook: La Niña is likely to continue into the Northern Hemisphere spring (77% chance during March-May 2022) and then transition to ENSO-neutral[5] (56% chance during May-July). Annual Kern River runoff is forecast to be 40% of average or 184,300-acre feet[6]. If this occurs it would

[1] La Niña is an oceanic and atmospheric phenomenon that is the colder counterpart of El Niño, as part of the broader El Niño–Southern Oscillation (ENSO) climate pattern.
[2] Snow Water Equivalent, or SWE , is a commonly used measurement used by hydrologists and water managers to gage the amount of liquid water contained within the snowpack. In other words, it is the amount of water that will be released from the snowpack when it melts.
[3] The water year is from October 1 to September 30.
[4] Historic Kern River Basin Mean Water Year Volume: 725,600 af.
[5] Neither El Niño nor La Niña.
[6] Includes total inflow into Lake Isabella.

make 2022 the third lowest annual runoff since 1961. The peak Kern River basin flow is forecast to be 3,400-acre feet on May 7.

Notable High-Volume Years	Notable Low-Volume Years
2019 - 1,201,000 af	2021 - 147,000 af
2017 - 1,811,000 af	2015 - 130,400 af
1983 - 2,318,000 af	1977 - 186,000 af
1969 - 2,227,000 af	1961 - 175,000, af

Upper Kern Water Year Average 30.17”
South Fork Kern Water Year Average 17.19”

To Date Kern River Basin Water Year Precipitation

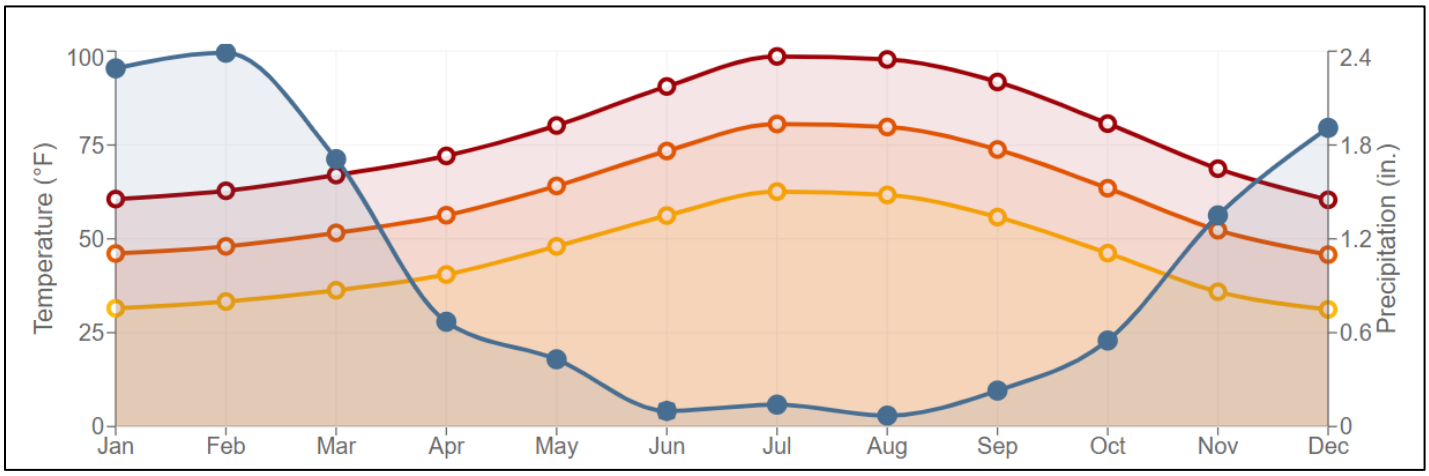
Station	Elevation	Monthly Precipitation (inches)								
		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Total
Blackrock	8,114’	0.92	0.31	2.24	0.11	0.06				3.64
Breckenridge	7,485’	0.98	0.12	2.71	0.96	0.39				5.16
Democrat	2,364’	1.02	0.02	5.70	0.00	0.29				7.03
Johnsondale	4,684’	1.88	0.21	6.60	0.00	0.38				9.07
Lake Isabella Dam	2,680’	0.81	0.00	7.41	0.12	0.26				8.60
Peppermint	7,385’	2.01	0.42	6.54	0.54	0.23				9.74
Piute Peak	6,648’	0.54	0.00	4.47	0.05	0.06				5.12
Riverkern[7]	3,044’	0.44	0.00	5.42	0.00	0.16				6.02
Walker Pass	5,572’	0.40	0.00	3.33	0.00	0.00				3.73
Wofford Heights	3,935’	1.54	0.02	6.89	0.00	0.38				8.83

To Date Notable Very Low Rainfall

Death Valley National Park Furnace Creek Visitor Center: 0.65”, Elevation -193’

[7] Kern River Powerhouse Number 3 thirty-year (1991-2020) average annual rainfall is 11.84”.

Kern River Powerhouse #3 (Riverkern) Monthly Weather 1991-2000



NOAA U.S. Climate Normals Quick Access

https://www.ncei.noaa.gov/access/us-climate-normals/#dataset=normals-monthly&timeframe=30&location=CA&station=USC00044523

Previous Water Year

2021 TOTAL Kern River and Lake Isabella Water Volume

Observed Water Year Flow: 20% of average - 147,000 af - the second lowest year on record since 1961

2021 TOTAL Kern River Basin Percent of Average Precipitation

Upper Kern: 32%, 9.58”
South Fork Kern: 29%, 4.98”

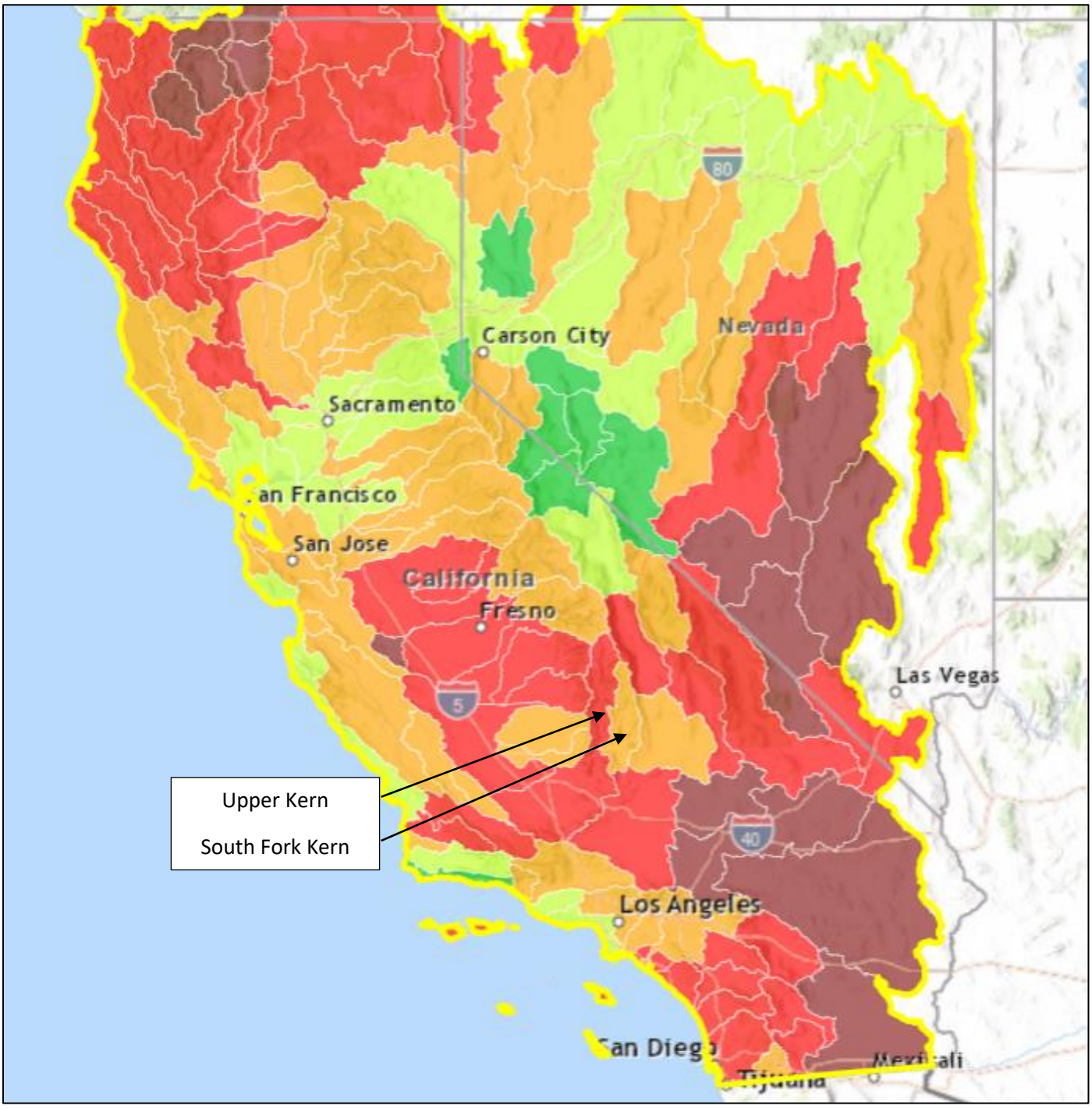
2021 TOTAL Kern River Drainage Rainfall

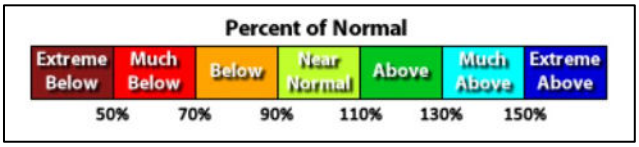
Blackrock: 6.60”, Elevation 8,114’
Democrat: 5.36”, Elevation 2,364’
Johnsondale: 7.56”, Elevation 4,684’
Lake Isabella Dam: 5.50”, Elevation 2,680’
Piute Peak: 3.15”, Elevation 6,648’
Riverkern: 3.41”, Elevation 3,044’
Walker Pass: 2.05”, Elevation 5,572’
Wofford Heights: 6.52”, Elevation 3,935’

2021 TOTAL Notable Very Low Rainfall

Death Valley National Park Furnace Creek Visitor Center: 1.56”, Elevation -193’

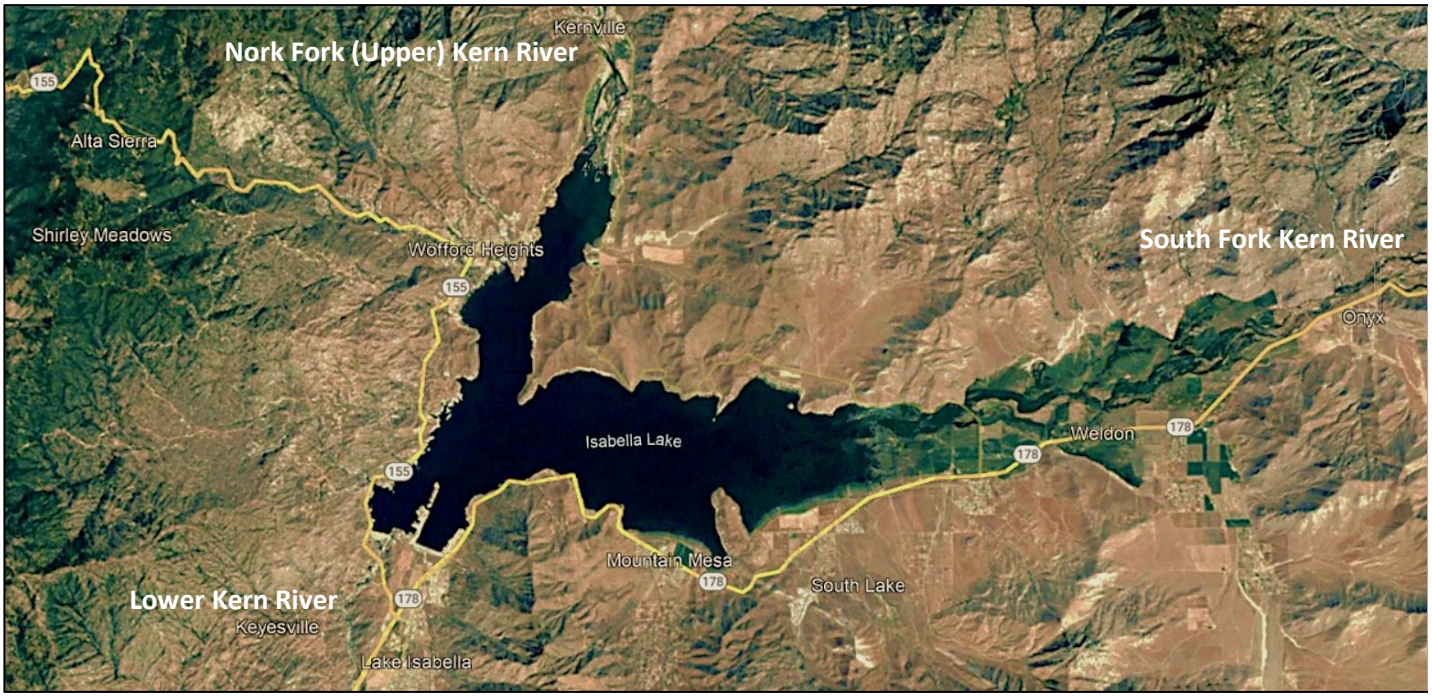
California and Nevada
River Basin Water Year Average – October 1, 2021, to Date





NOAA California Nevada River Forecast Center
https://www.cnrfc.noaa.gov/?product=hucPrecipSeasonal&lat=37.796&lng=-119.412&COUNTIES=true

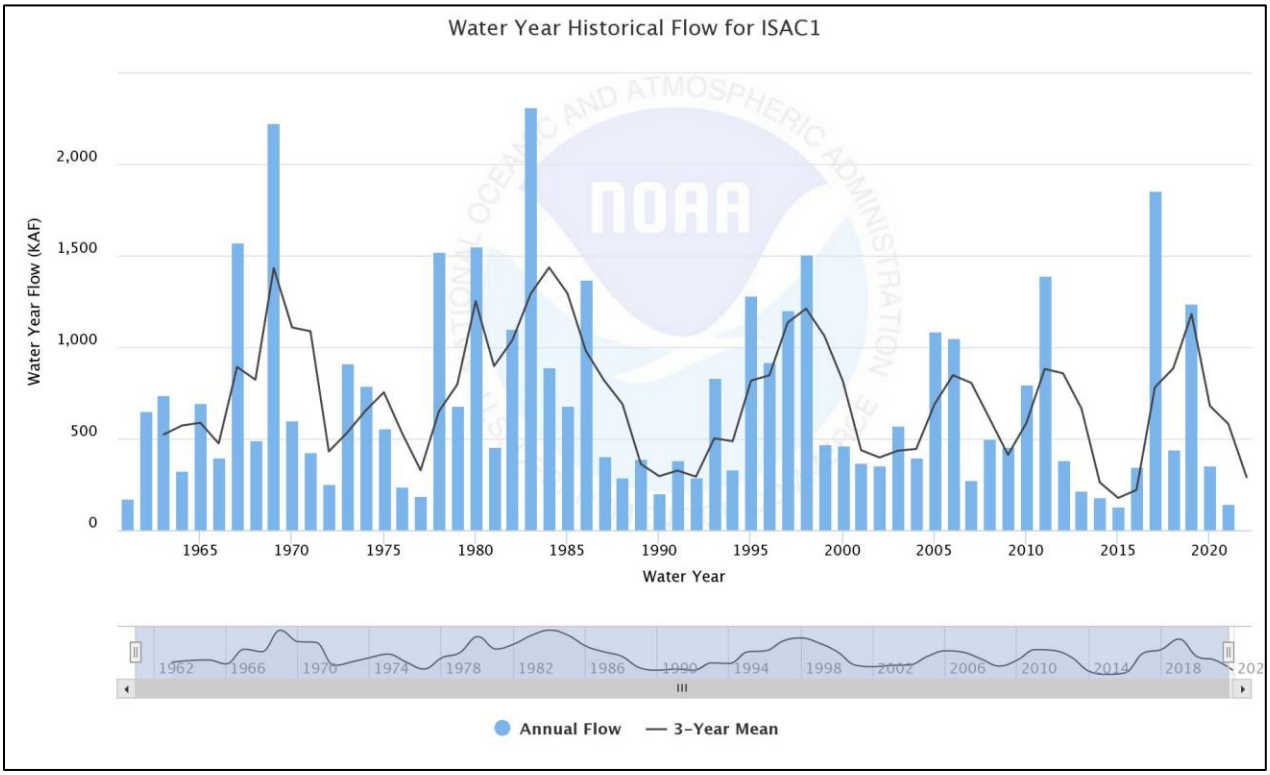
A Full Lake Isabella in 1986



Annual Lake Isabella Flows From 1961 to 2021

The water year is from October 1 to September 30

KAF = thousands of acre feet

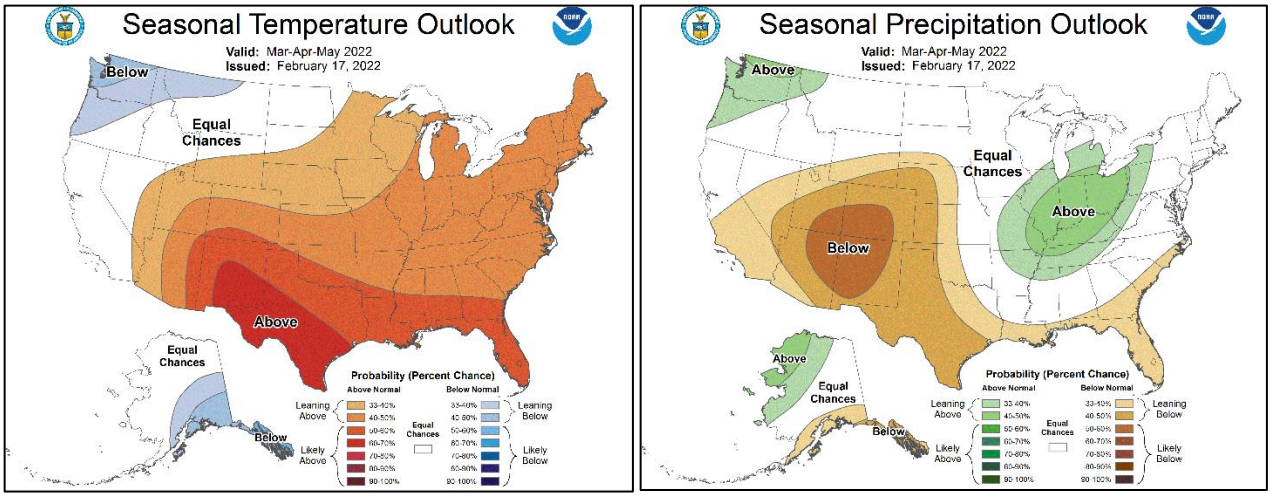


Kern River - Lake Isabella (ISAC1)

https://www.cnrfc.noaa.gov/ensembleProduct.php?id=ISAC1&prodID=12

National Weather Service Climate Prediction Center Seasonal Outlook

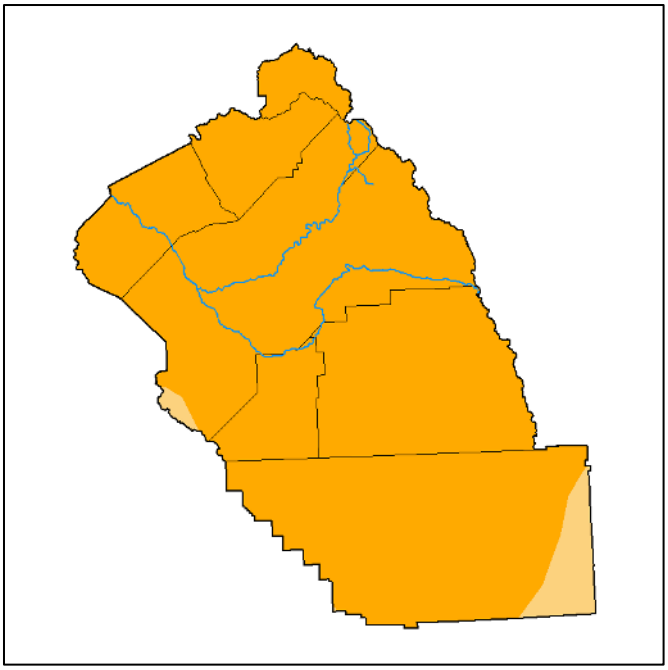
The Climate Prediction Center is forecasting an equal chance of normal temperatures and leaning below normal precipitation for the southern Sierra Nevada from March 2022 through May 2022.



National Weather Service Climate Prediction Center Seasonal Outlook
https://www.cpc.ncep.noaa.gov/

U.S. Drought Monitor – To Date[8]

The U.S. Drought Monitor shows Tulare County and most of Kern County is in severe drought.



[8] The U.S. Drought Monitor is not a statistical model, although numeric inputs are many: the Palmer Drought Severity Index, the Standardized Precipitation Index, and other climatological inputs; the Keech-Byram Drought Index for fire, satellite-based assessments of vegetation health, and various indicators of soil moisture; and hydrologic data, particularly in the West, such as the Surface Water Supply Index and snowpack. U.S. Drought Monitor https://droughtmonitor.unl.edu/

Fun Facts

- The 2021 Kern River water volume was 147,000-acre feet and that amount of water is the equivalent of a water column that is one-acre square in area by 28 miles high. In 1983 the Kern River water volume was 2,318,000-acre feet or equivalent to a one-acre square in area of water by 439 miles high.

- The International Space Station orbits the earth at about 230 miles above the earth's surface or the equivalent of a one-acre square water column that is 1,214,400 feet high.

- QUESTION: What is the measurement of flow in a river?
  ANSWER: The measurement used to determine the flow in a river is "CFS", which is Cubic Feet per Second flowing past a measurement point. Gauges along the river indicate how much water is moving past a given point. The higher the "CFS" the higher the flow.

- The Kern River supplies 20% of Kern County's municipal, inustrial and agricultural water usage.

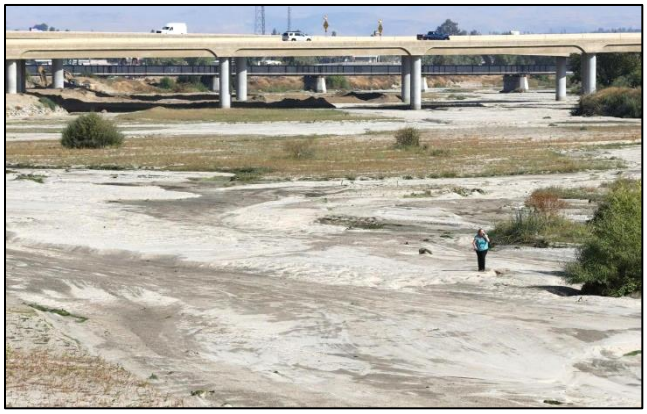
- QUESTION: Annualy, who uses the water in Kern County?
  ANSWER: Municipal and Industrial: 166,000 acre-feet; Agricultural: 2,294,000 acre-feet.

- In 2020 Kern County's highest value crops were:
  1. Grapes valued at $1,425,274,000 (93,100 acres)
  2. Citrus valued at 1,303,348,000 (65,770 acres)
  3. Almonds valued at $1,144,377,000 (229,000 acres)
  4. Pistachios valued at $944,542,000 (142,000 acres)

  Kern County 2020 Crop Report: http://www.kernag.com/dept/news/2021/2020_Kern_County_Crop_Report.pdf

  Check Out the Kern County Crop Map: https://maps.kerncounty.com/H5/Index.html?Viewer=Agriculture

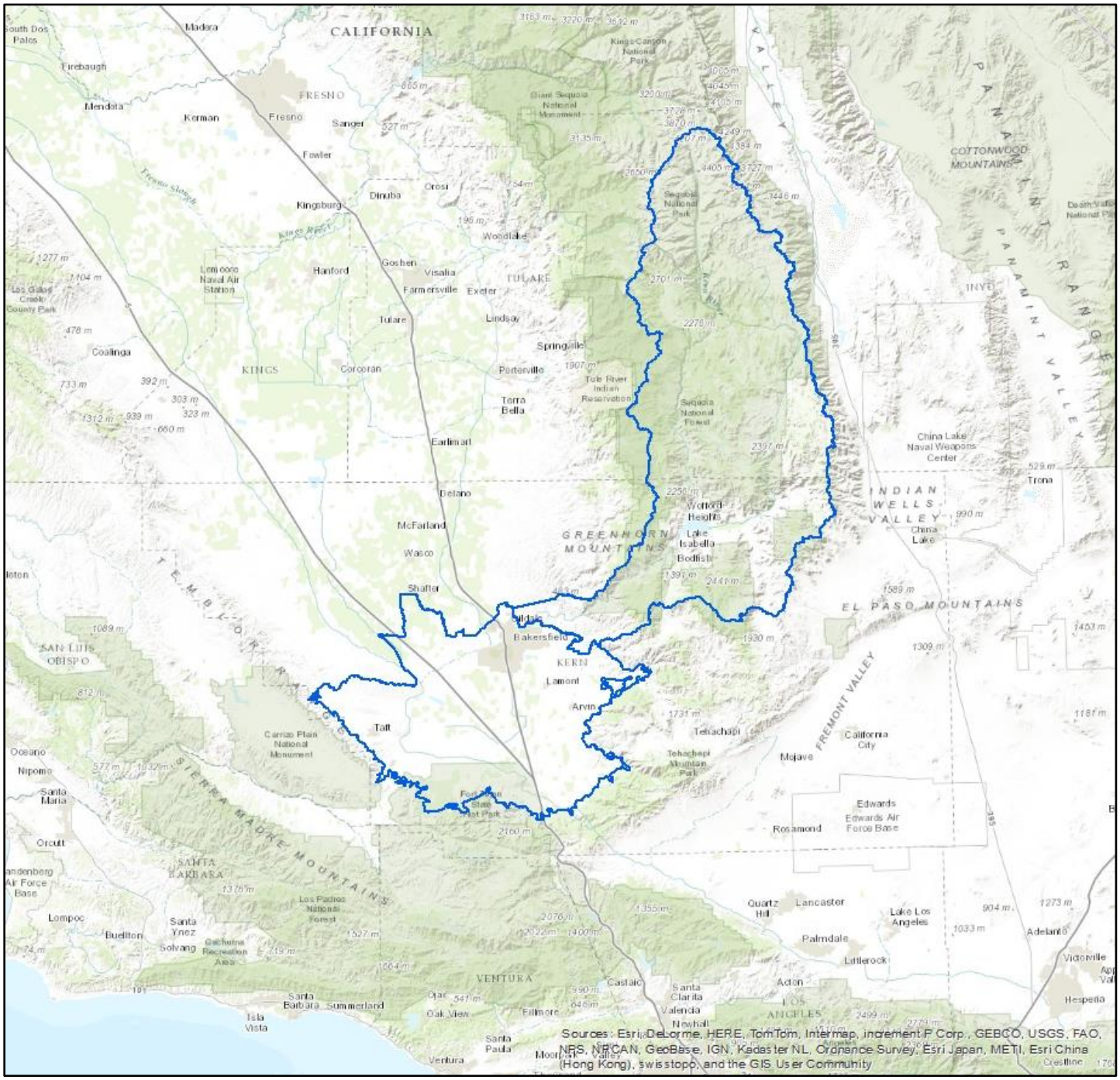
- QUESTION: Why does the Kern River not run through Bakersfield?
  ANSWER: In all but the wettest of years in Bakersfield, all of the Kern's flows are diverted out of the river channel into canals to support farming. Much of this water flows parallel to the riverbed throughout the year, particularly during the summer.



This leaves Bakersfield residents without the aesthetic centerpiece of their city and makes the Kern River Parkway a mere shadow of what it could be as a quality of life amenity.

Support "BRING BACK THE KERN"
https://www.bringbackthekern.org/

Kern River Basin



Source

- Kings-Kern Divide
- Location: Sequoia National Park
- Elevation: 13,608 feet (4,148 m)

Mouth

- Buena Vista Lakebed
- Location: San Joaquin Valley
- Elevation: 299 feet (91 m)

River Length: 164 miles (264 km)
Basin Size: 3,612 square miles (9,360 km2)

Snow Depth and Density

The most important characteristic of snow to water managers and hydrologists is its water content. However, depth is of interest to many people also. Our data collection equipment measures the weight of the snowpack, and therefore its water content.

DENSITY

New-fallen snow can range in density depending on the air temperature and intensity of the storm. In California, densities of 12% are common. This means that for every 10 inches of snow that accumulates, it will melt to a pool of water 1.2 inches deep.

After it falls, it settles and compacts. The snowpack gets less and less deep, but the snow doesn't melt or go anywhere. Rather, its density increases. When conditions are cold, such as at high elevations in January, it will compact until its density is around 33%. As time goes on, and more snow falls on top, the snow beneath will further compact. At this point, varying levels in a column of snow will have different densities.

Therefore, snow depth is a fleeting indicator of the snowpack. By obtaining a measure of the water content of the snow, which doesn't change unless more precipitation occurs or the pack melts, we have a good handle on how the rivers will react in the spring.

DEPTH

By examining field measurements of depth and water content from the past 90 years, we have a general idea of how deep the snowpack is for a given water content each month. Snow depths on an average-weather year can be approximated by multiplying Snow Water Content values reported near the first of each month by the following factor:

- January 3.0
- February 2.8
- March 2.5
- April 2.25
- May 2.0

After May, the snowpack will probably remain at slightly above 50% density as it melts. Rain falling on this snow may accelerate its melt rate, but the intense sunshine of late spring and summer is the principal melting energy source.

Information provided by the California Cooperative Snow Surveys:
http://cdec.water.ca.gov/snow/

California Snow Survey

At the California Department of Water Resources, the snow surveyor's job is a year-round one. Before the first snow of the season falls, special teams' journey to the "snow country"' to stock cabins with food and provisions for the winter months. Some of the cabins are so remote that the only way to reach them is by horseback and pack animal. The table shows the seventeen snow survey courses that are in the Kern River drainage.

Snow Course Number	Name and Location	Elevation
265	Beach Meadows	7,650
257	Big Whitney Meadow	9,750
250	Bighorn Plateau	11,350
261	Bonita Meadows	8,300
262	Casa Vieja Meadows	8,300
251	Cottonwood Pass	11,050
253	Crabtree Meadow	10,700
249	Dead Horse Meadow	7,300
254	Guyot Flat	10,650
260	Little Whitney Meadow	8,500
264	Quinn Ranger Station	8,350
259	Ramshaw Meadows	8,700
256	Rock Creek	9,600
258	Round Meadow	9,000
275	Sandy Meadows	10,650
252	Siberian Pass	10,900
255	Tyndall Creek	10,650

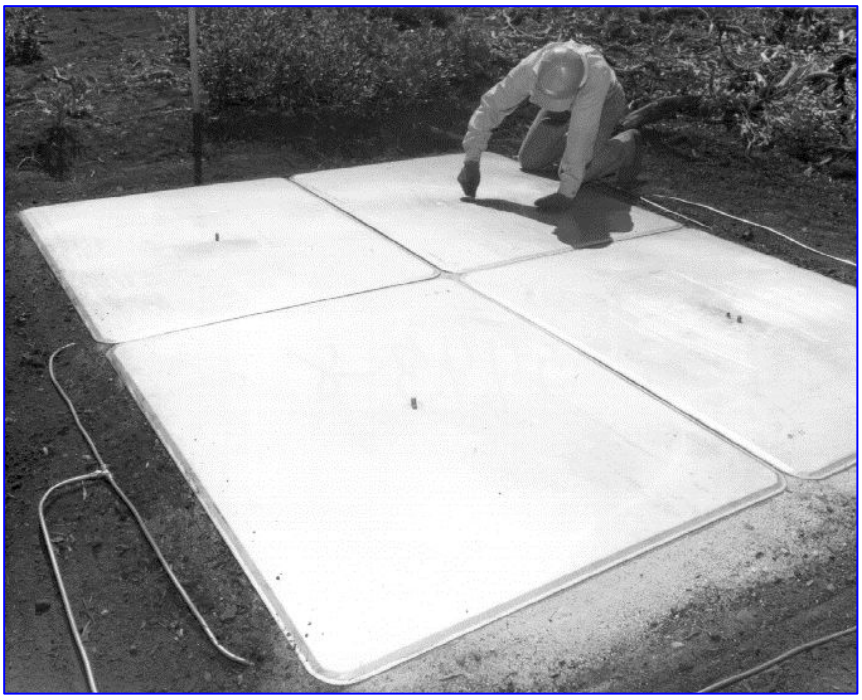
Other field work undertaken during the summer includes installing, operating, and evaluating experimental equipment to provide cooperating agencies with information for designing future automatic snow data collection networks.

Back at State headquarters in Sacramento the snow surveys personnel revise historic data and coordinate activities with other agencies so that it will be "all systems go" when the year's first surveys begin in January. On or about the first day of each winter month surveyors from cooperating agencies venture into the mountains. Each of the State's 300-plus snow courses is visited at least once by snow surveyors for data gathering. Even at stations monitored automatically, data must be verified.

An average snow course is 1,000 feet long. Most courses consist of about ten sample points to insure sound statistical data. From two to six courses are measured in a day, depending upon how severe the weather is and whether the snow surveyors travel on skis, snowshoes, over snow vehicle, such as a snow cat or snowmobile, or by helicopter. In wilderness areas motorized equipment is not allowed so the surveyors travel on cross-country skis and stay overnight in backcountry cabins.

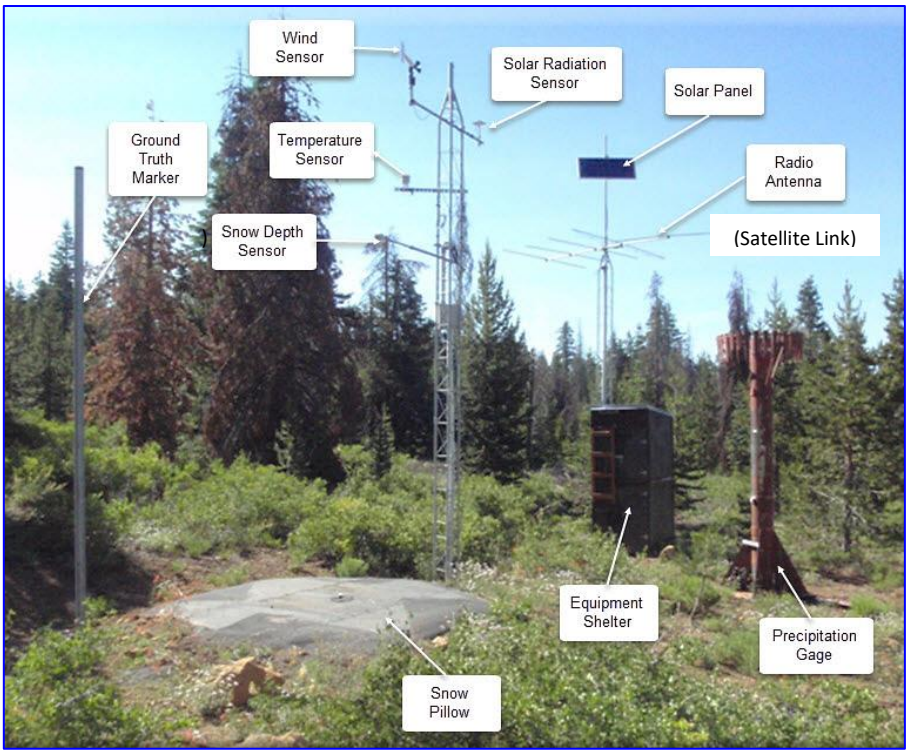
Automated Snow Sampling

A snow pillow is an automated device that measures snowpack water content 24 hours per day and transmits the data collected each hour via satellite communications. The snow pillow measures the water equivalent of the snowpack based on hydrostatic pressure created by overlying snow. In the Kern River drainage there are eight snow pillows shown in the table.



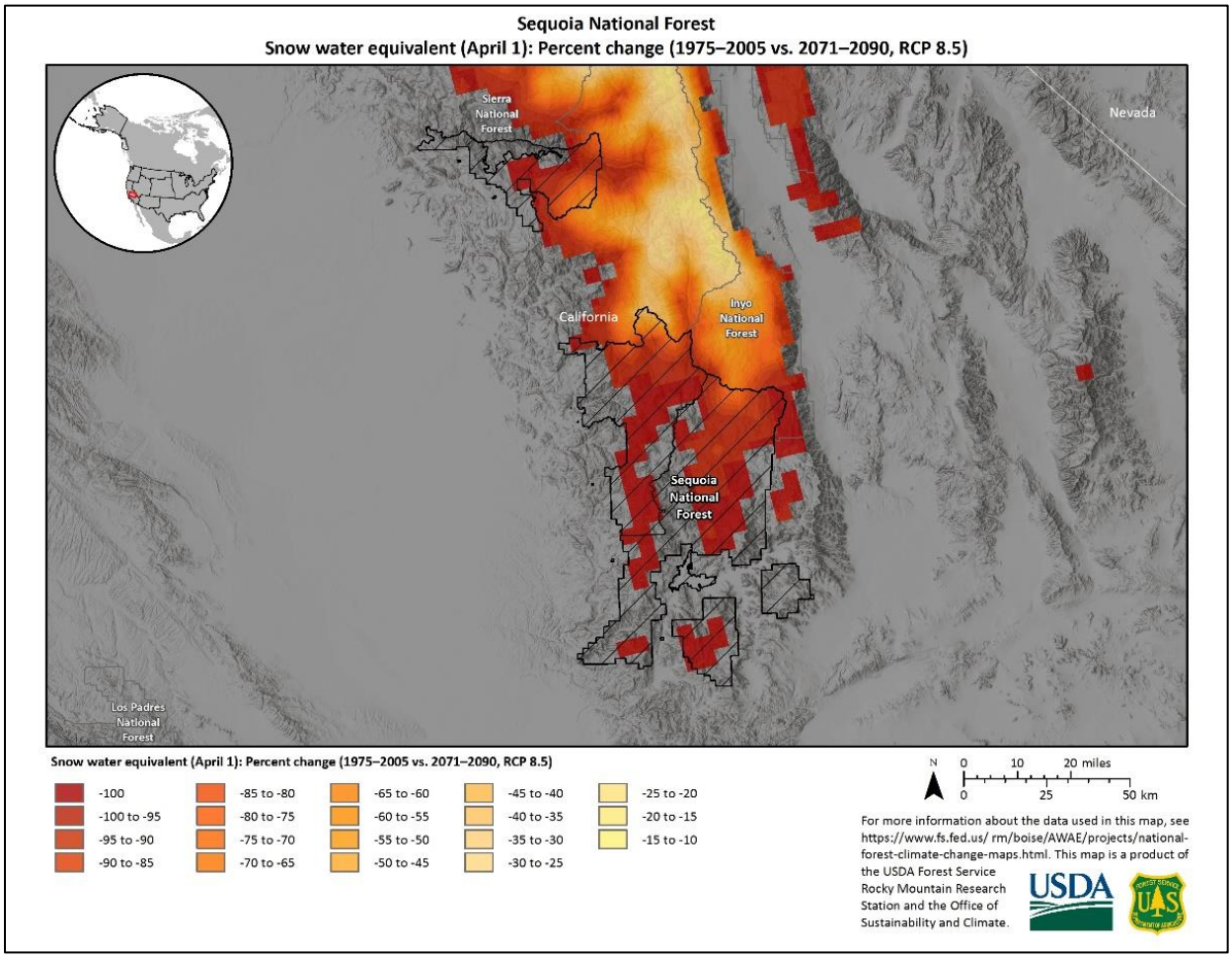
Name and Location	Elevation
Beach Meadows	7,650
Casa Vieja Meadows	8,300
Chagoopa Plateau	10,300
Crabtree Meadow	10,700
Pascoes	9,150
Tunnel Guard Station	8,900
Upper Tyndall Creek	11,400
Wet Meadows	8,950

Snow pillows were developed in the early 1960s.

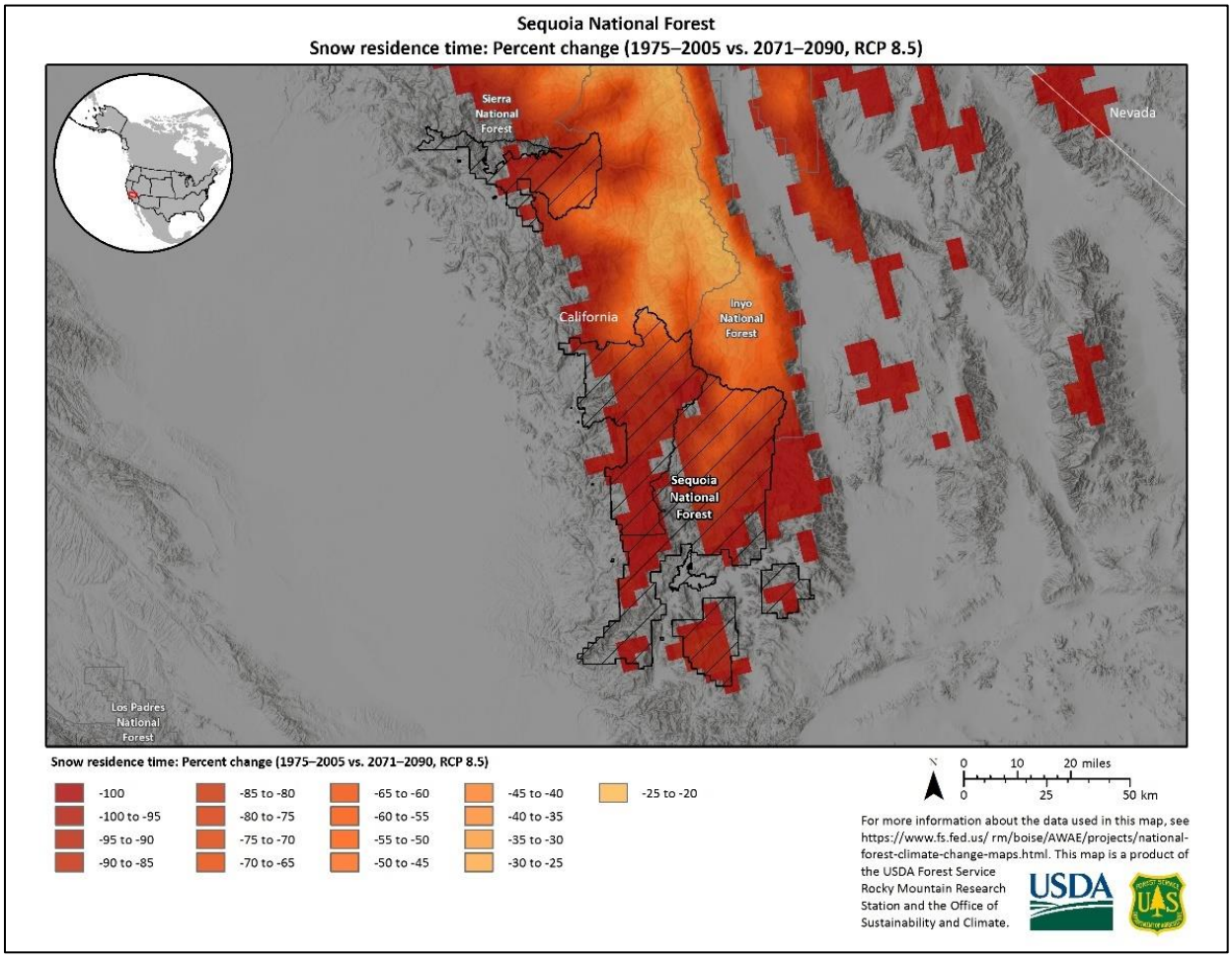


Climate Change is Forecast to Reduce Snowpack

Forecast Snow Water Equivalent (April 1) Percent Change 1975-2005 vs. 2071-2090



Forecast Snow Residence Time Percent Change 1975-2005 vs. 2071-2090



USDA Forest Service Climate Map Exporter

https://usfs.maps.arcgis.com/apps/Cascade/index.html?appid=84d0b8b9388343149f5365de517a6689

Additional Links

Most Recent Snow (Water Content) Data
http://cdec.water.ca.gov/cgi-progs/getAll?sens_num=3

El Niño/Southern Oscillation (ENSO) Diagnostic Discussion
https://www.cpc.ncep.noaa.gov/products/analysis_monitoring/enso_advisory/index.shtml

California Nevada River Forecast Center Interactive Map Interface
https://www.cnrfc.noaa.gov/ol.php?type=snow

Send Inquires and Suggestions To:
kernriversnowandwaterreport@gmail.com

The Kern River Snow and Water Report was a free educational service provided by the Keepers of the Kern up until their retirement. The report is compiled by Scott Williams and is not copyrighted so please share. Science!

See the Magnificent Sierra Nevada in Real Time:

Sierra Nevada California Webcams

"The Best Webcams in the West"

"If it's worth doing, it's worth overdoing"
The MythBusters