Staff Workshop Regarding Emergency Regulation Efforts in Scott River and Shasta River Watersheds

October 6, 2023

CALIFORNIA
Water Boards

State Water Resources Control Board, Division of Water Rights

Workshop Purpose

- Inform an emergency regulation for Scott River and Shasta River watersheds for Board consideration later this year
- Speakers invited by State Water Board staff to answer specific questions related to:
  - state of the fisheries,
  - emergency regulation flows, and
  - groundwater local cooperative solutions
- Exchange information
- No Board action will be taken

Ground Rules

1) **This is a public workshop**

   We are here to listen to and respect the perspectives and ideas shared.

2) **Listen actively and with an open mind**

   We can better understand other perspectives when we try to see things from their lens. You can respect another person's point of view without agreeing with the point of view.

3) **Stay on point and on time**

   We have limited time today. Please respect the group's time and give everyone an opportunity to be heard. Keep comments brief and to the point.

4) **Mute your microphone when not speaking**

   To limit distractions and disruptions, please ensure your microphone is muted when not in use (in the room and online).

Logistics

- Fire Safety and Emergency Preparedness
- Restrooms
- How to provide comments:
  - Virtual: fill out virtual speaker card linked in the workshop notice
  - In-person: scan QR code at back of room and fill out form
- Questions should be emailed to: ScottShastaDrought@waterboards.ca.gov
  - May be workshop questions or suggested questions for speakers
- Meeting is being transcribed

Today’s Schedule

- Emailed out to interested parties on September 29th with some copies at back of room
- Broken into four main sections:
  - State of the Fisheries
  - Emergency Flows
  - Groundwater Local Cooperative Solutions
  - Data
- Each section/topic will include:
  - Presentations from invited speakers responding to specific questions posed by staff
  - Opportunity for additional questions from staff
  - Opportunity for comments

State of the Fisheries in Scott River and Shasta River Watersheds & Klamath Basin

Panelists

- California Department of Fish and Wildlife/National Marine Fisheries Service (20 minutes)
- Councilman Troy Hockaday, Karuk Tribe (15 minutes)
- Michael Belchik, Yurok Tribe (15 minutes)
- Sarah Schaefer, Quartz Valley Indian Tribe (15 minutes)

Questions from Staff

Comments

CDFW/NMFS Fishery Presentation (20 minutes)

- Please describe the state of the fisheries in the Scott River and Shasta River watersheds with a focus on coho, Chinook, and steelhead.
- What would healthy fish numbers be for these watersheds?
- How important are the Scott River and Shasta River watersheds coho, Chinook, and steelhead populations to the Klamath Basin populations?

SHASTA SCOTT EMERGENCY DROUGHT STATE OF THE FISHERIES

PRESENTED BY:

Michael Harris, California Department of Fish and Wildlife

Our Mission

Mission: To manage California's diverse fish, wildlife, and plant resources, and the habitats upon which they depend, for their ecological values and their use and enjoyment by the public.

CDFW Trustee For Fish and Wildlife Agency Role

As trustee for California's fish and wildlife resources, CDFW has jurisdiction over the conservation, protection, and management of fish, wildlife, native plants, and habitat necessary for biologically sustainable populations of those species.

NOAA Fisheries Presentation

Presented by: Michael Harris, Klamath Watershed Program CDFW

SWRCB hearing on minimum flow requirements for the Scott and Shasta Rivers

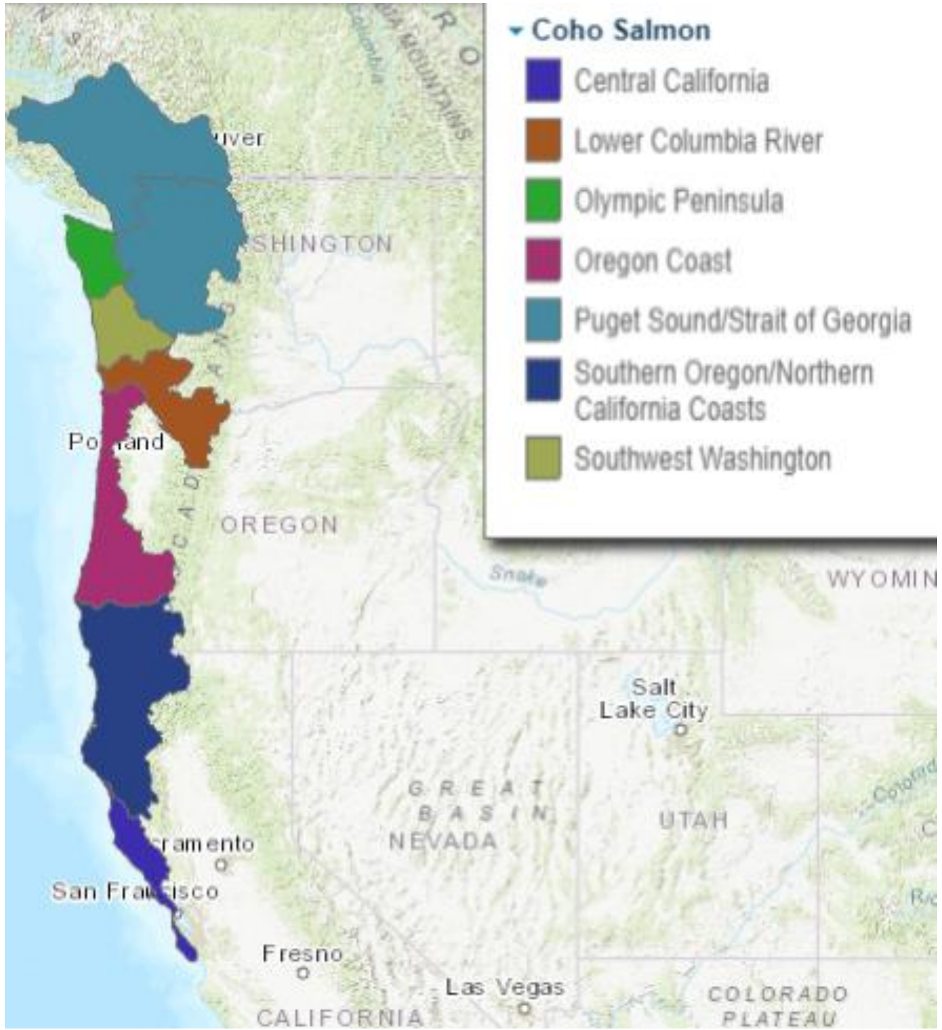
NOAA FISHERIES
West Coast Region, California Coastal Office

Jeff Abrams
Fisheries Biologist
Klamath Branch

October 6, 2023

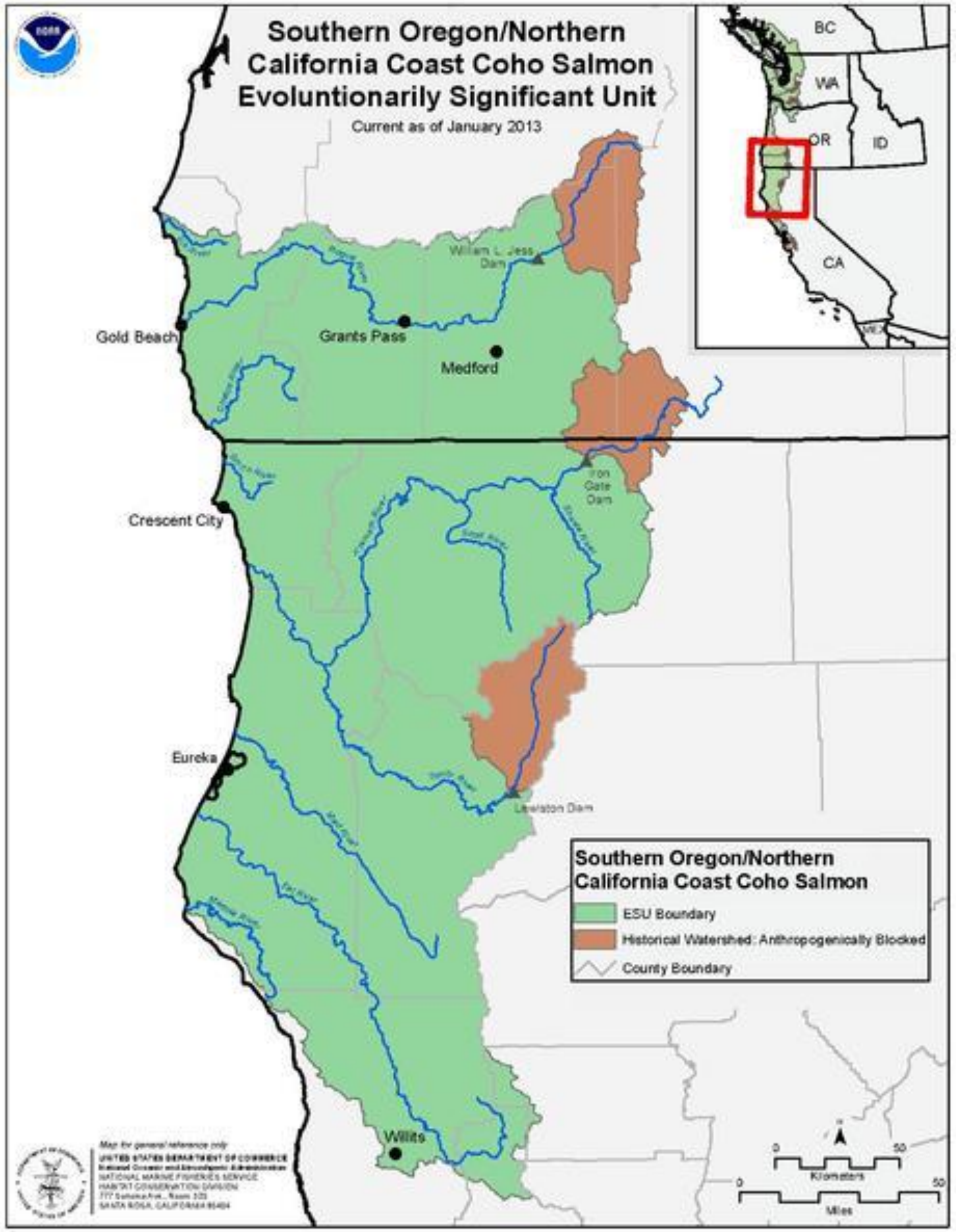
Klamath Salmon and Steelhead

- Evolutionarily Significant Unit (ESU) Policy (56 FR 58491, 1991):
  - SONCC coho and UKTR Chinook salmon
- Distinct Population Segment (DPS) Policy (61 FR 4722, 1996):
  - KMP Steelhead
- Listable management units defined in the Federal Endangered Species Act of 1973



SONCC coho salmon ESU

- Coastal Rivers and Streams from the Elk River (OR) to the Mattole River (CA)
- ESA Status - Threatened
  - May 6, 1997 (62 FR 24588) and June 28, 2005 (70 FR 37159); updated April 14, 2014 (79 FR 20802)
- Viable Salmonid Populations (VSP) parameters
  - Abundance
  - Productivity
  - Spatial Structure (connectivity)
  - Diversity



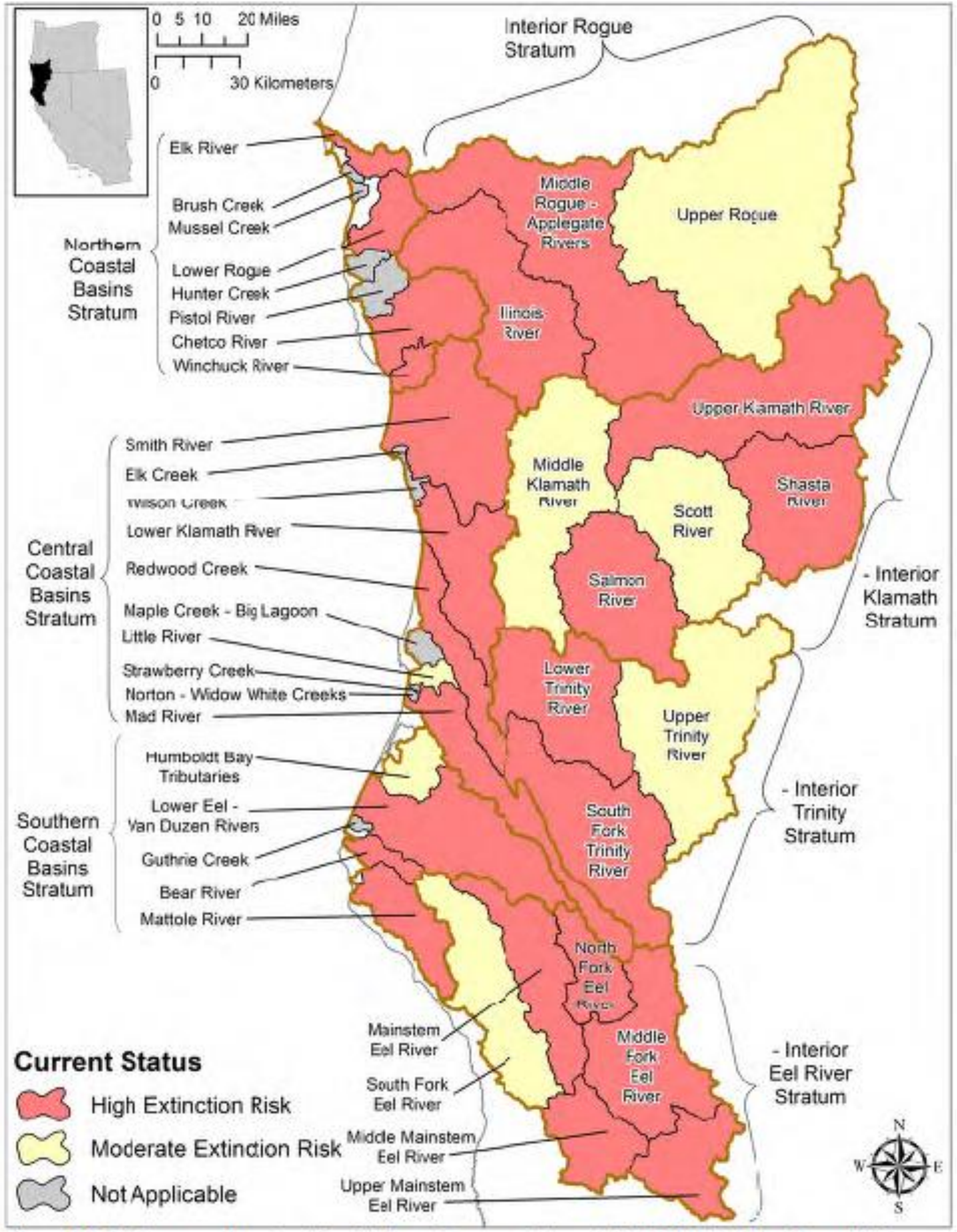
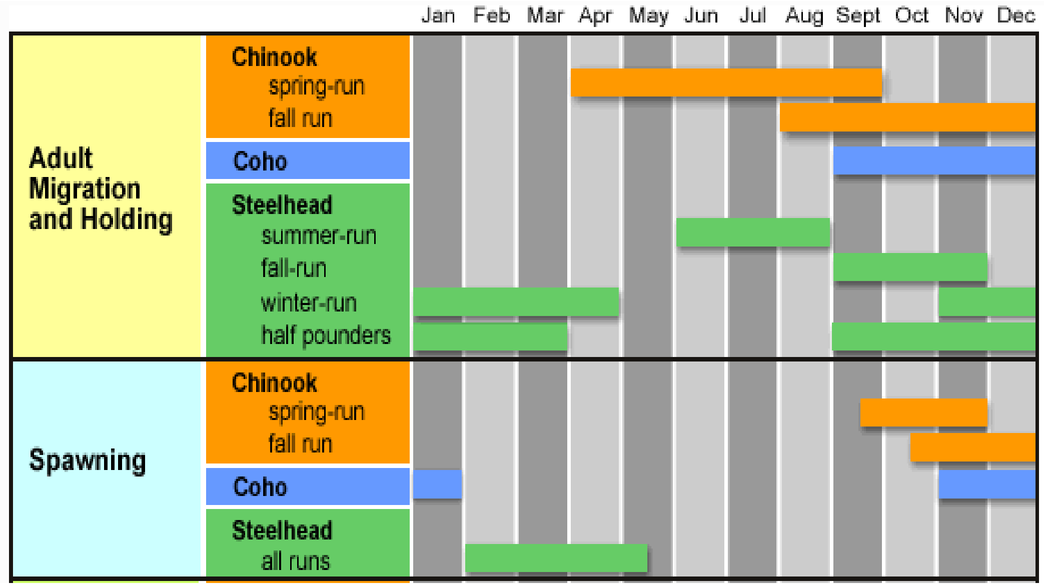


Figure ES-2. Current extinction risk of independent populations in the SONCC coho salmon ESU.

NOA

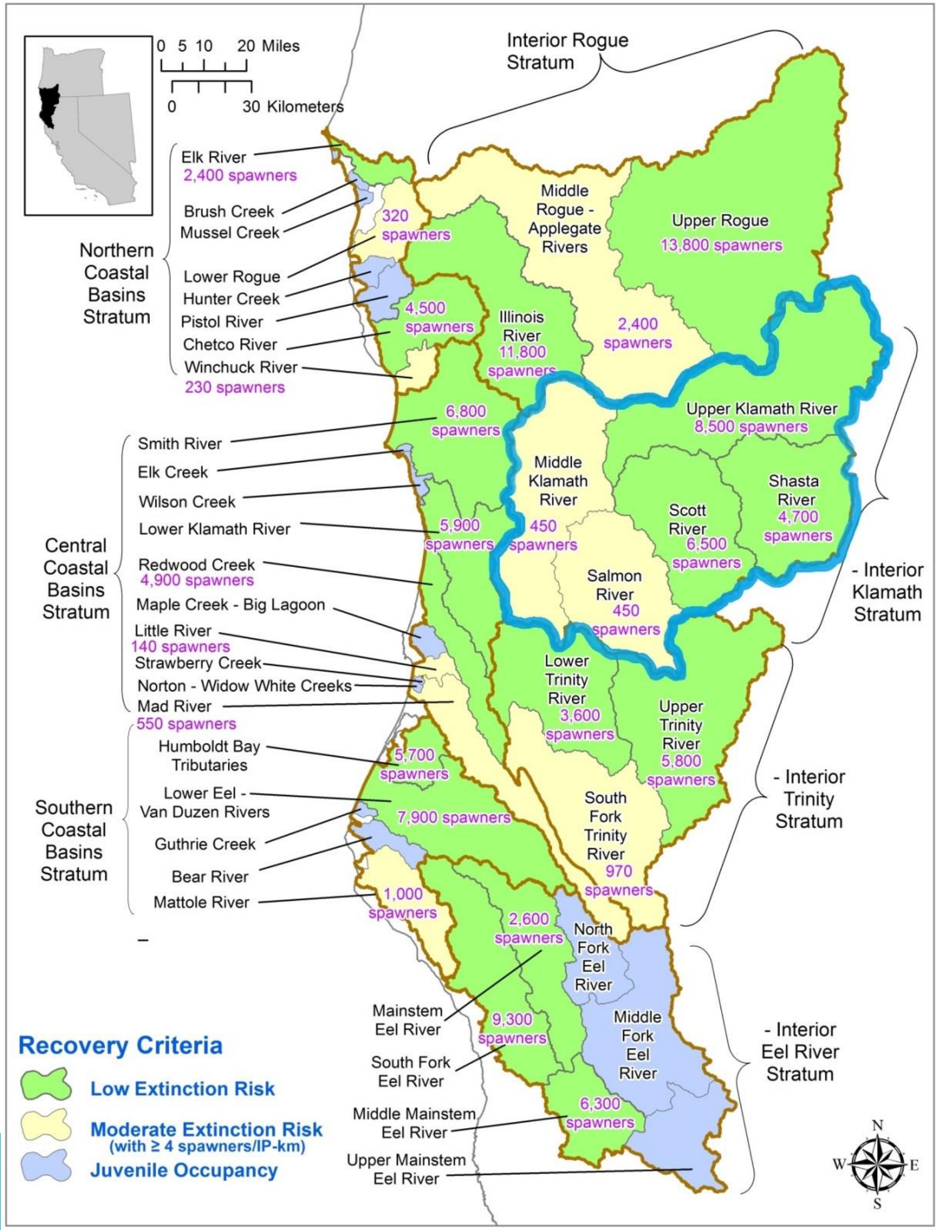
SONCC Coho Salmon Recovery Plan

Life Stage	Basic Requirements
Spawning (adult)	Appropriate substrate, water quality, access
Over summer rearing (juvenile)	Water quality (temperature), access
Over winter rearing (juvenile)	Water quality (velocity), access
Smolt (transition)	Water quality, access to the ocean



SONCC Coho Salmon Recovery Plan

- Recovery Criteria
  - Shasta River = 4,700 spawners
  - Scott River = 6,500 spawners



SONCC Coho Salmon Recovery Plan

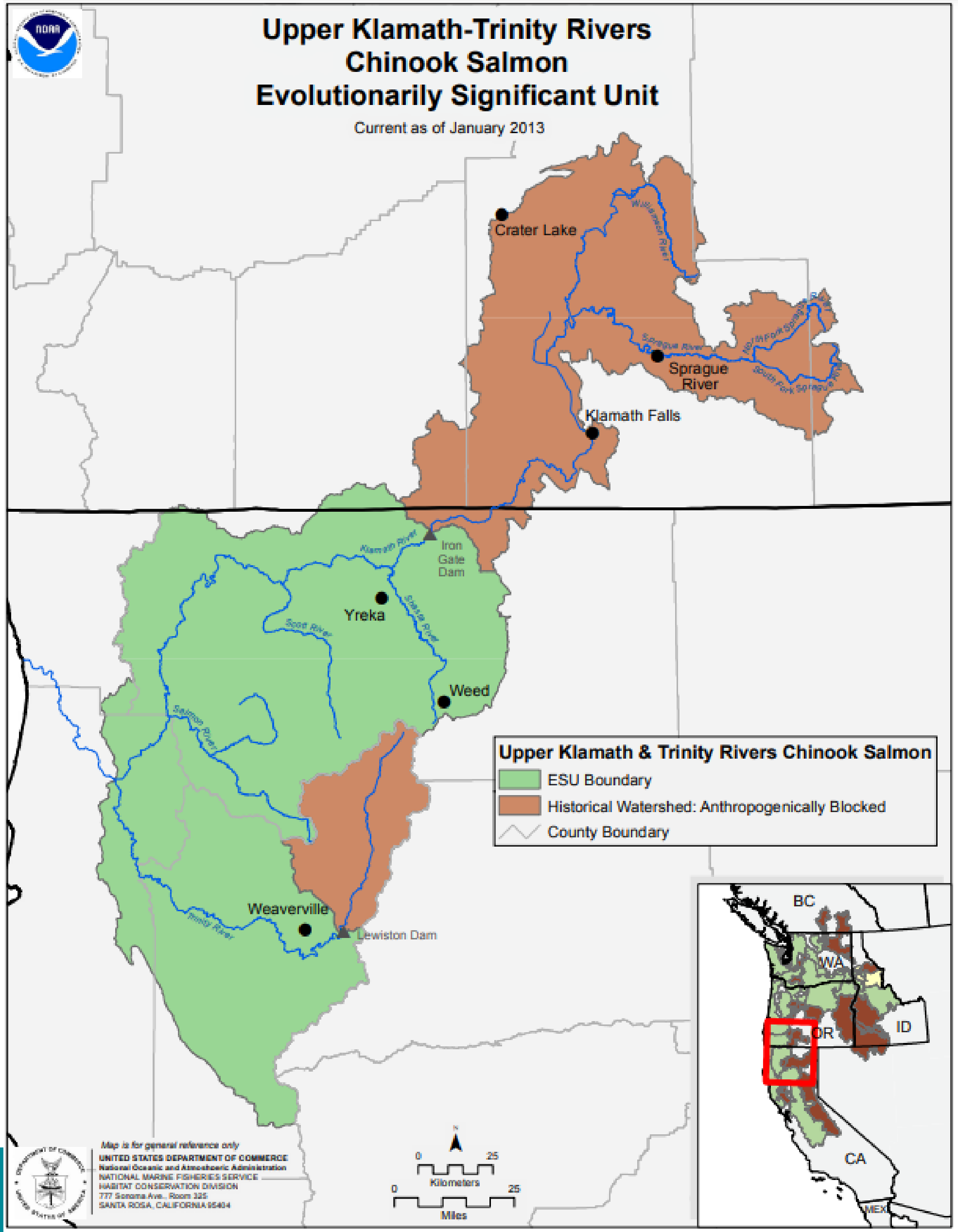
Population	Limiting Factor for Recovery
Middle Klamath River	Structure (simplified channels) & Water Quality (too warm)
Upper Klamath River	Hydro Function (unnatural flow regime) & Barriers (dams)
Shasta River	Hydro Function (unnatural flow regime) & Water Quality (too warm)
Scott River	Hydro Function (unnatural flow regime) & Riparian (degraded conditions)
Salmon River	Structure (simplified channels) & Riparian (degraded conditions)

SONCC coho salmon in the Scott and Shasta

Stratum	Population	Extinction Risk	Depensation Threshold (1*IP-km)	Extinction Risk Criteria Used[1]
Interior Klamath	Middle Klamath River	Moderate	113	Spawner density
	Upper Klamath River	High	425	Spawner density
	Shasta River	High	144	Spawner density
	Scott River	Moderate	250	Spawner density
	Salmon River	High	114	Spawner density

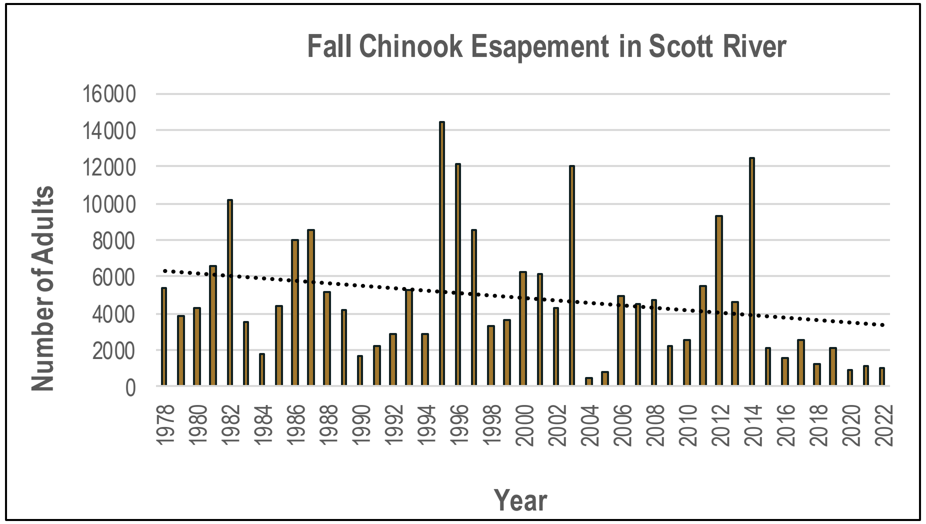
Upper Klamath Trinity River (UKTR) Chinook Salmon

- All spring-run and fall-run populations from the Trinity and Klamath Rivers and tributaries upstream from their confluence.
- ESA Status – under petition
  - 1998 Status Review (Listing not warranted)
  - 2012 petition response (listing not warranted
  - 2017 petition (response pending)
- Southern Resident Killer Whales (Endangered)



Upper Klamath Trinity River (UKTR) Chinook Salmon

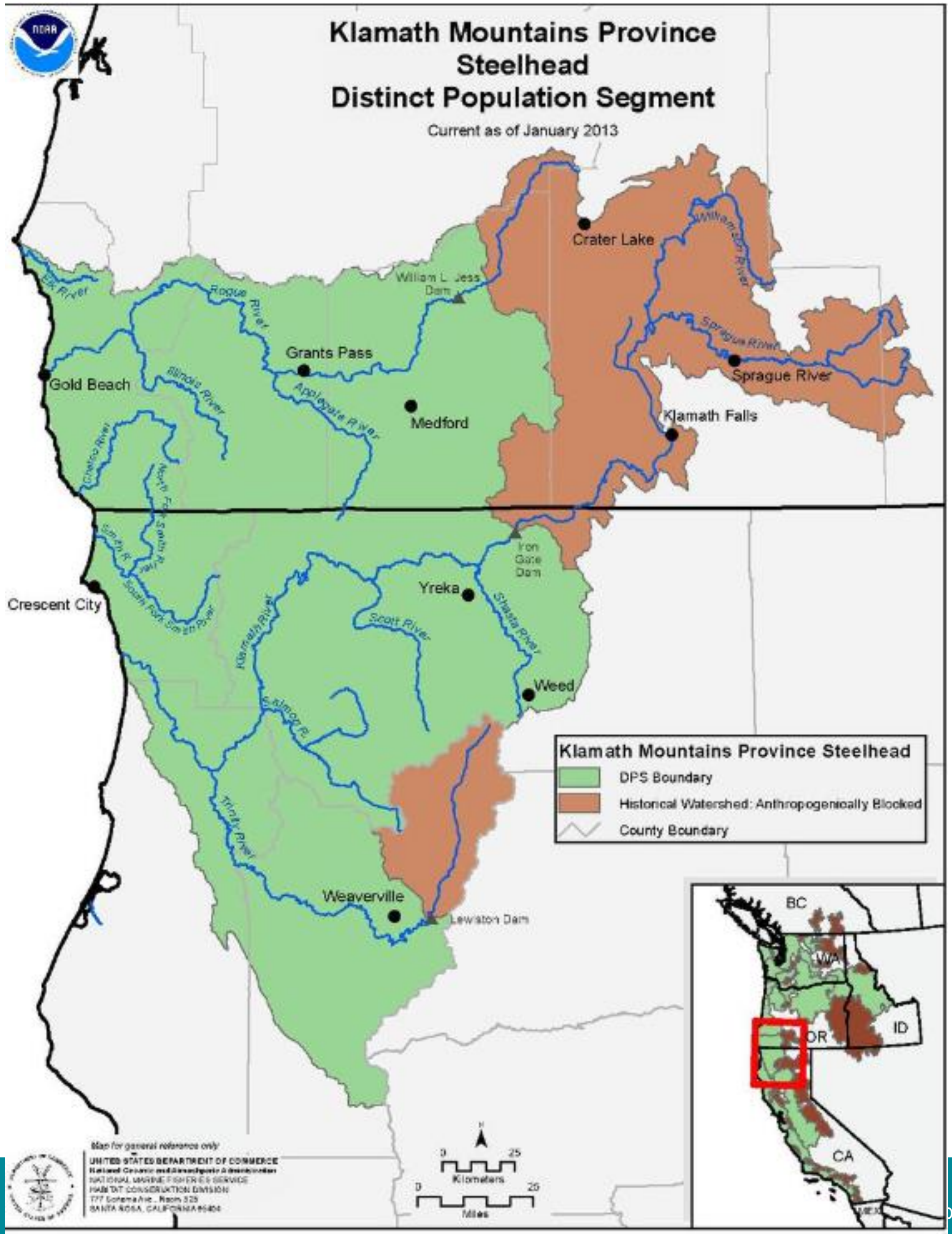
- Magnuson Stevens Act (1976)
  - Preventing overfishing
  - Rebuilding overfished stocks
  - Increasing long-term economic and social benefits
  - Ensuring a safe and sustainable supply of seafood
  - **Protecting habitat that fish need to spawn, breed, feed, and grow to maturity**
- Federal Tribal Trust Responsibilities
  - Local tribes are co-managers of the salmon and steelhead fisheries in partnership with the state and federal government



Klamath Mountain Province Steelhead DPS

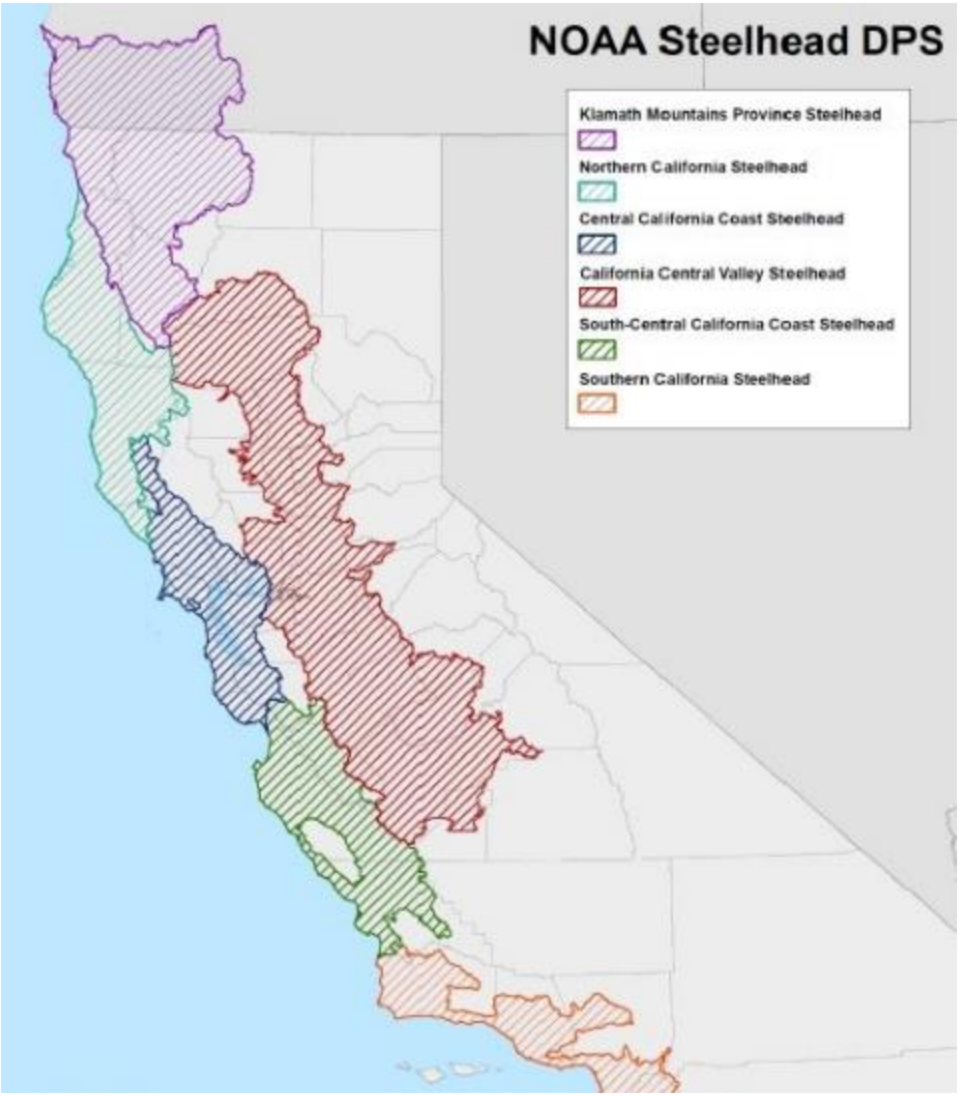
- winter and summer steelhead inhabiting coastal river basins between the Elk River in Oregon and the Klamath River in California

- ESA Status – not warranted
  - 1995 Status Review (proposed threatened)
  - 1998 Status Review (listing not warranted)
  - 2001 status review (listing not warranted)



Status of other California Steelhead DPSs

- Northern California
  - Threatened (2000)
- Central California Coast
  - Threatened (1997)
- Central Valley
  - Threatened (1998)
- South-Central California Coast
  - Threatened (1997)
- Southern California
  - Endangered (1997)



Conclusions

- 1) The primary stressors to salmon and steelhead in the Scott and Shasta rivers are altered hydrology and poor water quality.
- 2) Low flow barriers in the Scott River degrade the migratory corridor and limit spatial distribution and diversity of life history strategies (e.g., early spawners, late spawners).
- 3) The Shasta River coho population, which is predominantly impacted by poor water quality, has been significantly below the depensation threshold for the last 10 years, and is at high risk of extinction in the near future.
- 4) In order to conserve salmonid populations in the Scott and Shasta rivers, NMFS recommends flows return to a more natural hydrograph that aligns with life history requirements and supports our VSP parameters for healthy populations.
- 5) A minimum flow setting process will result in improved water quality and address passage issues in the Scott and Shasta rivers.
- 6) NMFS supports the Karuk Tribe petition that asks the SWRCB to begin a minimum flow setting process in the Scott and Shasta Rivers and recommends interim flows be developed for immediate implementation.

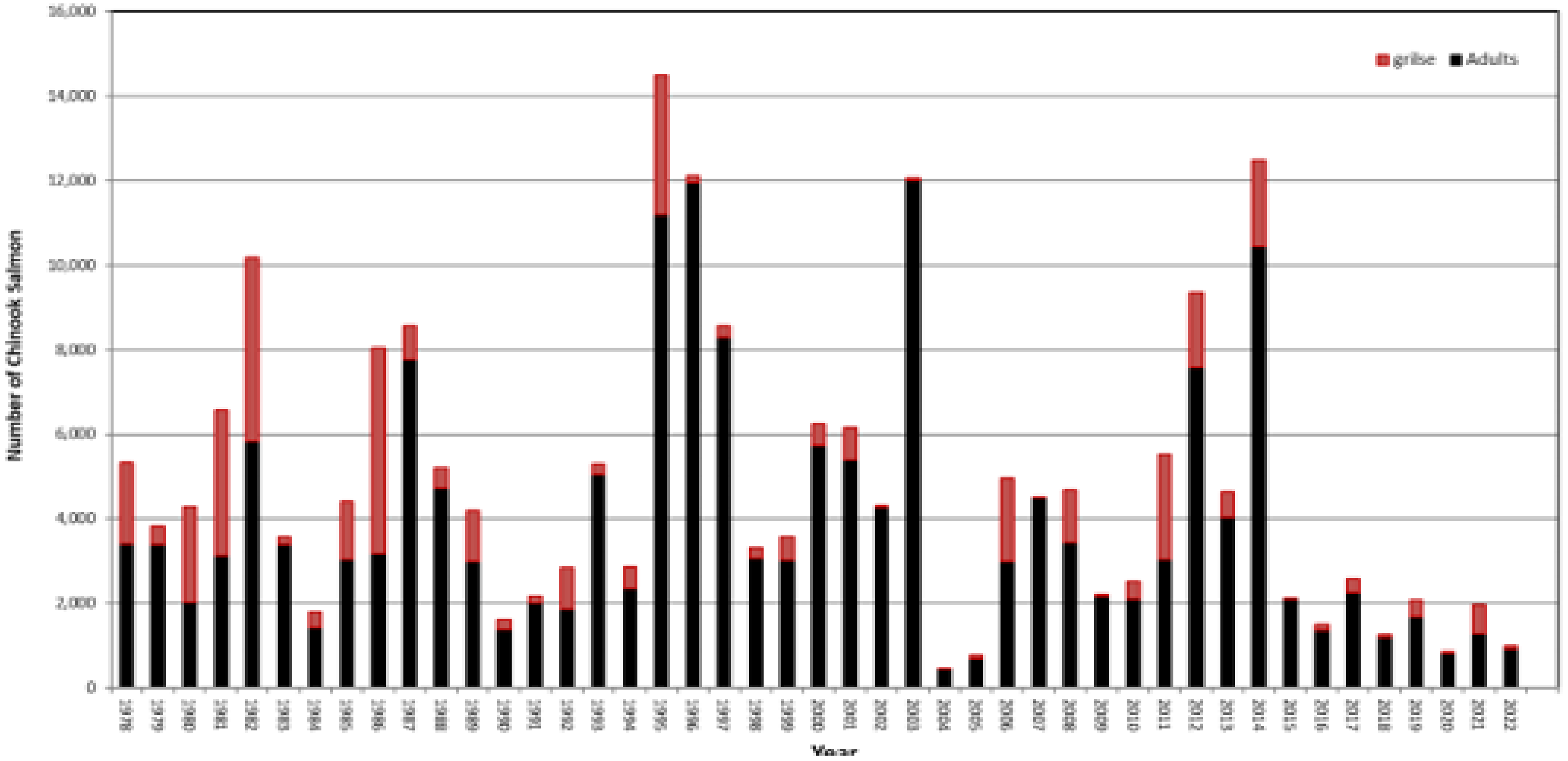
Scott and Shasta River Fish Population Update

Presented by: Michael Harris, Klamath Watershed Program CDFW

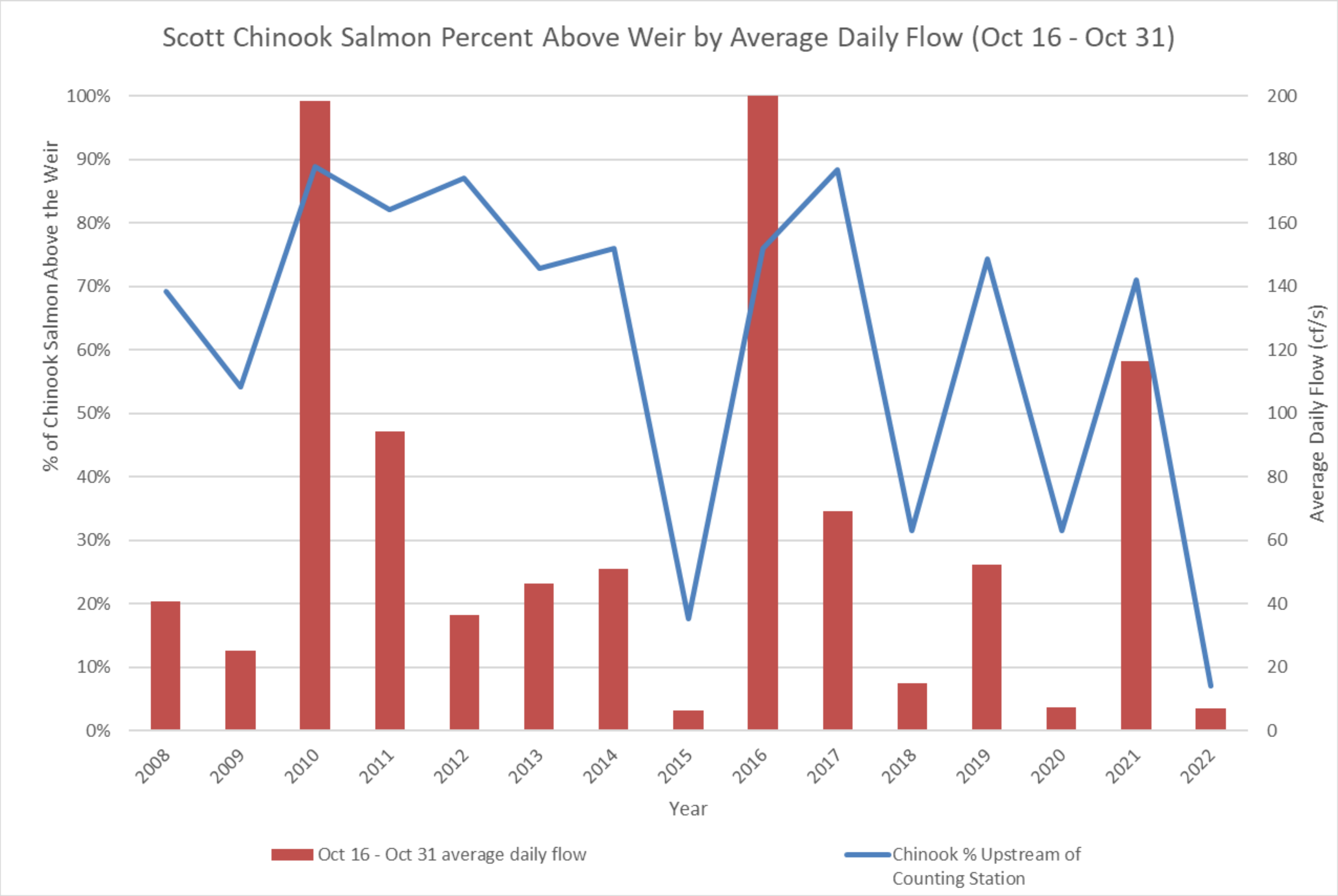
Scott River Adult Chinook Salmon Population Estimates

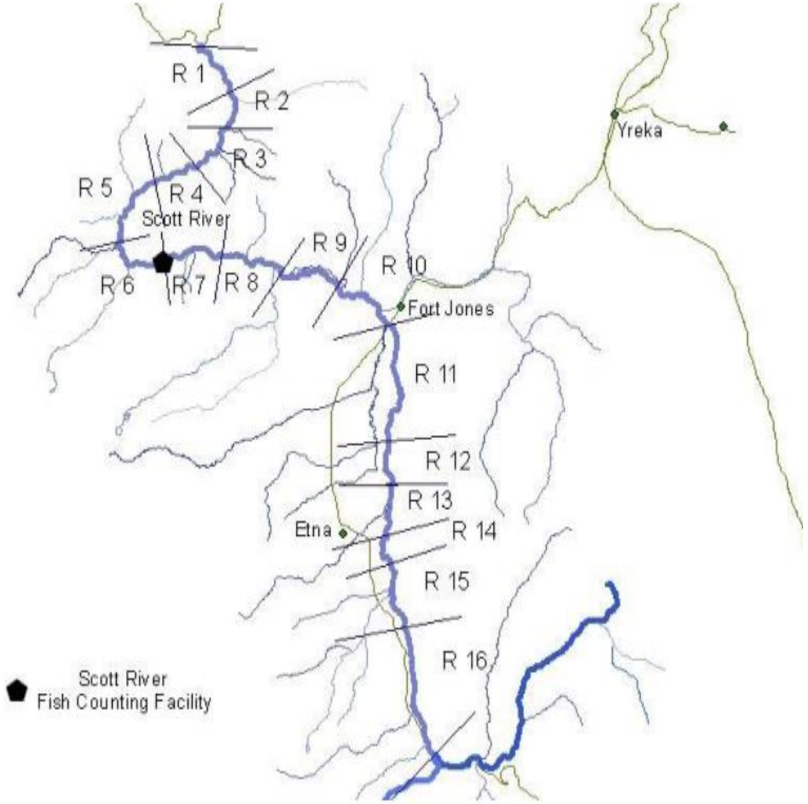
Chinook salmon on the Shasta River: Photo Credit -The Nature Conservancy

- Klamath Basin Emergency Chinook fishery closure
- Scott Population - 65% reduction from historic average



Scott River Chinook Salmon Watershed Distribution

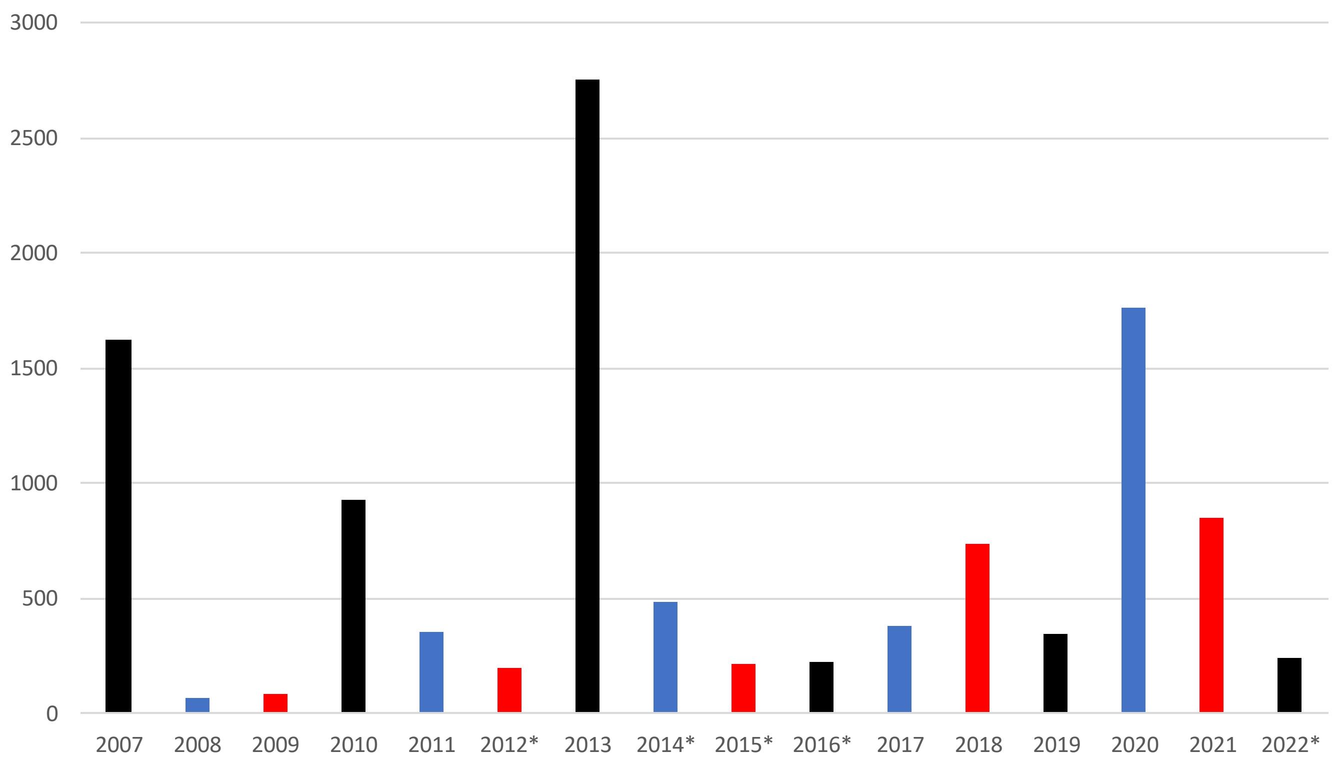




Scott River Adult Coho Salmon Minimum Escapement

- Adult Coho Salmon Population minimum
  - Video counting weir pulled at high flow
- Blue and red cohort is steadily increasing
- Black cohort
  - System production capacity
  - 90% population reduction 2014 & 2015 drought
- NMFS Scott River Coho Recovery Target: 6,500 adults

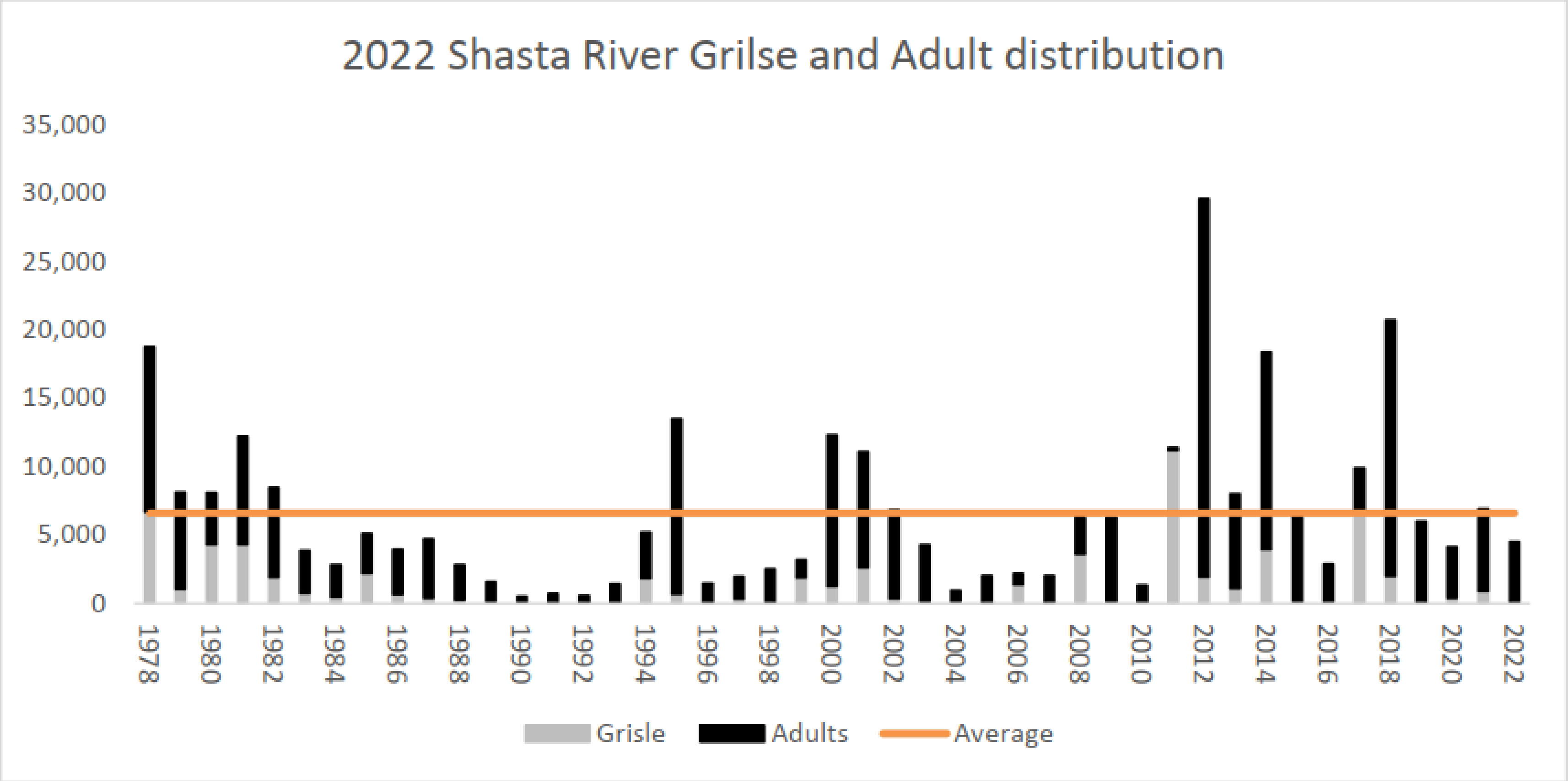
Adult Coho Salmon Returns to Scott River, CA 2007-2021



* Abundance affected by early removal of the counting station which may have resulted in under counts of coho

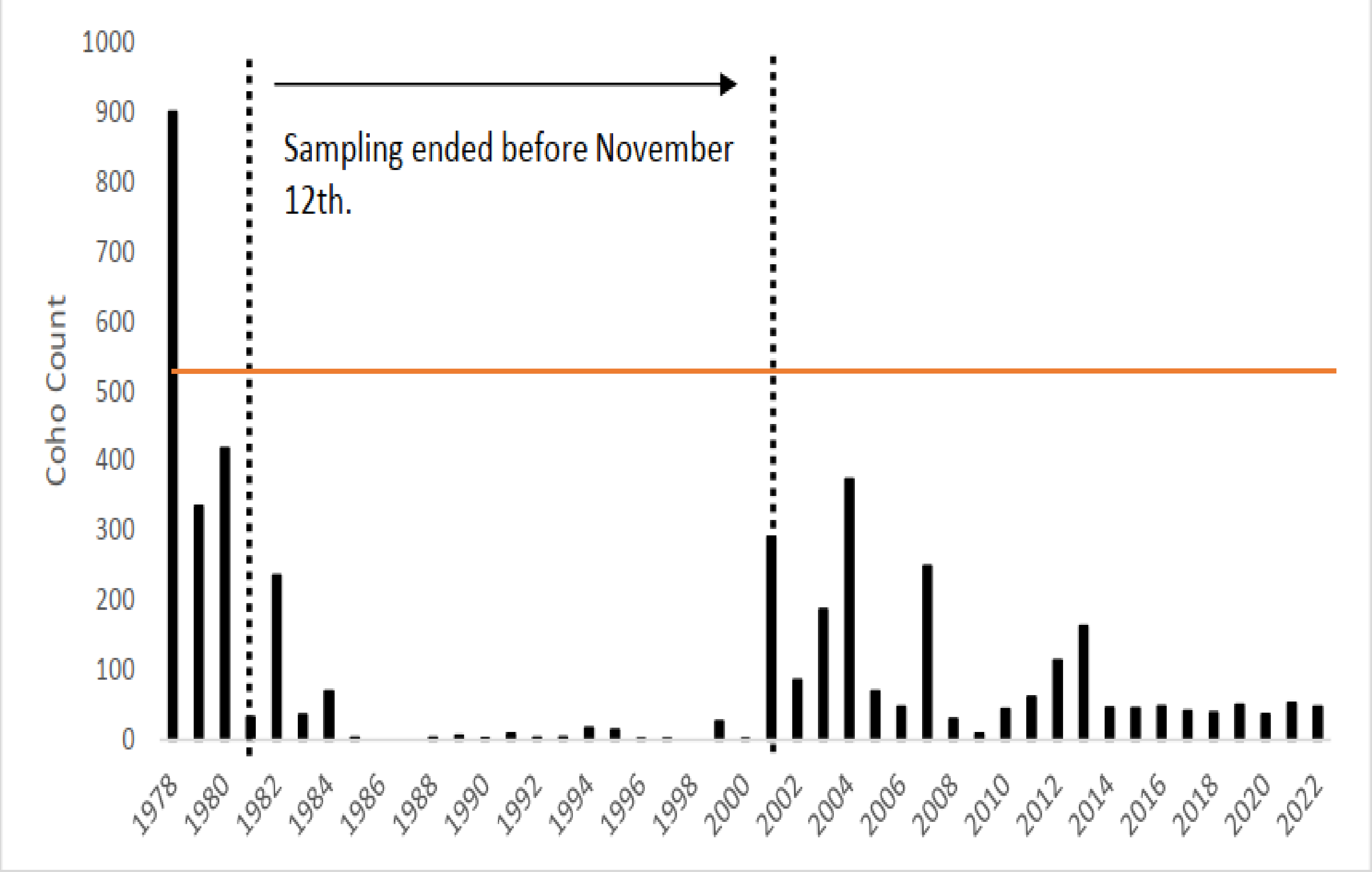
Shasta River Adult Chinook Salmon Population Estimates

- 45 Year Average: 6,591 fish
- 2020 and 2021 2,000+ fish below average
- Shasta Population Contribution to Klamath Basin
  - Historically12%
  - Current 21%
- 1931 Shasta Chinook Population Estimate: 81,844 adults



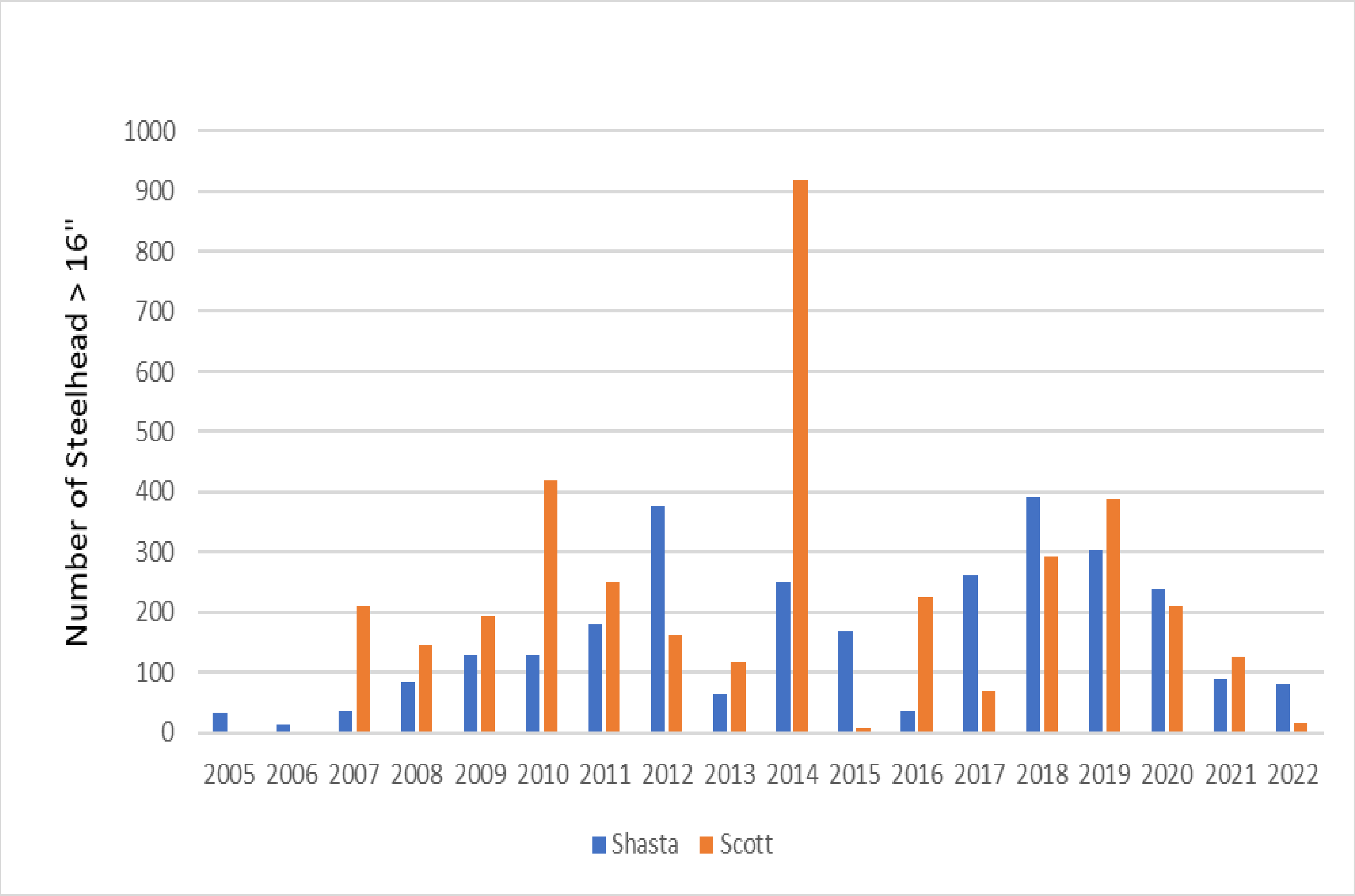
Shasta River Adult Coho Salmon Minimum Escapement

- Adult Coho Salmon Po pulation minimum
  - Video counting weir pulled at high flow
- Average of 43 adults returning since 2014
- NMFS Shasta River Coho Recovery Target:4,700 adults



Scott & Shasta River Steelhead Passage Information

- Video Weir Monitoring Dataset
    - Scott 2007
    - Shasta 2005
- Minimum number of returning adults only
    - High flows prevent continued monitoring
- 1965 Scott Population Estimate: ~5,000 adults
- 1933 Shasta River Population estimate: 8,400 adults



Summary Shasta and Scott Fish Population Update

Scott River

- Access to valley spawning and rearing habitat
- Fragmented baseflow habitat – surface flow connectivity

Shasta River

- Access to valley spawning and rearing habitat
- Fragmented baseflow habitat – water quality

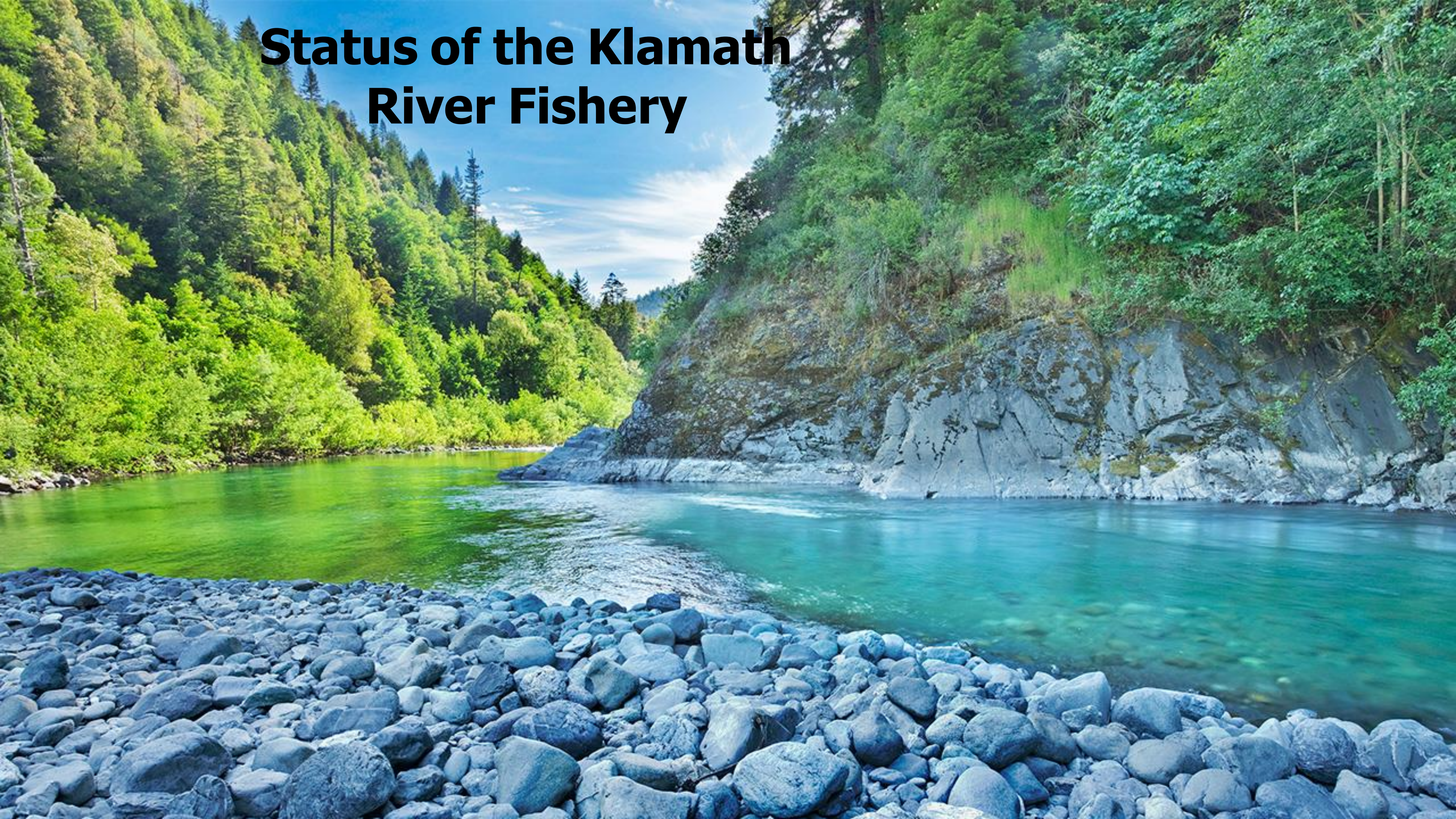
Karuk Tribe Fishery Presentation (15 minutes)

- What is the state of Klamath/Pacific fisheries, and how has that status affected your tribe? Please provide any information on recent trends, life history, or other items you think are relevant

Yurok Tribe Fishery Presentation (15 minutes)

- What is the state of Klamath/Pacific fisheries, and how has that status affected your tribe? Please provide any information on recent trends, life history, or other items you think are relevant

Status of the Klamath River Fishery



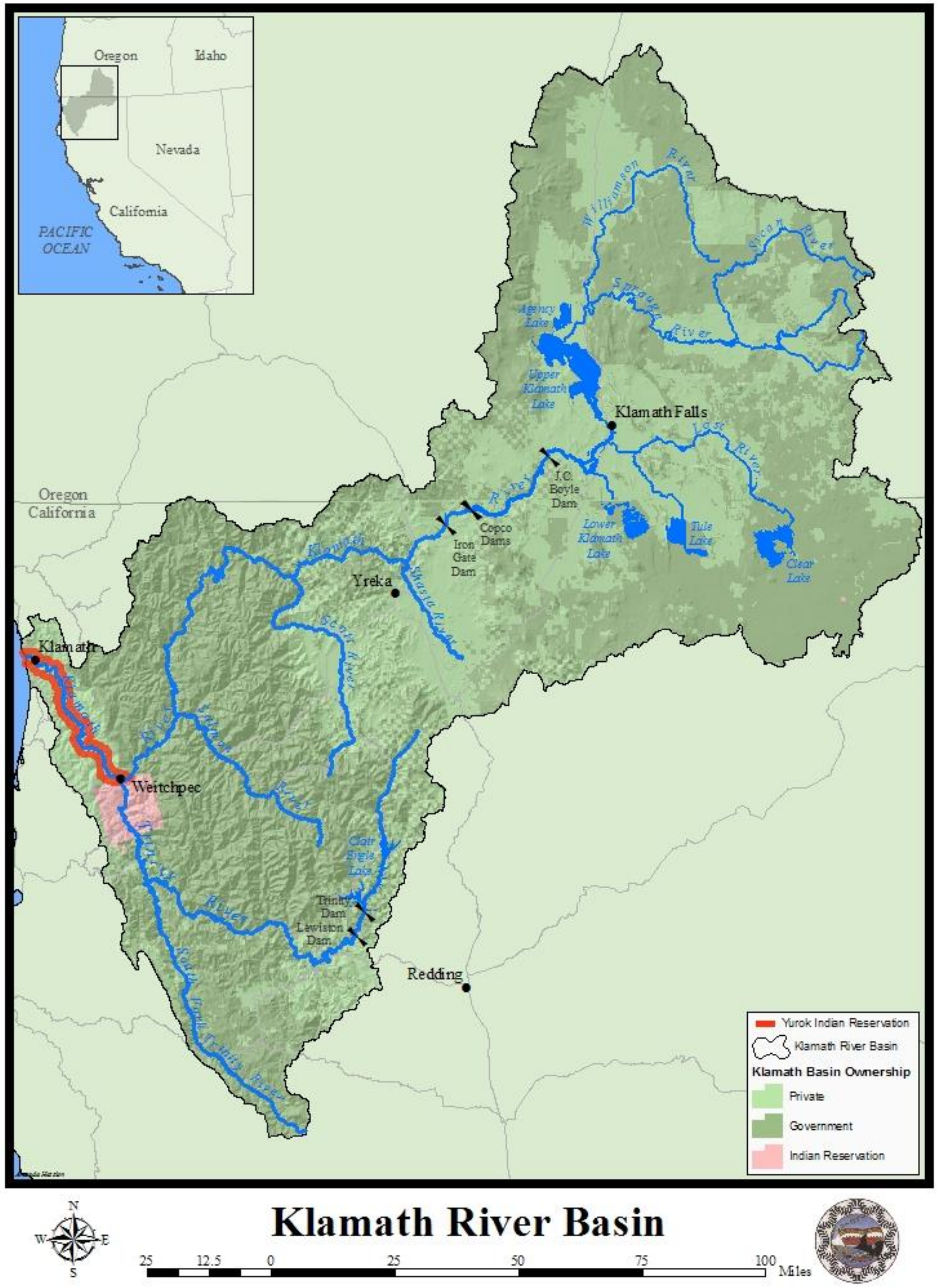
Yurok People Depend upon Fall and Spring Chinook Salmon, Coho Salmon, Steelhead, Lamprey, and Sturgeon for Ceremonial, Subsistence, and Commercial Purposes






Yurok are Stewards of the River

- All anadromous fish migrate through the Yurok Reservation as adults as they enter the river and as juveniles as they leave the river for the ocean.
- The Tribe manages the river for future generations of Yurok People.



Yurok People Sacrificed Much to Gain Recognition of our Fishing Rights

I conclude that when the United States set aside what are today the Hoopa Valley and Yurok Reservations, it reserved for the Indians of the reservations a federally protected right to the fishery resource sufficient to support a moderate standard of living. I also conclude, however, that the entitlement of the Yurok and Hoopa Valley Tribes is limited to the moderate living standard or 50% of the harvest of Klamath-Trinity basin salmon, whichever is less. Given the current depressed condition of the Klamath River basin fishery, and absent any agreement among the parties to the contrary, the Tribes are entitled to 50% of the harvest.

= Solicitor's Opinion Conclusion Clarifying Fishing Rights

- A fishing right becomes meaningless if there are no fish to harvest.
  - Associated with the fishing right comes the right to adequate habitat and associated flow to sustain our fishery.

Historical declines

Table 1-4. Declines in Klamath River Anadromous Fishes (adapted from USDI 2013).

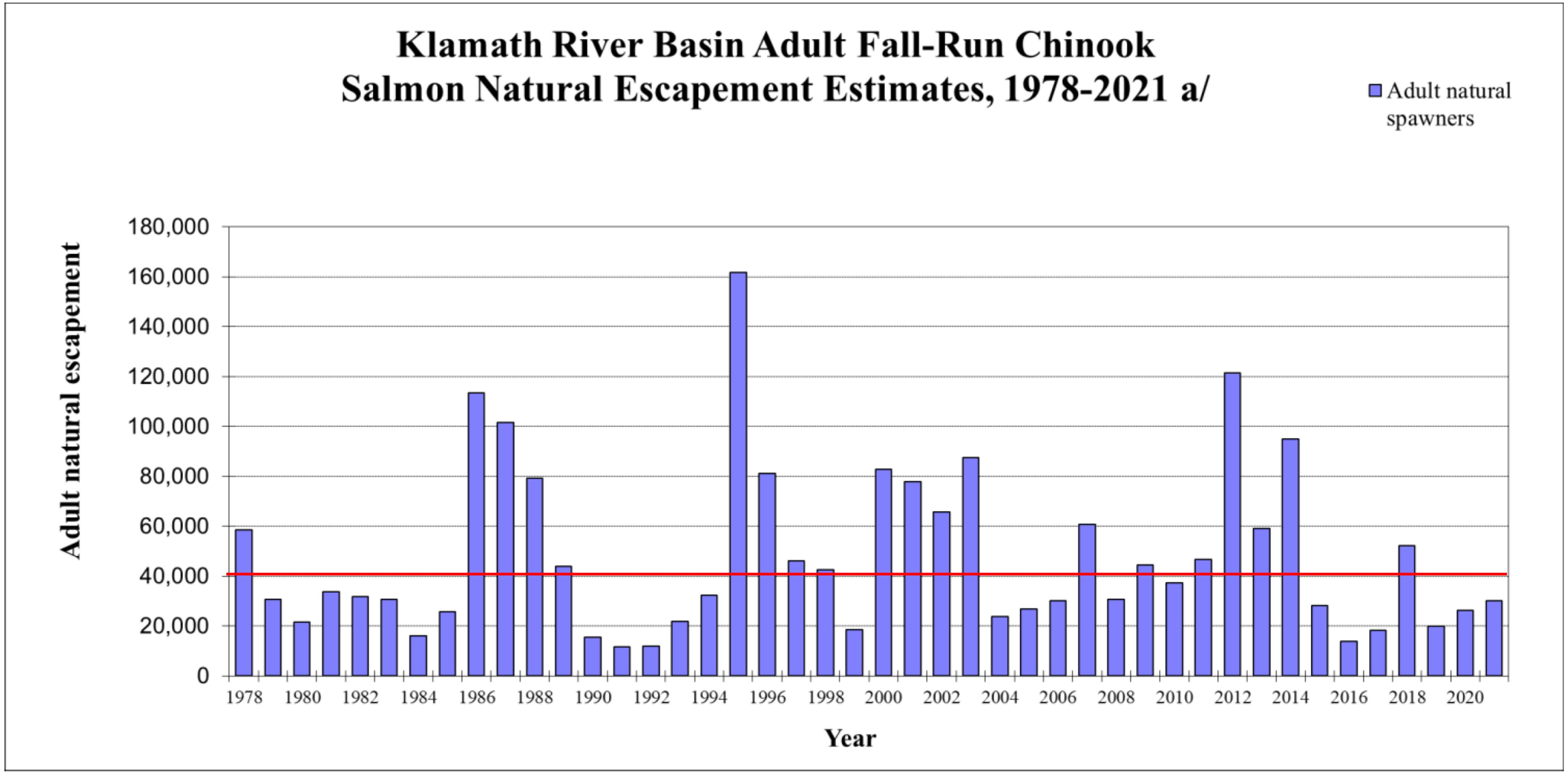
Species	Historical Level	Percent reduction from historical levels (estimates of individual runs)	Source
Pacific Lamprey	Unknown	98% (Represents reduction in tribal catch per effort)	Petersen Lewis (2009)
Steelhead Trout	400,000[1]	67% (130,000)	Leidy and Leidy (1984); Busby et al. (1994)
Coho Salmon	15,400 - 20,000	52% to 95% (760 - 9,550)	Moyle et al (1995); Ackerman et al. (2006)
Fall-run Chinook Salmon	500,000[2]	92% to 96% (20,000 - 40,000)[3]	Moyle (2002)
Spring-run Chinook Salmon	100,000[2]	98% (2,000)[2]	Moyle (2002)

[1] This estimate is from 1960. Anadromous fish numbers were already in decline in the early 1900s (Snyder 1931).

[2] Includes Klamath River and Trinity River Chinook.

[3]Excludes hatchery-influenced escapement.

Fall Chinook Run Size has been in Decline since 2014

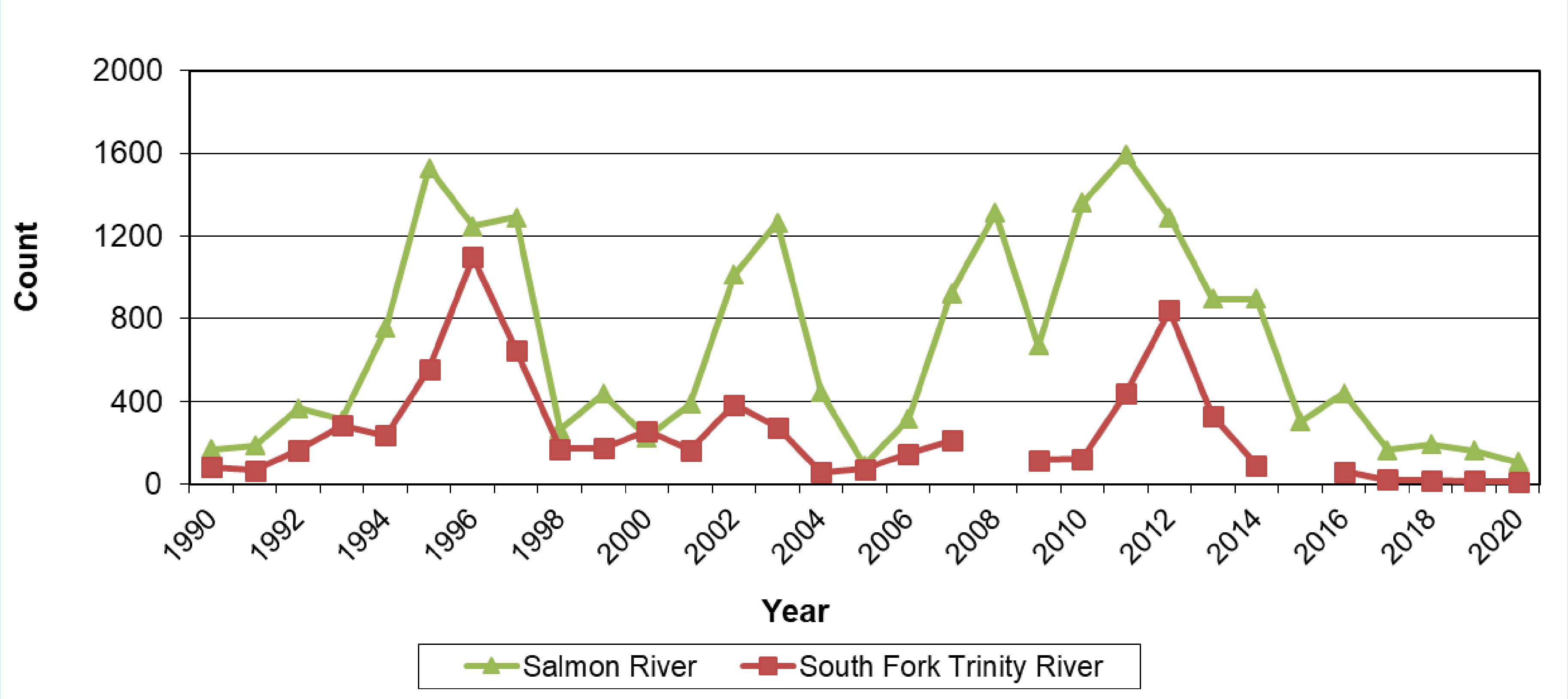


a/ 2021 data are preliminary

- Average escapement during past six years (2015 – 2021) has been 32% of the average relative to the prior six years and 43% of the average relative to the period of record prior to 2015.
- Natural adult spawning escapement has been below Maximum Sustained Yield (MSY - 40,700) during 6 of the past 7 years.
  - Have been considered "overfished" by the Pacific Fisheries Management Council since 2018.

Remnant Populations of Wild Spring Chinook Salmon are in Severe Decline, Nearing Extirpation in the South Fork Trinity River

Snorkel Survey Counts of Spring Chinook (Adults and Grilse) in the Salmon River and South Fork Trinity River, 1990 – 2020.



Klamath River Spring Chinook runs so poor, the State of California protected them under the State ESA in 2021

TMS Spring chinook salmon now protected under state...

NEWS > AGRICULTURE

Spring chinook salmon now protected under state Endangered Species Act

Yurok has not had a Viable Commercial Fishery since 2015

- Attempted to have one in 2019, but was complete failure – the fish didn't arrive.
  - Run size was 32% of what was forecast, and fish were extremely small.
    - Age-4 component (driver of the net fishery) was only 16% of what was projected.
- Completely closed the fall fishery in 2017 for the first time ever to let the minimal allocation escape to the spawning grounds (we had a very small Elders fishery)

The state of the Yurok fall fishery in 2023

The Yurok Tribal Council is concerned that the abundance of Klamath River fall Chinook salmon are in significant decline, as evidenced by the extremely low returns during recent years.

Since 2015, the minimum number (40,700) of adult natural origin Chinook salmon spawners, the amount needed to maximize sustained yield, <u>did not return in seven of the eight fall seasons</u>.

The PFMC predicts only <u>23,614</u> adult natural origin salmon will return in 2023, <u>the second-lowest estimate since 1997</u>.

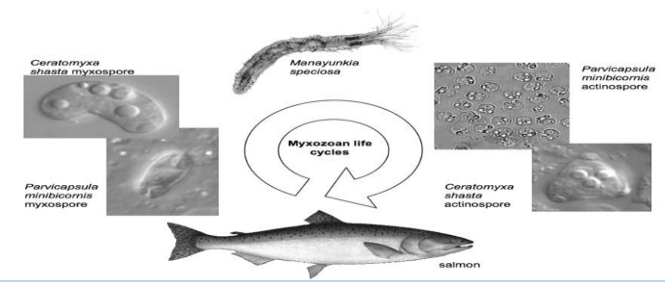
The Klamath River Basin fall fishery has been managed as a de minimis fishery for many years.

Therefore, the Yurok Tribal Council has adopted the following regulations as conservation measures:

> The Yurok Tribe will harvest zero fall-run Chinook salmon on the Yurok Reservation in 2023.

Primary Factors Contributing to the Recent Decline of the Fishery Resource

High Juvenile Disease Rates



Dams

Lack of Peak Flows

Poor Habitat, primarily due to agriculture diversions in mainstem river and tributaries such as the Scott and Shasta Rivers and compounded by lack of access to habitats blocked by dams.

Poor Ocean Conditions

CONSTRUCTION ACTIVITIES AT COPCO 1 DAM APRIL 2023. PREPARATION FOR DEMOLITION. PHOTO CREDIT: SHANE ANDERSON

Good News!

Significant genetic structure preserved throughout the Basin

Limited homogenization as opposed to Central Valley Chinook

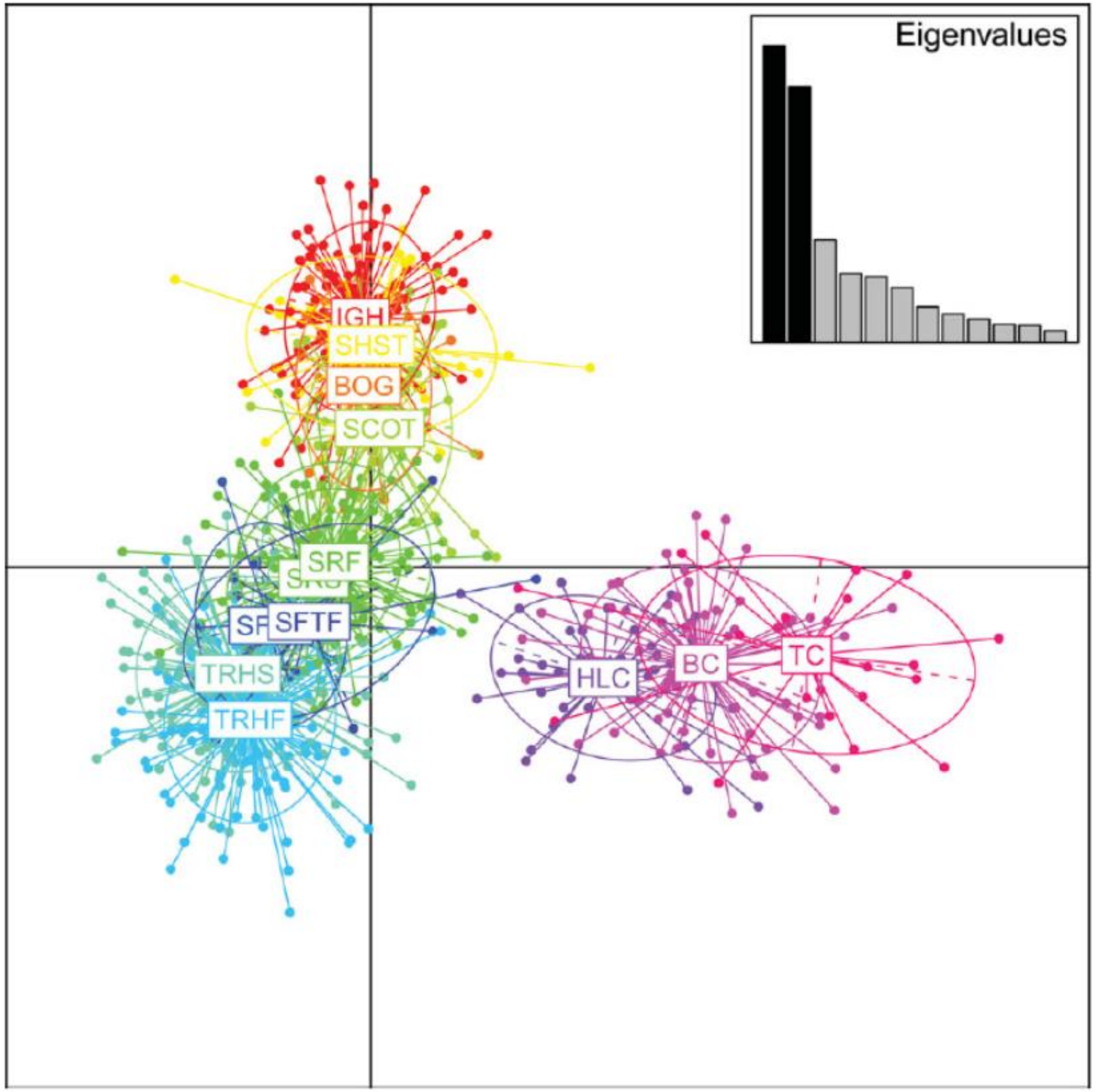


FIGURE 4. Scatterplot of the first two principal components of DAPC using population locations as prior clusters. Populations are labeled inside their 95% inertia ellipsis and dots represent individuals. The inset indicates the eigenvalues of the first 12 principal components. Population SFTF superimposes SFTS and SRF superimposes SRS. Population abbreviations are defined in Table 1. [Figure available online in color.]




Quartz Valley Tribe Fishery Presentation (15 minutes)

- What is the state of Klamath/Pacific fisheries, and how has that status affected your tribe? Please provide any information on recent trends, life history, or other items you think are relevant

Quartz Valley Indian Reservation

Sarah Schaefer
Environmental Director

The Klamath River tribes are dependent upon fish for physical and cultural survival. Many indigenous people believe that when the fish are gone, it is the end of the world. We are already seeing negative effects of declining fisheries in declining mental and physical health. Some Klamath River communities have issued a state of emergency due to high suicide rates.

- **Lack of access to traditional food**
- **Loss of spring run salmon directly related to health related epidemics**
- **Poverty and hunger among highest in nation**
- **Heart disease rates 3 times the USA average**

Historic consumption of salmon for Karuk people was ~450 lb per person annually

Today <5 lbs of salmon are consumed by Karuk people annually

The loss of spring run Salmon populations in the 1970's caused the most dramatic diet shift of any Native American tribe in the USA and is directly linked to catastrophic increases in diabetes rates which are 4 times the USA average

In recent decades Shackleford Creek becomes de-watered annually
From the effects of surface diversions killing thousands of ESA protected fish

Many beneficial uses have been impacted from lack of water including cultural practices such as basket-making

Another negative effect from dramatic decreases in salmon is the lack of thousands of carcasses annually spread throughout the watershed.

These carcasses bring nutrients from the ocean to the forest that provide food and fertilizer to the inland areas.

Coho Salmon Were Once Significant Members of California's Coastal Stream And Ocean Ecosystems Where Numbers Exceeded Hundreds of Thousands only 50 Years Ago

There has been a 70% decline in Coho from the 1960's to 1994

Today only hundreds survive

Without urgent management actions scientists predict this species will be extinct from California within this century

The Problem With LCS's

- Not standardized or verifiable
- Temperature must be considered
- along with flows
- Flows should be considered throughout the watershed- not just at the gage site
- No accountability (self policing is ineffective)
- No standard of measurement

Tribal trust responsibilities for the indigenous peoples of the Klamath River watershed have been largely ignored and caused severe negative impacts to human health and the environment

In conclusion, the Quartz Valley Indian Community supports recovery flow standards which was the goal set by congress when adopting the ESA

Where does the State Waterboard draw the line in saving endangered species and the people whose culture relies on them?

Thank You For the Opportunity to present On behalf of the Quartz Valley Indian Reservation

Emergency Flows for Scott River and Shasta River

Panelists

- California Department of Fish and Wildlife Staff (25 minutes)
- Sari Sommarstrom (15 minutes)
- Gary Black, Shasta Producers (15 minutes)

LUNCH

- Elias Scott, North Coast Regional Water Quality Control Board (20 minutes)
- Dr. Thomas Harter and Leland Scantlebury, Scott Valley Integrated Hydrologic Model (10 minutes) and Bronwen Stanford, The Nature Conservancy (10 minutes)

Questions from Staff

Comments

CDFW Emergency Flows Presentation (25 minutes, Scott & Shasta)

- Please provide support and background for the drought emergency minimum flows, with a focus on the summer flow of 50 cubic feet per second (cfs) in the Shasta River and the summer and early fall flow requirements on the Scott River.

- What other factors should the Board be considering with respect to emergency flows (e.g., provide recommended ramp down flows at end of regulation, etc.)?

CDFW Emergency Flows Presentation (25 minutes, Scott & Shasta)

- The flow requirements in the Scott River watershed were not met in the summer and fall of 2022, even though curtailments were in place. The Board has received conflicting input regarding these flow targets, one set of input stating that the flow targets are too high and cannot be met in certain water years, another set of input stating that noncompliance with curtailments and additional curtailment of groundwater would have resulted in higher flows, and another set focused on the improvements in the system even when the target flows themselves are not reached. What factors or information should the Board be considering relative to the fact that the flows were not met?

SHASTA SCOTT EMERGENCY DROUGHT INSTREAM FLOWS RECOMMENDATIONS

PRESENTED BY:

Michael Harris, California Department of Fish and Wildlife

Scott and Shasta River Instream Flows

Presented by: Michael Harris, Klamath Watershed Program CDFW

Goals of Emergency Drought Flows

Avoiding the extinction vortex

- Maintaining genetic diversity/viability
- Minimizing population level impacts from catastrophic events such as disease outbreaks, severe drought, poor ocean conditions, etc.
- Maintain life history diversity (accommodating late and early spawners, etc.)

Maintaining sufficient stocks

- **Provide sport, commercial and tribal fishery opportunity**
- **Increase marine derived nutrients to benefit entire ecosystem**

Every cfs matters

- Access to habitat
- Mitigates temperature impacts
- Provide habitat for riparian and in- stream flora and fauna including aquatic invertebrates (salmonid food)

USGS Scott and Shasta Reference Gages

- Gages: USGS Scott River near Fort Jones and Shasta at Yreka

https://waterdata.usgs.gov/monitoring-location/11519500/#parameterCode=00060&period=P7D&showMedian=true

https://waterdata.usgs.gov/monitoring-location/11517500/#parameterCode=00060&period=P7D&showMedian=true

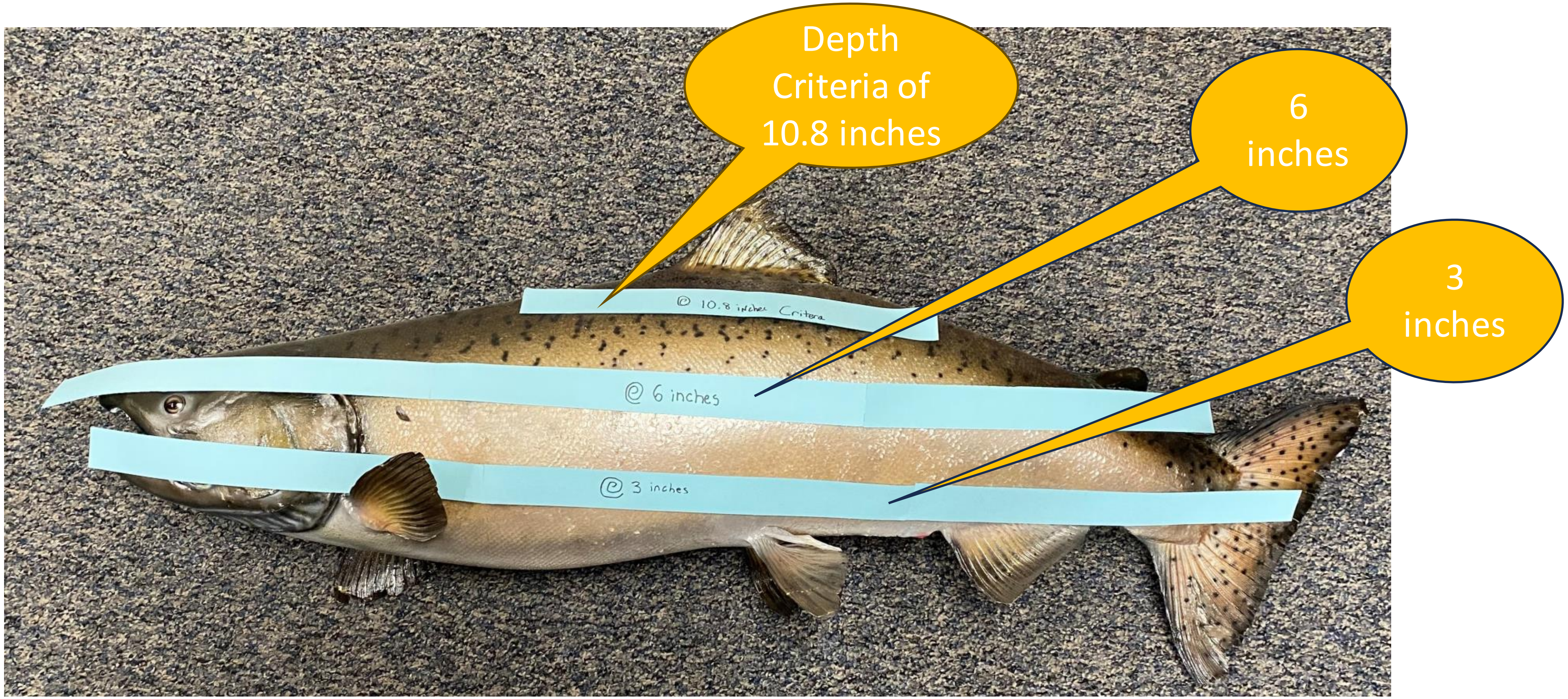
- US Forest Service Water Rights for Fisheries
  - Minimum Subsistence-Level Fishery: spawning, egg incubation, migration, summer survival
  - High Flows For Fisheries
- Enforceable Recommendations
  - High quality, real-time data
  - Publicly available
- Lack of Gaging Stations

Instream Flow Components

- Adult Migration
- Spawning & Redd Protection
- Juvenile Rearing

Photo credit: NOAA

Adult Migration: Passage Flows



CDFW and NOAA Adult Depth Criteria

0.9 feet (10.8") for Chinook Salmon

0.7 feet (8.4") for Coho Salmon and Steelhead

Adult Migration: Passage Flows (cont.)

Depth needed for:

- Volitional passage
- Thermal protection
- Protection from predators
- Reduced energy expended
  - ➢ Energy needed to build the redd after migration
- Reduced injury potential
  - ➢ Particularly important for Steelhead who can survive after spawning and out-migrate to the ocean again

Known Flow Passage Barriers:

- Scott River: four on mainstem, multiple on tributaries

Adult Migration: Passage Flows (cont.)

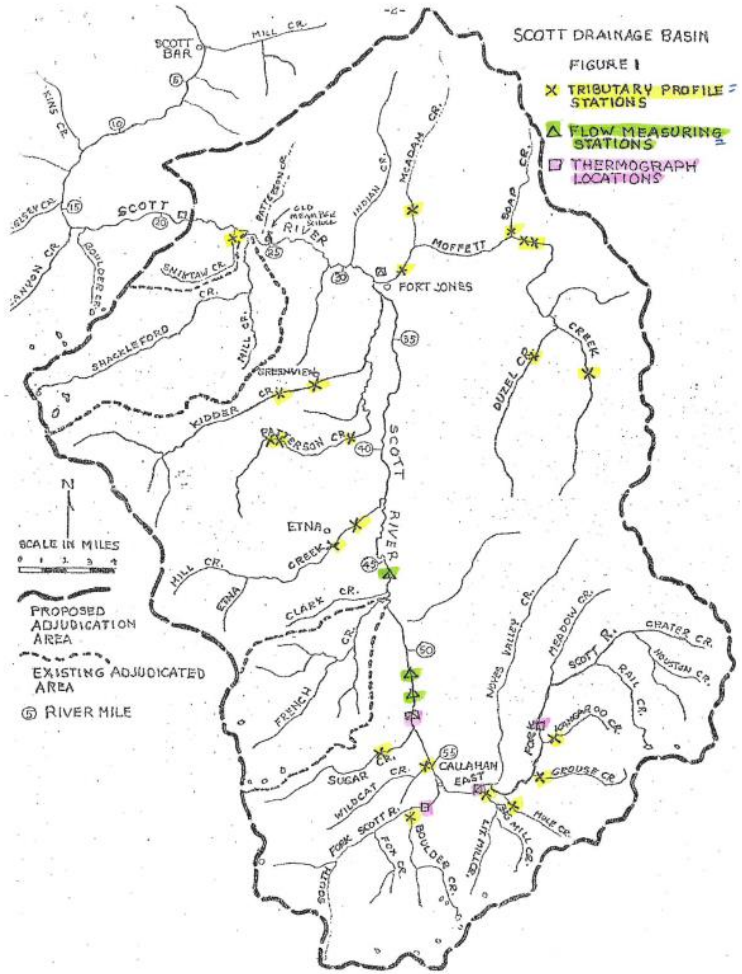
Scott River

Scott River Instream Flow Recommendations

Where did Scott River Emergency Flow Recommendations come from?

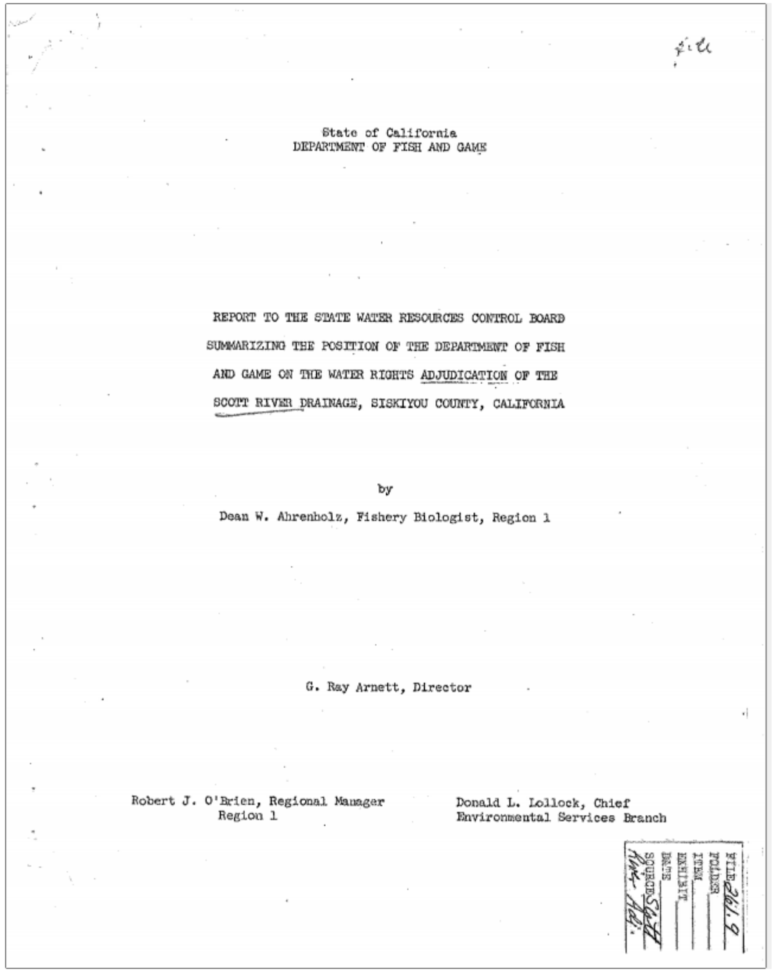
- Review of Scott River adjudication and Klamath National Forest Right,
- CDFG 1974 – Stream flow needs for Anadromous Salmonids in the Scott River,
- Division of Water Rights 1975 – Hydrogeologic Conditions in the Scott Valley,
- Correspondence between CDFG and SWRCB in the 1970's leading up to the 1980 Decree,
- Scott River Adult Coho Spawning Ground Surveys,
- Yurok 2015_Evaluation of Anadromous Fish Flow Needs,
- 2020 field notes comparing fall flows to adult migration,
- 2020 CDFW juvenile outmigration and annual reports,
- Attachment 1 of our May 3 correspondence to the SWRCB (2017 Flow Study),
- Attachment 2 of our May 3 correspondence to SWRCB (Internal memo), and
- In consultation with CDFW and NOAA subject matter experts.

1974 CDFG Report to the SWB Summarizing Scott River Flow Needs



CDFG Scott River minimum flow recommendations in the mainstem and key tributaries:

- 22 Cross Sections
- 4 temp locations
- 4 gage sites



State of California
DEPARTMENT OF FISH AND GAME

REPORT TO THE STATE WATER RESOURCES CONTROL BOARD SUMMARIZING THE POSITION OF THE DEPARTMENT OF FISH AND GAME ON THE WATER RIGHTS ADJUDICATION OF THE SCOTT RIVER DRAINAGE, SISKIYOU COUNTY, CALIFORNIA

by

Dean W. Ahrenholz, Fishery Biologist, Region 1

G. Ray Arnett, Director

Robert J. O'Brien, Regional Manager
Region 1

Donald L. Lollock, Chief
Environmental Services Branch

FILE
FOLDER
ITEM
EXHIBIT
DATE
SOURCE

Table 4. Scott River tributary rearing and spawning flow needs for anadromous salmonids

Stream	Location	Stream Mile	CFS Summer Rearing	CFS Spawning SH	CFS Spawning SS	Approximate Drainage Area (Sq. Mi.)
Moffett Cr.	Near Fort Jones	0.5	8.2	45	(a)	125.0
Moffett Cr.	Hwy. 3 bridge	7.3	7.4	(a)	(a)	70.0
Moffett Cr.	Sissel Gl.	18.6	2.4	7.7	(a)	17.3
McAdam Cr.	Near mouth	0.0	12.0	34.0	(a)	28.2
Soap Cr.	Near mouth	0.0	1.7	7.0	(a)	8.8
Duzel Cr.	Near mouth	0.0	2.2	5.5	(a)	18.0
Boulder Cr.	Near mouth	0.0	8.5	26.0	(a)	12.6
Etna Cr.	Etna City diversion	7.3	23.0	110.0	65	20.25
Etna Cr.	Hwy. 3 bridge	2.6	23.0	90.0	51	25.1
Grouse Cr.	Near mouth	0.0	7.2	23.0	(a)	11.0
Kangaroo Cr.	Near mouth	0.0	4.4	16.0	(a)	6.5
Kidder Cr.	Hwy. 3 bridge	5.0	25.0	80.0	55	31.2
Mill Big Cr.	Near mouth	0.0	5.5	17.0	(a)	9.2
Mule Cr.	Near mouth	0.0	2.5	12.0	(a)	3.9
Patterson Cr.	Hwy. 3 bridge	6.3	10.0	30.0	20.0	14.4
Sniktaw Cr.	One mile from mouth	1.0	4.5	9.2	(a)	-
Sugar Cr.	Hwy. 3 bridge	0.6	10.0	32.0	(a)	13.2
Wildcat Cr.	Hwy. 3 bridge	0.01	5.0	23.0	(a)	8.2

(a) No spawning determinations made.

SH: Steelhead
SS: Silver salmon

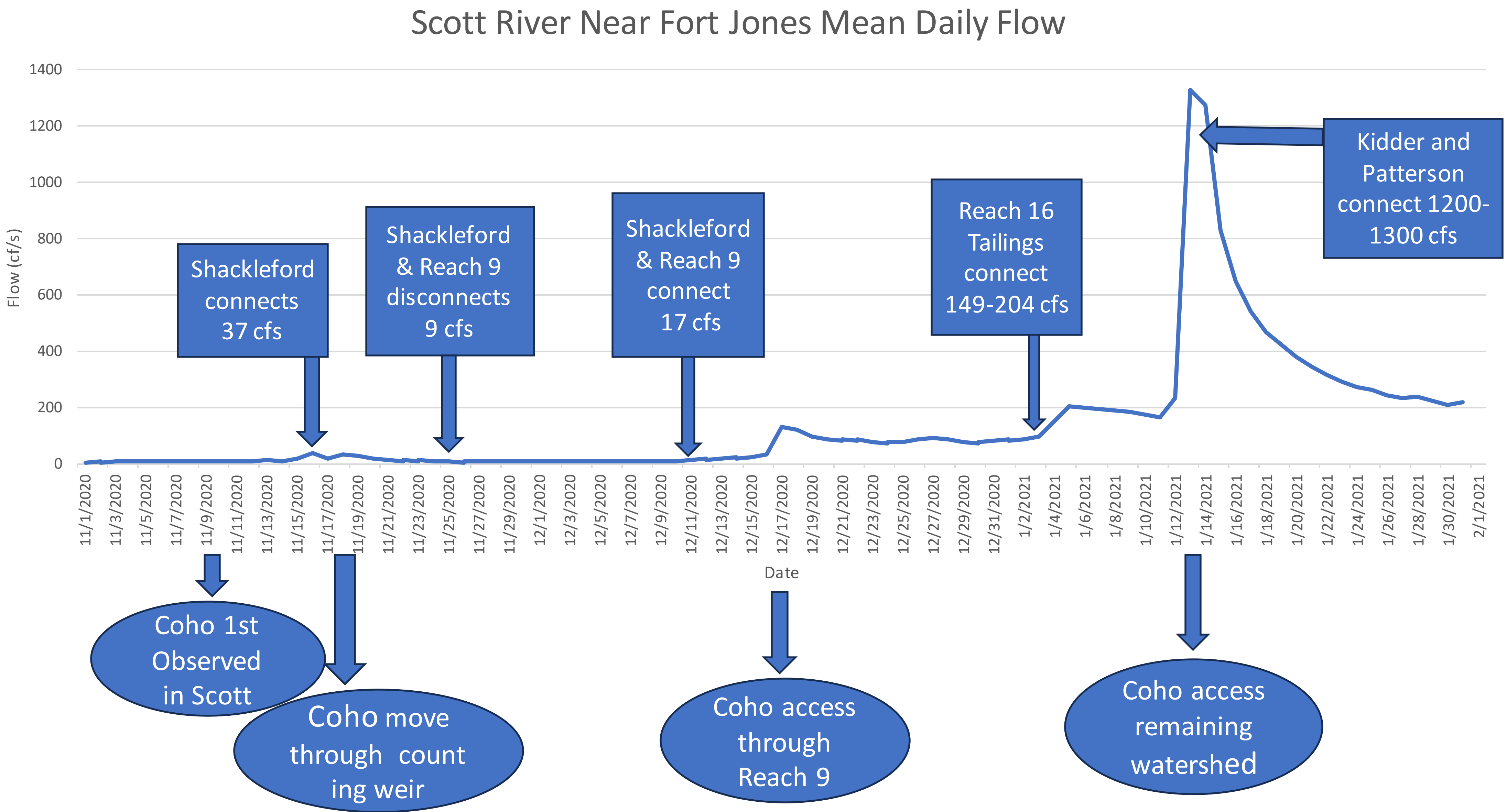
Table 6. Minimum Streamflow Recommendations by the Month for the Scott River Basin Streams

Stream	Location	River or Stream Mile	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Moffett Cr.	Near Ft. Jones	0.5	45.0	45.0	45.0	45.0	38.0	30.0	8.2	8.2	8.2	8.2	30.0	45.0
Moffett Cr. (a)	Stream gage	7.31	22.0	22.0	22.0	22.0	15.0	15.0	7.4	7.4	7.4	7.4	15.0	22.0
Moffett Cr.	Sissel Gl.	18.6	7.7	7.7	7.7	7.7	6.4	5.1	2.4	2.4	2.4	2.4	5.1	7.7
McAdam Cr.	Near mouth	0.0	34.0	34.0	34.0	34.0	28.0	23.0	12.0	12.0	12.0	12.0	23.0	34.0
Soap Cr.	Near mouth	0.0	7.0	7.0	7.0	7.0	5.9	4.7	1.7	1.7	1.7	1.7	4.7	7.0
Duzel Cr.	Near mouth	0.0	5.5	5.5	5.5	5.5	4.6	3.7	2.2	2.2	2.2	2.2	3.7	5.5
Boulder Cr.	Near mouth	0.0	26.0	26.0	26.0	26.0	22.0	17.0	8.5	8.5	8.5	8.5	17.0	26.0
Etna Cr.	City diversion	7.3	110.0	110.0	110.0	110.0	92.0	73.0	23.0	23.0	23.0	23.0	43.0	65.0
Etna Cr.	Hwy. 3 bridge	2.6	90.0	90.0	90.0	90.0	75.0	60.0	23.0	23.0	23.0	23.0	34.0	51.0
Grouse Cr.	Near mouth	0.0	23.0	23.0	23.0	23.0	19.0	15.0	7.2	7.2	7.2	7.2	15.0	23.0
Kidder Cr.	Hwy. 3 bridge	5.0	80.0	80.0	80.0	80.0	67.0	53.0	25.0	25.0	25.0	25.0	37.0	55.0
Mill, Big Cr.	Near mouth	0.0	17.0	17.0	17.0	17.0	14.0	11.0	5.5	5.5	5.5	5.5	11.0	17.0
Mule Cr.	Near mouth	0.0	12.0	12.0	12.0	12.0	10.0	8.0	2.5	2.5	2.5	2.5	8.0	12.0
Kangaroo Cr.	Near mouth	0.0	16.0	16.0	16.0	16.0	13.0	11.0	4.4	4.4	4.4	4.4	11.0	16.0
Patterson Cr.	Hwy. 3 bridge	6.3	30.0	30.0	30.0	30.0	25.0	20.0	10.0	10.0	10.0	10.0	13.0	20.0
Sniktaw Cr.	1 mile from mouth	1.0	9.0	9.0	9.0	9.0	7.7	6.1	4.5	4.5	4.5	4.5	6.1	9.2
Sugar Cr.	Hwy. 3 bridge	0.6	32.0	32.0	32.0	32.0	27.0	21.0	10.0	10.0	10.0	10.0	21.3	32.0
Wildcat Cr.	Hwy. 3 bridge	0.01	23.0	23.0	23.0	23.0	19.0	15.0	5.0	5.0	5.0	5.0	15.3	23.0
E.F. Scott R.	Callahan	0.0	95.0	95.0	95.0	95.0	95.0	63.0	32.0	32.0	32.0	63.0	95.0	95.0
S.F. Scott R.	Callahan	0.0	93.0	93.0	93.0	93.0	93.0	62.0	31.0	31.0	31.0	62.0	93.0	93.0
Scott R.	Farmer's diversion	53.4	155.0	155.0	155.0	155.0	155.0	103.0	62.0	62.0	62.0	103.0	155.0	155.0
Scott R.	Stream gage station	21.0	426.0	426.0	426.0	426.0	426.0	284.0	192.0	192.0	192.0	284.0	426.0	426.0

(a) No spawning recommendations used.

1974 Minimum Flow Recommendations

2020 Coho Salmon "Belly-Scraping" Passage Scenario



September Flow Recommendation – Scott River

- USGS Fort Jones Gage
- Mean September flow (cfs)
- 5 water year types
- Two time periods: 1942-1979 & 1980-2020

	1942-1979 Period	1980-2020 Period
Water Year Type	Mean September flow cfs	Mean September flow cfs
Extremely Wet	81.8	76.9
Wet	77.2	46.5
Normal	55.9	22.4
Dry	44.4	14.9
Critically Dry	33.1	9.7

Scott River Emergency Flow Modifications

SCOTT RIVER	KNF Water Right - Table 1	Proposed Regulation Flows 2021	Reasoning for Deviations	Proposed Regulation Flows 2022	Reasoning for Modifications
January	200	200		200	
February	200	200		200	
March	200	200		200	
April	150	150		150	
May	150	150		150	
June 1-15	150	125	Unaware of a fisheries justification to split June, averaged KNF Water Right	125	
June 16-30	100	125		125	
June 24-30	100	125		90	ramp down to avoid fish stranding
July 1-15	60	50	Unaware of a fisheries justification to split July, averaged KNF Water Right	50	
July 15-31	40	50		50	
August	30	30		30	
September	30	33	Average September "critically dry" flow 1942-1979	33	
October	40	40		40	
November	200	60	2020 coho tributary passage flow	60	
December	200	150	2020 coho tailings passage flow	150	

Emergency Drought Flow Effects In Scott River

- Benefits for Scott River:
  - Improved west side tributary habitat for Coho Salmon juveniles
  - Improved groundwater elevation, which provides earlier surface water connection and increased cold water discharged to the river, supporting healthy riparian habitat
  - Improved surface flows and connectivity during Chinook, Coho Salmon and Steelhead migration

Shasta River

Where Did Shasta River Emergency Flow Recommendations Come From?

McBain and Trush 2014 – Shasta River Canyon Instream Flow Needs Assessment,

Deas and Null 2007 – Technical Memorandum to the North Coast Regional Water Quality Control Board modeling Year 2000 unimpaired flow and temperature results,

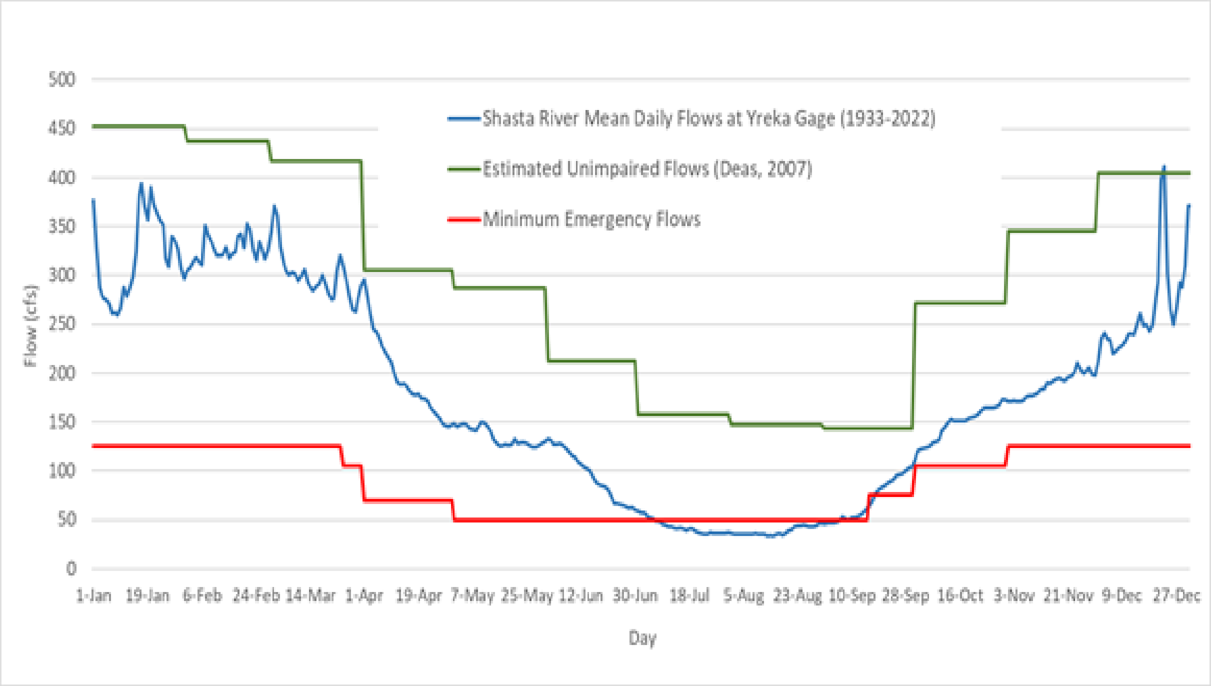
2020 CDFW Shasta River juvenile outmigration and annual reports, and

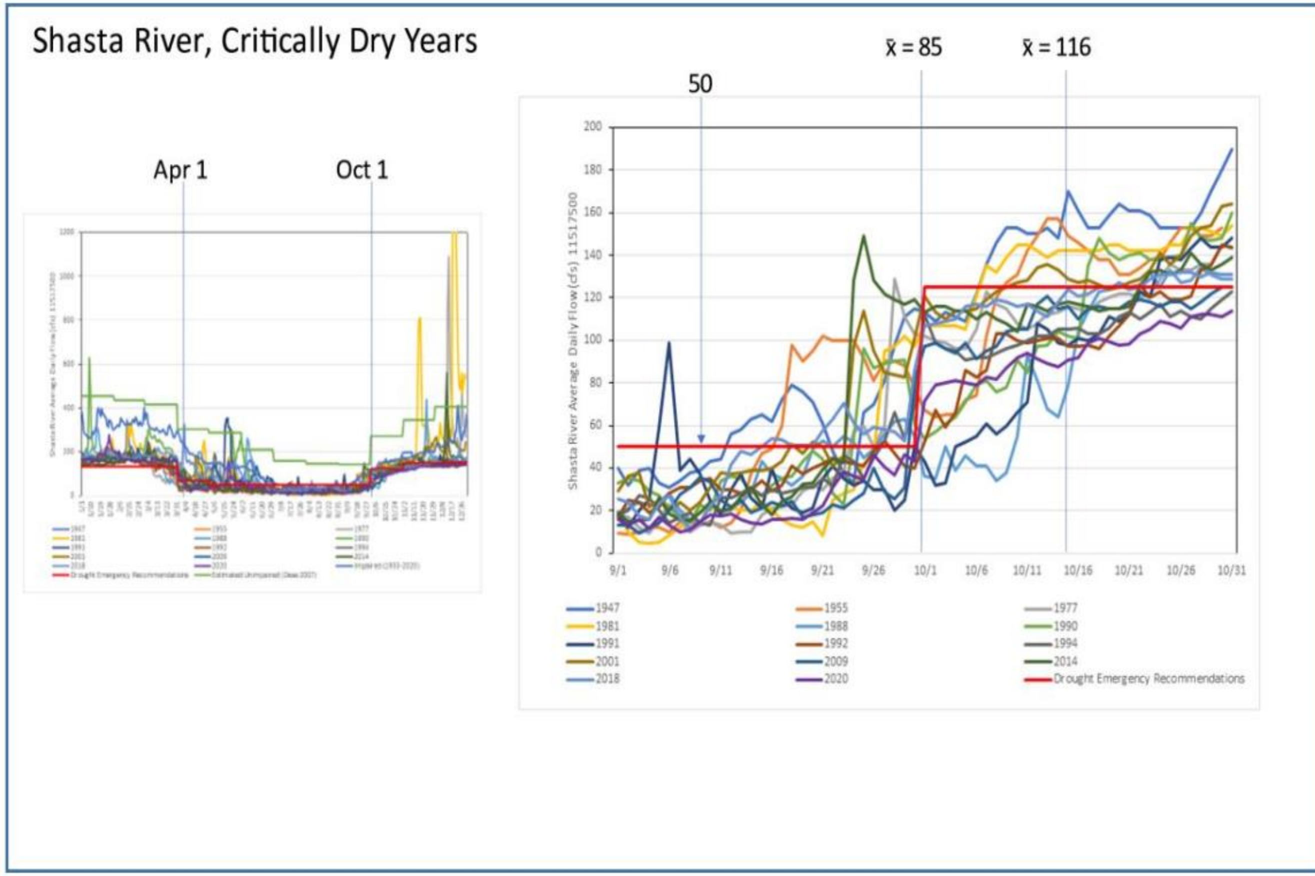
In consultation with CDFW subject matter experts.

McBain & Trush 2014. Shasta River Canyon Study

- Looked at 5 different lifestages for Chinook Salmon, Coho Salmon, and Steelhead
- Developed instream flow needs for wet/normal (0% to 60% exceedance) and dry (61% to 100% exceedance
- Used multiple analytical approaches for development of Instream Flow Needs (IFN)
  - Review of historic and present life history timing
  - Direct measurement of riffle crest thalweg depths, photo documentation photographic time series and Thompson Criteria
  - Evaluation of streamflow and maximum daily temperature
  - Regression Analysis
  - 2-D modeling
  - Wetted Perimeter

Feasibility of Recommended Shasta Flows



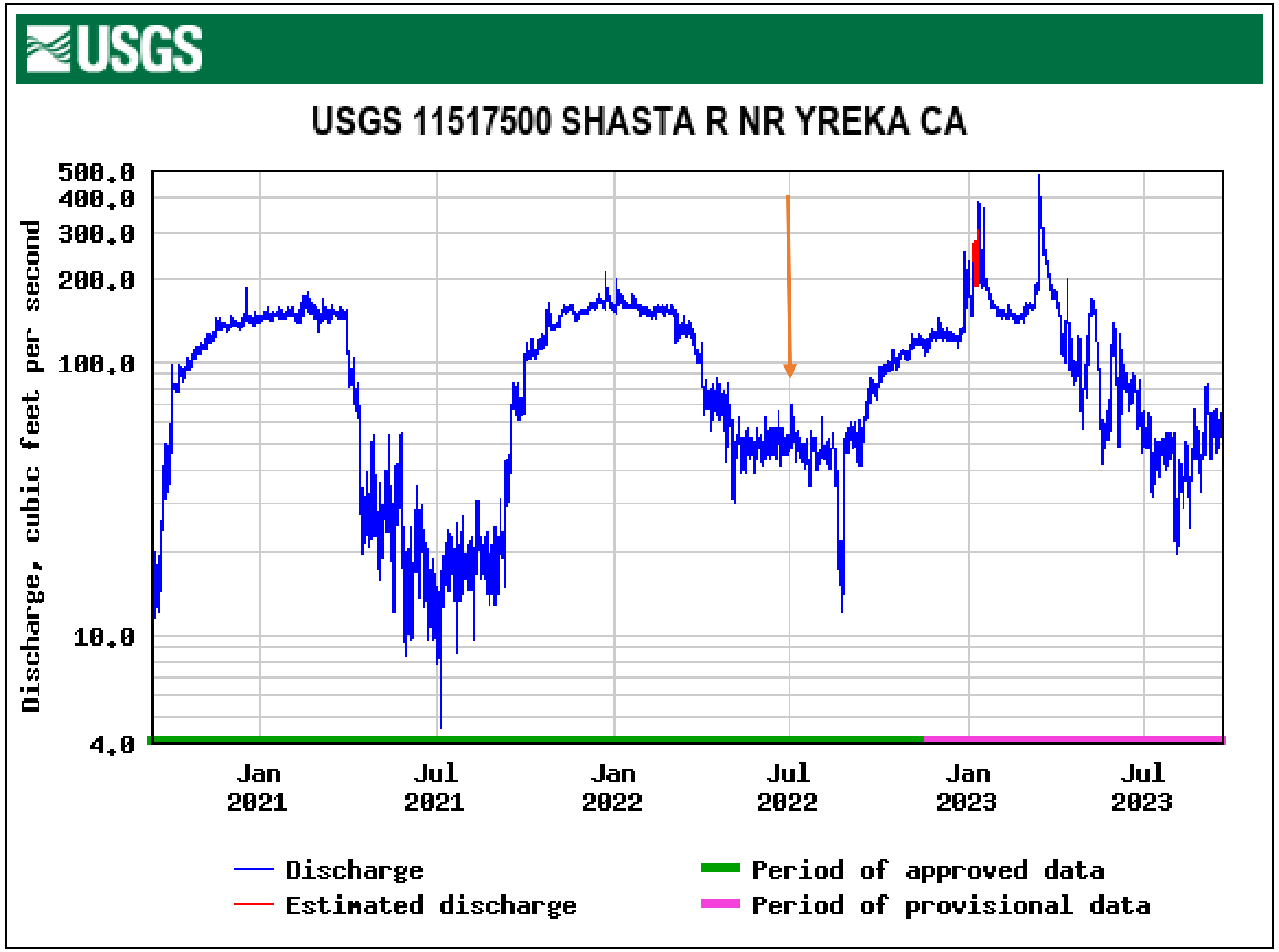


Shasta River Emergency Flow Modifications

SHASTA RIVER	McBain and Trush (2014)	Proposed Regulation Flows 2021	Modified Regulation Flows 2021	Reasoning for Deviations	Proposed Regulation Flows 2022	Reasoning for Modifications
January	135	135	125	modeled "critically dry" using M&T (2014)	125	
February	135	135	125		125	
March 1-24	135	135	125		125	
March 25 -31	135	135	135		105	ramp down to avoid fish stranding
April	70	70	70		70	
May	50	50	50		50	
June	50	50	50		50	
July	50	50	50		50	
August	50	50	50		50	
September 1-15	50	50	50		50	
Septmber 16-30	50	50	50		75	ramp up for adult migration
October	125	125	105	modeled "critically dry" using M&T (2014)	105	
November	150	150	125		125	
December	150	150	125		125	

Emergency Drought Flow Effects in the Shasta

- Benefits for Shasta River:
  - Improved habitat for salmonid juvenile's watershed wide
  - Lower water temperatures watershed wide
  - Improved surface flows during adult Chinook, Coho Salmon and Steelhead migration



Summary: Scott and Shasta River Instream Flows

- Solicited and reviewed all pertinent flow information
- Welcome new information and studies
- Recommended absolute minimum flows required for species survival
- Avoid potential future listings for other species
- Reviewing at all life stage flow needs of our three most vulnerable species to maintain stream function: Chinook, coho and steelhead
- No proposed changes to current flow recommendations

Dr. Sari Sommarstrom Emergency Flows Presentation (15 minutes, Scott Only)

- What emergency minimum flows do you propose and what scientific data and information support these flows?
- What other factors should the Board be considering with respect to emergency flows (e.g., provide recommended ramp down flows at end of regulation, etc.)?
- The flow requirements in the Scott River watershed were not met in the summer and fall of 2022, even though curtailments were in place. The Board has received conflicting input regarding these flow targets, one set of input stating that the flow targets are too high and cannot be met in certain water years, another set of input stating that noncompliance with curtailments and additional curtailment of groundwater would have resulted in higher flows, and another set focused on the improvements in the system even when the target flows themselves are not reached. What factors or information should the Board be considering relative to the fact that the flows were not met?

Scott River Flow Needs: Location, Timing & Expectations

Sari Sommarstrom, Ph.D.
Watershed Consultant (retired) &
Scott River Water Trust (retired)

EXPECTATIONS
need to be realistic

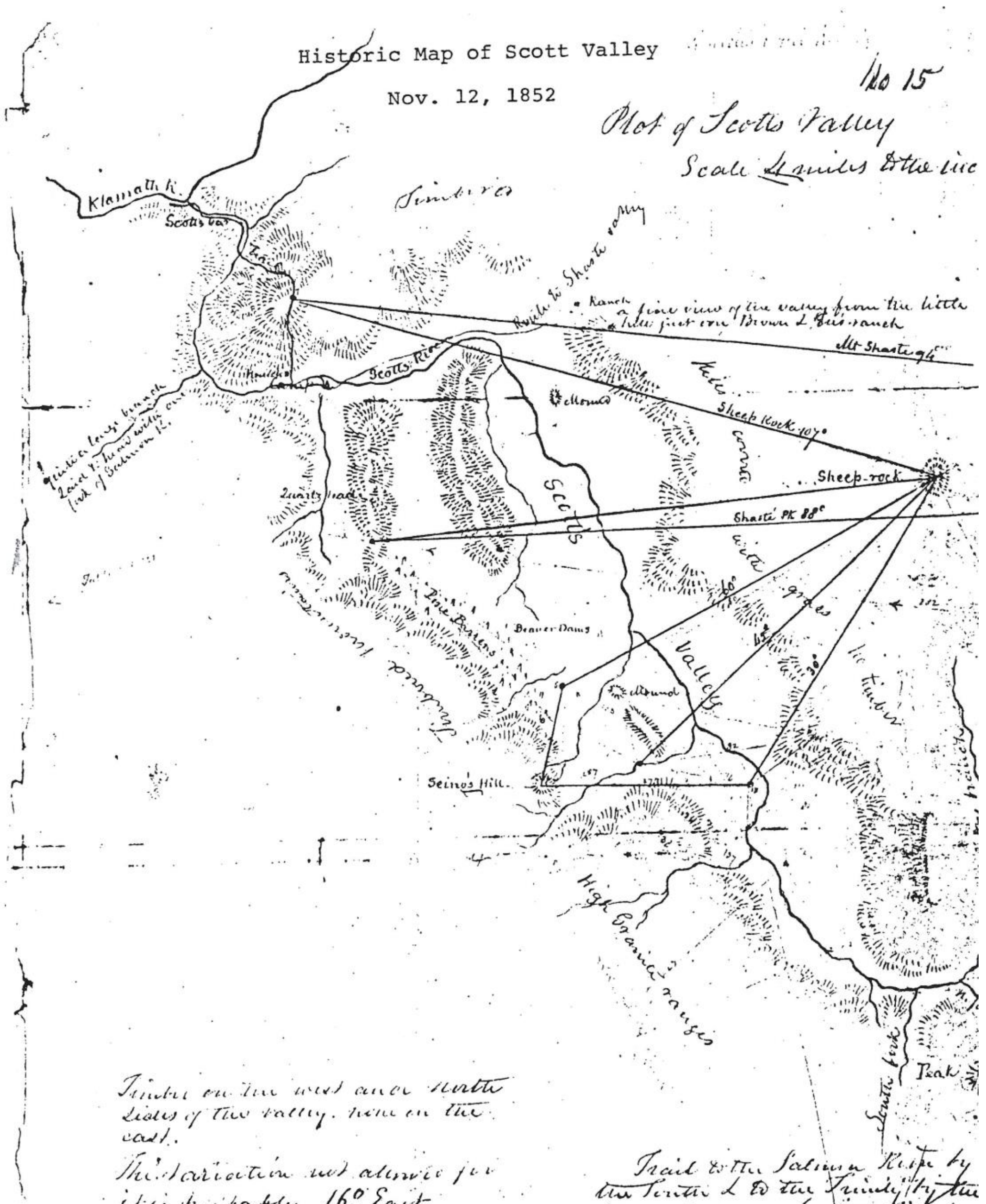
We need to agree on which stream reaches naturally are:

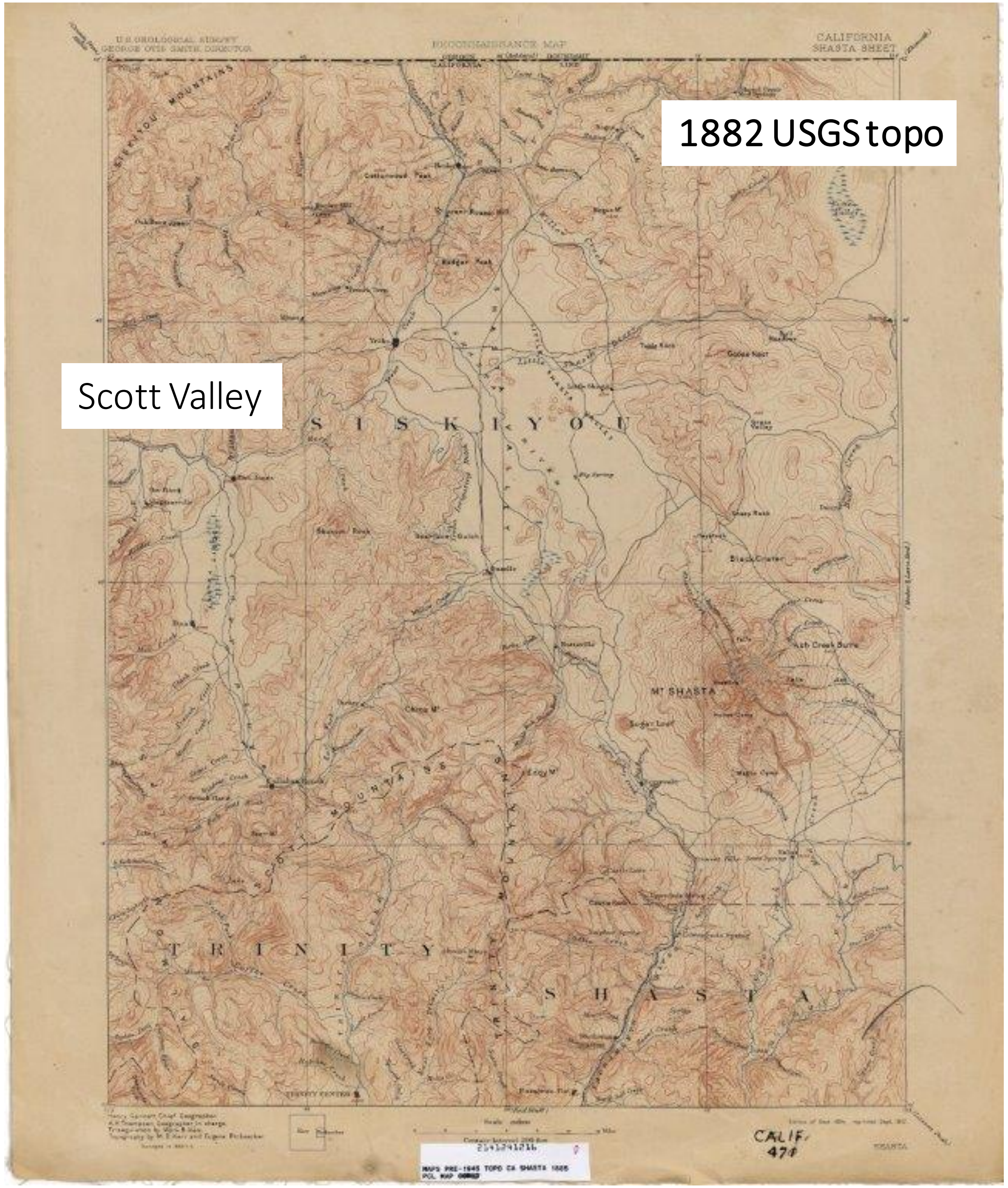
- not perennial: ephemeral & intermittent
- alluvial fans
- not supporting good spawning gravels
- not supporting good rearing habitat

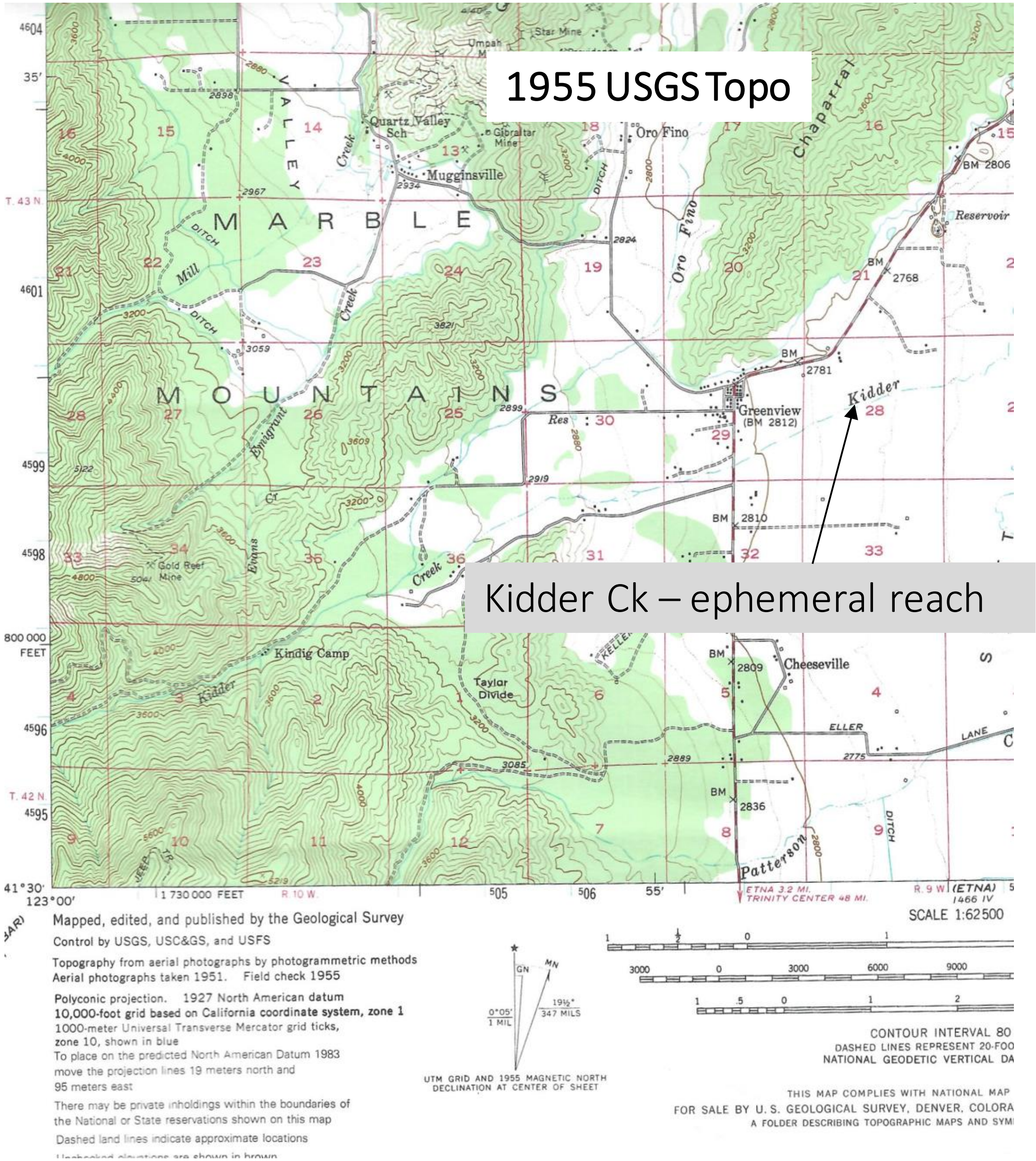
1852 US ARMY MAP of "Scott's Valley"

"...the two or three small branches which continue to flow during the dry season..."
~ George Gibbs, 1851

Figure 1-2

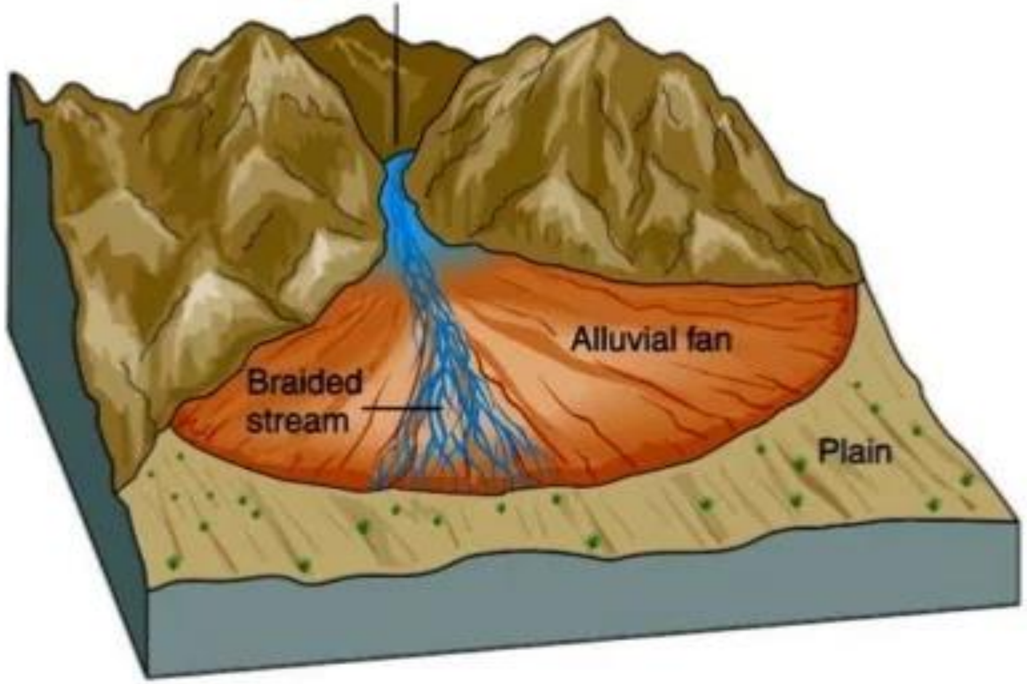



1882 USGS topo
Scott Valley
CALIFORNIA
SHASTA SHEET
S I S K I Y O U
T R I N I T Y
S H A S T A
Mt SHASTA
CALIF.
474


1955 USGS Topo
Kidder Ck – ephemeral reach
M A R B L E
M O U N T A I N S
Greenview
(BM 2812)
Kidder
Cheeseville
Mugginsville
Oro Fino
Quartz Valley
Kindig Camp
Taylor Divide
Patterson
Mapped, edited, and published by the Geological Survey
Control by USGS, USC&GS, and USFS
Topography from aerial photographs by photogrammetric methods
Aerial photographs taken 1951. Field check 1955
Polyconic projection. 1927 North American datum
10,000-foot grid based on California coordinate system, zone 1
1000-meter Universal Transverse Mercator grid ticks, zone 10, shown in blue
To place on the predicted North American Datum 1983 move the projection lines 19 meters north and 95 meters east
There may be private inholdings within the boundaries of the National or State reservations shown on this map
Dashed land lines indicate approximate locations
UTM GRID AND 1955 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET
SCALE 1:62500
CONTOUR INTERVAL 80
THIS MAP COMPLIES WITH NATIONAL MAP
FOR SALE BY U. S. GEOLOGICAL SURVEY, DENVER, COLORA

ALLUVIAL FAN

Simplified Model



Alluvial fans are highly complex, steeply-sloping (>1 – 2^0) fluvial systems found at the base of active mountain ranges. They show significant changes down fan from proximal debris flow deposits to mid-fan braided stream deposits to distal fan sheet flow and playa deposits beyond the fan toe.

KIDDER CREEK'S ALLUVIAL FAN
and Braided Stream

1958 study by USGS (Mack):
"Geology and Groundwater Features of Scott Valley"

Most of the tributary streams from the north and west "have yearlong flow in their upper reaches, but in the dry summer months, much of the water sinks into the coarse, permeable gravel of the upland areas and the streams do not normally maintain flow to the valley floor after the beginning of July."

Page 8

Other Alluvial Fans in Scott Valley

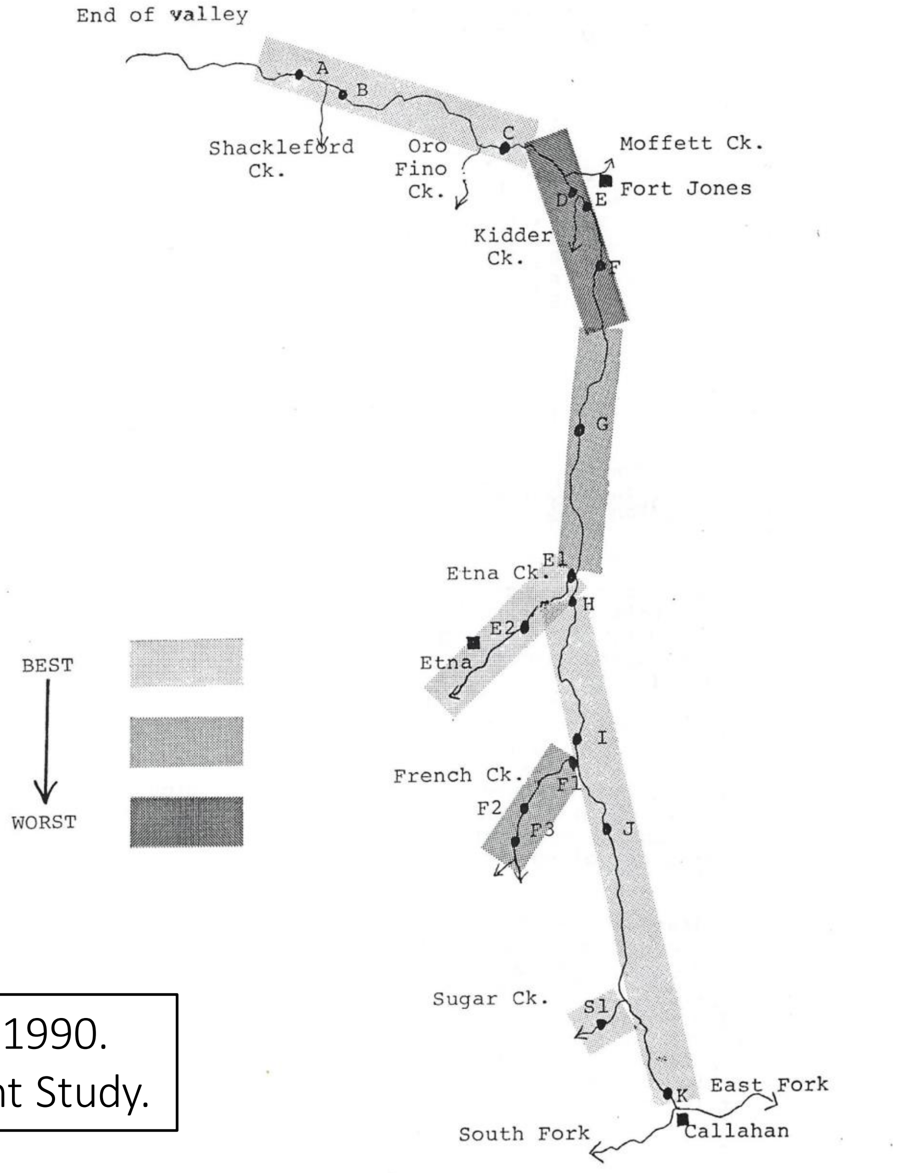
Upper Shackleford Creek

Etna Creek

Patterson Creek

SPAWNING GRAVEL QUALITY: Sand-bed vs. Gravel-bed zones

Figure 4-16. Spawning Gravel Quality in Scott Valley



4-40

Sommarstrom, Kellogg & Kellogg. 1990.
Scott River Basin Granitic Sediment Study.

REARING HABITAT QUALITY

GOOD – FRENCH CREEK

POOR – MAINSTEM SCOTT RM 35

LOCATIONS: Historic & Current Spawning Sites

↓

Rearing Sites

Final Report

Scott River Fall Chinook Spawning Ground Surveys
2019 Season

A female Chinook salmon resting in the Scott River mainstem. Photo courtesy of Jim Morris (2019).

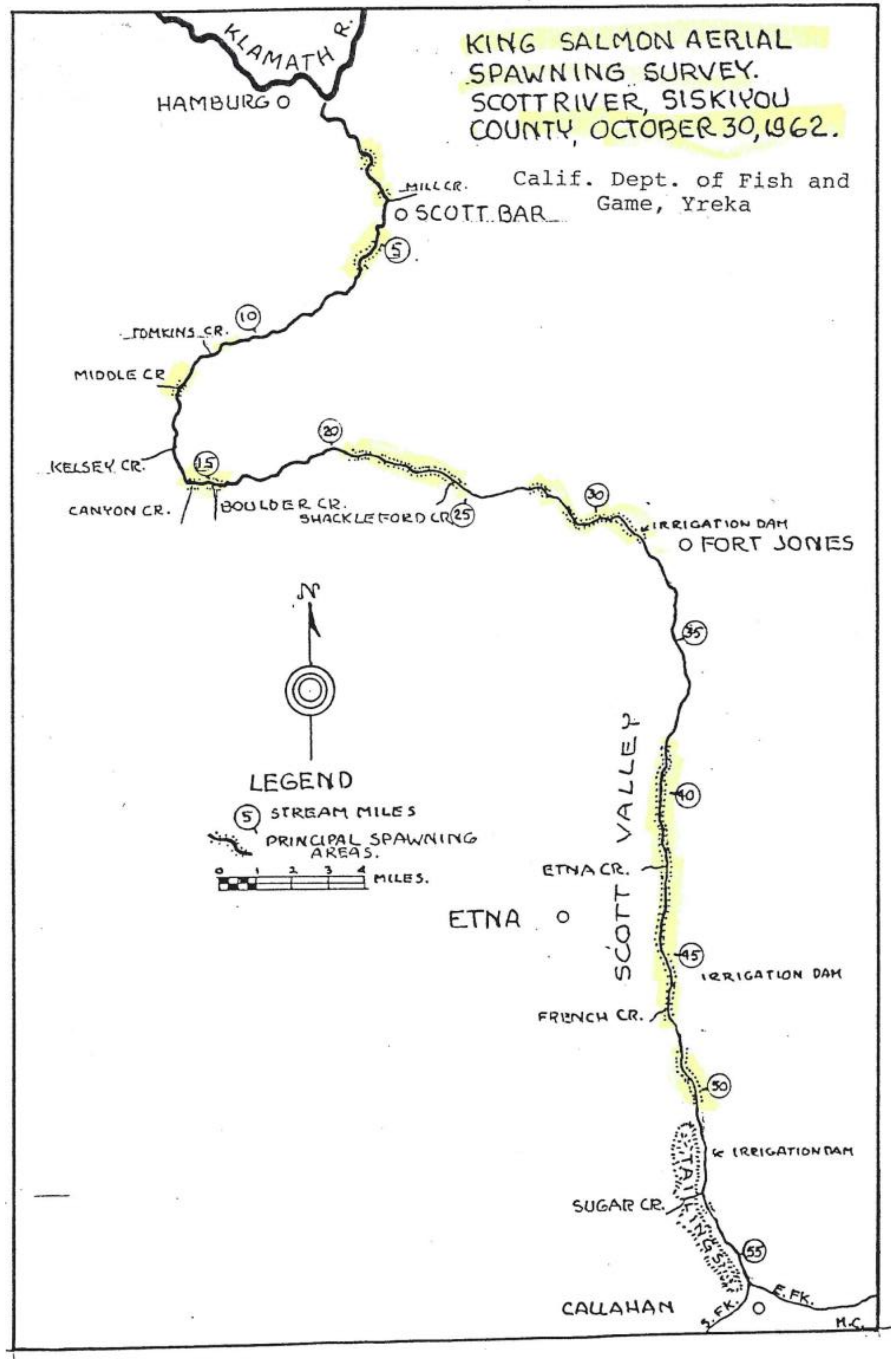
Work Completed by the
Siskiyou Resource Conservation District
for the
United States Fish and Wildlife Service
(Grant Agreement #F18AP00224 and #F19AP00242)

Report Prepared by Emma Morris, Chris Voigt and Lindsay Magranet

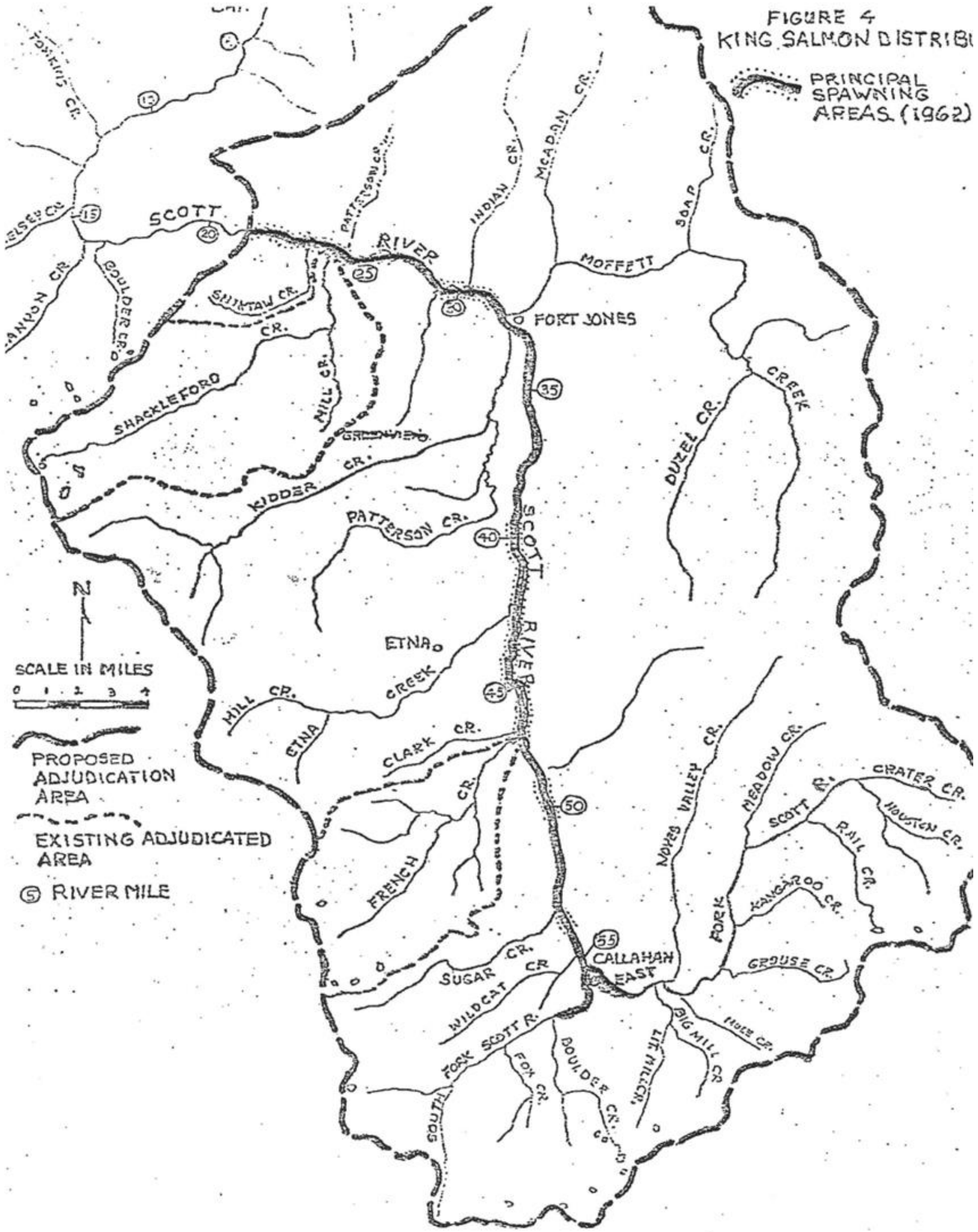
March 2020

CHINOOK

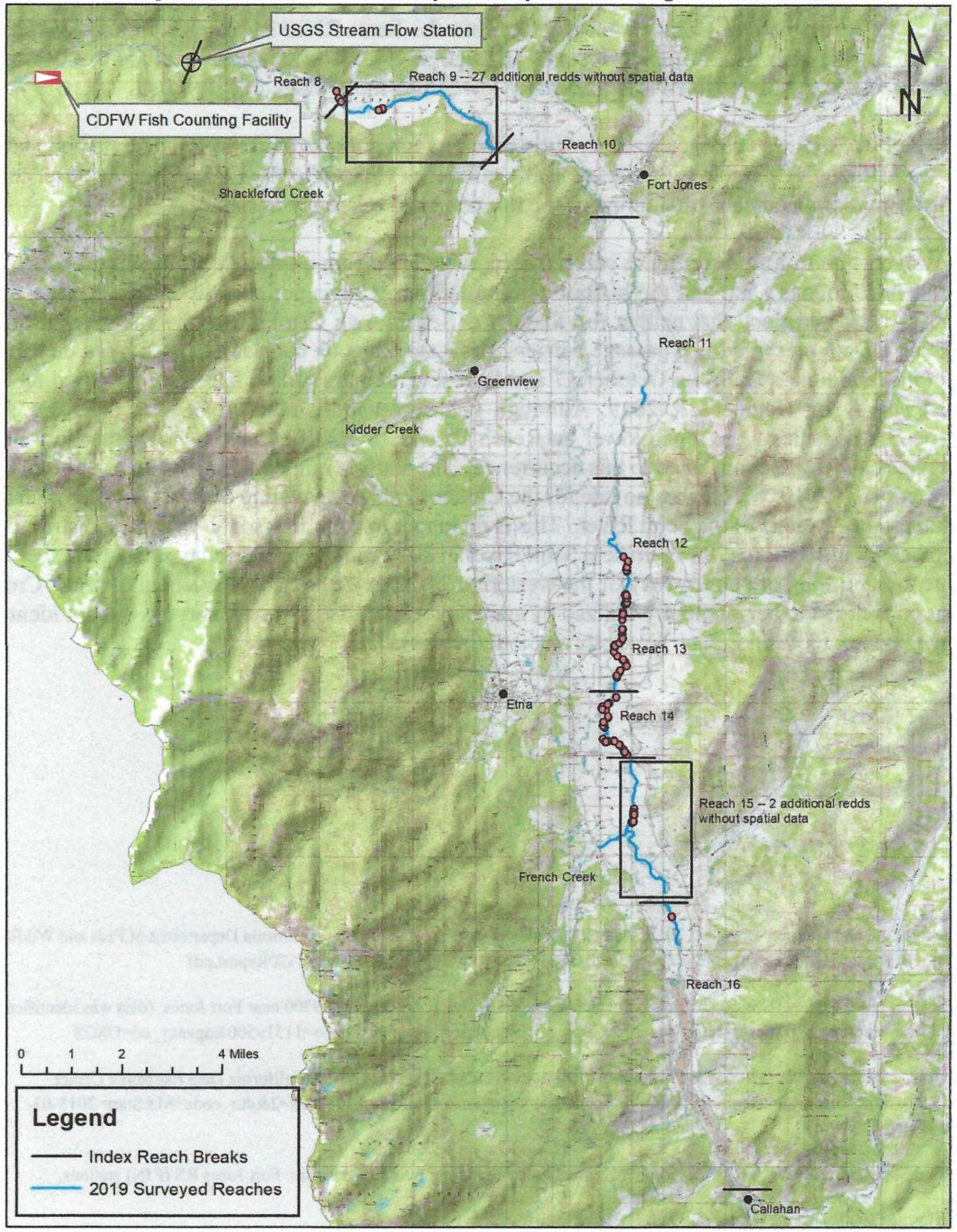
CDFG
1962



CDFG
1974



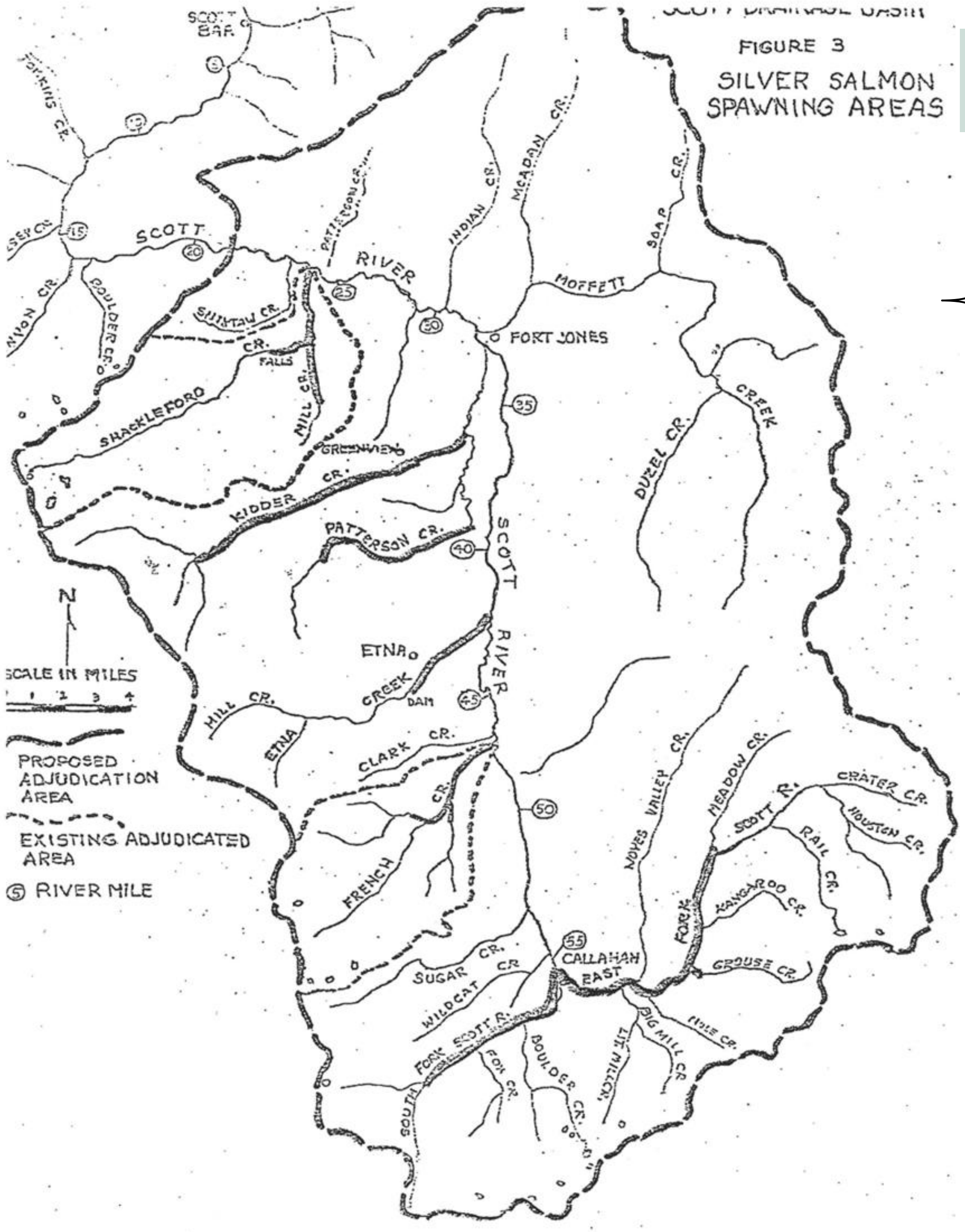
Map 2. Chinook redds identified by the Siskiyou RCD during the 2019 fall run.



2019 Chinook Redd Locations

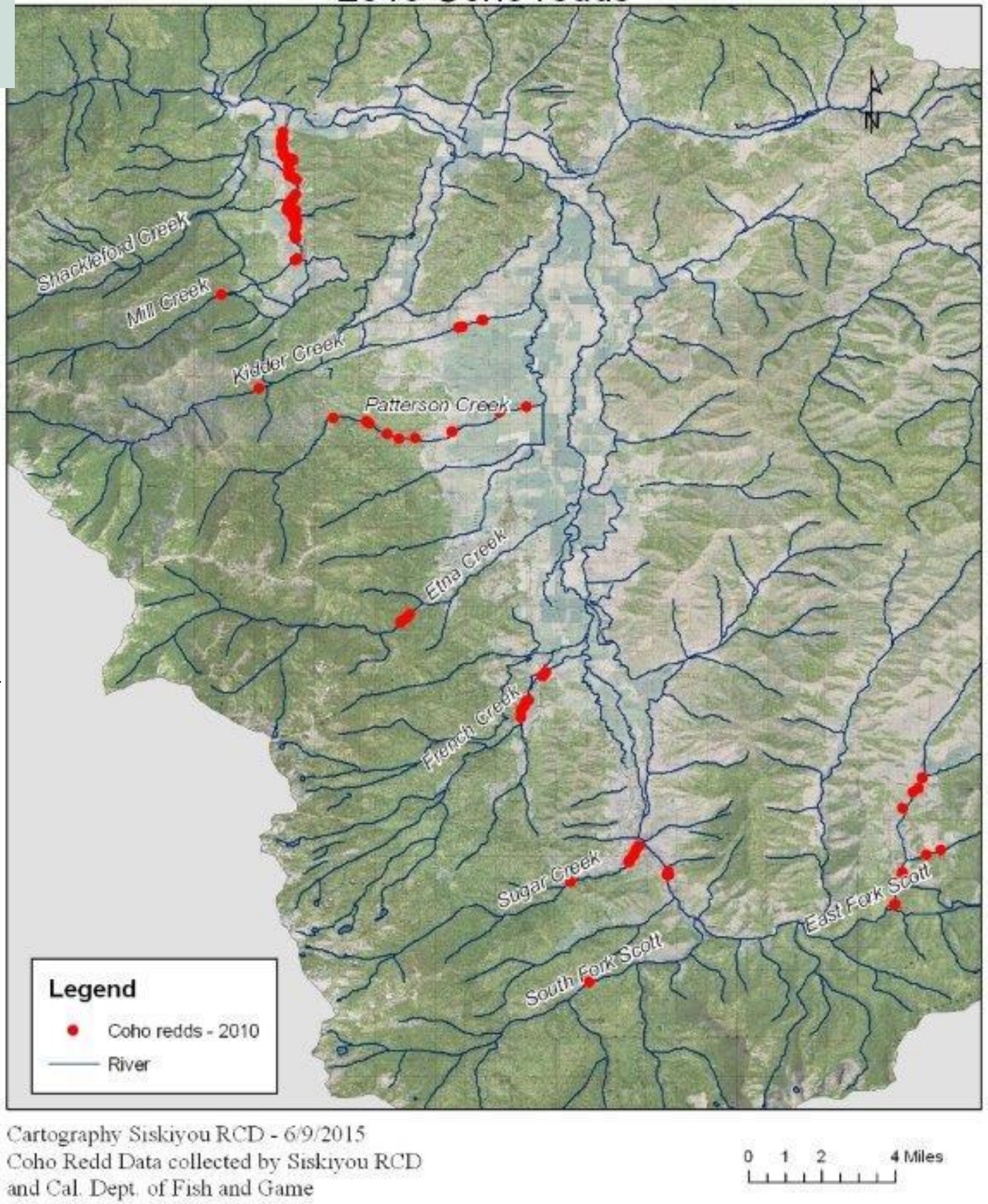
Siskiyou RCD Surveys

COHO



1974
CDFG

Scott River coho redd distribution
2010 Coho redds



2010
RCD

2017 Monitoring Report

Photo by L. Magranet

June 2018

Report prepared by Lindsay Magranet
Siskiyou Resource Conservation District

For the
Scott River Water Trust

REARING HABITAT

DATA ON
LOCATIONS &
QUALITY
FOUND IN MANY
REPORTS SINCE 1990

SCOTT RIVER
WATERSHED COUNCIL

Scott River Fisheries Monitoring Project
Field Tech Note: July 18, 2023 - September 19, 2023

Scott River Fisheries Monitoring Project - Field Tech Note

Direct Observation for Juvenile Salmonids - July 18, 2023, through September 19, 2023

TIMING OF FLOWS

❖ **CHINOOK** ADULT ACCESS & SPAWNING:	**OCTOBER** - NOVEMBER
❖ CHINOOK EGG INCUBATION & REARING:	OCTOBER - FEBRUARY
❖ CHINOOK JUVENILE OUTMIGRATION:	FEBRUARY – **JUNE**
❖ **COHO** ADULT ACCESS & SPAWNING:	NOVEMBER - JANUARY
❖ COHO EGG INCUBATION:	NOVEMBER - MARCH
❖ COHO REARING:	YEAR-ROUND
❖ COHO JUVENILE OUTMIGRATION:	FEBRUARY - JUNE

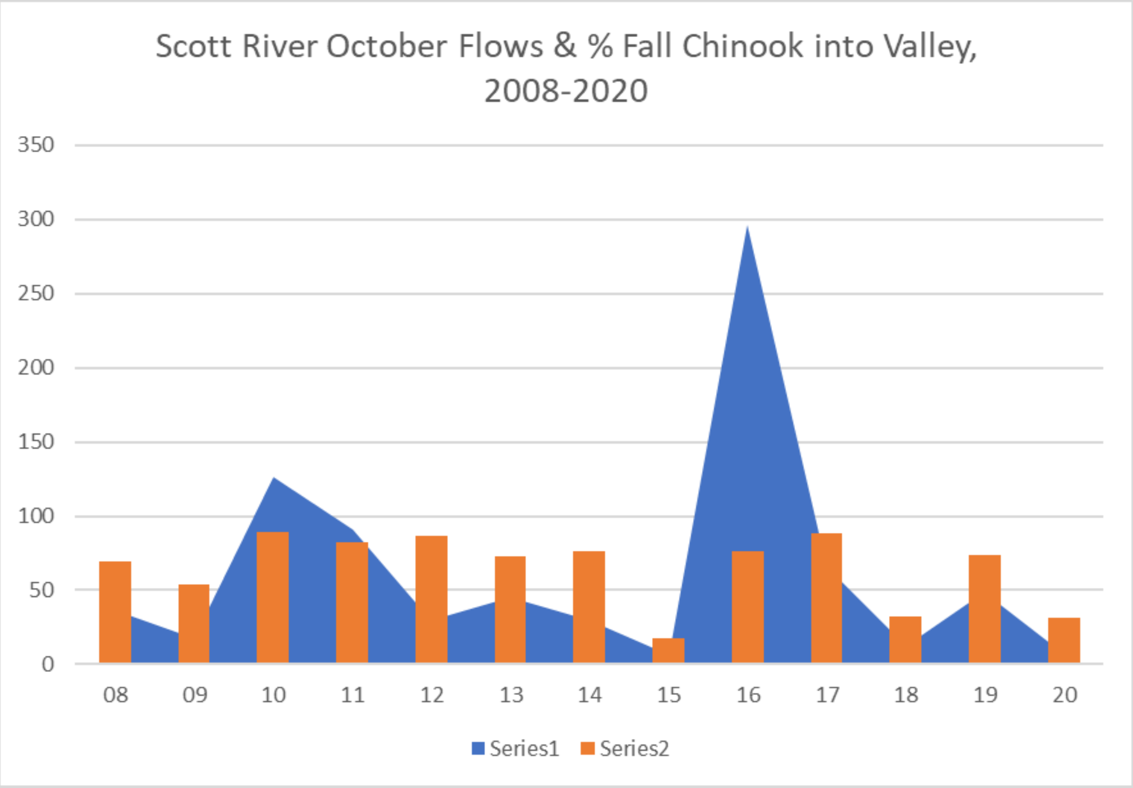
CDFW Fish Counting Weir – RM 18

Adult Chinook Salmon, Coho Salmon & Steelhead data since 2007

Annual Reports!

% Fall Chinook in Scott Valley vs. Canyon

Year	Oct. Mean Flow	% Chinook into Valley
08	36.7	69
09	17.6	54
10	126.3	89
11	91.3	82
12	29.9	87
13	45.3	73
14	29.6	76
15	6.27	18
16	296.6	76
17	65.6	88
18	12.6	32
19	49	74
20	7.13	31
21	64.6	71
22		7
	Below 40 cfs target flow	



Canyon Survival of Chinook Young?

BY 2020 (69% below weir) & BY 2021 (29% below)

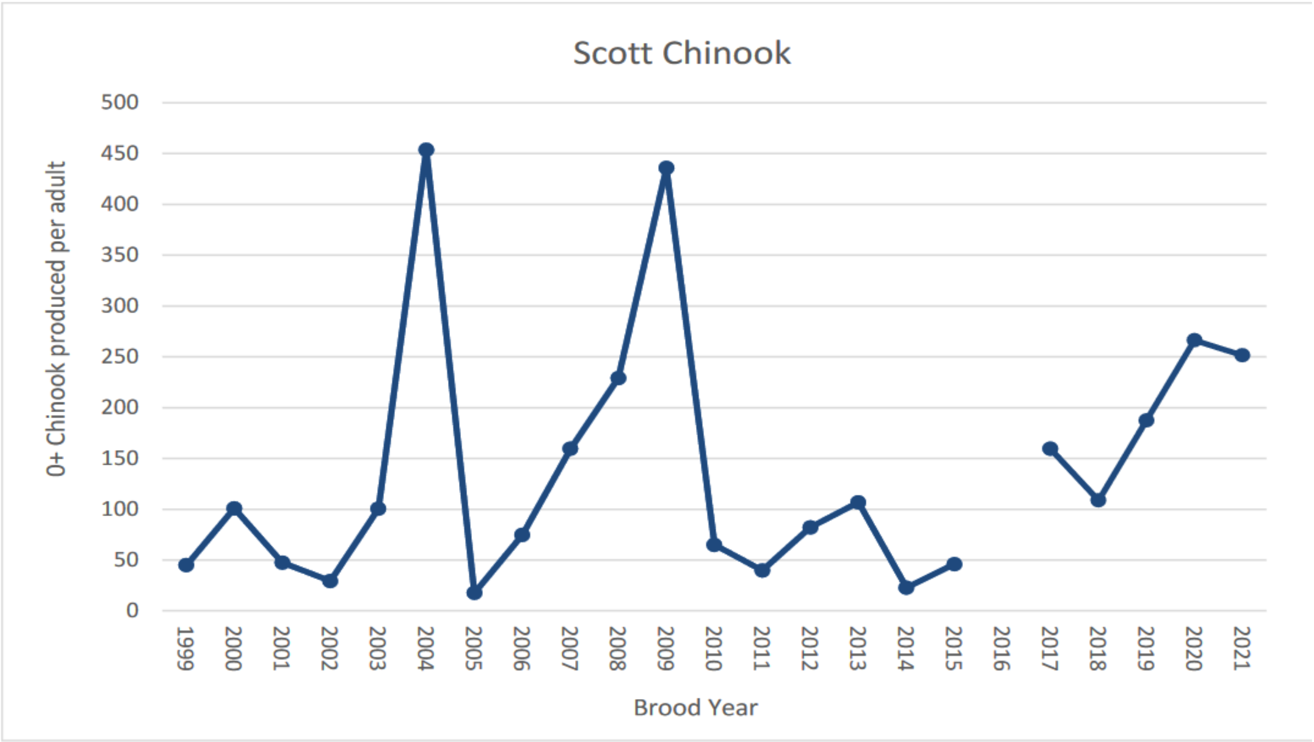


Figure 16. Number of 0+ Chinook Salmon produced per adult spawner in the Scott River by brood year, for Brood Years 1999-2015, 2017-2021.

Average = **137**
0+ Chinook per adult

2022 0+ recruits per
2021 adult = **251.4**

2021 0+ recruits per
2020 adult = **266.3**

UNREASONABLE EXPECTATIONS: Precipitation Trends vs. Flow Trends

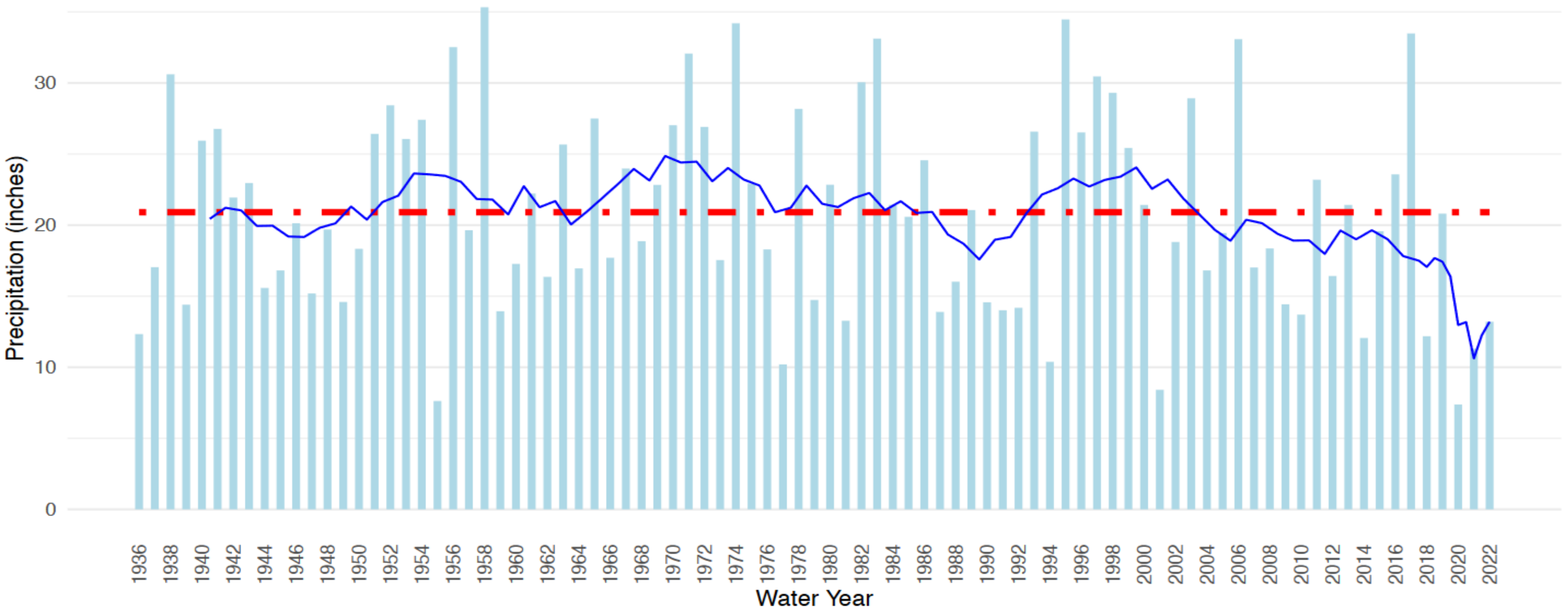


Figure 4: Fort Jones annual precipitation from 1935 to 2022, according to CDEC data. The long term mean is shown as a red dashed line, and the ten year rolling mean is the blue trendline.

1974 CDFG FLOW REQUIREMENTS =
ONLY PERCENT OF MEAN ANNUAL FLOW

Table 5. Flow requirements for spawning and rearing in the Scott River and East and South Forks

Stream	Mean Annual Flow - CFS	Rearing	% Mean Annual Flow	Spawning - CFS			
				King Salmon	% Mean Annual Flow	Silver Salmon	% Mean Annual Flow
South Fork	93.34 (a)	31	33.3	93	100	93	100
East Fork	94.93 (b)	32	33.3	95	100	95	100
Scott River	206.77 (c)	62	30.0	155	75	155	75
Scott River	638.50 (d)	192 30%	30.0	426	67	426	67

(a) U.S.G.S. Records 10/56 - 9/60
(b) U.S.G.S. Records 10/59 - 9/68
(c) The sum of East Fork, South Fork, and Sugar Creek; does not include Wildcat Creek runoff.
(d) U.S.G.S. Records 10/59 - 9/68

Comparison to USFS & E-reg Flows

	Scott Decree USFS – table 1[1]	Scott Decree USFS – table 2[2]	Scott Decree USFS – total[3]	CDFG - 1974	CDFW - 2022
January	200	226	426	426	200
February	200	226	426	426	200
March	200	226	426	426	200
April	150	276	426	426	150
May	150	276	426	426	150
June 1 - 15	150	134	284	284	125
June 16 - 30	100	184	284	284	125/ 90
June 24 - 30	-	-	-	-	90
July 1 - 15	60	132	192	192	50
July 16 - 31	40	152	192	192	50
August	30	47	77	192	30
September	30	32	62	192	33
October	40	96	136	284	40
November	200	226	426	426	60
December	200	226	426	426	150

CDFW 2017 Flow Criteria Critique: Not based on reality of fish & flow response

Steelhead spawners in Patterson Creek, Scott River

CHINOOK SALMON SPAWNER – SCOTT RIVER MILE 43
Don’t need a Critical Riffle Analysis

Measurements are in cubic feet per second (cfs), as measured at the USGS Gage below Fort Jones (river mile 21.5)

	Mean Monthly Flow '42-'22	Petition Proposed Permanent	SWB-CDFW 2022 Minimum Flow
January	988	362	200
February	1090	362	200
March	1000	354	200
April	999	134	150
May	1,100	165	150
June 1 - 15	669	165	125
June 16 - 30		165	125/ 90
June 24 - 30		-	90
July 1 - 15	168	165	50
July 16 - 31		134	50
August	54	77	30
September	45	62	33
October	96	134 / 139	40
November	286	266	60
December	784	337	150

FALL FLOWS

3 Hypothetical Models used by CDFW

A. **Hatfield-Bruce Model:** from 1980 article

--Intended only for planning and research purposes

B. **Q fish passage Model**: "North Coast Instream Flow Policy"

--Developed to evaluate new water rights permits

--Provided lowest flow results and not selected as Interim Flow

C. **Tessman-Tennant Model**: from Northern Great Plains

--Uses Mean annual Flow for low flow months

- Real world Scott River data on fish – much from CDFW - and flow need to be assessed instead of adopting the hypothetical 2017 Interim Flow Criteria, which used no local fish data.

- Instream Flow Incremental Methodology (IFIM) "is not intended for prescribing instream flow standards", says the Instream Flow Council (2002), yet CDFW's Criteria would be used for that purpose for Permanent Flows.

- Proposing maximum, unreasonable winter flow criteria will block **needed aquifer recharge projects**, while summer-fall flows that are needed for fish habitat cannot benefit from winter recharge.

Real World Flow & Fish Data Needed

Spawning access

Spawning success

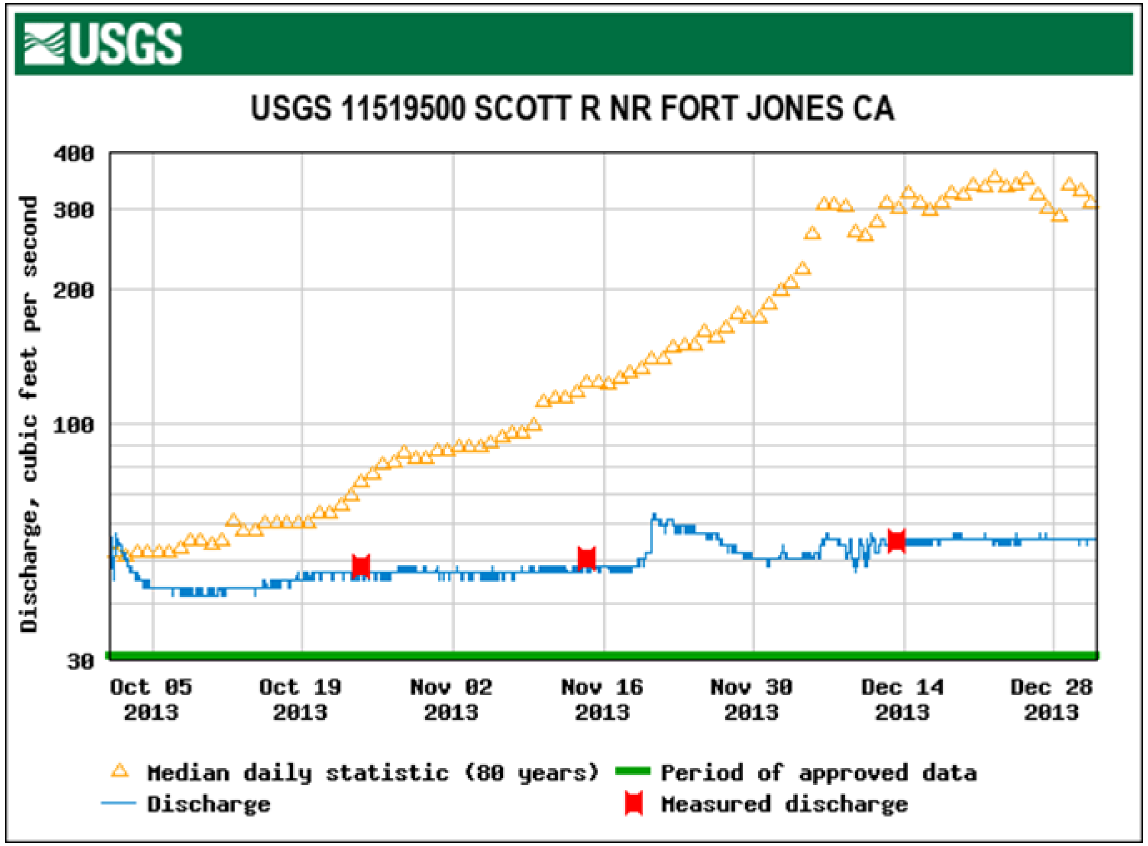
Flow on Date of First Fish: 2012 Example

1 Chinook on 10/5 at 21 cfs

4 Coho on 10/27 at 41 cfs

Date	DAILY - 2012		
	2012	2012	2012
	Chinook	**Flow**	Coho
10/1	0	19	
10/2	0	20	
10/3	0	21	
10/4	0	20	
10/5	1	21	
10/6	1	22	
10/7	5	22	
10/8	10	22	
10/9	6	23	
10/10	24	24	
10/11	58	25	
10/12	133	25	
10/13	127	25	
10/14	328	26	
10/15	383	27	
10/16	408	28	
10/17	548	28	
10/18	454	29	
10/19	333	30	
10/20	471	31	
10/21	154	32	
10/22	270	34	
10/23	217	35	
10/24	192	39	
10/25	180	39	
10/26	155	40	0
10/27	364	41	4
10/28	529	43	4
10/29	516	44	4
10/30	578	45	4

Water Year 2013: USGS Gage Flow x Fish Access

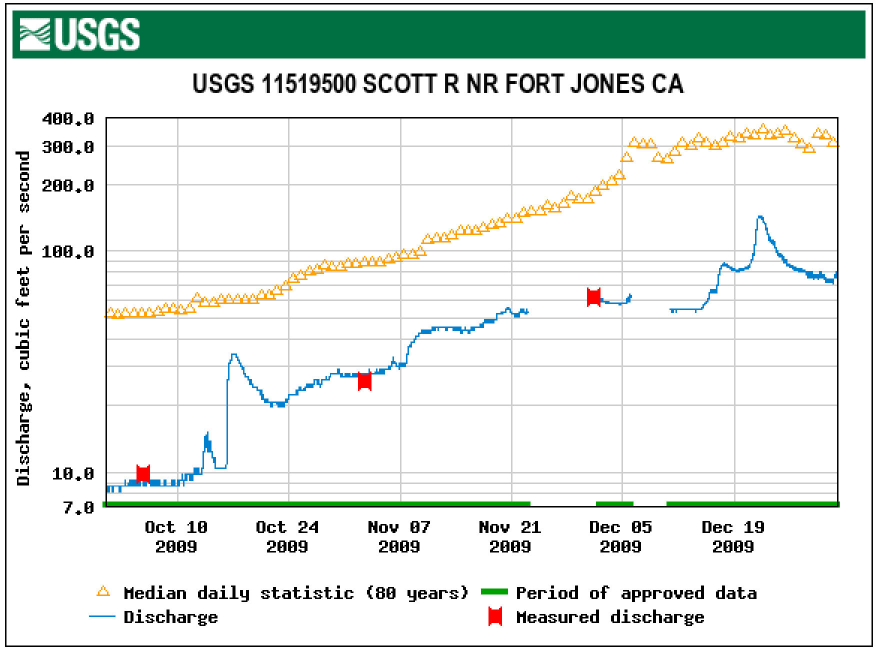


2013 Chinook Spawners = 4,624 (**73% above weir**) (10/1 to 12/3)

2013 Coho Spawners = 2,752 (10/21 to 2/6) (no tributary access)

Oct. mean flow = 45.3 cfs (vs. 40) Nov. mean flow = 50.5 cfs (vs. 60) Dec. mean flow = 54.2 cfs (vs. 150)

2009



2009 Chinook Spawners = 2,211 (**54%** above weir) (10/14 to 12/22)

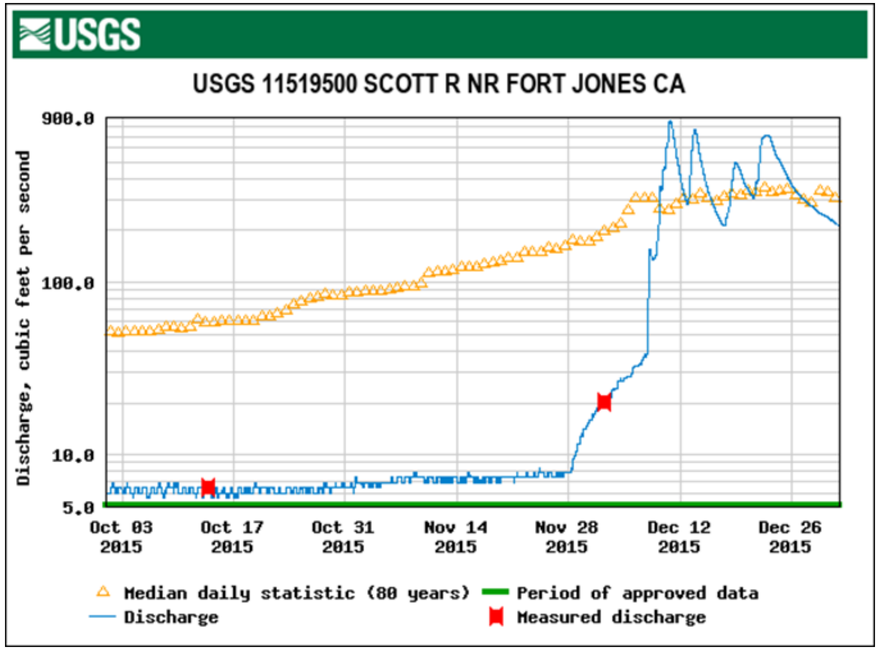
2009 Coho Spawners = 81 (11/20 to 1/1)

Oct. mean flow = 17.6 cfs (vs. 40 cfs)

Nov. mean flow = 48 cfs (vs. 60 cfs)

Dec. mean flow = 73.6 cfs (vs. 150 cfs)

2015



2015 Chinook Spawners = 2,113 (**18%** above weir) (10/6 to 12/9 when weir removed)

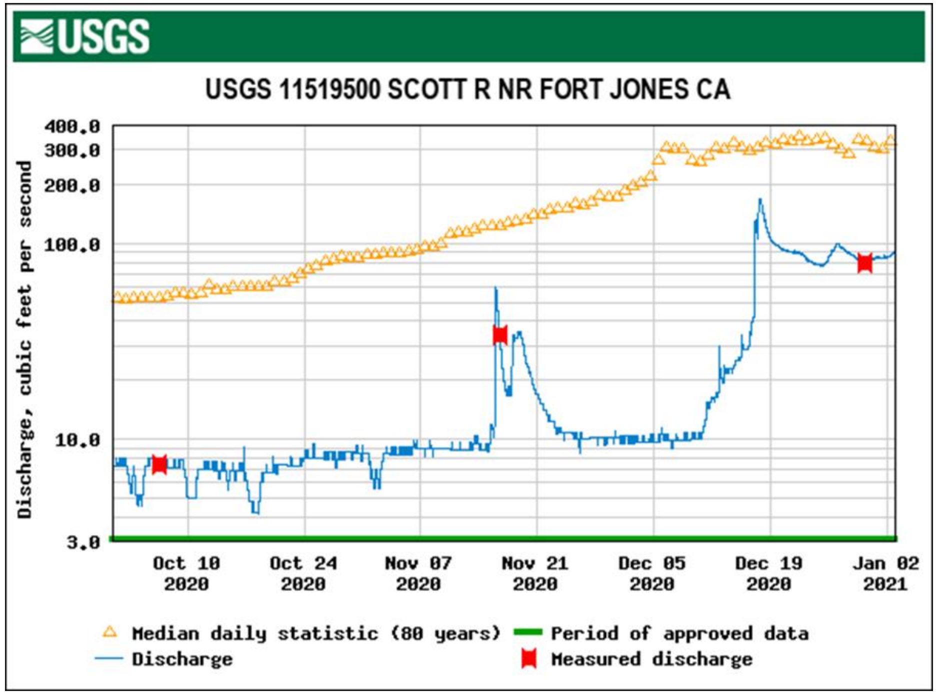
2015 Coho Spawners = 212* (12/4 to 12/9)

Oct. mean flow = 6.27 cfs (vs. 40 cfs)

Nov. mean flow = 7.75 cfs (vs. 60 cfs)

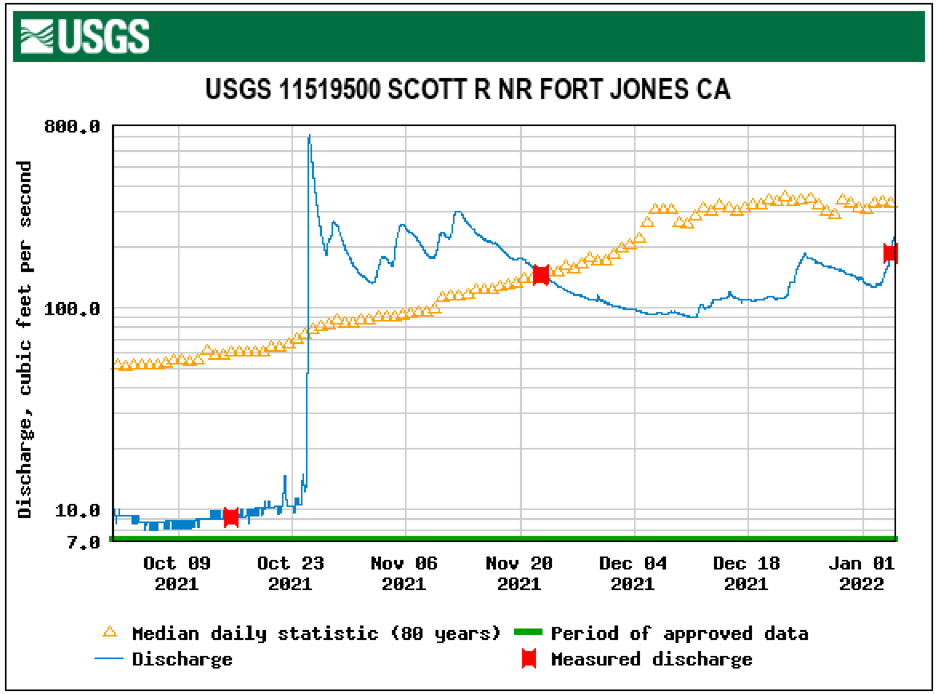
Dec. mean flow = 308.4 cfs (vs. 150 cfs)

2020



2020 Chinook Spawners = 855 (**31%** above weir)
(9/29 to 12/16)
2020 Coho Spawners = 1,766 (9 below weir)
(11/16 to 1/4)
Oct. mean flow = 7.1 cfs (vs. 40 cfs)
Nov. mean flow = 12.7 cfs (vs. 60 cfs)
Dec. mean flow = 52.6 cfs (vs. 150 cfs)

2021



2021 Chinook Spawners = 1,961 (**71%** above weir)
(10/21 to 11/6)
2021 Coho Spawners = 852
(10/24 to 1/2)
Oct. mean flow = 64.6 cfs (vs. 40 cfs)
Nov. mean flow = 180.8 cfs (vs. 60 cfs)
Dec. mean flow = 118.6 cfs (vs. 150 cfs)

Winter Flow "Need" vs. "Modeled"

Scott River Coho Spawning Returns, Flows & Run Timing in Selected Drought Years

YEAR	Coho Spawners	Nov. Flow Mean	Dec. Flow Mean	Run Timing
2009	81	48 cfs	73.6 cfs	11/20 to 1/1
2012	201*	139.5 cfs	1,014 cfs	10/26 to 11/29
2013	2,752	50.5 cfs	54.2 cfs	10/21 to 2/6
2015	212*	7.75 cfs	308.4 cfs	12/4 to 12/9
2020	1,766	12.7 cfs	52.6 cfs	11/16 to 1/4
2021	852	180 cfs	118.6 cfs	10/24 to 1/2

*incomplete count due to early removal of counting weir

Real flow data = 54 to 180 cfs for Coho spawning access

Modeled figure from 2017 CDFW Report = 362 cfs

What is the definition of "SUCCESS"?

- Meet realistic EXPECTATIONS within the context of the nature of the Scott River Watershed – an undammed river with no surface water storage for controlled releases.
- **Use real Flow & Fish data** for LOCATION and TIMING for spawning and rearing.
- Define EXPECTATIONS of spawning distribution (% locations), if needed.
- Address how/when/where tributary flows affect Coho distribution and survival.
- Ensure that Aquifer Management for flow expectations requires Supply as well as Demand management.

❑ Achievable -- Supportable -- Reasonable

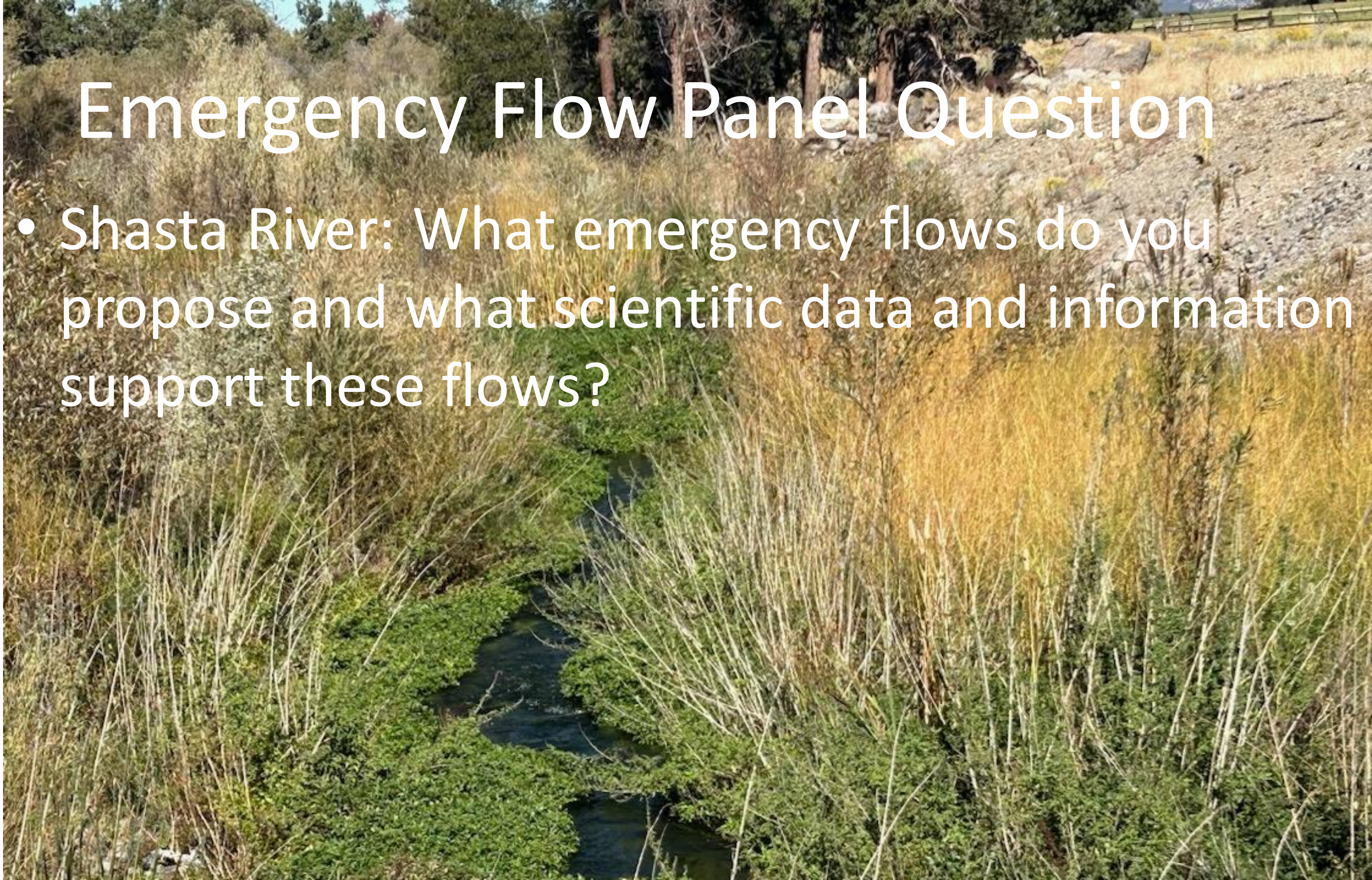
Gary Black Emergency Flows Presentation (15 minutes, Shasta Only)

- What emergency minimum flows do you propose and what scientific data and information support these flows?
- What other factors should the Board be considering with respect to emergency flows (e.g., provide recommended ramp down flows at end of regulation, etc.)?


Emergency Regulation Efforts in Scott and Shasta River Watersheds October 6th, 2023
Shasta River
Shasta Valley Producers
Gary Black

Emergency Flow Panel Question

- Shasta River: What emergency flows do you propose and what scientific data and information support these flows?



Where improvements could be made

- Agriculture: 50 cfs minimum canyon summer flow requirement resulted in loss of irrigation use on several thousand acres resulting in stand loss and economic impact
- Fisheries: 50 cfs minimum canyon summer flow requirement provides limited protection of cold over-summering areas by focusing on canyon flows (over 26°C in summer) while allowing potential impact to critical known over-summering areas

Shasta River Drought Emergency Regulation Flow Schedule for Yreka Gage

Month	2021 E-Regs. Flow/CFS	2022 E-Regs. Flow/CFS
Jan	135	125
Feb	135	125
March 1-24	135	125
March 25-31	105	105
April	70	70
May	50	50
June	50	50
July	50	50
August	50	50
Sept 1-15	50	50
Sept 16-30	75	75
Oct	125	105
Nov	150	125
Dec	150	125

Shasta River Canyon Flows During Summer

- Strong Opinions/Impacts about summer flows in Shasta Canyon
- Varied opinion on inputs that affect water temperature that require more research and collaboration
- Trying to achieve suitable temperatures in canyon should not be a consideration of emergency curtailment

McBain and Trush – Shasta River Canyon Instream Flow Needs, 2014

- “There is insufficient evidence in this report to determine whether future over-summering in the Shasta Canyon is a viable life history tactic for juvenile Coho salmon and steelhead.”

- “If summer rearing is not determined to be a viable future life history tactic, a lower summer instream flow which promotes juvenile migration and BMI productivity would be recommended.”

Our Approach for Balanced Summer Emergency Regulations

1. Protect and expand over-summering areas that provide the greatest good
2. Implement agency approved cold water protection/over-summering projects immediately
3. Reduce canyon flow value in summer as available habitat becomes minimal
4. Develop Water Year Type
   - I. Use proposed minimum flow schedule in canyon for critically dry years.
   - II. Add achievable additional flow measures on wetter year types
5. Water quality is a limiting factor

Shasta Canyon Minimum Flows

- Scientific data and information used to justify our approach for Minimum Canyon Flow

- McBain and Trush, Inc. and Humboldt State University, Environmental Resources Engineering Department. 2014. Shasta River Canyon Instream Flow Needs Assessment

- Podlech, M. 2023. Outline of Shasta River Flow Recommendations for Summer 2023. July 31 memorandum.

- Podlech, M. 2022. Review of CDFW Recommendations for the 2022 Readoption of Drought Emergency Regulations on the Shasta River and Recommendations for Alternative Instream Flow Management During Extreme Drought Conditions. June 13 memorandum.

- Podlech, M. 2021. Review of Best Available Information Regarding Shasta River Salmonid Instream Flow Needs During Extreme Drought. November 11 memorandum.

Canyon Flow -Adult Migration and Spawning Period

Month	SWRCB 2022 CFS	SVP Proposed CFS	SVP Justification of proposed minimum flow
Sept 16 – 24	75	60	Podlech - Ramp up to mimic natural hydrograph regime and cue migration
Sept 25 – 30	75	70	Podlech - Ramp up to mimic natural hydrograph regime and cue migration
Oct	105	90	Podlech Memo 11/2021 McBain & Trush, 2014, Section 6.2.2 – Maximum canyon spawning 90-105 cfs.
Nov	125	105	McBain & Trush Section 6.2.2 – High end of canyon spawning 90-105 cfs
Dec	125	105	McBain & Trush Section 6.2.2 – High end of canyon spawning 90-105 cfs CFDW Memo to SWRCB, 4/2022

Winter, Spring Out-Migration, Redistribution

Month	SWRCB 2022 CFS	SVP Proposed CFS	Justification
Jan	125	90	- fry and juvenile winter rearing needs are lower than adult spawning flows (see M&T)
Feb	125	90	- provides composite maximum rearing habitat for all species and life stages (see M&T Section 6.3)
March 1-24	125	90	- drop from 105 cfs to 90 cfs avoids redd dewatering per CDFW 0.2 ft threshold noted in 4.20.22 memo to SWRCB
March 25-31	105	70	-Ramp down consistent with CDFW 4.20.22 memo - see M&T Table 13: riffle passage depths at 25 cfs fully suitable for smolt outmigration passage (CDFW depth criterion = 0.4 ft)
April	70	50	- see Podlech 6.13.22 memo - see M&T Table 13: riffle passage depths at 25 cfs fully suitable for smolt outmigration passage (CDFW depth criterion = 0.4 ft)
May	50	30	- see Podlech 6.13.22 memo - see M&T Table 13: riffle passage depths at 25 cfs fully suitable for smolt outmigration passage (CDFW depth criterion = 0.4 ft)

Canyon - Summer Rearing

Month	SWRCB 2022 CFS	SVP Proposed CFS	Justification
June	50	30	-M&T Section 6.3.3 and Podlech 6.13.22 memo - CDFW Holmes Big Sur River, 2014 (velocity suitability value 0.0 - .59fps) -High quality rearing supported at 33 cfs, independent of water temps (M&T page 104 cfs)
July-August 28	50	30 cfs if 3 day max T ≤ 24C° 25 cfs if 3 day max T ≥ 24C°	-Maximum rearing habitat available between 90-105 cfs. (M&T) -High quality rearing supported at 33 cfs, independent of water temps (M&T page 104 cfs) -Podlech 6.13.22 memo - reduction to 25 cfs expected to help protect isolated steelhead rearing habitat by reducing warm water inputs to cool temperature refugia.
August 29 – Sept 15	50	50	Support early-migrating Chinook (M&T Section 6.1.3 and Podlech 11.11.21 memo)

Over-Summering Approach

- Most of over-summering habitat within SHA boundary
- Use the Template Safe Harbor Agreement and associated commitments to provide and expand over-summering habitat
- Provide LCS coverage for willing participants
- SWRCB to make determination on 1707 petitions prior to 3/1/2024 that support habitat expansion

Adjustment of Emergency Regs. for Normal and Wetter Water Years

- Normal or Wetter could provide additional measures including increased/extended spring flows for outmigration and distribution

- Active SHA will produce increased spring and fall flow contribution

Scientific data and information supporting SHA objectives

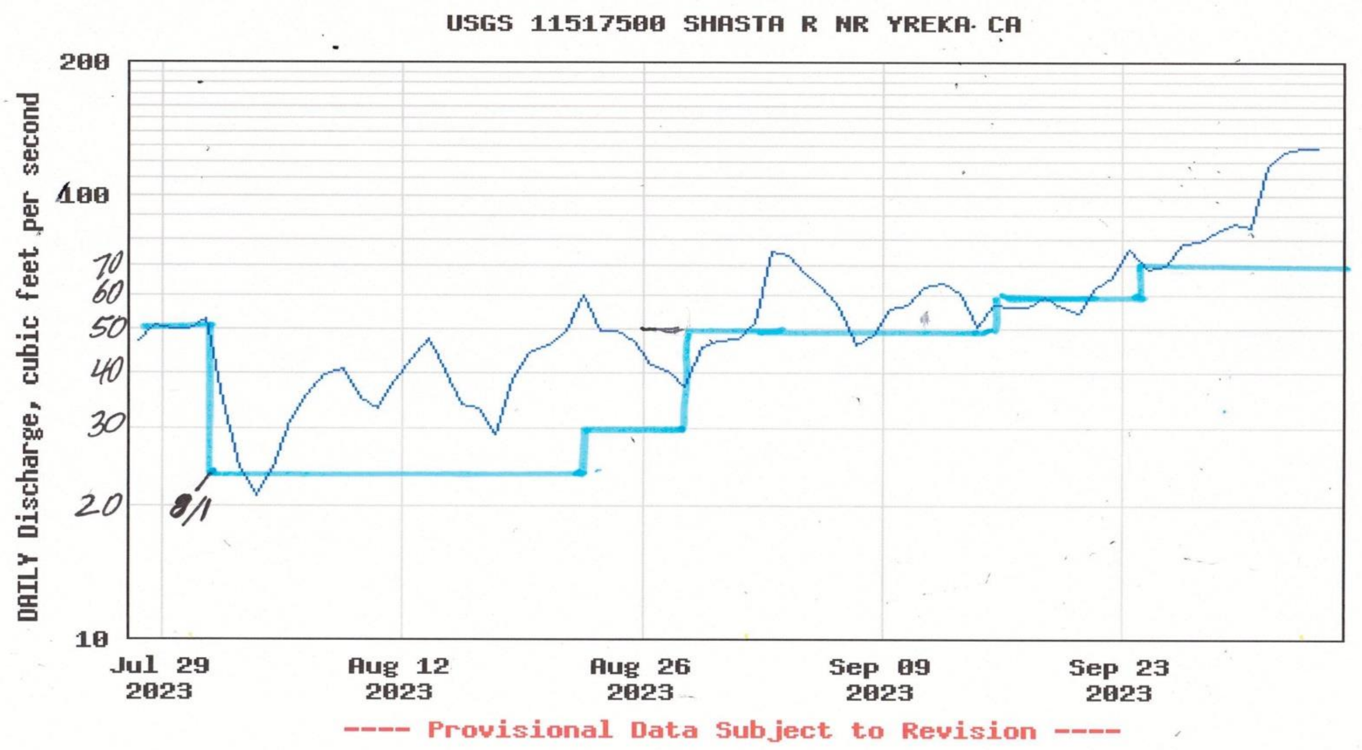
- McBain and Trush – Shasta River Big Springs Complex Interim Instream Flow Needs Assessment, 2013

- National Marine Fisheries Service (NMFS) Shasta River Safe Harbor Agreement Flow Management Strategy, 2020

2023 Local Flow Trial

- Podlech developed guide 8/1 - 9/30 using Yreka gage
- Participants included ground water, riparian users and adjudicated rights within decree
- SHA contributions assisted and maintained over-summering habitat
- Utilized neighborhood reaches/gages to achieve canyon objective in reach based approach

2023 Locally Led Trial



Transition to Long Term Approach

- Our Proposed Emergency Approach transitions well to long term objectives
- Monitoring plan and monitoring budget must become an active part of this effort
- Science Assessment panel must be developed to fairly interpret data and guide monitoring/trials for each watershed
- Regulatory urgency cannot get ahead of science

2024 E-regs need revisions and more flexibility

- Shasta Valley Producers, Siskiyou County Farm Bureau, AgWA willing to provide redline version of 2022 e-regs
- Surface water and/or groundwater LCS boundaries can be less defined
- Stock water prohibition shortened or based on reasonable flow values
- Recharge and recharge research is an investment in the future

Summary

- We want to address flow issue with you
- Our knowledge/ willingness is invaluable
- We have broadened our vision
- Respect and complement on-going processes
- Science must lead

Elias Scott Emergency Flows Presentation (20 minutes, Scott & Shasta)

- Please provide a brief overview of your February 10, 2023, Analysis of Mike Podlech's Memo dated June 13, 2023, Regarding CDFW Instream Flow Recommendations for the 2022 Readoption of Drought Emergency Recommendations, as well as other water quality data and information pertinent to evaluating the impact of the emergency regulation.
- Did water quality change in the Scott and Shasta following implementation of the emergency flow requirements? If so, describe the data and changes that were observed, and any associated conclusions regarding benefits to water quality parameters associated with Scott/Shasta fisheries.

Elias Scott Emergency Flows Presentation (20 minutes, Scott & Shasta)

- What other factors should the Board be considering with respect to emergency flows (e.g., provide recommended ramp down flows at end of regulation, etc.)?

- The flow requirements in the Scott River watershed were not met in the summer and fall of 2022, even though curtailments were in place. The Board has received conflicting input regarding these flow targets, one set of input stating that the flow targets are too high and cannot be met in certain water years, another set of input stating that noncompliance with curtailments and additional curtailment of groundwater would have resulted in higher flows, and another set focused on the improvements in the system even when the target flows themselves are not reached. What factors or information should the Board be considering relative to the fact that the flows were not met?

Flow and Water Quality in the Scott and Shasta Watersheds

Eli Scott
Senior Environmental Scientist
Scott and Shasta Watershed Steward
North Coast Regional Water Quality Control Board

CALIFORNIA Water Boards

State Water Resources Control Board Staff Workshop, October 6, 2023

Topics to Cover

- Flow and the Scott and Shasta TMDLs
- Data Collection Efforts
- Water quality observations
  - Scott River Observations
  - SRWA Curtailment Violation
  - Podlech 30 cfs proposal

Scott and Shasta Watersheds

- Scott – Snow-melt driven, deep alluvial basin
- Shasta – Spring fed, volcanic, stable base flow
- Scott River TMDLs –Sediment and Temperature
  - 303(d) listed for sediment in 1992
  - 303(d) listed for temperature in 1998
  - TMDLs for sediment and temperatures approved by the EPA in 2006

Scott and Shasta Watersheds

- Shasta River TMDLs – Dissolved Oxygen and Temperature
  - Listed for organic enrichment/dissolved oxygen in 1992
  - Listed for temperature in 1994
  - TMDLs for dissolved oxygen and temperature approved by the EPA in 2007

Flow as a Driver of Impairment - Scott

- Scott River temperature impairment driven by 5 main anthropogenically influenced factors:
  - Stream shade provided by riparian vegetation
  - **Stream flow affected by changes in groundwater accretion**
  - **Stream flow affected by surface diversion**
  - Channel geometry
  - Microclimate

Flow as a Driver of Impairment - Scott

- Stream flow affected by changes in groundwater accretion
  - Source of cold water
  - Contributions from groundwater develop temperature refugia and provide increased **flow** and **thermal mass**
  - Thermal mass buffers temperature changes from atmospheric temperature, solar radiation, and inputs of warmer water (tributary or tailwater flows)
  - **Increased flow reduces travel time**, thus reducing the time a unit of water is exposed to solar radiation
  - **Increased flow increases pool depth**, providing additional temperature refugia

Flow as a Driver of Impairment - Scott

- Stream flow affected by surface diversion
  - Especially important in smaller tributaries, which tend to host over-summer juvenile salmonid rearing
    - **Total diversions can constitute a large proportion of total stream flow**
    - French Creek, Shackleford Creek, Kidder Creek, East Fork Scott

Flow as a Driver of Impairment - Shasta

- Shasta River temperature impairment driven by 5 main anthropogenically influenced factors:
  - Stream shade provided by riparian vegetation
  - Tailwater return flows
  - **Stream flow affected by groundwater accretion and spring inflows**
  - **Stream flow affected by surface diversion**
  - Lake Shastina and minor channel impoundments

Flow as a Driver of Impairment - Shasta

- Stream flow affected by groundwater accretion and spring inflows (cold water inputs)
  - June 16, 2022
    - Big Springs Creek and Little Springs Creek - approximately 73 cfs
    - Shasta River at GID Pumps - 92 cfs
    - **Big Springs and Little Springs ~ 80% of the Shasta River flow**
  - Smaller springs and accretions
    - Enhance larger cold water sources
    - Provide over-summer refugia

Shasta River Above Big Springs Creek, April 15, 2021

Big Springs Creek, April 15, 2021

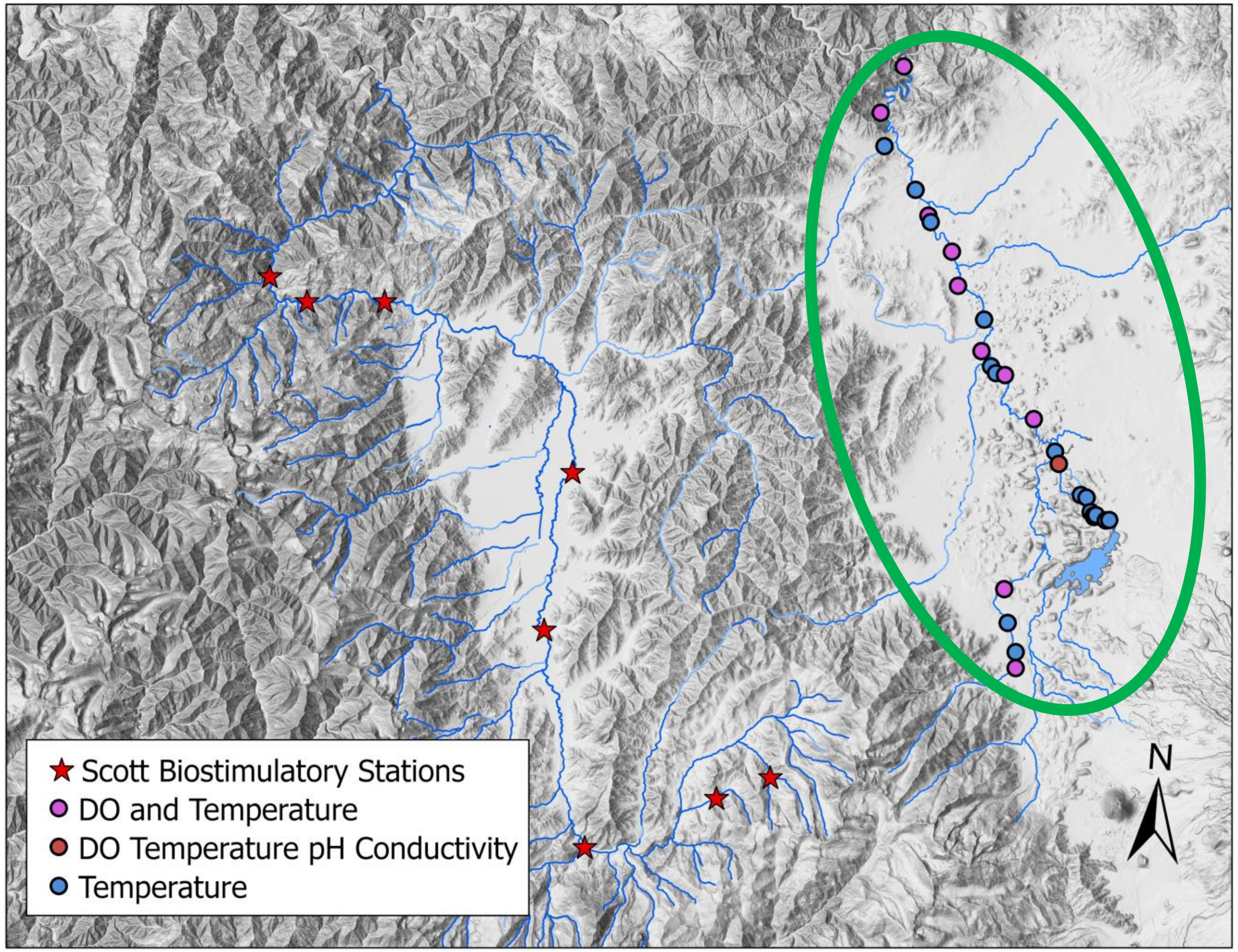
Flow as a Driver of Impairment - Scott

- Surface diversions and Stream Flow
  - Surface diversions (Riparian + Adjudicated) downstream of Big Springs Creek can range from 60 – 120 cfs depending on availability
  - Decrease thermal mass and velocity → Increases travel time and the impacts of air temperature/solar radiation
  - Increases the overall effect of heating from irrigation tailwater.

Water Quality Monitoring Efforts

Shasta – Stewardship Monitoring Network

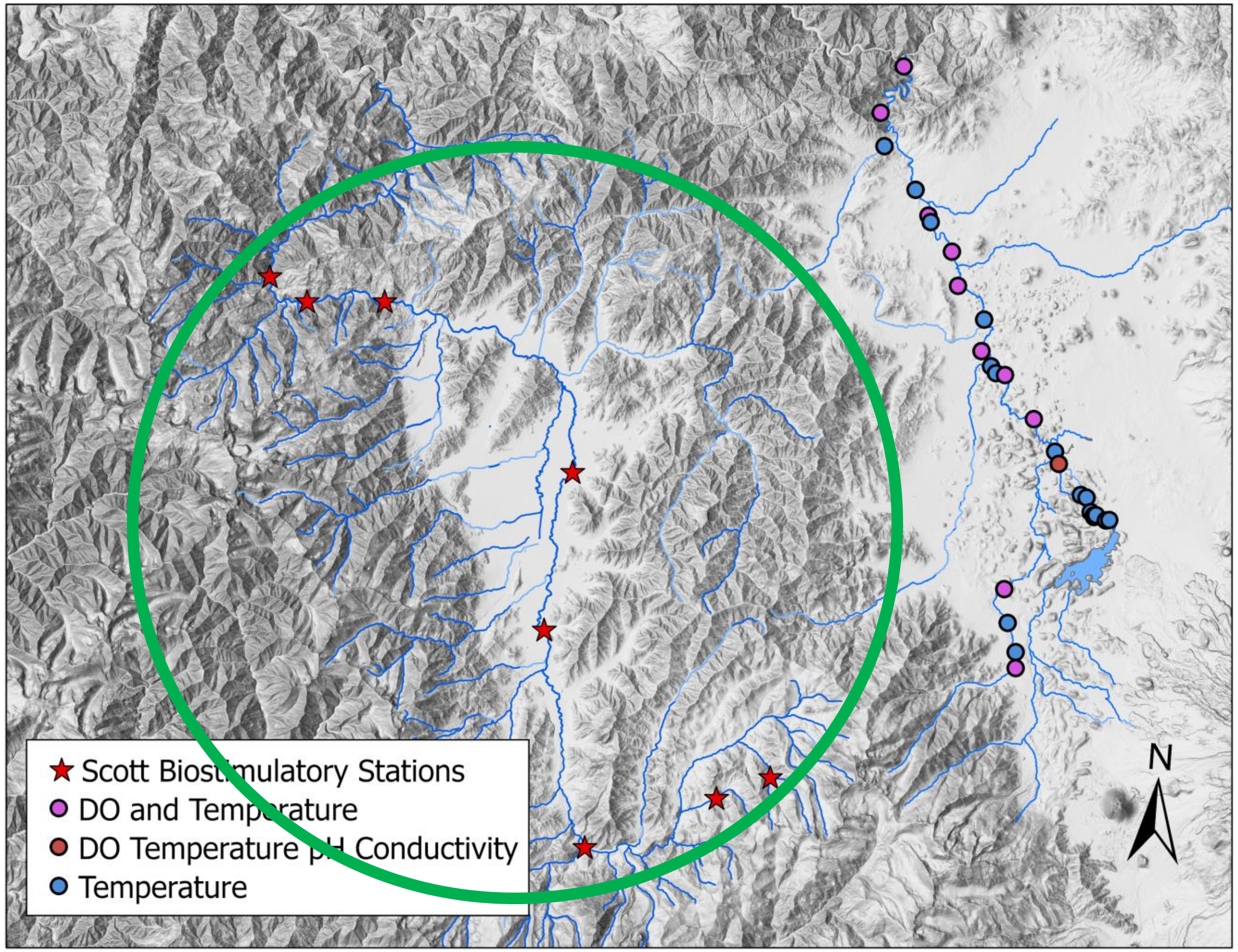
- Continuous temperature and dissolved oxygen
- 33 Temperature stations
- 10 dissolved oxygen Stations
- Deep historical record



Water Quality Monitoring Efforts

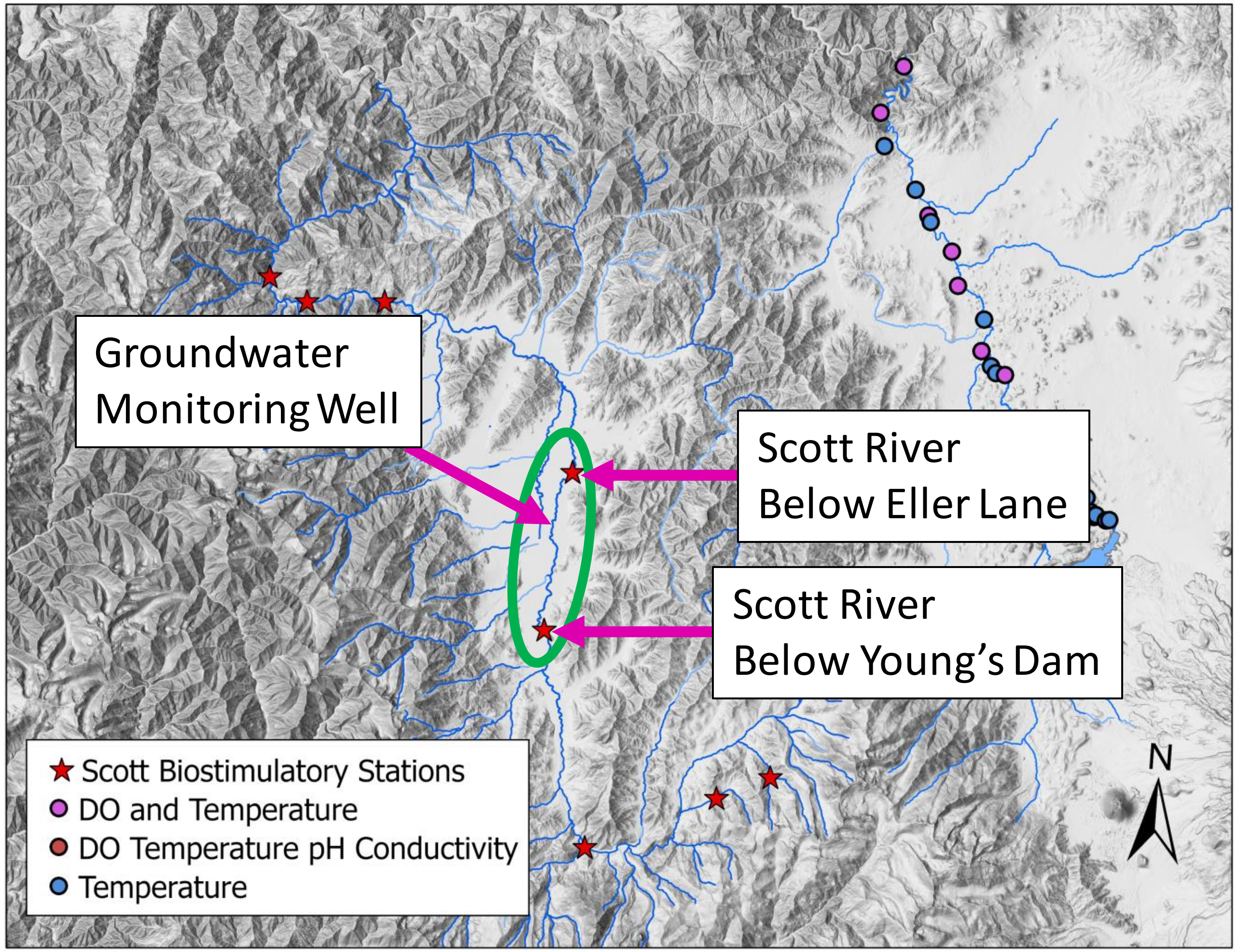
Scott - Biostimulatory Conditions Monitoring

- 7 Locations, focused on the mainstem
- Biweekly nutrient and photopoint monitoring
- Continuous temperature and dissolved oxygen
- Summertime baseflow measurement
- CRAM every 5 years



Assessing Impacts of the Emergency Regulation

- Scott River below Eller Lane
- Scott River below Young's Dam
- Groundwater monitoring well between these sites
- Caveat: Site-specific changes between two years at each site.



Effect of the Emergency Regulations - Scott

Scott River Below Eller Lane – August 11, 2021
No Regulation

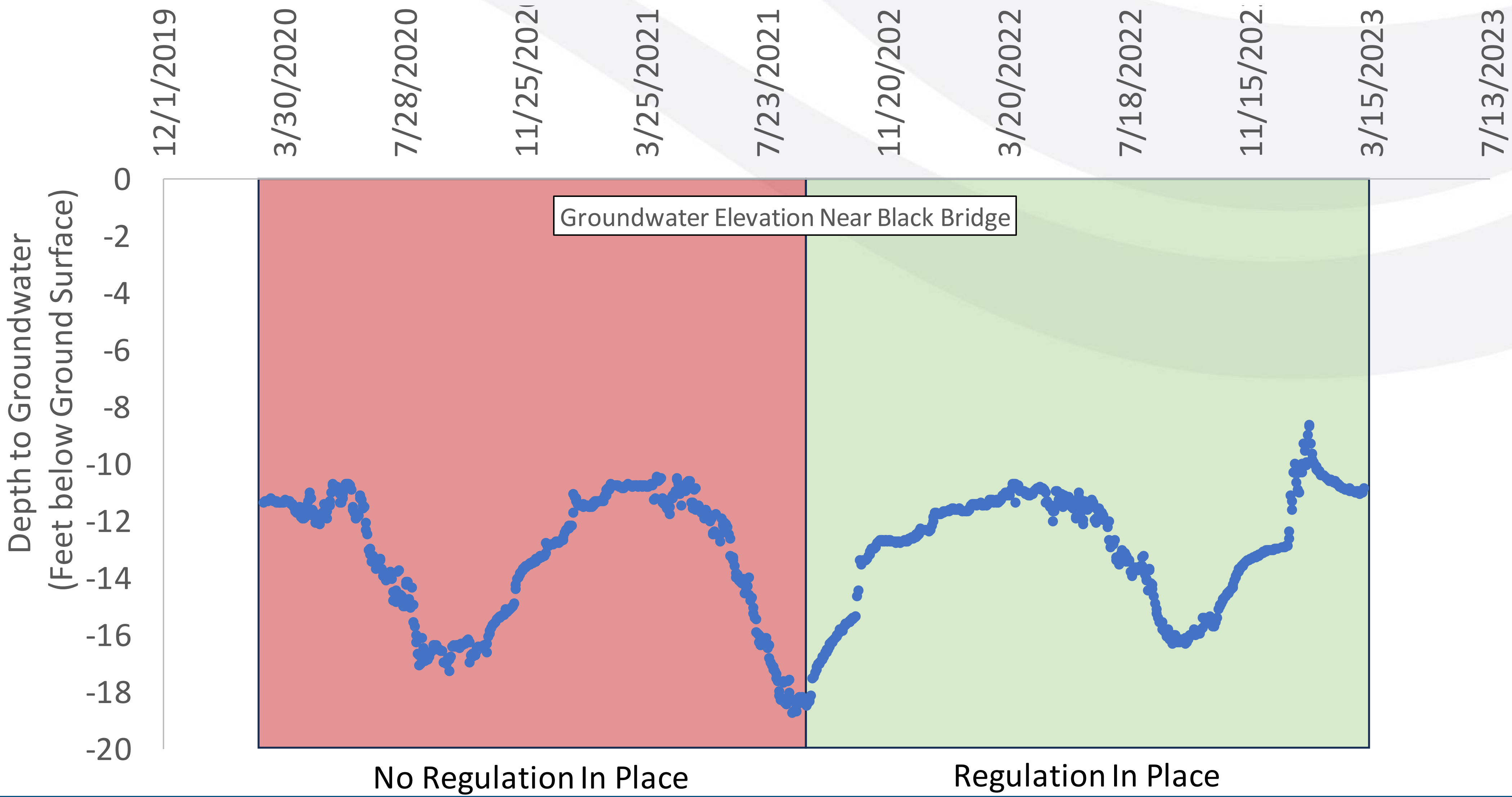
Scott River Below Eller Lane – August 17, 2022
Regulation In Place

Effect of the Emergency Regulations - Scott

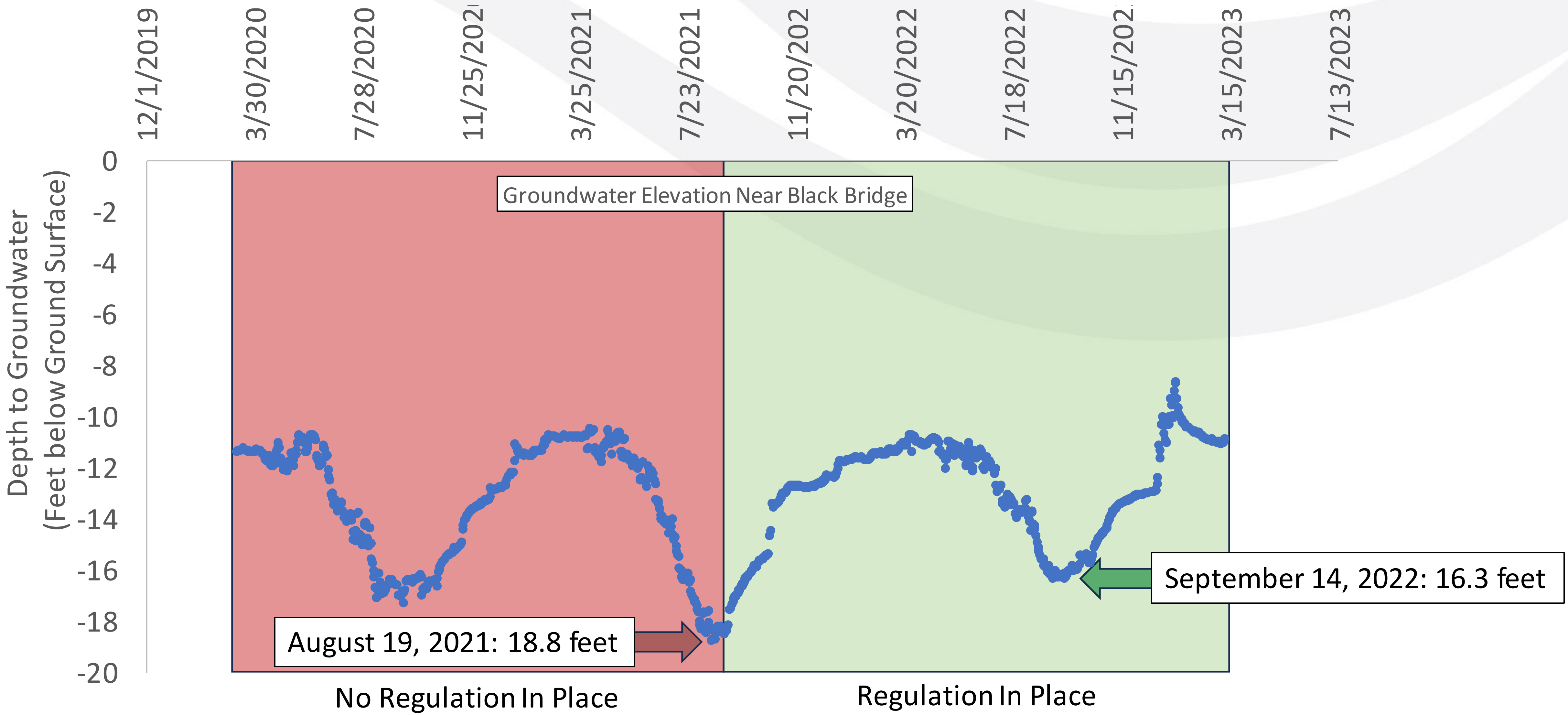
Scott River Below Youngs Dam – August 11, 2021
No Regulation

Scott River Below Youngs Dam – August 17, 2022
Regulation In Place

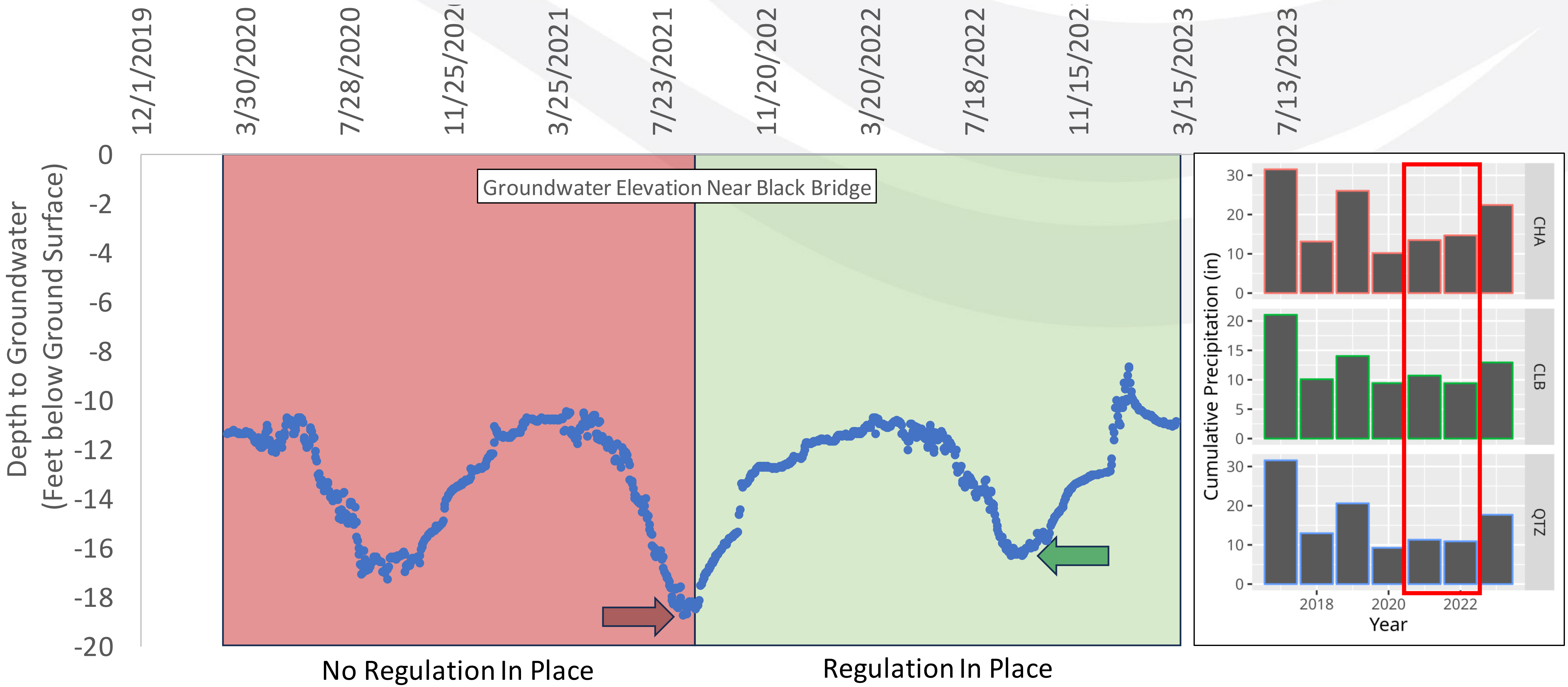
Effect of the Emergency Regulations - Scott



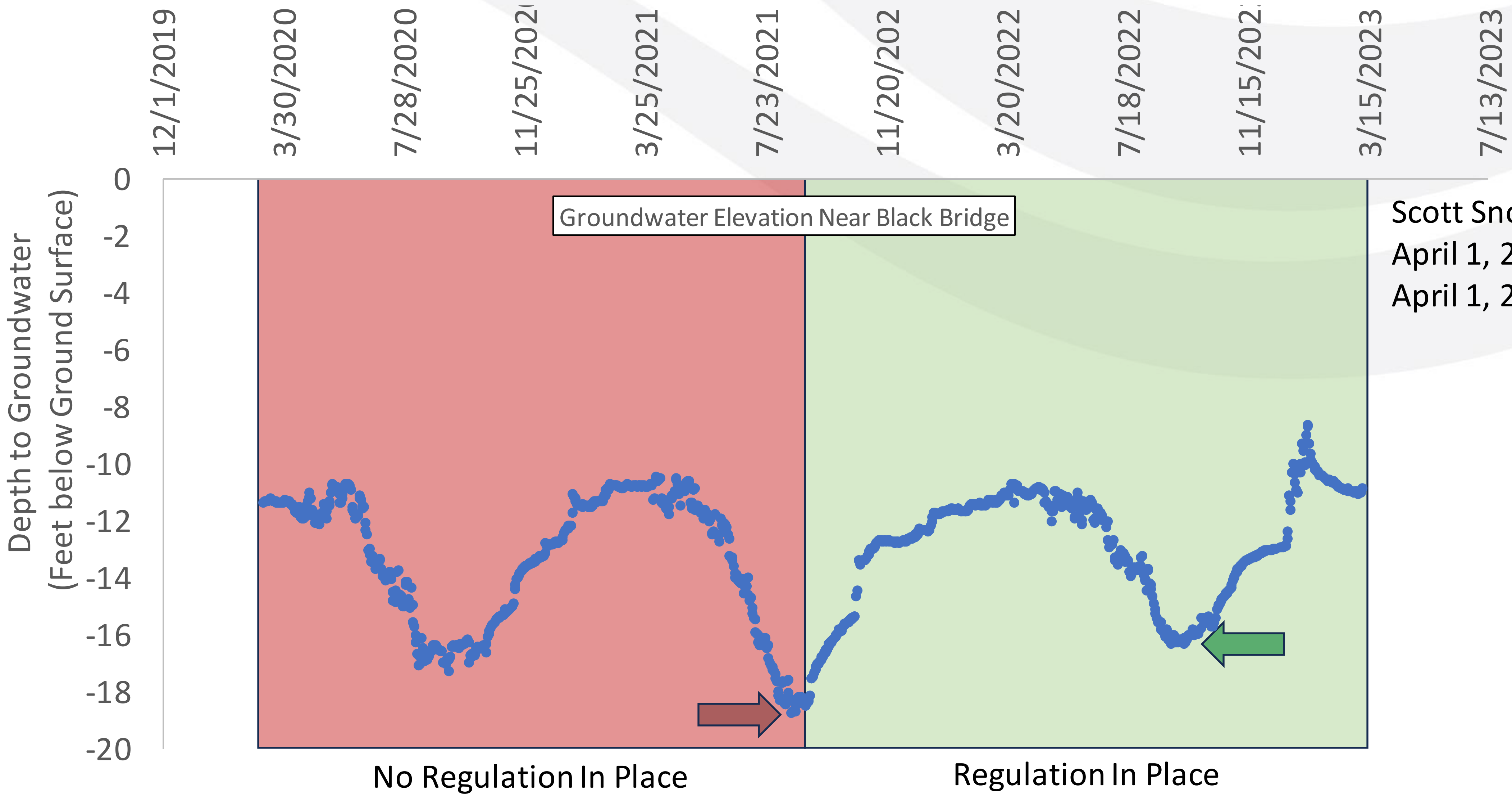
Effect of the Emergency Regulations - Scott



Effect of the Emergency Regulations - Scott

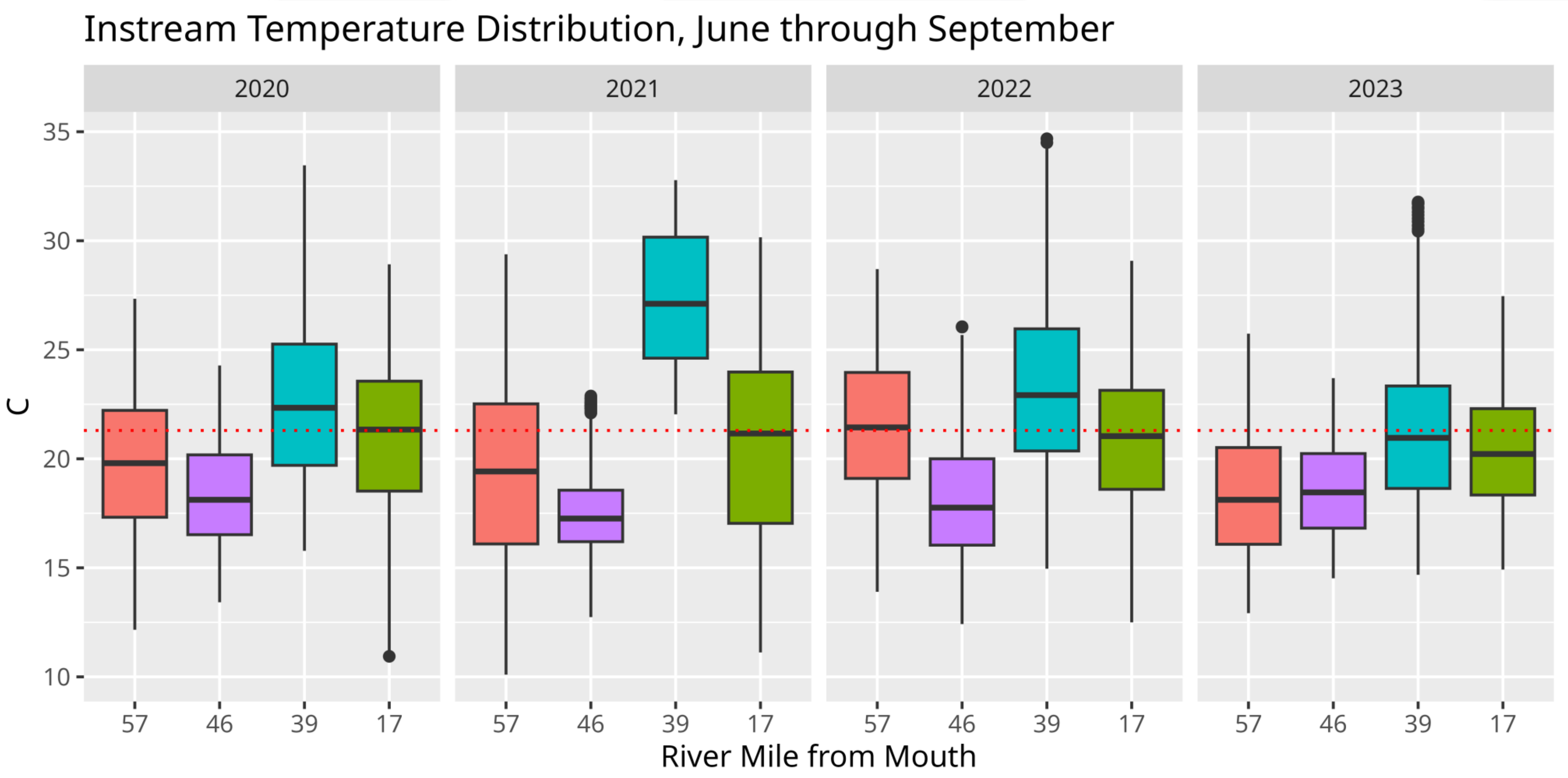


Effect of the Emergency Regulations - Scott



Scott Snowpack
April 1, 2021: 73%
April 1, 2022: 27%

Effect of the Emergency Regulations - Scott



Effect of the Emergency Regulations - Scott

The Good

- Increased groundwater elevations in 2022 as compared to 2021
- Increased wetted area across much of the watershed

The Less Good

- Summer groundwater-fed baseflows insufficient to counter the effects of atmospheric temperature, incoming solar radiation
- Fourth lowest Chinook run in the Scott in the 45-year record
- Only 7% of estimated returning spawners made it into the valley

Recommendations for Fall Flows - Scott

Preserving Scott River flows comes down to timing.

- Timing of fall/winter precipitation
- Timing of snow melt
- Timing of groundwater extraction (Cut off dates, In-Lieu Recharge, etc)
- Timing of groundwater recharge -> timing of instream groundwater accretions
- Need to understand how each effort ties into timing
- Need to clearly quantify timing uncertainty in our models
    - SVIHM, River Forecasting, etc

Recommendations for Fall Flows - Scott

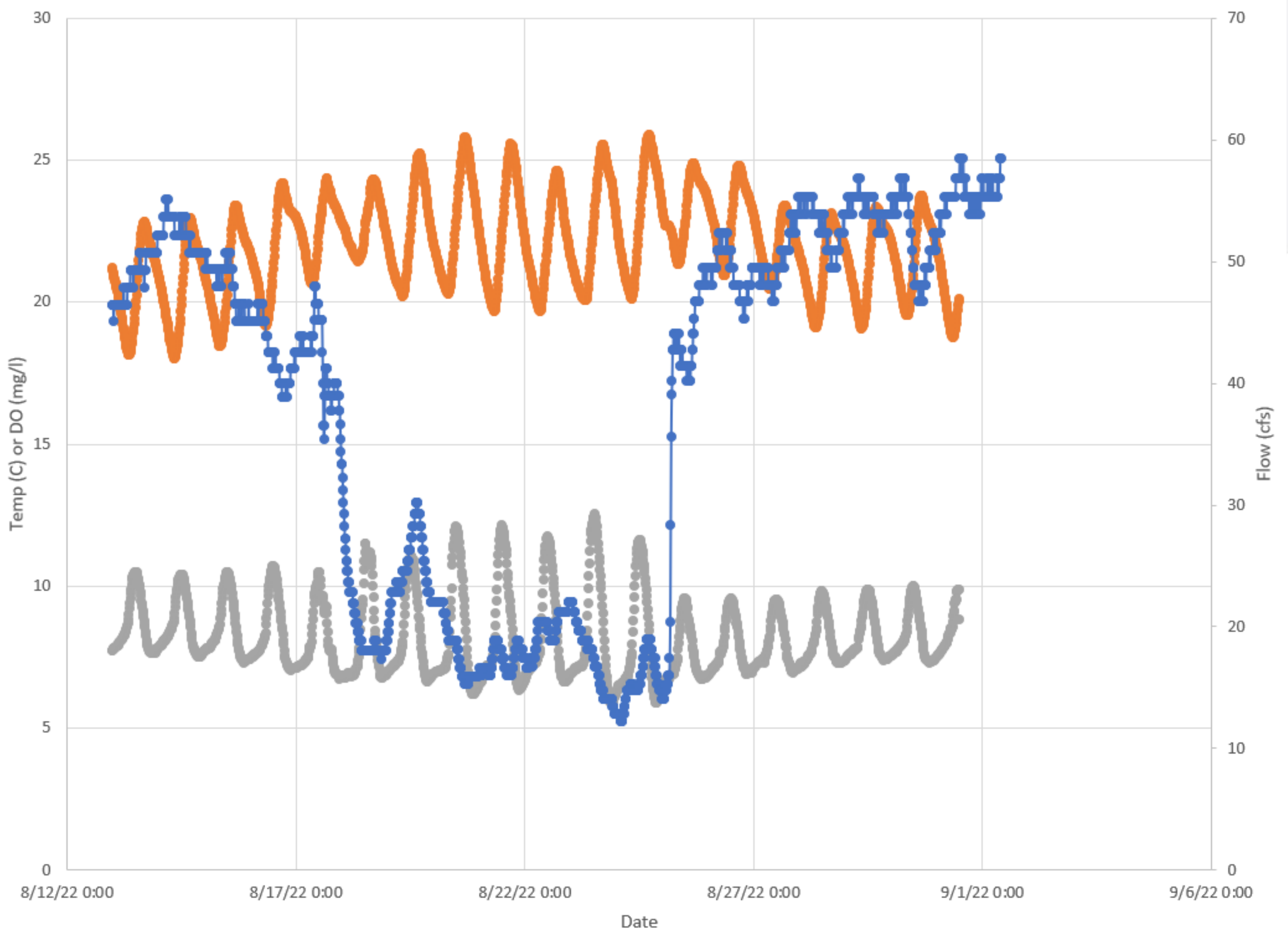
- Strategic irrigation management – establish thresholds for groundwater elevations that trigger a change in irrigation practices
  - Could include pumping cut-off date based on water year type
- Implement Managed Aquifer Recharge (MAR) and In-lieu Recharge (ILR) to their fullest extent, coupled with surface diversions limitations tied to low flows at FJ gage
- 20% improvement in irrigation efficiency where appropriate
  - Major improvements over the last decade, still room for improvement

Effect of the Emergency Regulations - Shasta

- Two “flow experiments”
  - SRWA Curtailment Violation
  - Analysis of Podlech 30 cfs recommendation
- Hypotheses regarding drivers of water quality conditions

Shasta River Water Association

- Violated curtailment between August 17 and August 25
- Flows dropped from 46.8 cfs to as low as 11.7 cfs
- Impacts to water quality observed included increase in daily maximum temperature and a stronger diurnal fluctuation in DO
- Measured at Salmon Heaven, temperature TMDL compliance point in the Shasta River canyon



Impacts of Flow on Temperature

Time Period	Average Flow (cfs)	Average Daily Max Water Temp (C)	Average Daily Max Air Temp (C)	Number of Days
Pre-Diversion	47.4	23.27	37.17	5
Diversion	19.4	25.33	37.83	5
Post Diversion	51.7	23.67	36.95	5
Difference in Temp		1.86	0.51	

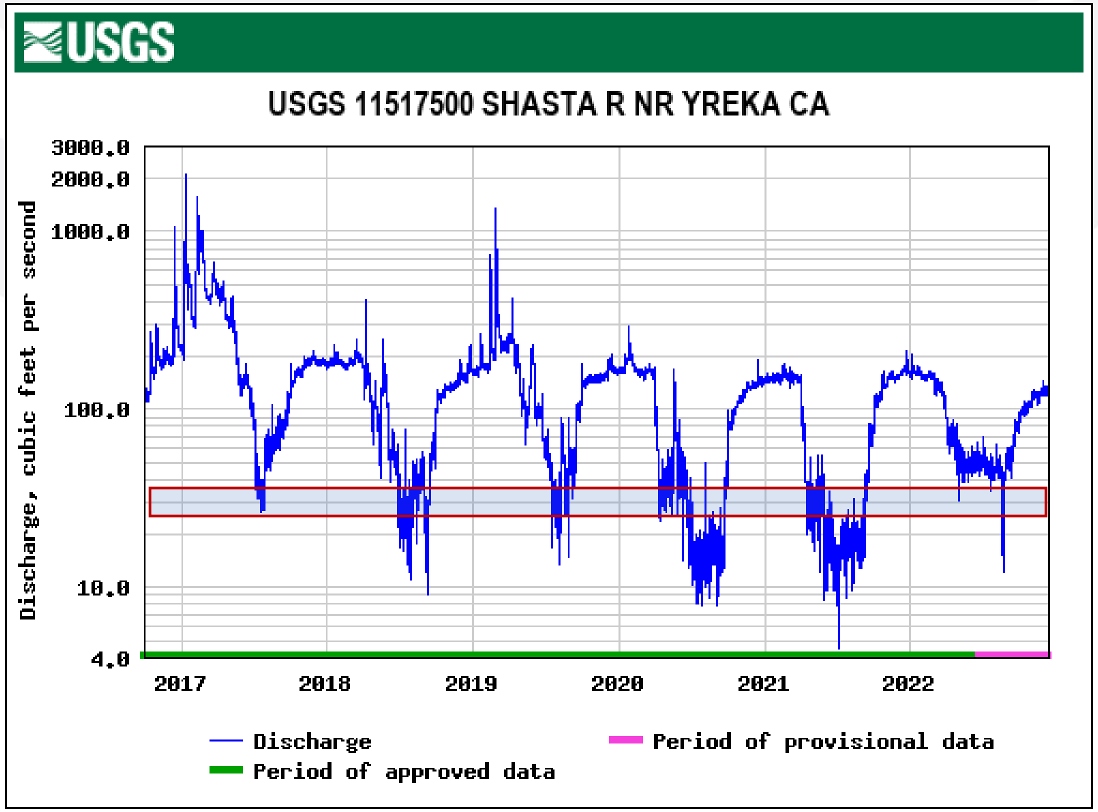
- Diversion by SRWA resulted in increased temperature by 1.86 C

Podlech Recommendation

- Recommended lowering the summertime minimum instream flow requirements in the Shasta from 50 cfs to 30 cfs
- Analyzed McBain and Trush, 2014 – Shasta River Canyon Instream Flow Needs
- State Water Board requested Regional Board analyze the water quality impacts of a potential 30 cfs summer-time flow target

Regional Water Board Analysis

- Three flow regimes:
  - Baseline (pre-curtailment): 2021 July flows
  - Podlech: Identified 2018 July flows as most comparable to Podlech's recommendation
  - Curtailment: 2022 July flows
- Reviewed Maximum Temperature at Salmon Heaven as well as MWMT across the Shasta



Results

Year	Date Range	Average Daily Flow (cfs)	Average Daily Max Air Temp (C)	Average Daily Max Solar Radiation (W/m³)	Average Daily Max Water Temp (C)	Change (C)
Baseline	7/10 – 7/20	18.5	38.7	1014	27.8	N/A
Podlech	7/14 – 8/3	25.5	38.6	904	26.7	1.1
Curtailment	7/10 – 7/20	46.2	38.6	1069	26.0	1.8

- All study windows had **relatively similar** average daily maximum air temperatures, indicating similar impact of air temperature on water temperatures
- Podlech Flows had the lowest average daily maximum solar radiation
  - **Expect lower water temperatures**

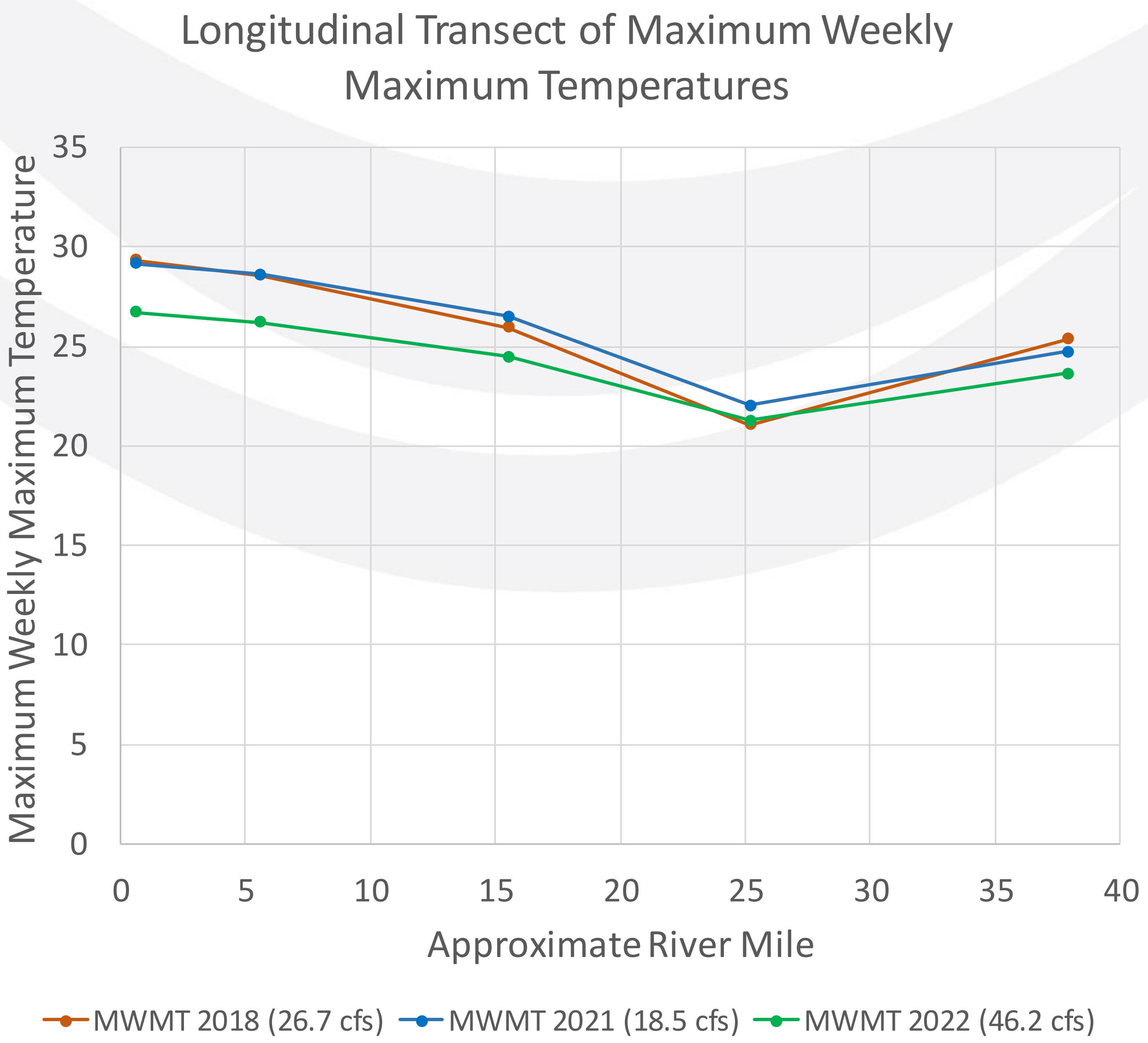
Results

Year	Date Range	Average Daily Flow (cfs)	Average Daily Max Air Temp (C)	Average Daily Max Solar Radiation (W/m³)	Average Daily Max Water Temp (C)	Change (C)
Baseline	7/10 – 7/20	18.5	38.7	1014	27.8	N/A
Podlech	7/14 – 8/3	25.5	38.6	904	26.7	1.1
Curtailment	7/10 – 7/20	46.2	38.6	1069	26.0	1.8

- Podlech Flows showed a **1.1 C** reduction in average daily maximum temperature over Baseline
- Curtailment flow of 50 cfs showed a **1.8 C** reduction in average daily maximum temperature over Baseline
- Curtailment Flow of 50 cfs had a **greater reduction** in instream temperature despite having the highest average daily maximum solar radiation

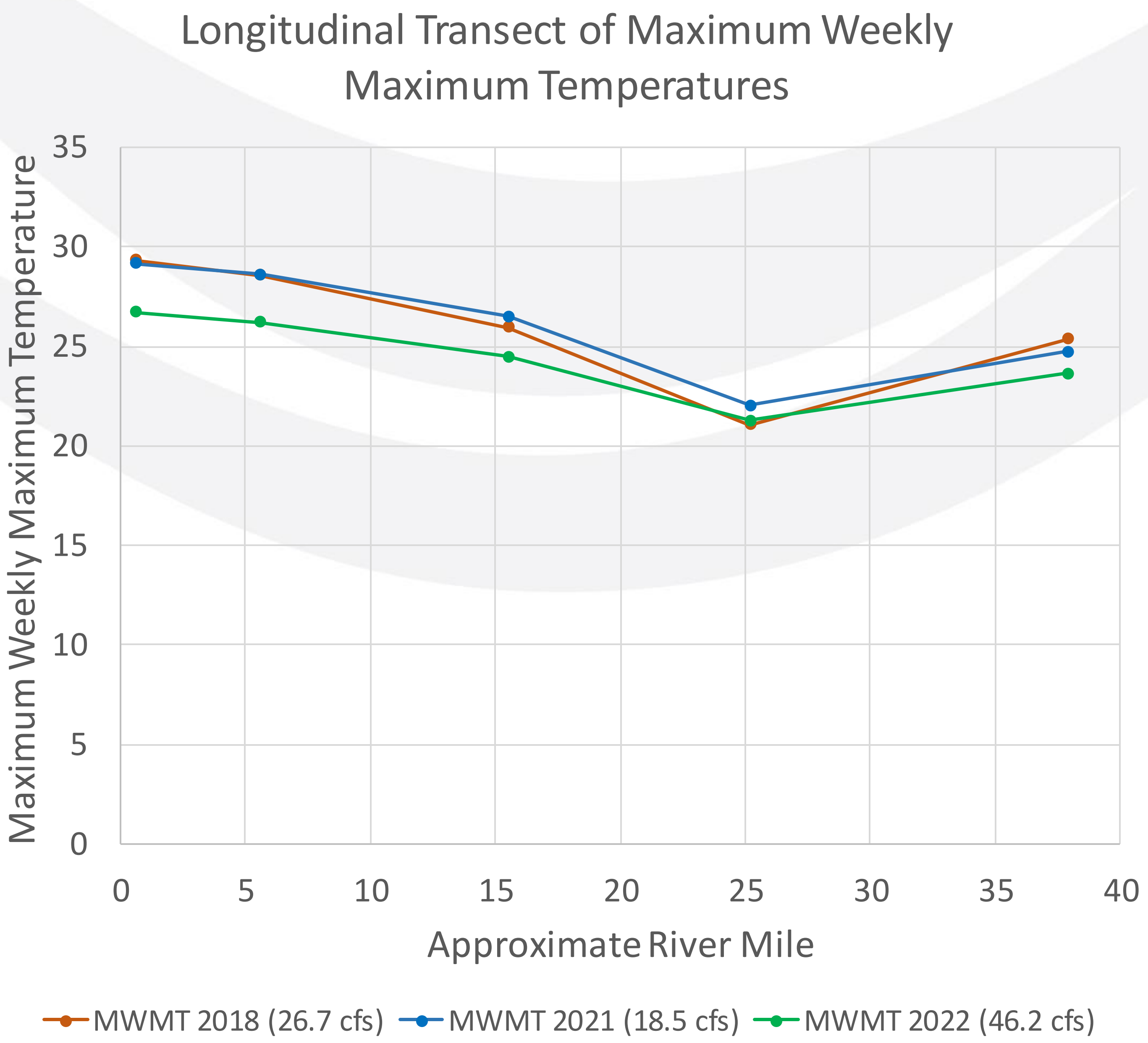
Results

- Curtailment Flow showed consistent improvement in instream temperature from River Mile 25 to the mouth – 2.41C reduction in MWMT.
- Podlech Flow shows some improvement from River Mile 25 to 15, but then returns to baseline conditions seen in 2021.
- Curtailment Flow may have provided more available habitat downstream of Big Springs confluence to support over summering Juvenile Salmonids



Results

- CDFW 2022 Field Memo indicates presence of Steelhead at Salmon Heaven on July 27, 2022, indicating potential cold-water refugia being utilized for over summering.



Conclusions

- 30 cfs may provide temperature reductions compared to baseline condition, but less of a benefit than 50 cfs
- MWMT analysis shows 30 cfs provides no discernable water quality benefits over 2021 baseline starting at about RM 15
- 50 cfs appears more effective to preserve cold water to the mouth. Hypothesize that this is due to:
    - Reduced travel time from increased water velocity
    - Reduction in tailwater inputs due to reduced water use
    - Preservation of localized cold-water inputs, which provide refugia
- **50 cfs is the water quality equivalent of "belly scraping flows"**

Effect of the Emergency Regulations - Shasta

- Increased cold water Flow from Big Springs due to the priority of Big Springs Irrigation District's Right
  - First to be curtailed in the watershed
- Decreased diversion of surface water during critical summer period
  - Preserves cold water further downstream
- Observed decreased instream temperatures in the most downstream reaches
- Increased habitat availability for salmonids during the summer months

Questions?

Dr. Thomas Harter and Leland Scantlebury, UC Davis (10 minutes) and Bronwen Stanford, The Nature Conservancy (10 minutes)

- Some third parties characterize the existing Scott Valley Integrated Groundwater Hydrologic Model results as saying that the emergency flow targets are too high and would be impossible to meet in most years. Is this a fair characterization? Why or why not?
- What other factors should the Board be considering with respect to emergency flows (e.g., provide recommended ramp down flows at end of regulation, etc.)?

Dr. Thomas Harter and Leland Scantlebury, UC Davis (10 minutes) and Bronwen Stanford, The Nature Conservancy (10 minutes)

- The flow requirements in the Scott River watershed were not met in the summer and fall of 2022, even though curtailments were in place. The Board has received conflicting input regarding these flow targets, one set of input stating that the flow targets are too high and cannot be met in certain water years, another set of input stating that noncompliance with curtailments and additional curtailment of groundwater would have resulted in higher flows, and another set focused on the improvements in the system even when the target flows themselves are not reached. What factors or information should the Board be considering relative to the fact that the flows were not met?

EMERGENCY FLOWS:

Some third parties characterize the existing Scott Valley Integrated Groundwater Hydrologic Model results as saying that the **emergency flow targets are too high and would be impossible to meet in most years. Is this a fair characterization?** Why or why not?

Thomas Harter, Leland Scantlebury, Claire Kouba, Jonas Pyschik[1], and Laura Foglia
University of California Davis

[1] now at University of Freiburg, Germany

State Water Resources Control Board Workshop, October 6, 2024

EMERGENCY FLOWS:

Some third parties characterize the existing Scott Valley Integrated Groundwater Hydrologic Model results as saying that the **emergency flow targets are too high and would be impossible to meet in most years. Is this a fair characterization?** Why or why not?

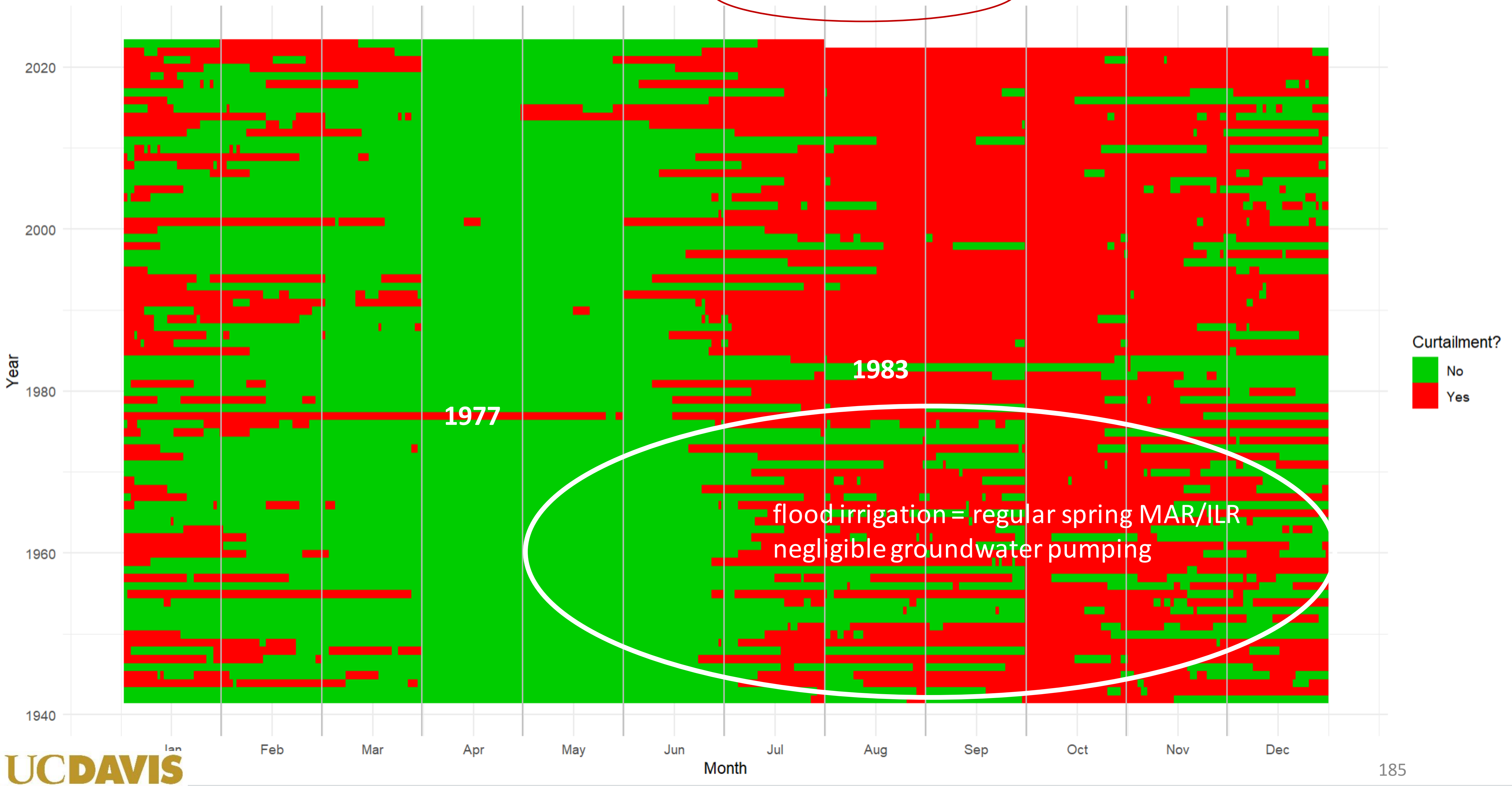
Thomas Harter, Leland Scantlebury, Claire Kouba, Jonas Pyschik[1], and Laura Foglia
University of California Davis

[1] now at University of Freiburg, Germany

- Without actions: in 1 of 4 years (since 2020: 1 in 5 years)
- Curtailment rules of 2022, in 24 of 32 years in 1991-2023:
  - no significant improvement in summer flows
  - more pronounced improvements in fall flows
- Full curtailment of groundwater and surface water, in 24 of 32 years in 1991-2023:
  - significant increase in the number of years where summer flows are compliant
  - almost all fall flows in compliance with the emergency flows, especially in September and October

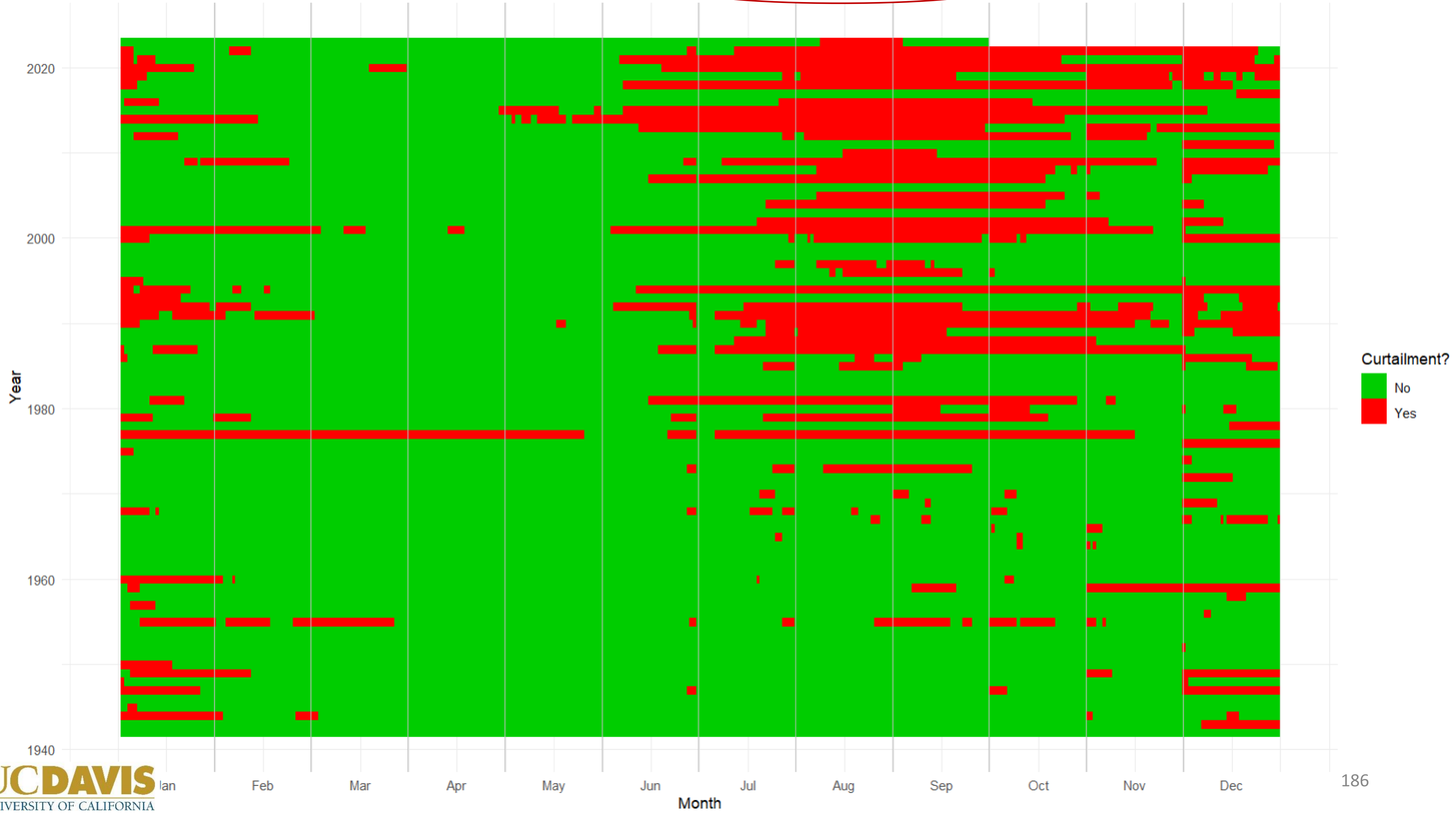
UCDAVIS
UNIVERSITY OF CALIFORNIA

Hypothetical historic curtailments in Scott Valley based on historic flows and 2017 CDFW instream flow table, Pyschik and Harter, UC Davis 2023.



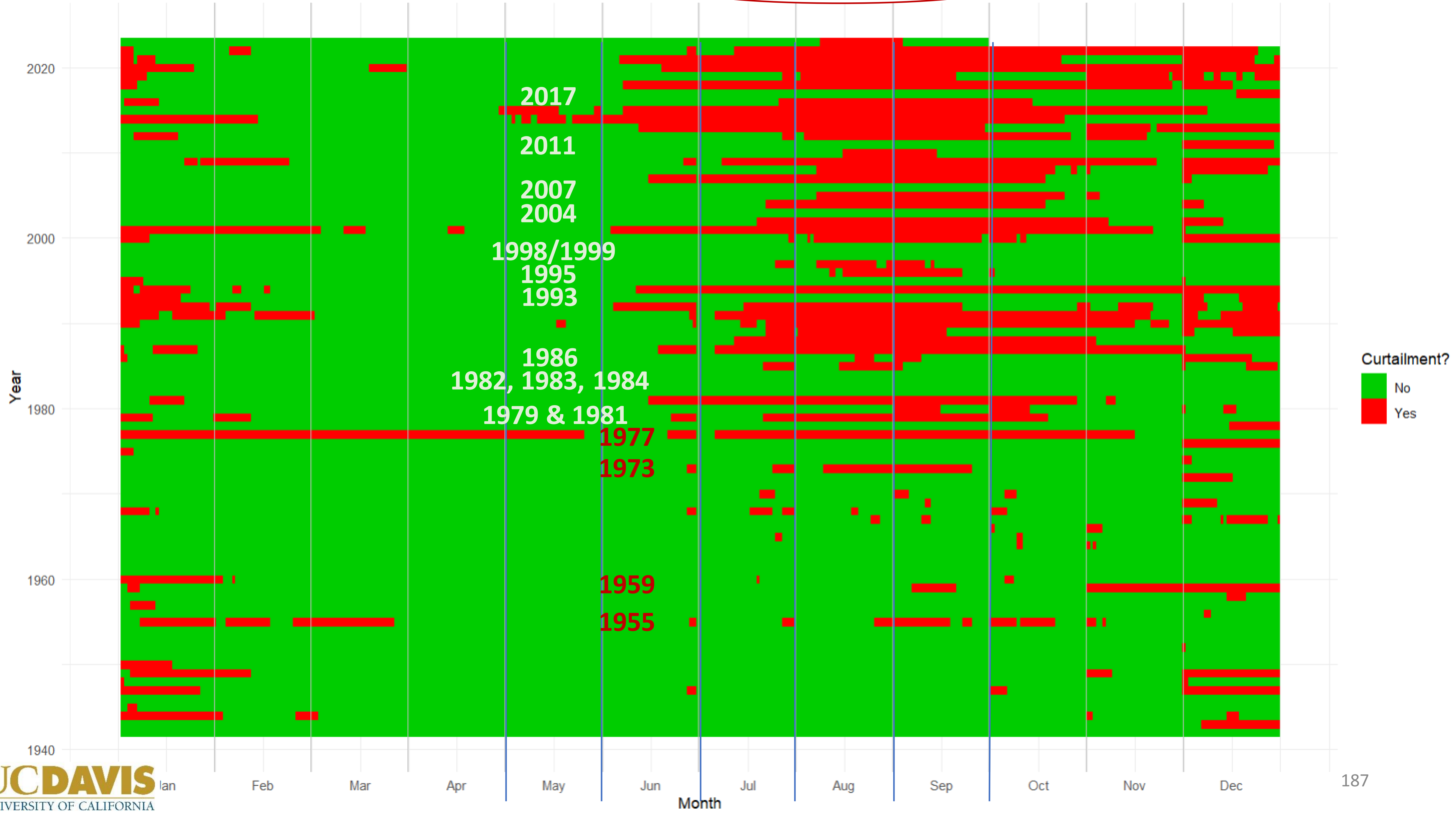
UCDAVIS
UNIVERSITY OF CALIFORNIA

Hypothetical historic curtailments in Scott Valley based on historic flows and 2021 SWRCB Emergency Flows, Pyschik and Harter, UC Davis 2023.

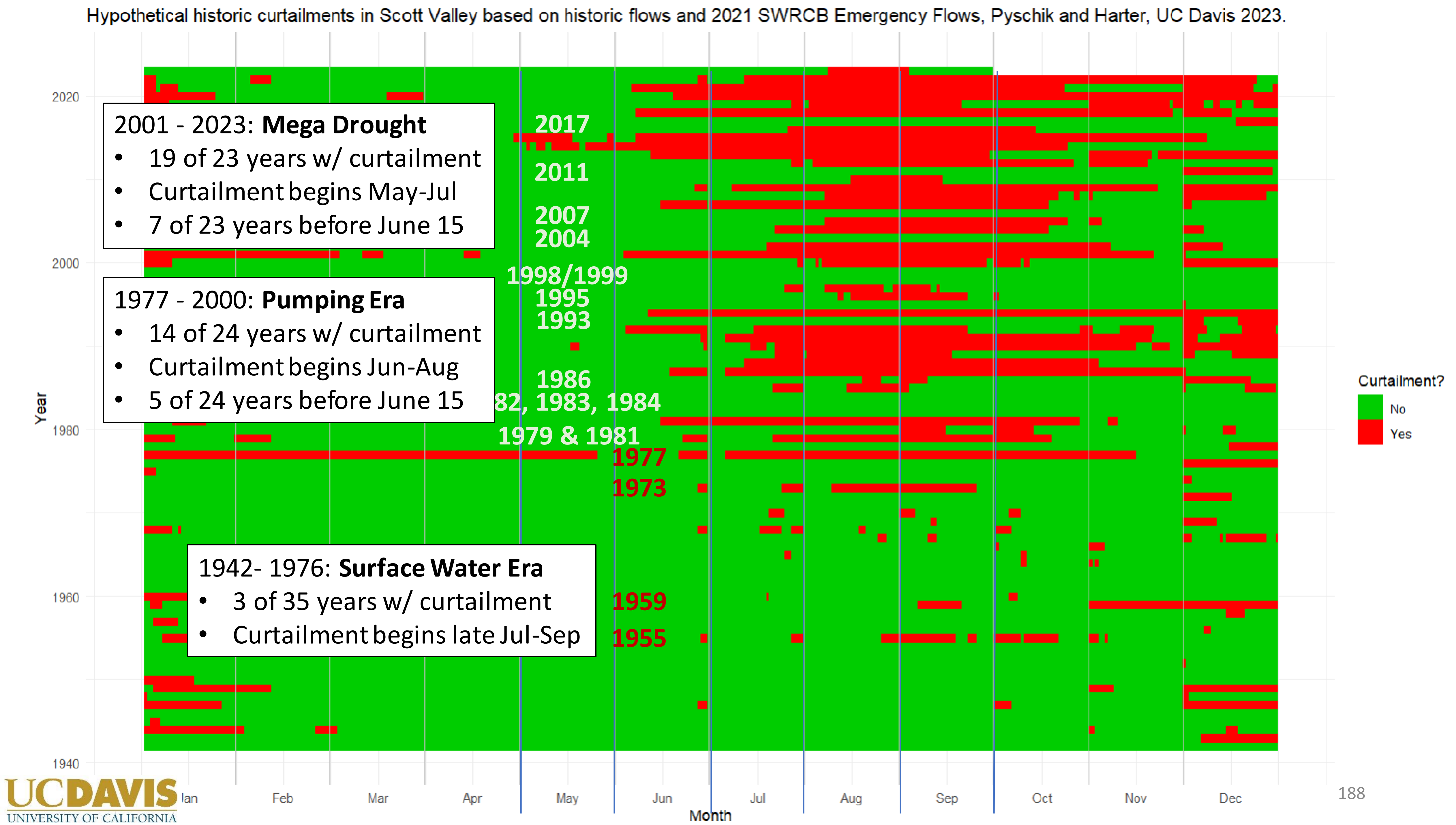


UC DAVIS
UNIVERSITY OF CALIFORNIA

Hypothetical historic curtailments in Scott Valley based on historic flows and 2021 SWRCB Emergency Flows, Pyschik and Harter, UC Davis 2023.

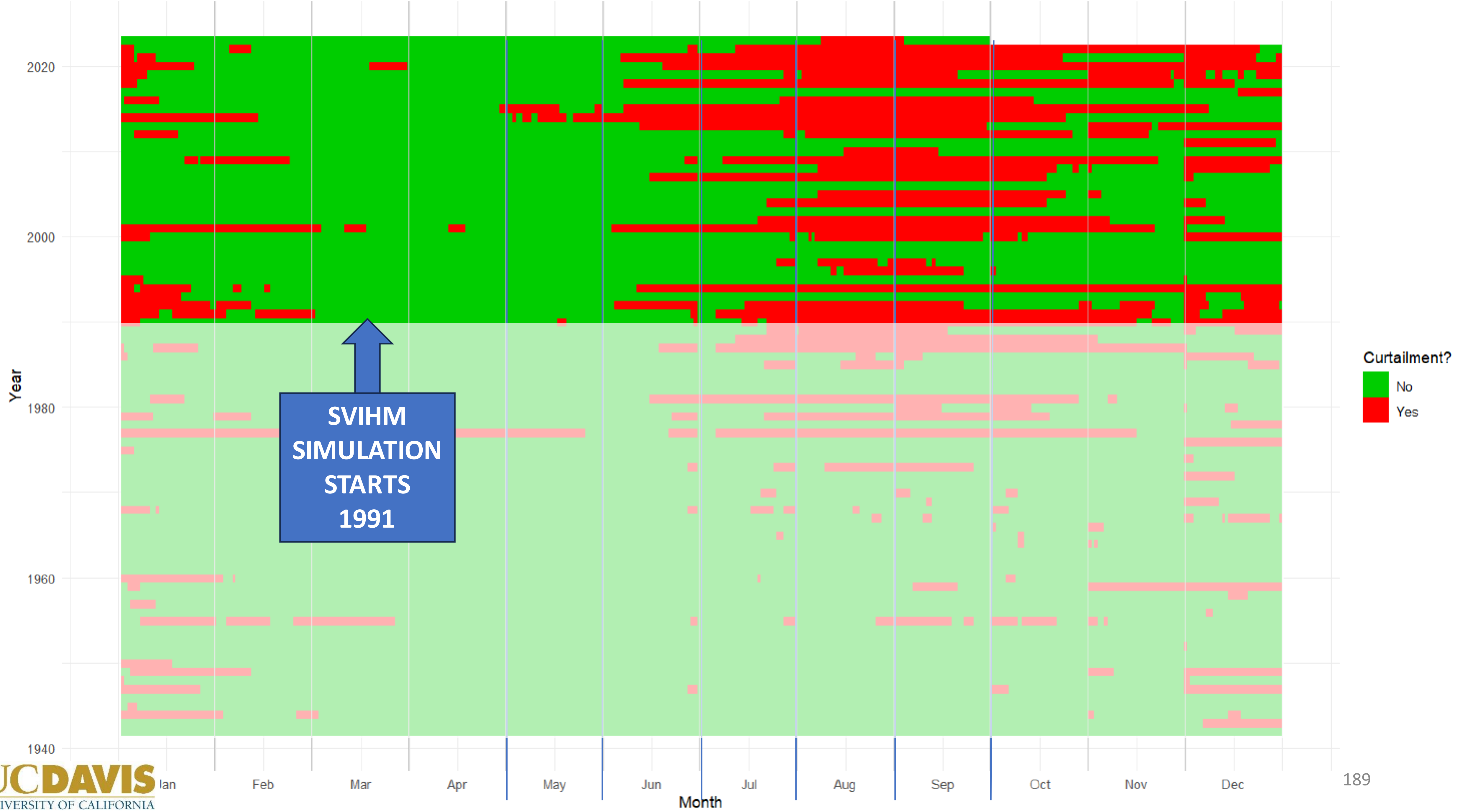


UCDAVIS
UNIVERSITY OF CALIFORNIA



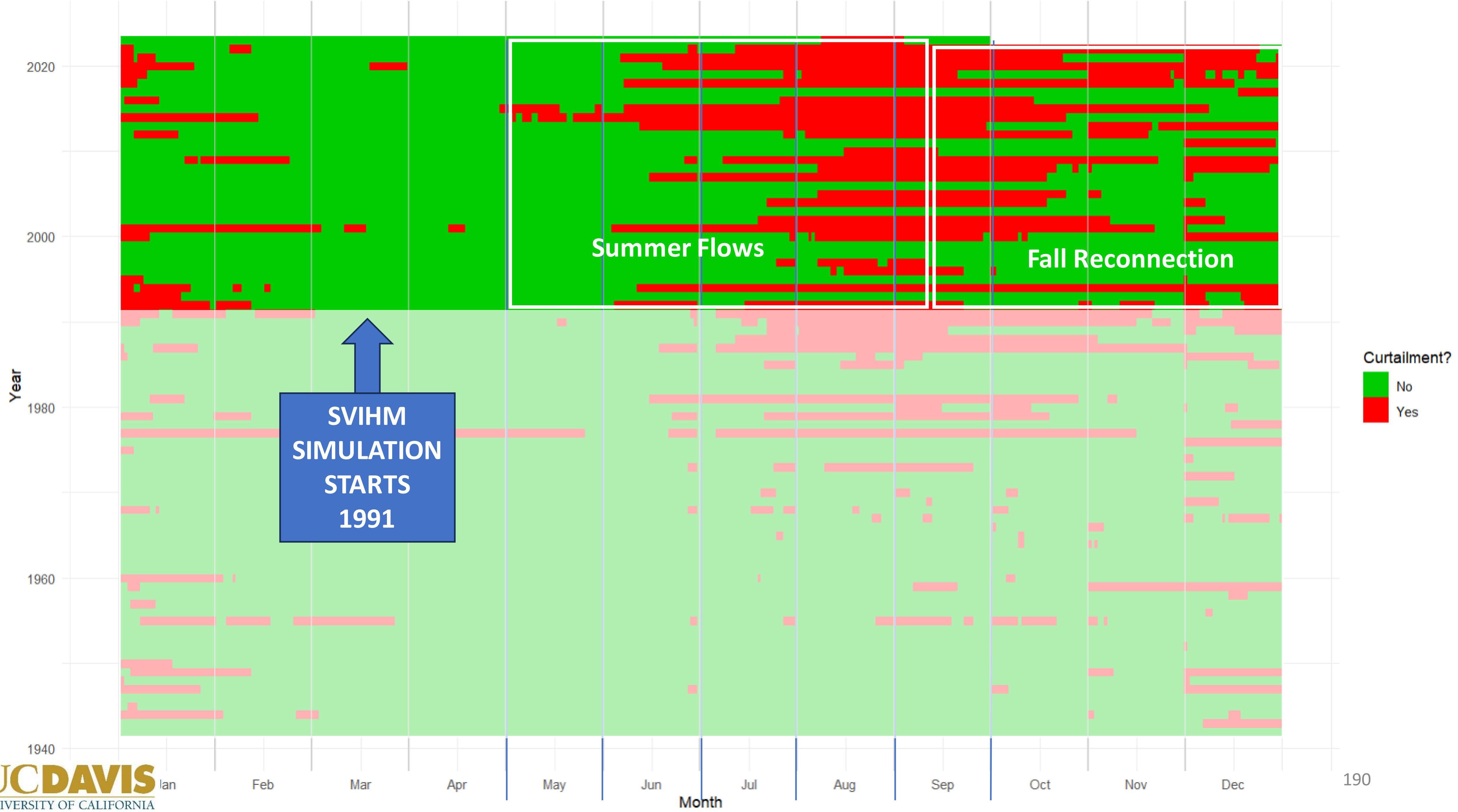
UC DAVIS
UNIVERSITY OF CALIFORNIA

Hypothetical historic curtailments in Scott Valley based on historic flows and 2021 SWRCB Emergency Flows, Pyschik and Harter, UC Davis 2023.



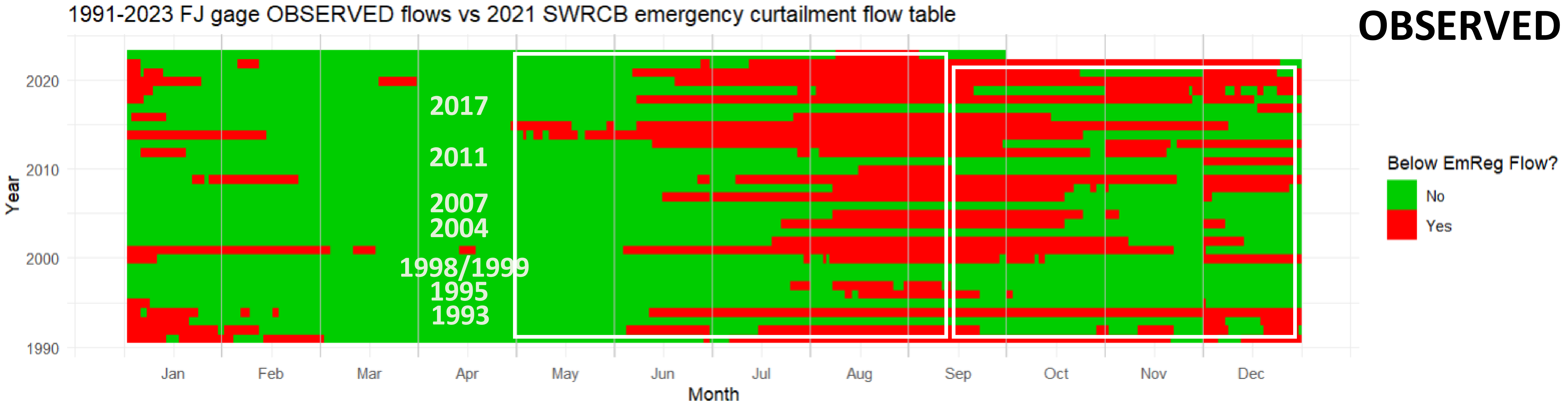
UCDAVIS
UNIVERSITY OF CALIFORNIA

Hypothetical historic curtailments in Scott Valley based on historic flows and 2021 SWRCB Emergency Flows, Pyschik and Harter, UC Davis 2023.

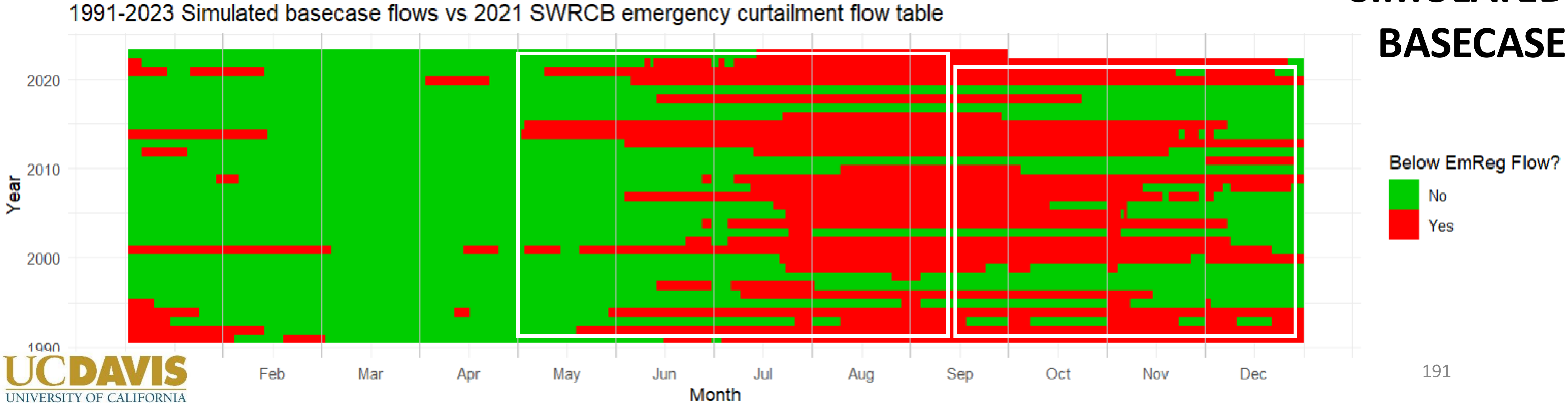


UCDAVIS
UNIVERSITY OF CALIFORNIA

OBSERVED



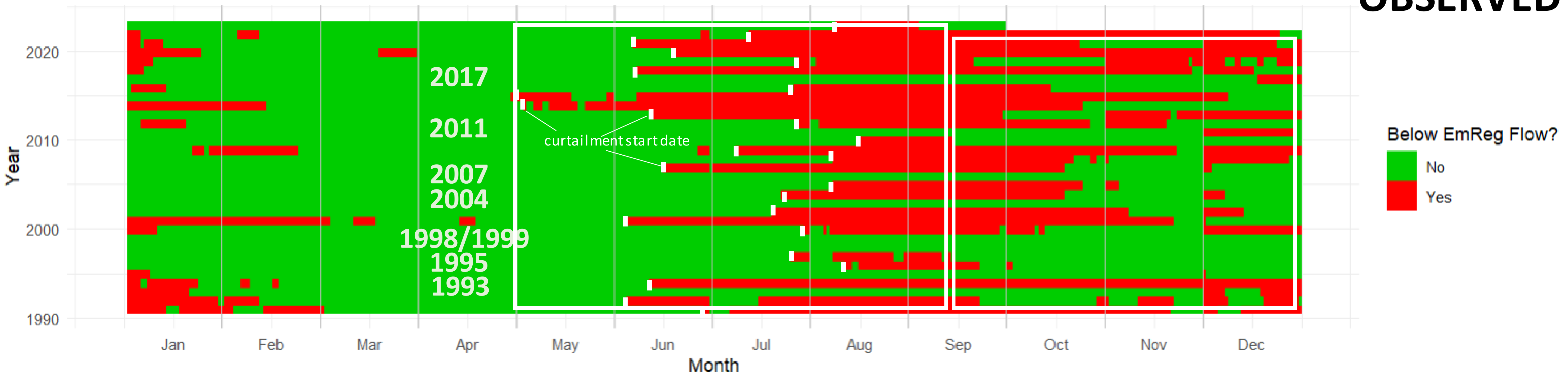
SIMULATED BASECASE



UC DAVIS
UNIVERSITY OF CALIFORNIA

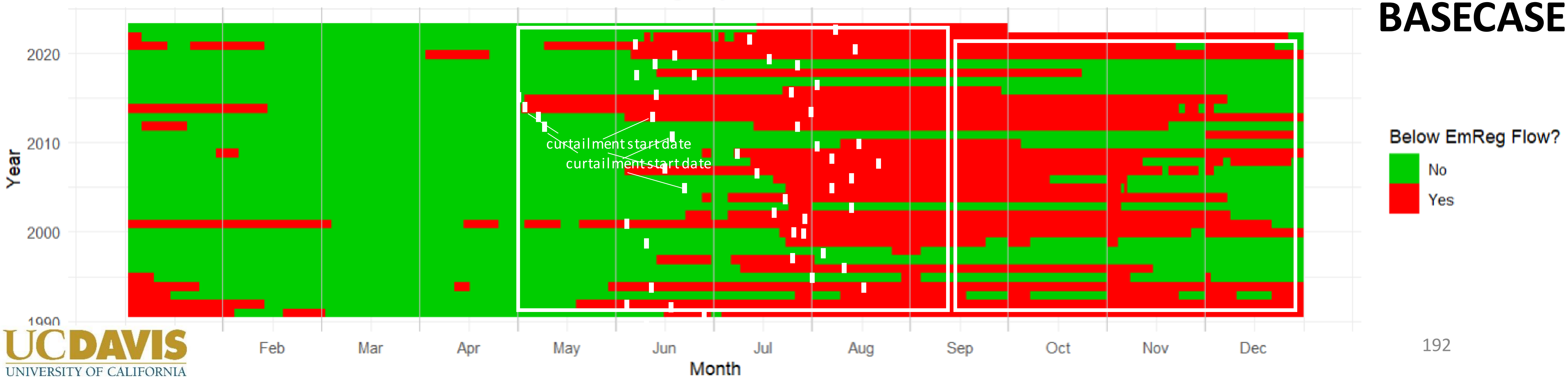
OBSERVED

1991-2023 FJ gage OBSERVED flows vs 2021 SWRCB emergency curtailment flow table



SIMULATED BASECASE

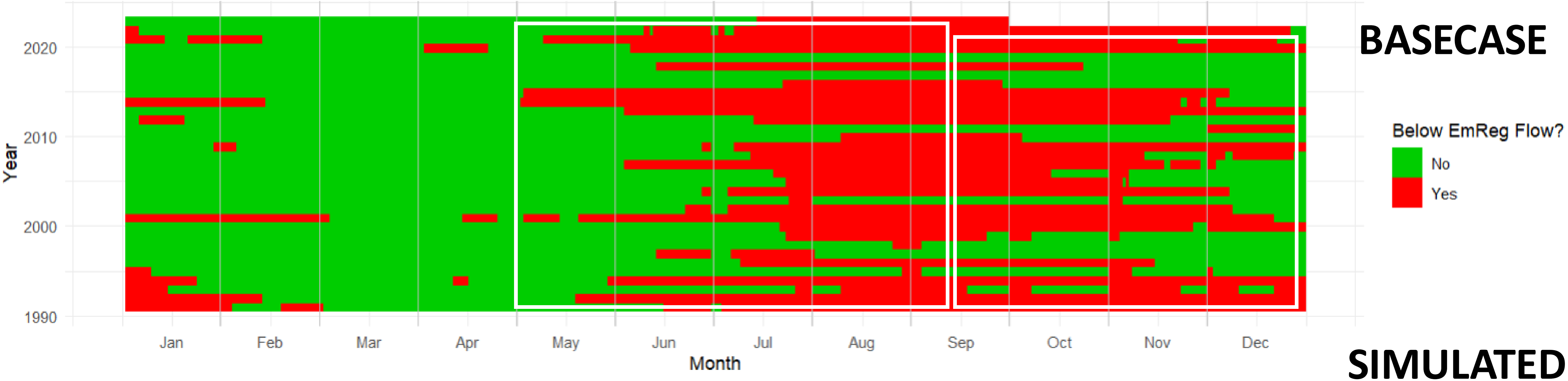
1991-2023 Simulated basecase flows vs 2021 SWRCB emergency curtailment flow table



UC DAVIS
UNIVERSITY OF CALIFORNIA

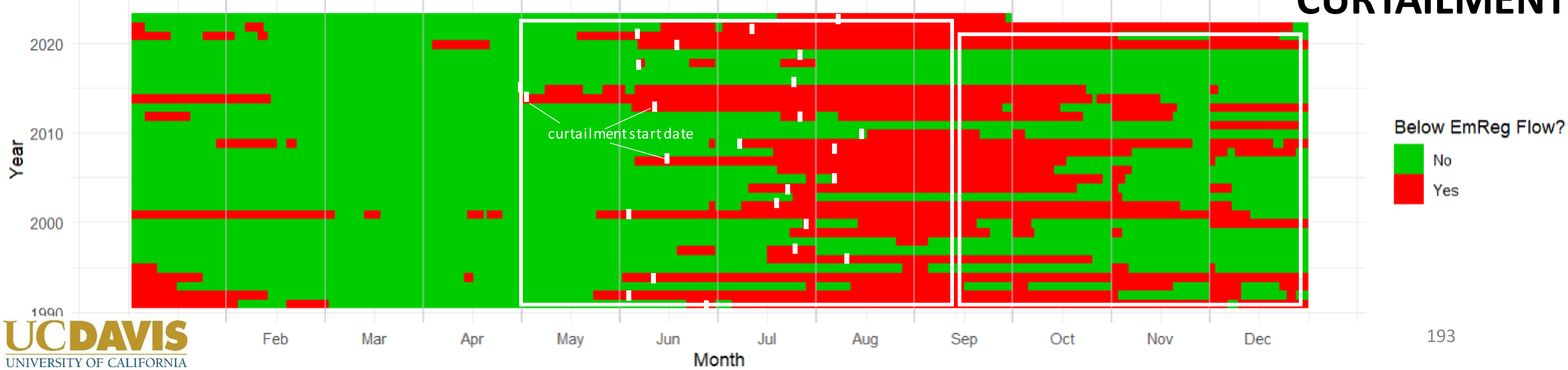
SIMULATED BASECASE

1991-2023 Simulated basecase flows vs 2021 SWRCB emergency curtailment flow table



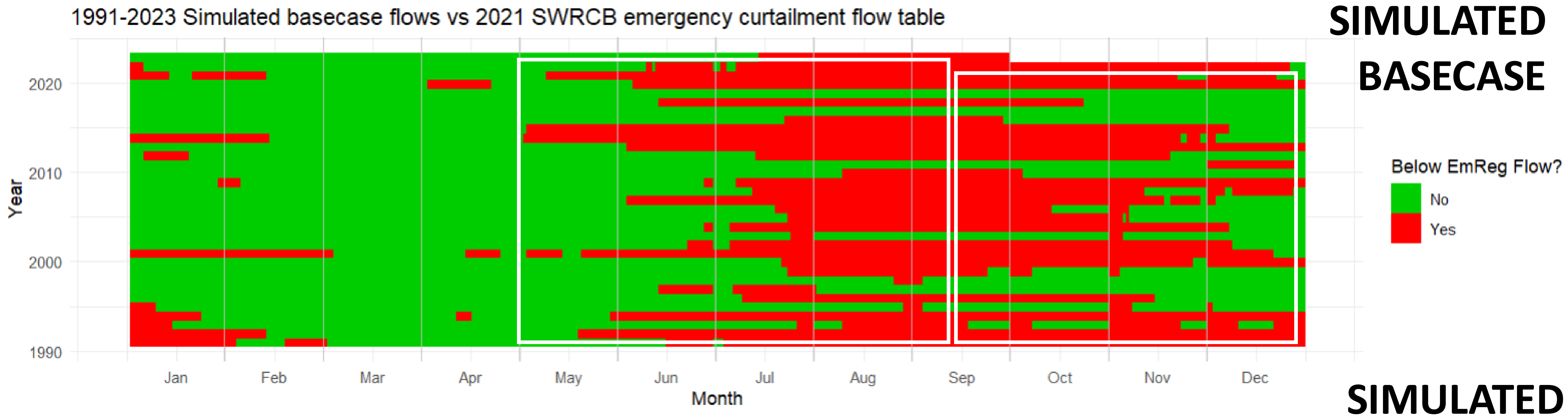
SIMULATED LCS & SW CURTAILMENT

1991-2023 Simulated SW curtailment and 30% LCS scenario flows vs 2021 SWRCB emergency curtailment flow table

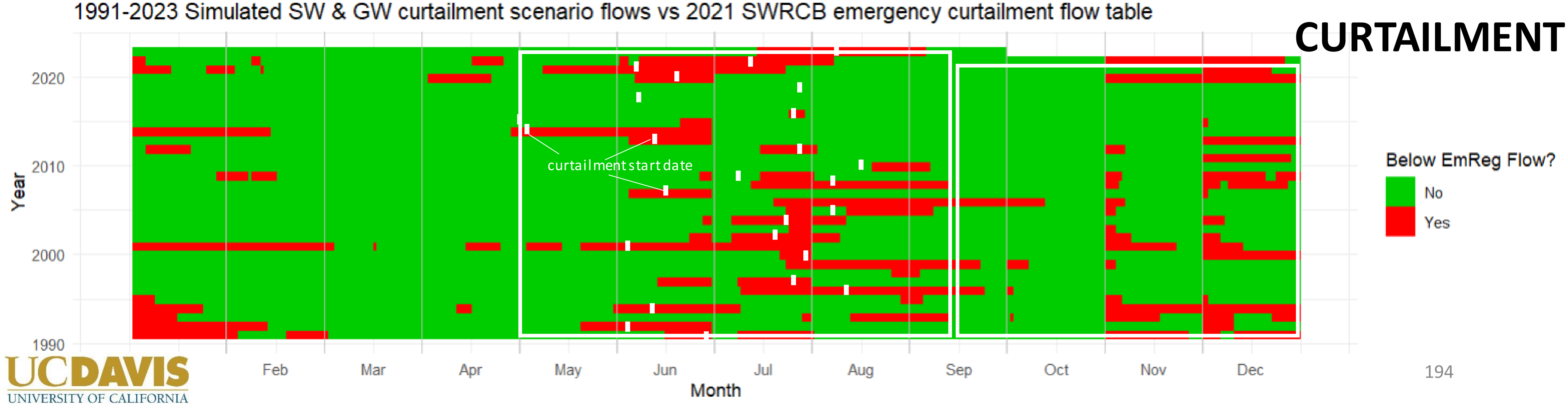


UC DAVIS
UNIVERSITY OF CALIFORNIA

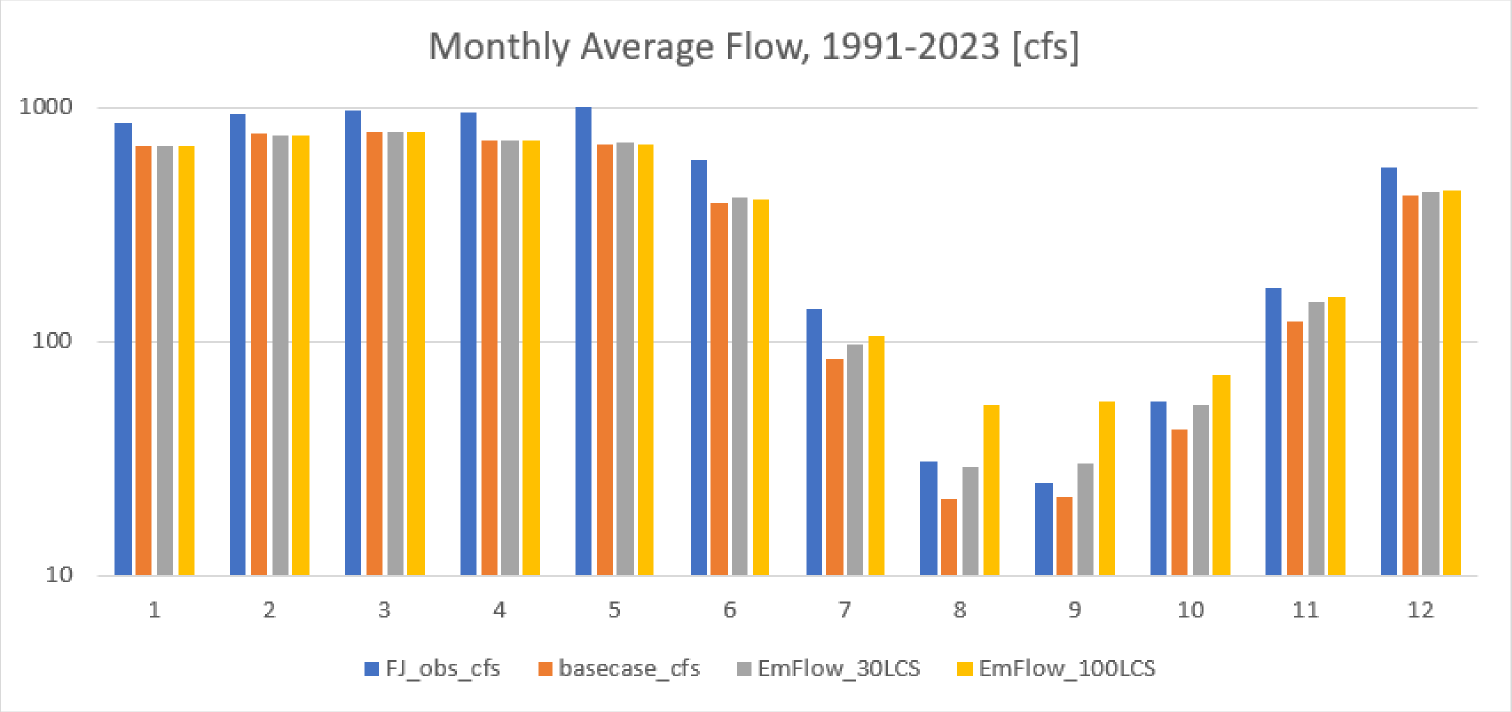
SIMULATED BASECASE



SIMULATED GW & SW CURTAILMENT



UCDAVIS
UNIVERSITY OF CALIFORNIA



Average annual FJ flow increase:

Surface Water Curtailments and LCS (30%) for GW:
5715 acft/yr = 7.9 cfs = 2.0%

Jul-Aug Mean Increase: 10 cfs (8%)
Sep-Nov Mean Increase: 15 cfs (24%)

Surface Water & Groundwater Curtailment:
9,900 acft/yr = 13.7 cfs = 3.4%

Jul-Aug Mean Increase: 27 cfs (50%)
Sep-Nov Mean Increase: 33 cfs (53%)

UCDAVIS
UNIVERSITY OF CALIFORNIA

EMERGENCY FLOWS:

What other factors should the Board be considering with respect to emergency flows (e.g., provide recommended ramp down flows at end of regulation, etc.)?

What factors or information should the Board be considering relative to the fact that the flows were not met?

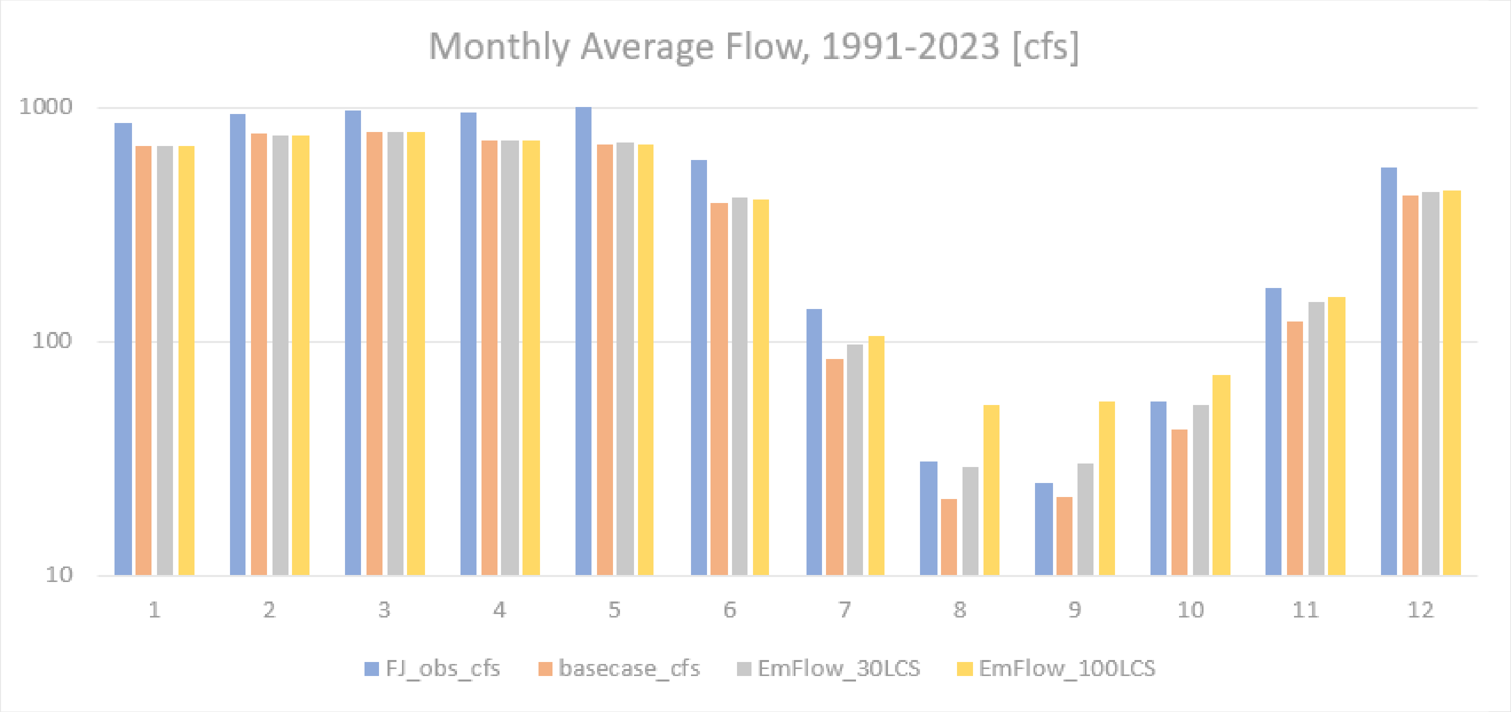
UCDAVIS
UNIVERSITY OF CALIFORNIA

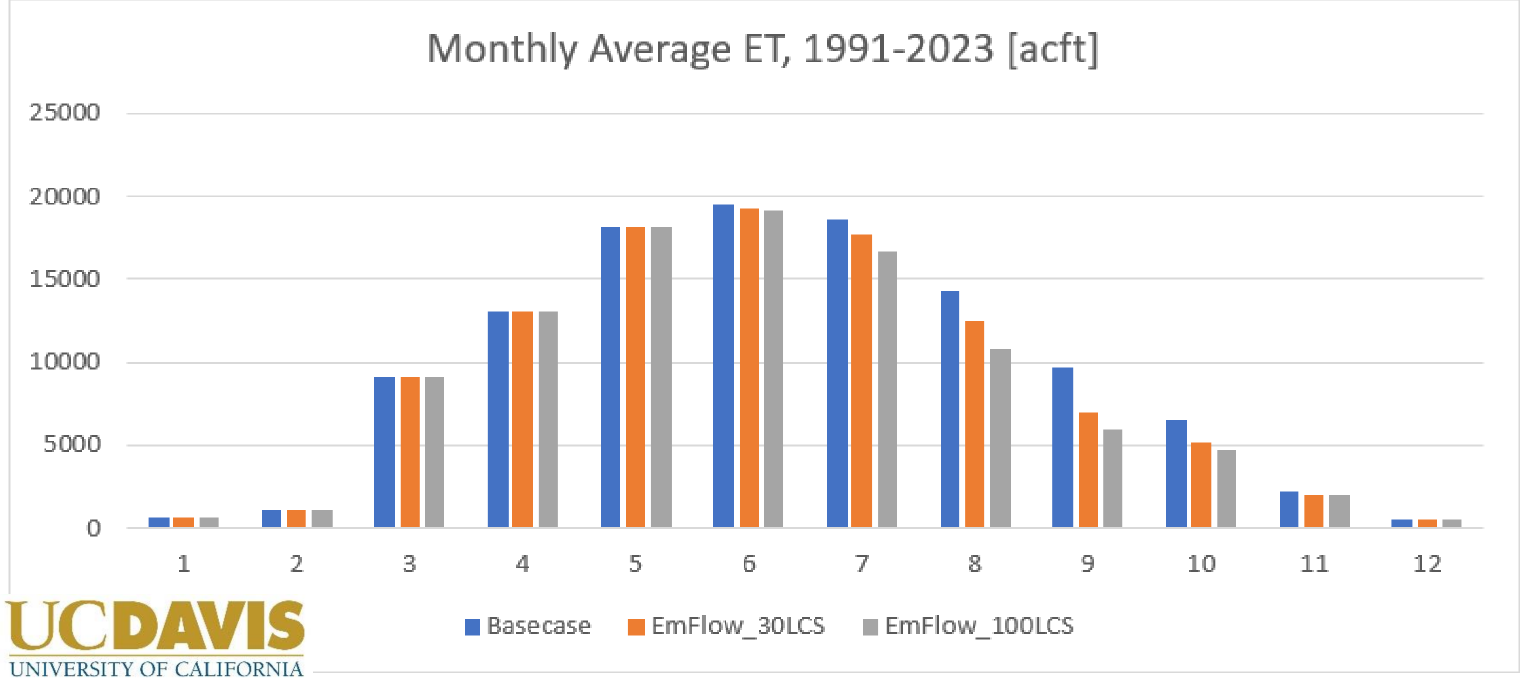
EMERGENCY FLOWS:

What other factors should the Board be considering with respect to emergency flows (e.g., provide recommended ramp down flows at end of regulation, etc.)?

What factors or information should the Board be considering relative to the fact that the flows were not met?

- Lack of sufficient flow predicted by model (see previous slides)
- Model suggests only small ET changes between 2020 and 2022
- OpenET annual estimates are consistent with modeled differences due to curtailment
  - Exception: Modeled reduction of ET in September & October 2022 (relative to 2020) is larger than OpenET monthly estimates would suggest





Average annual FJ flow increase:

Surface Water Curtailments and LCS (30%) for GW:

5715 acft/yr = 7.9 cfs = 2.0%

Jul-Aug Mean Increase: 10 cfs (8%)
Sep-Nov Mean Increase: 15 cfs (24%)

Surface Water & Groundwater Curtailment:

9,900 acft/yr = 13.7 cfs = 3.4%

Jul-Aug Mean Increase: 27 cfs (50%)
Sep-Nov Mean Increase: 33 cfs (53%)

Average annual ET reduction:

Surface Water Curtailments and LCS (30%) for GW:

7200 acft/yr = 10 cfs = 6.4%

Jul-Aug Mean Reduction: 1380 acft/mo (8%)
Sep-Nov Mean Reduction: 1408 acft/mo (23%)

Surface Water & Groundwater Curtailment:

11,800 acft/yr = 16.3 cfs = 10.5%

Jul-Aug Mean Reduction: 2750 acft/mo (17%)
Sep-Nov Mean Reduction: 1920 acft/mo (31%)

Simulated ET [acft]

2020 vs. 2022

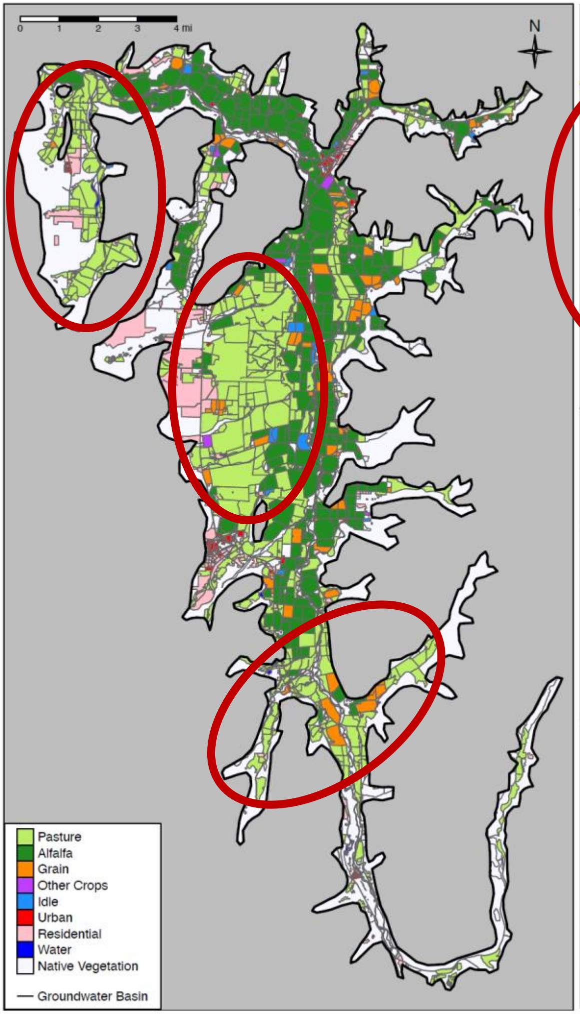
Month	2020	2022	Difference	% ET Reduction
1	528	673	145	-28%
2	1,221	1,136	-85	7%
3	9,830	11,078	1248	-13%
4	15,263	13,385	-1877	12%
5	14,759	18,156	3397	-23%
6	18,339	20,385	2046	-11%
7	18,296	18,021	-275	2%
8	**12,330**	**11,536**	**-794**	**6%**
9	**7,847**	**4,608**	**-3239**	**41%**
10	**4,984**	**2,776**	**-2207**	**44%**
11	1,620	2,068	448	-28%
12	337	247	-90	27%
Annual	**105,354**	**104,070**	**-1284**	**1%**

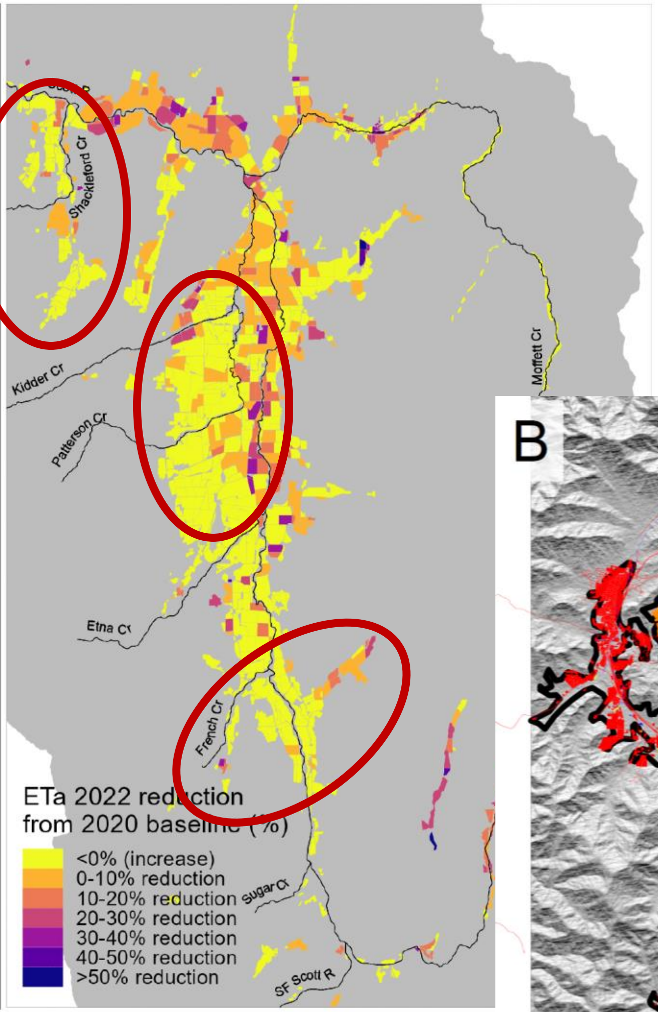
2022 w/o curtailment vs. 2022

Month	2022 w/o C	2022	Difference	% ET Reduction
1	673	673	0	0%
2	1,136	1,136	0	0%
3	11,078	11,078	0	0%
4	13,385	13,385	0	0%
5	18,159	18,156	-3	0%
6	20,397	20,385	-12	0%
7	18,260	18,021	-240	1%
8	**14,416**	**11,536**	**-2880**	**20%**
9	**8,666**	**4,608**	**-4058**	**47%**
10	**5,957**	**2,776**	**-3180**	**53%**
11	2,068	2,068	0	0%
12	247	247	0	0%
Annual	**114,443**	**104,070**	**-10374**	**9%**

Note: Simulated crops use only available water, leading to ET reduction under less irrigation. However, additional effects of plant stress response to deficit irrigation is not simulated. Real ET reduction may be larger.

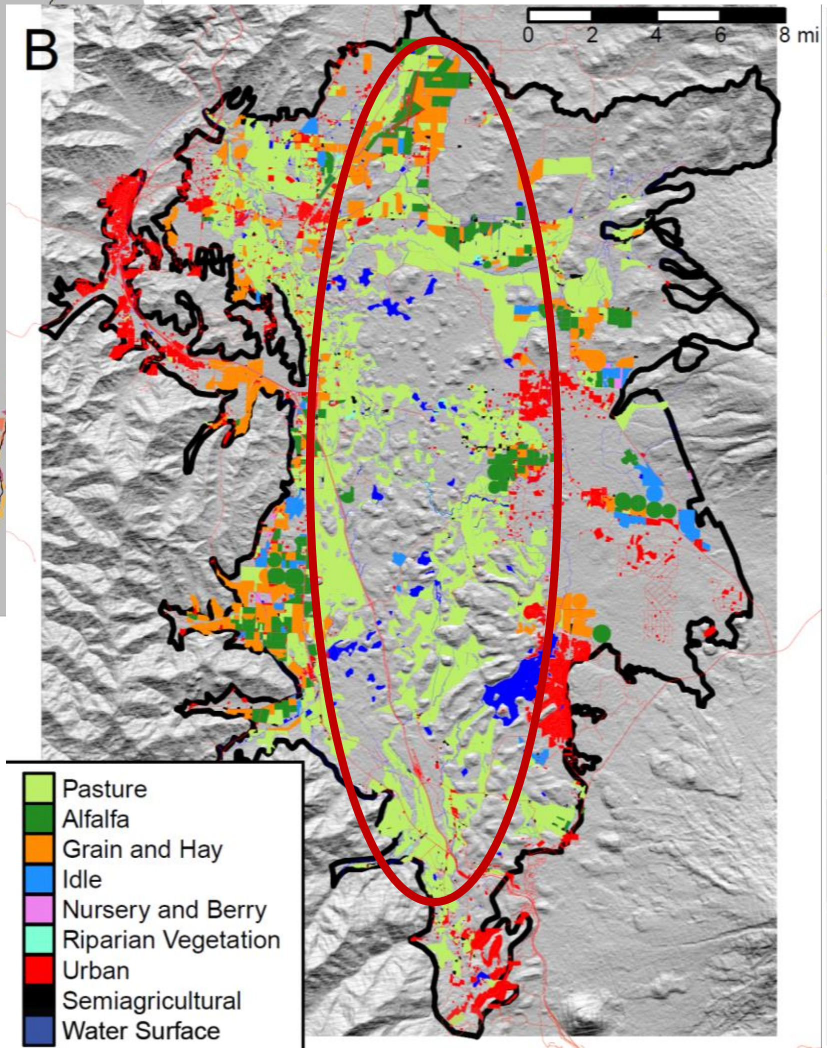
UCDAVIS
UNIVERSITY OF CALIFORNIA

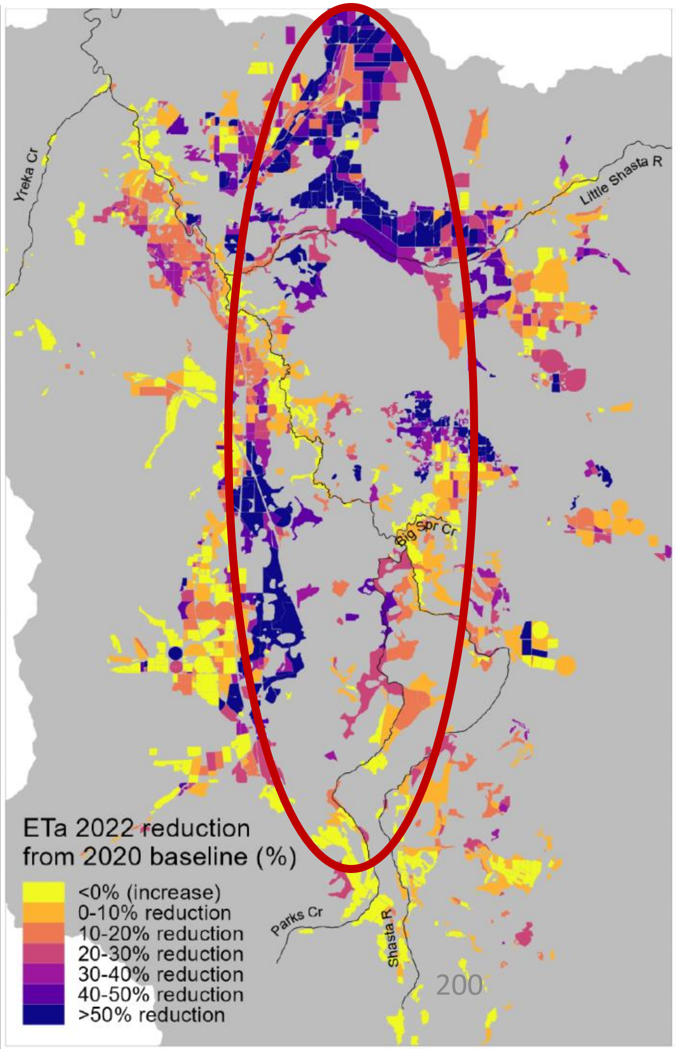




Pasture – negligible ET reduction in Scott Valley

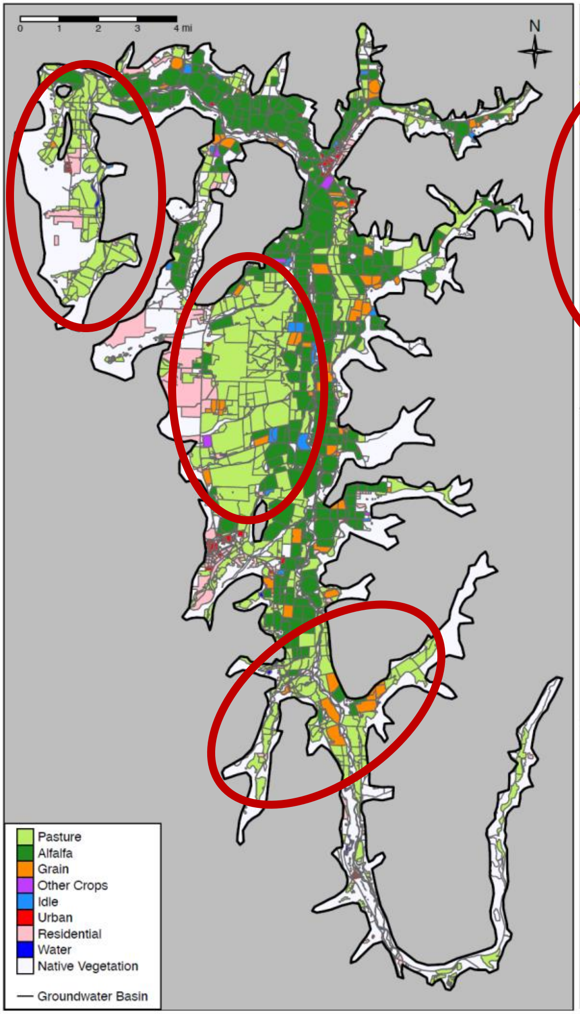
Pasture – over 40% ET reduction in Shasta Valley

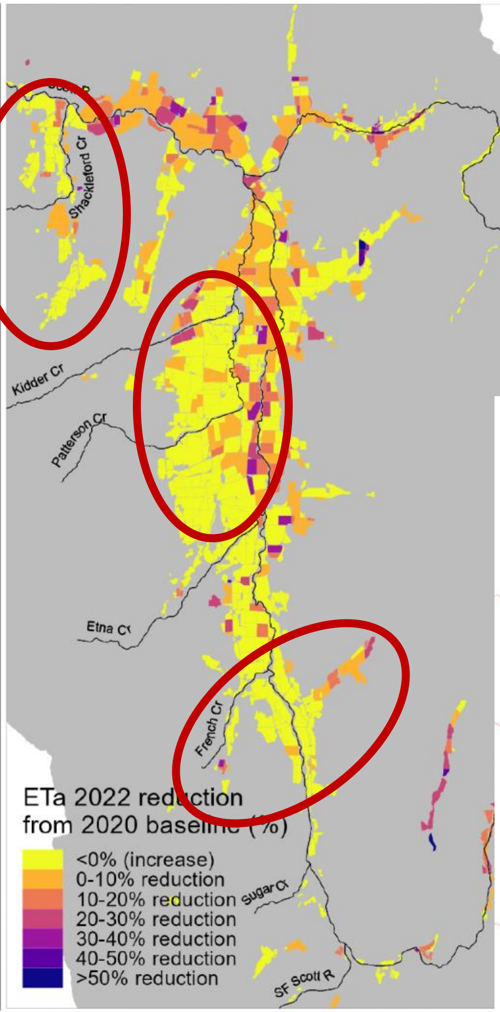




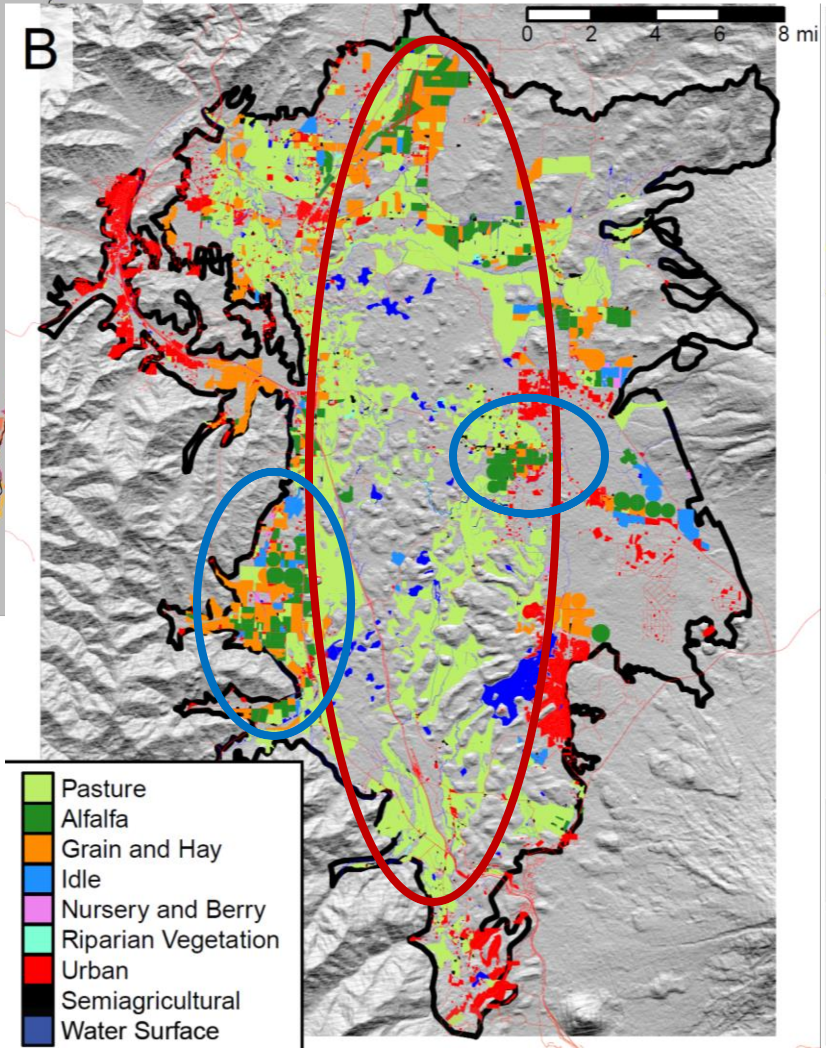
Least Shasta Valley ET reduction: alfalfa (groundwater-irrigated)

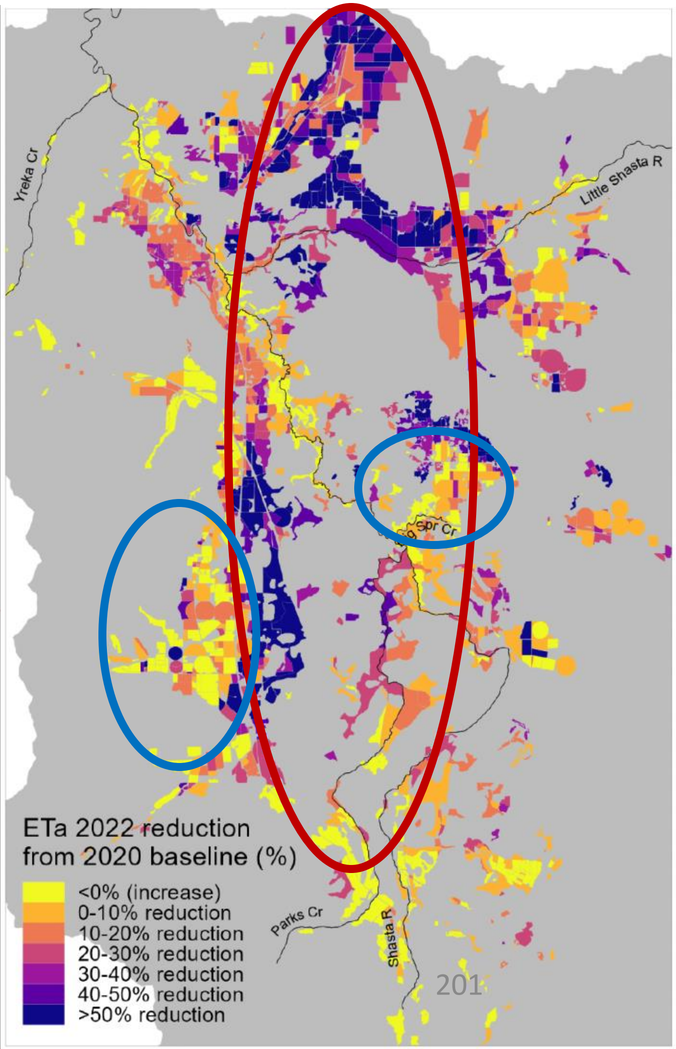
Pasture – over 40% ET reduction in Shasta Valley



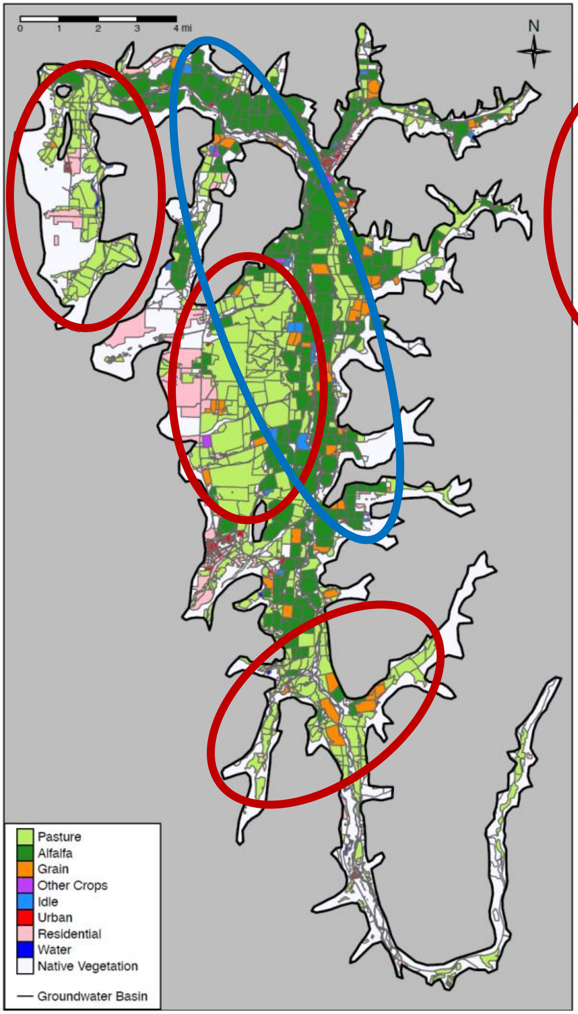


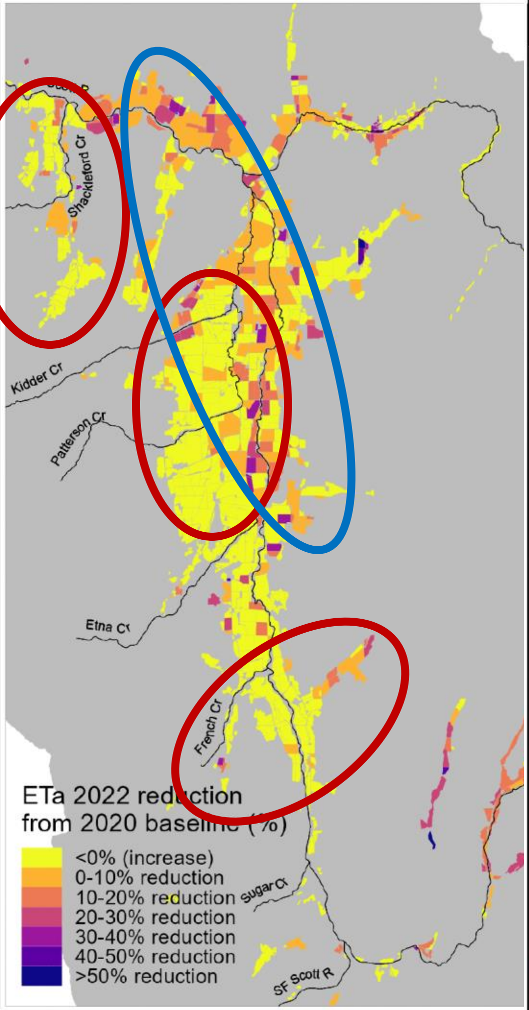
Pasture – negligible ET reduction in Scott Valley

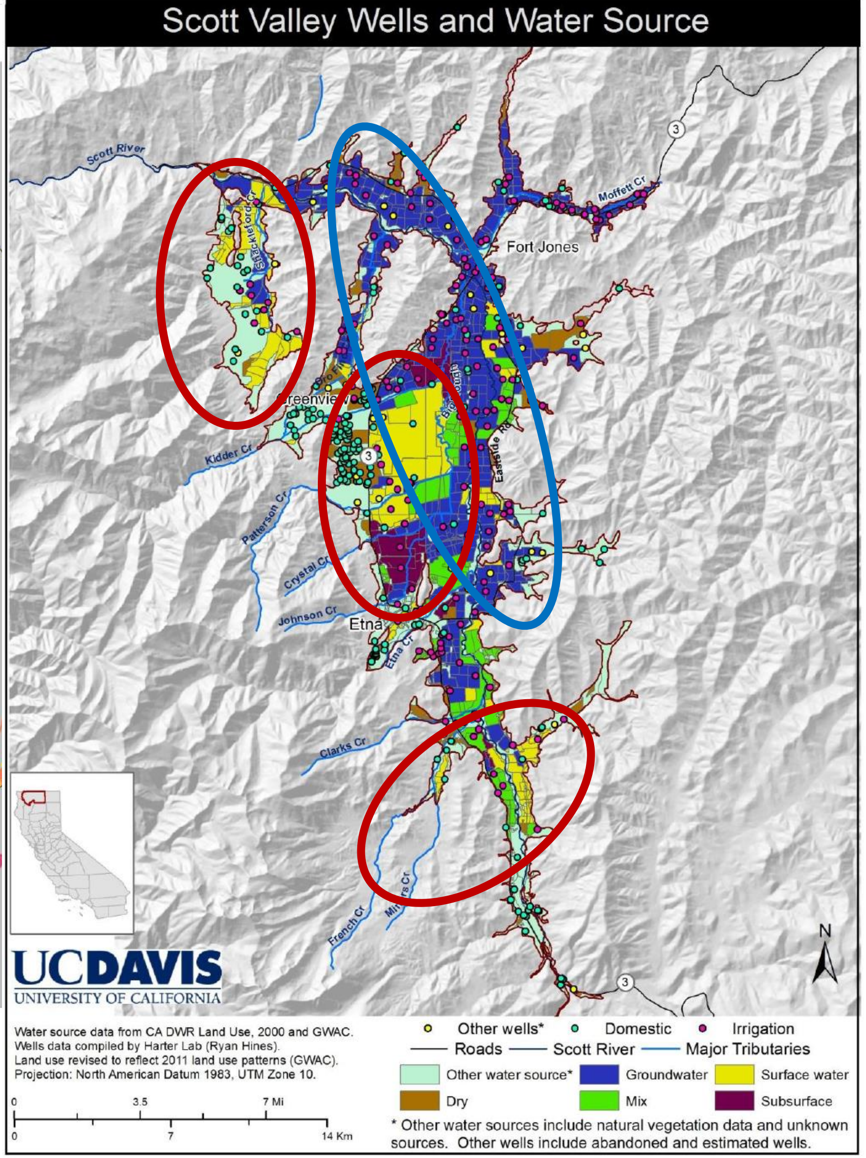




UCDAVIS
UNIVERSITY OF CALIFORNIA







Largest Scott Valley ET reduction:
alfalfa (mostly groundwater-irrigated)

UCDAVIS
UNIVERSITY OF CALIFORNIA

The Nature Conservancy

Emergency Flow Targets in the Scott and Shasta Rivers

Bronwen Stanford, Ph.D.

OCTOBER 6, 2023

Scott River now experiences "drought" flows most years

From the Petition for Rulemaking to Set Minimum Flows on the Scott River

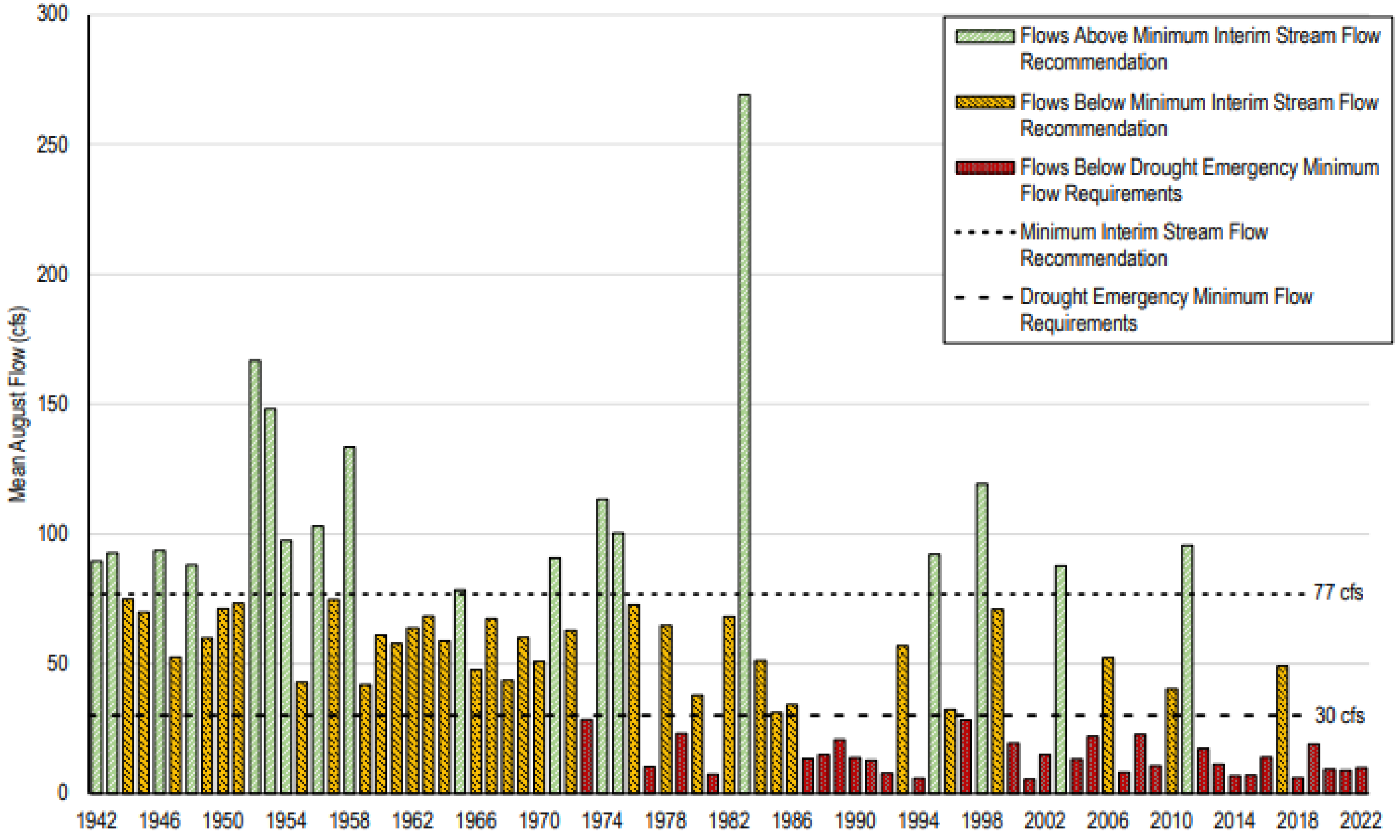


Figure 1. Mean August flows for the Scott River for the 1942 to 2022 water years.

The Nature Conservancy

Interim criteria are needed until permanent criteria are developed for the Scott and Shasta

- Flow criteria seek to reduce extreme stress to aquatic life from low flow conditions.

- Year-round environmental flow criteria are necessary for Scott and Shasta Rivers to prevent further decline of listed species.

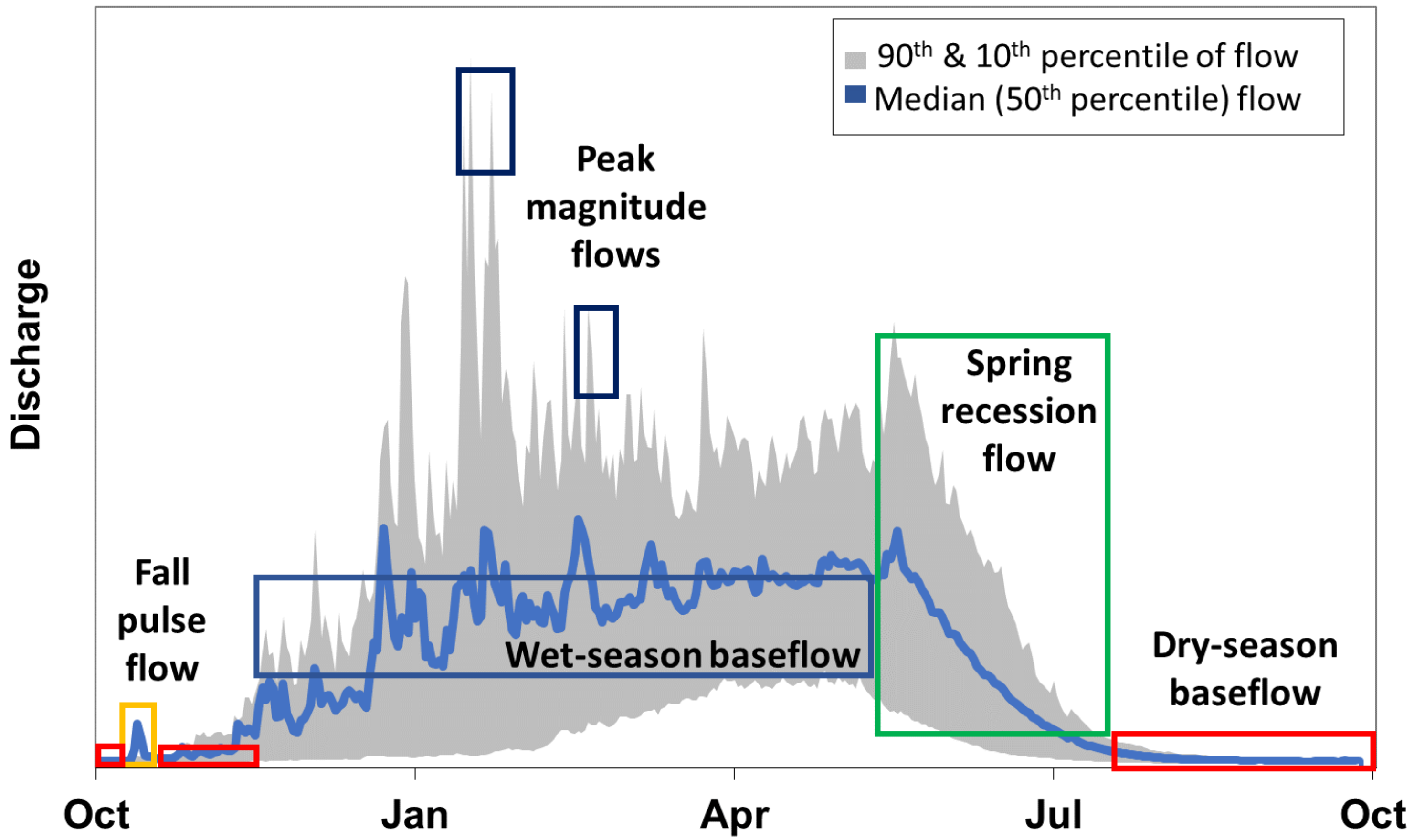
- Interim criteria should be adopted to protect instream condition while permanent criteria are being developed.

- To be effective, these criteria must apply to both surface water and groundwater use. Enforcement and measurement is necessary to ensure compliance with regulations.

Flow criteria are needed for the full year to protect ecological function

Perennial rivers need water year round

Information on CEFF available at eflows.ucdavis.edu



Yarnell et al. 2020 *RRA*

The Nature Conservancy

Dry season flow is one of the five functional flows in the Scott and Shasta Rivers

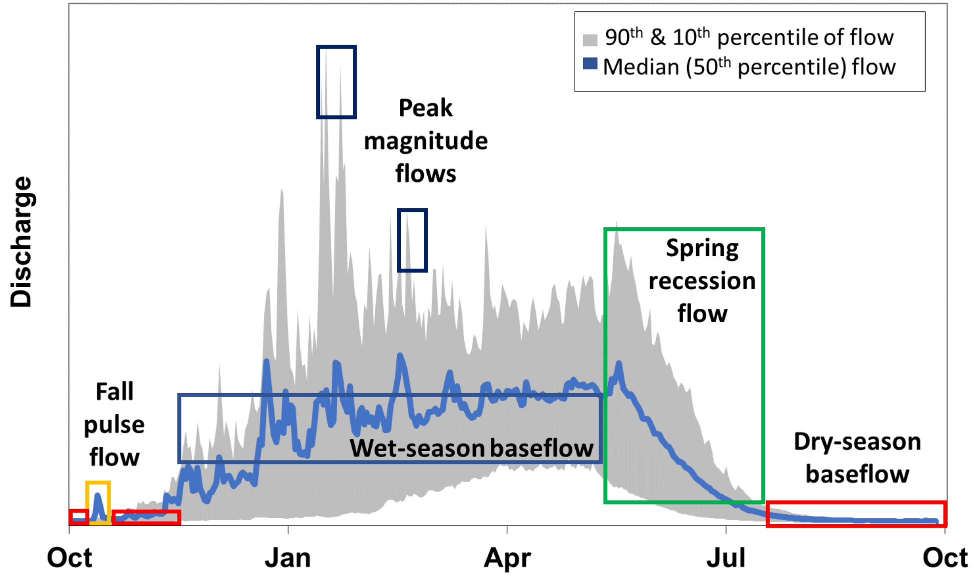
Dry-season baseflow – juvenile rearing, connectivity for migration, temperature management

Fall pulse flow – migration cue, improves water quality

Peak magnitude flows – floodplain access for juveniles, maintains habitat condition

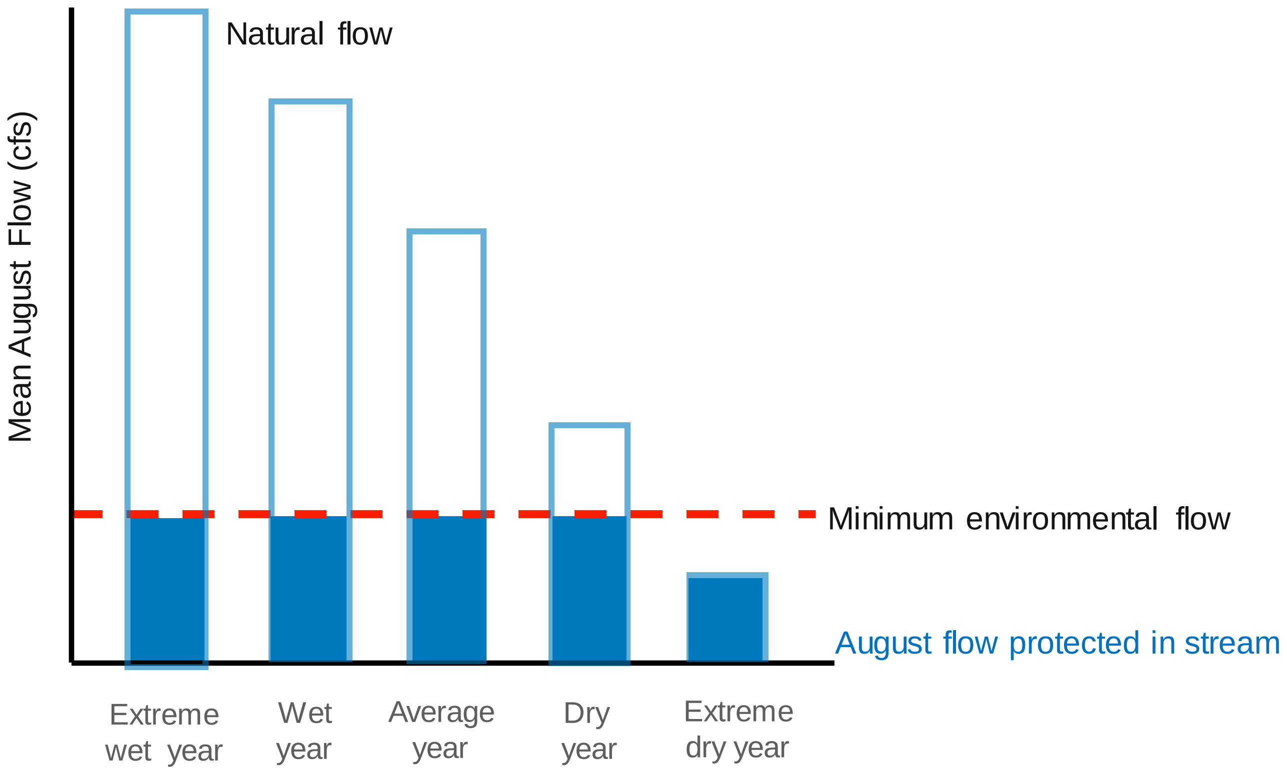
Wet-season baseflow – connectivity for migration, maintains cool temperatures

Spring recession flow – connectivity for migration, maintains cool temperatures, migration cue



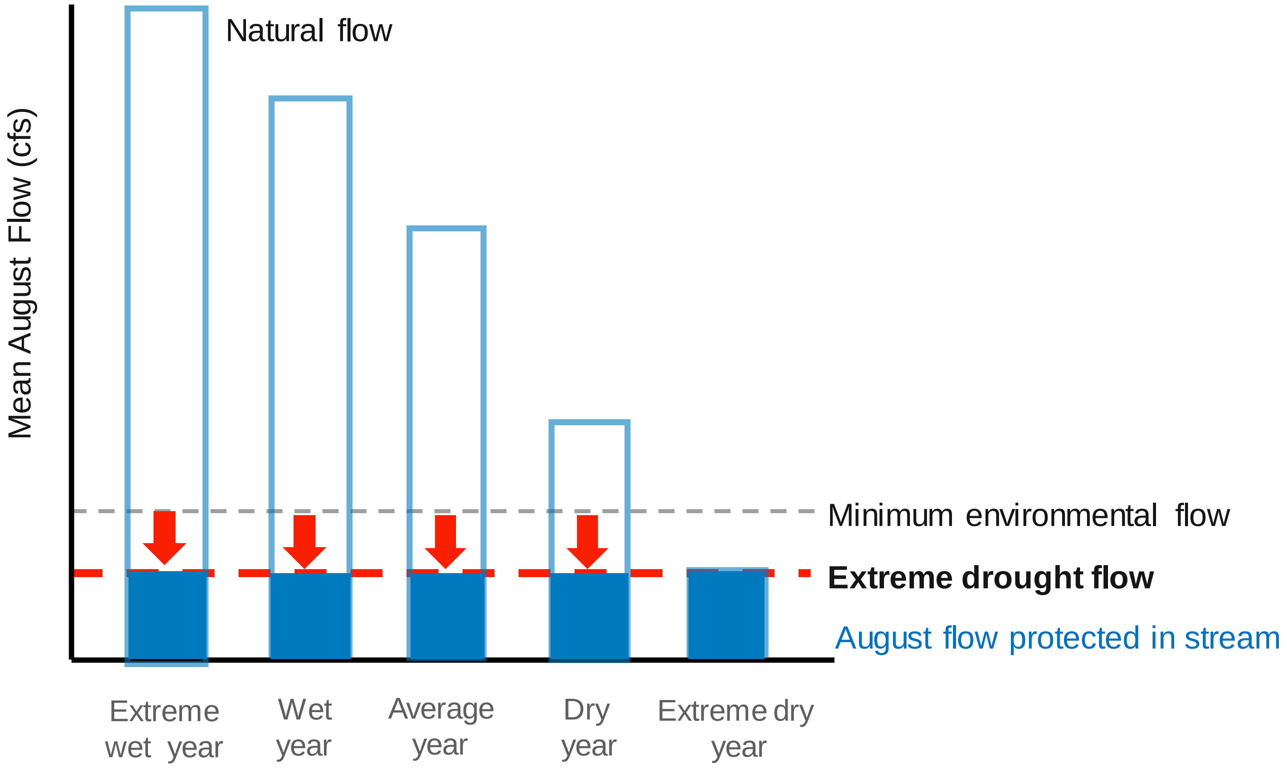
Emergency flows should protect ecological function

- Naturally occurring dry years represent highly stressful conditions for many species
- Criteria must be set higher than drought low flows to protect river health
- When flow criteria cannot be met, water remaining instream should be full natural flow
- Curtailments maximize the number of years that meet flow criteria



Emergency flows should protect ecological function

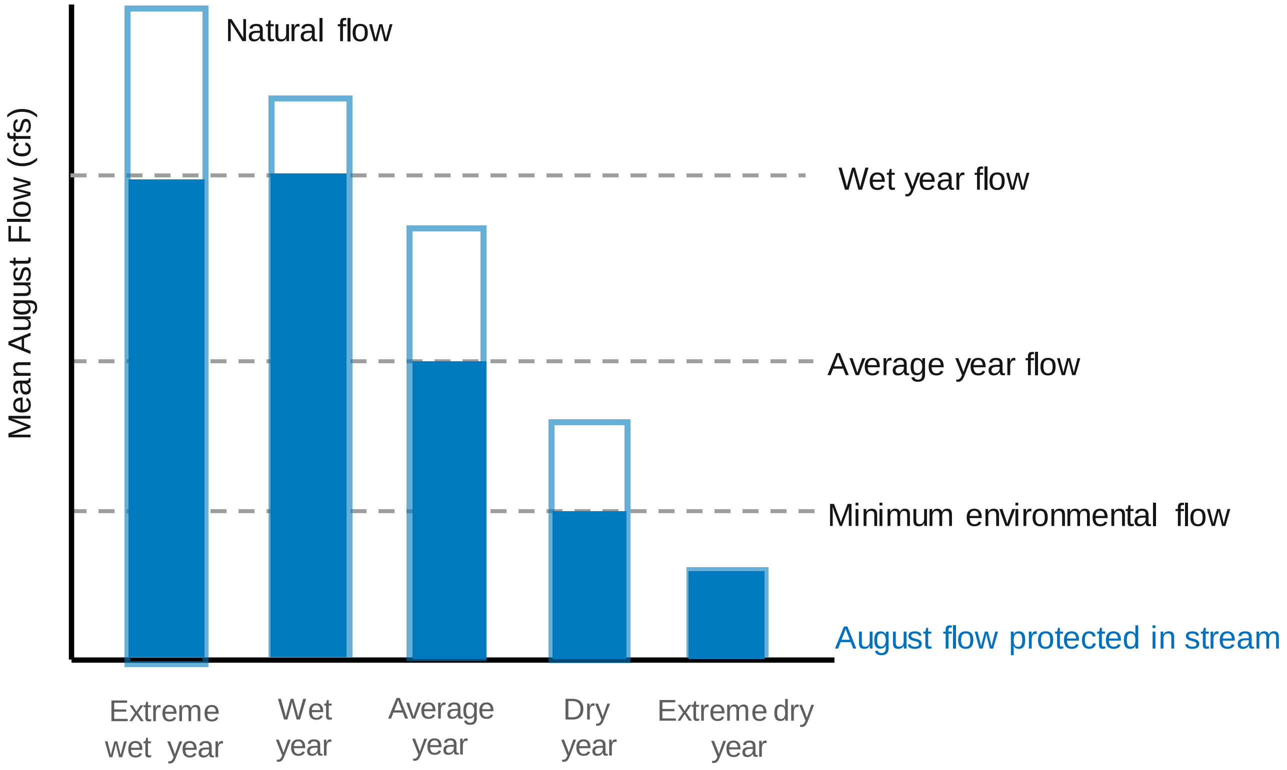
- Naturally occurring dry years represent highly stressful conditions for many species
- Criteria must be set higher than drought low flows to protect river health
- When flow criteria cannot be met, water remaining instream should be full natural flow
- Curtailments maximize the number of years that meet flow criteria



The Nature Conservancy

Long term criteria should vary by water year type

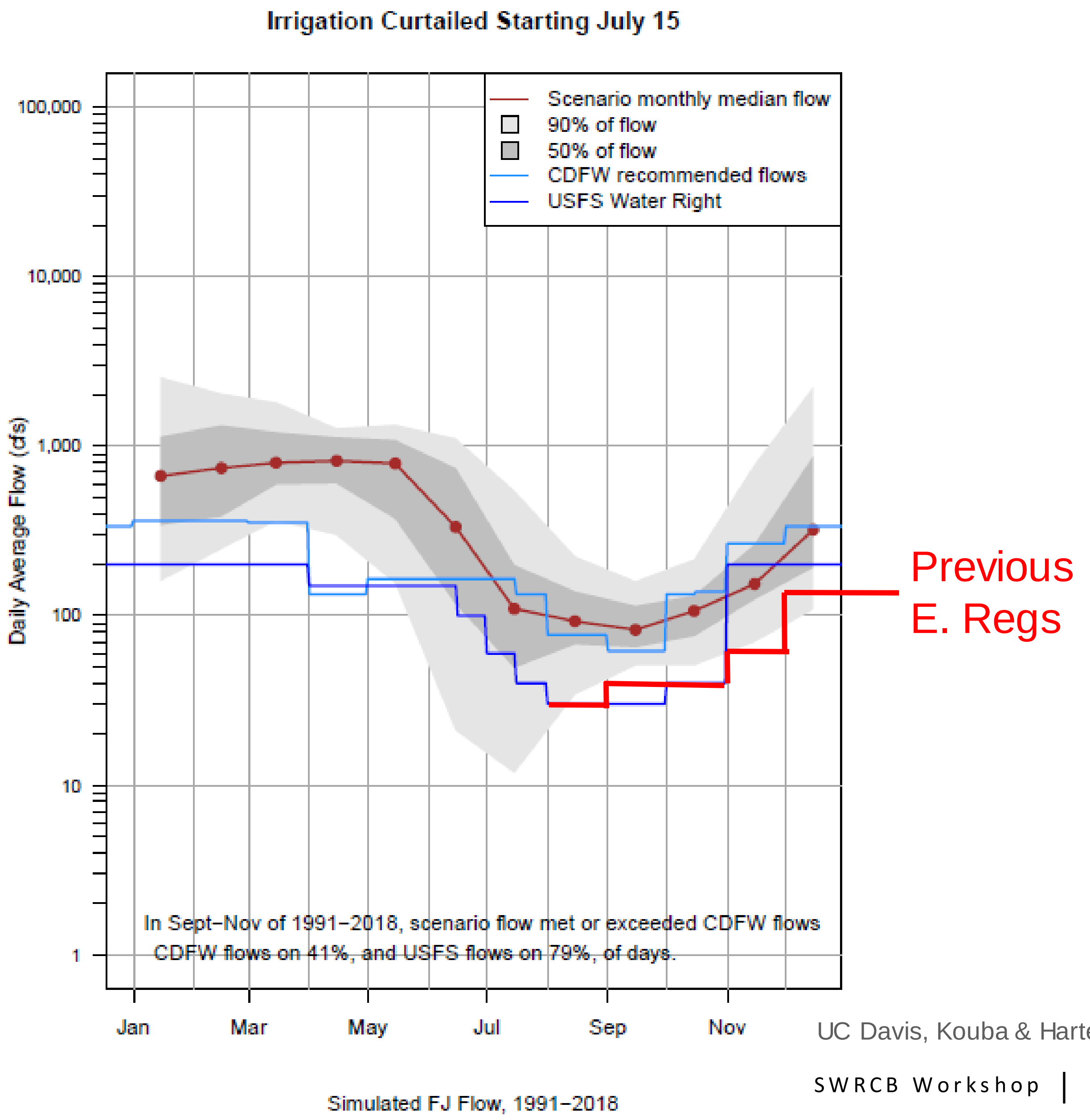
- Criteria should include flows for wet and average years as well as dry years



Emergency Regs thresholds are achievable

July 15 curtailment modeling scenario

Model shows required minimum instream flows are met August–November **in all but the 5% driest years**



UC Davis, Kouba & Harter

The Nature Conservancy

Timing of curtailments is key

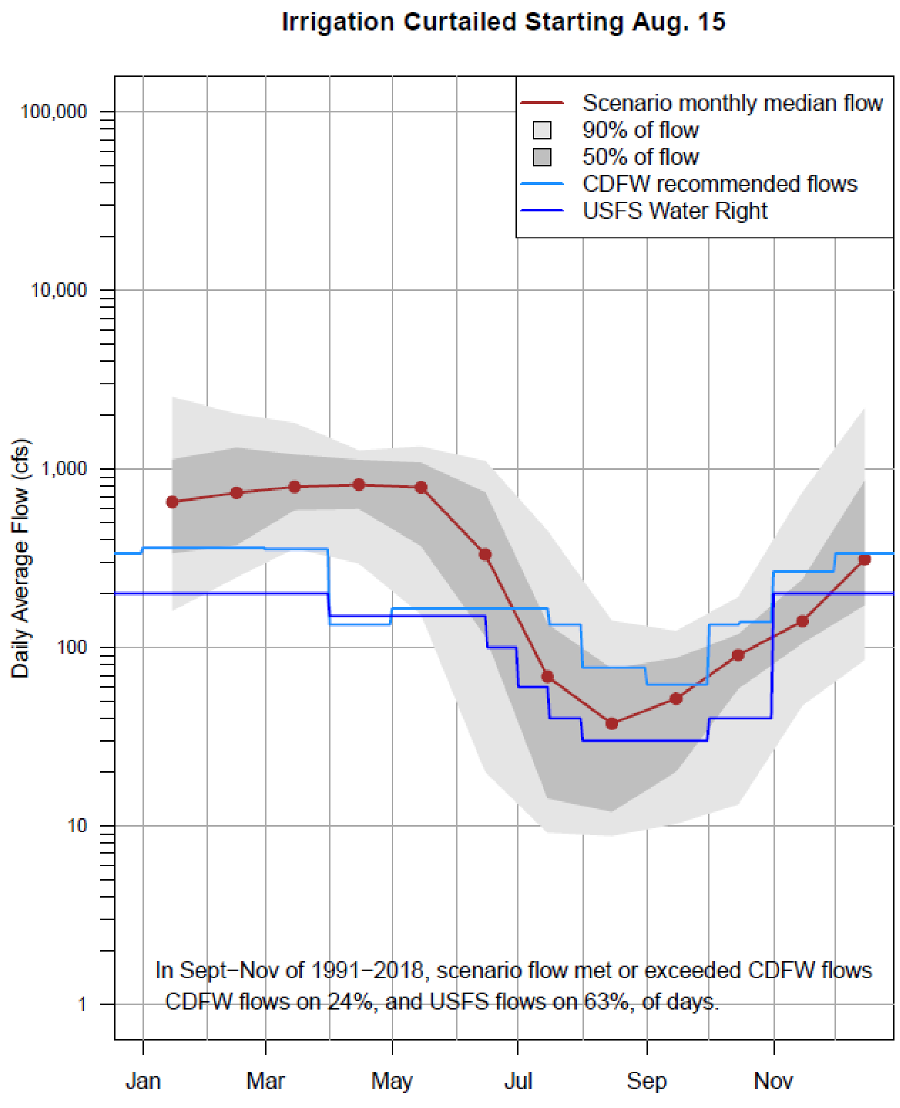
July 15 curtailment modeling scenario

Model shows required minimum instream flows are met August–November in all but the 5% driest years

August curtailment modeling scenarios

Model shows fewer flow benefits, as majority of irrigation water has already been applied

Additional information on water use can help improve modeling of curtailment scenarios

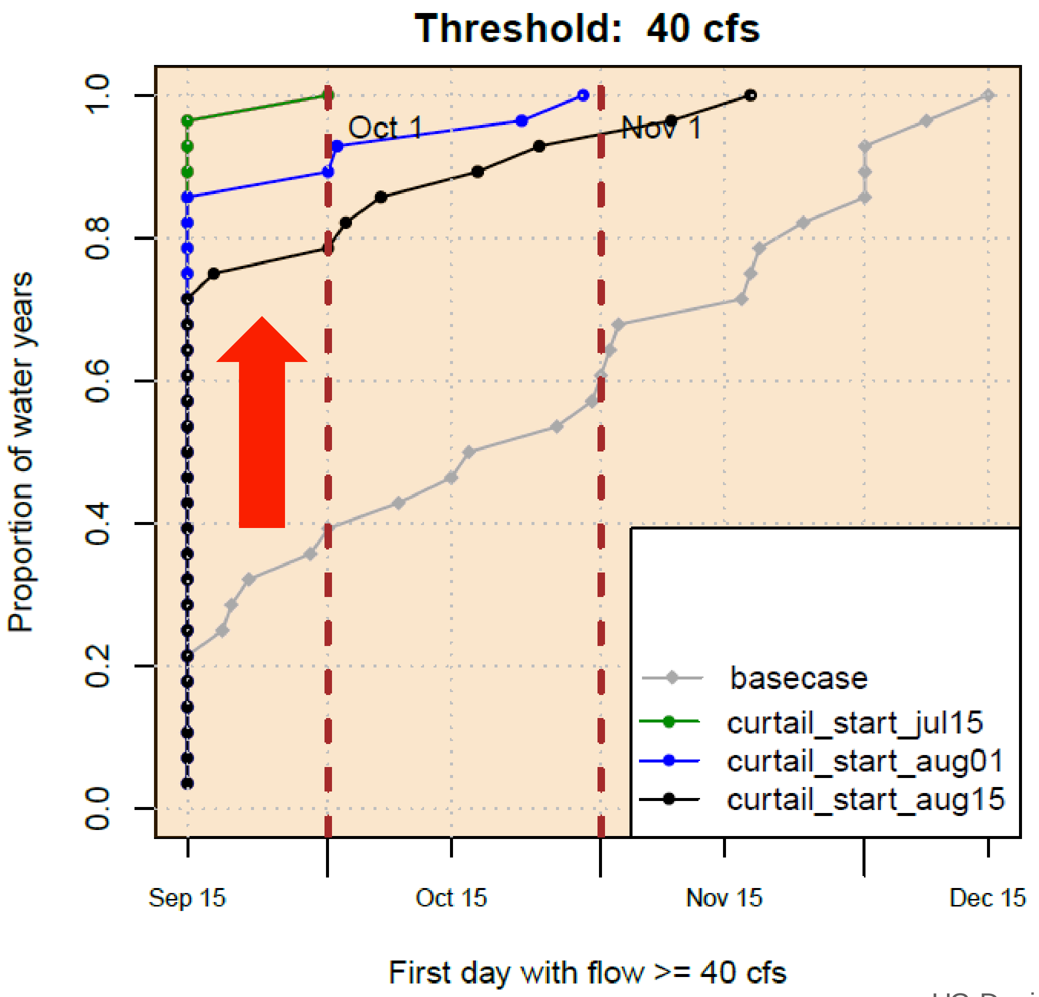


UC Davis, Kouba & Harter

Timing of curtailments is key

Fall reconnection:

- Model shows that earlier curtailment results in earlier fall reconnection date
- July 15th curtailment scenario estimates 40cfs or more instream by Oct 1st in 100% of years

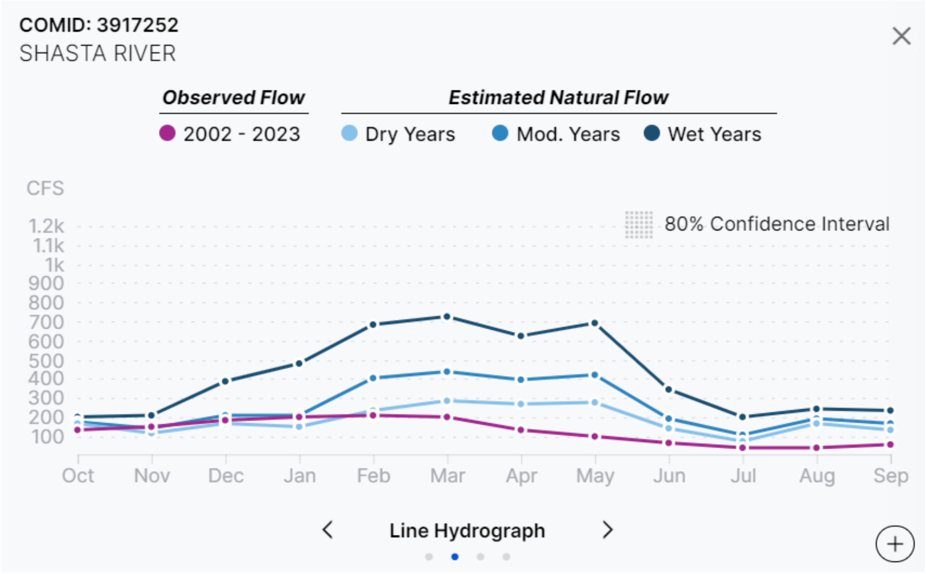


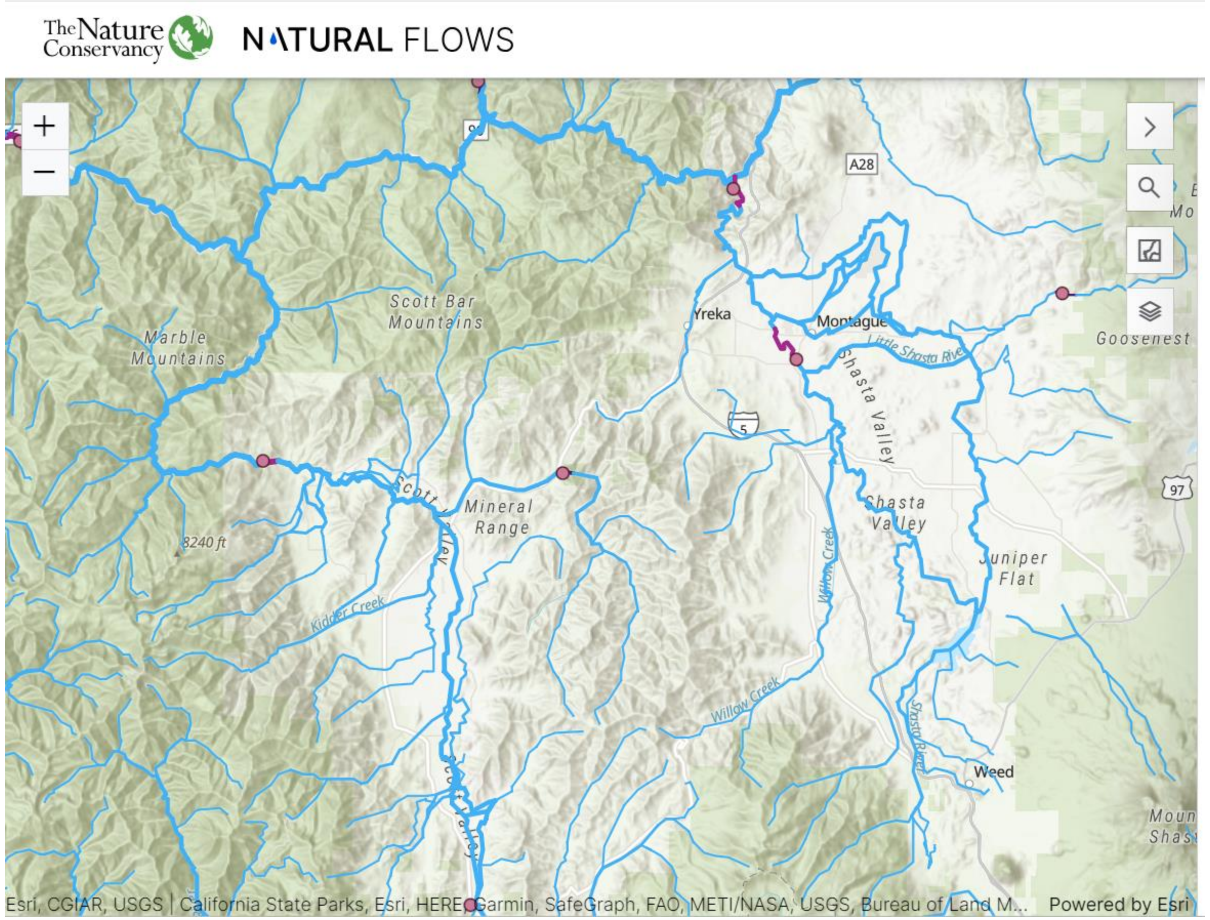
UC Davis, Kouba & Harter

Existing flow science tools can support flow criteria development

rivers.codefornature.org

Includes ecological flow criteria and natural baseline data for both rivers





Emergency regulations are appropriate and needed

- Perennial rivers need flows year-round.
- Interim criteria should be designed to protect ecological function.
- Modeling shows the emergency regs are achievable in almost all years with July 15 curtailment.
- Our tools can help inform criteria development in the Scott and Shasta rivers.

Groundwater Local Cooperative Solutions

Staff Presentation

Panelists

- Chris Voigt, formerly with Siskiyou Resource Conservation District (10 minutes)
- CDFW (10 minutes)
- Eli Asarian, Riverbend Science (10 minutes)
- Dr. Thomas Harter & Leland Scantlebury, UC Davis (10 minutes)
- Theodora Johnson, Scott Valley Agricultural Water Alliance (10 minutes)

Questions from Staff

Comments

Groundwater Local Cooperative Solutions

Scott-Shasta Workshop

October 6, 2023

CALIFORNIA Water Boards

Instream Flow Unit, Division of Water Rights

2021-2023 Local Cooperative Solutions Overview

- Legally binding alternative to curtailment
  - Emergency Regulation Section 875(f)(4)(a through d)
- Landowners propose conservation plans to reduce water use or provide other fishery benefits

- LCS Types:
  - **Groundwater**
  - Equal-or-better for anadromous fishery
  - Livestock diversion
  - Diversion cessation
  - Flow contribution
- LCS Scope:
  - Individual
  - Tributary-wide
  - Watershed-wide

Groundwater Local Cooperative Solutions

- **Scott River Watershed:**
  - 30% reduction in water use for the irrigation season (April – October) relative to a 2020 or 2021 baseline
  - Monthly 30% reduction for July through October

(CCR, §875(f)(4)(D)(ii).)

- **Shasta River Watershed:**
  - 15% reduction in water use for the irrigation season (March – November 1)
  - Monthly 15% reduction for June through September

(CCR, §875(f)(4)(iii).)

Groundwater Local Cooperative Solutions

Proposals had to include:

- Narrative description of verifiable conservation actions
- Demonstrate that water savings can be achieved and monitored
- Place of Use (POU)
- Signed Binding Coordination Agreement with Coordinating Entity

Binding Coordination Agreement:

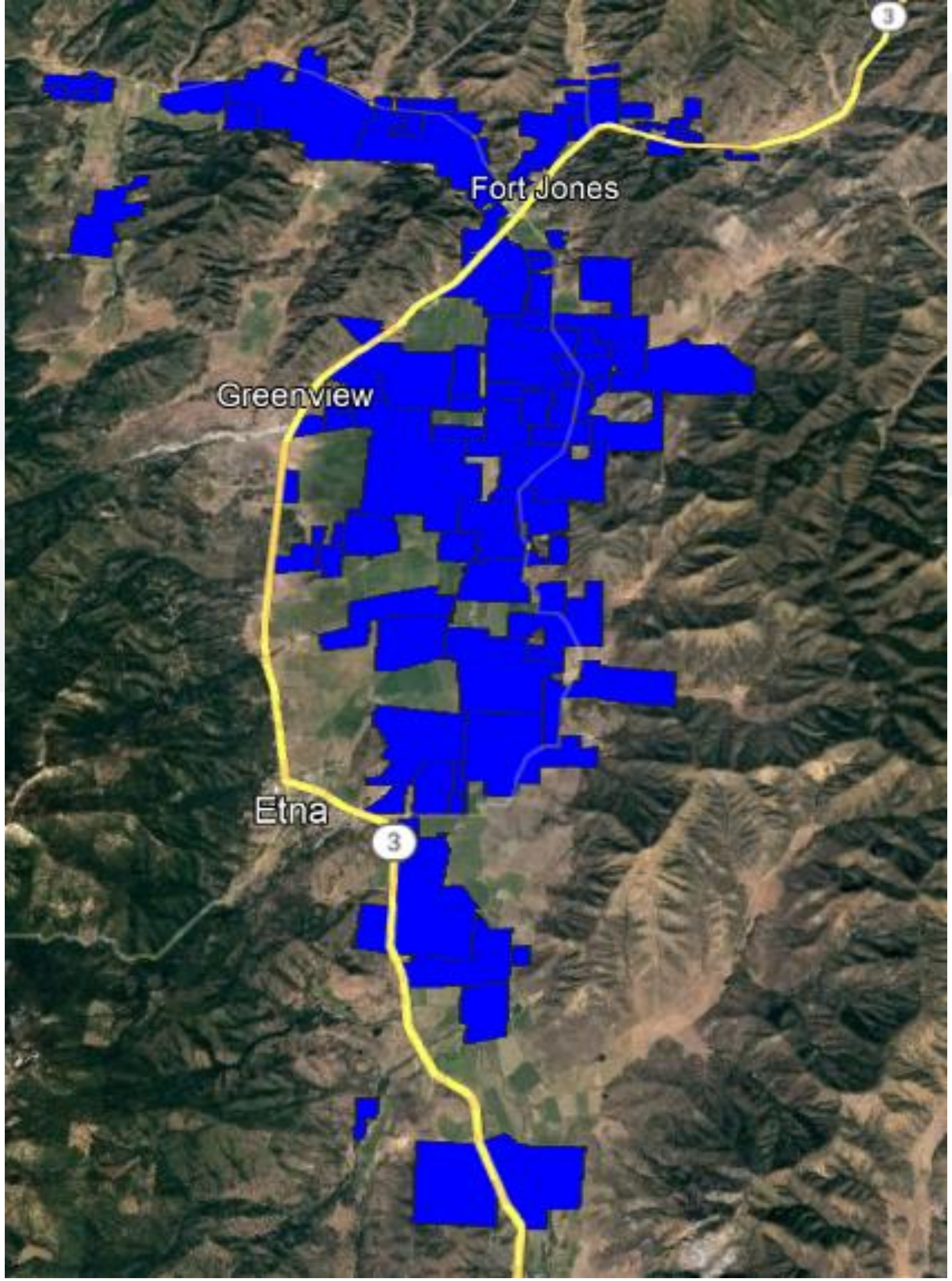
- Legally binding agreement with a third-party Coordinating Entity (CDFW, RCDs)
- Coordinating Entity:
  - Verifies implementation of conservation actions
  - Assists with plan development

Examples of Groundwater Local Cooperative Solution Conservation Actions

- Fallow cropland
- Shut off end-guns
- Convert from less efficient irrigation equipment to more efficient equipment
- Switch from thirsty crops to less thirsty crops (e.g., alfalfa to grain)
- Install soil moisture sensors
- Reduce nozzle size and water pressure
- Reduce irrigation set times, number of passes, and application rates
- Fewer cuttings
- No cover crop
- Early cessation of irrigation

Scott Valley 2022 Irrigation Season Participation

- 47 local cooperative solution plans covering 17,268 acres
  - 97% of groundwater irrigated acreage
  - 50% of total irrigated acreage
- Enforcement actions were taken against four overlying groundwater pumpers who were not enrolled in groundwater local cooperative solution program



Chris Voigt Groundwater LCS Presentation (10 minutes)

- What observations do you have from assessing groundwater local cooperative solutions?
- What was your role in verifying compliance with the groundwater local cooperative solution commitments?
- Are there recommendations you have that would improve the process of developing and verifying groundwater local cooperative solutions?
- Should future groundwater local cooperative solutions, if adopted, incorporate conservation and efficiency investments made prior to 2021? If so, how?

The Local Cooperative Solution in Scott Valley 2022

Implementation and Verification

What was your role in verifying compliance with the groundwater local cooperative solution commitments?

- I was tasked with developing the entire program, so I communicated with potential participants on the front end and was available for them, as needed, during the development process of their curtailment plans.
- I reviewed plans and signed people up for the LCS/Binding Agreement once I saw a 30% saving on their plan.
- I developed the field verification process and carried out all field verification visits.
- I was in communication with Water Board representatives, Adam Weinberg and Kevin DeLong periodically throughout the entire process.

What observations do you have from assessing groundwater local cooperative solutions?

- **Large amount of trust involved by all parties:**

  - The Water Board had to trust that participants would adhere to the terms of their curtailment plan and the Water Board also had to trust the 3rd party field verification process; (that it would be implemented, that it would be meaningful and able to be documented, etc.).

  - The participants had to Trust the Water Board that they would honor their curtailment plan without additional restrictions added on at a later time. The participants also had to trust that the 3rd party verification process would be honest and fair.

  - The 3rd party verifier had to trust the participant that they would (and did) adhere to their 30% curtailment plan and also trust the Water Board that they would honor participants curtailment plan (once approved) without additional restrictions added on at a later time.

  - I felt like this part of the process, the Trust issue, was successful and I'd like to see all parties continue to develop and build on that trust going forward.

What observations do you have from assessing groundwater local cooperative solutions?

- **Attitude of the participants**

  - Once potential participants heard that the curtailment order was going to be going int effect, they wanted to sign up ASAP, so that they could continue to irrigate at a reduced rate.

  - Most participants were able to come up with a plan by April and they adhered to the plan for the entire irrigation season.

  - Regarding the field verification of the curtailment plans, some participants started the inspection process before the actual curtailment order went into effect out of an abundance of caution and willingness to adhere to the plan.

  - Overall, for all participants, there was a willingness to engage and ensure compliance.

What observations do you have from assessing groundwater local cooperative solutions?

- **Techniques used to achieve 30% savings: Irrigation**

- **Pivots**
    - switch to LEPA or LESA nozzles from older conventional nozzles
    - switch to variable frequency drive pump,
    - reduce amount of water per pass by reducing the amount applied per pass or increase speed of a pass without reducing the rate of application.

- **Wheel lines:**

- switch to pivot
- switch out to smaller valve size,
- reduce set times (e.g., from 12 hours/pass to 9 hours/pass)

- **K-lines/ Pods:** reduce time of irrigation.
- **Flood:** reduce number of irrigation cycles.

What observations do you have from assessing groundwater local cooperative solutions?

- **Other ways that participants reduced water use**

  - **Conversion to Wheat:** Usually irrigation is finished by late June or early July.

  - **Fallow:** Corners of fields irrigated with wheel lines or pods and less productive fields were fallowed

What observations do you have from assessing groundwater local cooperative solutions?

- **Limitations of compliance monitoring of on-site field verifications:**

  - Pivots were easiest to monitor because I could look and see what they were set to, it was also easy to verify new LEPA/LESA nozzles.

  - Flood irrigation was easy to verify because the pump was either on or off and the flood irrigation cycle is predictable. No point in doing a partial flood cycle or even extra flood cycles.

  - Wheel lines were easy to see that nozzles had been changed but I had to trust folks on their word that set times were reduced.

  - K-Lines/Pods: similar to wheel lines, I had to trust folks on their word about irrigation times.

Are there recommendations you have that would improve the process of developing and verifying groundwater local cooperative solutions?

- **Streamlining the process would be better for everyone.**
  - Especially on the front end of the process
  - One idea might be a group of different spreadsheet templates to use, say 5-6 different templates from simple to more complex; or maybe developed for different crop type or irrigation methods.
  - Having a suite of standardized/pre-approved spreadsheet templates might be one way to streamline the process.

Are there recommendations you have that would improve the process of developing and verifying groundwater local cooperative solutions?

- **Communication was overall pretty good but can always be improved.**
  - I thought communication with Water Board representatives was good
  - But some participants struggled with getting information because most of it was online and some folks don't really do computers at all.
  - I did my best to be available to help guide them through the process.
  - Some participants struggled with creating the plan in a spreadsheet form, but I know that Adam Weinberg and or Kevin DeLano were able to help them create that.

Are there recommendations you have that would improve the process of developing and verifying groundwater local cooperative solutions?

- **We need to continue to build trust, Trust but Verify.**

  - From my perspective, all parties involved did a good job.

  - The field verification is crucial because without that nobody really knows if participants were adhering to their plan.

Are there recommendations you have that would improve the process of developing and verifying groundwater local cooperative solutions?

- **More carrot less stick.**
  - Agricultural groundwater users understand the situation and no one wants to use more water than they really need to.
  - Folks want to (and generally always do) operate as efficiently as possibly at all times to keep costs down but usually irrigation efficiency improvements come at a substantial financial cost.
  - Low interest agricultural loans specifically for irrigation efficiency improvements, subsidy programs for pivot conversion and availability of soil-moisture meters could help improve engagement with these opportunities for improvement.

Should future groundwater local cooperative solutions, if adopted, incorporate conservation and efficiency investments made prior to 2021? If so, how?

- Yes, ask for verifiable records such as receipts for new equipment purchased and electric bills going back to, for example, 2014, as a middle ground in the previous drought (2011-2017 drought), compared to the most recent (2020-2022 drought). Some more progressive agricultural groundwater users started making certain irrigation efficiency improvements back then and have been operating as efficiently as possible since well before 2020.
- Irrigation efficiency willingness versus actual financial ability of folks to actually make these sort of large capital expenditures is an issue, especially for the smaller farms and ranches, the mom and pop type operations.
- There's lots of room for efficiency improvements but many folks don't have the money to pay for those improvements out of pocket.
- There is a need for financial aid for water users to carry out these efficiency improvements whether it's for conversion from wheel line to pivot or simply free or heavily discounted soil-moisture meters, any additional resources would be welcome.
- There is a continuous need for more instream flow monitoring on the mainstem Scott River and western tributaries.
- Additionally, continuous real-time monitoring of precipitation, soil-moisture, and ET at several locations throughout the valley would be helpful to refine our understanding of Scott Valley's water balance.

Thank You

CDFW Groundwater LCS Presentation (10 minutes)

- What observations do you have from assessing groundwater local cooperative solutions?
- What was your role in verifying compliance with the groundwater local cooperative solution commitments?
- Are there recommendations you have that would improve the process of developing and verifying groundwater local cooperative solutions?
- Should future groundwater local cooperative solutions, if adopted, incorporate conservation and efficiency investments made prior to 2021? If so, how?

Scott and Shasta River Local Cooperative Solutions

Presented by: Michael Harris, Klamath Watershed Program CDFW

Local Cooperative Solution (LCS)

- 2 Coordinating Entities
  - Siskiyou RCD: 21 LCSs
  - CDFW: 26 LCSs
- CDFW Inspection Reports
  - Checklists for each ranch
  - 54% ranches received at least one inspection
    - 5 ranches had 2 or more inspections
  - 55% LCS proposed actions verified
- CDFW Reporting
  - 69% met the requirement
  - Not reported: Sept/Oct

2022 Local Cooperative Solution Site Inspection Report   Name of LCS or Owner:

Section A – General Information (If necessary, complete additional inspection reports for each separate inspection location.)	
Inspector Information	
Inspector Name:	**Email:** **@wildlife.ca.gov**
Company Name: CA Dept of Fish and Wildlife	**Phone Number:**
Inspection Details	
Inspection Date:	**Inspection Location:**
Inspection Start Time:	**Inspection End Time:**
Weather Conditions During Inspection:	

Did you verify conservation actions approved in the LCS? ☐ Yes ☐ No

If "Yes," supply the verifiable actions checked:

- ☐ enhance irrigation pivot efficiencies/LEPA systems
- ☐ reduced pivot revolutions
- ☐ reduced end gun usage
- ☐ reduced wheel lines sets and use
- ☐ fallowed corners
- ☐ grain crops to eliminate fall irrigation
- ☐ fall forbearance/no 4th cut irrigation
- ☐ POMI pump rendered unusable for 2022

Other Notes

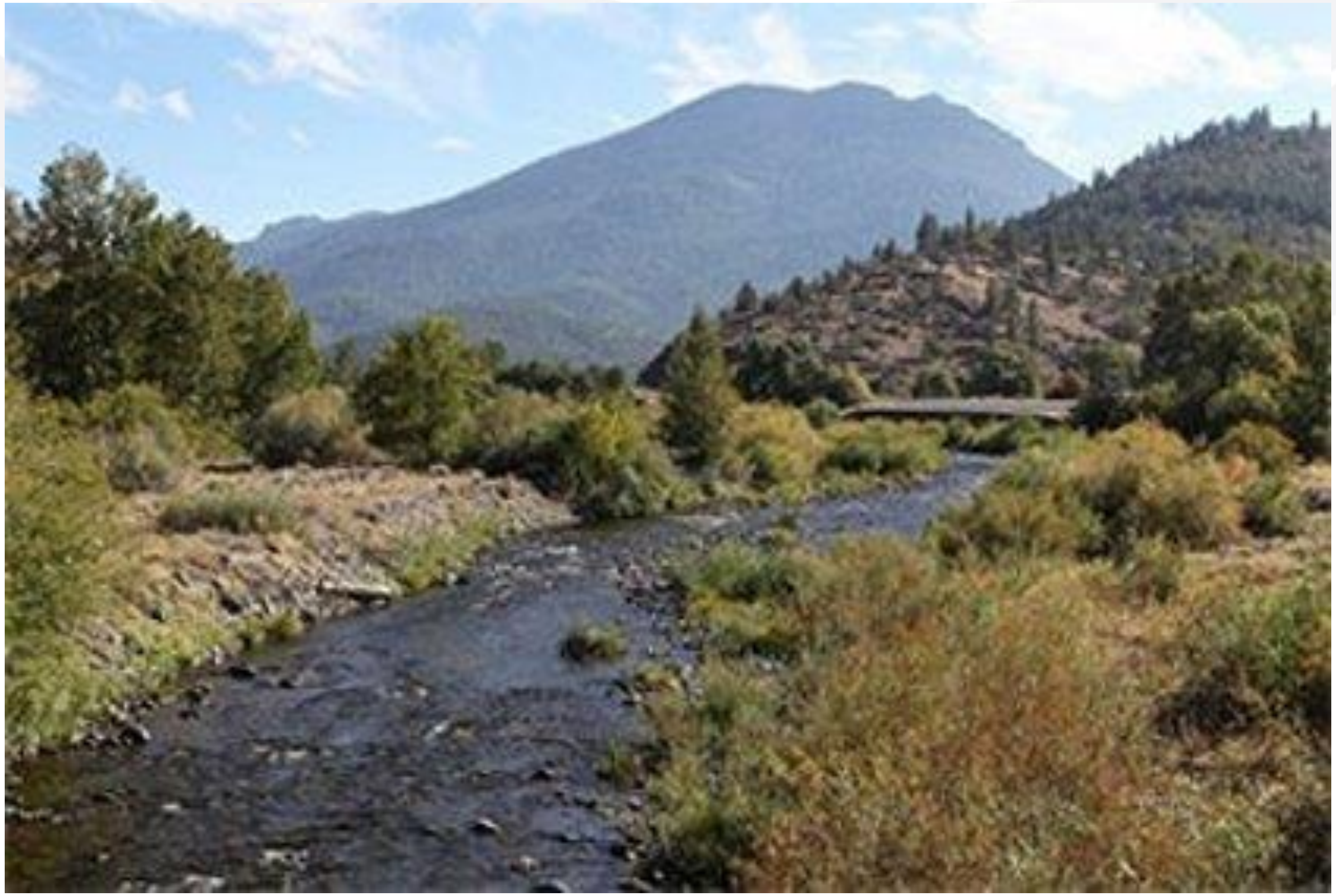
CDFW Example LCS Site Inspection Checklist

Local Cooperative Solution Conservation Actions	Shasta	Scott (acres unless otherwise stated)
% Reservoir capacity		50% capacity
Nozzle pressure reduced		3576.96
3 alfalfa cuttings only		3012
Set time reduced		2681.7
Application rate reduced		2529.27
Nozzle size reduced		1375.66
Revolutions reduced		1127
Converted to Grain		1068.7
Corners shutoff early/ completely		874+
Fallowed by Oct. 1		742
LEPA Installed		566
Fallowed by June		385
Fallowed by Sept. 10-15		326
# passes reduced		314.01
Fallowed all year		307.83
LESA Installed		285
Converted to Pivots		212.02 acres & 22 wheel lines
Cover crops fallowed		194
Fallowed by July 1		172
Fallowed by Sept 1		117
Converted Orchard grass to Alfafa		112
Pivot off 1 day/wk		112
One pump ceased		100
Wheel line rotated with Pivot		70
Dairy pump off 1 day/wk		64
2 alfalfa cuttings only		61
Converted to Wheat		52
Converted to Bluegrass		45
Converted to grass		42
Fallowed by Oct. 31		27
VFD installed		24.1 acres & 15 drives
# of Nelson flow control valves installed		17
Forgo surface water use		13
# of pivots installed with iWob		11
Flood irrigation converted to Wheel line		11
# of Sprinklers reduced		10
# of soil sensors installed		10
1st alfalfa cutting only		10
Sets per pass reduced		5
Fallowed by Aug 1		5
Applied compost and biochar		5
# of in-line flow meter installed		1
CFS dedications	1.5	

Local Cooperative Solution Conservation Actions	Scott (acres)
Irrigation Infrastructure Upgrades	6148.74
Reduction in Water Usage	6942.98
Fallowing	5358.83
Crop Conversion	1319.7

LCS: Benefits

- Relationship building
- Water usage modifications plans/discussions
- Understanding of ranching practices
- Identifying best management practices

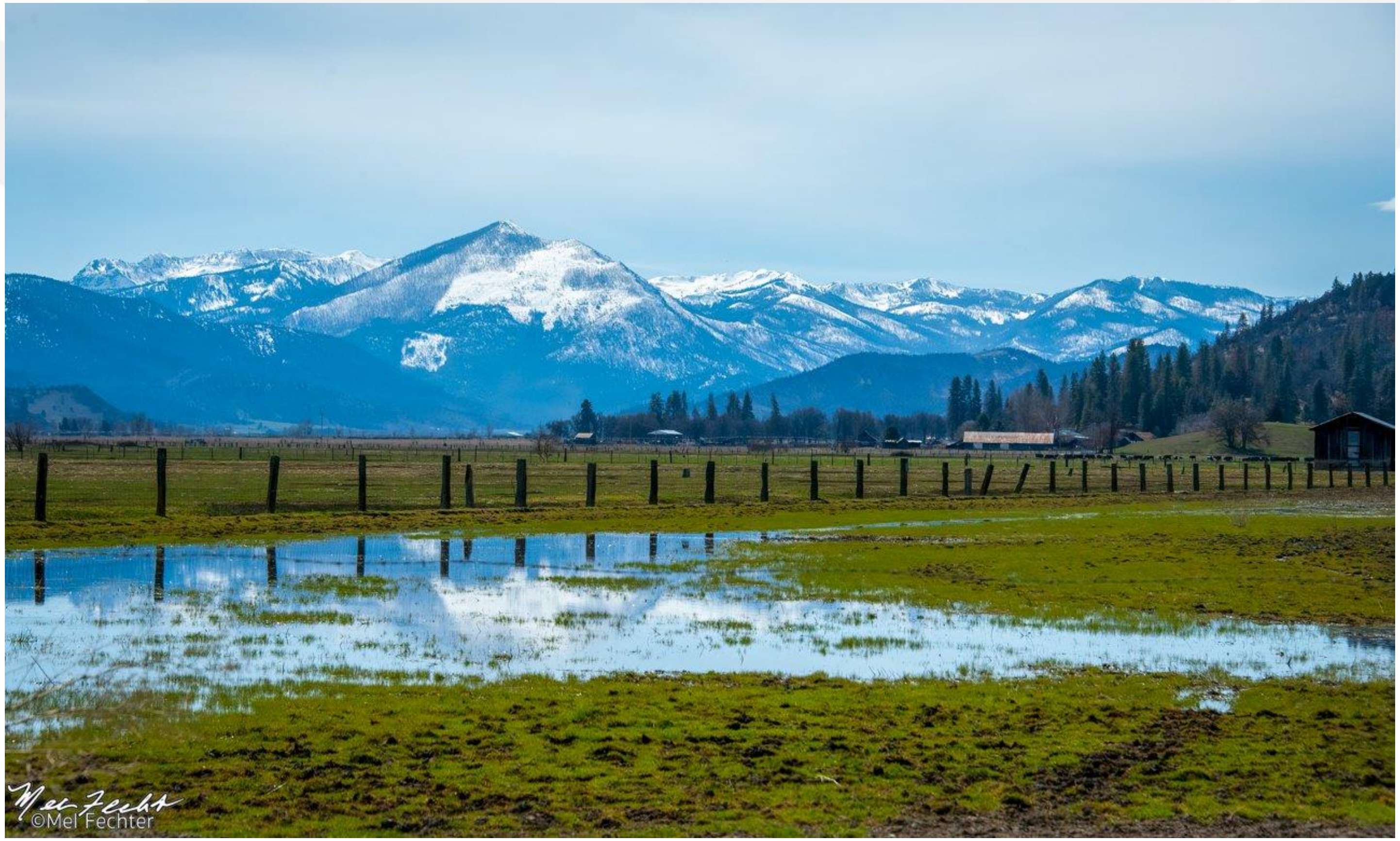


LCS: Improvement Recommendations

- Revise application format:
  - Provide a variety of clear alternatives and expectations for the LCS participant to choose from
  - Enrollment date deadline for LCS submittal
- Determine baseline water use
- Data collection and sharing requirements

Summary: Local Cooperative Solutions

- Supportive with modifications
- Streamline approval
- Baseline water usage
- Appreciate dialogue with landowners
- We are interested in implementing LCS's that have equal or greater conservation values than the curtailment:
  - Specific
  - Measurable
  - Achievable
  - Relevant
  - Time bound
  - Binding

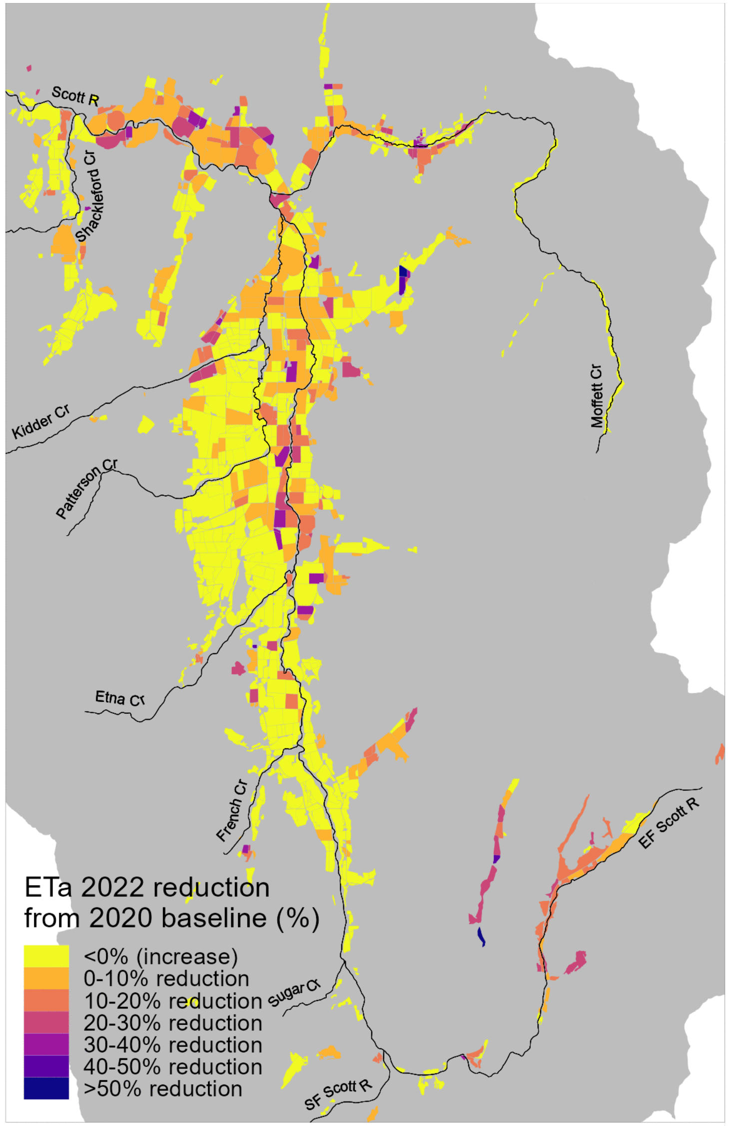


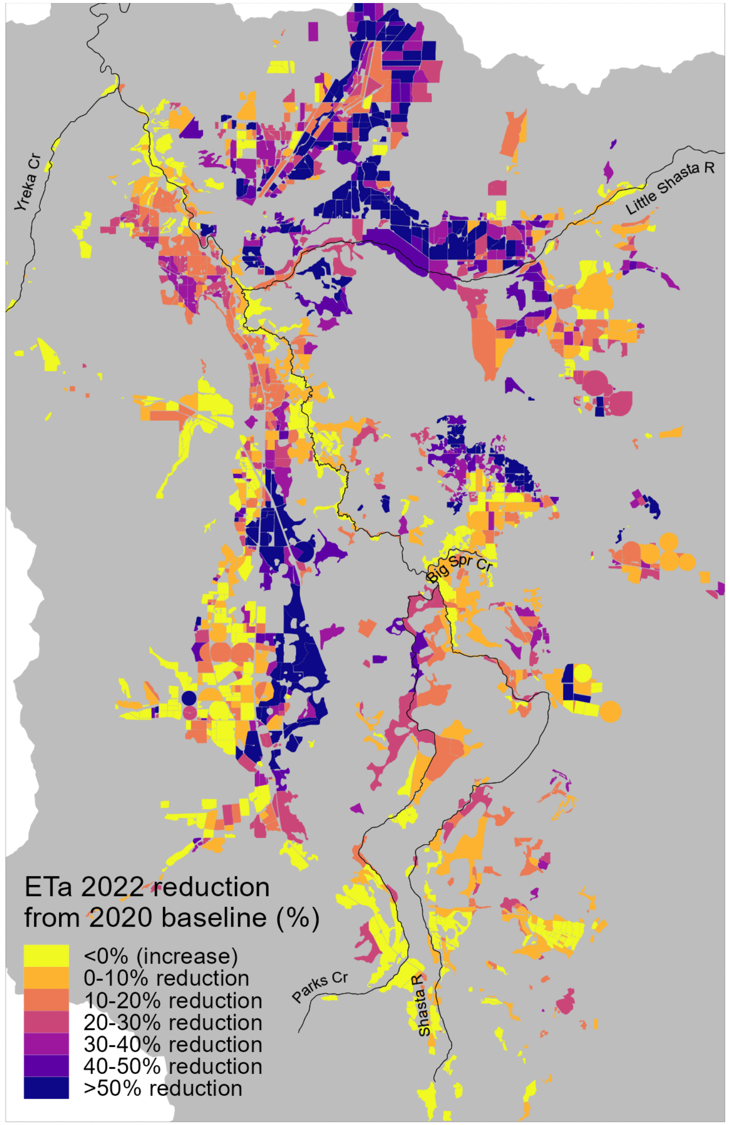
Eli Asarian Groundwater LCS Presentation (10 minutes)

- Please provide a brief overview of your report on *Evaluating the hydrologic effects of 2021-2022 Scott and Shasta irrigation curtailments using remotes sensing and streamflow gages* and its findings.
- What conservation actions would best support the regulation's goals of enhancing streamflow while providing for other beneficial uses of water? Why?
- Given the lack of groundwater pumping information, what water use baseline would you propose to evaluate new groundwater local cooperative solutions?

Evaluating the hydrologic effects of the 2021–2022 Scott-Shasta curtailments using satellite remote sensing and streamflow gages

Eli Asarian
Riverbend Sciences

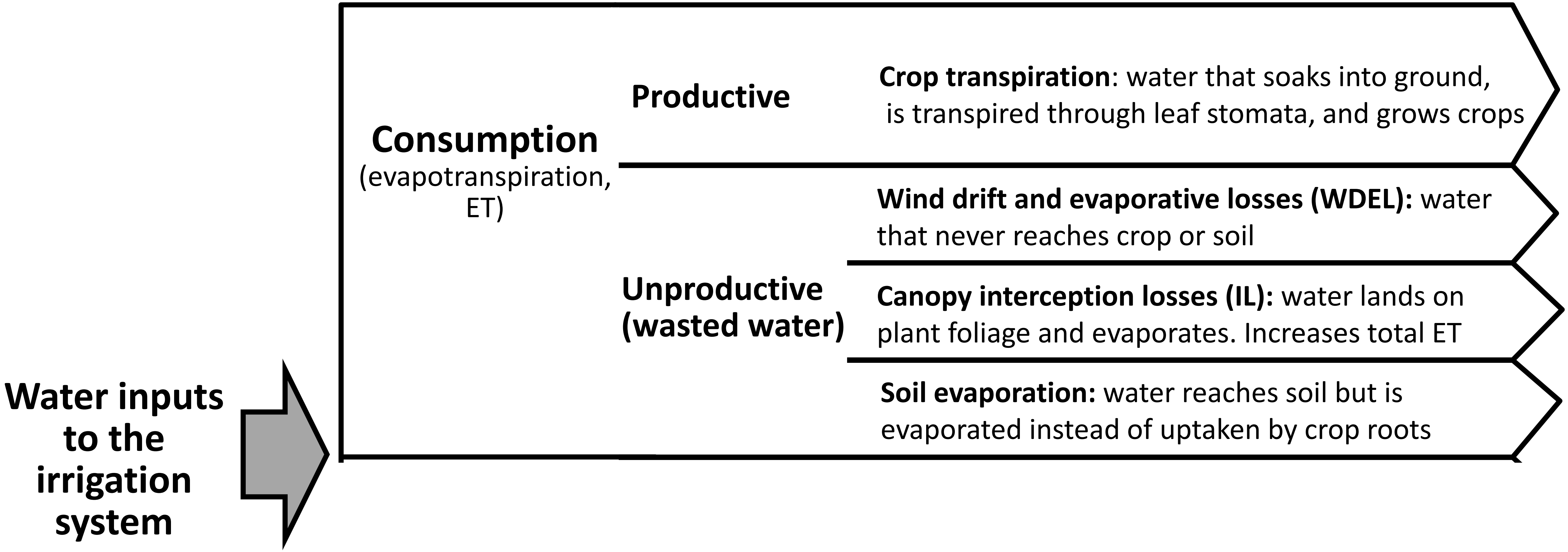


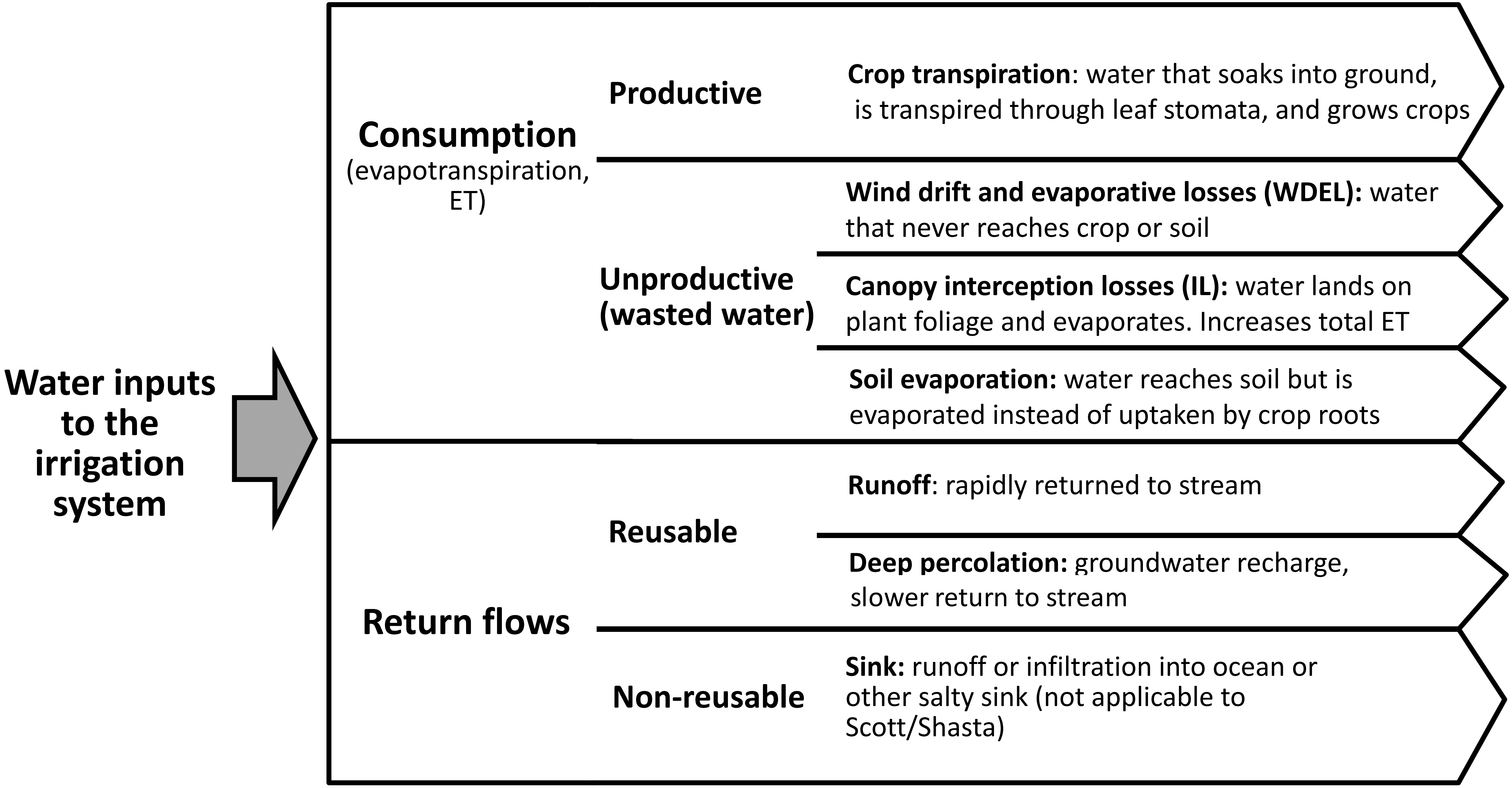


Funding provided by:
Klamath Tribal Water Quality Consortium

SWRCB Workshop Regarding Emergency Regulation Efforts in Scott River and Shasta River Watersheds

10/6/2023


Water inputs to the irrigation system
Consumption
(evapotranspiration, ET)
Productive
Crop transpiration: water that soaks into ground, is transpired through leaf stomata, and grows crops
Unproductive (wasted water)
Wind drift and evaporative losses (WDEL): water that never reaches crop or soil
Canopy interception losses (IL): water lands on plant foliage and evaporates. Increases total ET
Soil evaporation: water reaches soil but is evaporated instead of uptaken by crop roots


Water inputs to the irrigation system
Consumption (evapotranspiration, ET)
Productive
Crop transpiration: water that soaks into ground, is transpired through leaf stomata, and grows crops
Unproductive (wasted water)
Wind drift and evaporative losses (WDEL): water that never reaches crop or soil
Canopy interception losses (IL): water lands on plant foliage and evaporates. Increases total ET
Soil evaporation: water reaches soil but is evaporated instead of uptaken by crop roots
Return flows
Reusable
Runoff: rapidly returned to stream
Deep percolation: groundwater recharge, slower return to stream
Non-reusable
Sink: runoff or infiltration into ocean or other salty sink (not applicable to Scott/Shasta)

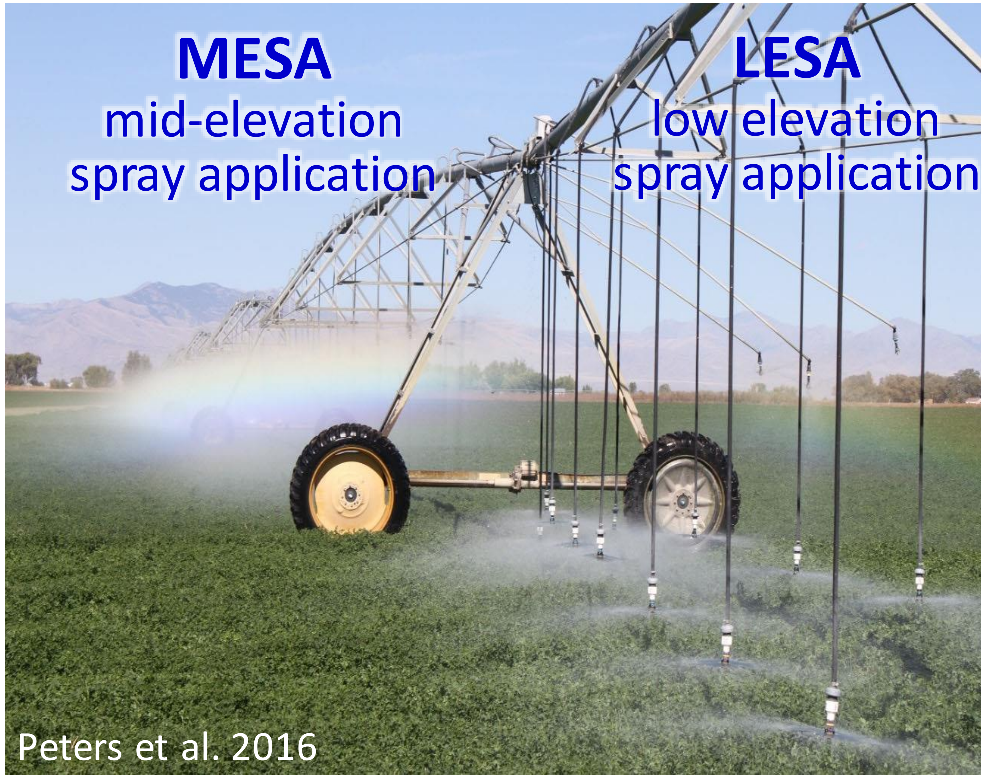
The More You Expose, the More You Lose: Limiting Center Pivot Irrigation Water Losses

Sarwar and Peters

~5-20%?

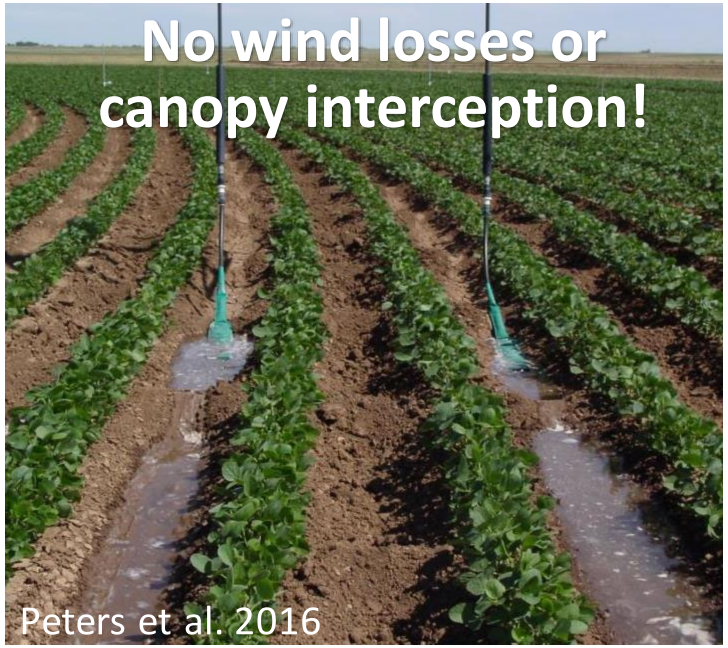
More consumptive use → **Less consumptive use**

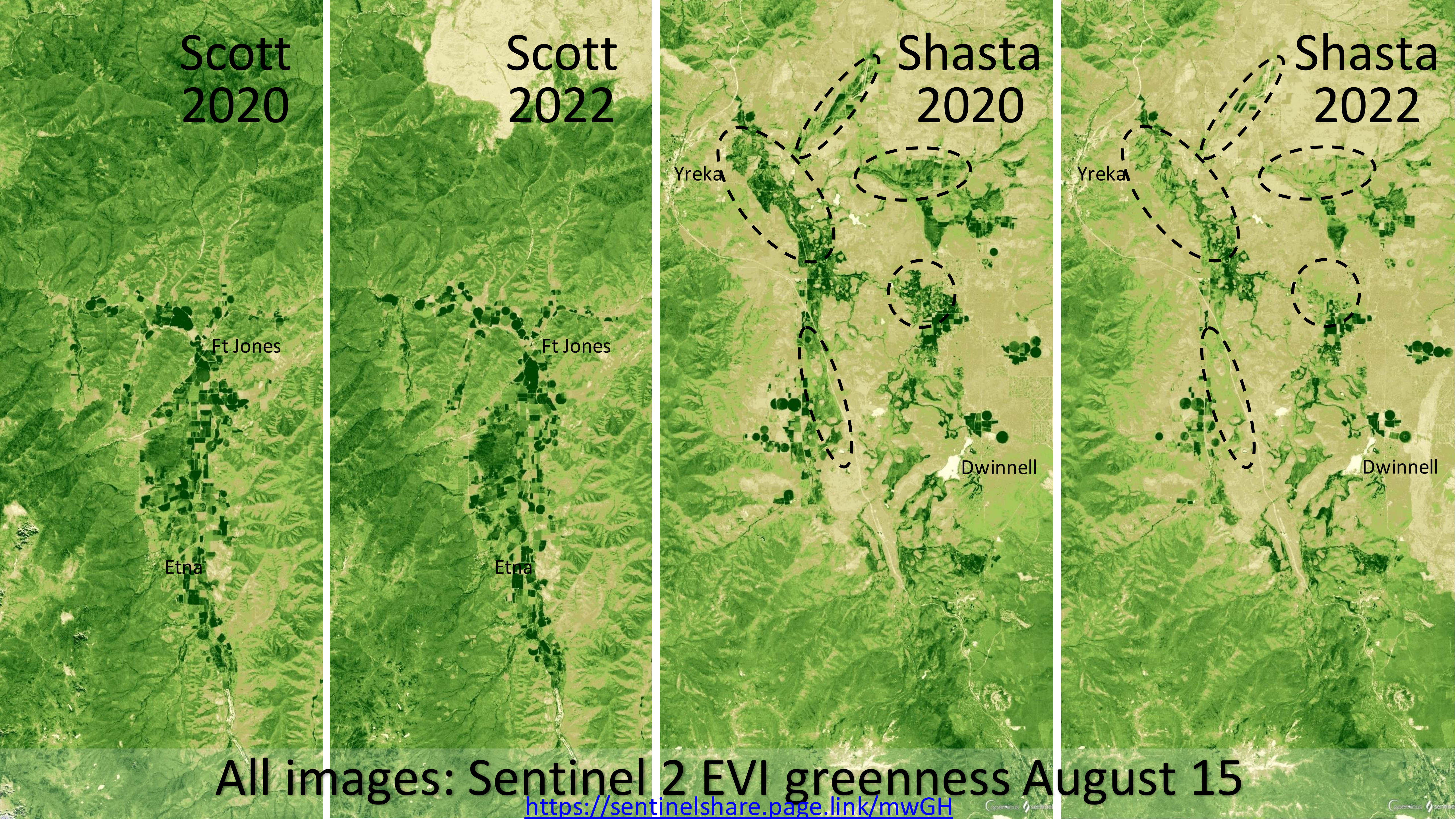
High-pressure impact sprinkler



LEPA

Low energy precision application



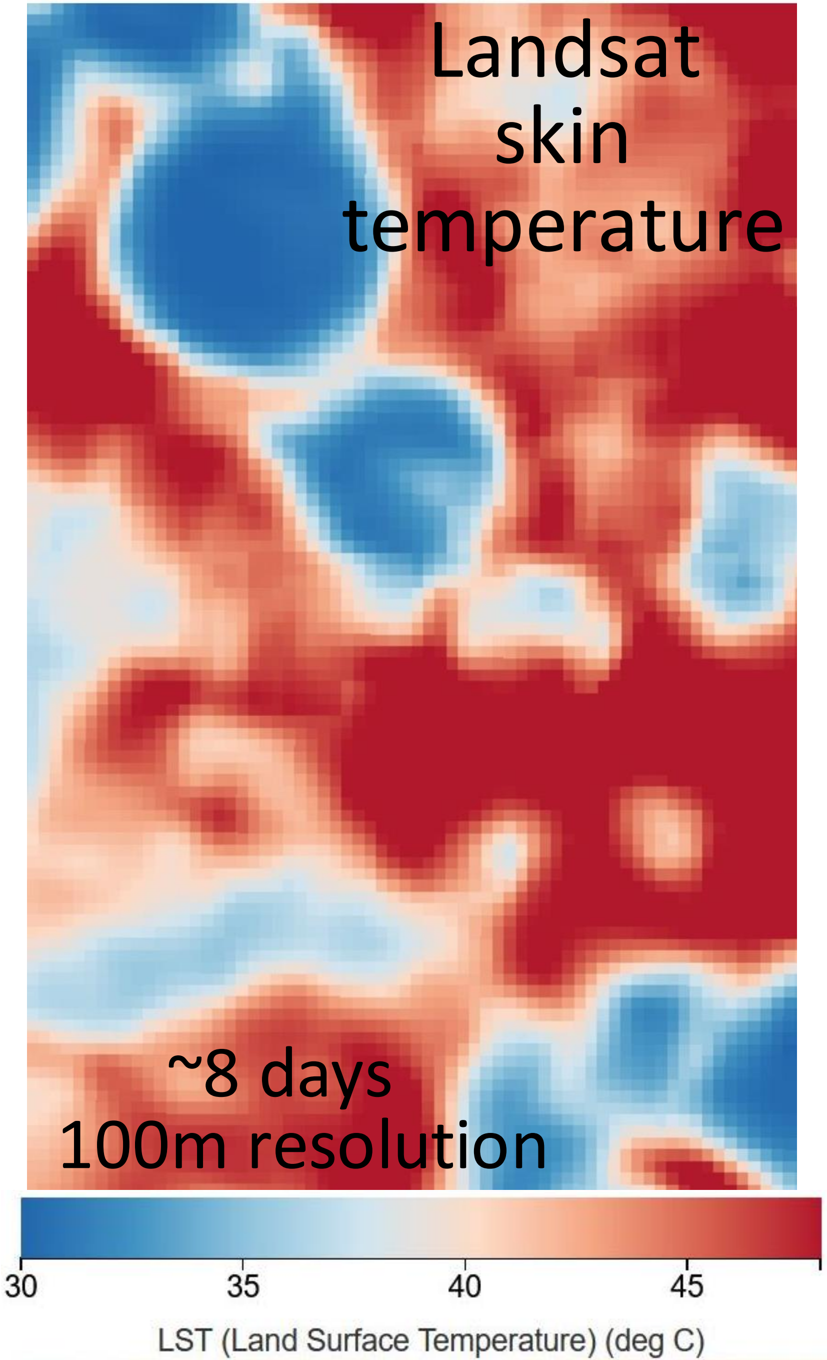


All images: Sentinel 2 EVI greenness August 15

https://sentinelshare.page.link/mwGH


USDA
NAIP aerial
1–2m resolution


True Color (Landsat 5/7/8/9 SR)
2022-07-20 to 2022-07-20, Mean
Landsat
True Color
~8 days
30m resolution


Landsat
skin
temperature
~8 days
100m resolution
30
35
40
45
LST (Land Surface Temperature) (deg C)

OPENET

https://openetdata.org/

EDF ENVIRONMENTAL DEFENSE FUND
Finding the ways that work

Google Earth Engine

NASA

DRI

USGS

UNIVERSITY of NEBRASKA–LINCOLN

HabitatSeven®

USDA ARS

University of Idaho

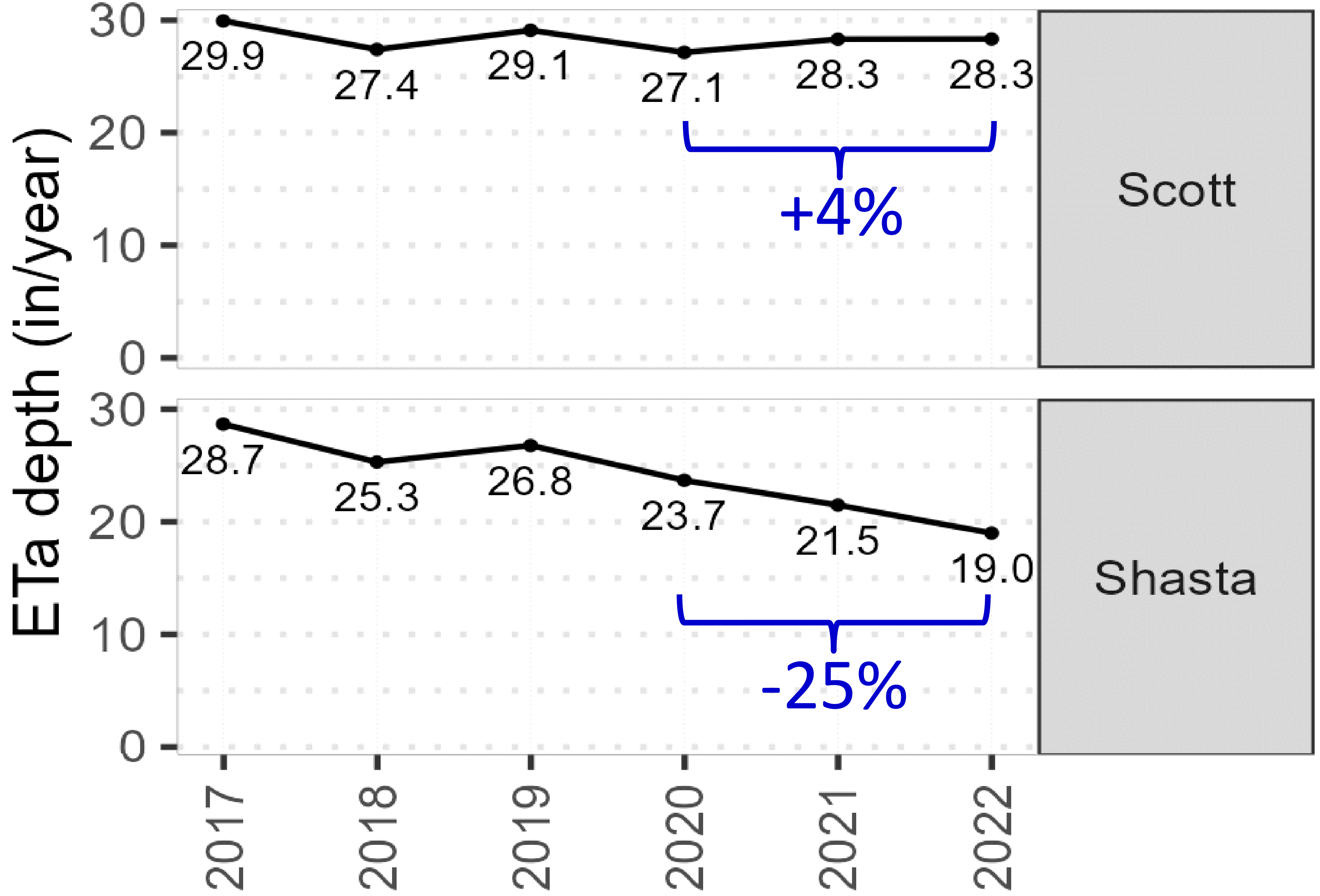
UNIVERSITY OF MARYLAND 1856

WISCONSIN
UNIVERSITY OF WISCONSIN–MADISON

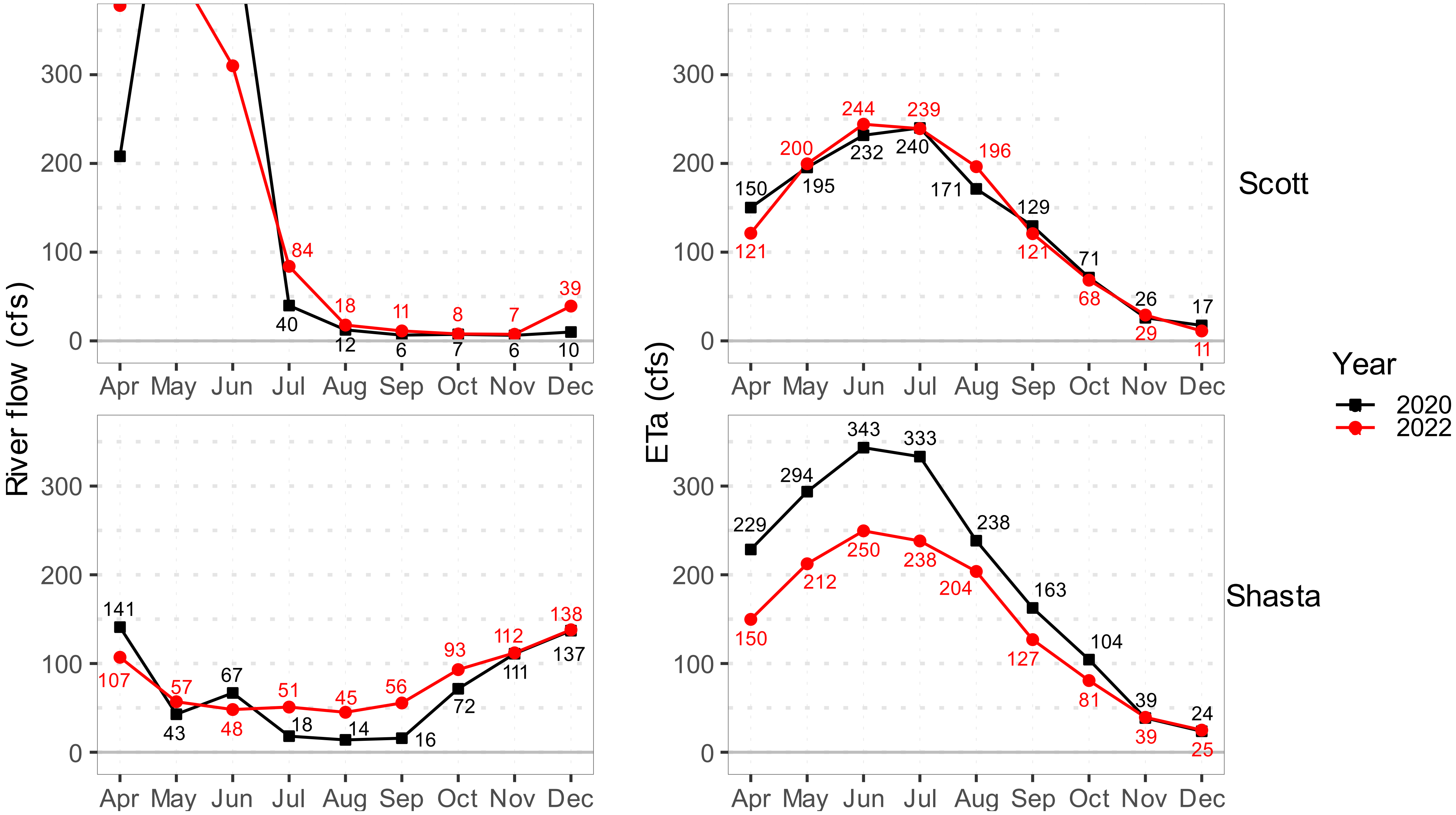
California State University MONTEREY BAY

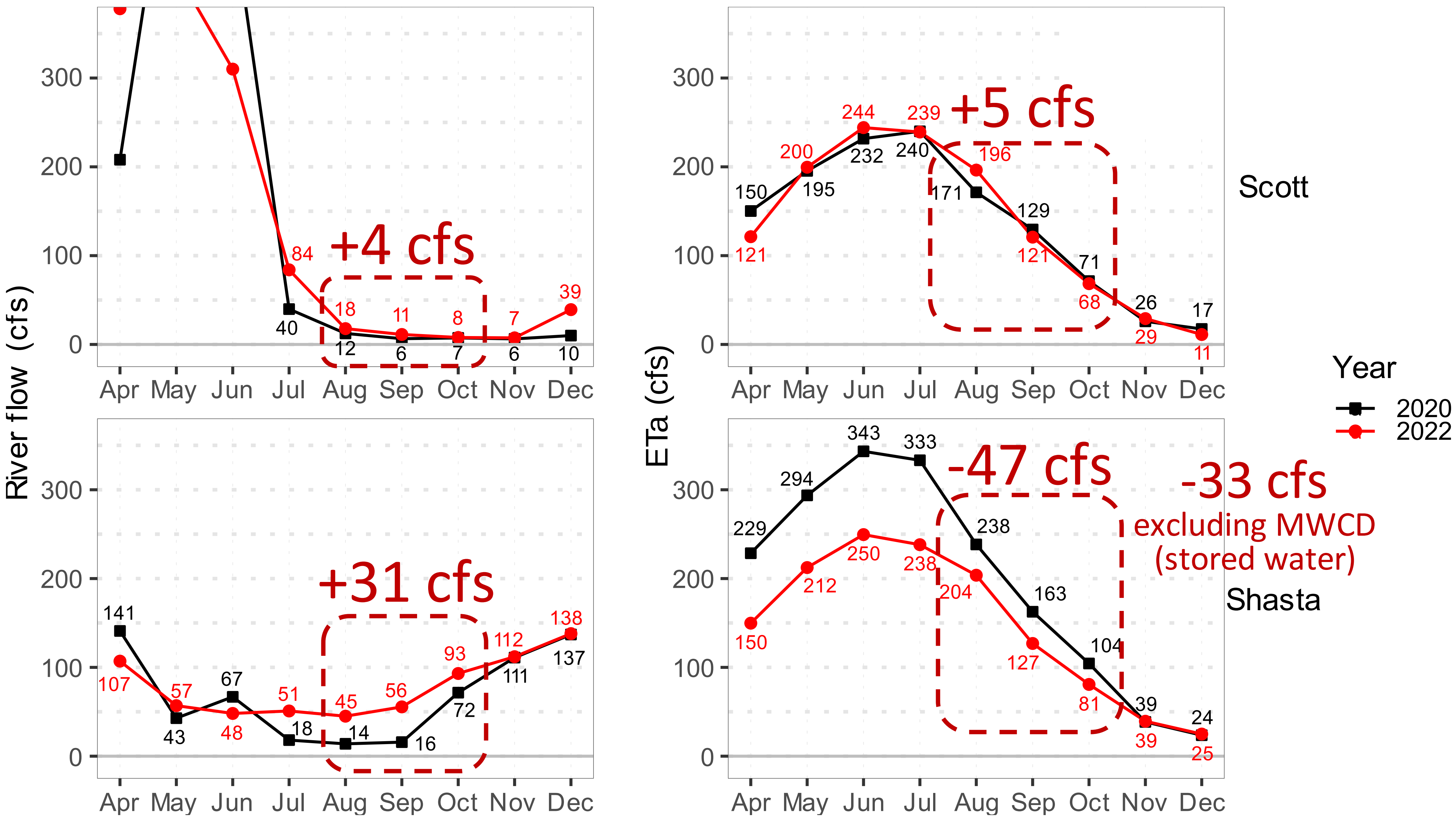
UFRGS
UNIVERSIDADE FEDERAL DO RIO GRANDE DO SUL

All OpenET fields

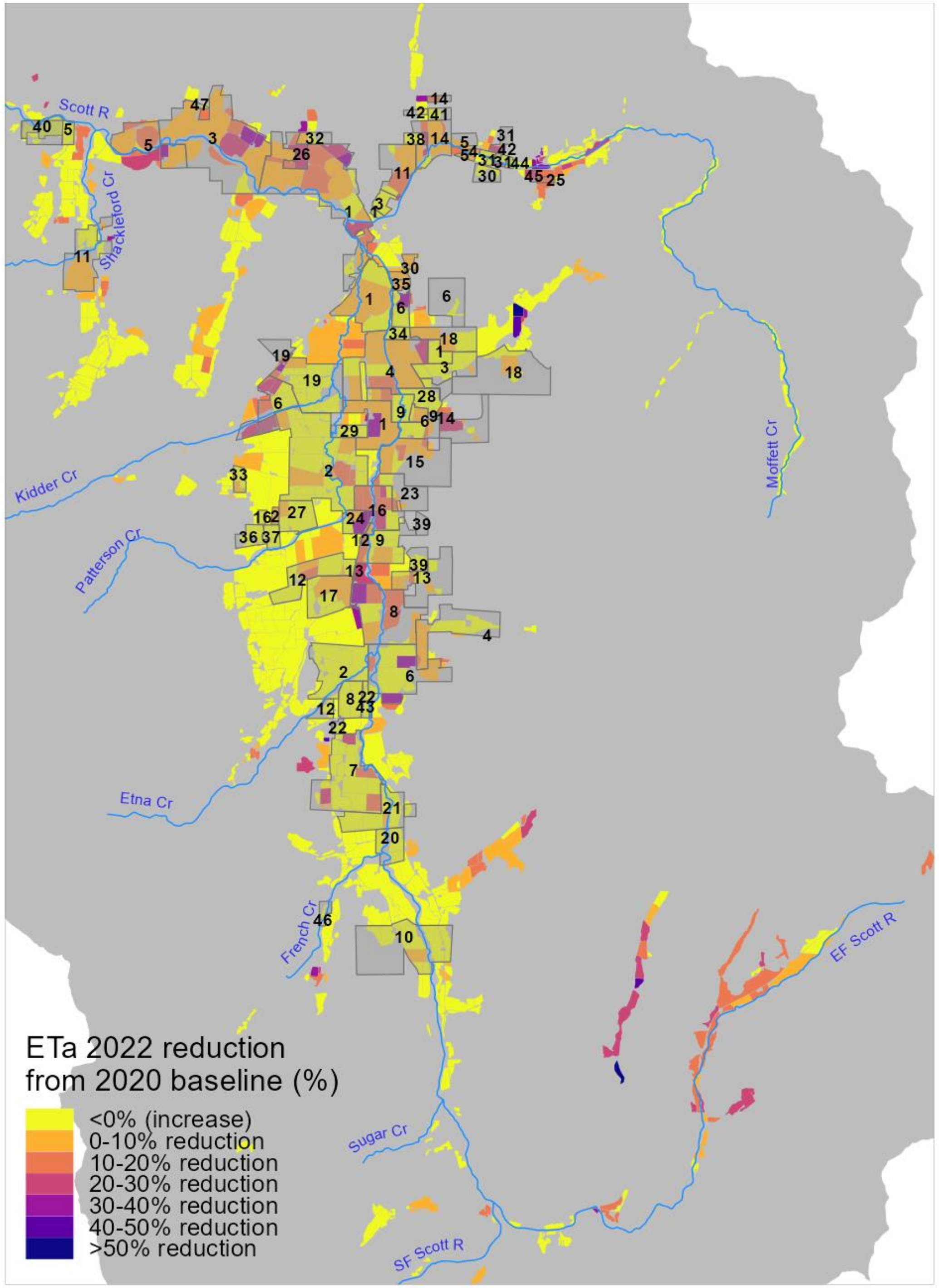


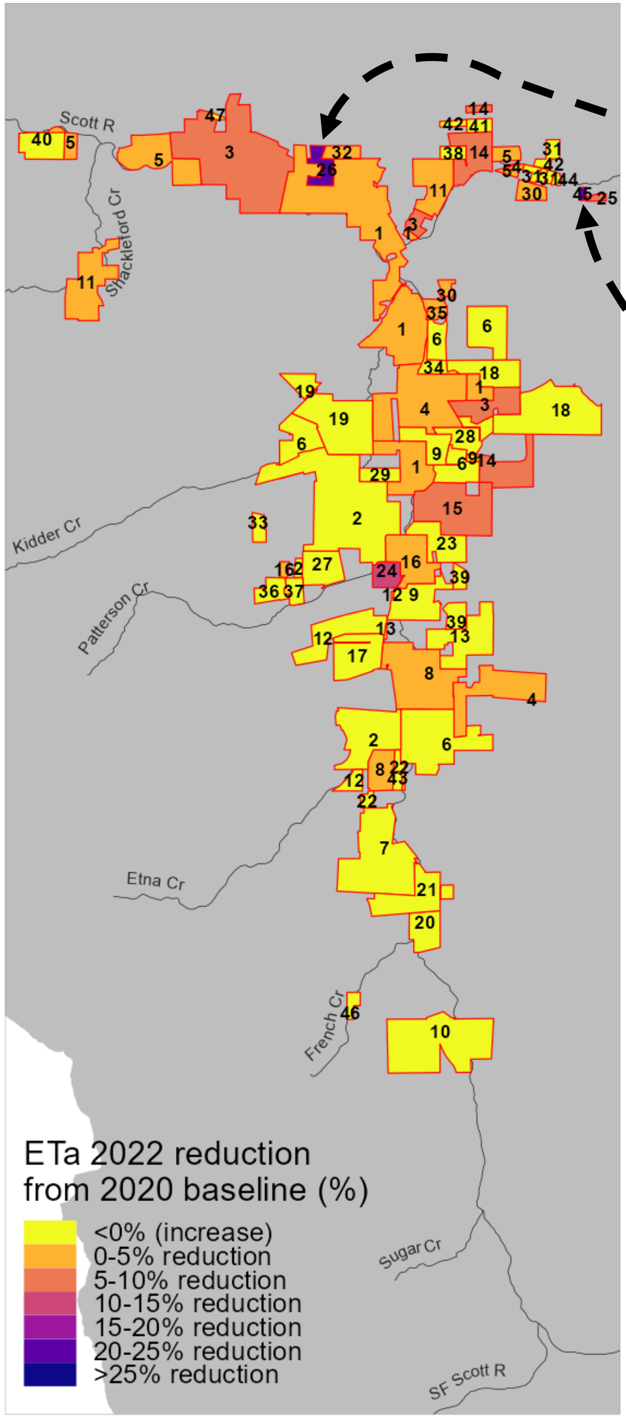
Flow differences match ET differences





River flow (cfs)
ETa (cfs)
+4 cfs
+5 cfs
+31 cfs
-47 cfs
-33 cfs
excluding MWCD
(stored water)
Scott
Shasta
Year
2020
2022
Apr May Jun Jul Aug Sep Oct Nov Dec

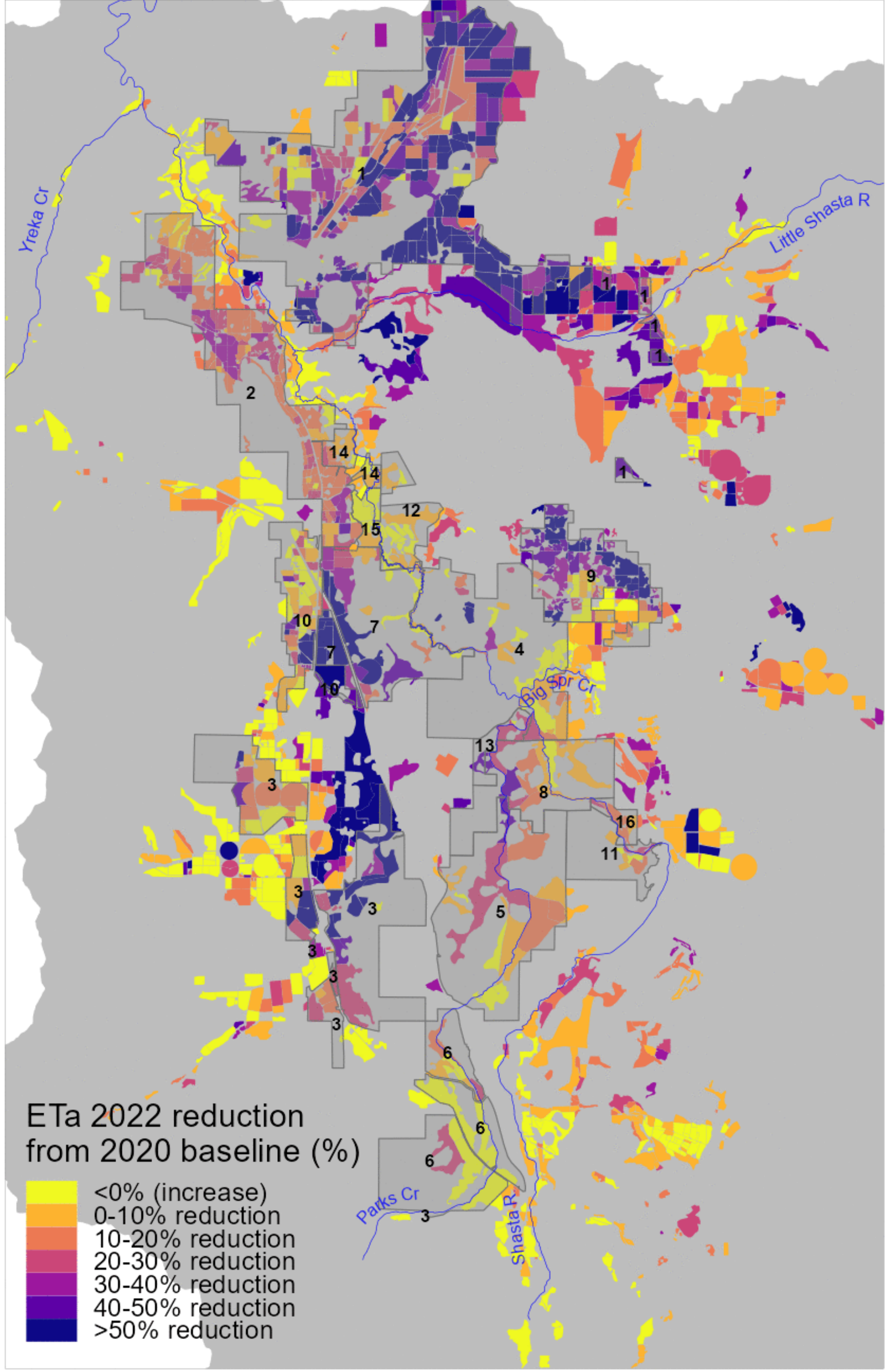


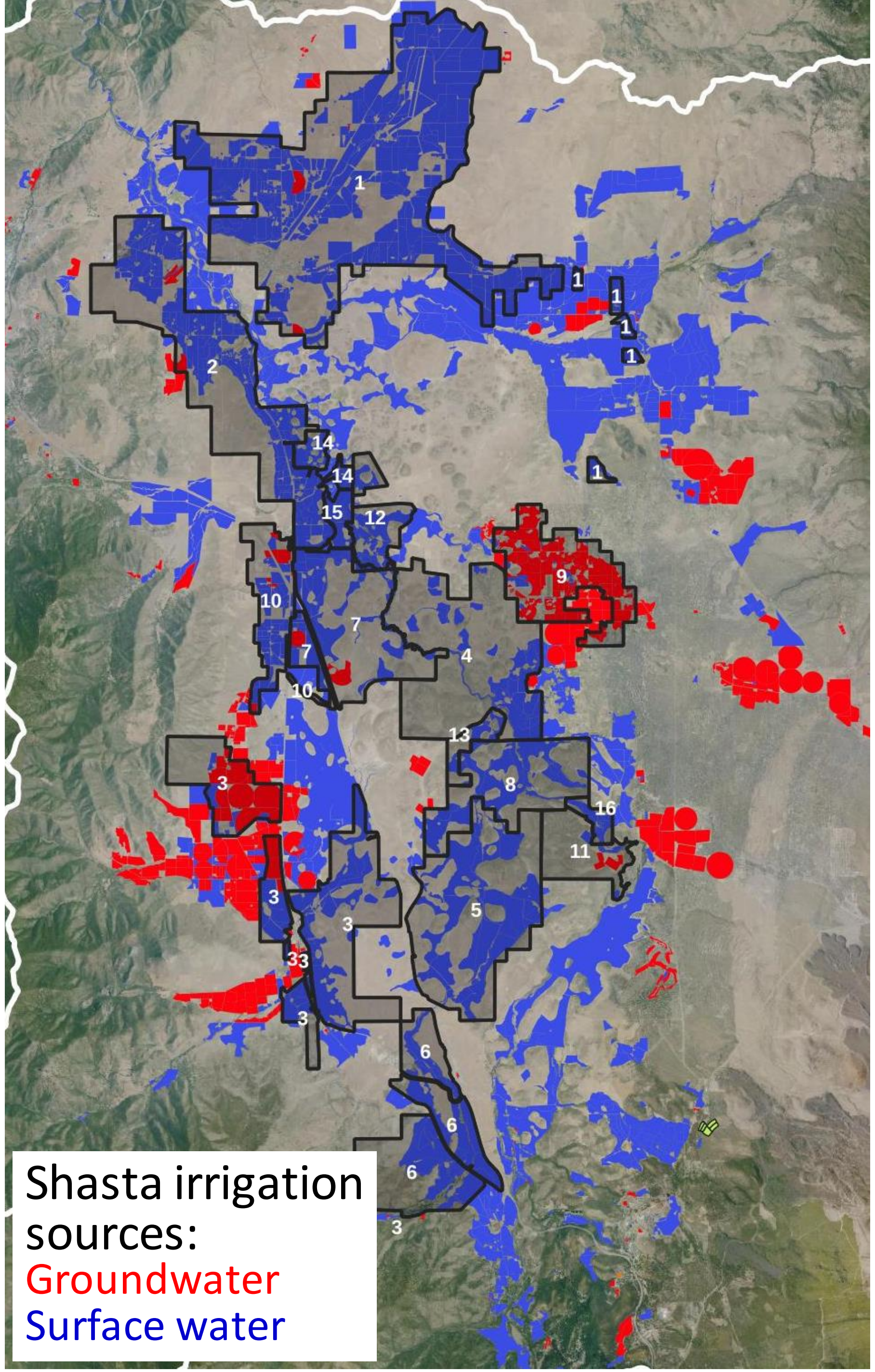


Ranch #26:
20% reduction
(34.4in → 27.5in),
no irrigation on 30% of
typical acreage

Ranch #45:
21% reduction
(29.6in → 23.5in),
no irrigation after June 30

2022 Scott Local cooperative solutions (LCS)


ETa 2022 reduction
from 2020 baseline (%)
<0% (increase)
0-10% reduction
10-20% reduction
20-30% reduction
30-40% reduction
40-50% reduction
>50% reduction
Yreka Cr
Little Shasta R
Big Spr Cr
Parks Cr
Shasta R


Shasta irrigation
sources:
Groundwater
Surface water

Why ETa reduction in Shasta, not Scott?

- Shasta has watermastered surface water, so easier to control than Scott groundwater

- Ineffective Scott LCS

Future LCS Recommendations

- Focus on ETa reductions
- Verification and records:
  - 2022 LCS primarily self-reporting, limited independent verification
  - LCS practices should be verifiable with records:
    - Water meters
    - Electricity meters (only works if no major changes to infrastructure)
    - Remote sensing
    - Photos
  - Don’t allow unverifiable actions in future LCS
    - E.g., hours per week of irrigation (unless there’s verifiable record)
- Improve baseline

Inflated Baselines

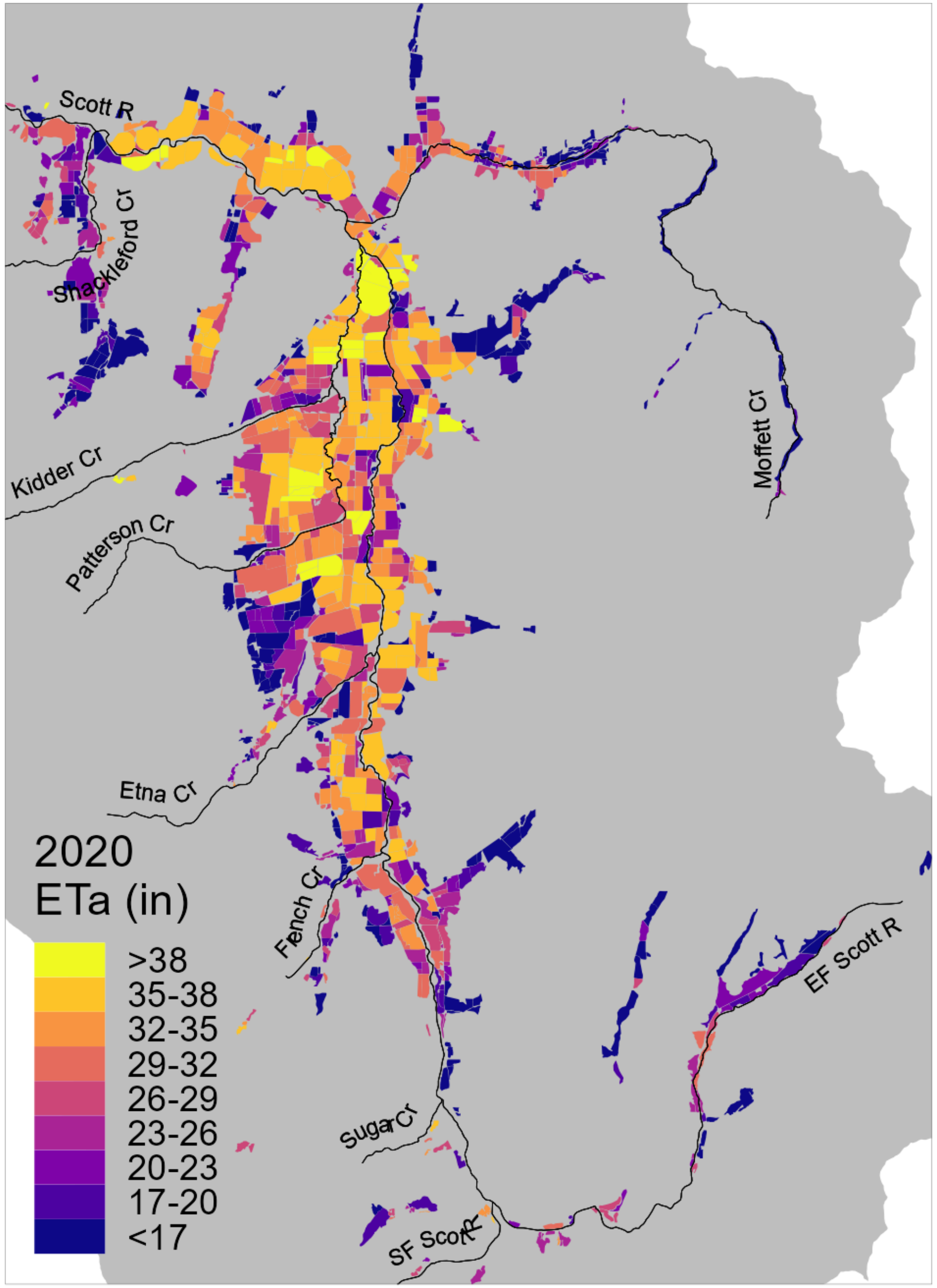
Source	Irrigation (inches)				Actual evapotranspiration [ETa] (inches)			
	All	Alfalfa	Pasture	Grain	All	Alfalfa	Pasture	Grain
SVIHM Foglia et al. (2013)	30.3	33.1	29.7	14.1	35.7	40.1	33.9	16.1
SVIHM Foglia et al. (2018)	22.6	21.5	26.0	10.3	34.2	36.8	34.8	16.1
LCS baseline 2020 or 2021	44.1							
LCS 2022	29.2							
OpenET 2017-2022					31.1			

Too low?

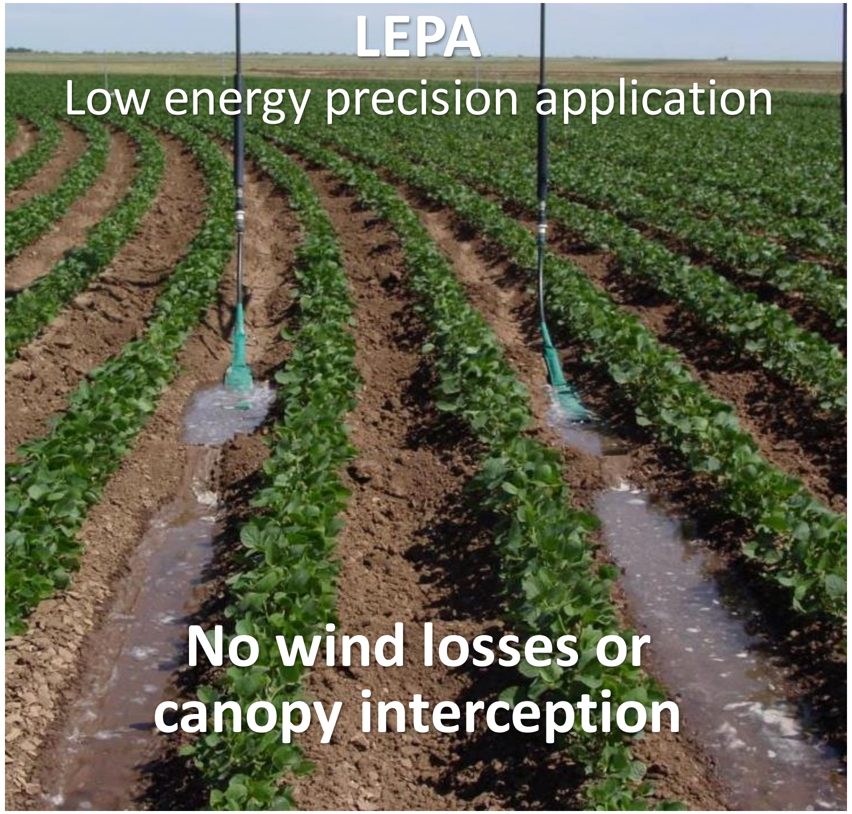
Too high?

Recommendations for Baselines

- Multi-year verifiable baseline
  - Alfalfa-grain crop rotations
  - Avoid inflation
- Consider irrigated acreage-based limits instead of historical water use
  - E.g., ~20? inches/year irrigation, ~25? inches/year ETa
  - Reward early adopters



- Practices that reduce ETa (good)
  - "The more you expose, the more you lose"
  - Crop switching: more grain, less alfalfa
  - Early cessation of irrigation
    - If verified and no early over-irrigation
  - Land fallowing
  - Permanent water rights purchases



- Practices that increase ETa (bad, don't do)
  - Decrease nozzle sizes
  - Convert flood to inefficient sprinklers
  - Irrigating additional land or more thoroughly irrigating

Recommendation: future LCS should meet threshold of equal or better than curtailment

Is the purpose to show activity or get results?

Dr. Thomas Harter and Leland Scantlebury GW Local Cooperative Solutions Presentation (10 minutes)

- What actions would support the regulation's goals of enhancing streamflow while providing for other beneficial uses of water? Why?

- Given the lack of groundwater pumping information, what water use baseline (if any) would you propose to evaluate new groundwater local cooperative solutions?

GROUNDWATER LOCAL COOPERATIVE SOLUTIONS (LCSs):

What actions would support the regulation's goals of enhancing streamflow while providing for other beneficial uses of water? Why?

Thomas Harter, Leland Scantlebury, Claire Kouba, Jonas Pyschik[1], and Laura Foglia
University of California Davis
[1] now at University of Freiburg, Germany

GROUNDWATER LOCAL COOPERATIVE SOLUTIONS (LCSs):

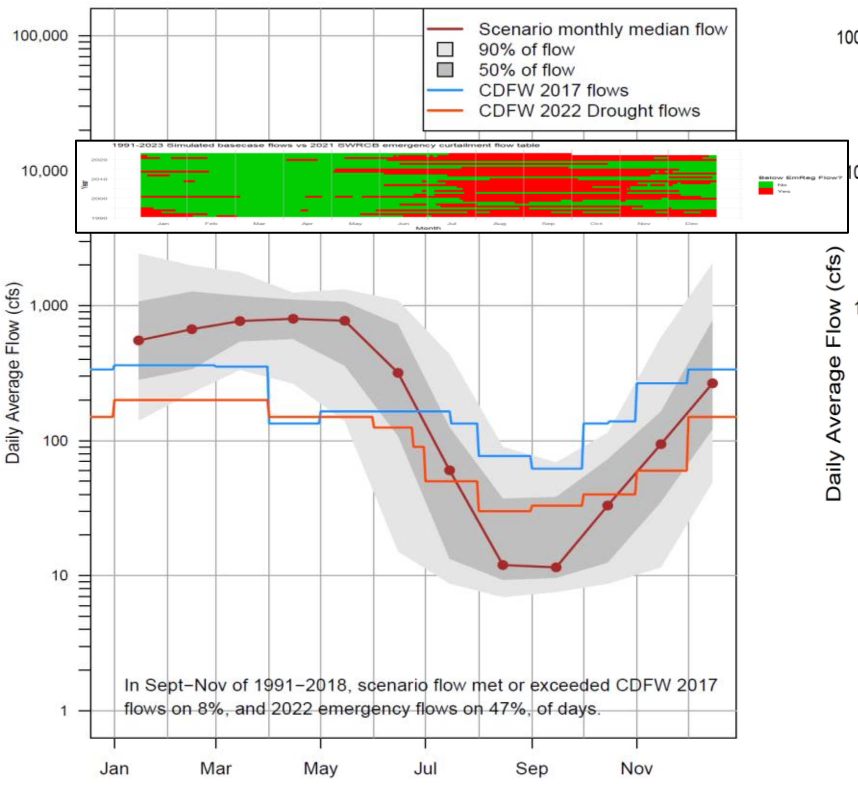
What actions would support the regulation's goals of enhancing streamflow while providing for other beneficial uses of water? Why?

Thomas Harter, Leland Scantlebury, Claire Kouba, Jonas Pyschik[1], and Laura Foglia
University of California Davis
[1] now at University of Freiburg, Germany

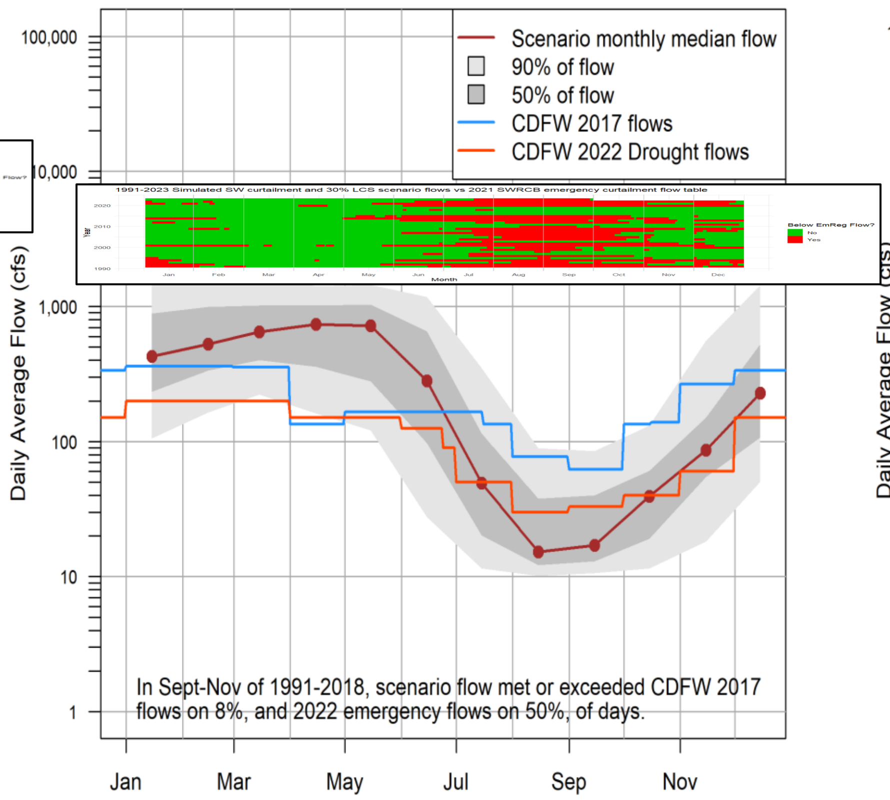
- Groundwater Sustainability Plan identifies additional options with relevant impact to fall flows:
  - MAR & ILR: up to two weeks earlier reconnection date, except in driest years
  - 20% reduction in consumptive use (and corresponding irrigation demand): up to two week earlier reconnection date, except in driest years
  - August 1 curtailment on alfalfa or August 1 full curtailment each year: all fall flows above 40 cfs, except in driest year (of the past 33 years).
  - Off-stream reservoir that can provide 60 cfs throughout the summer and fall, even in dry years
  - Benchmark: various reference unimpaired scenarios that include GDEs (bunch grasses, clover, riparian vegetation, wetland meadows)

Percentile Statistics of Monthly Fort Jones Gage Flow (from simulations)

Basecase (simulated historical)

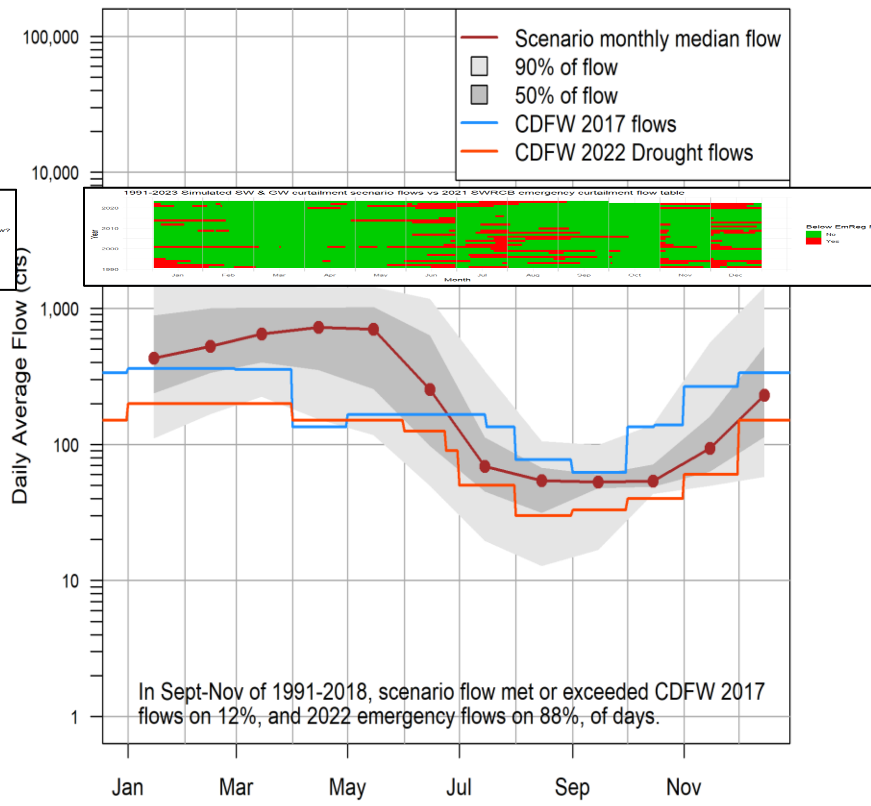


EmFlow_30LCS



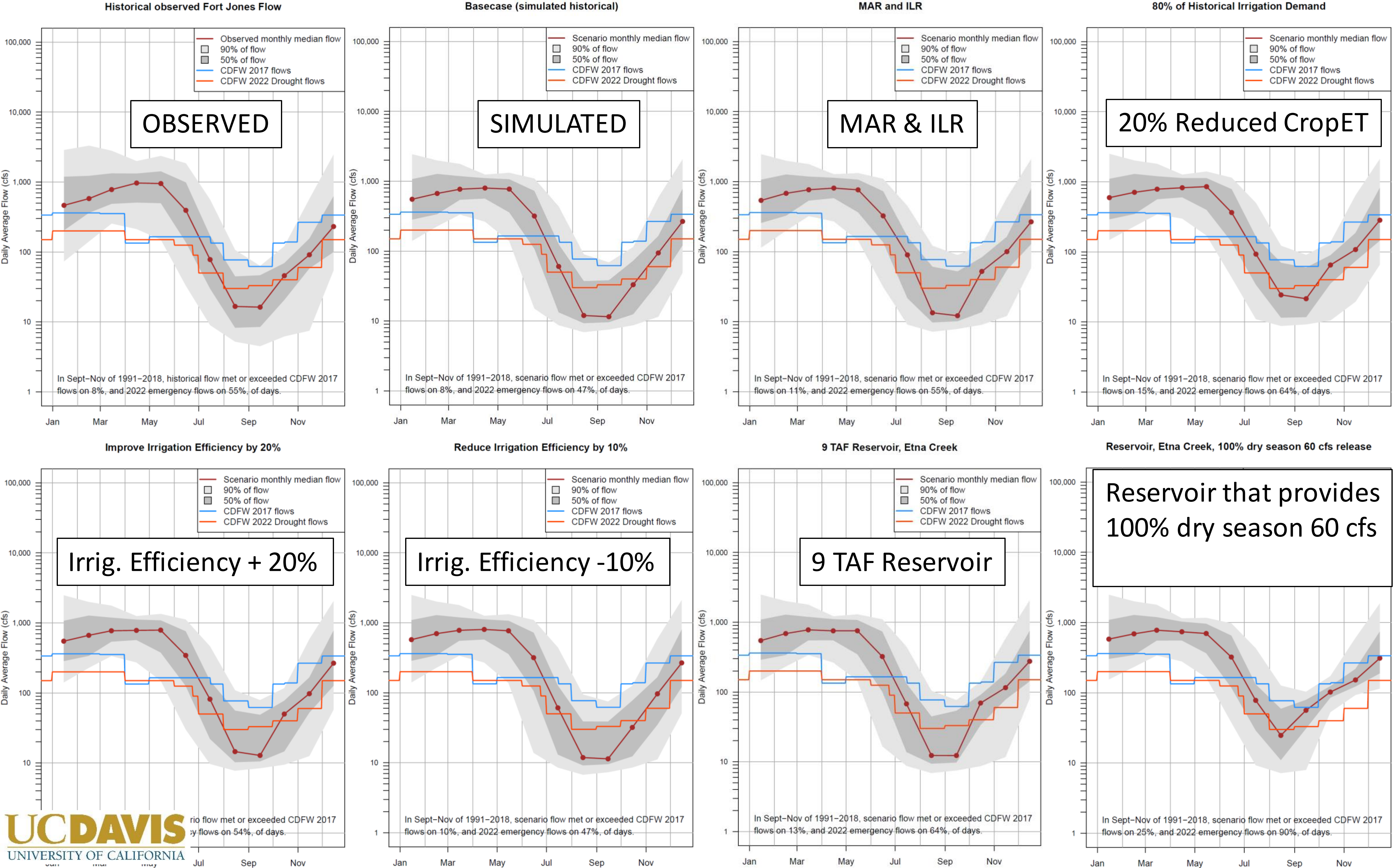
Simulated FJ Flow, 1991-2018

EmFlow_100LCS

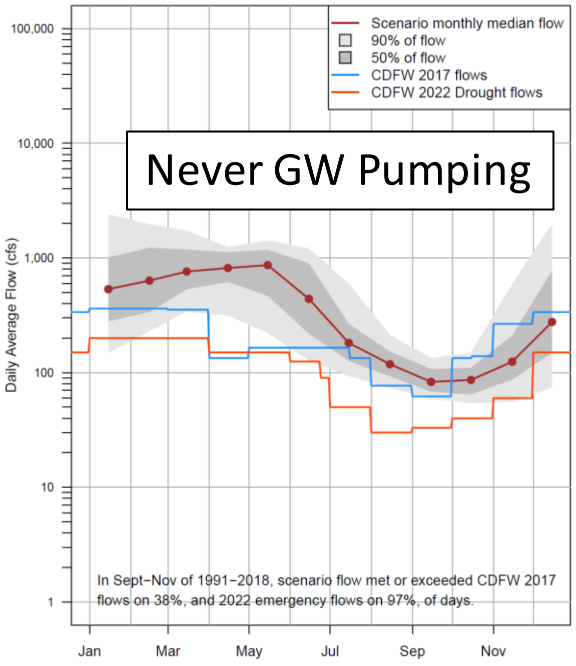


Simulated FJ Flow, 1991-2018

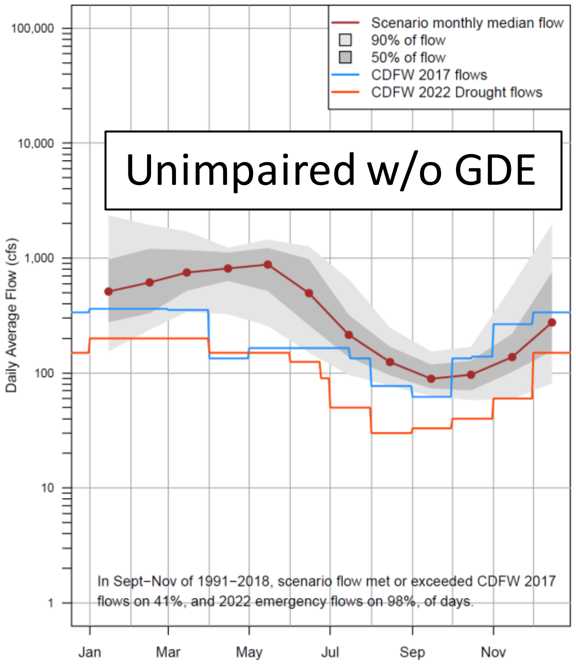
- 1 in 4 years has flows in the lower light grey zone
- 1 in 20 years has flows that fall *below* the light grey zone


Historical observed Fort Jones Flow
OBSERVED
Observed monthly median flow
90% of flow
50% of flow
CDFW 2017 flows
CDFW 2022 Drought flows
Daily Average Flow (cfs)
In Sept–Nov of 1991–2018, historical flow met or exceeded CDFW 2017 flows on 8%, and 2022 emergency flows on 55%, of days.
Basecase (simulated historical)
SIMULATED
In Sept–Nov of 1991–2018, scenario flow met or exceeded CDFW 2017 flows on 8%, and 2022 emergency flows on 47%, of days.
MAR and ILR
MAR & ILR
In Sept–Nov of 1991–2018, scenario flow met or exceeded CDFW 2017 flows on 11%, and 2022 emergency flows on 55%, of days.
80% of Historical Irrigation Demand
20% Reduced CropET
In Sept–Nov of 1991–2018, scenario flow met or exceeded CDFW 2017 flows on 15%, and 2022 emergency flows on 64%, of days.
Scenario monthly median flow
Improve Irrigation Efficiency by 20%
Irrig. Efficiency + 20%
rio flow met or exceeded CDFW 2017
y flows on 54%, of days.
Reduce Irrigation Efficiency by 10%
Irrig. Efficiency -10%
In Sept–Nov of 1991–2018, scenario flow met or exceeded CDFW 2017 flows on 10%, and 2022 emergency flows on 47%, of days.
9 TAF Reservoir, Etna Creek
9 TAF Reservoir
In Sept–Nov of 1991–2018, scenario flow met or exceeded CDFW 2017 flows on 13%, and 2022 emergency flows on 64%, of days.
Reservoir, Etna Creek, 100% dry season 60 cfs release
Reservoir that provides 100% dry season 60 cfs
In Sept–Nov of 1991–2018, scenario flow met or exceeded CDFW 2017 flows on 25%, and 2022 emergency flows on 90%, of days.
Jan
Mar
May
Jul
Sep
Nov
UC DAVIS
UNIVERSITY OF CALIFORNIA

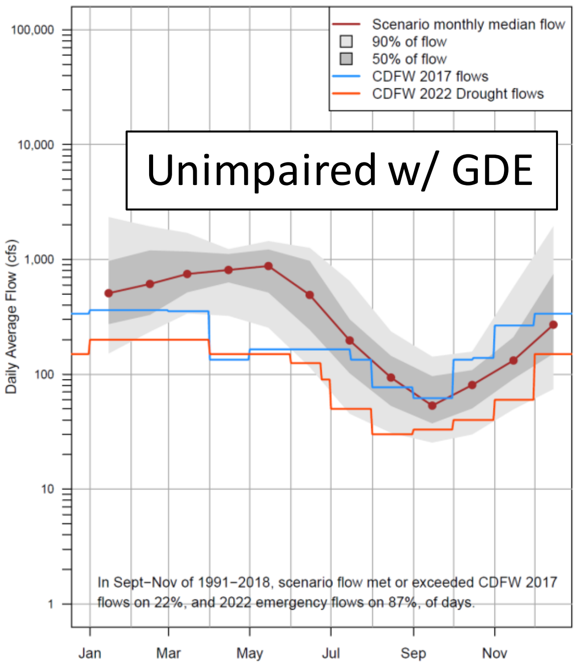
No Pumping, Both Zones



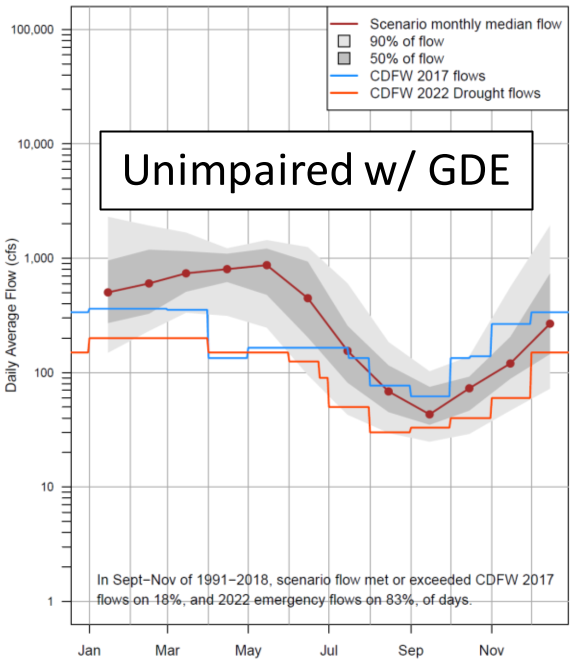
No Irrigation, Both Zones



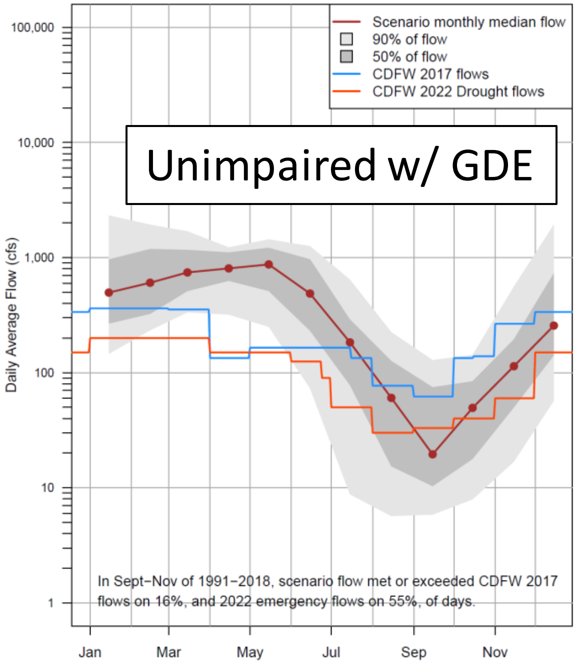
No Irrigation, Both Zones, ET Check 0.6 NV kc, 4.5m ext.d.



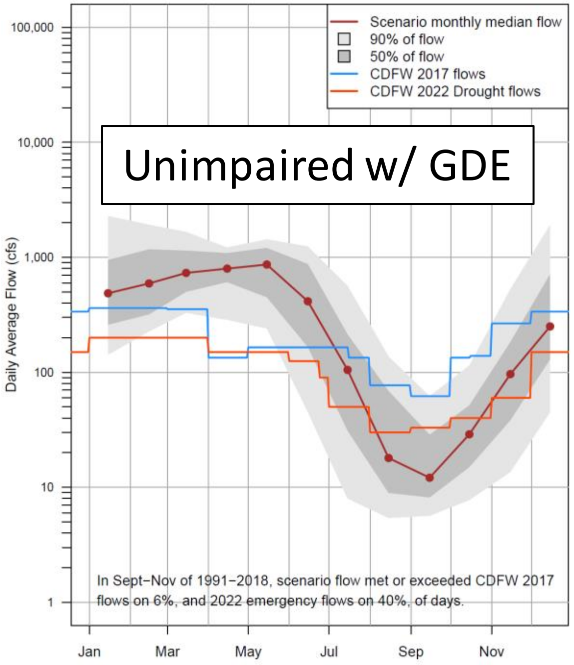
No Irrigation, Both Zones, ET Check 1.0 NV kc, 4.5m ext.d.

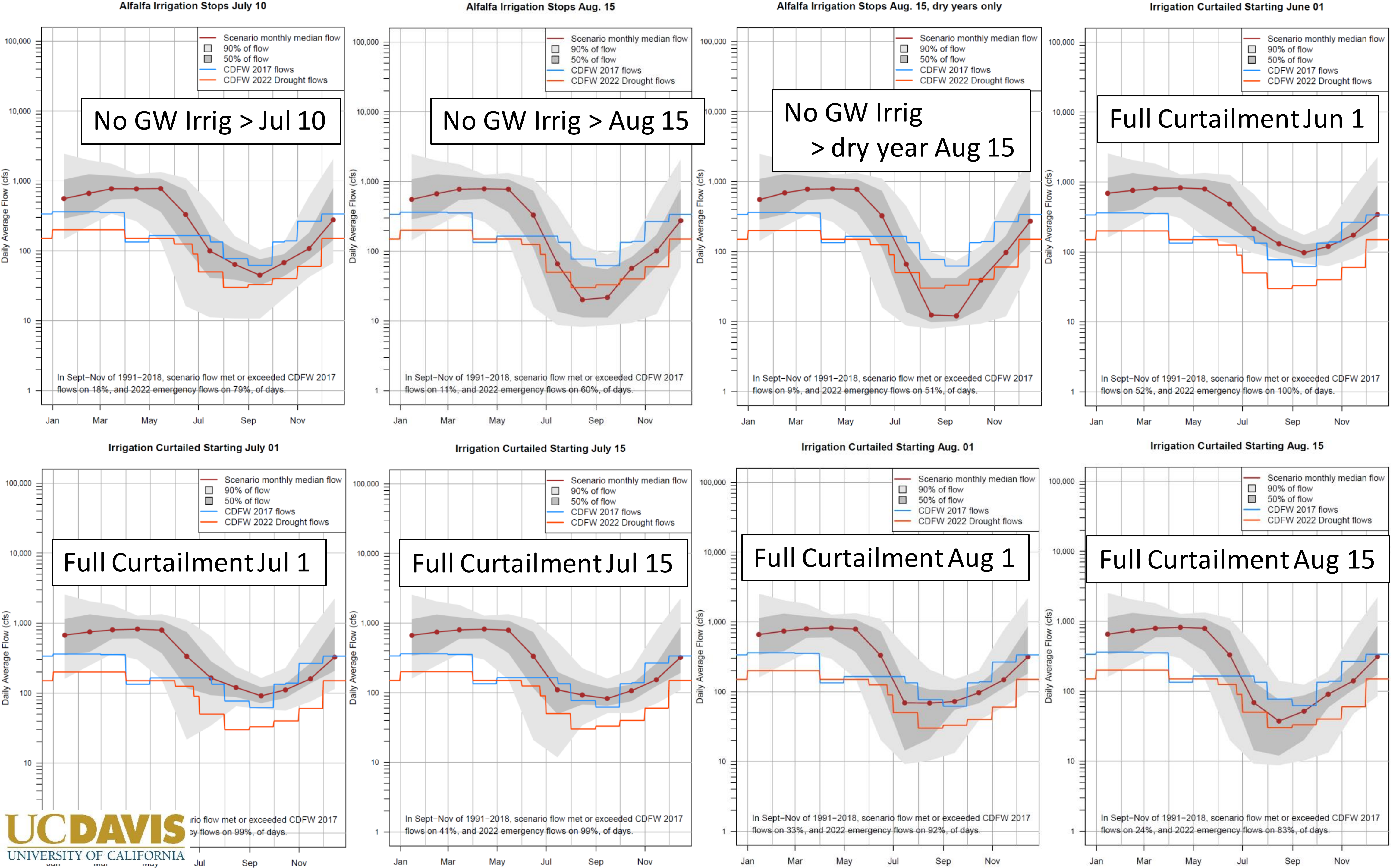


No Irrigation, Both Zones, ET Check 0.6 NV kc, 10m ext.d.



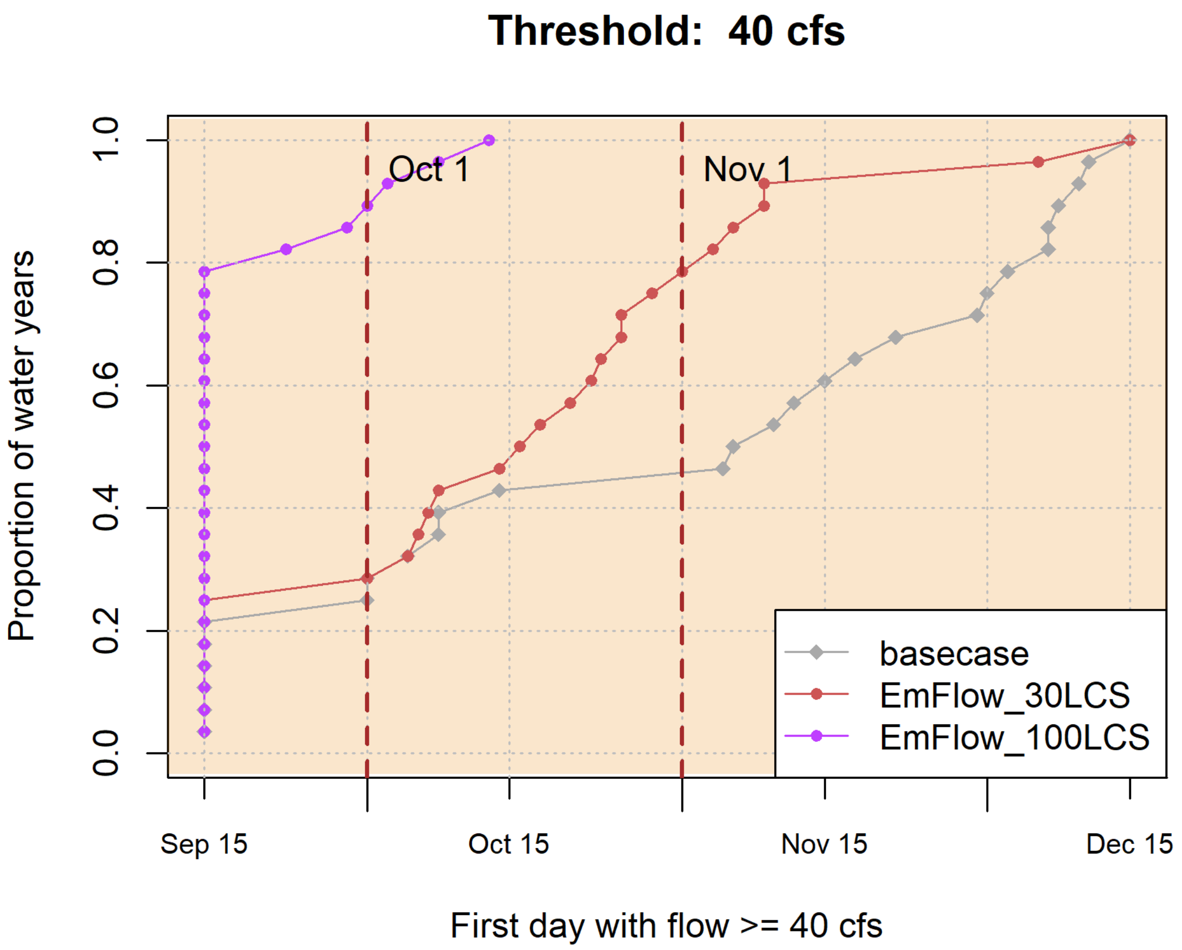
No Irrigation, Both Zones, ET Check 1.0 NV kc, 10m ext.d.



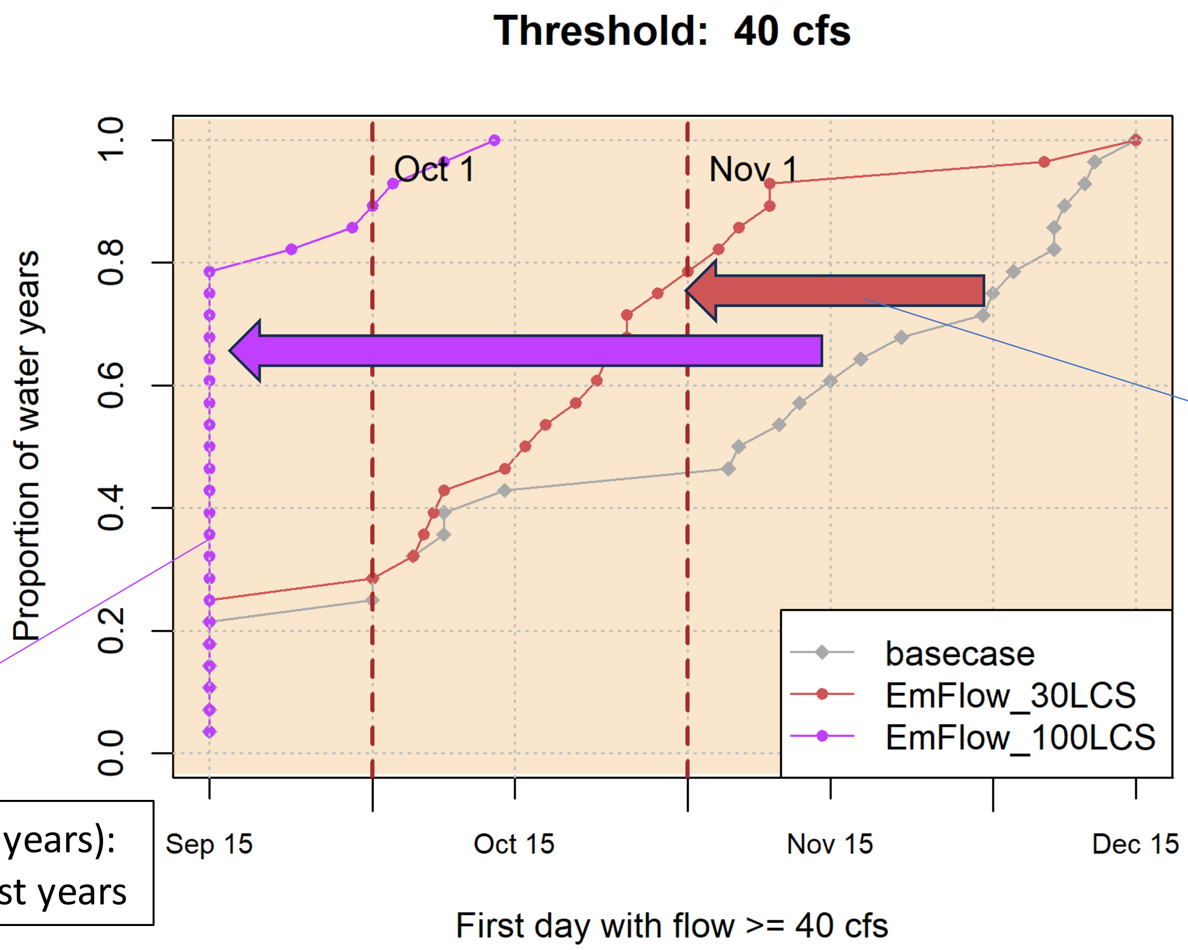


UC DAVIS
UNIVERSITY OF CALIFORNIA

Fall Reconnection Date, 1991-2018 – sorted early to late



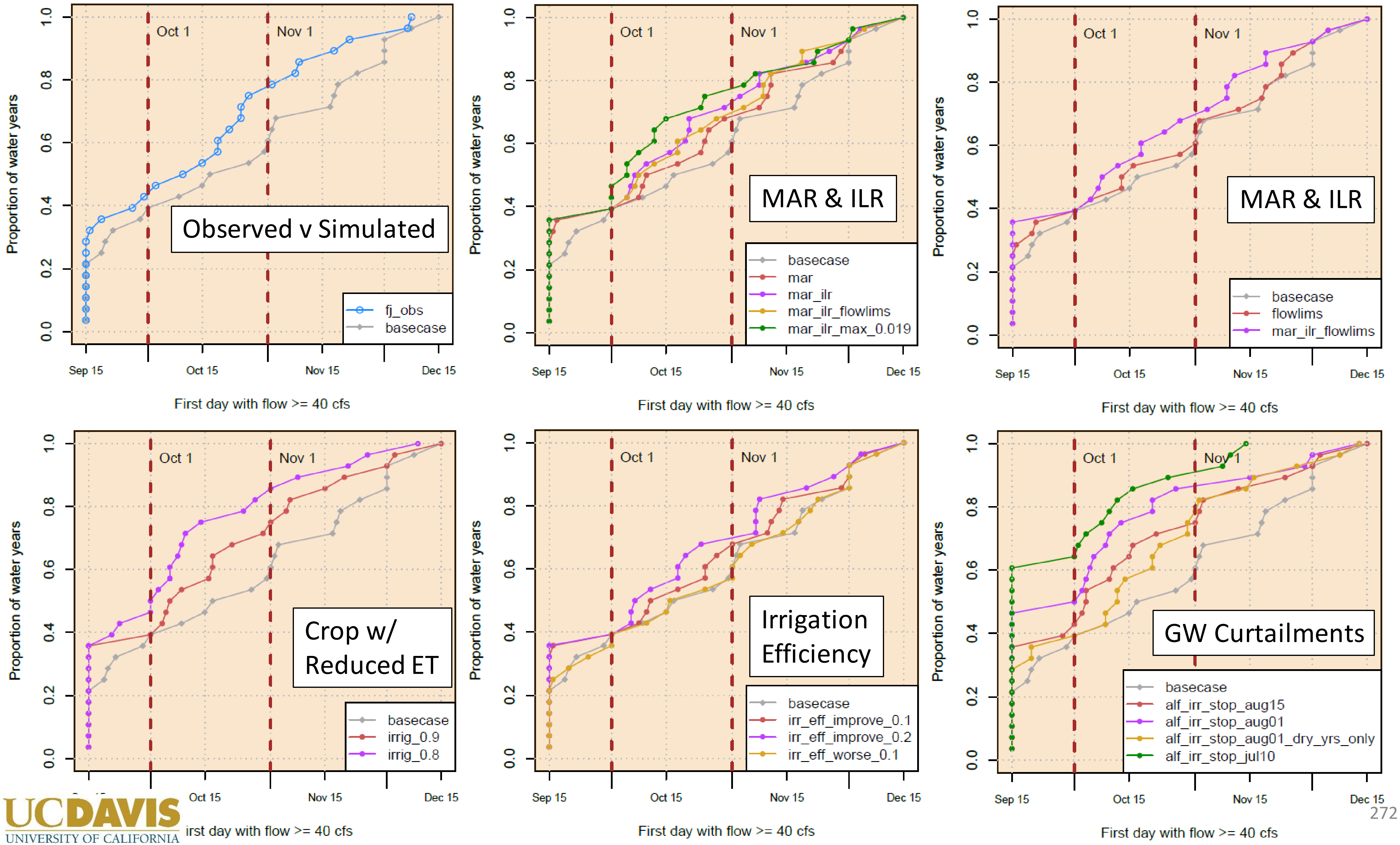
Fall Reconnection Date, 1991-2018 – sorted early to late



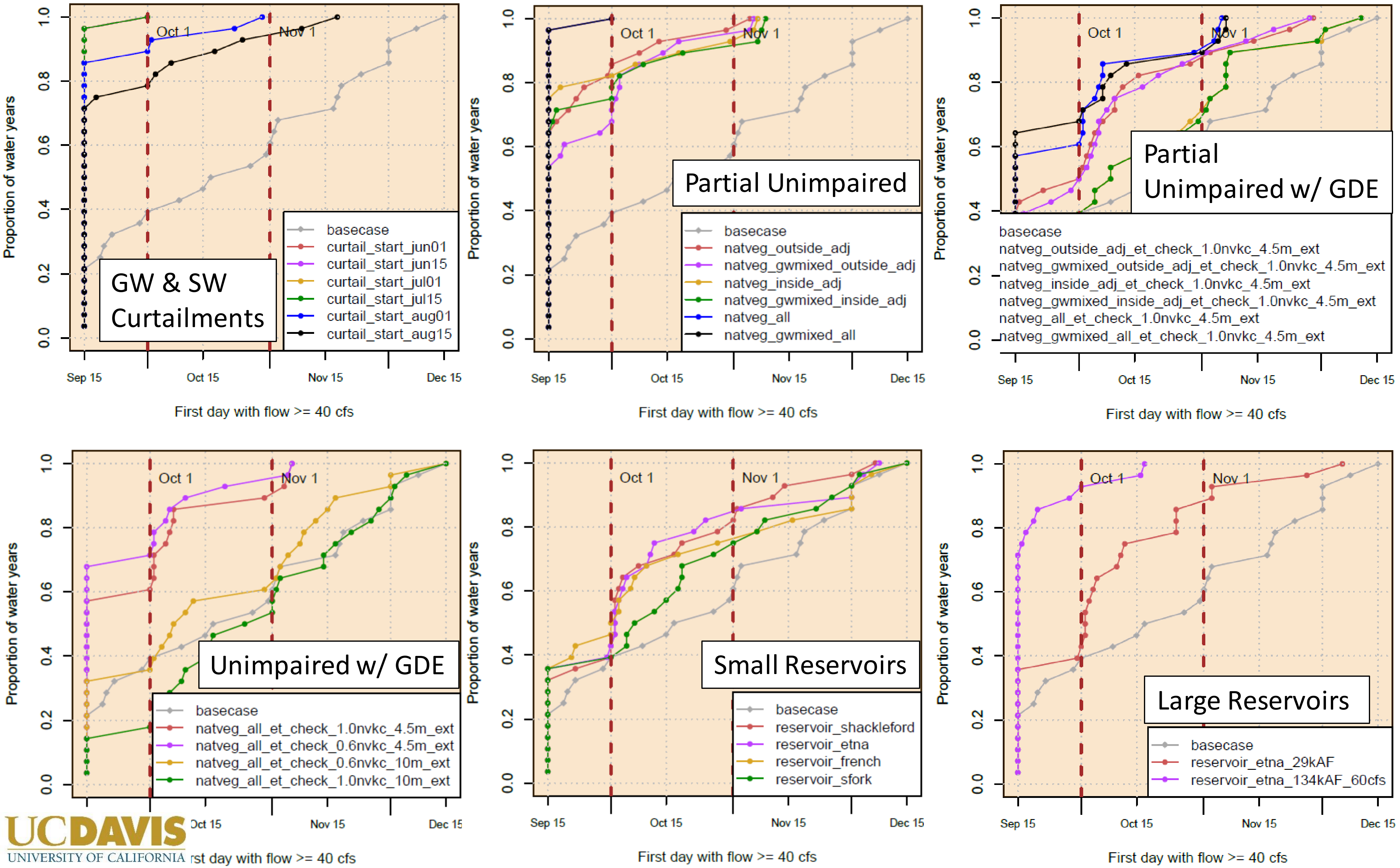
2022-like curtailment:
1 month earlier in all but the driest years

Full curtailment (in 24 of 32 years):
No loss of connection in most years

UCDAVIS
UNIVERSITY OF CALIFORNIA



UC DAVIS
UNIVERSITY OF CALIFORNIA



UC DAVIS
UNIVERSITY OF CALIFORNIA

Scott Valley GSP: Project Scenario Reversal of FJ Gage Flow Depletion

(see Scott Valley GSP, PDF page 1791)

Scott Valley Management Scenario Results

Summary Table

Scenario Type	Scenario ID	Scenario Depletion Reversal, Sep-Nov '91-'18 (TAF)	Relative Depletion Reversal, Sep-Nov '91-'18
Enhanced Recharge	MAR (Managed Aquifer Recharge) in Jan-Mar	13	10%
	ILR (In-Lieu Recharge) in the early growing season	12	9%
	MAR + ILR	25	19%
	Expanded MAR + ILR *(assumed max infiltration rate of 0.019 m/d)*	60	44%
Diversion Limits	All surface water diversions limited at low FJ flows	51	38%
	MAR + ILR, with all surface water diversions limited at low FJ flows	77	57%
Crop change	80% Irrigation demand	82	61%
	90% Irrigation demand	40	29%
Irrigation Efficiency	Improve irrigation efficiency by 0.1	5.8	4%
	Improve irrigation efficiency by 0.2	16	12%
	Reduce irrigation efficiency by 0.1	-3.2	-2%
Irrigation schedule change	Alfalfa irrigation schedule - July 10 end date	117	86%
	Alfalfa irrigation schedule - Aug 01 end date	82	60%
	Aug 01 end date, *dry years only ('91, '92, '94, '01, '09, '13, '14, '18)*	19	14%
	Alfalfa irrigation schedule - Aug 15 end date	45	33%
	Aug 15 end date, *dry years only ('91, '92, '94, '01, '09, '13, '14, '18)*	9	7%
Attribution - adjudicated area impacts	Natural Vegetation Outside Adjudicated area (NVOA)	171	126%
	Natural Vegetation, on Groundwater- or Mixed-source fields, Outside Adjudicated area (NV-GWM-OA)	**136**	100%
	Natural Vegetation Inside Adjudicated area (NVIA)	126	93%
	Natural Vegetation, on Groundwater- or Mixed-source fields, Inside Adjudicated area (NV-GWM-IA)	116	85%
	Natural Vegetation (NV)	287	212%
	Natural Vegetation on all Groundwater- or Mixed-source fields (NV-GWM)	233	171%
Reservoir	9 TAF Reservoir, 30 cfs release, Shackleford	46	34%
	9 TAF Reservoir, 30 cfs release, Etna	65	48%
	9 TAF Reservoir, 30 cfs release, French	78	58%
	9 TAF Reservoir, 30 cfs release, S. Fork	35	26%
100% reliable reservoir	29 TAF Reservoir, 100% reliability 30 cfs release	72	53%
	134 TAF Reservoir, 100% reliability 60 cfs release	250	184%

GROUNDWATER LOCAL COOPERATIVE SOLUTIONS (LCSs):

Given the lack of groundwater pumping information, what water use baseline (if any) would you propose to evaluate new groundwater local cooperative solutions?

GROUNDWATER LOCAL COOPERATIVE SOLUTIONS (LCSs):

Given the lack of groundwater pumping information, what water use baseline (if any) would you propose to evaluate new groundwater local cooperative solutions?

- Using improved/updated SVIHM to further assess relative merit of projects and management actions on streamflow replenishment
- Coordination with Groundwater Sustainability Plan implementation

Using real world observations and a computer model to take regular "measurements"

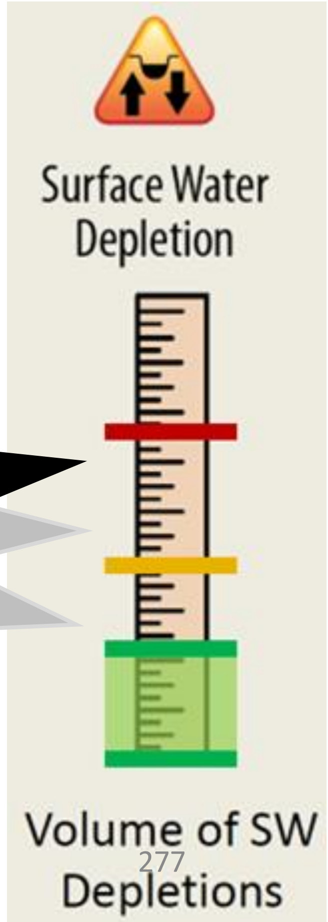
continuous monitoring: precipitation, snow-pack, stream-gages, water levels, stream transects, …

projects and management actions: implementation, monitoring of implementation

Tolley et al., 2019

SVIHM

"measurement"



- regular (annual?) update to extend simulation period to current using measured input data (stream inflow, precip, temp)
- regularly (every 5 years) recalibrated against new data, projects, research
- transparent input, model construction, public domain, peer review

UCDAVIS
UNIVERSITY OF CALIFORNIA

Theodora Johnson, Scott Valley AgWA GW Local Cooperative Solutions (10 minutes)

- What conservation practices did parties implement to reduce water use during the emergency regulation beyond those implemented as part of groundwater local cooperative solutions?
- What additional actions or practices are planned to reduce water use moving forward?
- Are there additional components or approaches to groundwater local cooperative solutions that the Board could consider, given the goal of enhancing flow while providing for other beneficial uses?

The LCS Experience in Scott Valley, 2022

Theo Johnson, Scott Valley Agriculture Water Alliance spokesperson

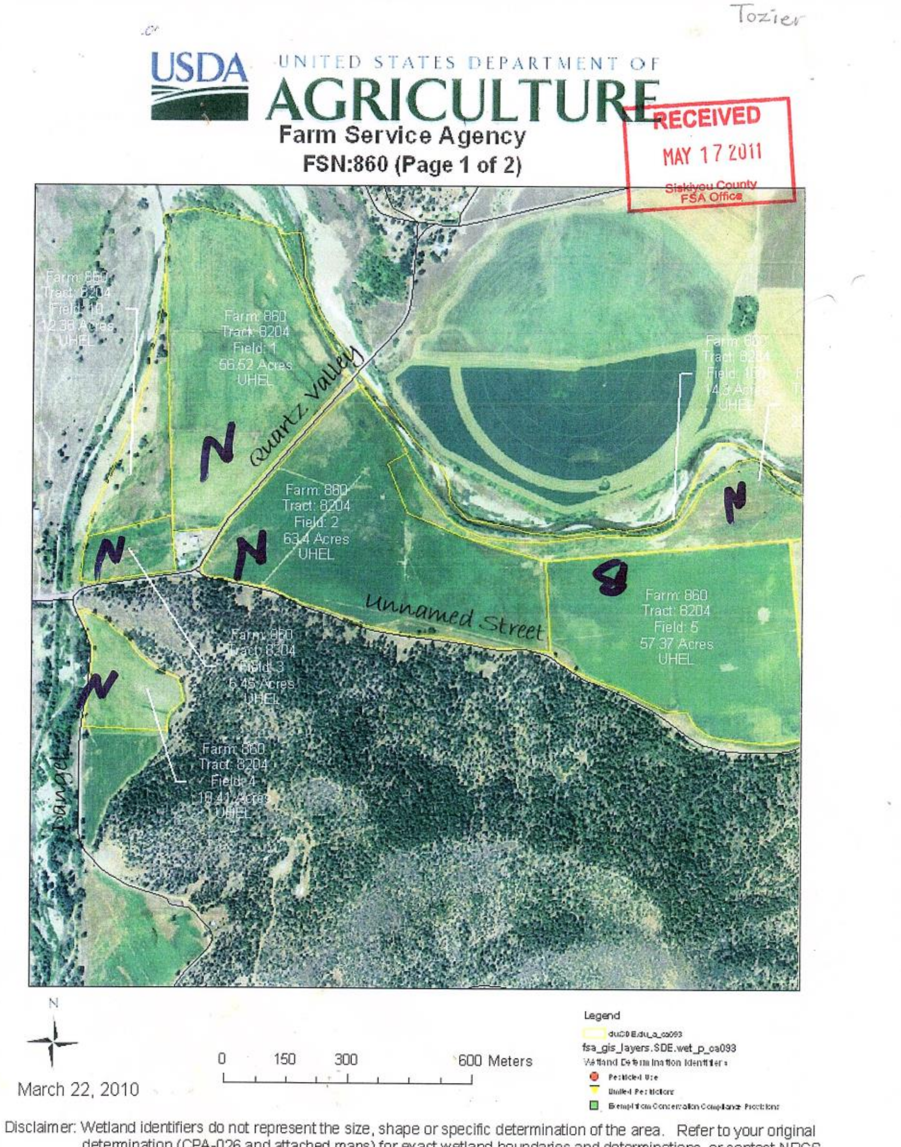
What was done in LCSs?

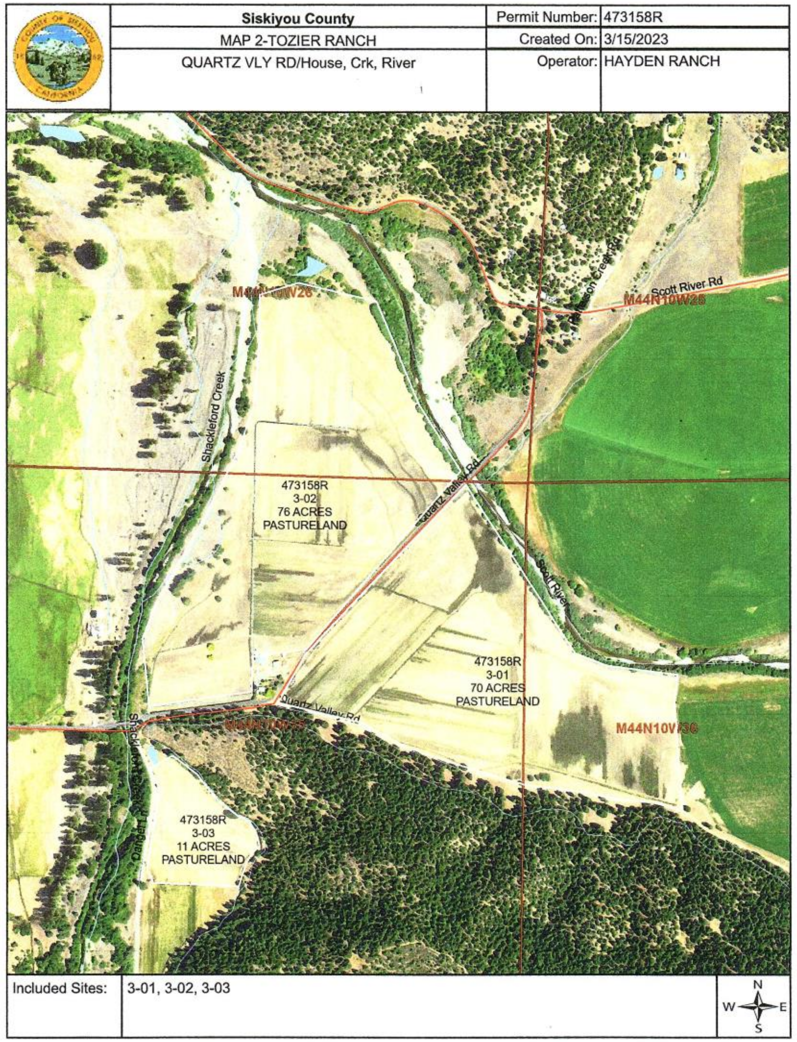
- Producers on 17,000 ac. strived to reach the 30% reduction in groundwater use by various means:
    - Fallowing fields
    - Fallowing center pivot corners
    - Turning off end guns (center pivots)
    - Reducing watering time
    - Crop change (grain)
    - Turn water off early
    - Replacing sprinkler nozzles to smaller/more efficient
    - Converting to center pivot
- Coordinating entities (CDFW and RCD) reported no compliance problems.
- Landowners on remaining 13,000 ac. of surface-irrigated land could not achieve LCSs, due to the "equal or better" requirement.
    - Thus, surface water users were 100% curtailed as of July 2.

LCS Experiences – by four Scott Valley irrigators

- “We had a reduction of 25 to 30% in hay production…I was worried to the point of not being able to sleep at night.” *--one of the valley’s larger hay farmers*
- “We sold cows and lost 35% hay production. The cows sold were at 50% value because the market was down.” *--a purebred cattle producer*
- “I would have had drastic losses, if I hadn’t been able to put in new irrigation systems. They really saved me.” *–large hay grower #2*
- “After 70 years raising cattle on our ranch, we sold all the cows in 2022 because the surface-irrigated pasture was completely devasted.” *–a cow/calf producer*

Tozier Ranch then and now (2010 vs. 2023)





Side-by-side: Pasture loss in 2023, Tozier Ranch

Another Scott Valley ranching family describes the impacts on their cattle operation. They were not alone.

- "We lost at least 25% of hay production causing us to purchase hay to feed our cattle at the highest prices ever because of the drought.
- We sold around 20% of our herd because of the lack of feed availability. We had to purchase hay to feed our cattle at a time when the price was double …putting an extreme amount of hardship on our family.
- We lost about 50% of pasture production, due to the diversion shut off…
- The big factor was the devastation of 20% of permanent stands of Alfalfa and at least 40% of the pasture stands, which was then taken over by noxious weeds--particularly tumble weed-- and creating a much worse fire hazard for our valley.
- The pasture grasses will need to be re-farmed and planted, costing us a lot of money, and fuel, time etc. Then it takes at least 2 years to reestablish a good stand, and in the meantime we have less feed for our cattle so we end up having to sell off more cows."

“This reduction and extra costs of running our business puts an extreme amount of stress on our family. We have mortgages and bills to pay and the extra bills and costs of running a business with these regulations are killing our small family farm. We have loans that need to be paid back as well, and it has become harder and harder to pay them back.”

Photo: June 3, 2022

Pasture suffered most.

- Lack of winter stockwater greatly reduced groundwater recharge, thereby reducing subirrigation and increasing the need for groundwater pumping—where possible.
- Dry ditches increased lag-time when irrigation ditches were turned on.
- Inability of surface irrigators to participate in LCS resulted in 100% curtailment on July 2.
- 30% loss of plant growth equates to 60% loss of forage available. (Proper management = leave three inches to prevent plant stress and allow regrowth)

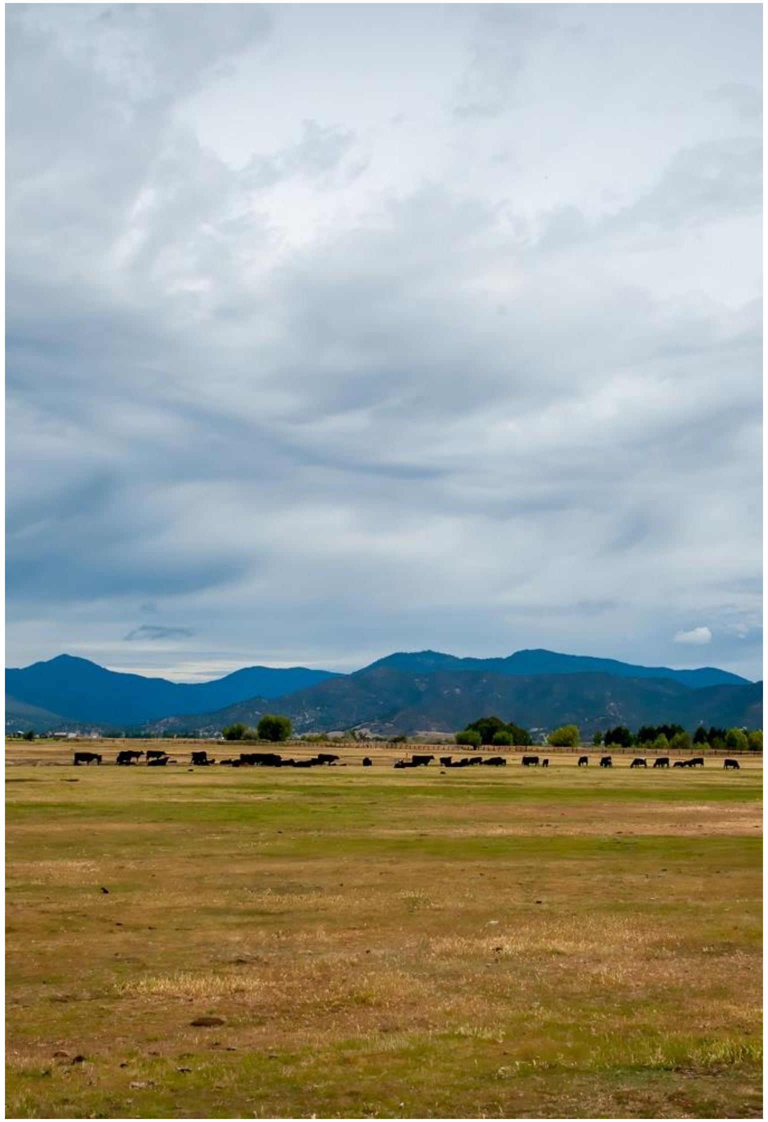


Photo: July 11, 2022 – Underwatered alfalfa

Note the "humps" in the alfalfa where wheel line sprinklers drained (draining must happen before each move of the wheel line). This shows how much more growth could have happened with full watering.

August 15, 2022 – Underwatered alfalfa

Note the uneven growth pattern of the alfalfa, indicating insufficient watering.

August 2022 – Fallowed ground

Note the fallowed pasture (above) and the obvious dry corners and dry ring where an end gun was turned off on an alfalfa stand—common water savings tactics under the LCSs.

Photo: August 15, 2022
Grain hay not economic (most of the time)

In Scott Valley, grain is a "rotation" crop planted every 5-7 years between alfalfa stands. It requires much less water, with irrigation usually ceasing by mid-June for grain hay (mid-July for combine harvest).

Why not switch to grain permanently?

- Grains require annual tilling and nitrates, unlike alfalfa. We currently have no nitrate pollution.

- A drastic increase in grain hay production would not be met with enough local demand, and would become uneconomic. Most years, grain hay is a break-even crop.

- No grain storage infrastructure in Scott Valley, with inadequate local market for the grain.

No compensation for 2022 emergency regulation losses

- USDA Farm Service Agency drought programs do not apply to irrigated pasture or hay fields.
- Most producers did not qualify for emergency funding via CDFW.
- August 2021 payments to 3 growers in Reach 9 to stop irrigating were a one-time experiment.

2024 LCS Recommendations

1. Base LCS reduction levels on predicted wet/dry year type.
    - As determined by April 1 and May 1 snowpack surveys and precipitation.
2. Provide several LCS options that producers may choose from, such as:
    - Option 1: Similar to 2022, but encourage bigger shift to early season irrigation and less in late season. Allow a 7-day flex around the end/first of a month.
    - Option 2: Instead of pumping reduction %, require a percentage of acres to be non-irrigated after a certain date. E.g., 15% off after July 15, 50% off after August 15, and 85-90% off after September 1.
3. Simplify process and facilitate compliance with standardized forms, if possible.
    - Multiple accidental reporting errors resulted in fines in 2022.

Other recommendations for 2024

1. Remove restriction on winter stockwater, as long as fishery needs are being met.
2. Focus on tributaries where fish rearing happens in summer months, reduce the mainstem flow requirement until Sept.
3. Have local office with full-time staff to support the regulated community.
   a) Correct problems when they are identified, not months later with a Notice of Violation.
   b) Could help relieve the stress of navigating the paperwork and compliance worries.
4. Maximize recharge opportunities through better project permitting and reasonable winter flow expectations.
5. Support water-saving irrigation improvements.

What water savings techniques were already in place in 2022?

And what more can we do?

Water Saving (and adding!) Techniques in Scott Valley

- Conversion to center pivot
- Converting drop hose and nozzle types on pivot
- Soil moisture sensors
- Variable Frequency Drive (VFD) pumps
- Laser leveling fields
- Incidental recharge via stockwater ditches
- Conjunctive use via off-stream diversions
- “Environmental” Managed Aquifer Recharge

➢ **If they are to stay in business, producers need financial and technical assistance to <u>further</u> reduce the amount of water they use.**

Wheel line to center pivot conversion

- 30% water savings is achievable.
- ~60% of valley has converted to pivot over 20 years.
- Interest in new pivots: at least 13 (covering 1,400 ac.).
- Cost to install has doubled since 2000. Now $120k to install average-length pivot (for 100 ac.)
- Technical and financial assistance needed.

Upgrading Drop hose and nozzle type (pivot)

- Types and efficiencies vary:
  - Mid Elevation Sprinkler Application (MESA) 78% Efficient
  - Low Energy Precision Application (LEPA) 95% efficient
  - Low Elevation Spray Application (LESA) 88% efficient
    - Source: Utah State University Extension, 2021
- Producers would benefit greatly from technical assistance on which type is best for soil type, crop type, slope, fences, and other field-specific factors. These factors affect which type of system is possible.

Low Energy Precision Application (LEPA)

- Best water-savings type for alfalfa in Scott Valley at present.
- ~10% currently used on existing pivots.
- Expensive: $15-20k to convert.
- Not suited to all fields/crops.

Soil moisture sensors

- Reads soil moisture levels, can send near-real time info to your phone.
- Prevents over- and under-watering.
- Currently used on <10% of Scott Valley irrigated acreage (estimate).
- Cost: ~$1,600-$2,000 per set. One sensor per 80 acres is adequate.
- If properly cared for, lasts about 5 years.

Variable Frequency Drives (VFDs)

- Connects to a pump's electrical supply and varies the frequency of the electricity powering the pump.
- Controls pump's performance and reduces amount of energy it consumes.
- Prevents over-pressurizing of system, which saves water.
- Prevents need for extra irrigation lines being used beyond the intended area.
- Roughly 1/3 irrigated acres in Scott Valley covered by VFDs.
- Cost: ~$8,000 each

Conjunctive use: Maintaining our Underground Reservoir

- Our aquifer is our only large reservoir (aside from snowpack.) It replenishes naturally, and through traditional stockwatering, where ditches mimic off-stream side-channels.
- Managed Aquifer Recharge (MAR) may reduce the need for groundwater pumping, and/or add to late-season flows.
  - Scott Valley Irrigation District “Environmental” MAR project
  - “Ditch Infiltration” study currently underway on west side (Larry Walker Associates)
- How can we do more?
  - Needs include repairs on ditches and existing infrastructure to increase water supply and distribution during high flows
  - Implement the “In-lieu” strategy of Scott Valley Integrated Hydrologic Model

Cost-share Opportunities: NRCS-Environmental Quality Incentive Program (EQIP)

- AgWA seeking targeted funds for Scott Valley to suit our unique groundwater conservation needs under current regulatory environment.
- Based on AgWA survey of local needs, NRCS calculated need of $5 million to conserve water on 4,000 acres over 3 years.
- Total improvement cost: $10 million, assuming 50% cost-share.
- 20 Scott Valley applications for EQIP are waiting for approval now.
- We appreciate the letters of support for targeted Scott Valley funds, sent by:
  - Quartz Valley Indian Reservation
  - Scott River Watershed Council
  - Siskiyou County Board of Supervisors
  - Siskiyou Farm Bureau
- <u>50% cost share helps, but major improvements still financially out of reach for many.</u>
  - Creative solutions needed, such as low-interest loans.

We want to be part of the solution.

Producers <u>and</u> the aquifer would benefit from:

- Investments by state agencies in water saving and storing techniques.
- Regulations that are:
  - Fine-tuned to fish needs
  - Include enough flexibility to allow producers to continue our businesses and preserve our home.

Data Needs for Scott River and Shasta River

Staff Presentation

Comments

Scott River and Shasta River Watershed Data Needs

October 6th Workshop

CALIFORNIA Water Boards

Division of Water Rights, IFU

Presentation Overview

- Groundwater Data + Needs (Scott River and Shasta River Watersheds)

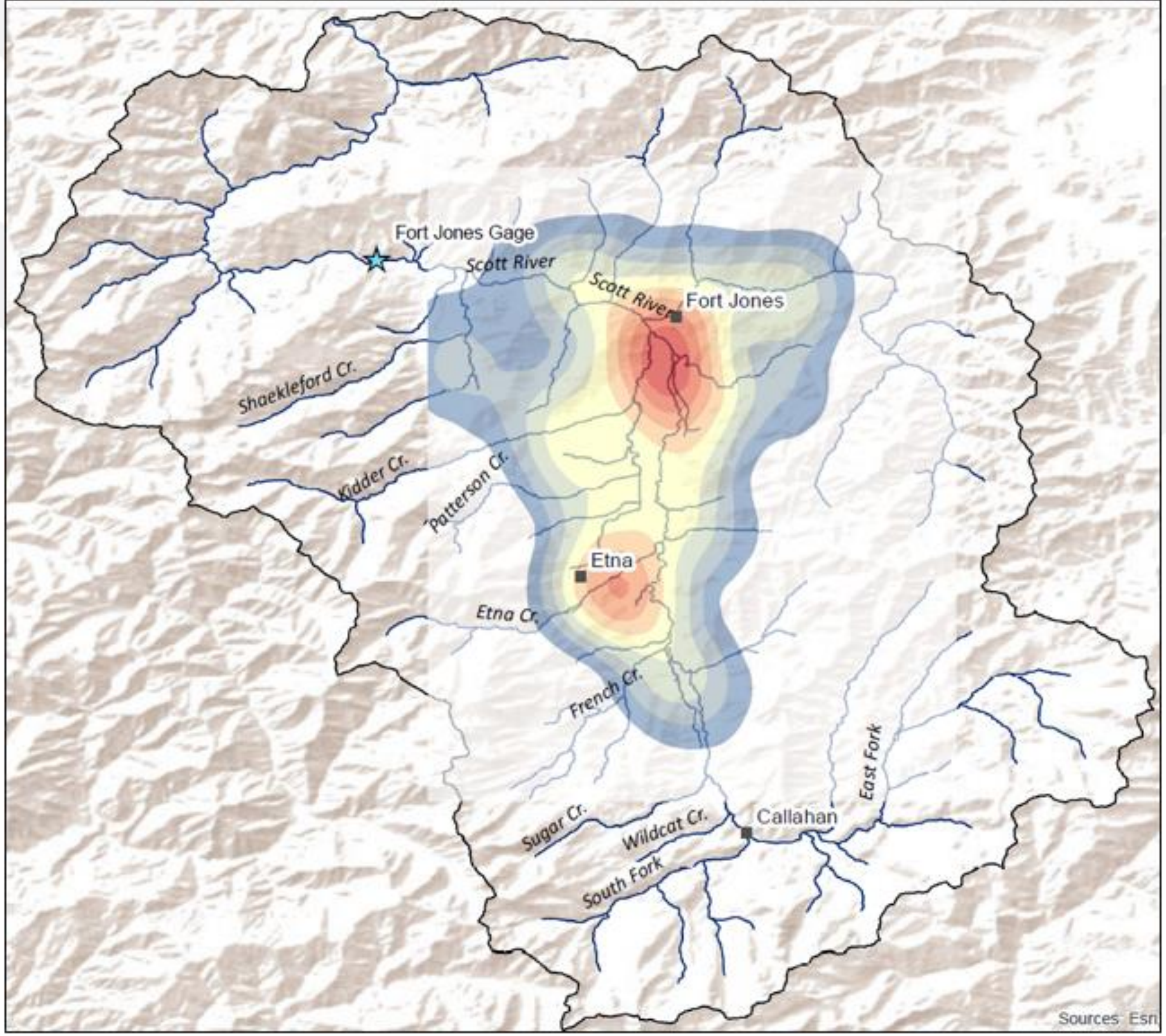
- Surface Water Data + Needs (Scott River and Shasta River Watersheds)

Scott River Watershed

Groundwater Data + Needs

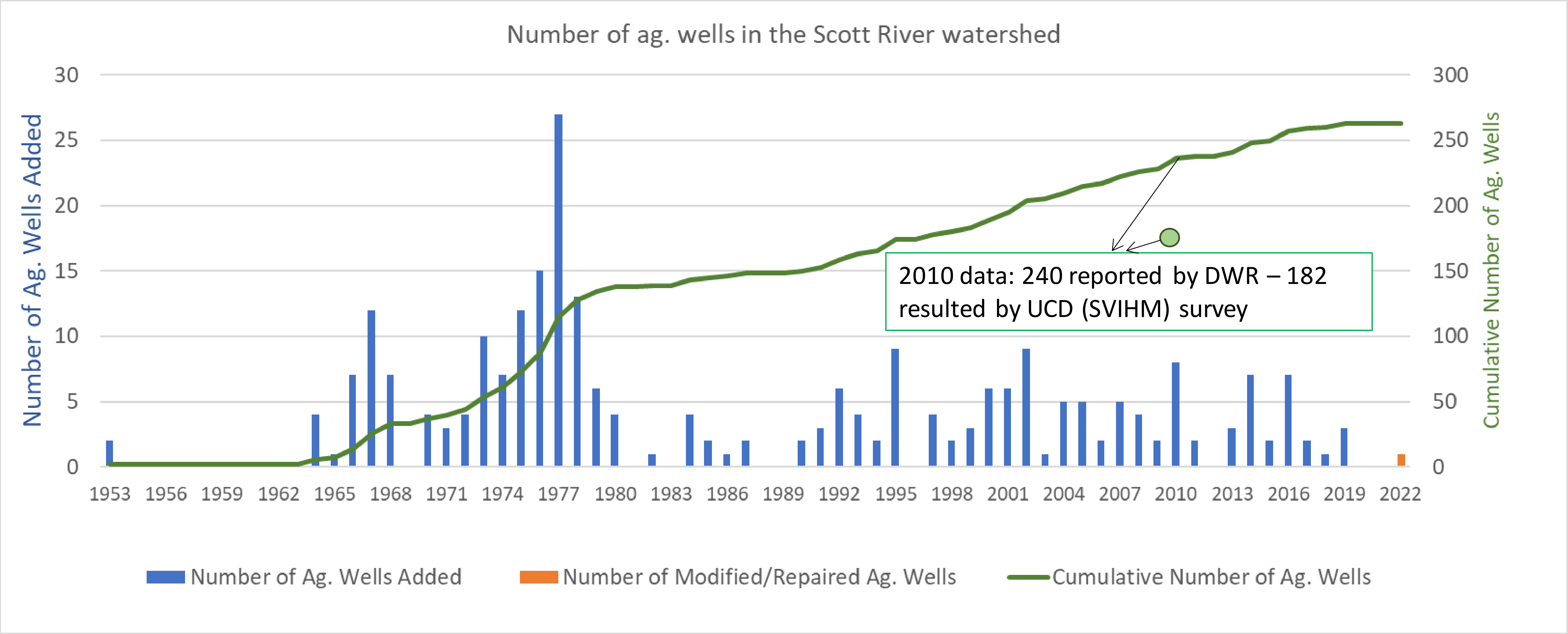
Groundwater Data Needs in Scott River Watershed: Distribution of 264* Agricultural Wells in Scott River Watershed

Department of Water Resources: Well Completion Reports - Datasets - California Natural Resources Agency Open Data – Last visited August 2023**)**



* Note: may include inactive and abandoned wells

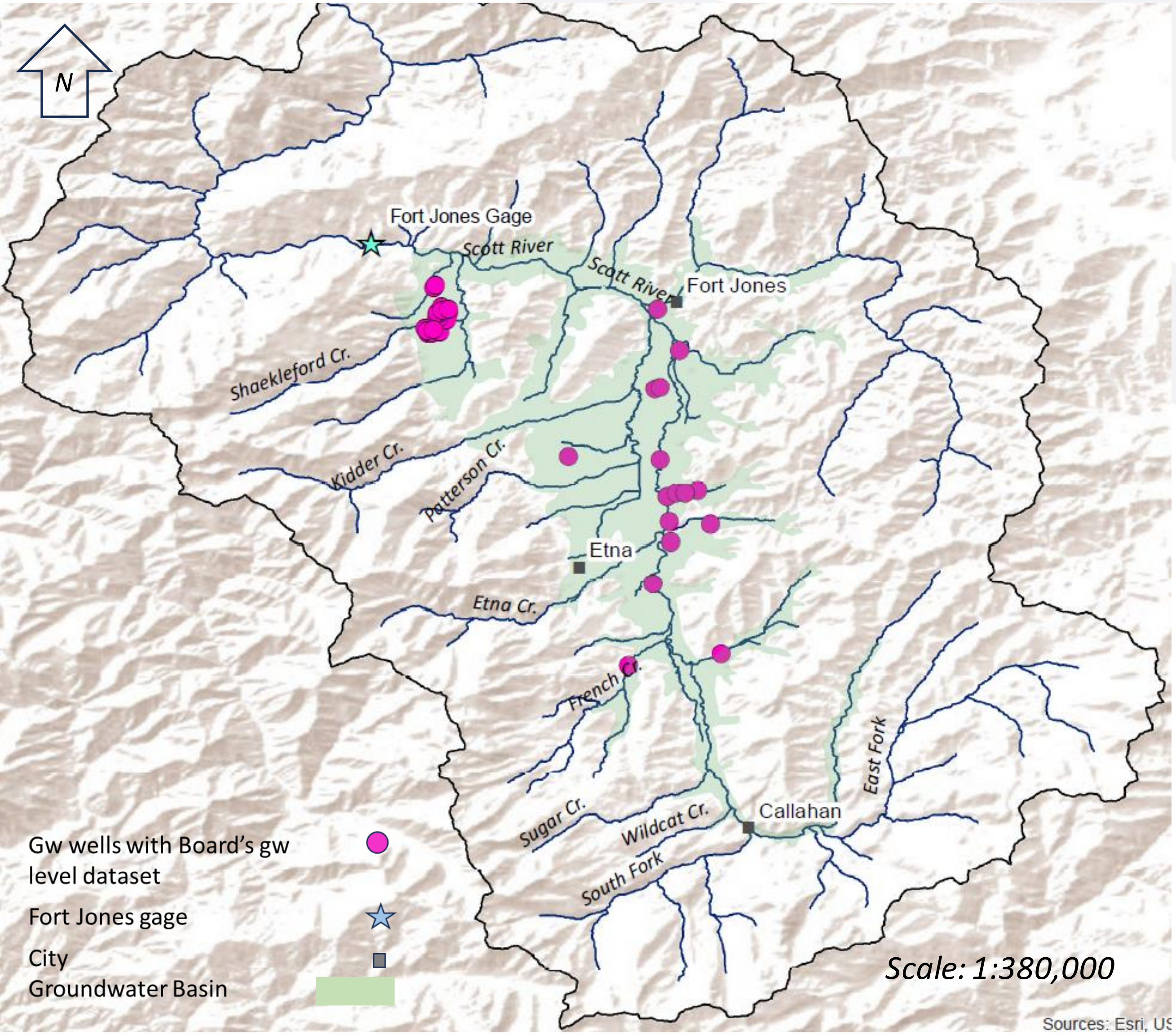
Groundwater Data Needs in Scott River Watershed: Agricultural Well* Statistics by Year



Adapted from [Well Completion Reports - Datasets - California Natural Resources Agency Open Data]

* Note: may include inactive and abandoned wells

Groundwater Data Needs in Scott River Watershed: Distribution of Agricultural Wells with Data



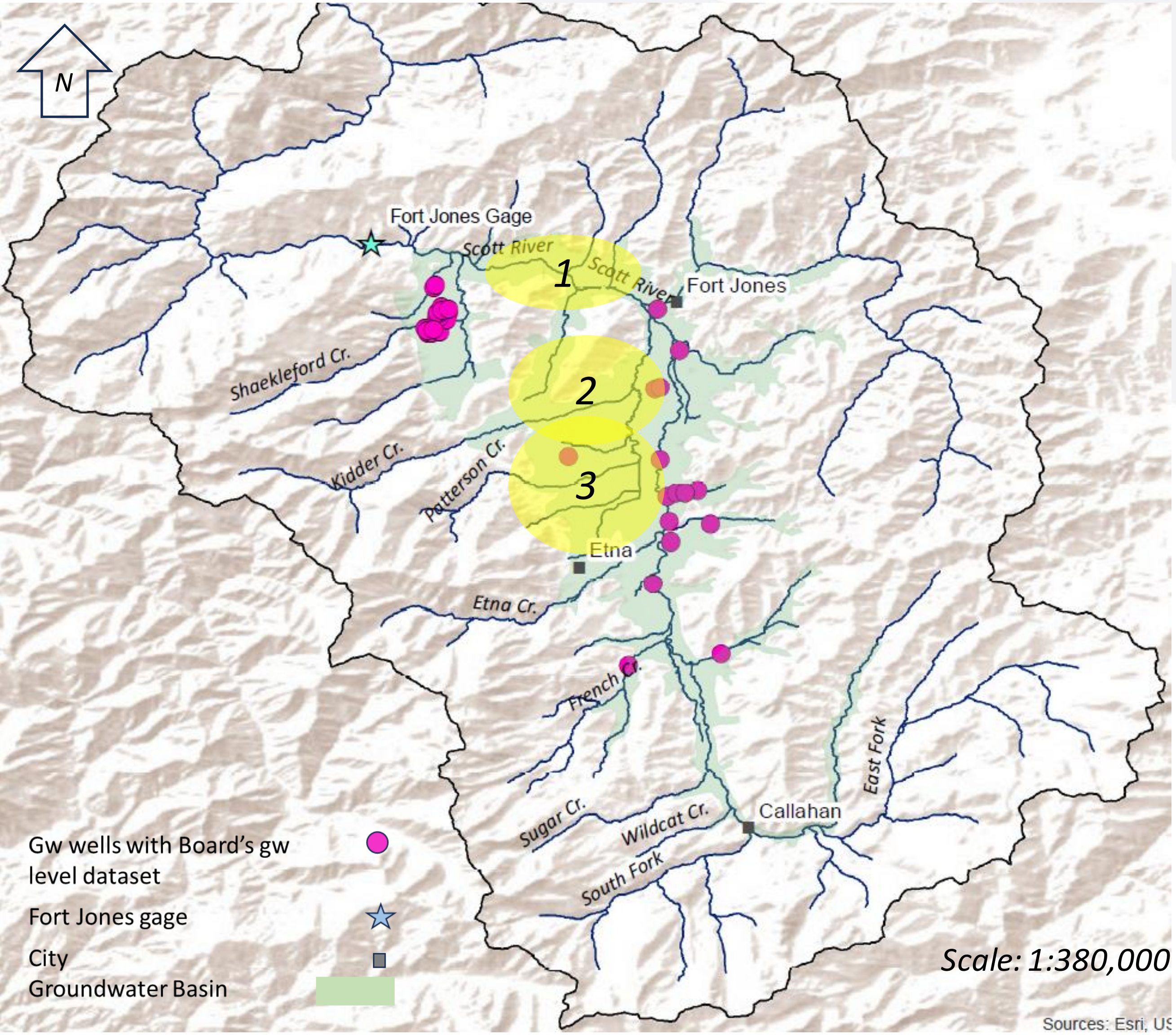
Groundwater monitoring networks in Scott River watershed includes wells from:

- SGMA monitoring network
- UC Davis and UC Cooperative Extension
- Department of Water Resources and CASGEM
- Quartz Velley Indian Reservation (QVIR)'s Network (Shackleford Creek)
- Others?

Board's Groundwater Level Dataset (at this time) comprised of 19 wells from GSA technical team and 27 wells from QVIR:

- Available data from various time periods in the range of 2007-2023 (min timeframe: 2021-2023)
- Nine (GSA) wells only monthly gw level readings
- Ten (GSA) wells are continuous (but only monthly max, min, and average data have been shared with Board)
- Data shared with well owners' permission;
- DWR/ CASGEM data are publicly available but have very limited detail

Groundwater Data Need in Scott River Watershed: Zones where Groundwater Data Needed



More groundwater data are needed, particularly for yellow highlighted zones:

1- Reach 9:

- Groundwater and surface water interaction is of high interest in this river reach - final passage barrier for Chinook salmon to get to more favorable spawning habitat upstream of Reach 9
- This was a gaining reach in the past

2- Kidder Creek: Groundwater level impacts Kidder Creek connection to mainstem, a major tributary to Reach 9

3- Between Etna Creek and Kidder Creek: For information about incoming mountain front recharge from the west-side tributaries that may inform summer baseflow levels in the mainstem.

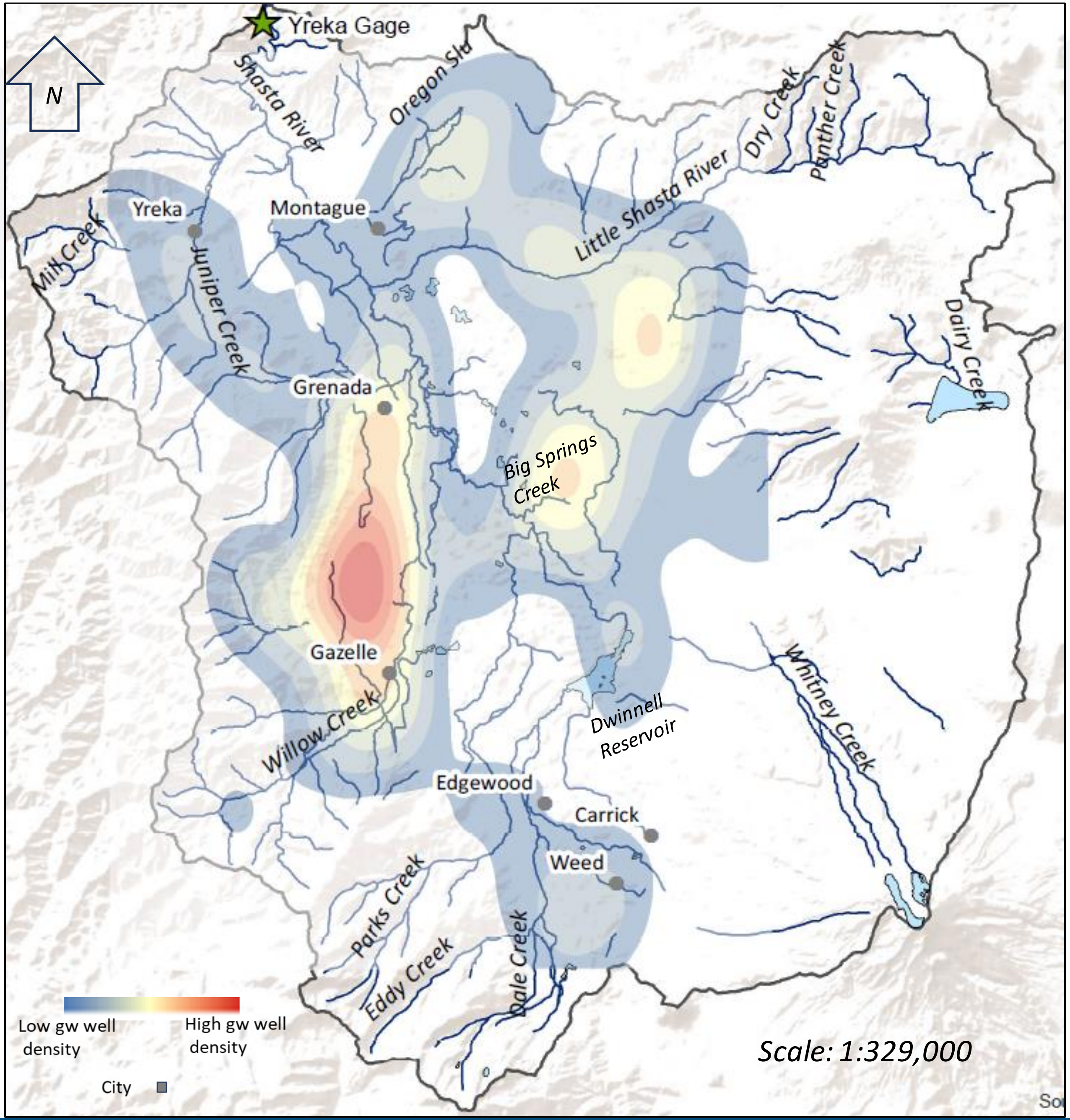
In addition to the groundwater level data, **groundwater pumping data are needed** for water budget and groundwater use/demand analysis

Shasta River Watershed

Groundwater Data + Needs

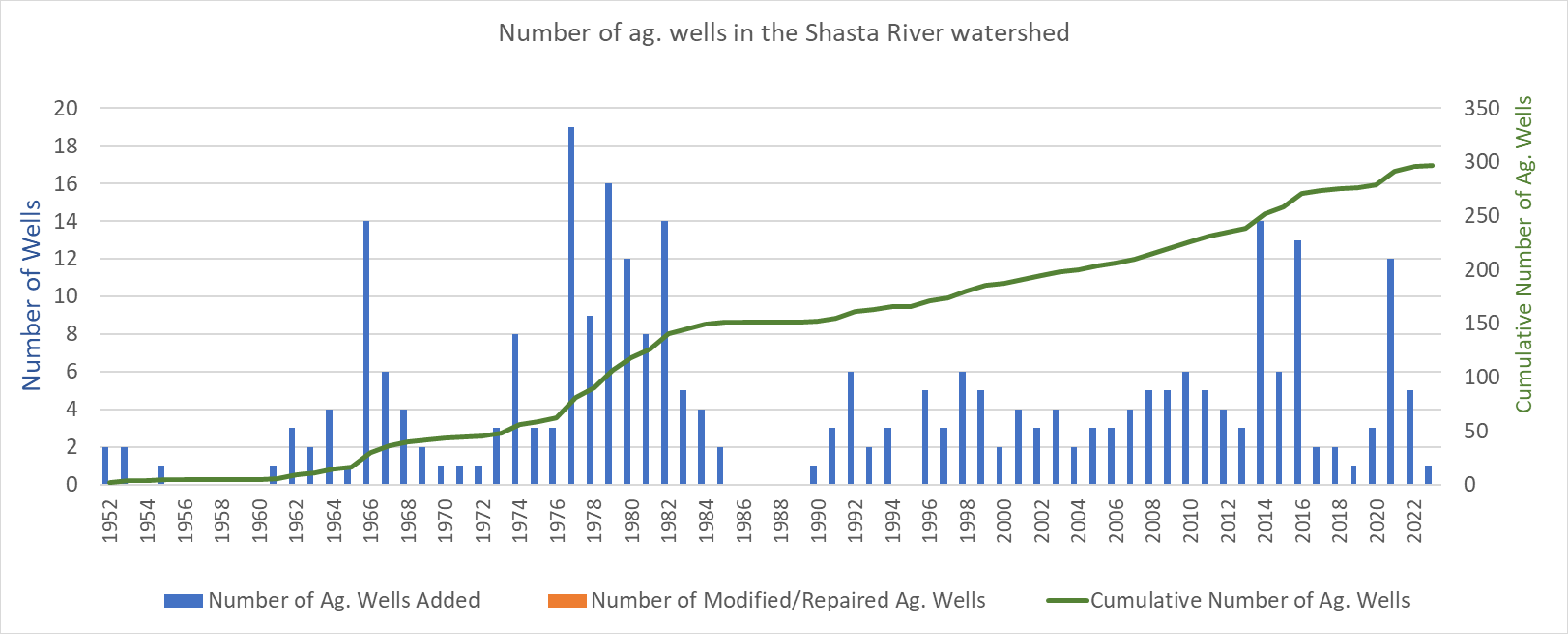
Groundwater Data Needs in Shasta River Watershed:
Distribution of 297* Agricultural Wells in Shasta River Watershed

Department of Water Resources: Well Completion Reports - Datasets - California Natural Resources Agency Open Data – Last visited August 2023**)**



* Note: may include inactive and abandoned wells

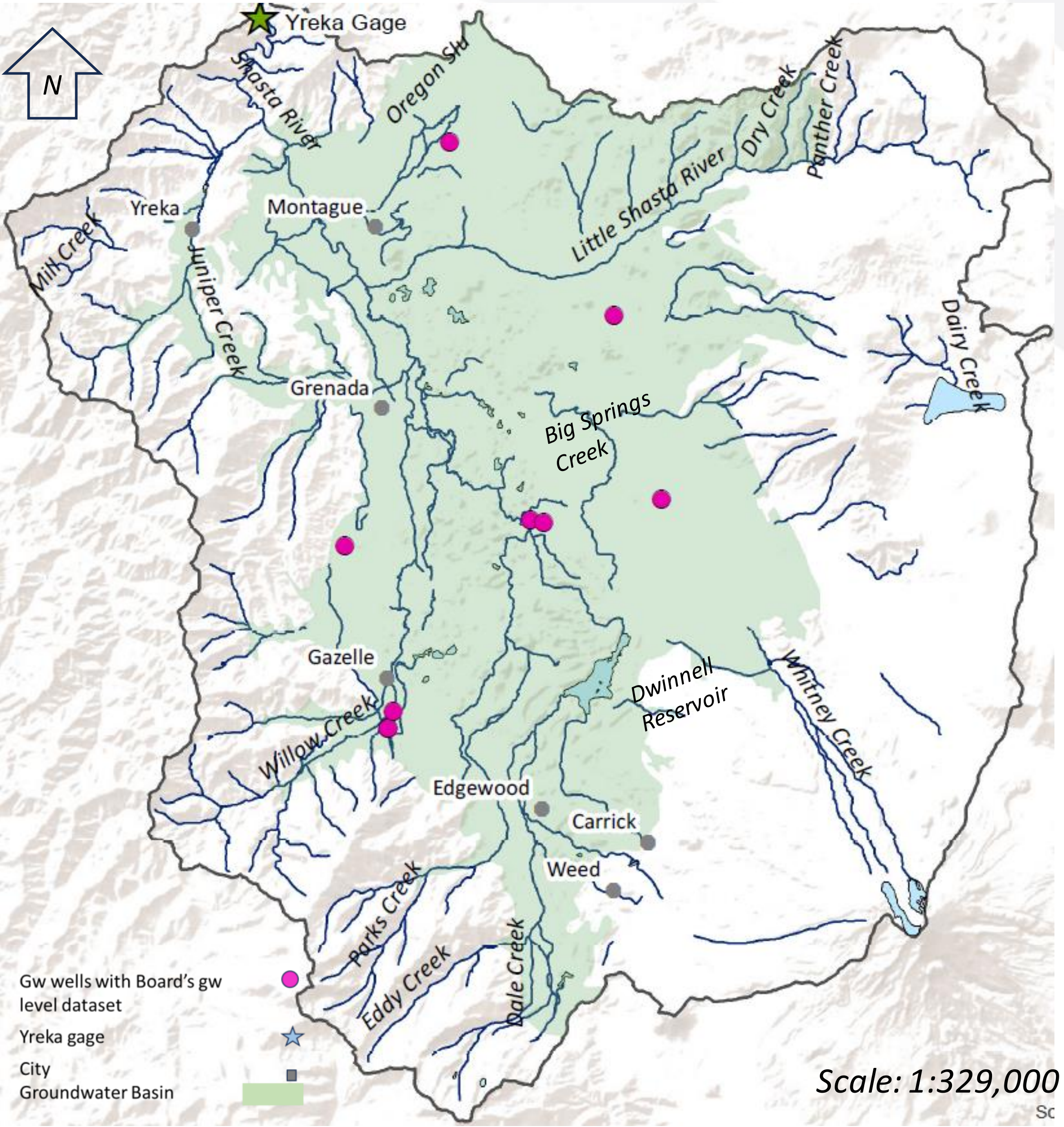
Groundwater Data Need in Shasta River Watershed: Agricultural Well* Statistics by Year



Adapted from [Well Completion Reports - Datasets - California Natural Resources Agency Open Data]

* Note: may include inactive and abandoned wells

Groundwater Data Needs in Shasta River Watershed: Distribution of Agricultural Wells with Data



Groundwater monitoring networks in Shasta River watershed include:

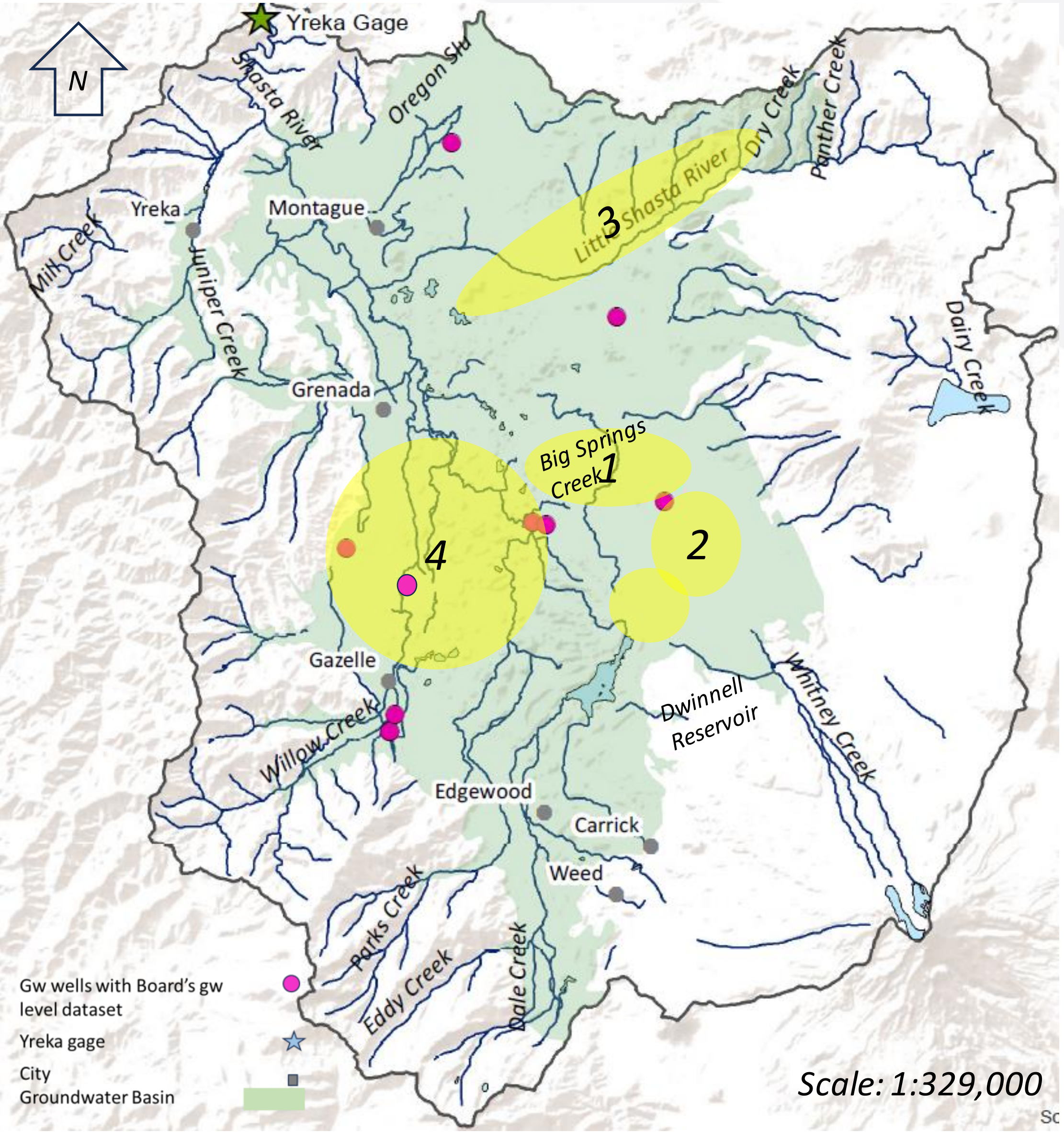
- SGMA monitoring network
- Department of Water Resources and CASGEM
- Other?

Board's Groundwater Level Dataset (at this time) comprised of 10 wells:

- Time periods of available data: 2019-2023 for seven wells; 2020-2023 for one well; 2021-2023 for one well; and 2023 only for one well
- Continuous data exist for all 10 wells. Monthly maximum, minimum, and average have been shared with Board for 9 wells.
- Data shared with well owners' permission

In addition, historical data (2010-2018) of 14 wells (not currently monitored) in the Big Springs area were collected.

Groundwater Data Needs in Shasta River Watershed: Zones where Groundwater Data are Needed



Groundwater data are needed, particularly for yellow highlighted zones:

1- Big Springs Creek sub-watershed: Big Springs Creek is one of the main sources of cold water in Lower Shasta during Spring and Summer

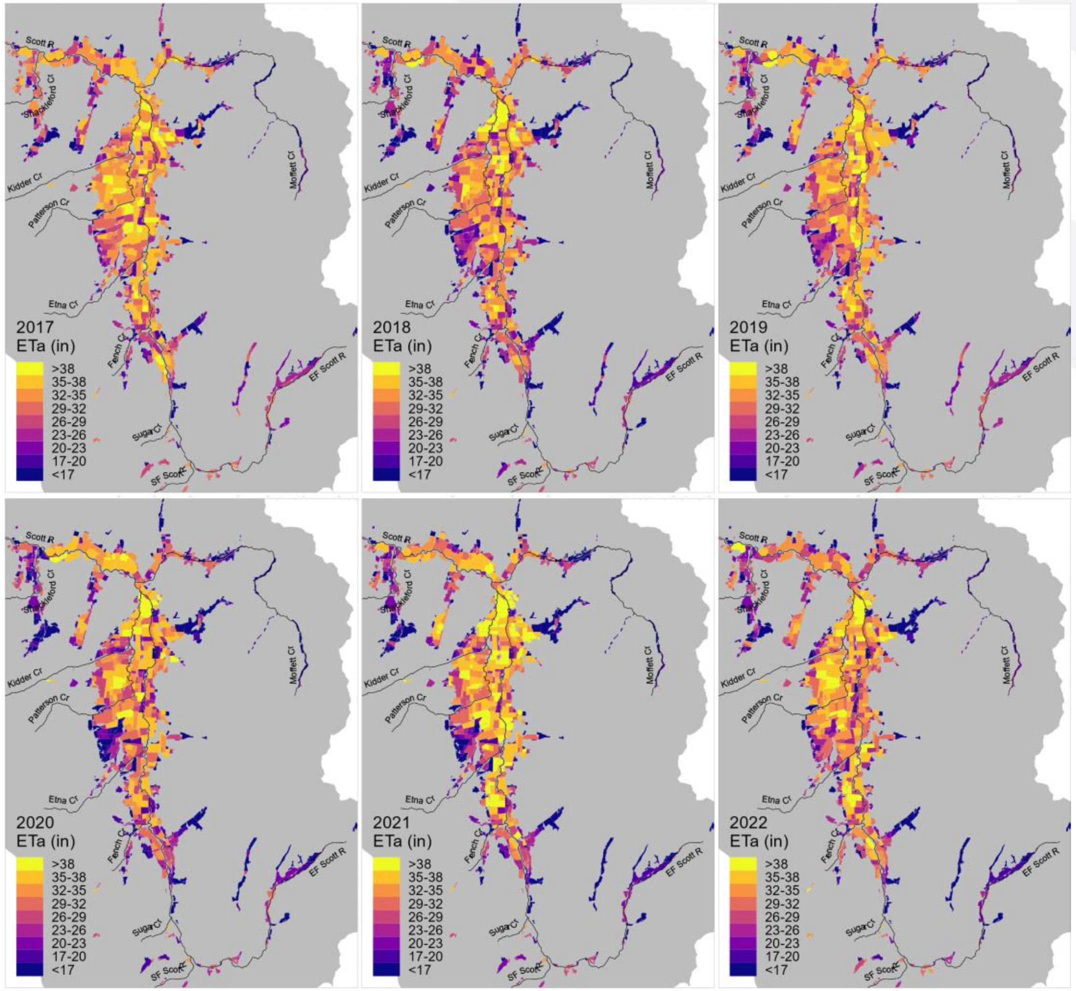
2- Northeast of Dwinnell Reservoir: Assist with water budget analysis

3- Little Shasta: Assist with water budget analysis

4- Between Gazelle and Granada: Multiple private drinking water wells and groundwater irrigated crops/ pastures

In addition to the groundwater level data, **groundwater pumping data are needed** for water budget and groundwater use/demand analysis

Groundwater Data Needs in Scott River and Shasta River Watersheds: Alternatives for Groundwater Use/Demand Data



Maps showing annual actual evapotranspiration (ETa) depth for each agricultural field in the Scott River sub-basin for the years 2017–2022. Data summarized from OpenET. (Asarian, J. E., (2022), “Evaluating the hydrologic effects of the 2021–2022 Scott and Shasta irrigation curtailments using remote sensing and streamflow gages”, prepared for Prepared for: Klamath Tribal Water Quality Consortium July 12, 2023)

UC Davis Scott Valley Integrated Hydrology Model (SVIHM)

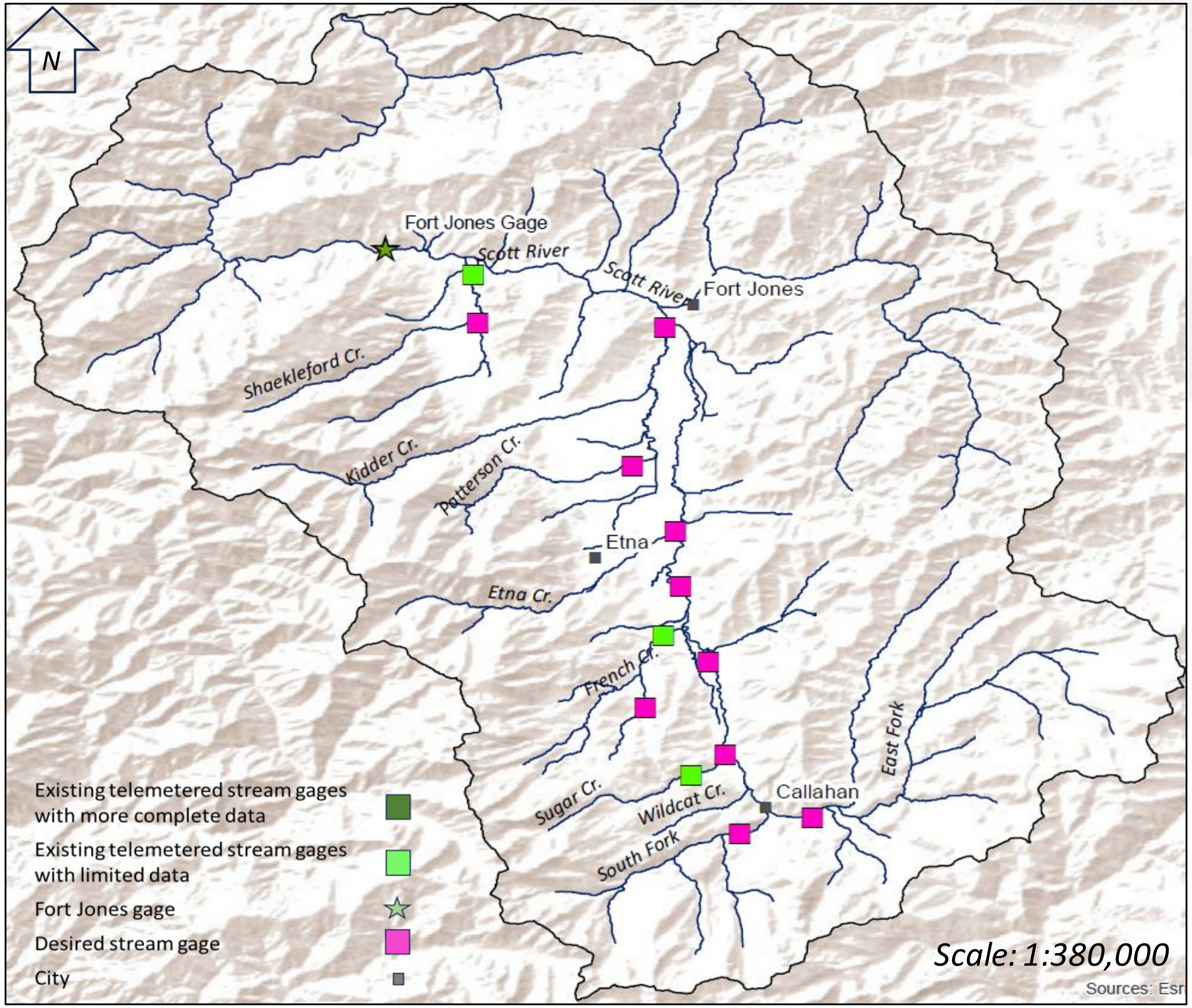
Estimation of GW Use/Demand

Groundwater Pumping Data

Scott River Watershed

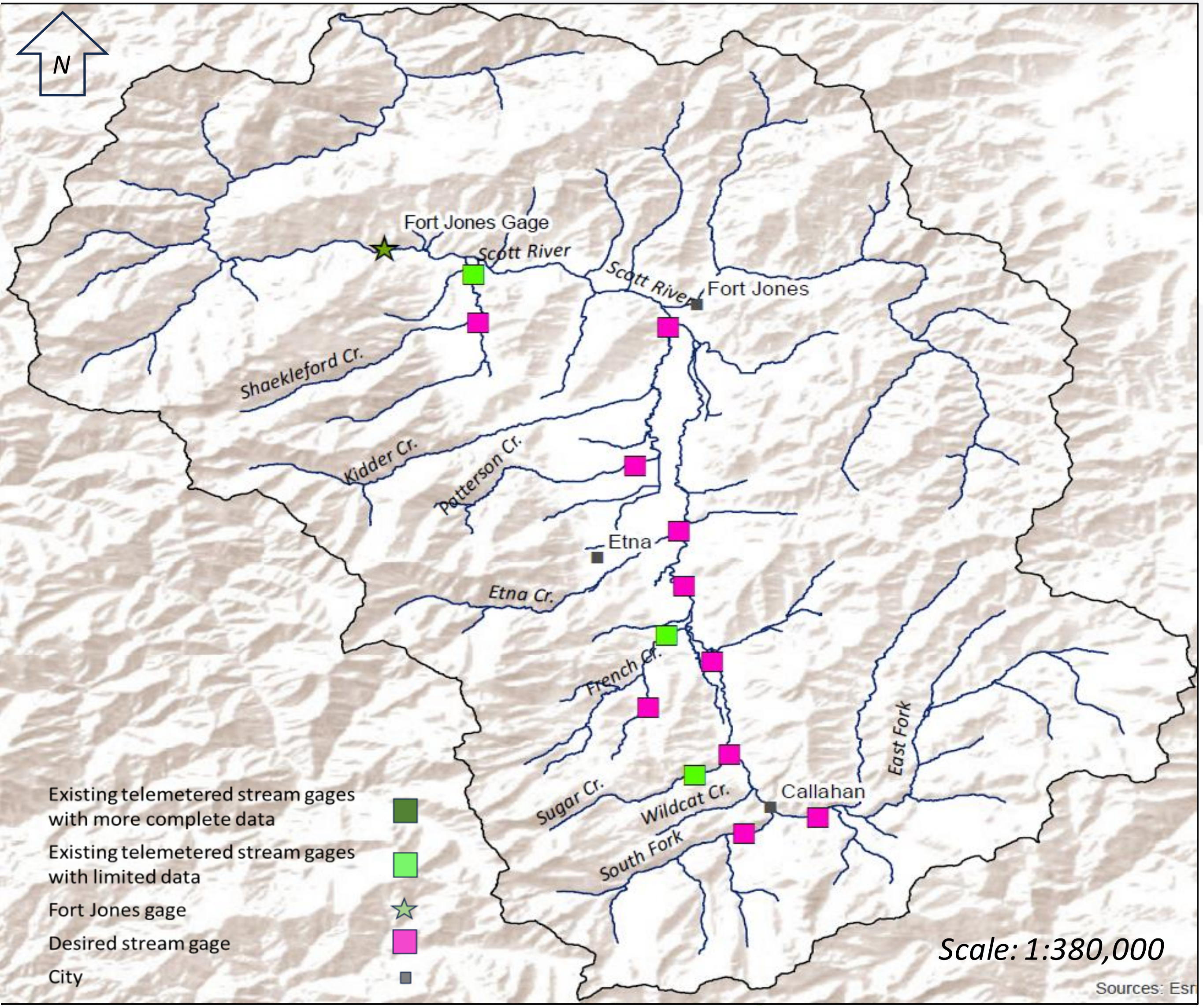
Streamflow Data + Needs

Surface Flow Data Needs in Scott River Watershed
Locations of Existing Telemetered and Desired Stream Gages in Scott River Watershed



- Four USGS and DWR telemetered stream gages exist
- USGS Fort Jones Gage with the period of record of 1941-present is the most important
- Board staff received inputs from CDFW, Scott-Shasta Watermaster District, and local community members on potential new stream gage locations
- Major criteria used to propose and rank new gages:
  - Support better understanding of water balance
  - Assist water quality management
  - Monitor important local fish habitats
  - Monitor 1707 dedications
  - Increase number of telemetered gages

Surface Flow Data Needs in Scott River Watershed
Benefit of Desired Stream Gages



1- Kidder Creek gage: Major tributary to Reach 9. Water quality monitoring

2- Mainstem Scott River Below Tailings gage: Passage into East Fork and South Fork – high quality rearing and spawning habitats; will help to understand water balance

3- Mill Creek gage: Critical coho rearing habitat

4- Midpoint Scott River gage: Assist with water availability analysis

5- Sugar Creek. gage: 1707 dedication on Sugar Creek; would help to monitor this dedicated water

6-Miners Creek gage: Critical coho salmon spawning and rearing stream

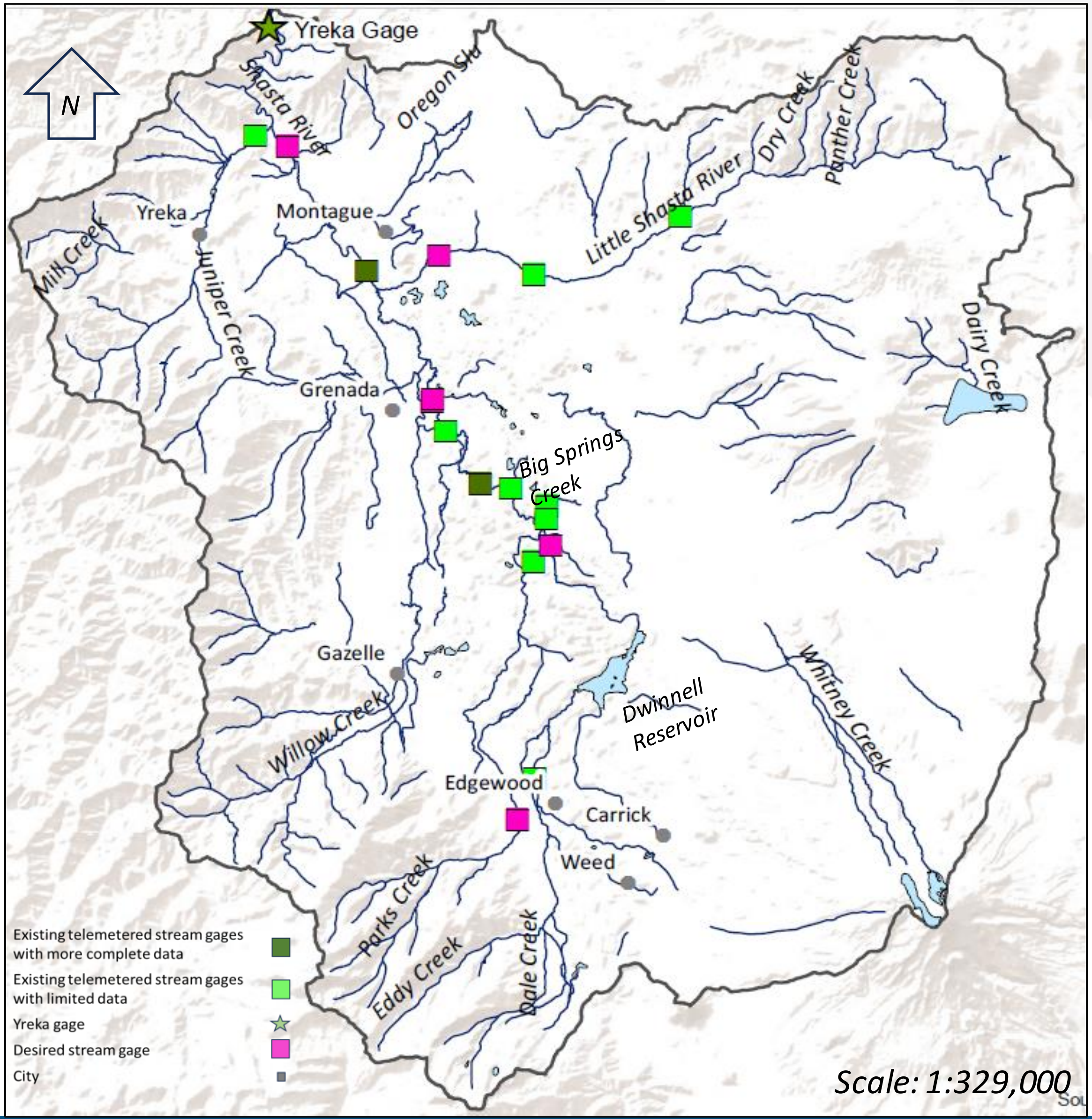
7, 8, and 9- Etna Creek gage, East and South Fork gages: Existing Scott River Watershed Council gage on Etna and DWR gages on East and South Fork Creeks are not telemetered (goal would be to add telemetry)

10 - Patterson Creek gage: Better estimate of water availability

Shasta River Watershed

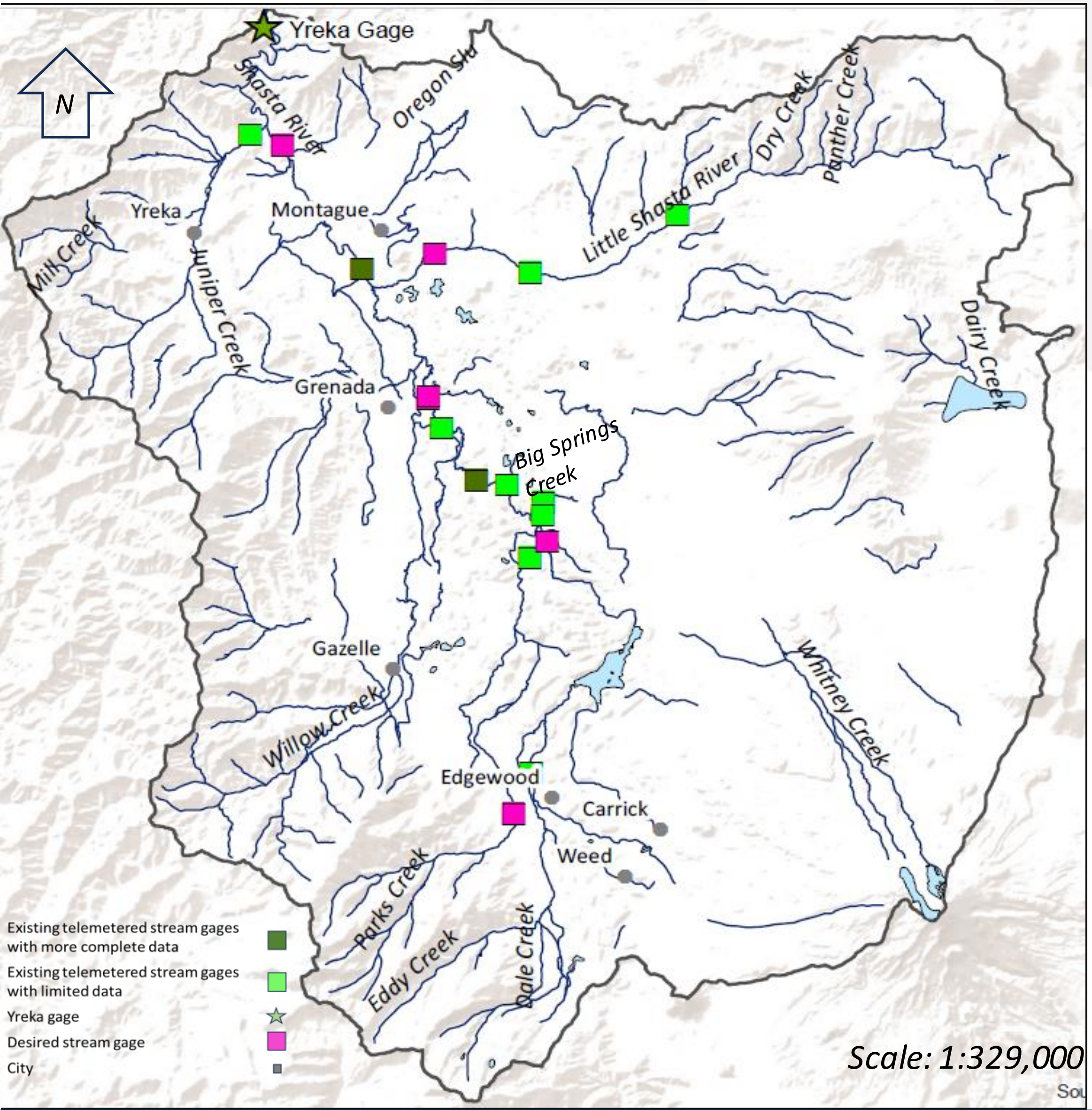
Streamflow Data + Needs

Surface Flow Data Needs in Shasta River Watershed
Locations of Existing and Potential New Stream Gages



- Twelve telemetered stream gages exist with different data availability
  - USGS Yreka Gage with record of 1933-present is most important
- Board staff received input from CDFW, Scott-Shasta Watermaster District, and local community members on potential new stream gage locations
- Major criteria used to propose and rank new gages:
  - Support better understanding of water balance
  - Assist water quality management
  - Monitor important local fish habitats
  - Assist Watermaster in diversion coordination
  - Monitor 1707 dedications

Surface Flow Data Needs in Shasta River Watershed
Benefit of Desired Stream Gages in Shasta River



1- Lower Shasta above Montague gage (A12 Bridge): Downstream major diverters below Big Springs confluence; water temperature TMDL compliance location

2- Lower Shasta, above confluence of Parks Creek gage : Characterizes flows out of Dwinnell before any tributaries join; helps with water balance of cold-water springs that join river between Dwinnell and Parks Creek; helps track any mainstem 1707 dedications

3- Little Shasta River gage: To help inform status of connection at confluence of Little Shasta with Shasta River; CDFW could use to assess if water can be diverted to the Wildlife Area in accordance with CDFW's 10 cfs bypass requirement

4- Lower Shasta near I-5 Bridge gage: Assist watermaster in determining the amount of flow in this area to help better manage flows within Watermaster area with a flow requirement; Temperature and dissolved oxygen monitoring would help determine/support TMDL compliance and better understand flow and water quality relationships

5- Parks Creek gage: Data quality is poor; monitor proposed Nature Conservancy 1707; measure water quality

6- Lower Shasta, downstream of A12 gage: Informative for 1707 and forbearance tracking

Voluntary and/or Regulatory Data Needs to Fill Groundwater and Surface Water Gaps in Scott River and Shasta River Watersheds

Groundwater	Surface Water
Groundwater Level Data (pressure transducers available)	New Stream Gages
Groundwater Pumping Data	Frequent Reporting of Diversion Plans
	Real-time Diversion Measurements

Other Data of Interest
Soil Moisture
Evapotranspiration
Temperature
Precipitation
Fisheries

Options for Obtaining Data

- Voluntary sharing of groundwater data
  - Historic
  - Ongoing
- Required
  - Groundwater Local Cooperative Solutions
  - Information Order

Additional Comments

- How to provide comments:
  - In-person: scan QR code at back of room and fill out form
  - Virtual: fill out virtual speaker card linked in the workshop notice
- Written comments can be emailed to: ScottShastaDrought@waterboards.ca.gov