EMERGENCY FLOWS:

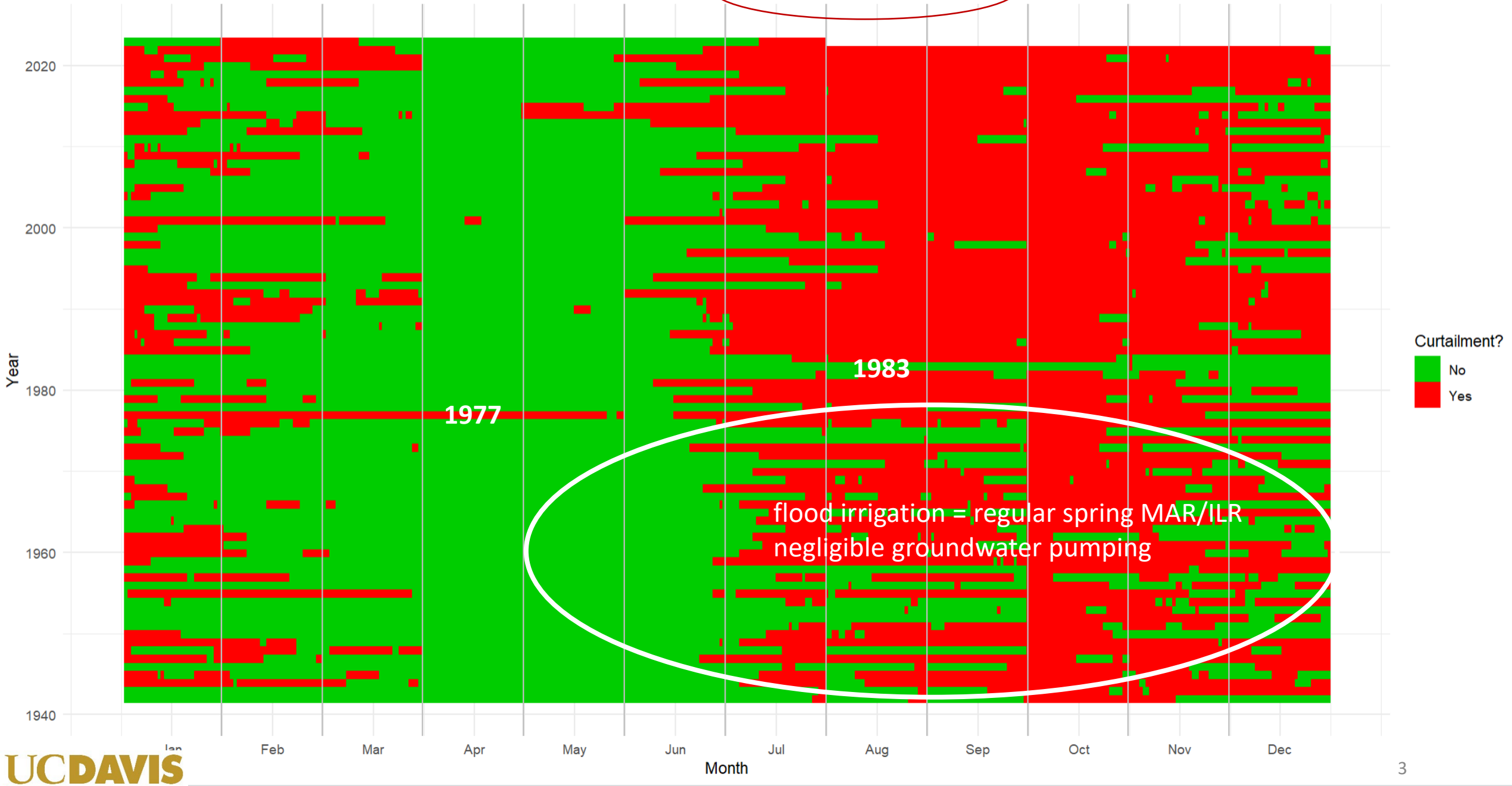
Some third parties characterize the existing Scott Valley Integrated Groundwater Hydrologic Model results as saying that the **emergency flow targets are too high and would be impossible to meet in most years. Is this a fair characterization?** Why or why not?

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

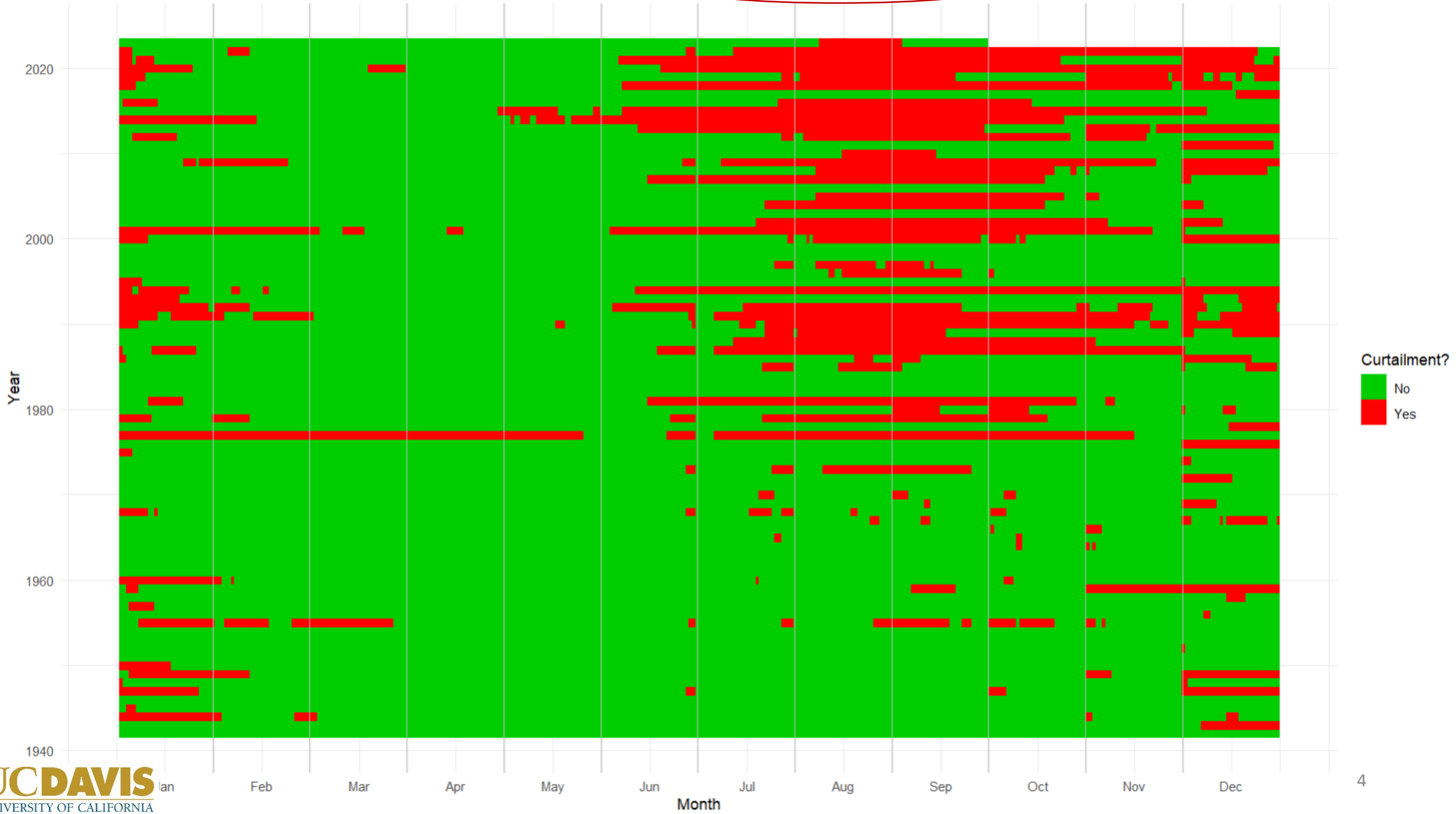
[1] now at University of Freiburg, Germany

- 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

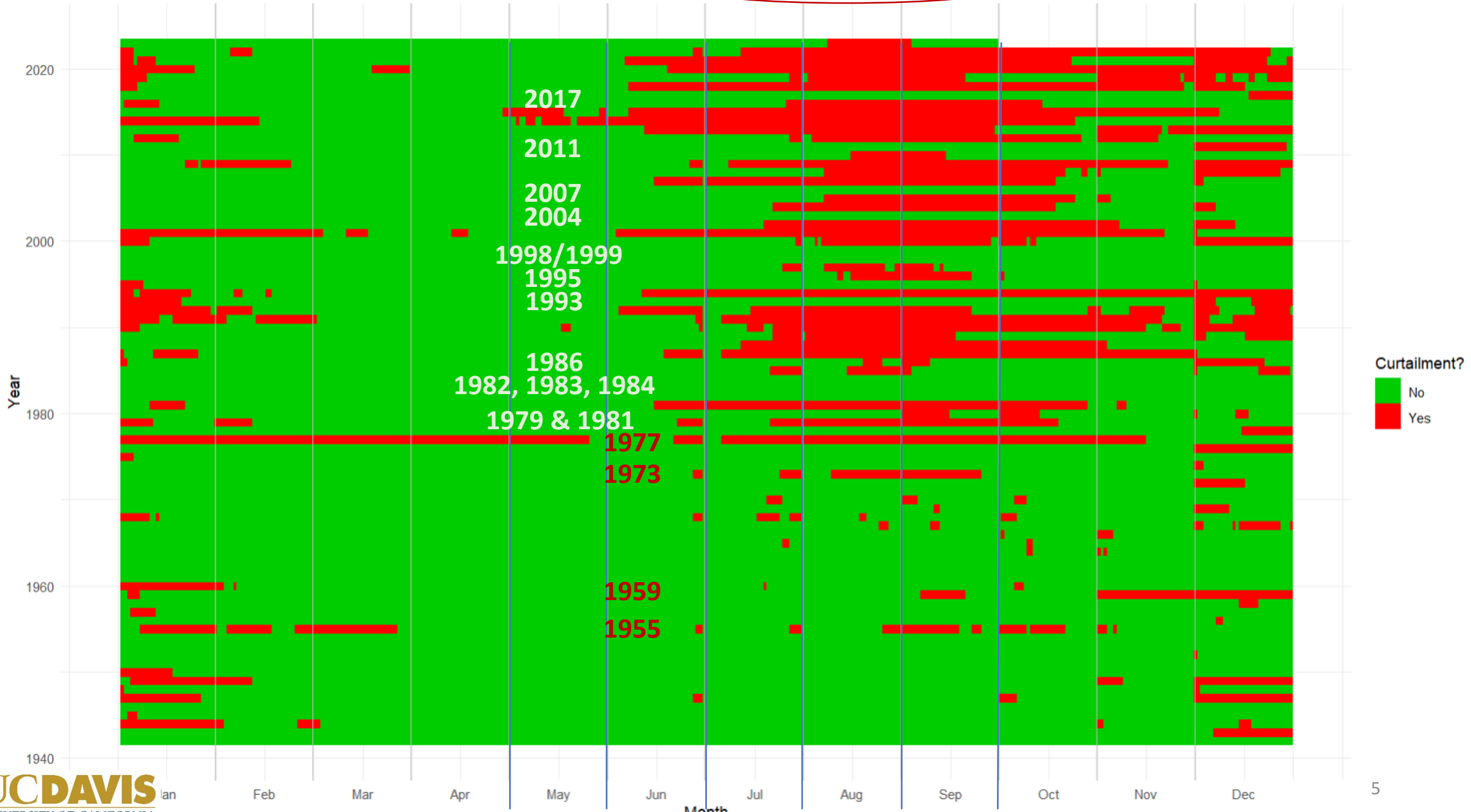
Hypothetical historic curtailments in Scott Valley based on historic flows and 2017 CDFW instream flow table, Pyschik and Harter, UC Davis 2023.



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



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



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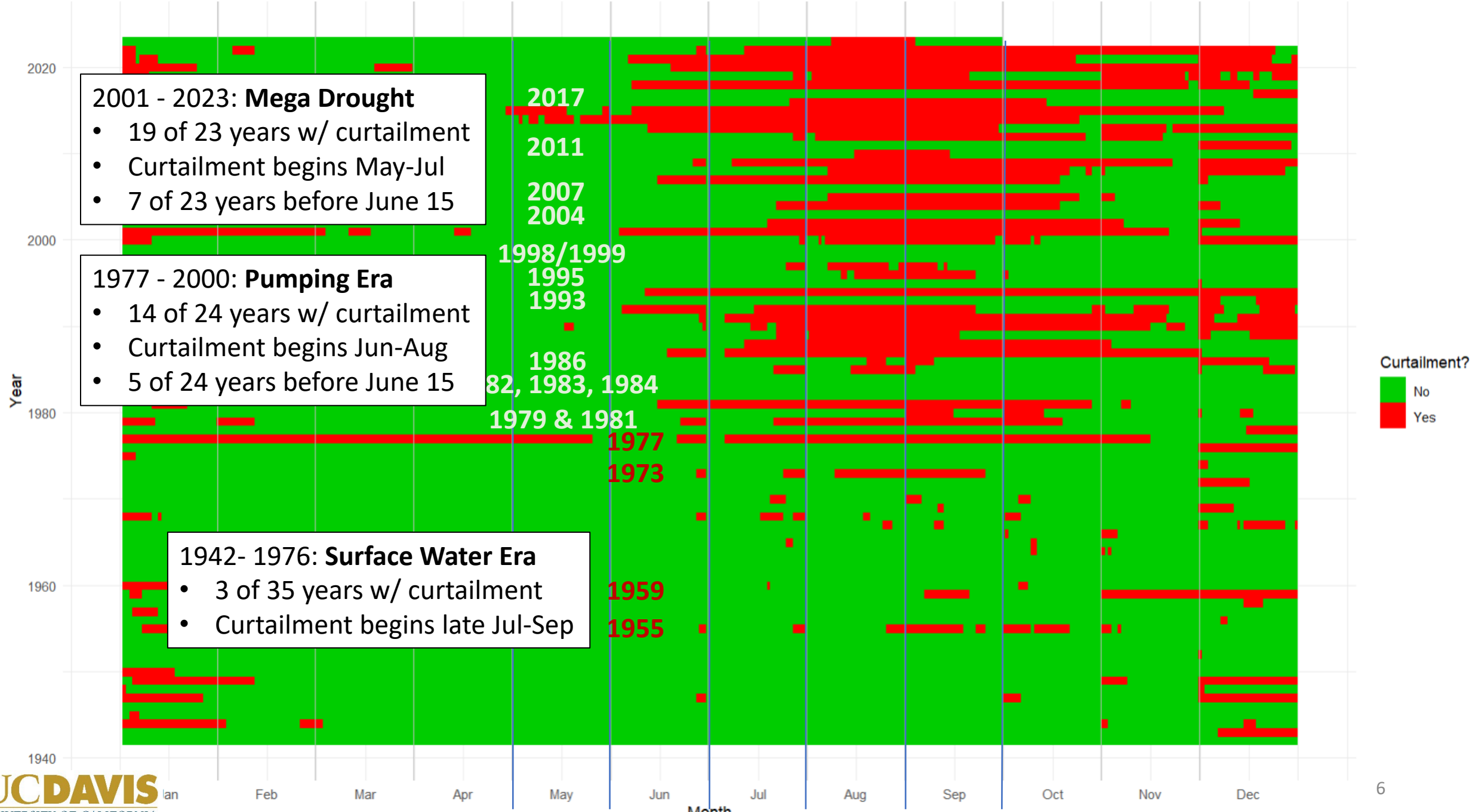
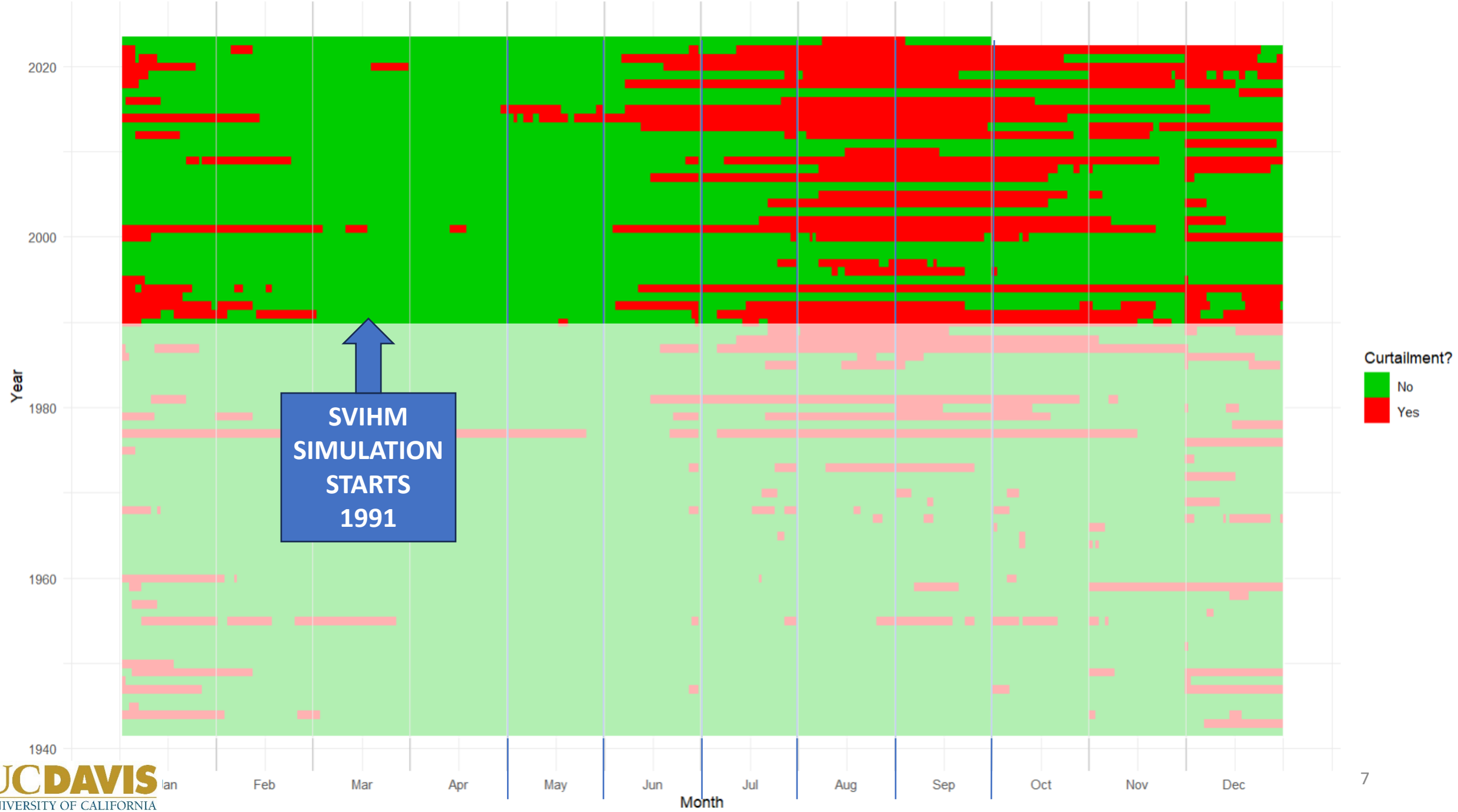
Hypothetical historic curtailments in Scott Valley based on historic flows and 2021 SWRCB Emergency Flows, Pyschik and Harter, UC Davis 2023.



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



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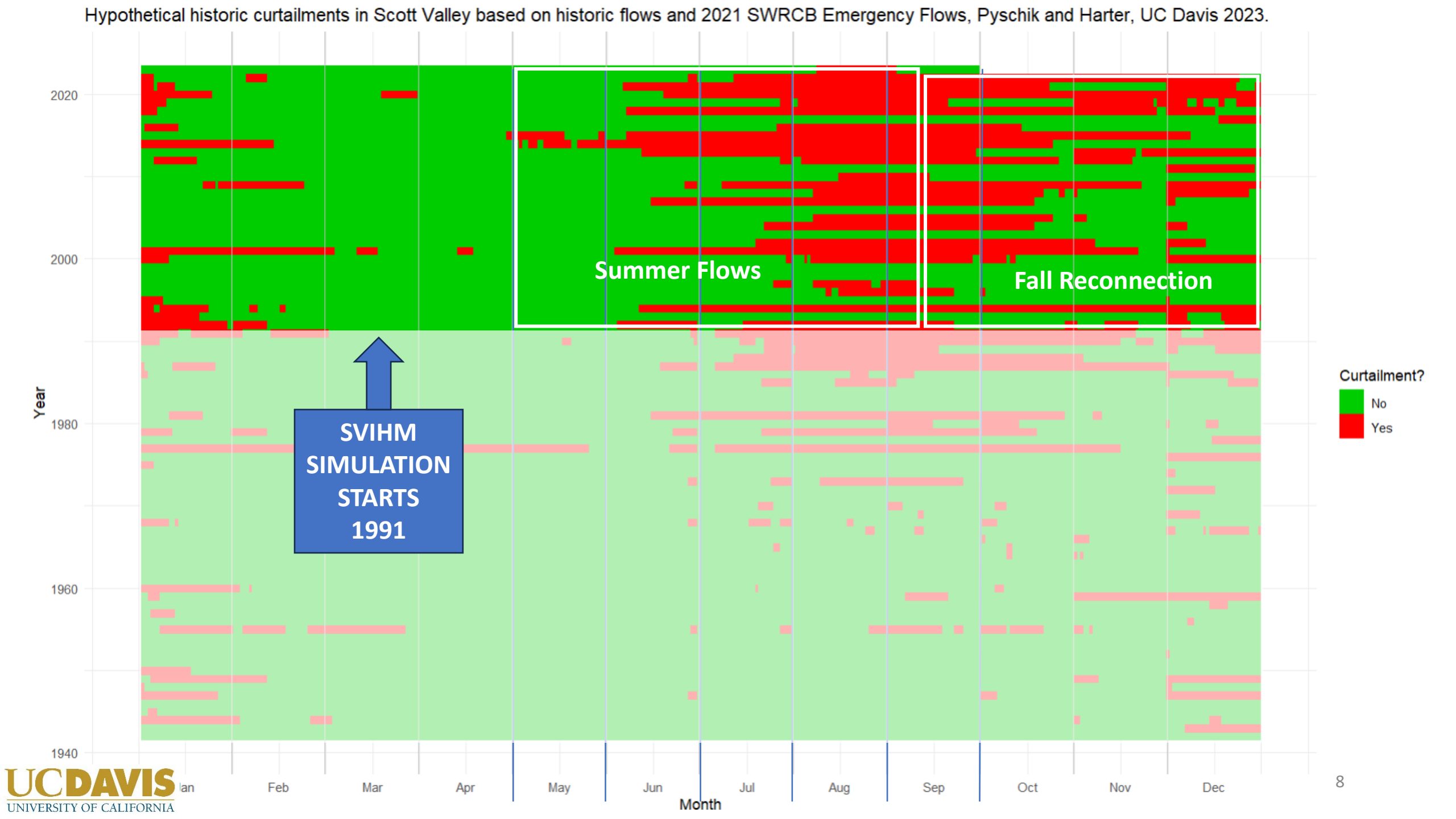
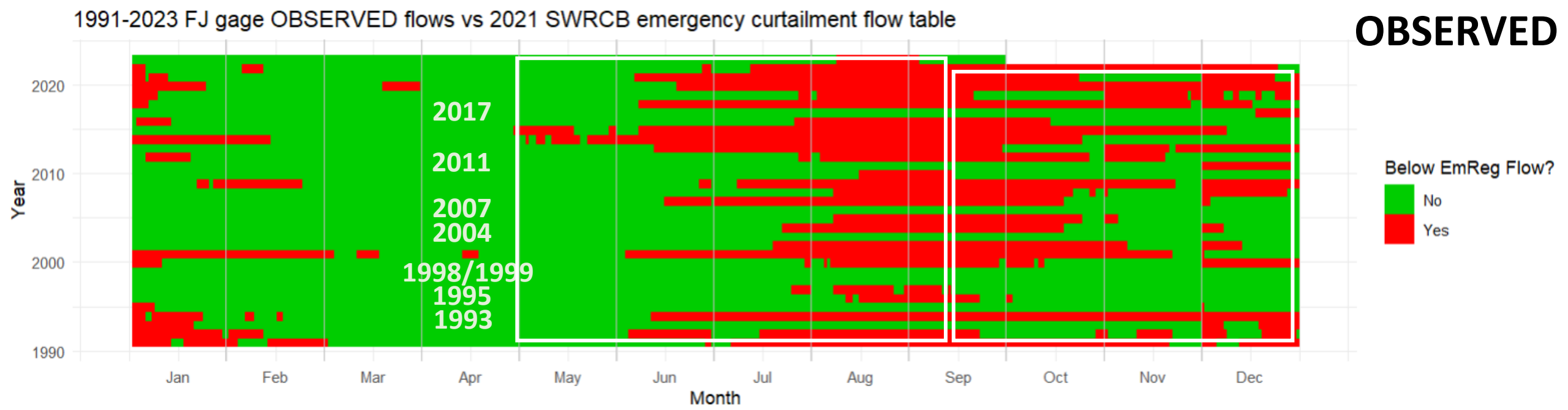
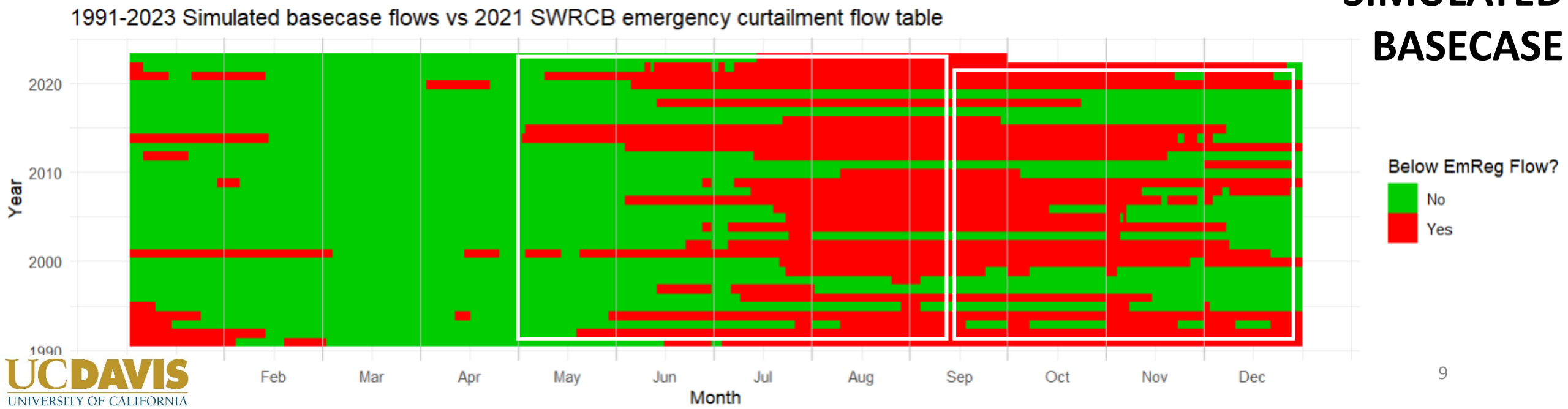

Hypothetical historic curtailments in Scott Valley based on historic flows and 2021 SWRCB Emergency Flows, Pyschik and Harter, UC Davis 2023.
Summer Flows
Fall Reconnection
SVIHM SIMULATION STARTS 1991
Year
2020
2000
1980
1960
1940
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Month
Curtailment?
No
Yes

OBSERVED



SIMULATED BASECASE



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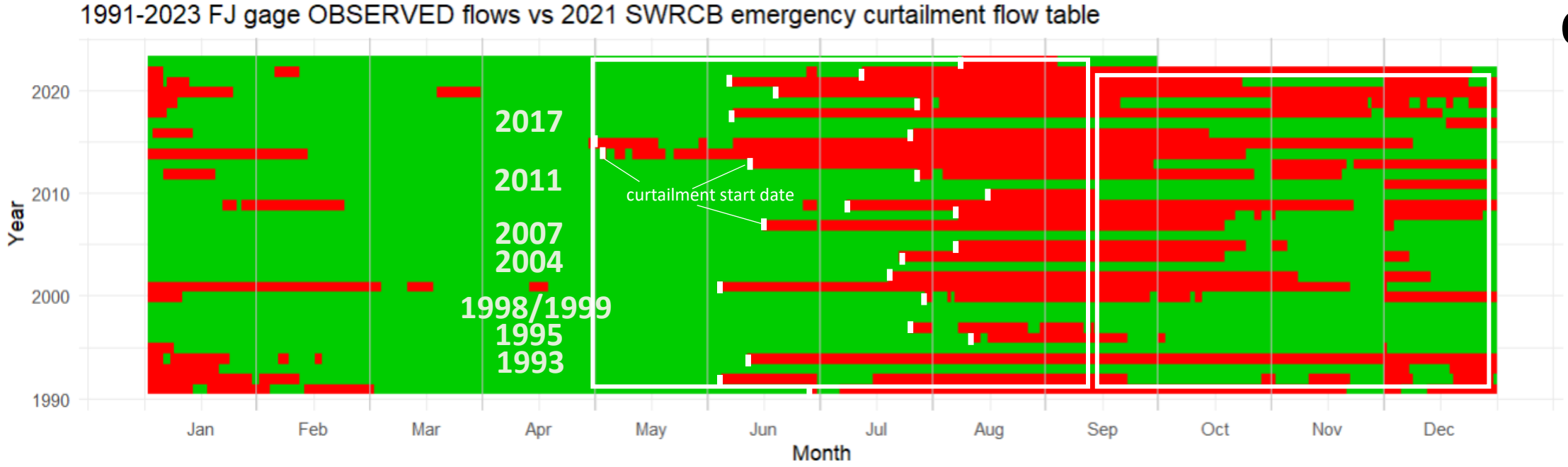
OBSERVED



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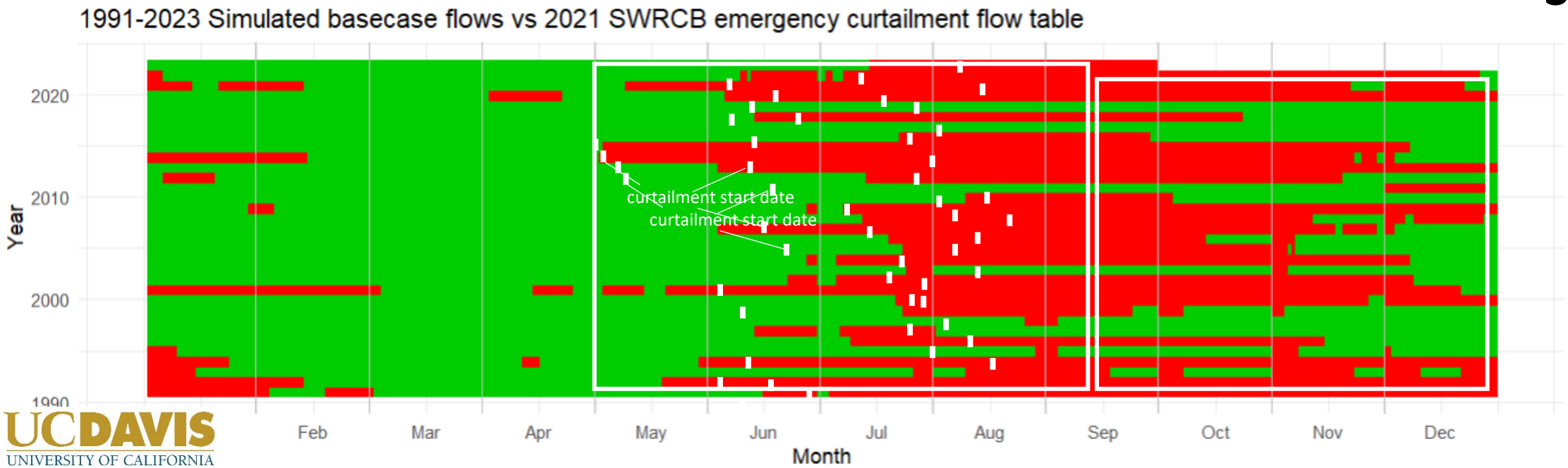

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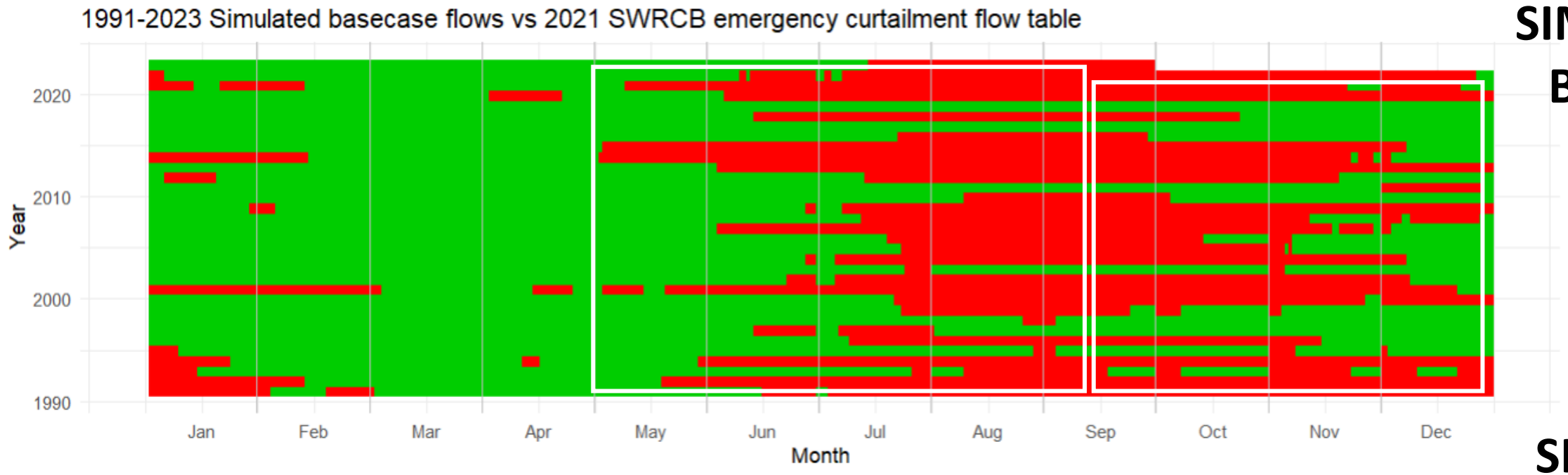
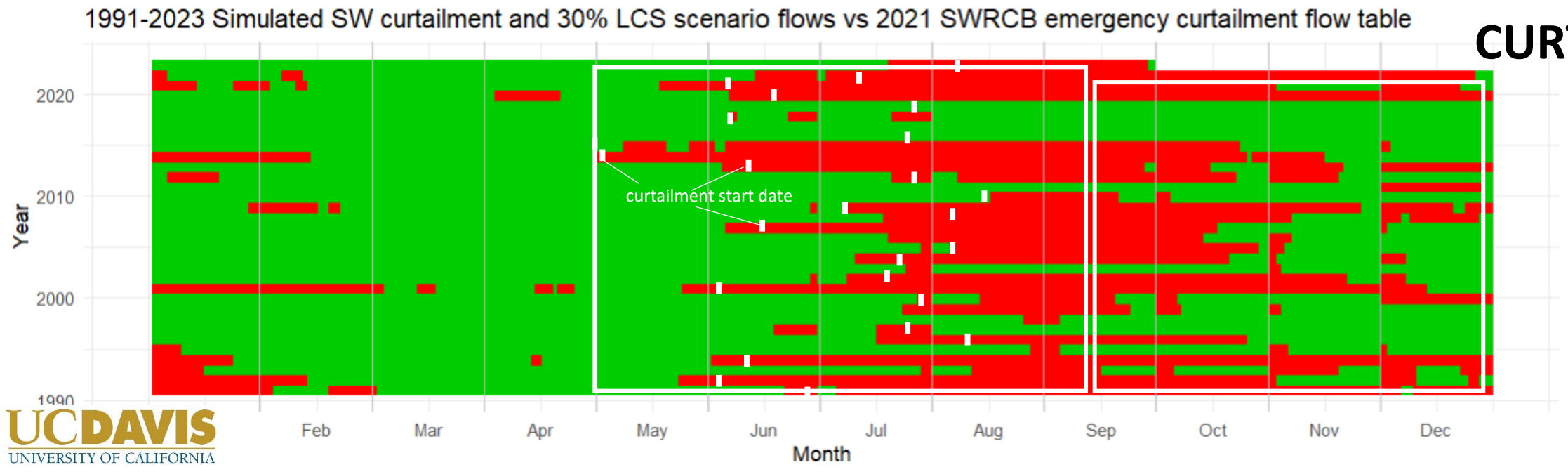
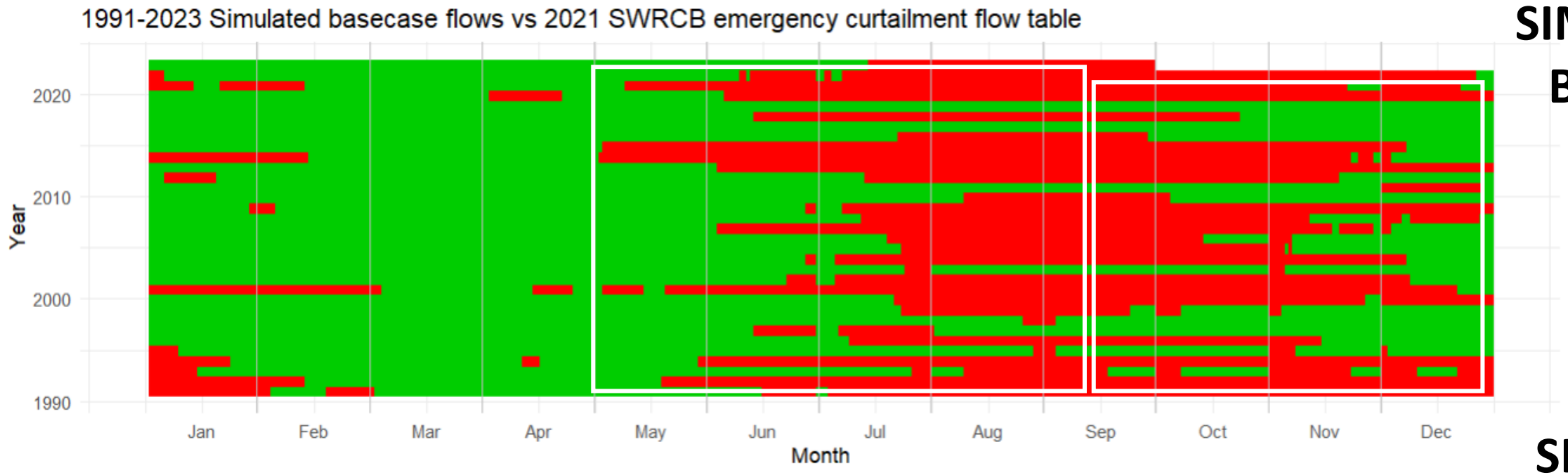


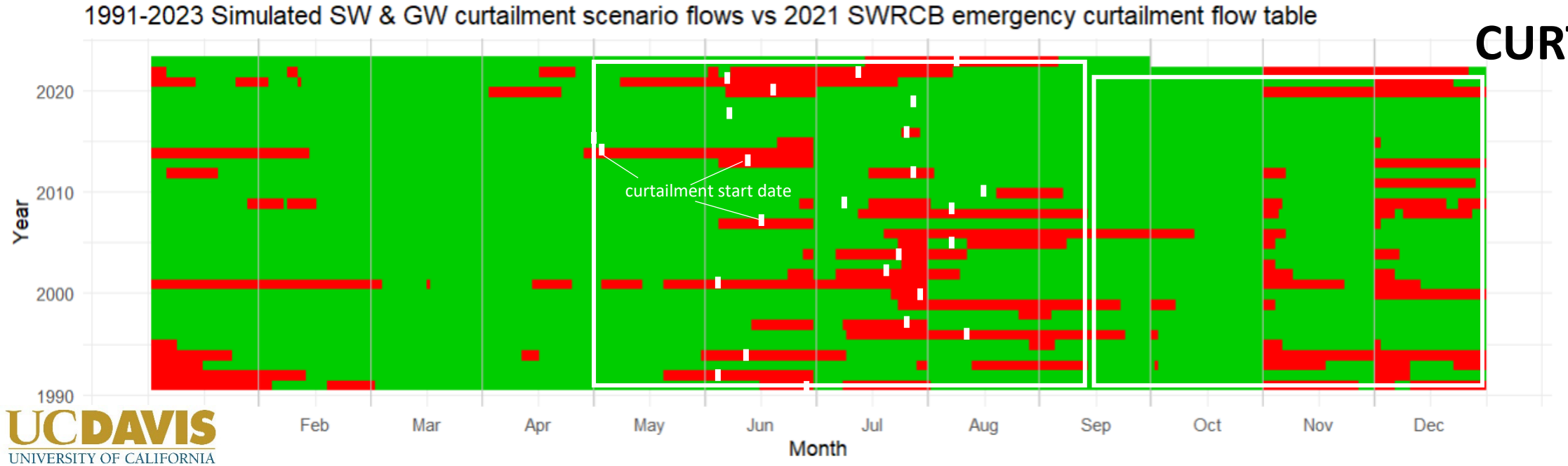
SIMULATED LCS & SW CURTAILMENT

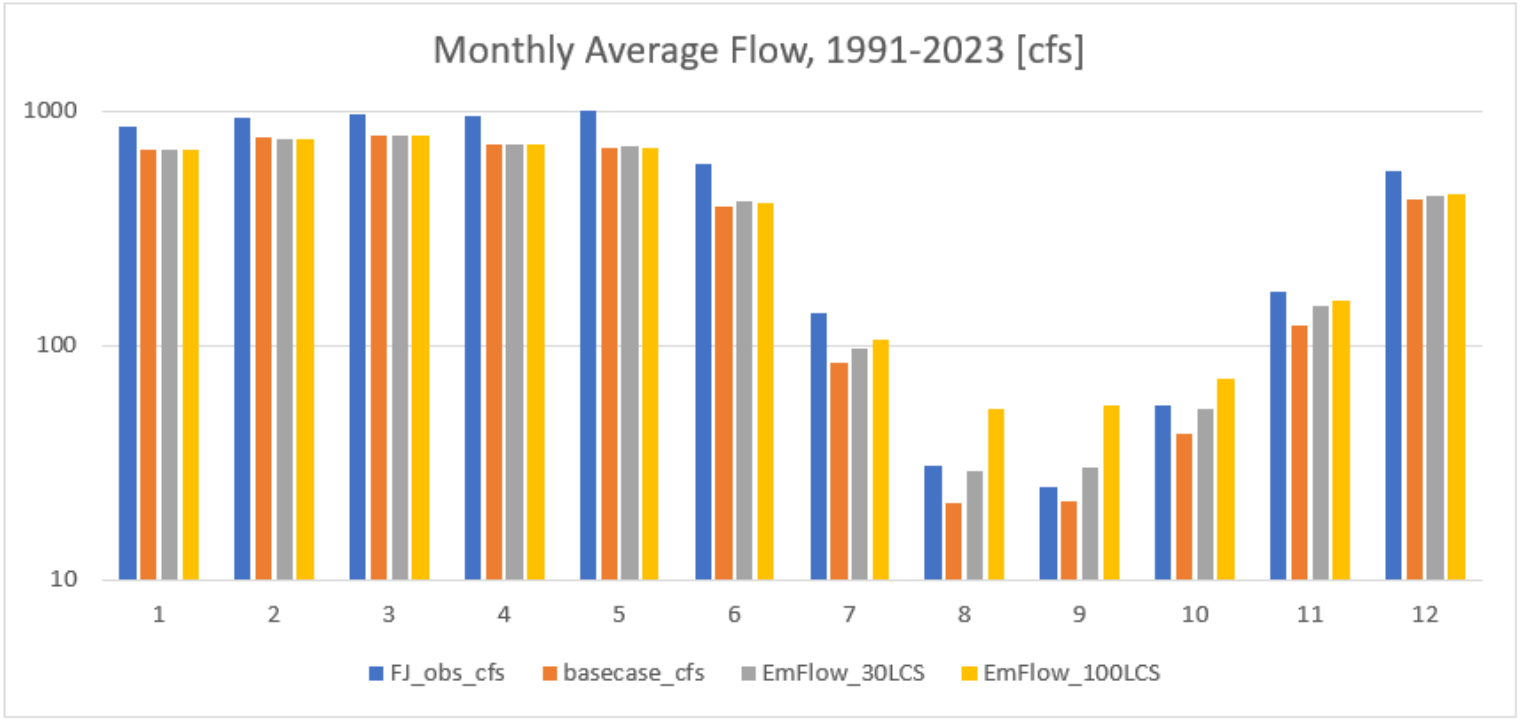


SIMULATED BASECASE



SIMULATED GW & SW CURTAILMENT





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%

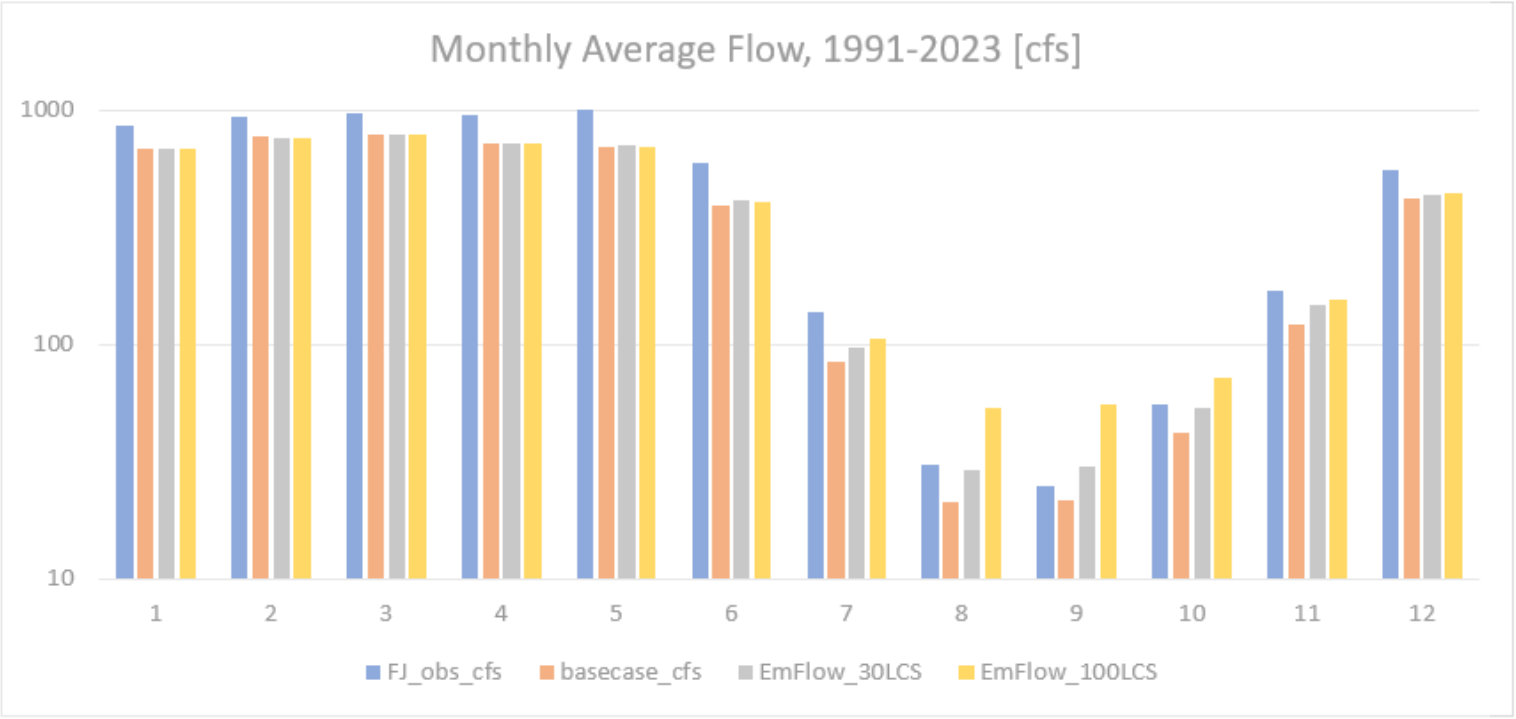
Jul-Aug Mean Increase: 27 cfs (50%)
Sep-Nov Mean Increase: 33 cfs (53%)

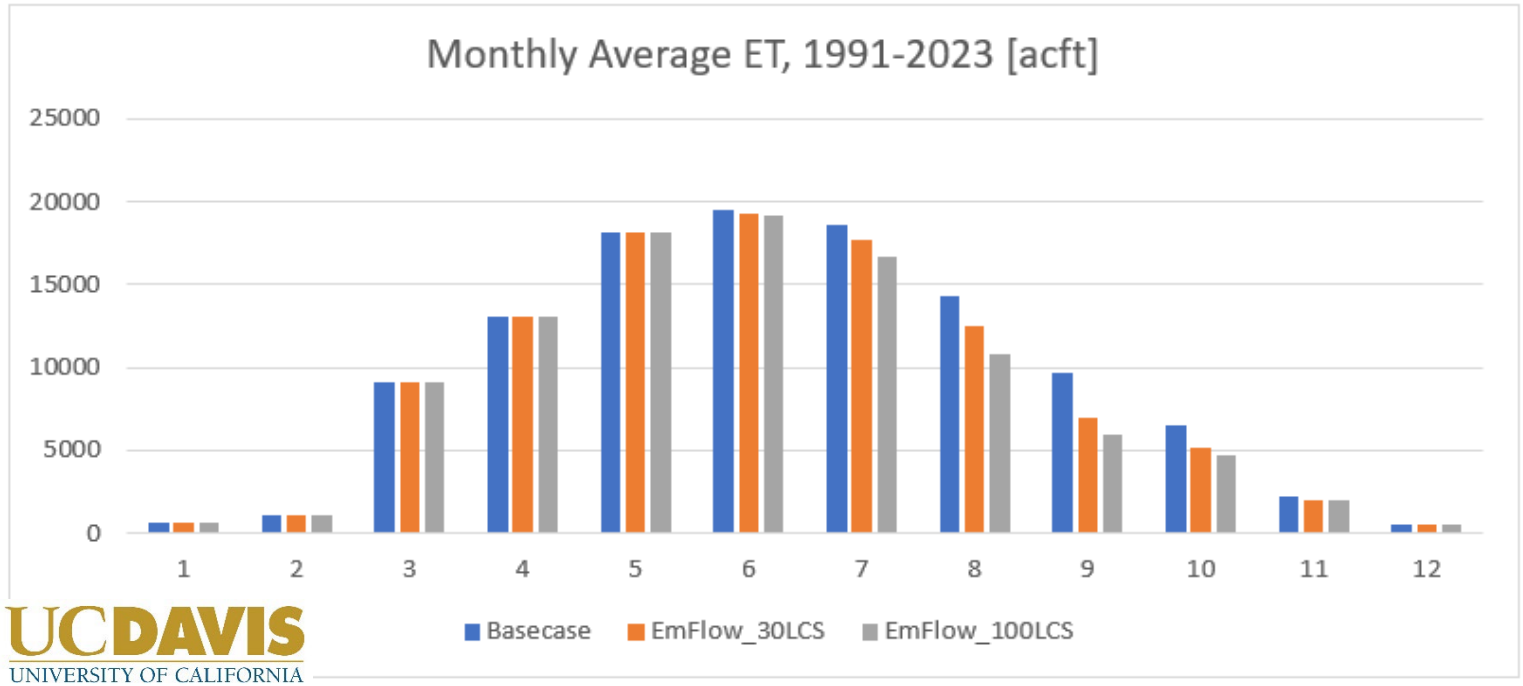
EMERGENCY FLOWS:

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





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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.

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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?

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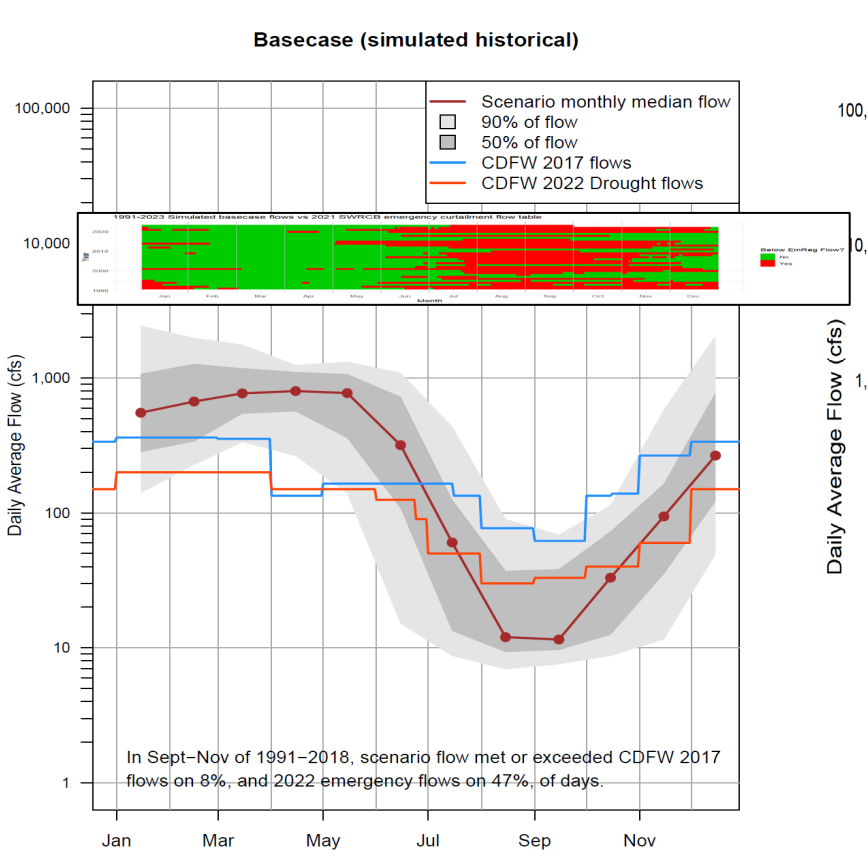
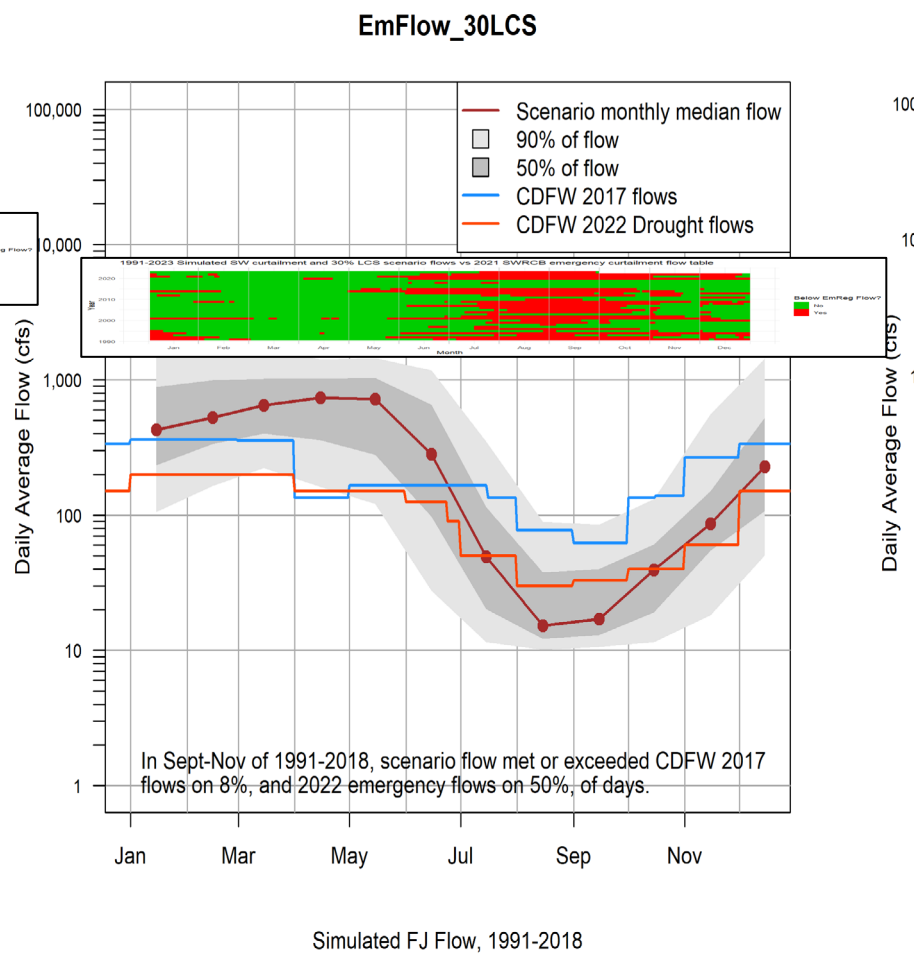
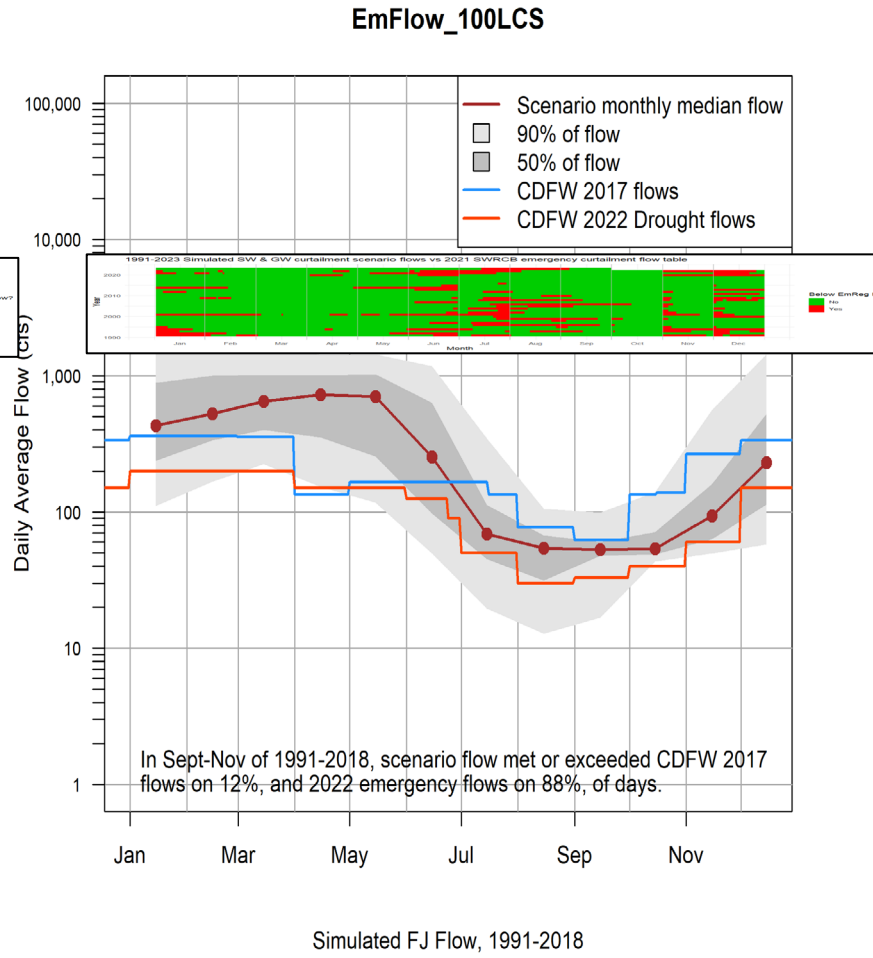
University of California Davis
[1] now at University of Freiburg, Germany

- 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)

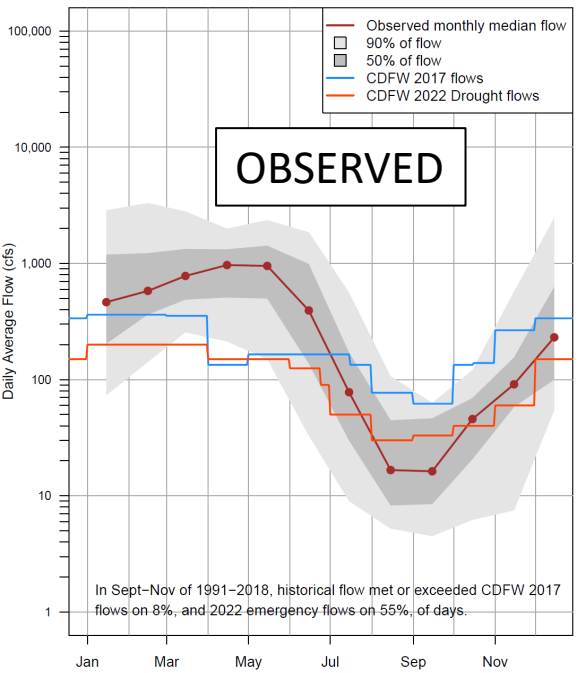




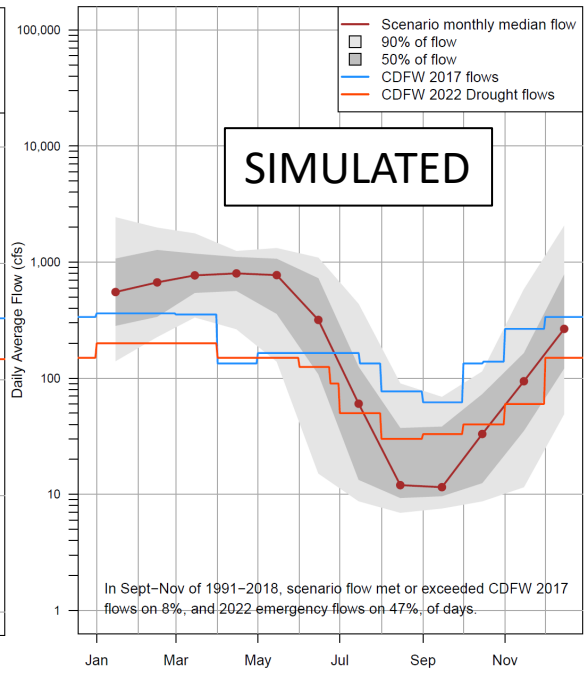


- 1 in 4 years has flows in the lower light grey zone
- 1 in 20 years has flows that fall *below* the light grey zone

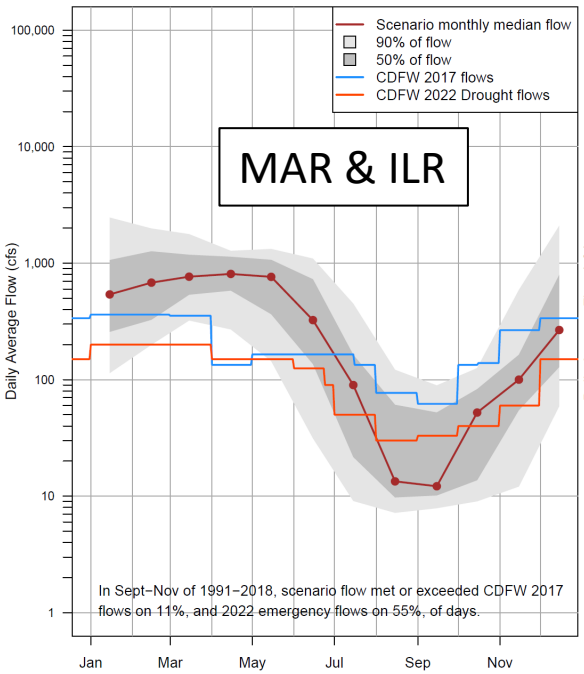
Historical observed Fort Jones Flow



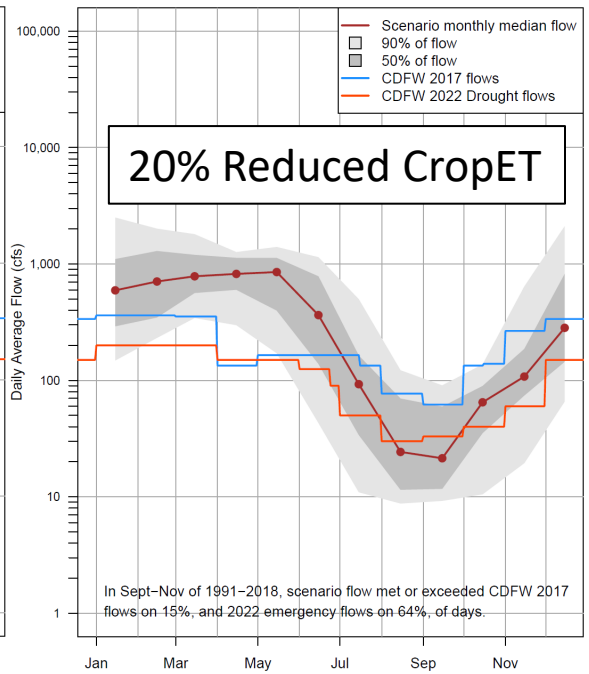
Basecase (simulated historical)



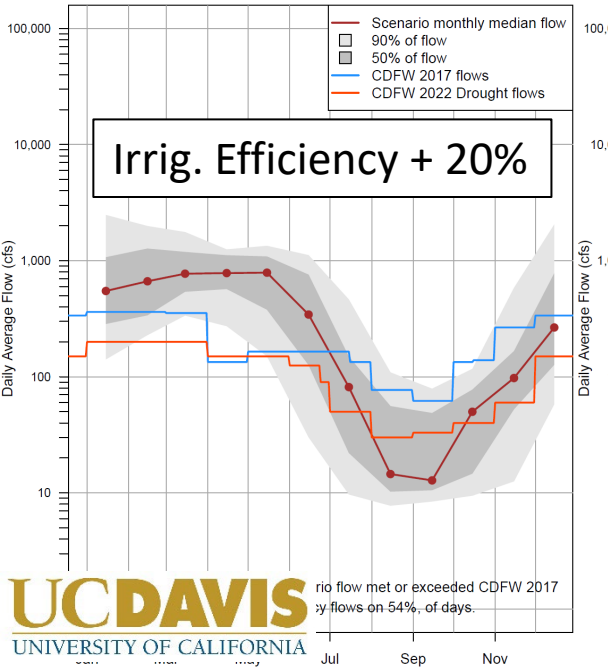
MAR and ILR



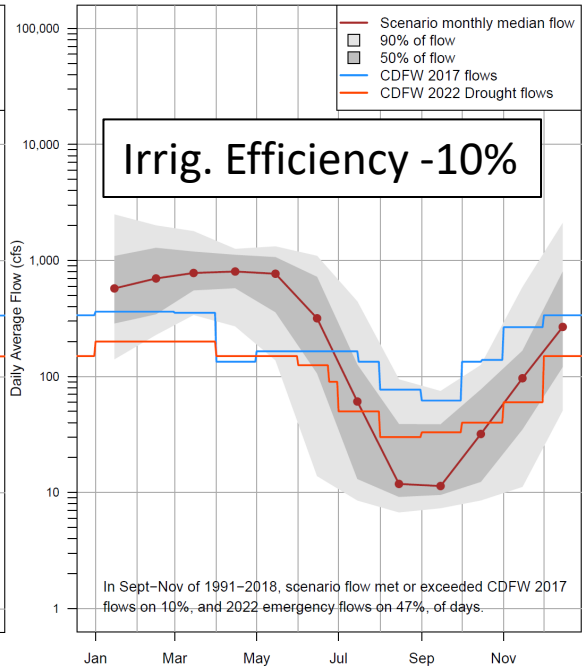
80% of Historical Irrigation Demand



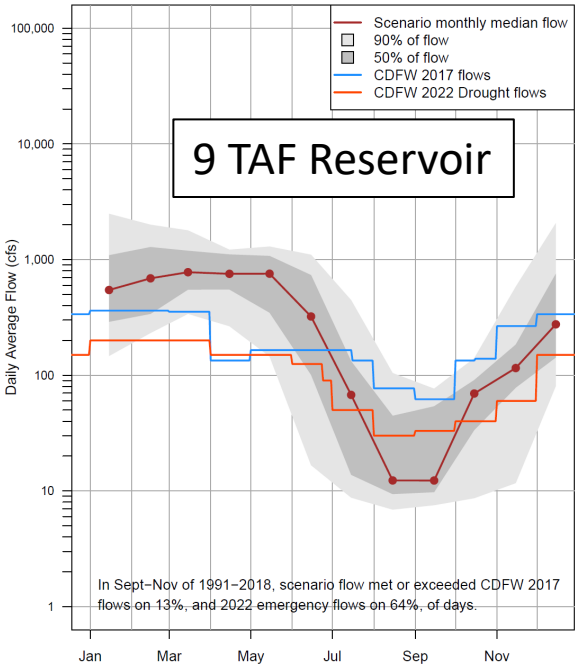
Improve Irrigation Efficiency by 20%



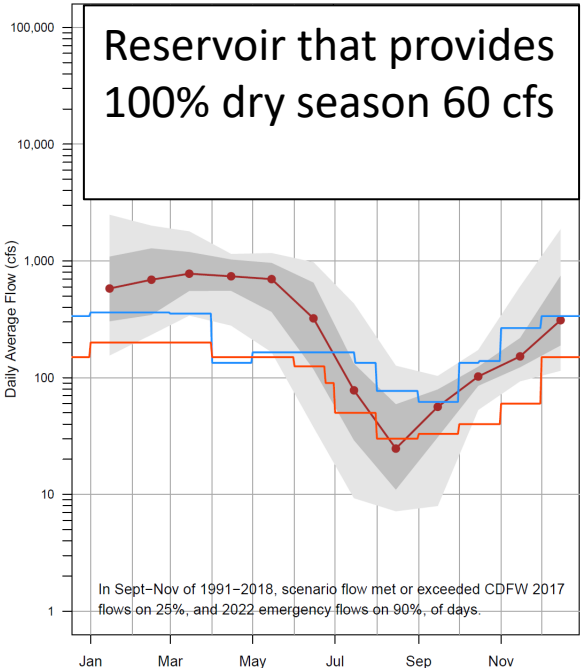
Reduce Irrigation Efficiency by 10%



9 TAF Reservoir, Etna Creek



Reservoir, Etna Creek, 100% dry season 60 cfs release



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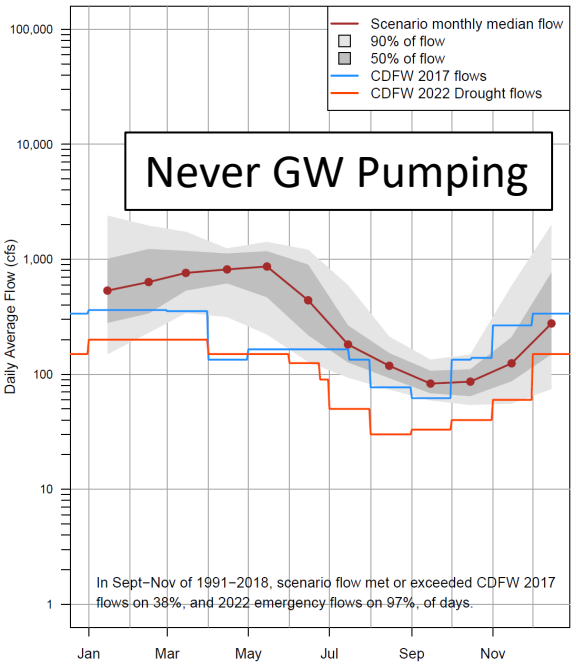
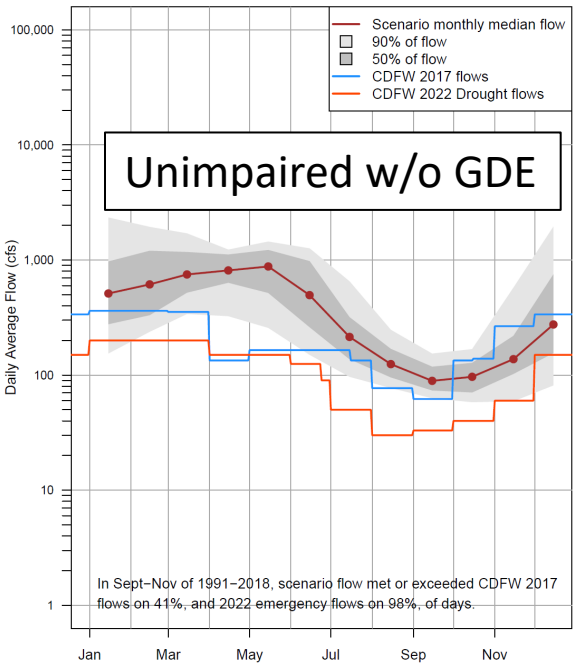
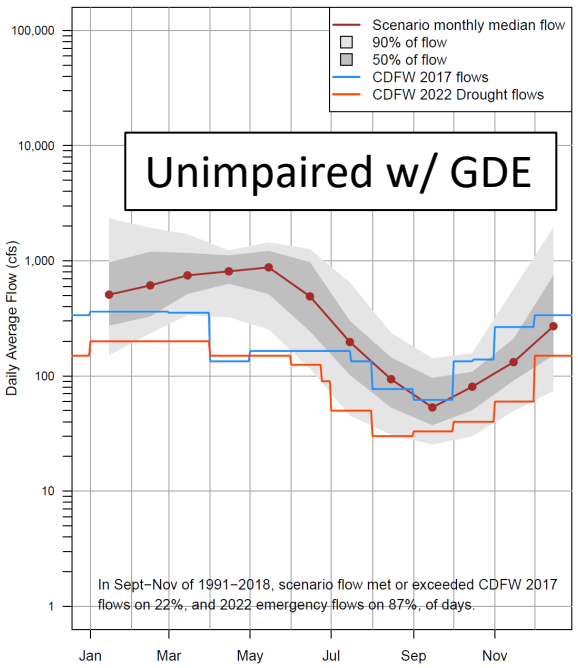
No Pumping, Both Zones



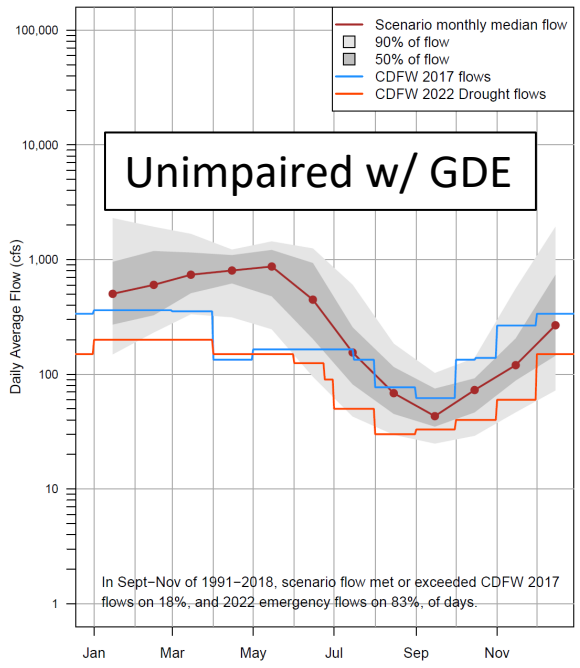
No Irrigation, Both Zones



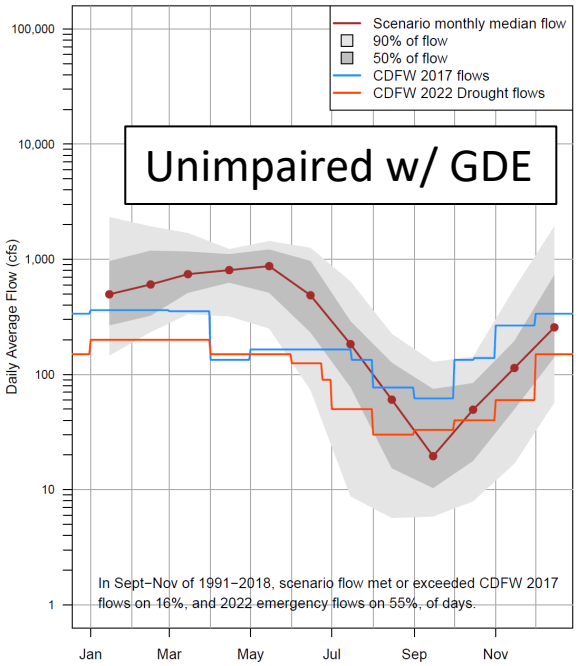
No Irrigation, Both Zones, ET Check 0.6 NV kc, 4.5m ext.d.



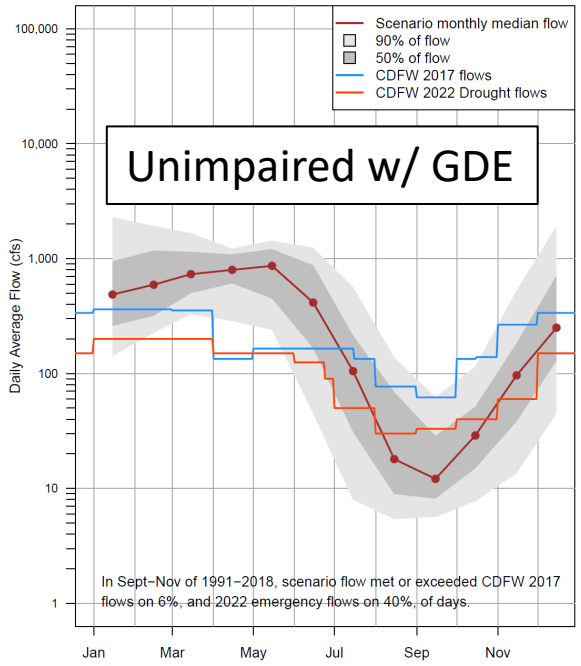
No Irrigation, Both Zones, ET Check 1.0 NV kc, 4.5m ext.d.



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.



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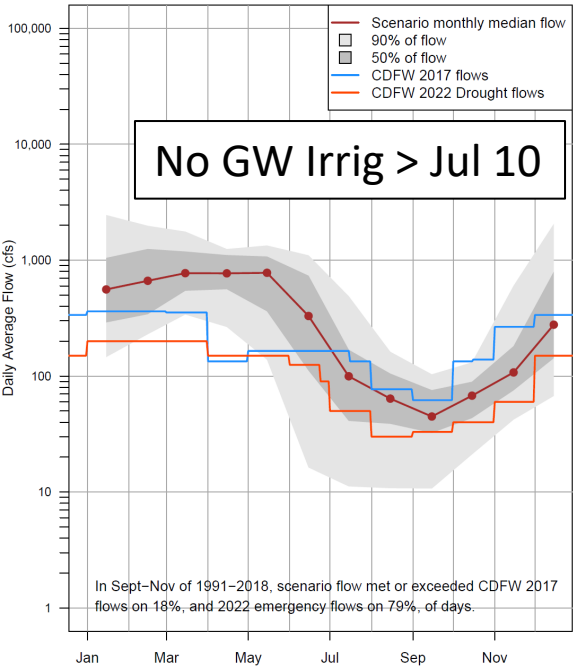
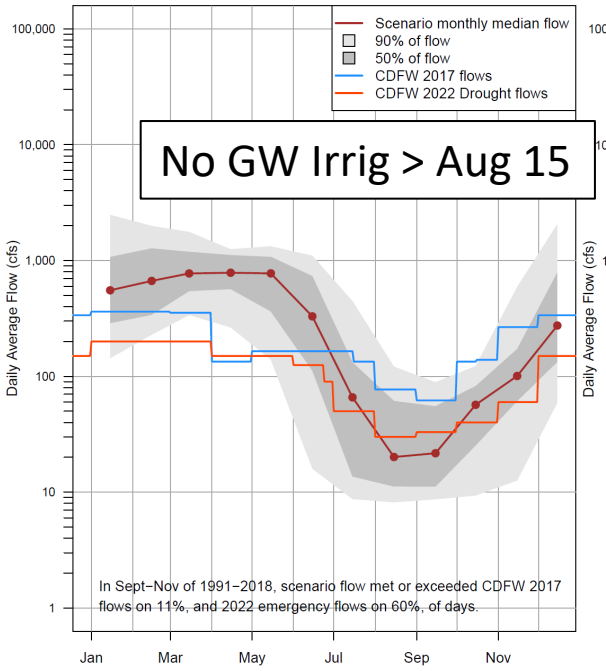
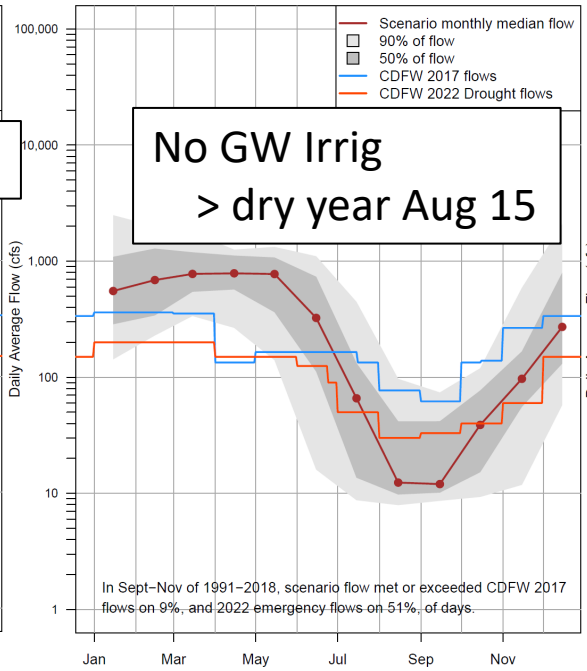
Alfalfa Irrigation Stops July 10



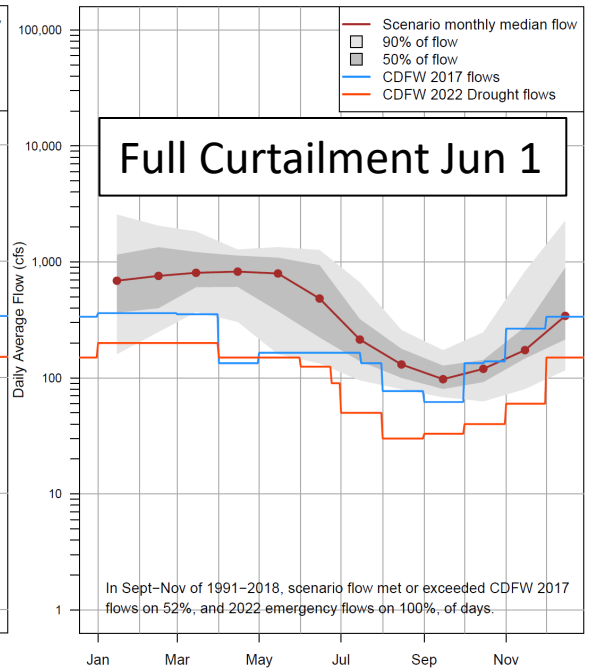
Alfalfa Irrigation Stops Aug. 15



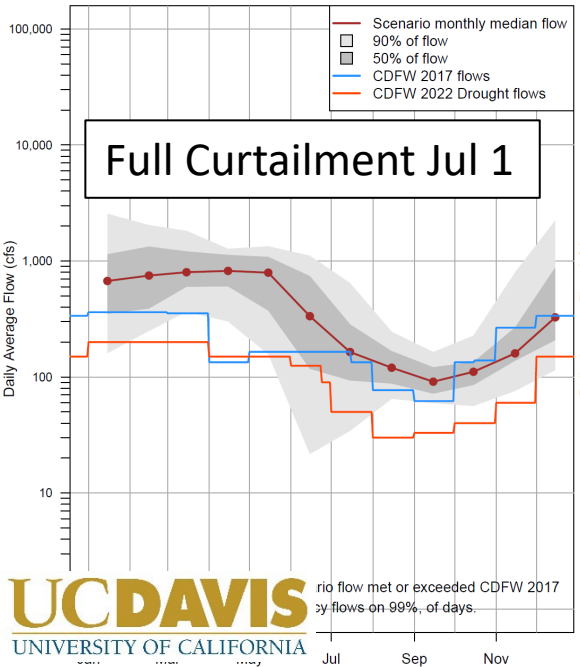
Alfalfa Irrigation Stops Aug. 15, dry years only



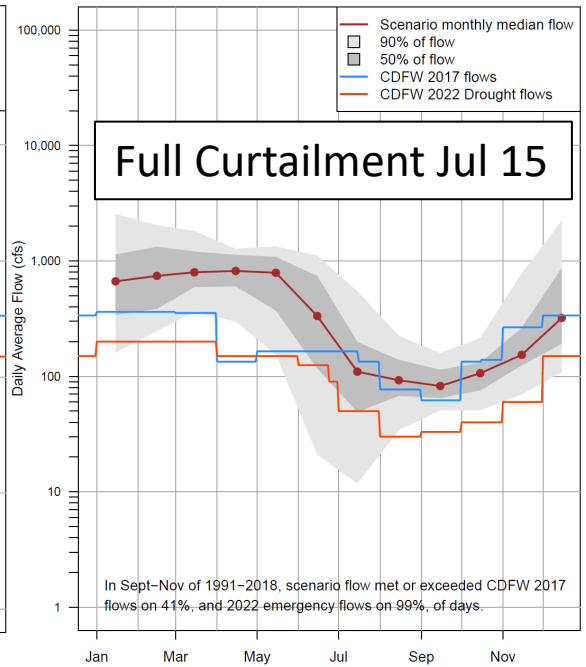
Irrigation Curtailed Starting June 01



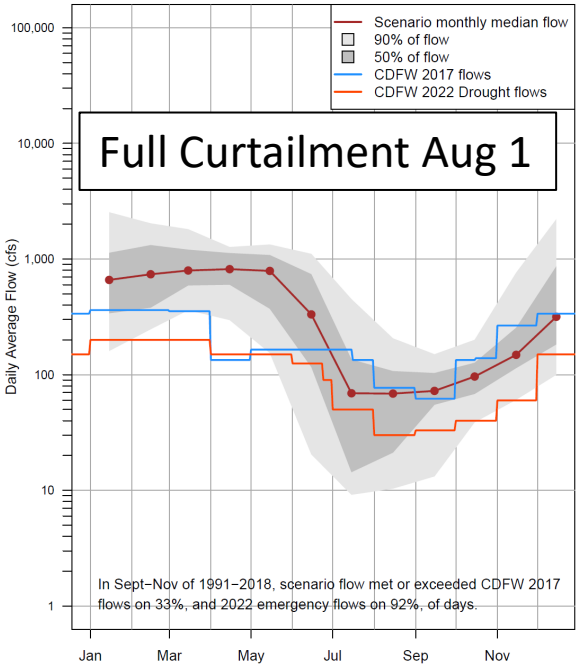
Irrigation Curtailed Starting July 01



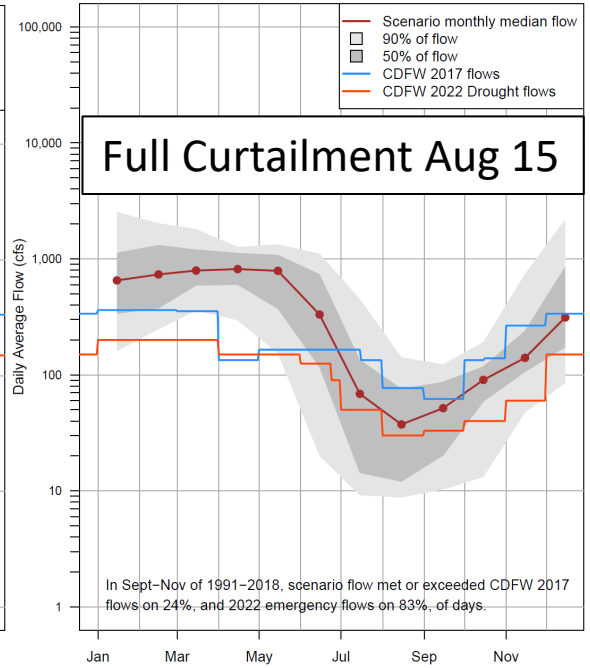
Irrigation Curtailed Starting July 15



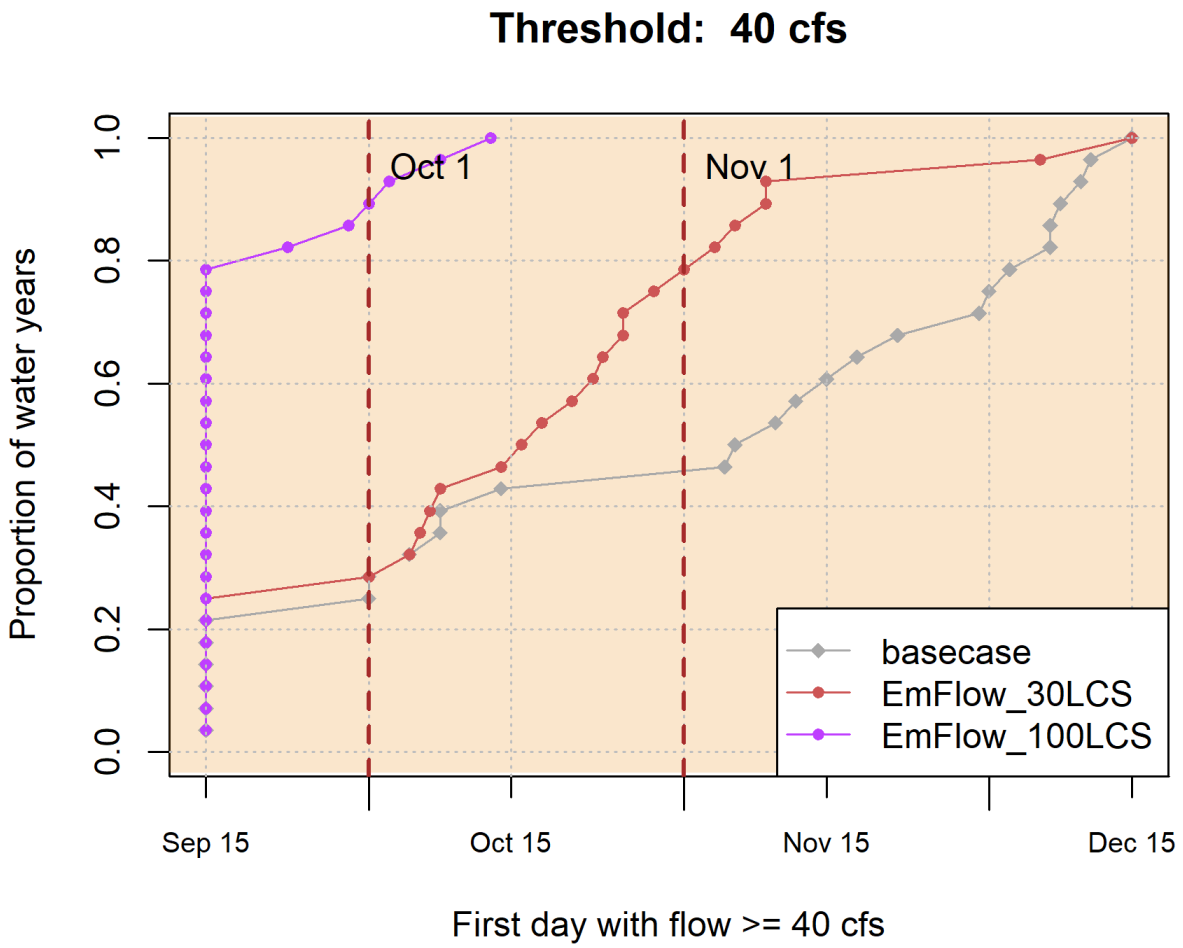
Irrigation Curtailed Starting Aug. 01



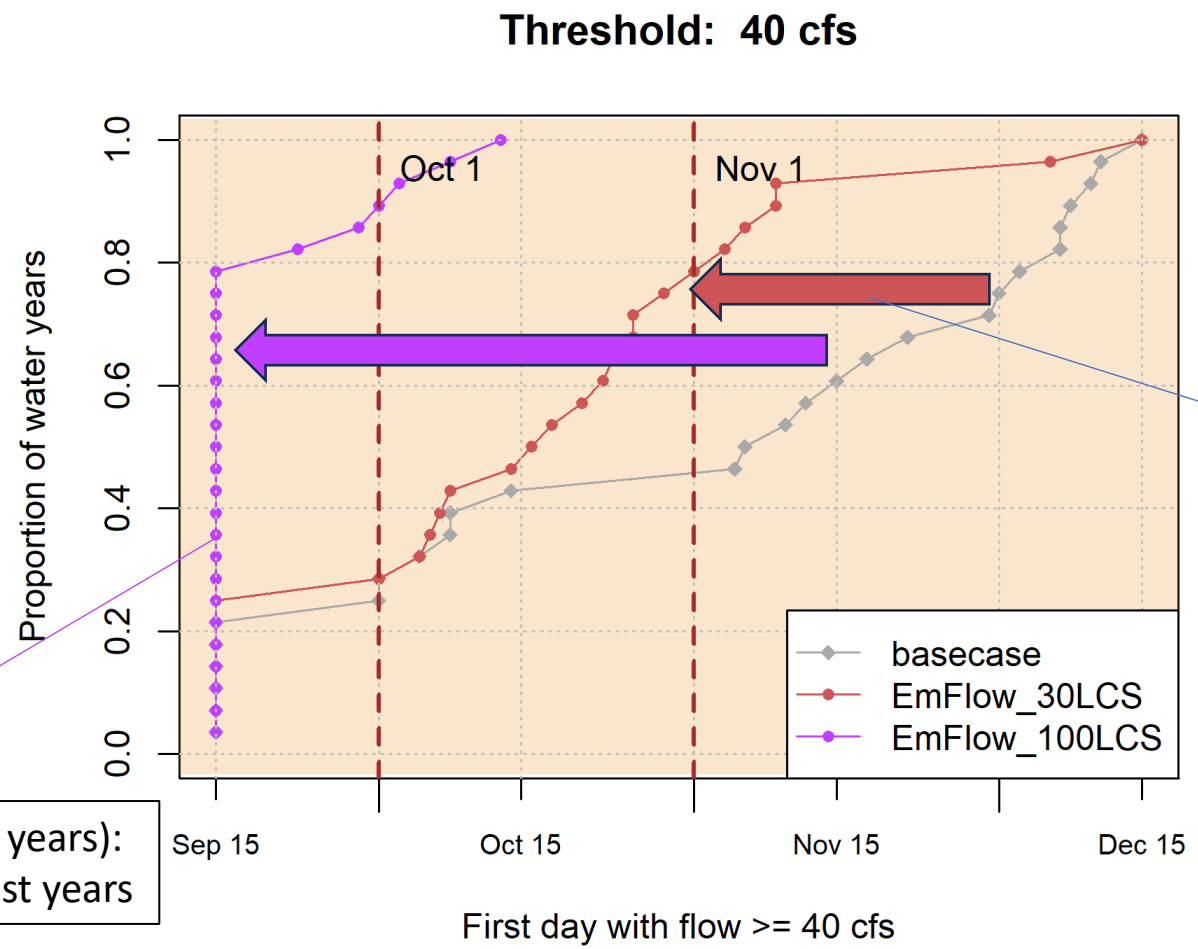
Irrigation Curtailed Starting Aug. 15



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

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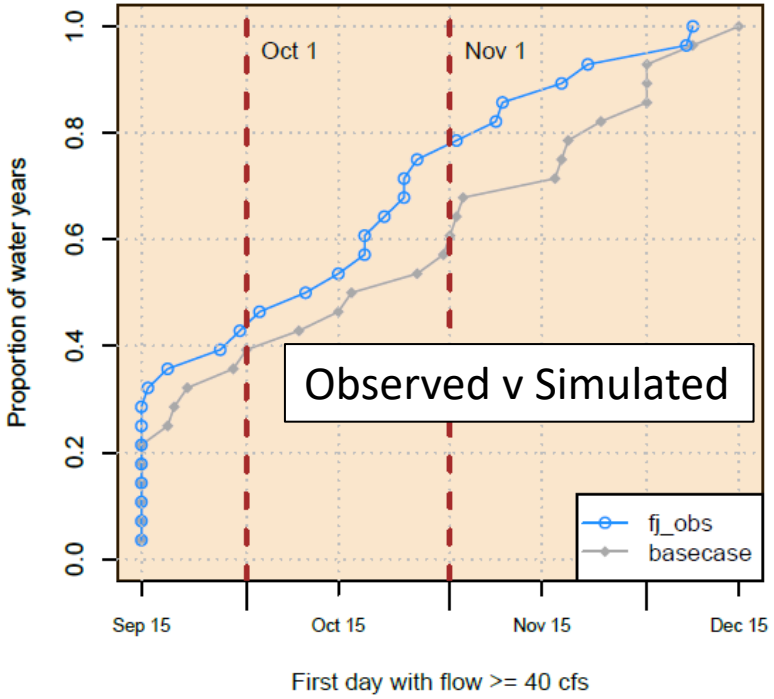
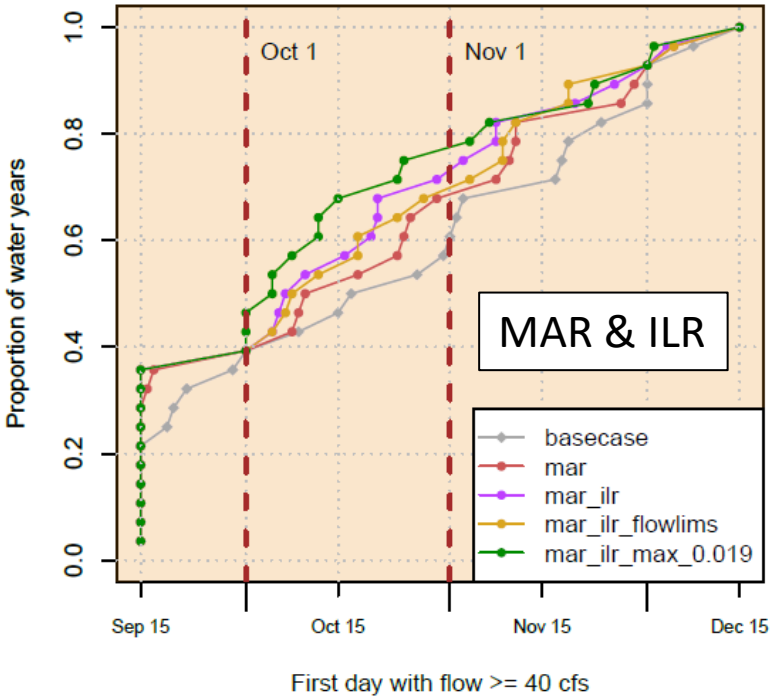
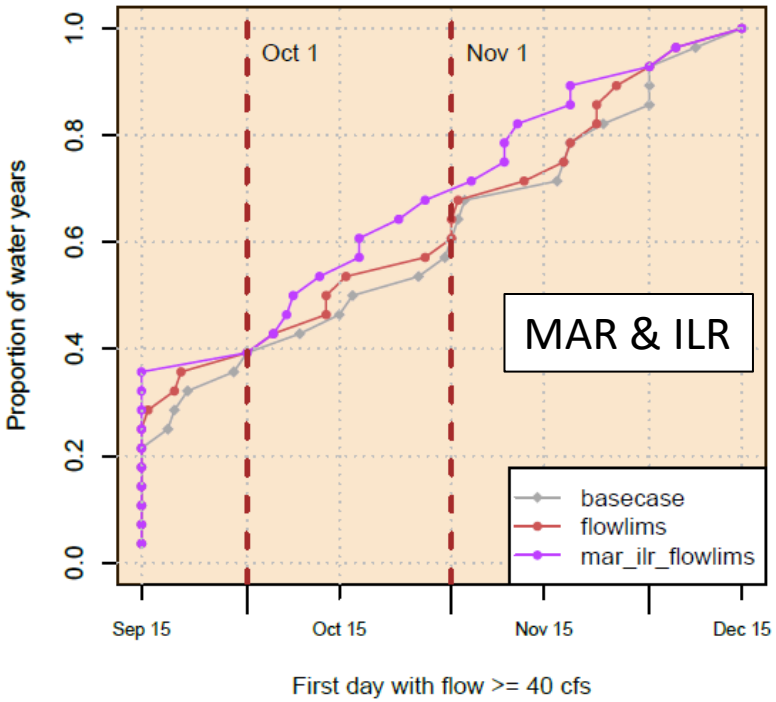
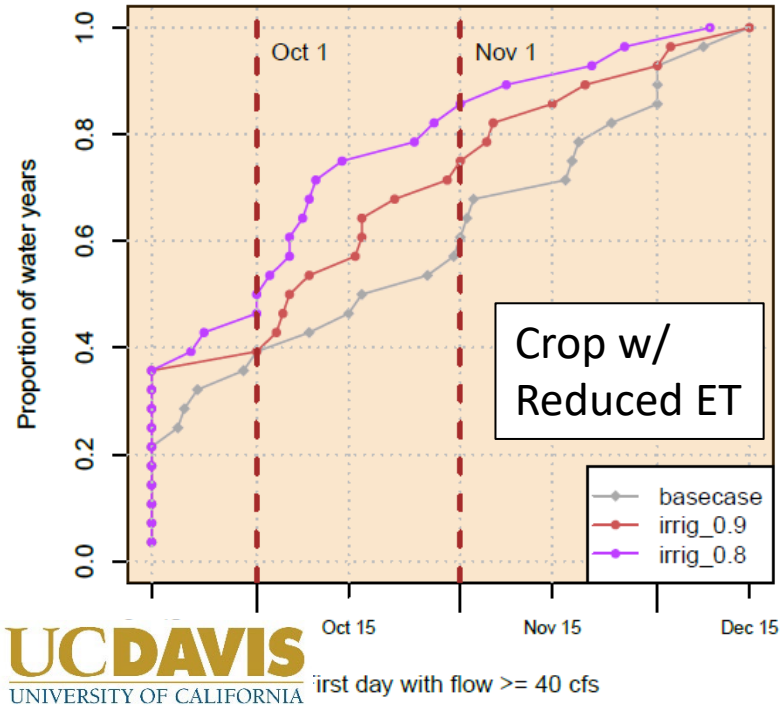
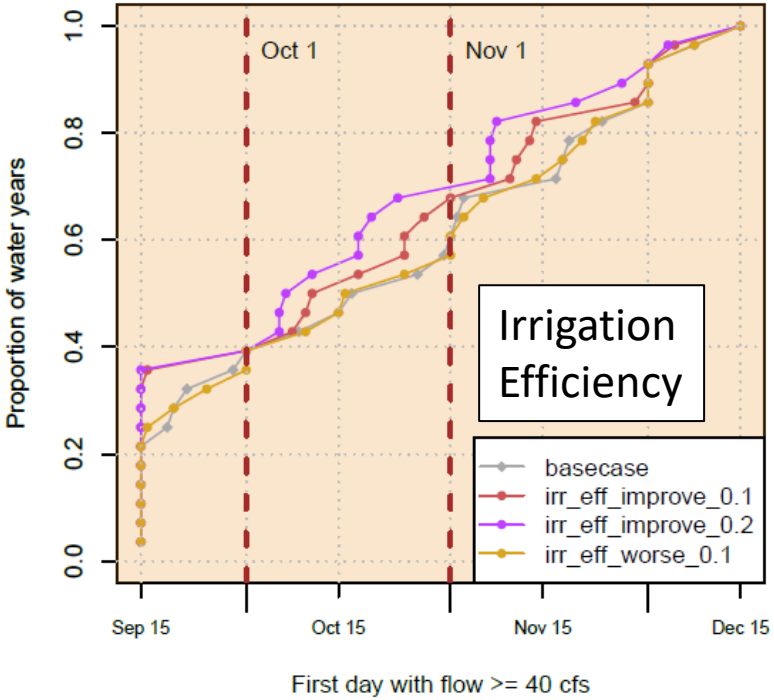
UNIVERSITY OF CALIFORNIA

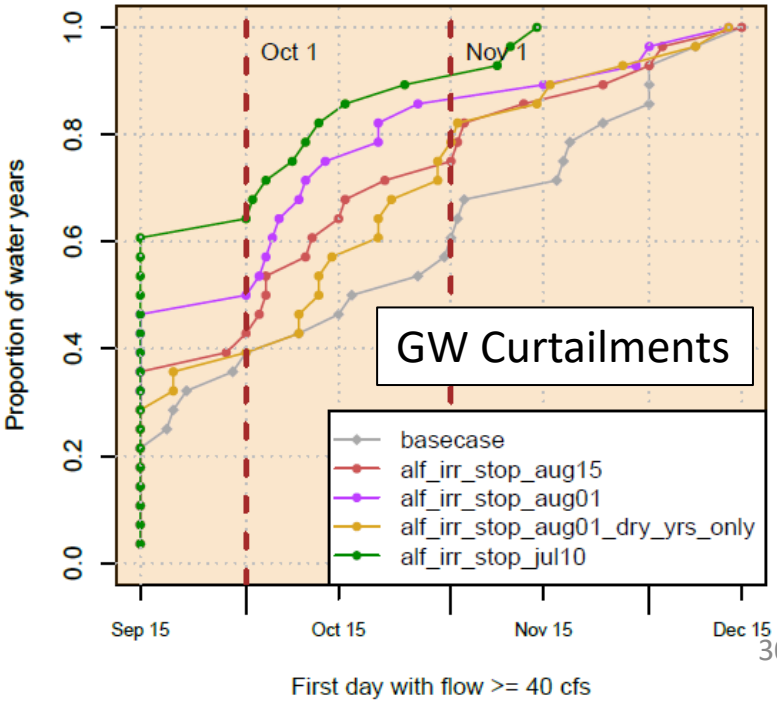

Oct 1
Nov 1
Observed v Simulated
fj_obs
basecase
Proportion of water years
Sep 15
Oct 15
Nov 15
Dec 15
First day with flow >= 40 cfs

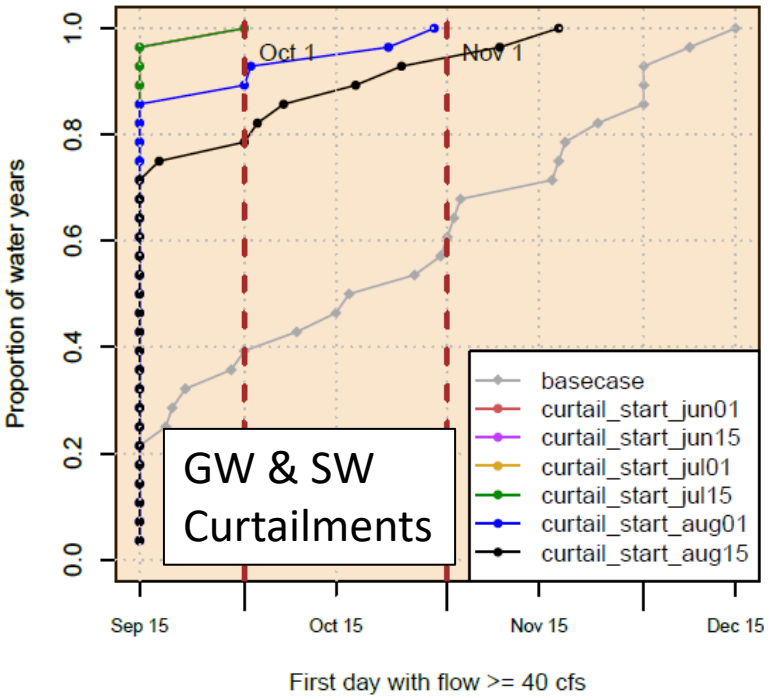

Oct 1
Nov 1
MAR & ILR
basecase
mar
mar_ilr
mar_ilr_flowlims
mar_ilr_max_0.019
Proportion of water years
Sep 15
Oct 15
Nov 15
Dec 15
First day with flow >= 40 cfs

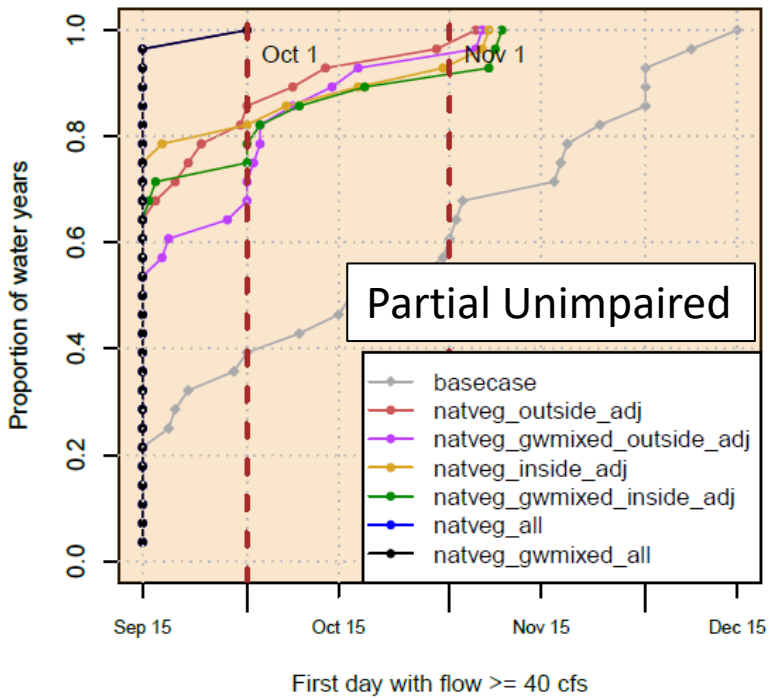

Oct 1
Nov 1
MAR & ILR
basecase
flowlims
mar_ilr_flowlims
Proportion of water years
Sep 15
Oct 15
Nov 15
Dec 15
First day with flow >= 40 cfs

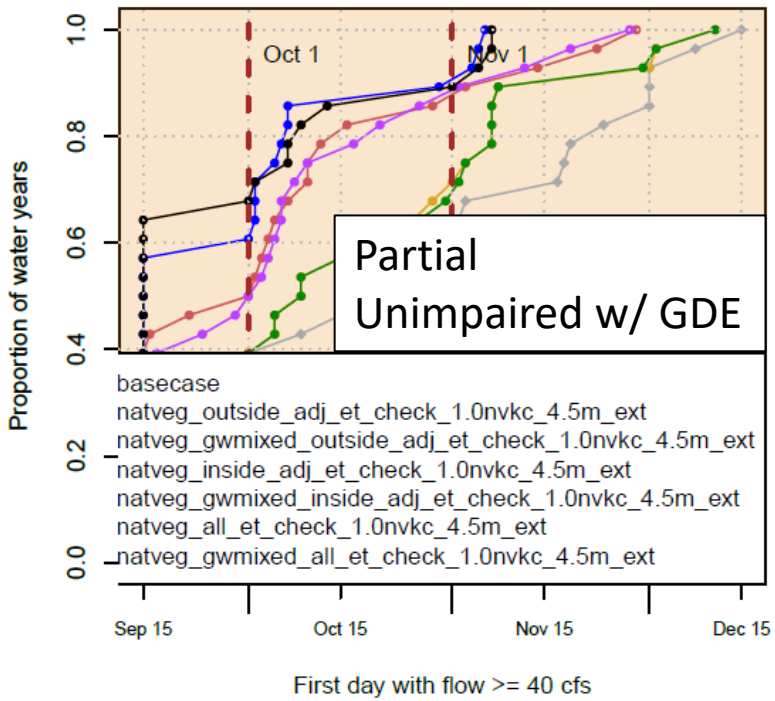

Oct 1
Nov 1
Crop w/
Reduced ET
basecase
irrig_0.9
irrig_0.8
Proportion of water years
Oct 15
Nov 15
Dec 15
irst day with flow >= 40 cfs

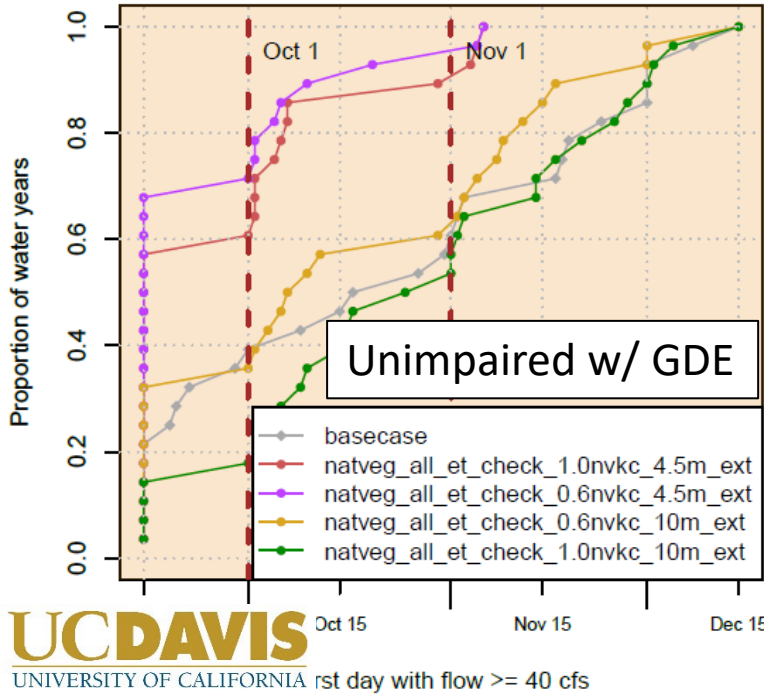

Oct 1
Nov 1
Irrigation
Efficiency
basecase
irr_eff_improve_0.1
irr_eff_improve_0.2
irr_eff_worse_0.1
Proportion of water years
Sep 15
Oct 15
Nov 15
Dec 15
First day with flow >= 40 cfs

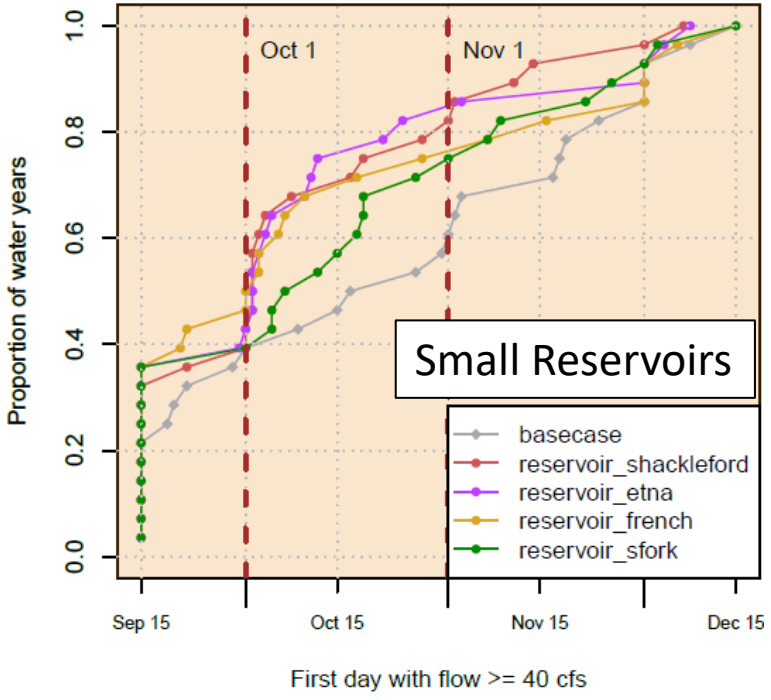

Oct 1
Nov 1
GW Curtailments
basecase
alf_irr_stop_aug15
alf_irr_stop_aug01
alf_irr_stop_aug01_dry_yrs_only
alf_irr_stop_jul10
Proportion of water years
Sep 15
Oct 15
Nov 15
Dec 15
First day with flow >= 40 cfs

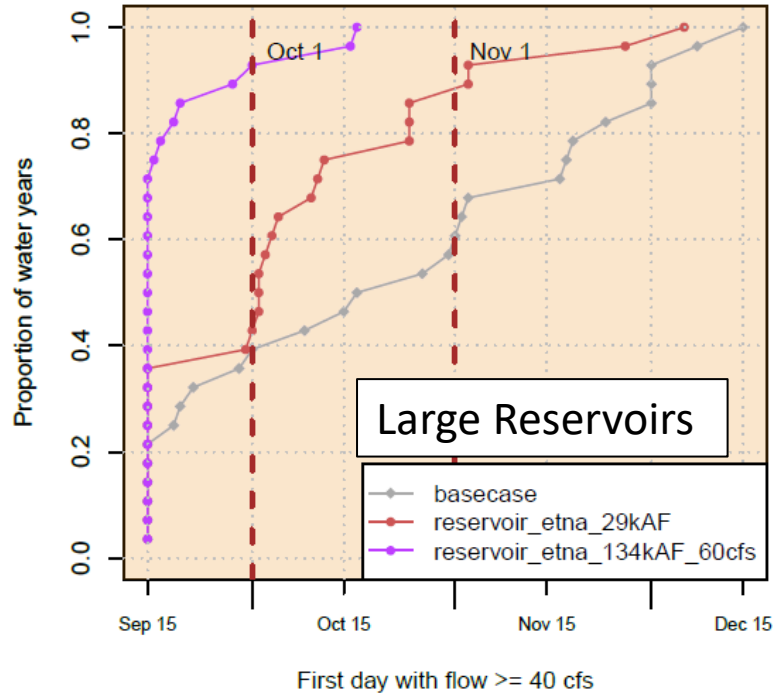

Oct 1
Nov 1
GW & SW Curtailments
basecase
curtail_start_jun01
curtail_start_jun15
curtail_start_jul01
curtail_start_jul15
curtail_start_aug01
curtail_start_aug15
Proportion of water years
Sep 15
Oct 15
Nov 15
Dec 15
First day with flow >= 40 cfs


Oct 1
Nov 1
Partial Unimpaired
basecase
natveg_outside_adj
natveg_gwmixed_outside_adj
natveg_inside_adj
natveg_gwmixed_inside_adj
natveg_all
natveg_gwmixed_all
Proportion of water years
Sep 15
Oct 15
Nov 15
Dec 15
First day with flow >= 40 cfs


Oct 1
Nov 1
Partial Unimpaired w/ GDE
basecase
natveg_outside_adj_et_check_1.0nvkc_4.5m_ext
natveg_gwmixed_outside_adj_et_check_1.0nvkc_4.5m_ext
natveg_inside_adj_et_check_1.0nvkc_4.5m_ext
natveg_gwmixed_inside_adj_et_check_1.0nvkc_4.5m_ext
natveg_all_et_check_1.0nvkc_4.5m_ext
natveg_gwmixed_all_et_check_1.0nvkc_4.5m_ext
Proportion of water years
Sep 15
Oct 15
Nov 15
Dec 15
First day with flow >= 40 cfs


Oct 1
Nov 1
Unimpaired w/ GDE
basecase
natveg_all_et_check_1.0nvkc_4.5m_ext
natveg_all_et_check_0.6nvkc_4.5m_ext
natveg_all_et_check_0.6nvkc_10m_ext
natveg_all_et_check_1.0nvkc_10m_ext
Proportion of water years
Oct 15
Nov 15
Dec 15
rst day with flow >= 40 cfs


Oct 1
Nov 1
Small Reservoirs
basecase
reservoir_shackleford
reservoir_etna
reservoir_french
reservoir_sfork
Proportion of water years
Sep 15
Oct 15
Nov 15
Dec 15
First day with flow >= 40 cfs


Oct 1
Nov 1
Large Reservoirs
basecase
reservoir_etna_29kAF
reservoir_etna_134kAF_60cfs
Proportion of water years
Sep 15
Oct 15
Nov 15
Dec 15
First day with flow >= 40 cfs

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?

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

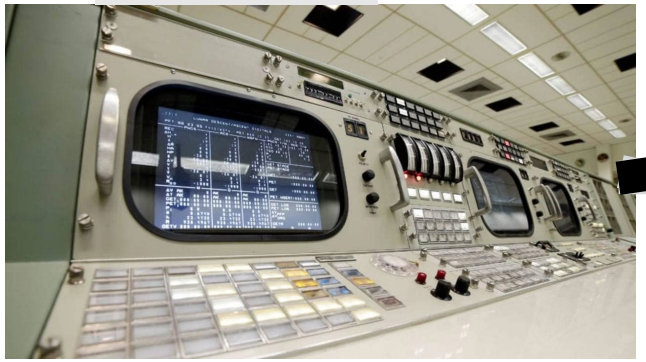
Using real world observations and a computer model to take regular “measurements”

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

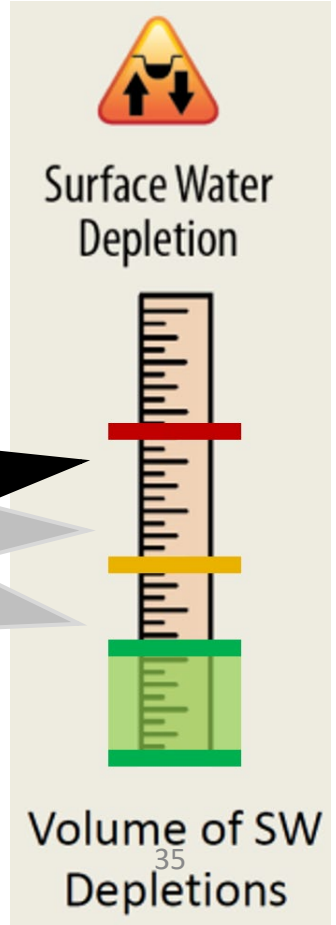
projects and management actions: implementation, monitoring of implementation

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