Appendix 4-A Scott Valley Management Scenario Results

Scott Valley Management Scenario Results

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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%

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Summary of scenarios

- Supply-side scenarios
  - Enhanced Recharge
  - Reservoirs
- Demand-side scenarios
  - Crop change
  - Irrigation efficiency
  - Irrigation schedule change
  - Diversion limits (or surface water leases)
- Attribution
  - Impact of pumping inside and outside adjudicated zone
- Range of depletion reversal: 4% - 86%
  - Excluding the Attribution scenarios (85% - 212% reversal) and the 100% reliable 60 cfs release scenario (184% reversal)

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Explanatory Material

The following information is intended to help a reader understand the scenario results plots and interpret them in the context of setting the surface water SMC for the Scott Valley Groundwater Sustainability Plan.

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Acronyms:

UR – Undesirable Result

- Informed by Sustainability Goal, but must be tied to metric(s)

MT – Minimum (or Maximum) Threshold.

- The MT is the boundary beyond which a UR occurs.
- *Note*: MT and UR definitions are **linked.**

MO – Measurable Objective

- Ideal operating range

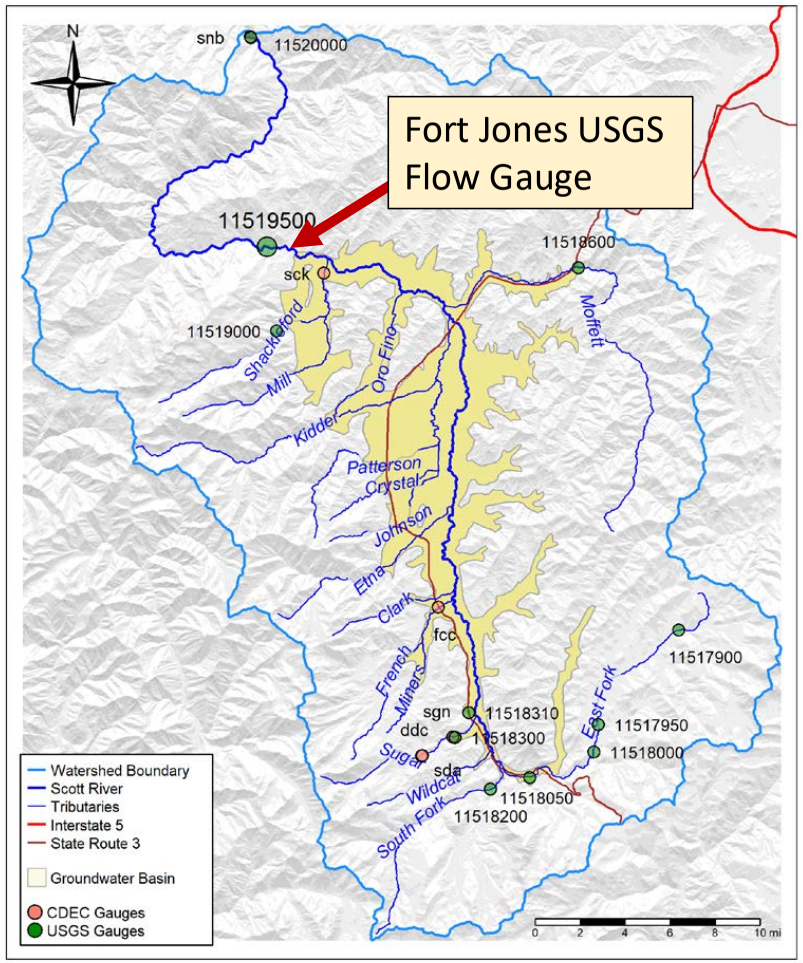
SMC – Sustainable Management Criteria (includes URs, MO and MTs)

PMAs – Projects and Management Actions

Quantifying the SMC

Streamflow Depletion is quantified as:

- the **difference in flow** at the Fort Jones Gauge…
- over the model period of 1991-2018…
- between the simulated Basecase (actual historical/current) conditions and a simulated management scenario.



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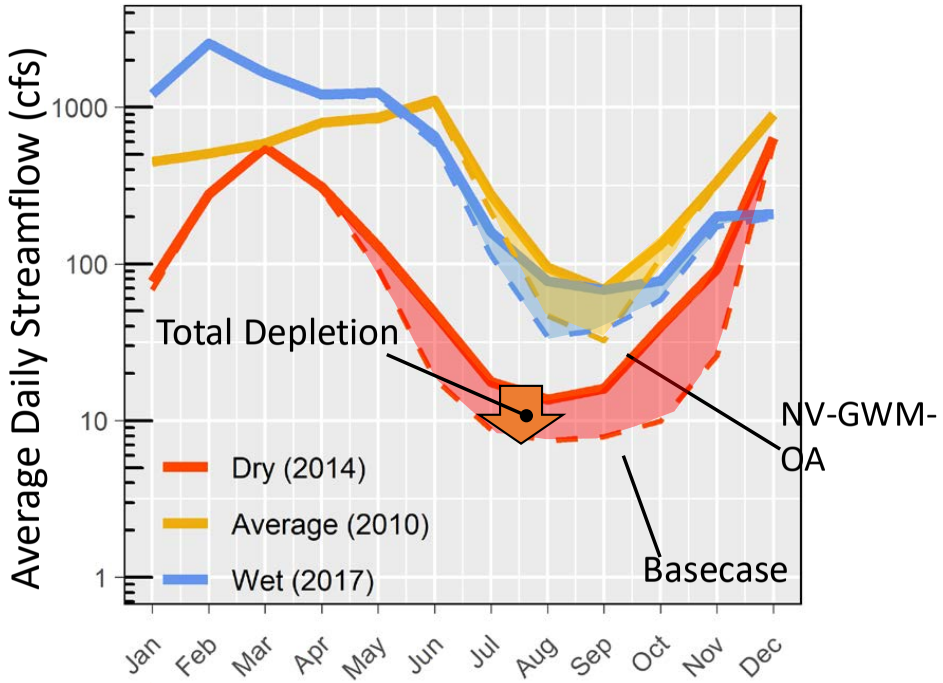
Quantifying the SMC

Total Streamflow Depletion* is quantified as:

- the **difference in flow** at the Fort Jones Gauge…
- over the model period of 1991-2018…
- between the simulated Basecase (actual historical/current) conditions and the simulated No Pumping** Reference case.

*Note: Areas not proportional due to log-y axis



Total Depletion, 2010

Total Depletion, 2017

Total Depletion, 2014

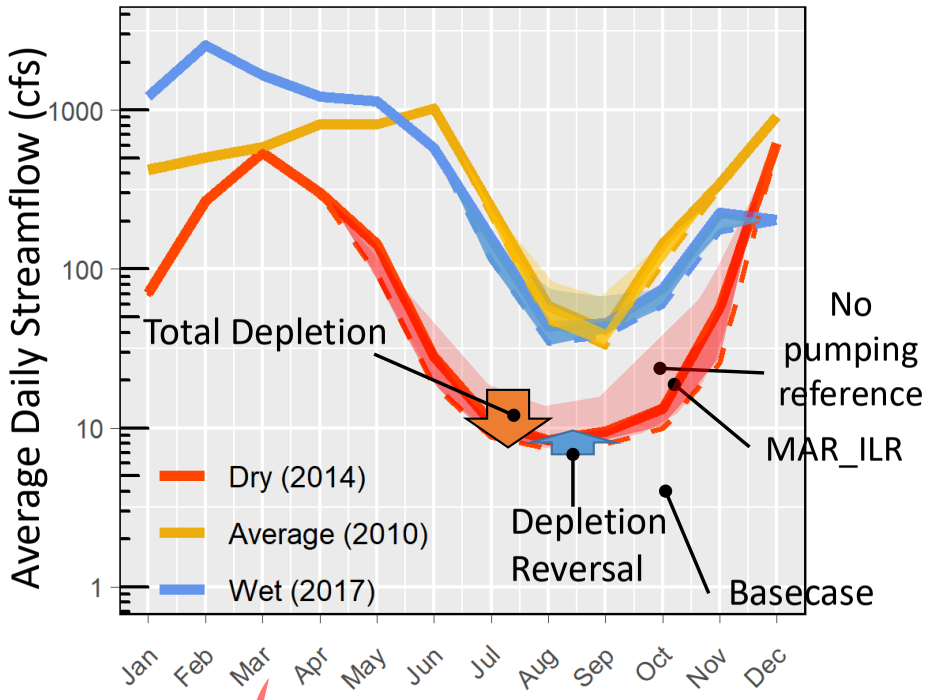
* Due to pumping in SGMA wells

** Also referred to as "Natural Vegetation on GW and Mixed-source fields Outside the Adjudicated Zone", or NV-GWM-OA

Quantifying the SMC

Depletion Reversal is quantified for **each** scenario as the difference between the Basecase (simulated historical & current) conditions and the relevant scenario (for example, MAR+ILR).

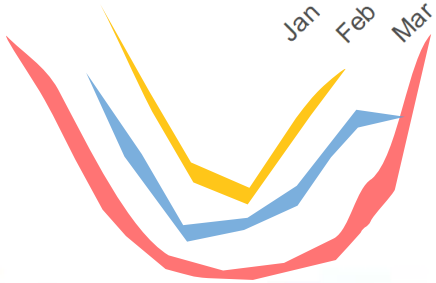
*Note: Areas not proportional due to log-y axis



Total Depletion, 2010

Total Depletion, 2017

Total Depletion, 2014



MAR+ILR Depletion Reversal, 2010

MAR+ILR Depletion Reversal, 2017

MAR+ILR Depletion Reversal, 2014

Note: Total Depletion, Depletion Reversal, and the remaining Depletion (i.e., the difference between Total Depletion and Depletion Reversal) can be computed for each day or each month of the simulation period. Averages for specific periods can also be computed.

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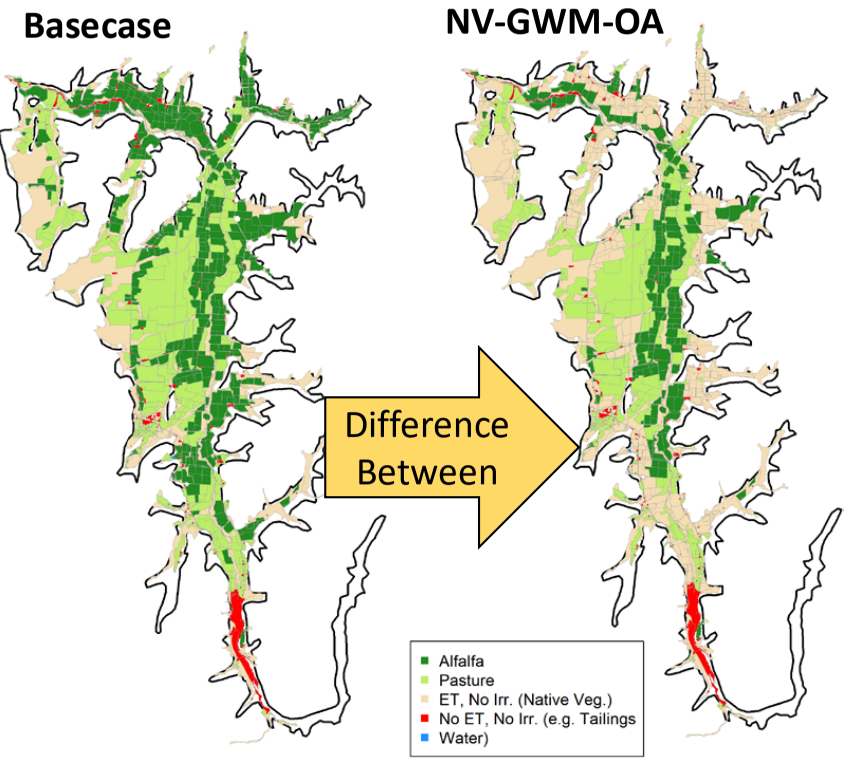
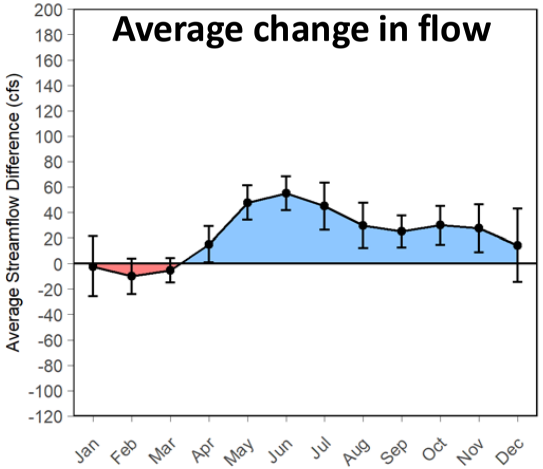
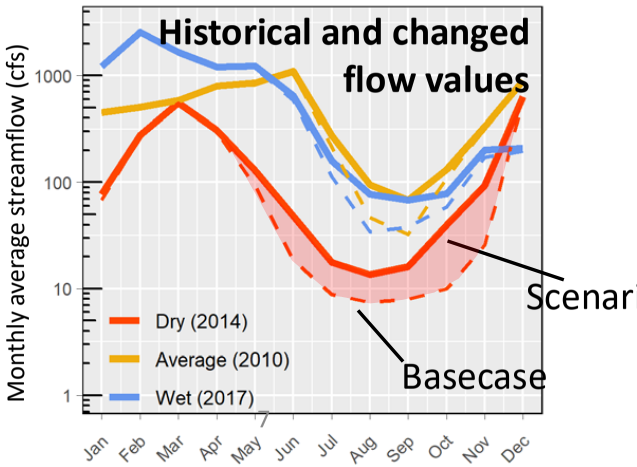
Total Depletion: no-pumping reference case maps







Basecase Landuse

Native Vegetation on *GW and Mixed Water Source Fields* Outside Adjudication

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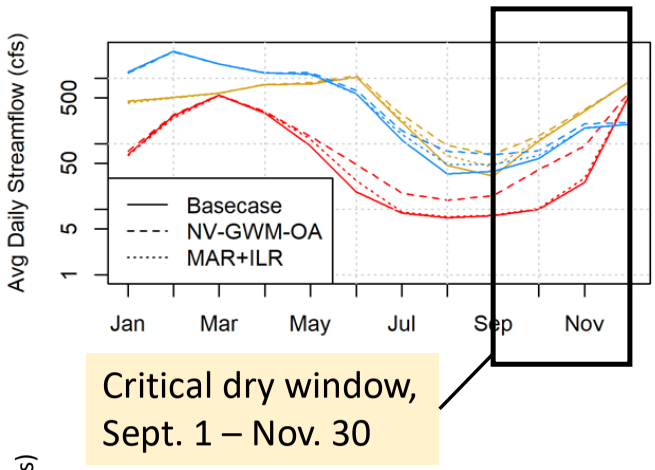
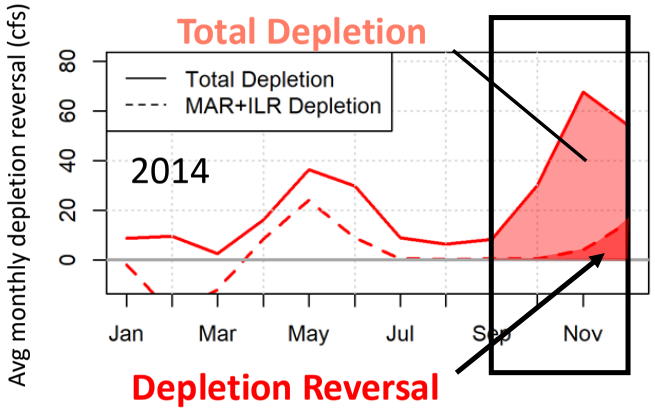
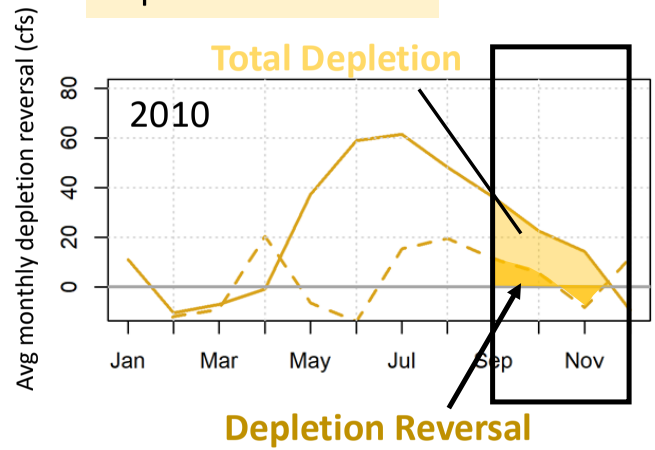
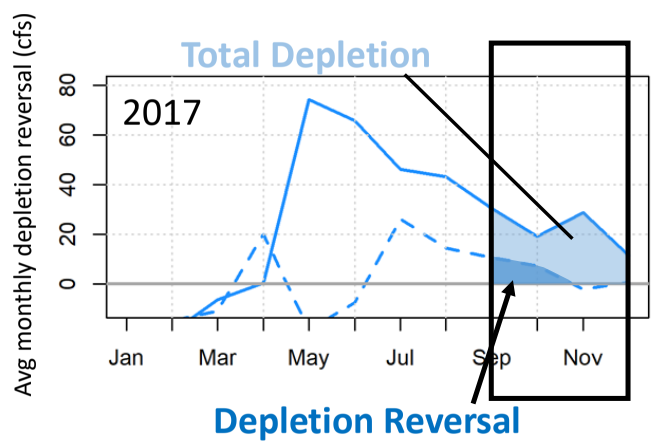
Quantifying Relative Depletion Reversal, Sept-Nov critical period



Critical dry window, Sept. 1 – Nov. 30







To calculate relative depletion reversal, sum the darker areas in the Sept-Nov window for each year and divide by the sum of the lighter areas in the Sept-Nov window.

Relative Depletion Reversal for MAR+ILR:

19%

of Total Depletion, Sept.-Nov. for 1991-2018.

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Setting the SMC – Minimum Threshold (MT)

- The MT selected will define the "significant and unreasonable" undesirable result.
- The MT will be set as the amount of stream depletion reversal achieved by the minimum required PMA.
- The PMA(s) selected to define the MT should be realistic, feasible, and fair.

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How to read and interpret graphs of scenario results

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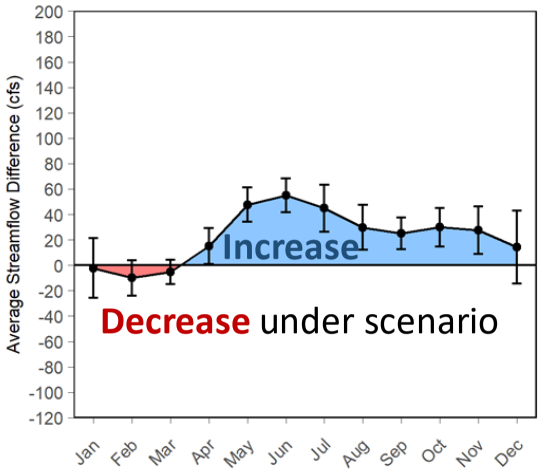
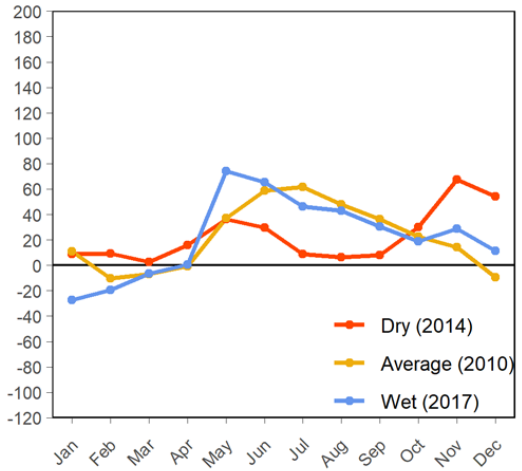
Flow Change Results

All flows and flow changes plotted are for the Fort Jones Gauge location

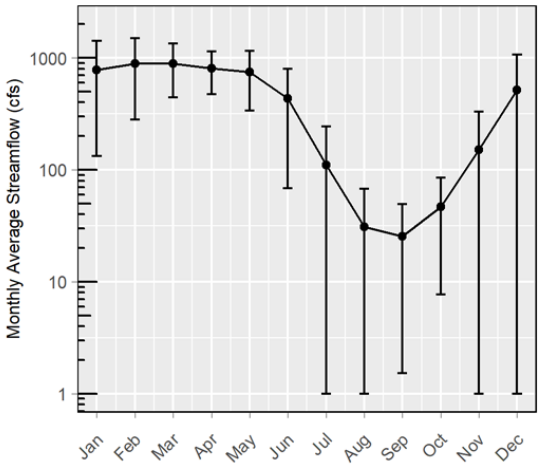
Change in flow, scenario minus basecase - 28 years, averaged monthly

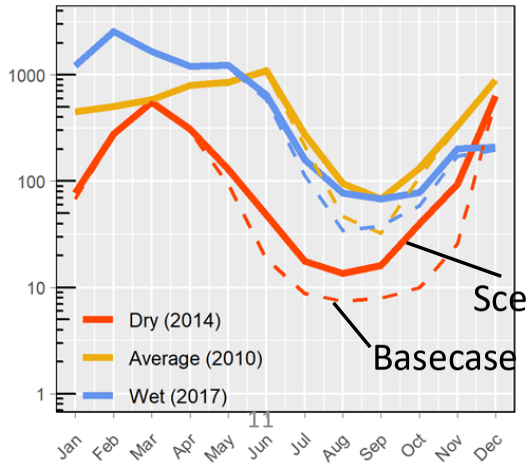




Change in flow, scenario minus basecase – 3 example years

Absolute flow value (simulated historical basecase) – 28 years, averaged monthly





Absolute flow value – 3 example years, Basecase and Scenario

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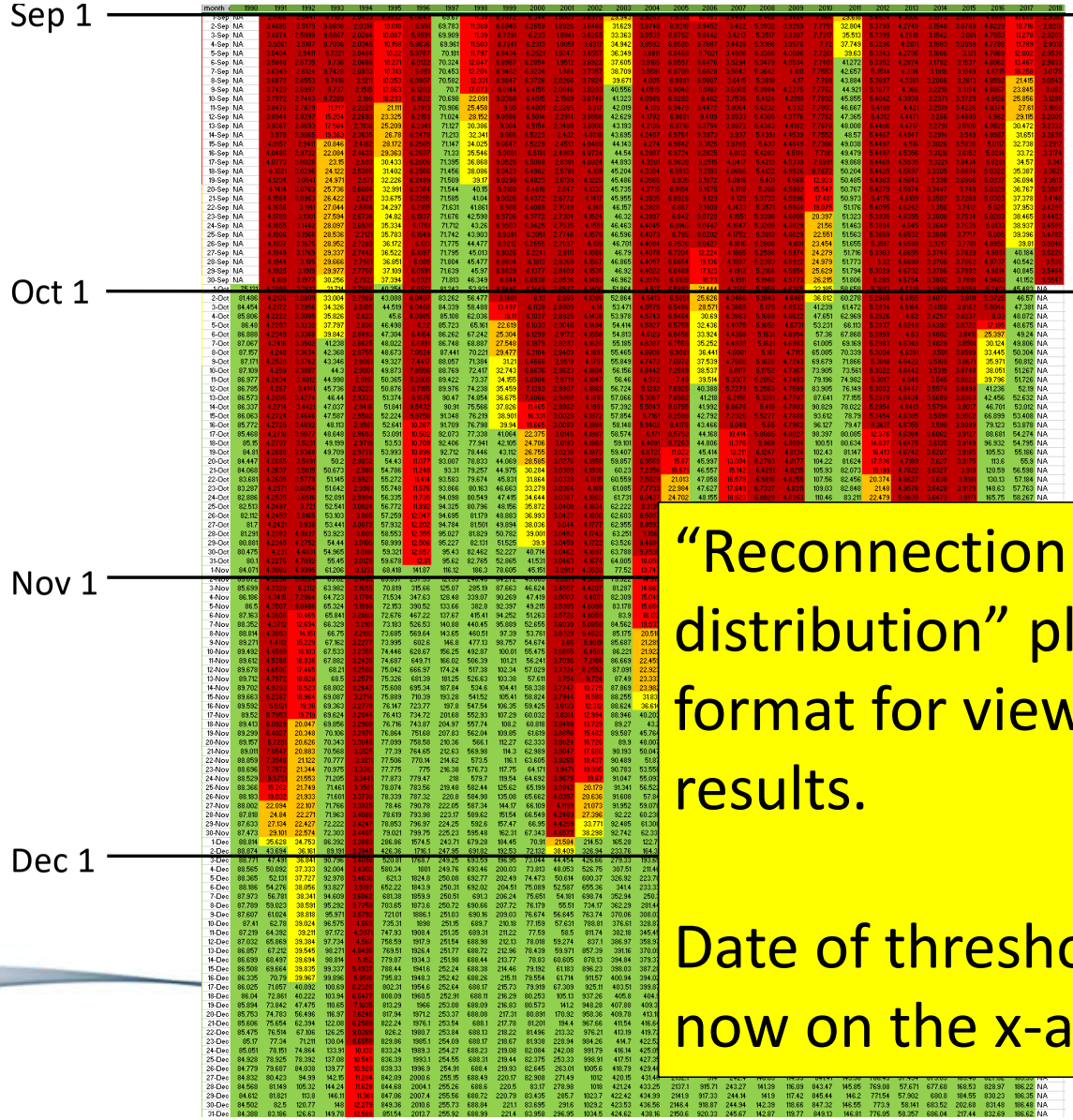
Threshold-passing or “reconnection” date distribution graphs

Basecase

(Simulated historical period)



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Below 10 cfs

10-20 cfs

20-30 cfs

30-40 cfs

Above 40 cfs

"Reconnection date distribution" plots are a new format for viewing these results.

Date of threshold-passing is now on the x-axis.

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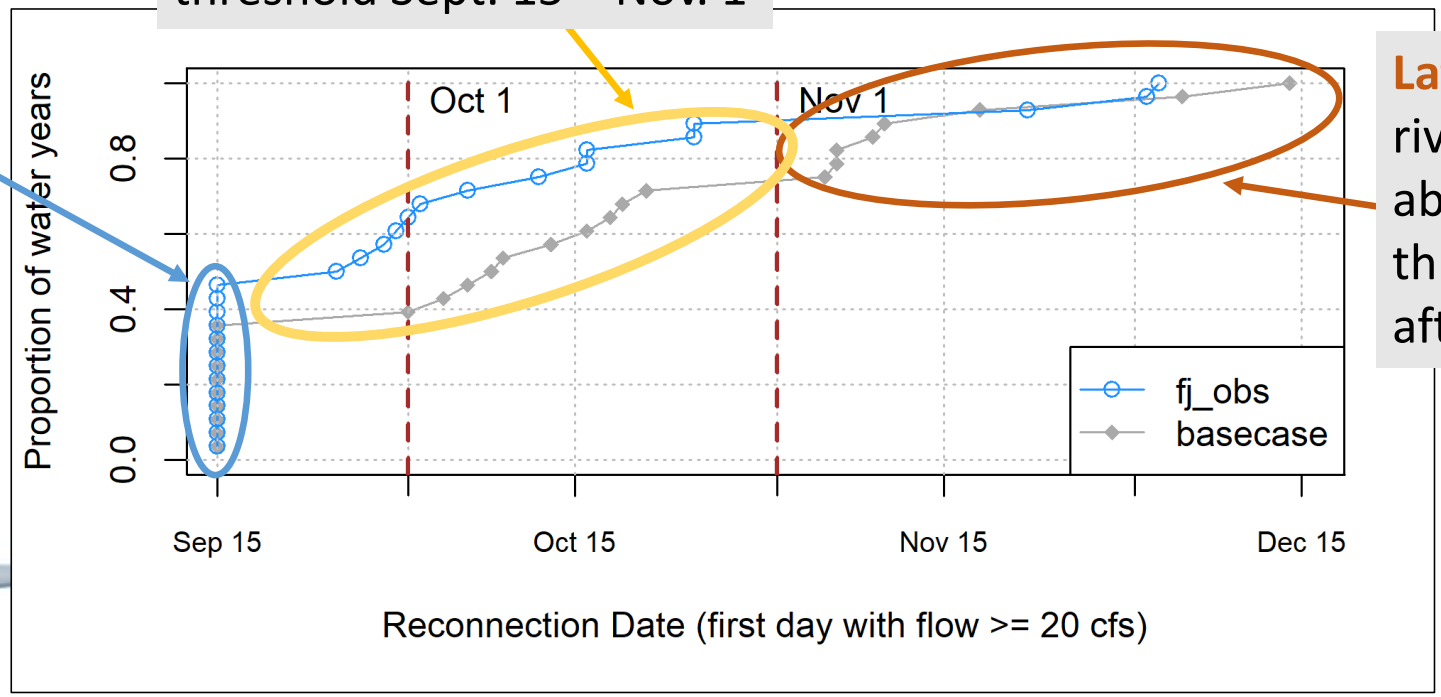
Threshold-passing or "reconnection" date distribution graphs

Intermediate years – river flow rose above the threshold Sept. 15 – Nov. 1

Early years – river passed this threshold on or before Sept. 15, or never fell below it



Late years – river flow rose above the threshold after Nov 1

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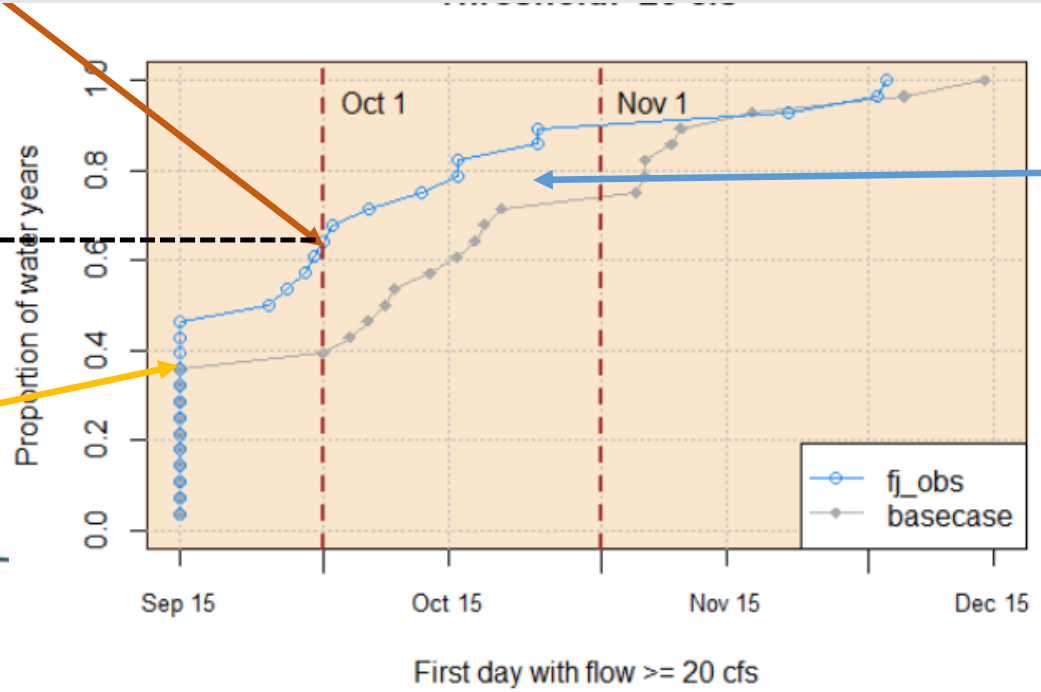
Threshold-passing or "reconnection" date distribution graphs

How to read this graph: From 1991-2018, the FJ gauge measured flow >20 cfs **on or before Oct. 1** in ~**63%** of years.

Y-intercept of ~0.63, or ~63%

Notes on model performance:
The basecase simulates 10 years with flow >20 cfs before Sept 15, or not dropping below 20 cfs at all **(early years)**; in the observed record it's 13 years.



Notes on model performance:
The discrepancies between the observed and simulated basecase distributions are another reason to think of scenario results as "relative change" rather than a prediction of future conditions.

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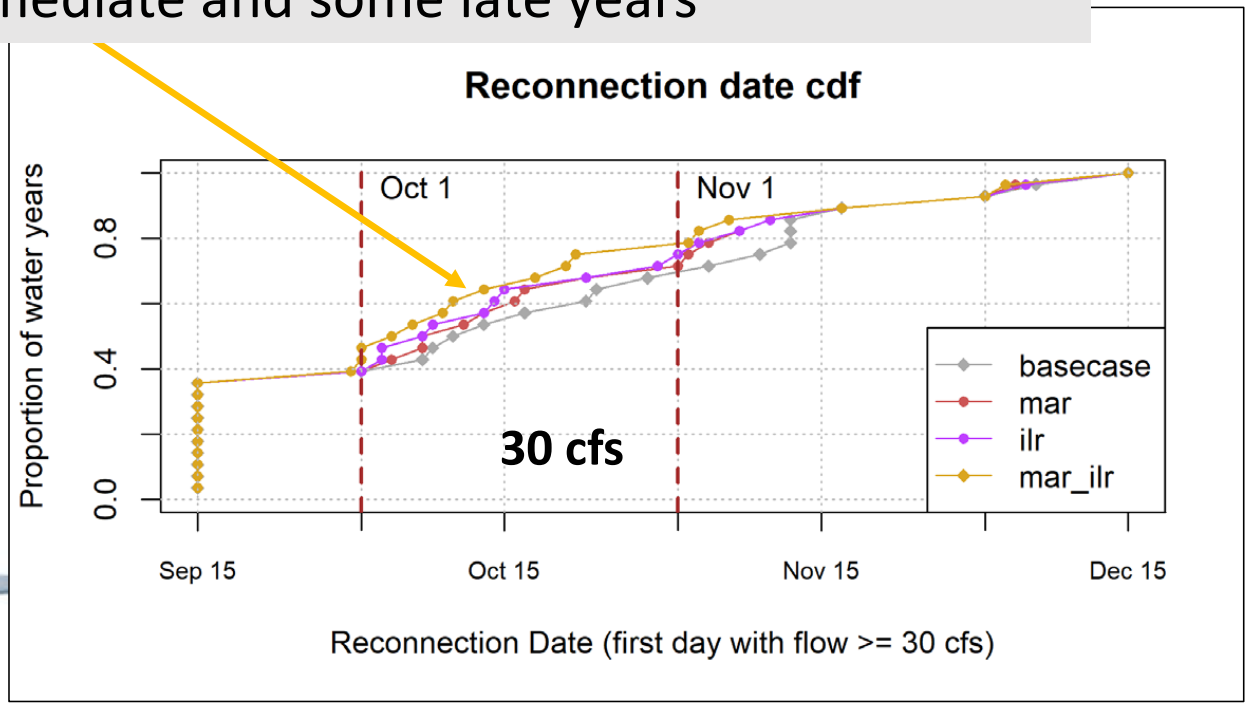
Threshold-passing or "reconnection" date distribution graphs

MAR+ILR: Generates a gain of ~7 days in higher-flow dais intermediate and some late years



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Scenario descriptions and visual references

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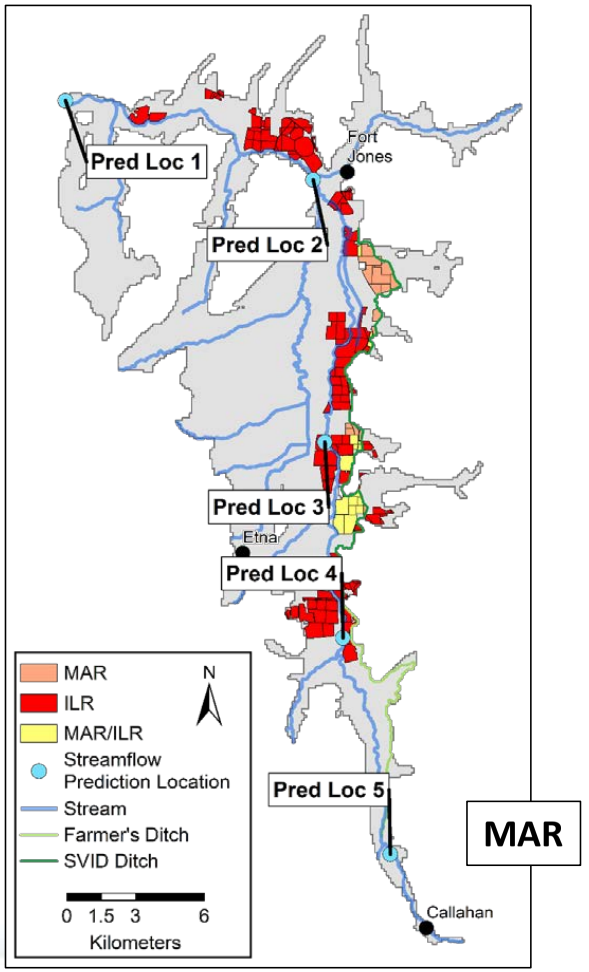
MAR (Managed Aquifer Recharge)

- 1,390 acres
- Surface water applied to orange and yellow fields, Jan-Mar.
- Water delivered through SVID Ditch



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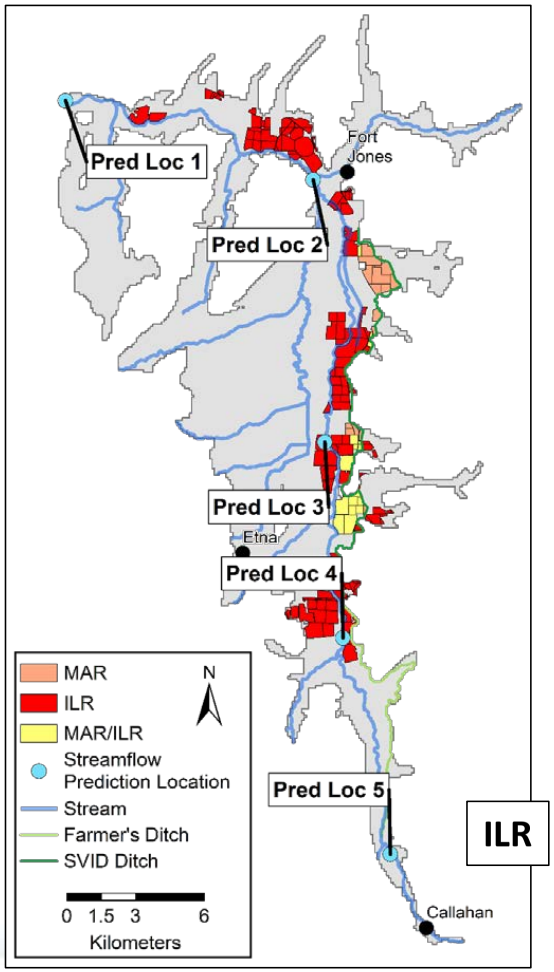
ILR (In-Lieu Recharge)

- 5,490 acres
- Operator applies surface water to yellow and red fields instead of pumping groundwater in the early growing season, as long as surface water is available.
- Water delivered through SVID Ditch



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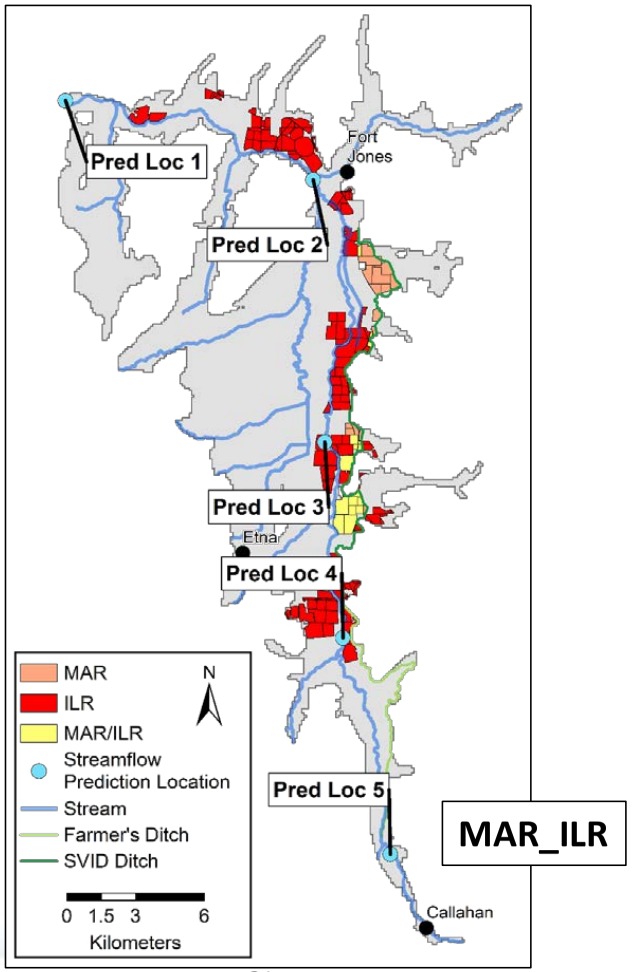
MAR+ILR

- 6,250 combined acres
- Both MAR (January-March) and ILR (early growing season) practices used.



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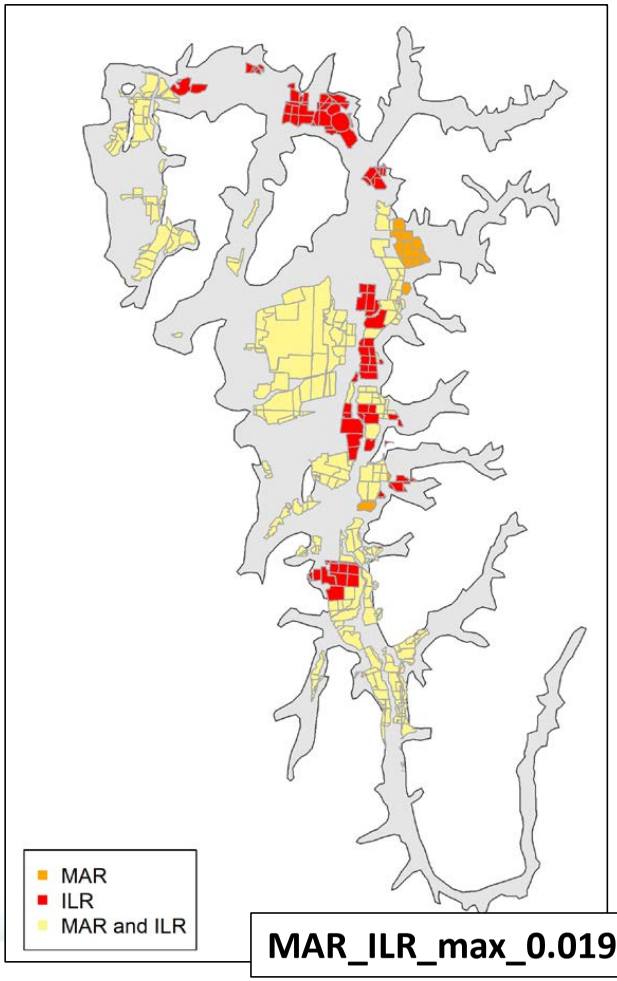
MAR+ILR expanded, 0.019 m/day, diversion limits on MAR

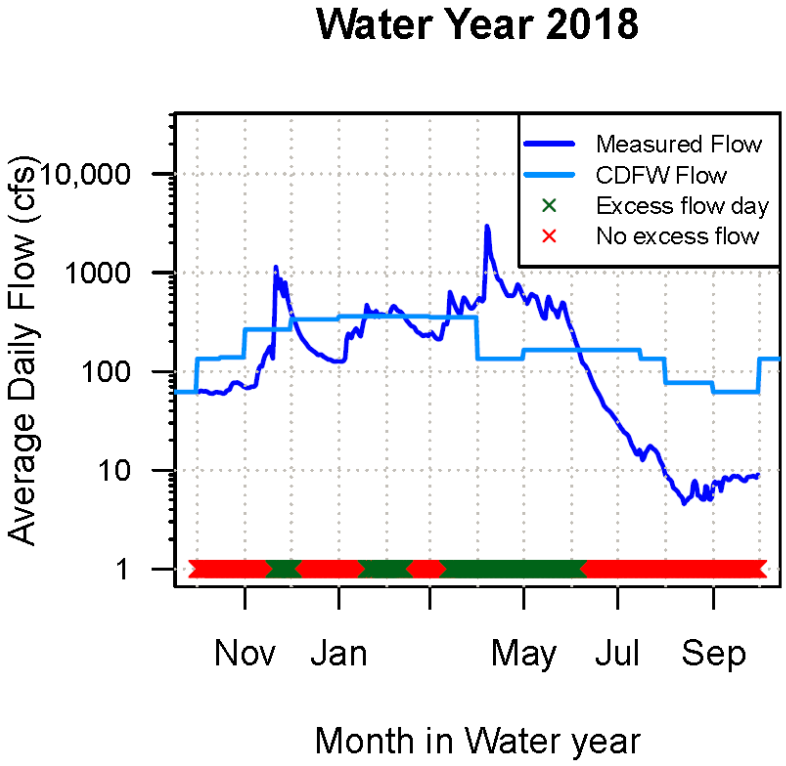
- 16,450 combined acres
- In this expanded scenario, MAR and ILR irrigation practices were assumed to be practicable on all fields with a surface water irrigation source.
  - MAR surface water diversions limited on days with FJ flow near or below the CDFW recommended instream flows.
  - Current known range of infiltration capacities is 0.003-0.035 m/day. In fields with unknown infiltration capacities, 0.019 m/day infiltration rate is assumed.



MAR_ILR_max_0.019

Restrictions on tributary flow diversions at low FJ flows

- Simulates the effect of limitations on surface water diversions in two scenarios:
  - the historical basecase
  - the MAR + ILR scenario.
    - "Available" water is defined as the proportion of total flow at the FJ gauge in excess of CDFW 2017 recommended instream flow values.
    - The "available" percentage is applied to the flow in each tributary and used to limit surface flow diversions.
- Surface water rights are not accounted for in this scenario. It is included in this appendix to explore the outcome of management actions such as surface water leases.



flow_lims
mar_ilr_flowlims

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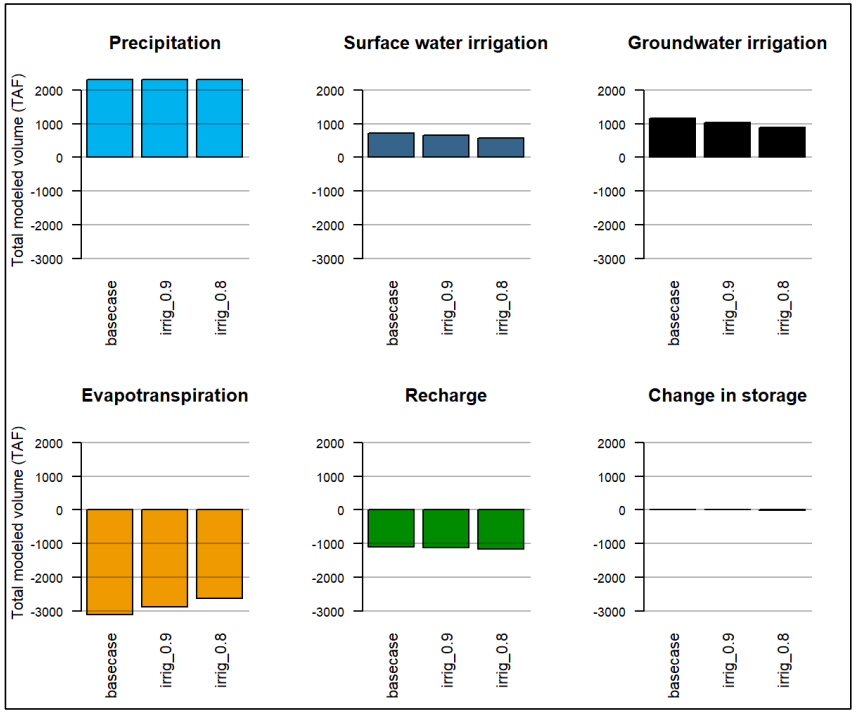
Irrigation demand change

- Two scenarios in which an unspecified crop change results in:
  - 90%
  - 80%

of the historical crop ET from all crops, which drives irrigation demand (a 10% or 20% reduction in ET on irrigated fields).



irrig_0.8
irrig_0.9

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Irrigation efficiency scenarios

- Three scenarios:
  - Improve by 10%
  - Improve by 20%
  - Reduced (worsen) by 10%

- These scenarios assume an unspecified change in irrigation equipment that results in either an increase or decrease in irrigation efficiency on all irrigated fields.

irr_eff_improve_0.1
irr_eff_improve_0.2
irr_eff_worse_0.1

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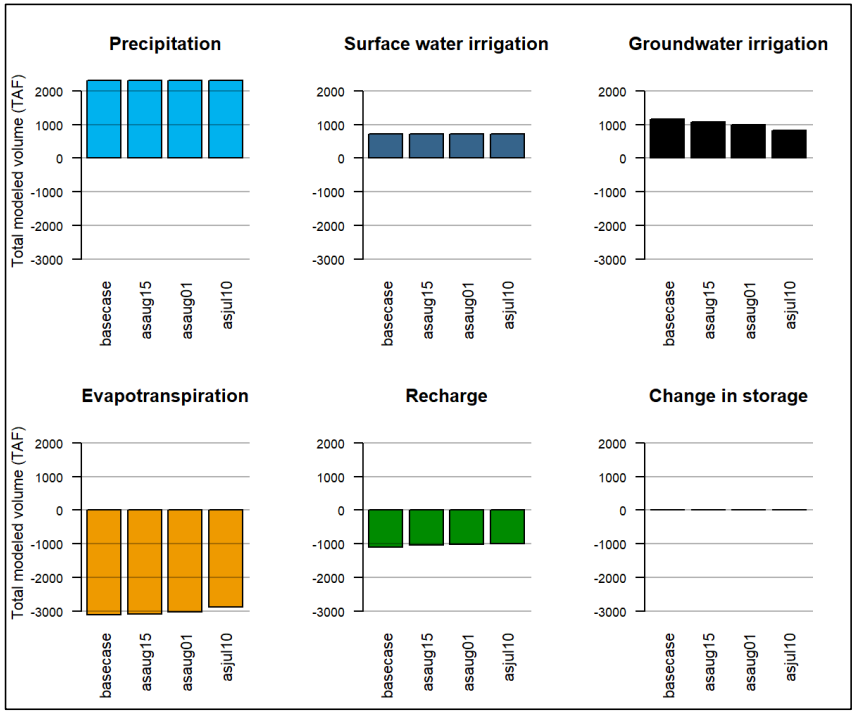
Alfalfa irrigation schedule change

- Three scenarios, in which irrigation on all alfalfa fields ceases, in all water years, on:
  - July 10
  - August 1
  - August 15
- Would presumably involve an incentive or compensation program (a back-of-the-envelope estimate of the value of the 3rd cutting of alfalfa is approximately $7.5 million).



alf_irr_stop_jul10
alf_irr_stop_aug01
alf_irr_stop_aug15

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Alfalfa irrigation schedule change, dry years only

- Two scenarios, in which irrigation on all alfalfa fields ceases, in dry water years only, on:
  - August 1
  - August 15
  - Dry water years in this simulation: ’91, ’92, ’94, ’01, ’09, ’13, ’14, ’18.
- Would presumably involve an incentive or compensation program (a back-of-the-envelope estimate of the value of the 3rd cutting of alfalfa is approximately $7.5 million).

alf_irr_stop_aug01_dry_yrs_only
alf_irr_stop_aug15_dry_yrs_only

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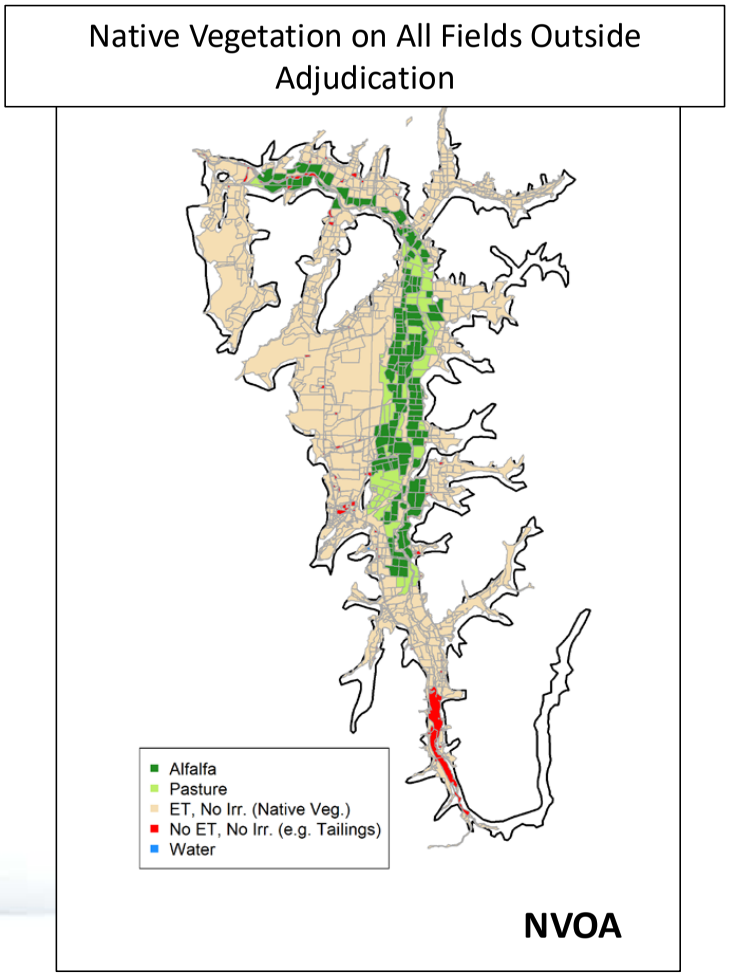
Turn off *all irrigation* outside adjudicated area

- 23,070 acres of cultivated crops converted to native vegetation.



Used as no-pumping reference case in SMC definition

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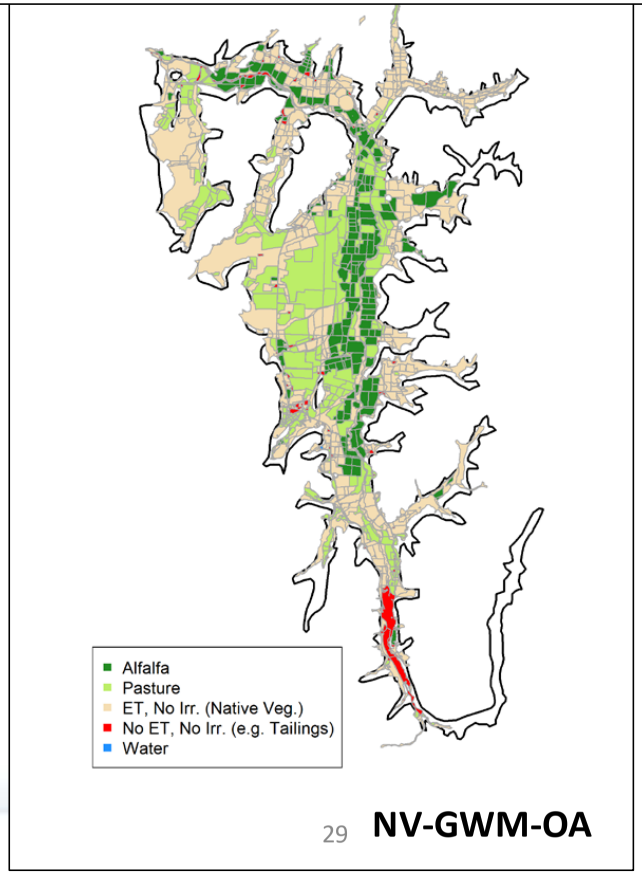
Turn off *pumping* outside adjudicated area

- 11,630 acres of cultivated crops converted to native vegetation.

Native Vegetation on *GW and Mixed Water Source Fields* Outside Adjudication



NV-GWM-OA

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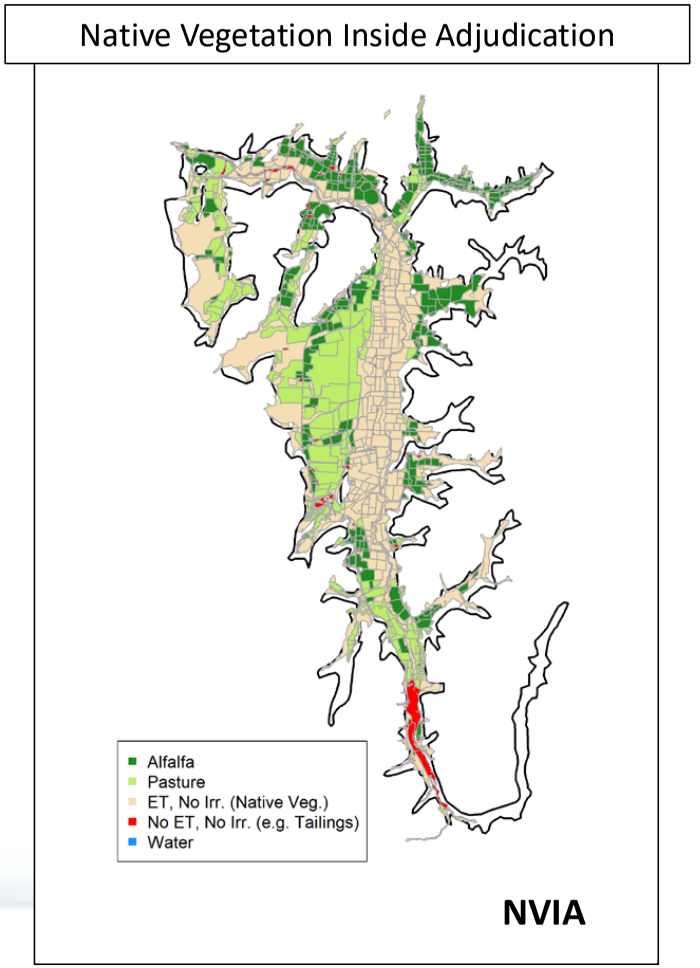
Turn off *all irrigation* **inside** adjudicated area

- 10,980 acres of cultivated crops converted to native vegetation.



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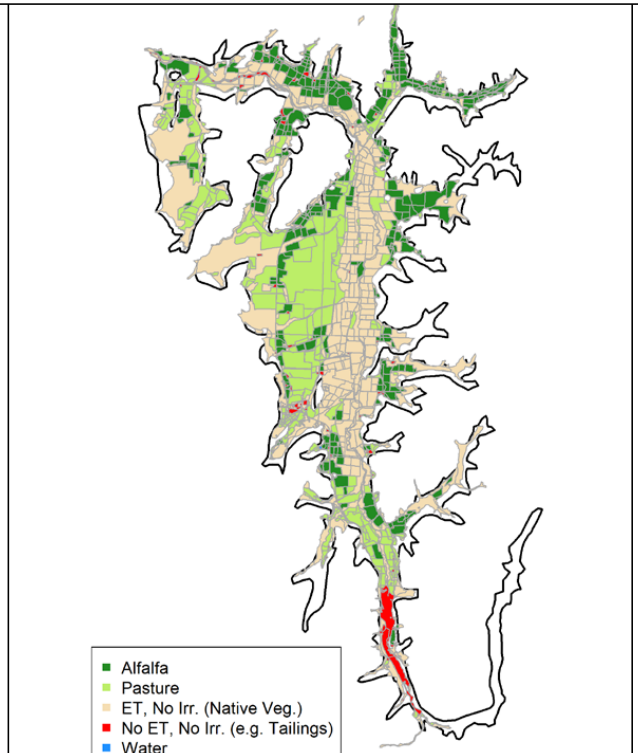
Turn off *pumping* **inside** adjudicated area

- 9,900 acres of cultivated crops converted to native vegetation.

Native Vegetation on *GW and Mixed Water Source Fields* Inside Adjudication



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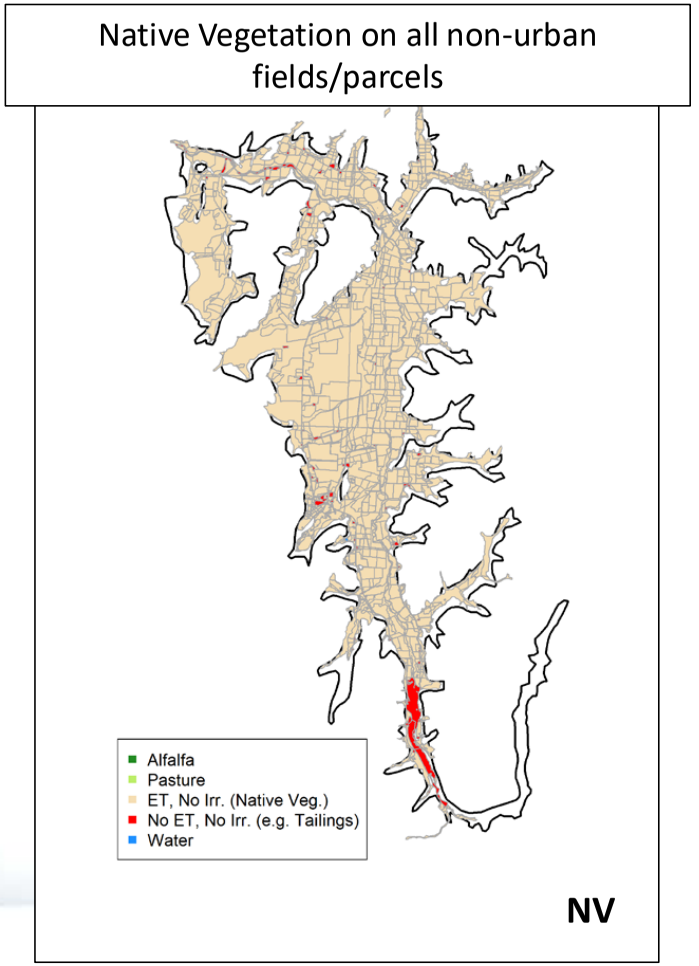
Turn off *all irrigation* in Scott Valley

- 34,040 acres of cultivated crops converted to native vegetation.



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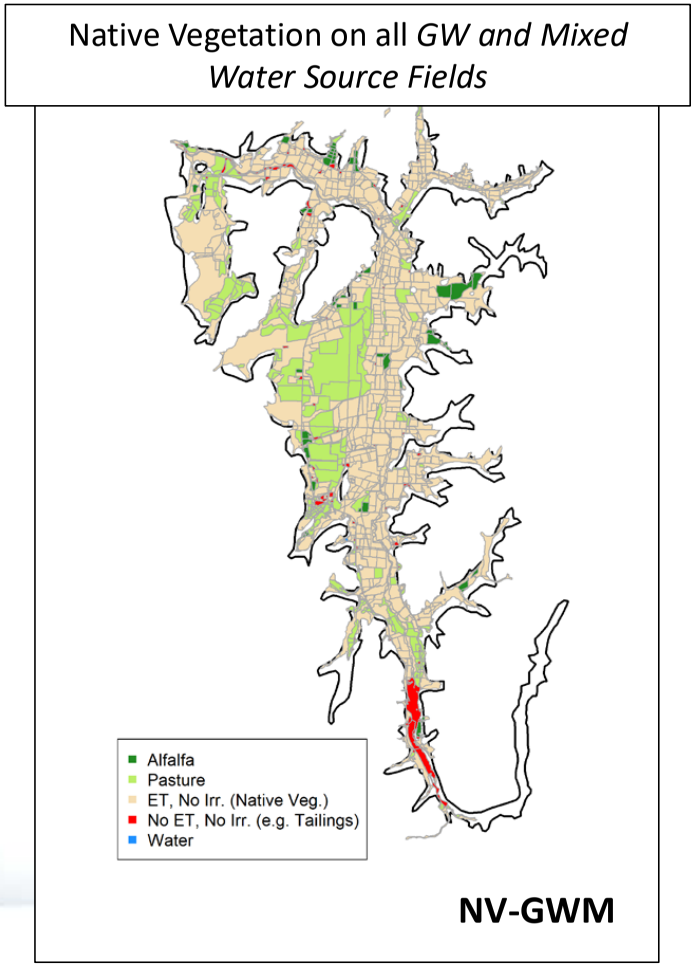
Turn off *all pumping* in Scott Valley

- 21,530 acres of cultivated crops converted to native vegetation.



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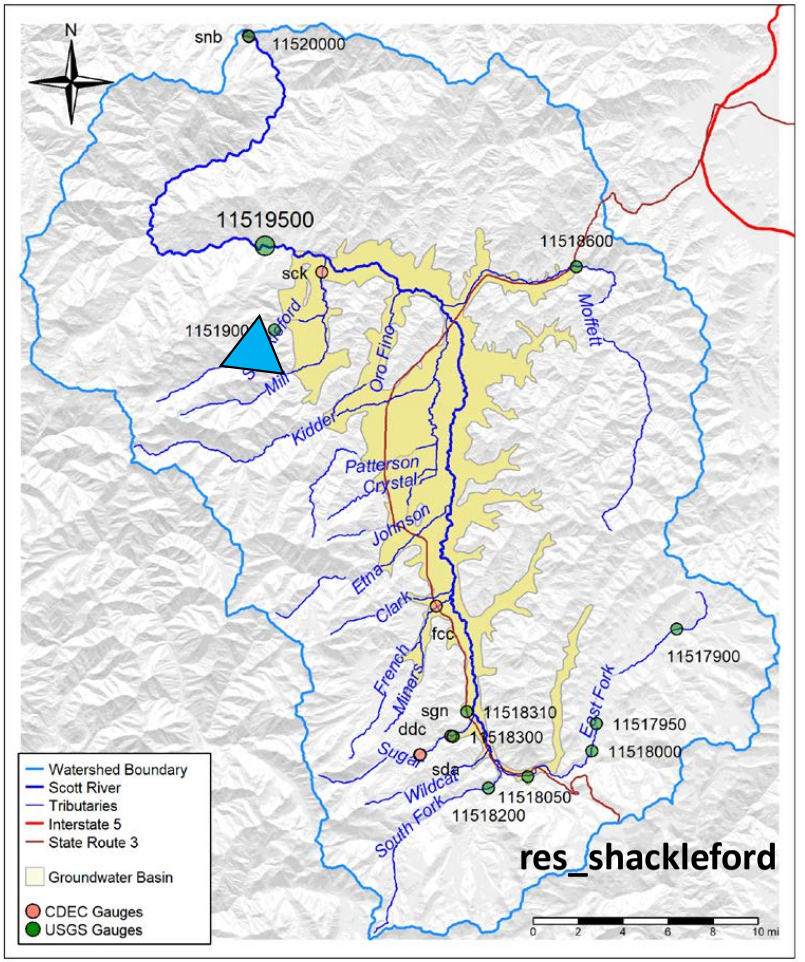
Reservoir, 30 cfs dry season release, Shackleford

- Alters the flow of Shackleford creek to simulate a 9 TAF reservoir storing and releasing flow.
- Holds all water except 30 cfs back in the wet season (Dec. 1-Mar. 31), until the reservoir is full.
- Allows water to pass through during the growing season (Apr. 1-June 31), but retains water in storage.
- Releases 30 cfs in the dry season (July 1-Nov. 30), unless the reservoir runs dry.



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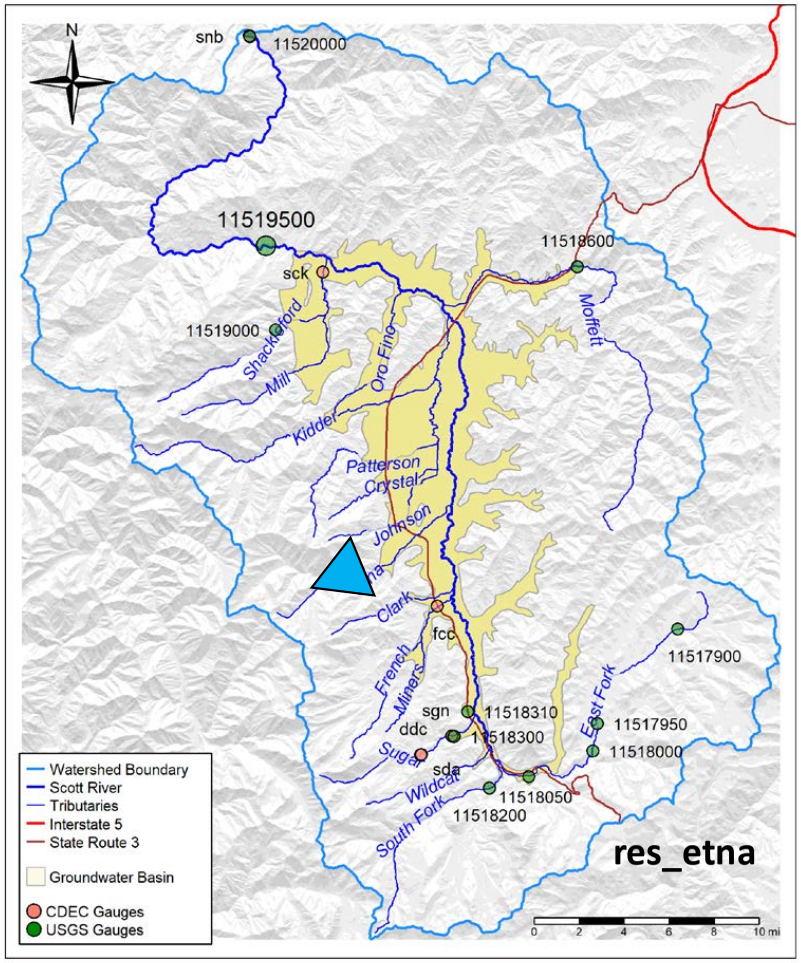
Reservoir, 30 cfs dry season release, Etna Creek

- Alters the flow of Etna creek to simulate a 9 TAF reservoir storing and releasing flow.
- Holds all water except 30 cfs back in the wet season (Dec. 1-Mar. 31), until the reservoir is full.
- Allows water to pass through during the growing season (Apr. 1-June 31), but retains water in storage.
- Releases 30 cfs in the dry season (July 1-Nov. 30), unless the reservoir runs dry.



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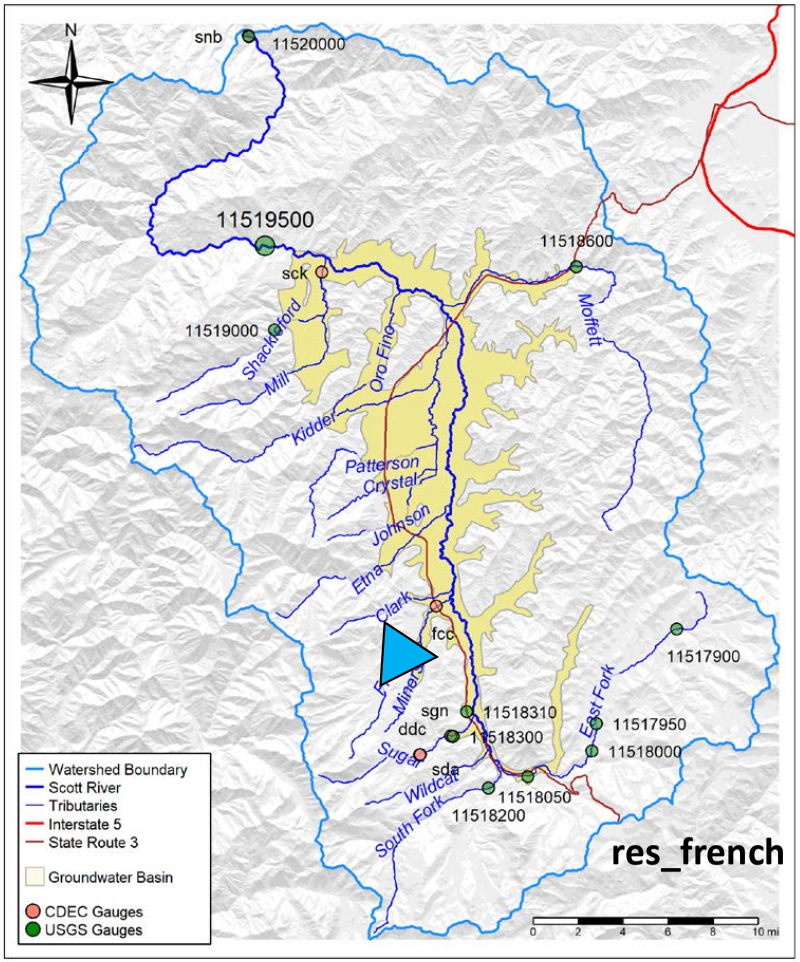
Reservoir, 30 cfs dry season release, French Creek

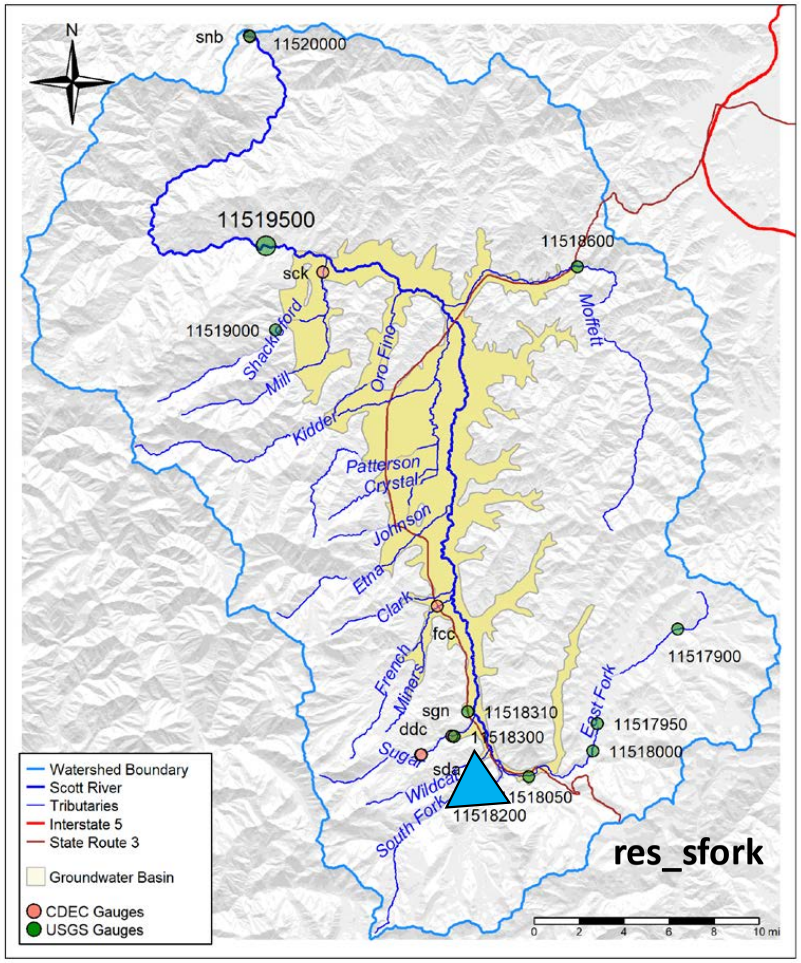
- Alters the flow of French creek to simulate a 9 TAF reservoir storing and releasing flow.
- Holds all water except 30 cfs back in the wet season (Dec. 1-Mar. 31), until the reservoir is full.
- Allows water to pass through during the growing season (Apr. 1-June 31), but retains water in storage.
- Releases 30 cfs in the dry season (July 1-Nov. 30), unless the reservoir runs dry.



DRAFT

Reservoir, 30 cfs dry season release, South Fork

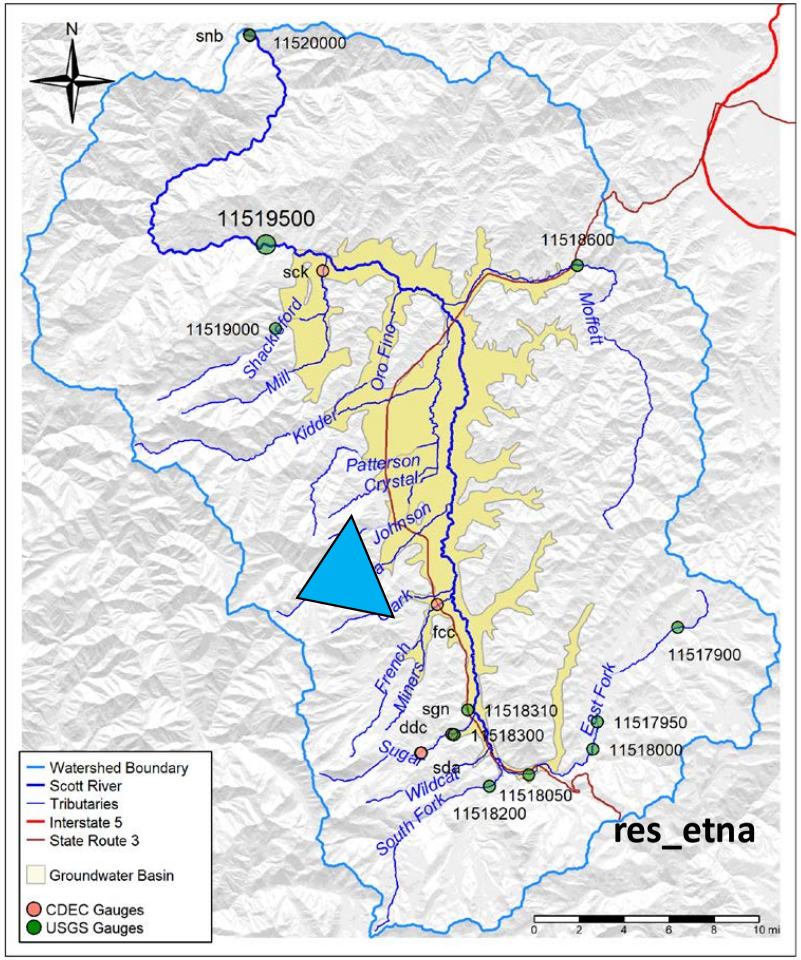
- Alters the flow of South Fork to simulate a 9 TAF reservoir storing and releasing flow.
- Holds all water except 30 cfs back in the wet season (Dec. 1-Mar. 31), until the reservoir is full.
- Allows water to pass through during the growing season (Apr. 1-June 31), but retains water in storage.
- Releases 30 cfs in the dry season (July 1-Nov. 30), unless the reservoir runs dry.



Multiple reservoirs providing 100% reliable 30 cfs dry season release at Etna Creek and Scott River

DRAFT

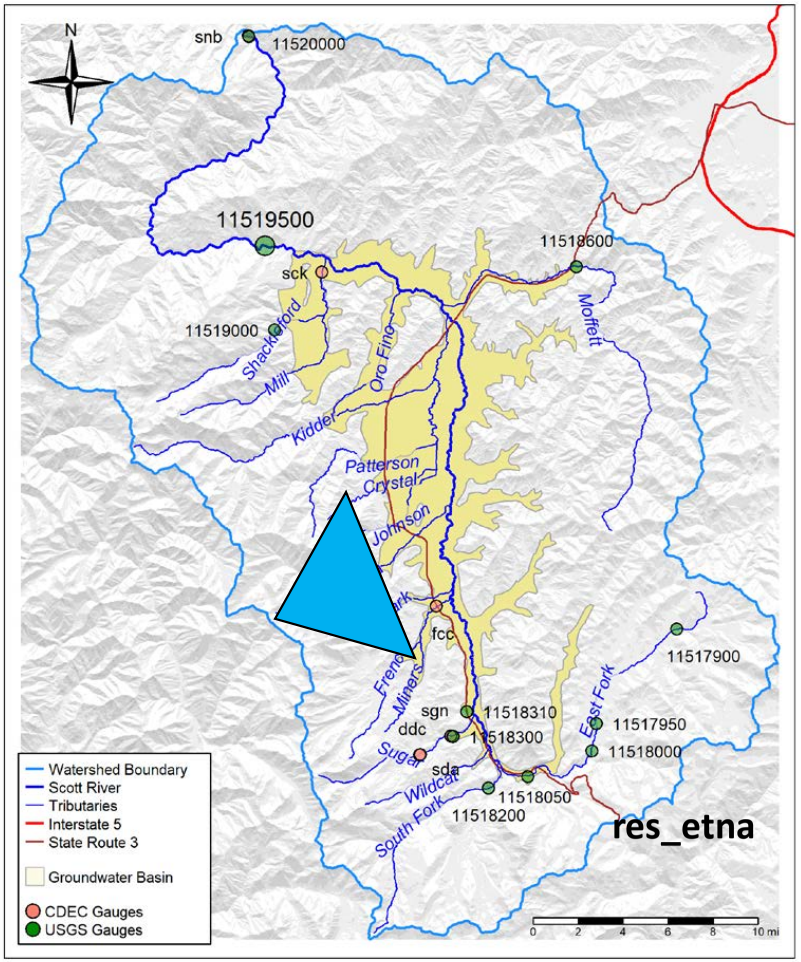
- Multiple reservoirs represented by one 29 TAF reservoir located on Etna Creek. Alters the flow of Etna creek to simulate storing and releasing flow.
- Holds all water except 30 cfs back in the wet season (Dec. 1-Mar. 31), until the reservoir is full.
- Allows water to pass through during the growing season (Apr. 1-June 31), but retains water in storage.
- Releases 30 cfs in every dry season (July 1-Nov. 30). This reservoir does not run dry during the 1991-2018 period.



Multiple reservoirs providing 100% reliable 60 cfs dry season release at Etna Creek and Scott River

DRAFT

- Multiple reservoirs represented by one 134 TAF reservoir located on Etna Creek. Alters the flow of Etna creek to simulate a storing and releasing flow.
- Holds all water except 30 cfs back in the wet season (Dec. 1-Mar. 31), until the reservoir is full.
- Allows water to pass through during the growing season (Apr. 1-June 31), but retains water in storage.
- Releases 60 cfs in every dry season (July 1-Nov. 30). This reservoir does not run dry during the 1991-2018 period.



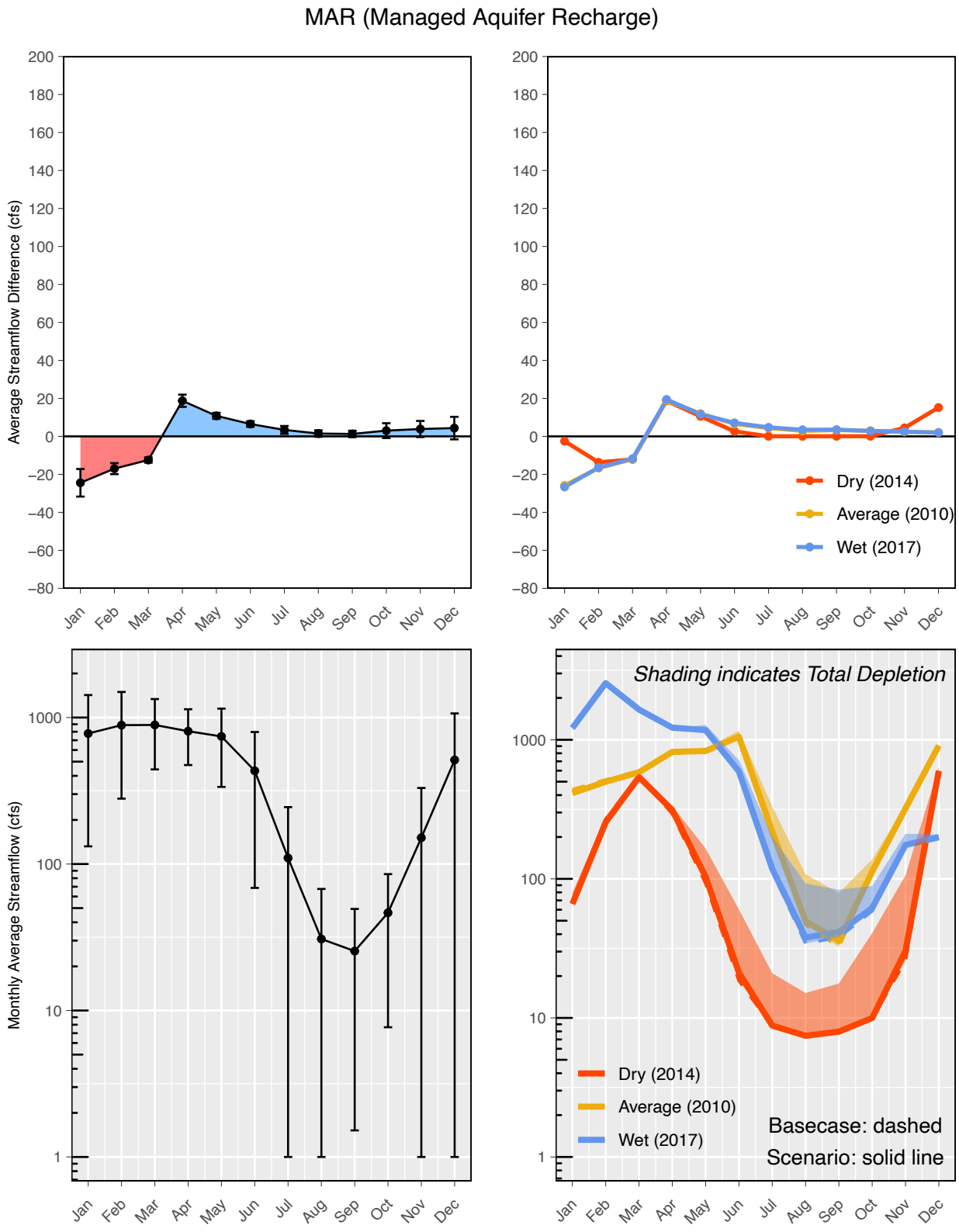
Flow change results (Fort Jones Gauge)

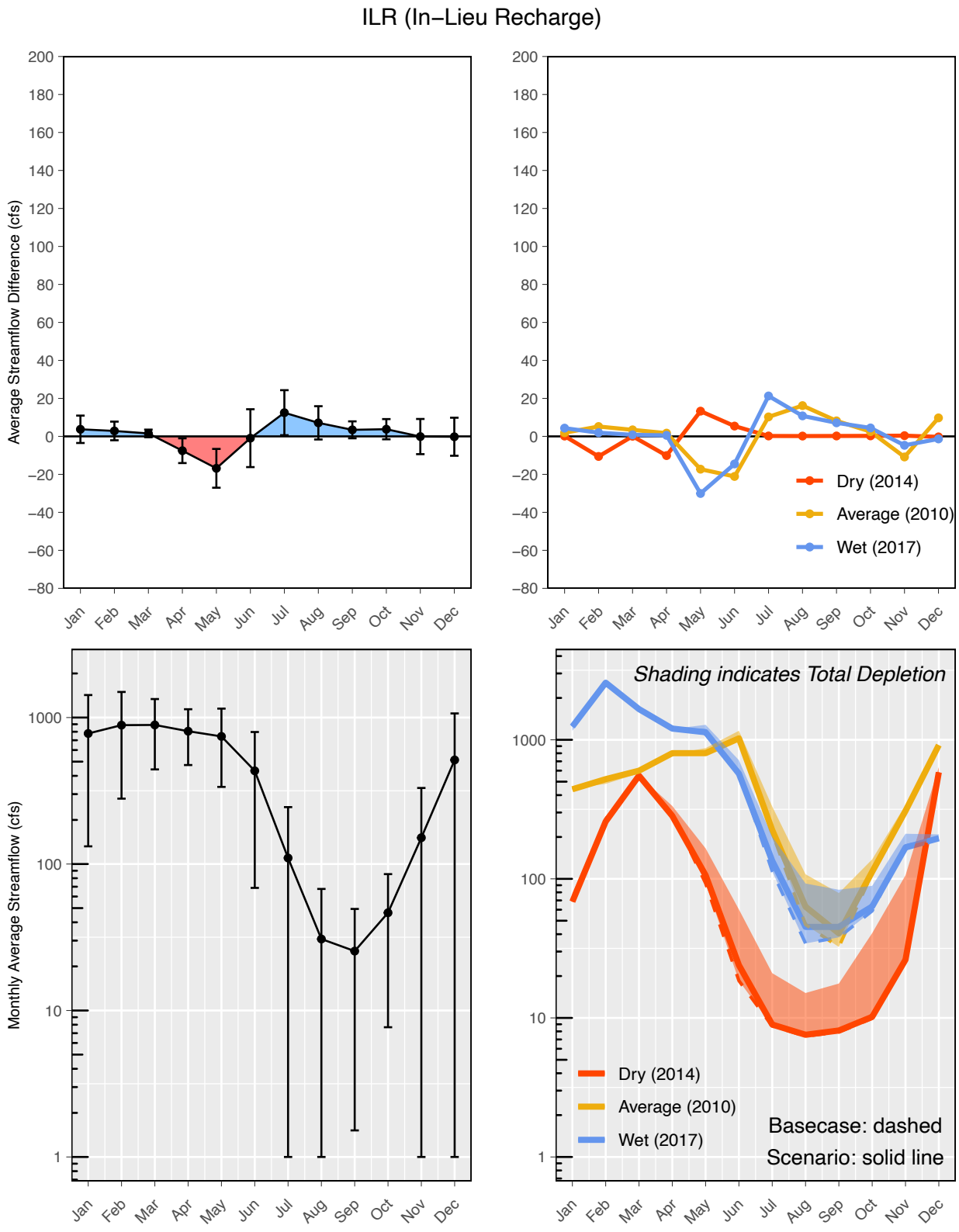
Changes in the simulated flow at the Fort Jones USGS flow gauge (number 11519500) are an indicator of the effect of a project or management action (PMA) on the Scott River stream system. Interpretation details are below; see explanatory plots at the beginning of this appendix for more information.

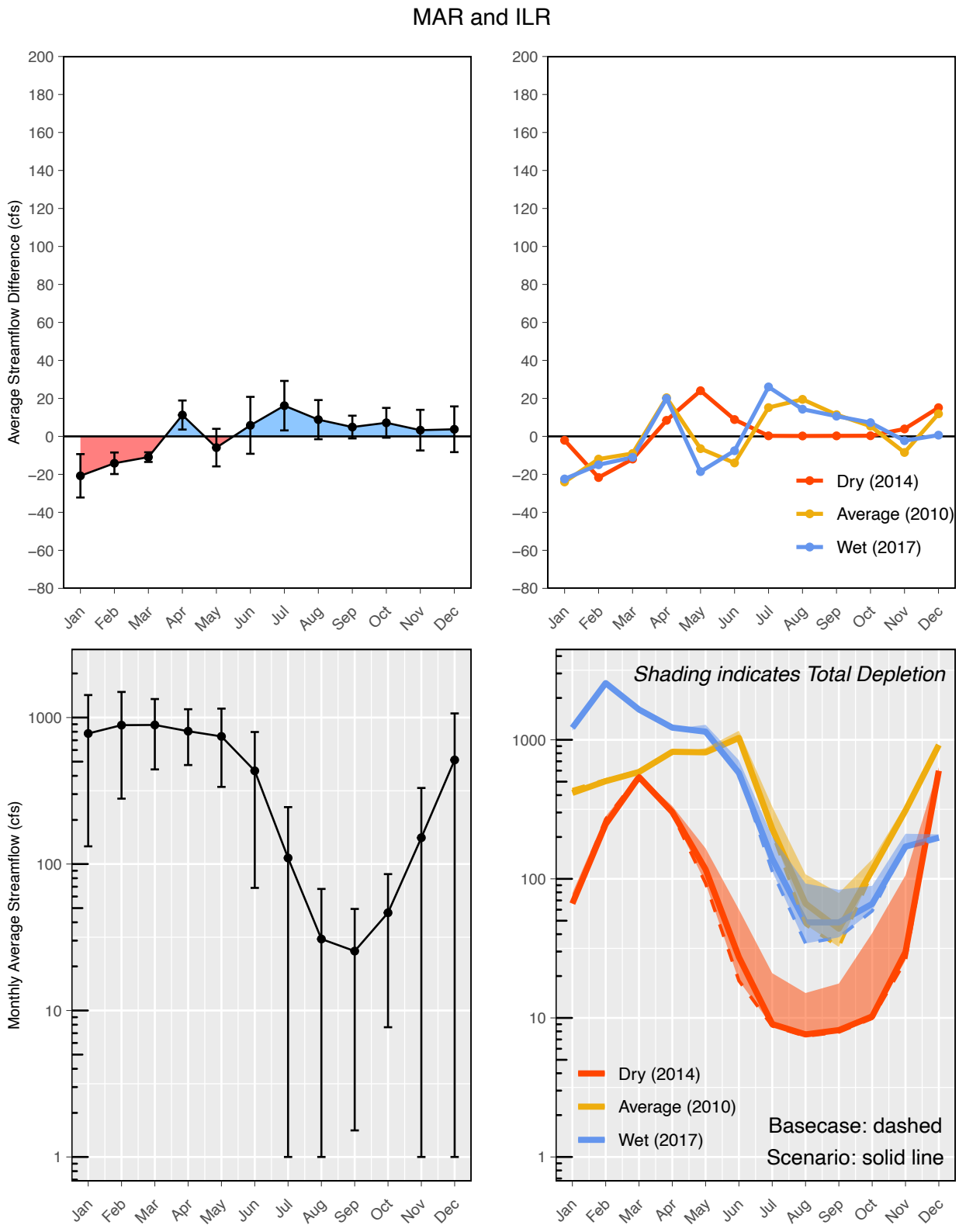
- Upper left plot: Black dots show the average change in flow (scenario minus basecase) in each month (e.g., all Januaries averaged over the 28-year model period). Whiskers indicate the standard deviation of flow values for each month. Blue areas show that on average, the scenario flow in those months is higher than the historical basecase, indicating that the project or management action would have increased flow in that month. Red areas indicate months with lower flow under the specified scenario.
- Upper right plot: Red, yellow and blue dots and lines indicate the monthly average change in flow in three example water years: 2014 (Dry), 2010 (Average), and 2017 (Wet). Some dots may be missing for some months - this indicates they are beyond the bounds of the figure axes. These example years are included to show deviations from average system behavior due to water year type and year-to-year variability.
- Lower left plot: Black dots show the monthly streamflow (averaged over the 28 year model period) in the historical basecase simulation. Whiskers show the standard deviation of those monthly flows. This is included for reference and is the same on every page of this appendix.
- Lower right plot: Dashed lines indicate the monthly hydrograph in the basecase (in dotted lines) and in the specified scenario (in solid lines) for the three example water years specified above. Shading has been added to each plot to indicate "Total Depletion" used to define the SMC.

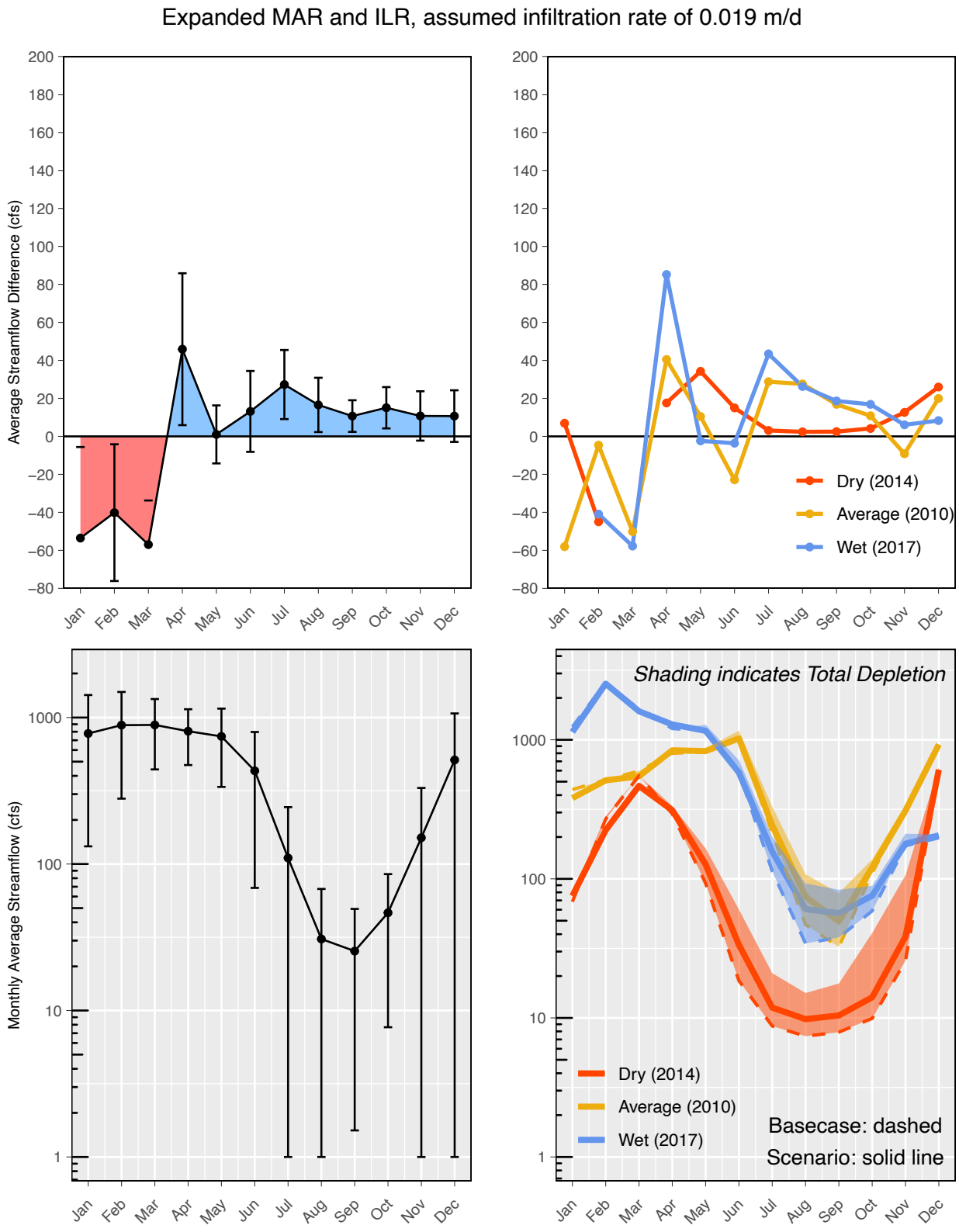
Total Depletion is defined as the difference in simulated Fort Jones flow between the basecase and the No-Pumping Reference Case, in which pumping is turned off outside the adjudicated zone and a reversion to natural vegetation is assumed on all fields serviced by groundwater or mixed groundwater-surface water sources. The No-Pumping Reference Case has also been referred to with these names: "No Pumping Outside Adjudicated Zone" or "Natural Vegetation, Groundwater and Mixed-source fields, Outside Adjudicated Zone [NV-GWM-OA]".

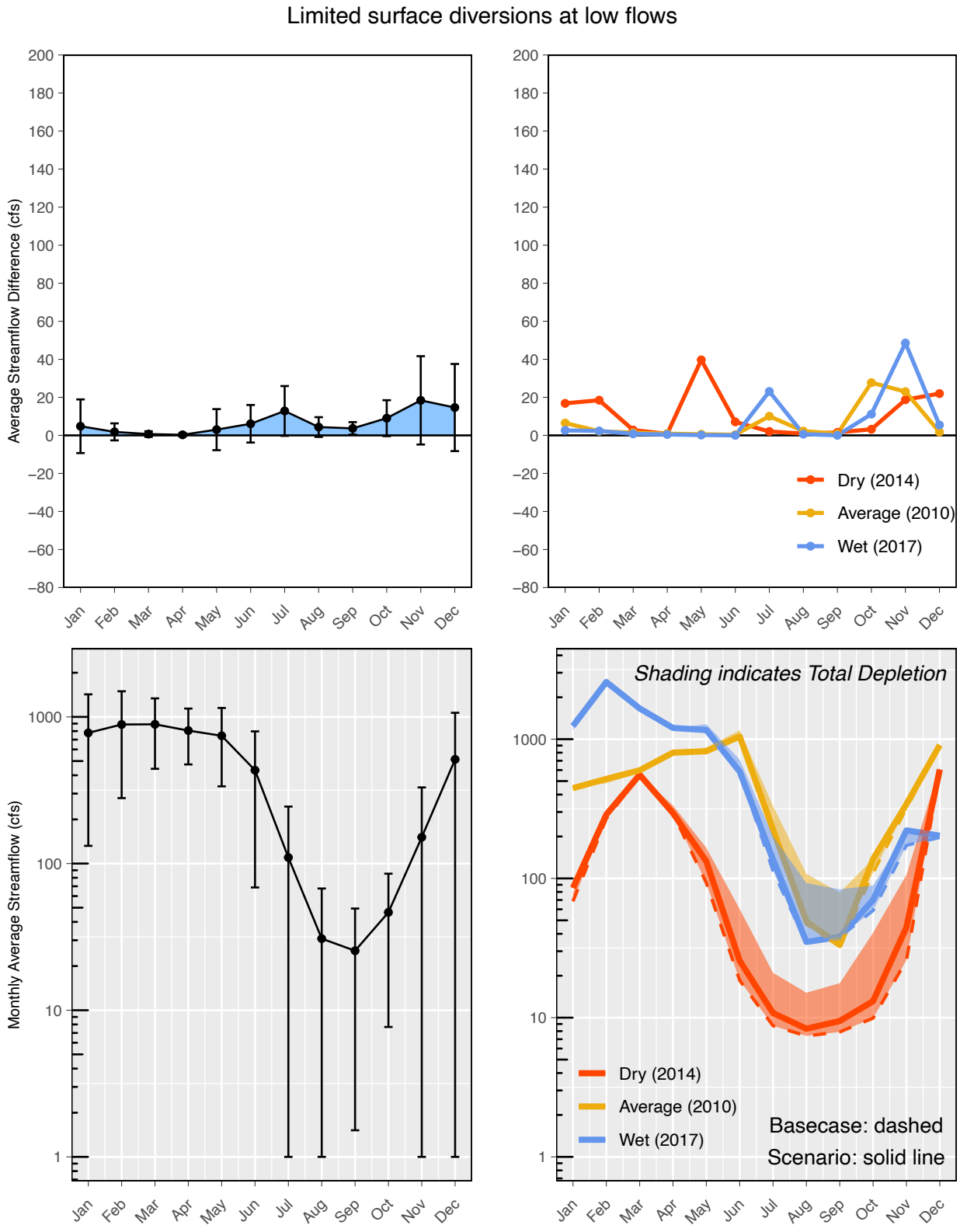
In all graphs, the Total Depletion is indicated by the shaded area. The top of the shaded area is the unmarked hydrograph for the No-Pumping Reference case. The bottom of the shaded area, marked by the dashed line, is the hydrograph of the Basecase. Hydrographs for the scenarios are shown with solid lines. The relative position of the solid line within the shaded area shows how much a PMA can increase streamflow (reverse stream depletion) relative to the Basecase (dashed line) and relative to the Total Depletion (shaded area).

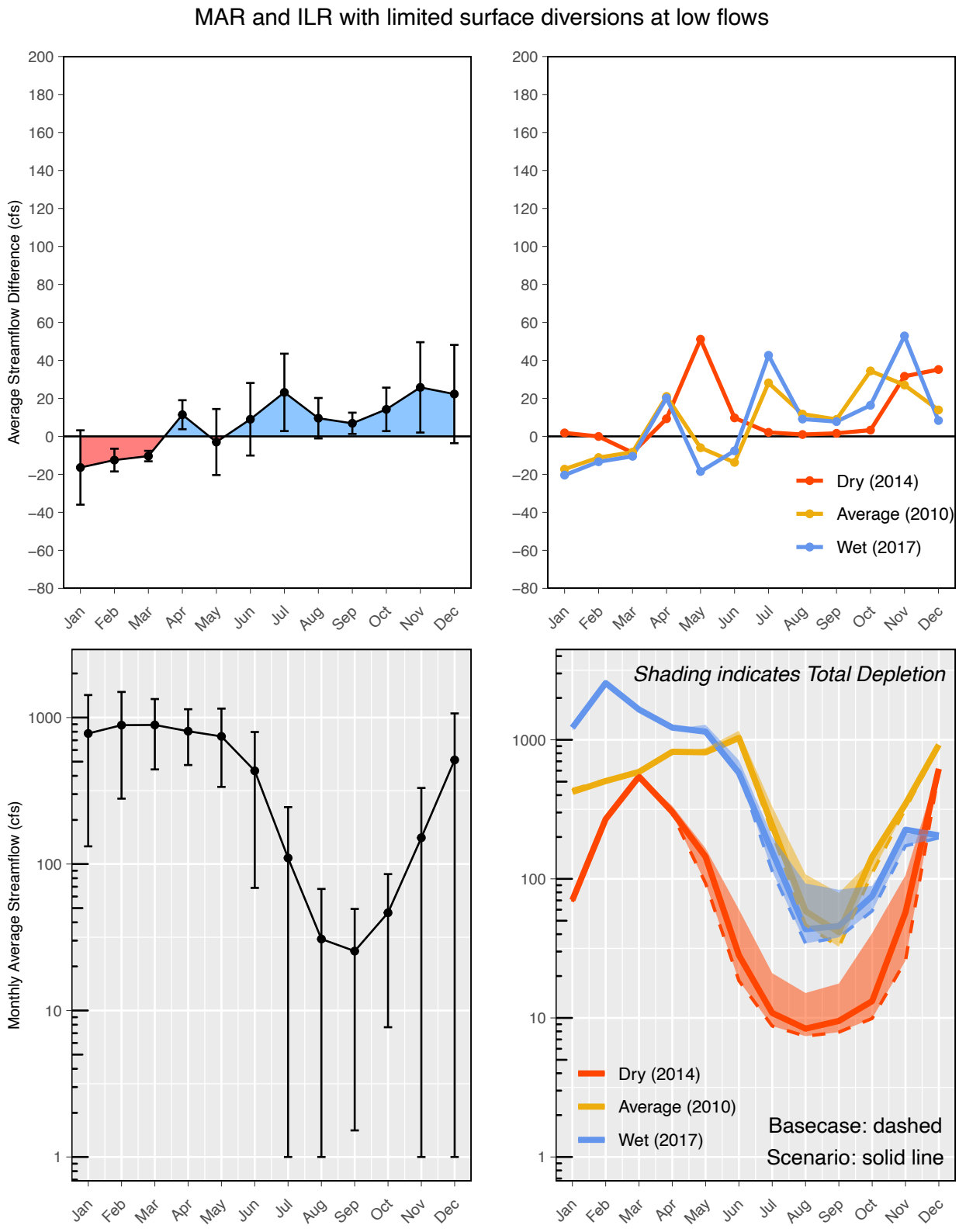

MAR (Managed Aquifer Recharge)
Average Streamflow Difference (cfs)
200
180
160
140
120
100
80
60
40
20
0
−20
−40
−60
−80
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Dry (2014)
Average (2010)
Wet (2017)
Monthly Average Streamflow (cfs)
1000
100
10
1
Shading indicates Total Depletion
Basecase: dashed
Scenario: solid line

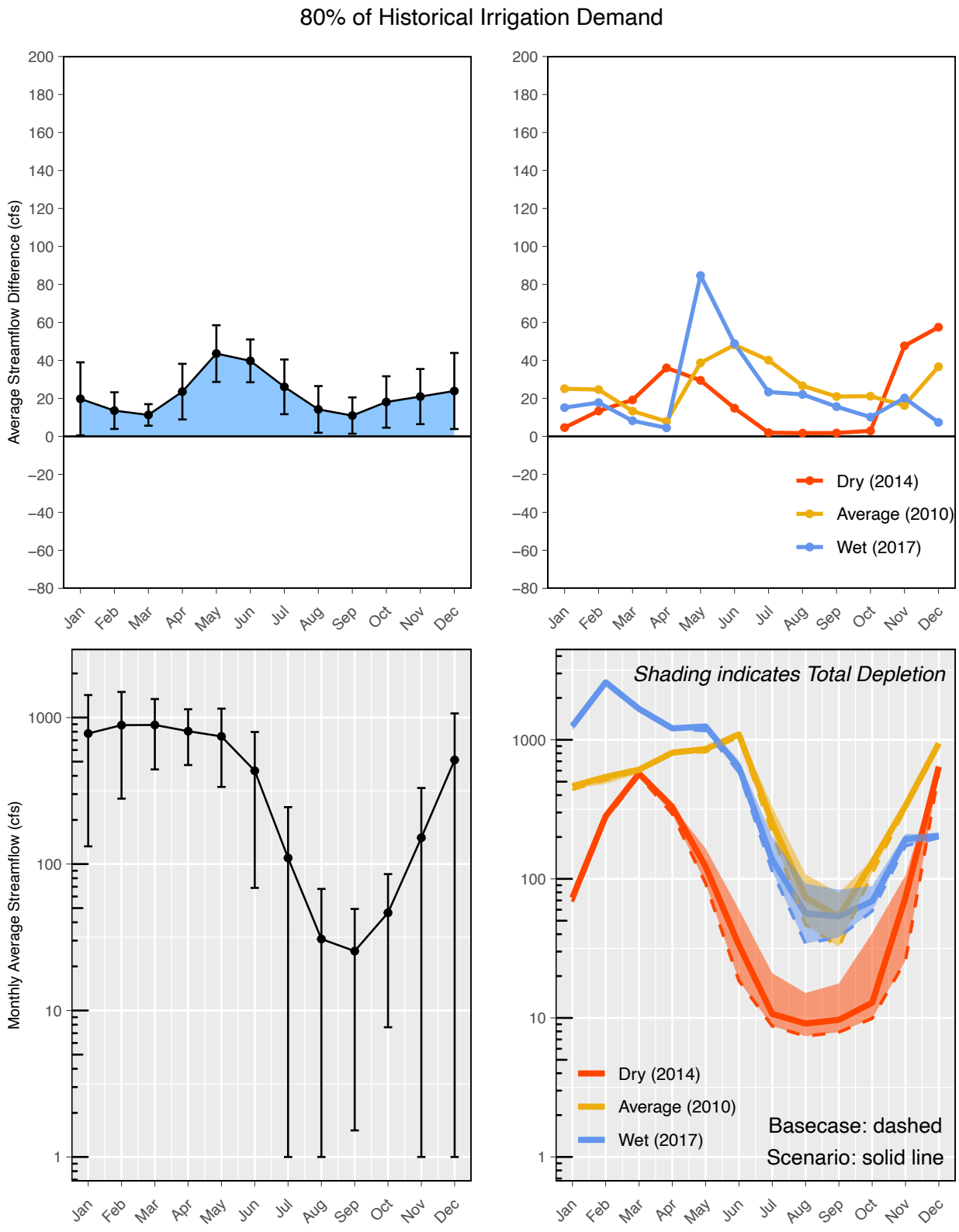

ILR (In−Lieu Recharge)
Average Streamflow Difference (cfs)
200
180
160
140
120
100
80
60
40
20
0
−20
−40
−60
−80
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Dry (2014)
Average (2010)
Wet (2017)
Monthly Average Streamflow (cfs)
1000
100
10
1
Shading indicates Total Depletion
Basecase: dashed
Scenario: solid line

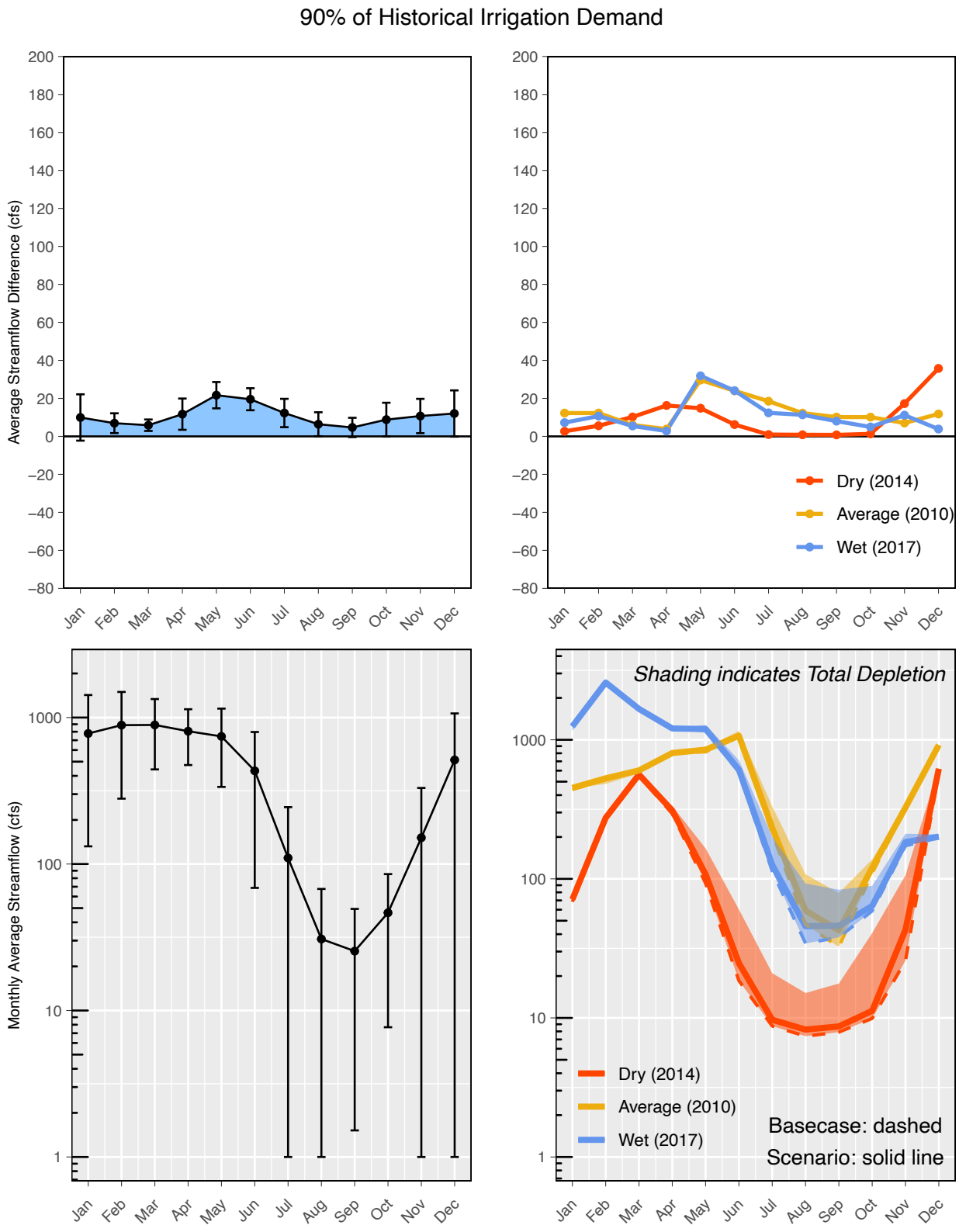

MAR and ILR
Average Streamflow Difference (cfs)
200
180
160
140
120
100
80
60
40
20
0
−20
−40
−60
−80
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Dry (2014)
Average (2010)
Wet (2017)
Monthly Average Streamflow (cfs)
1000
100
10
1
Shading indicates Total Depletion
Basecase: dashed
Scenario: solid line

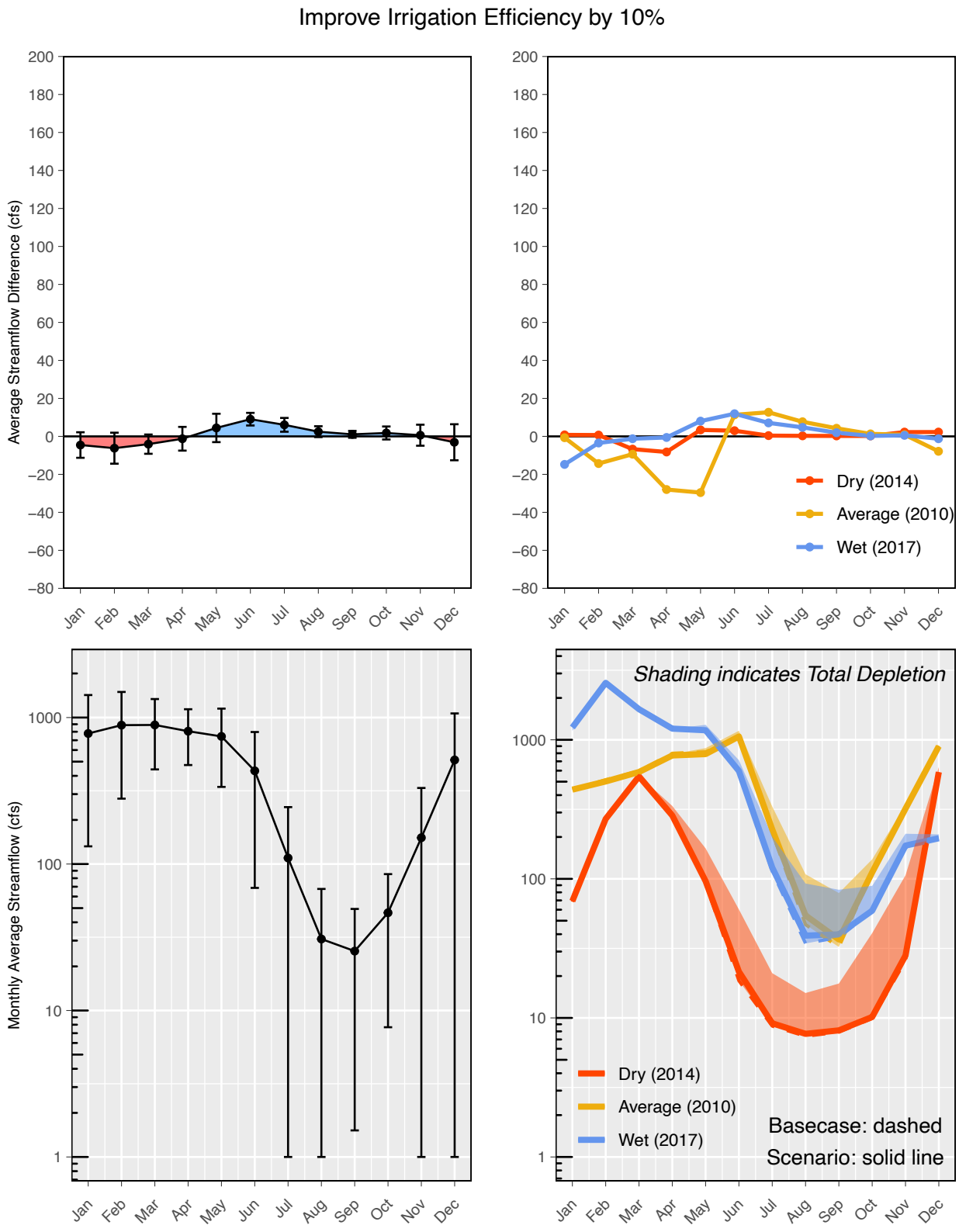

Expanded MAR and ILR, assumed infiltration rate of 0.019 m/d
Average Streamflow Difference (cfs)
Monthly Average Streamflow (cfs)
Dry (2014)
Average (2010)
Wet (2017)
Shading indicates Total Depletion
Basecase: dashed
Scenario: solid line
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec

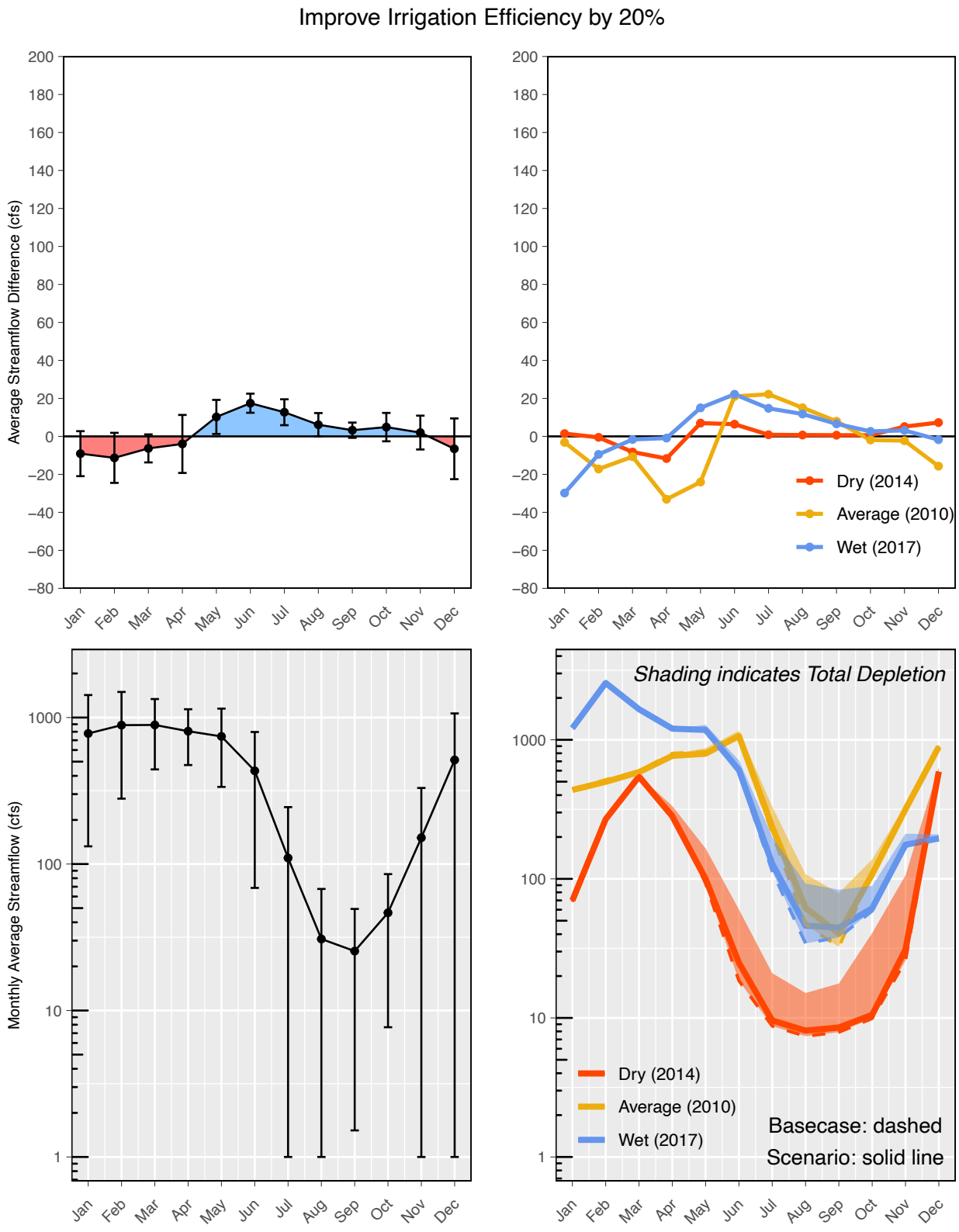

Limited surface diversions at low flows
Average Streamflow Difference (cfs)
200
180
160
140
120
100
80
60
40
20
0
−20
−40
−60
−80
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Dry (2014)
Average (2010)
Wet (2017)
Monthly Average Streamflow (cfs)
1000
100
10
1
Shading indicates Total Depletion
Basecase: dashed
Scenario: solid line

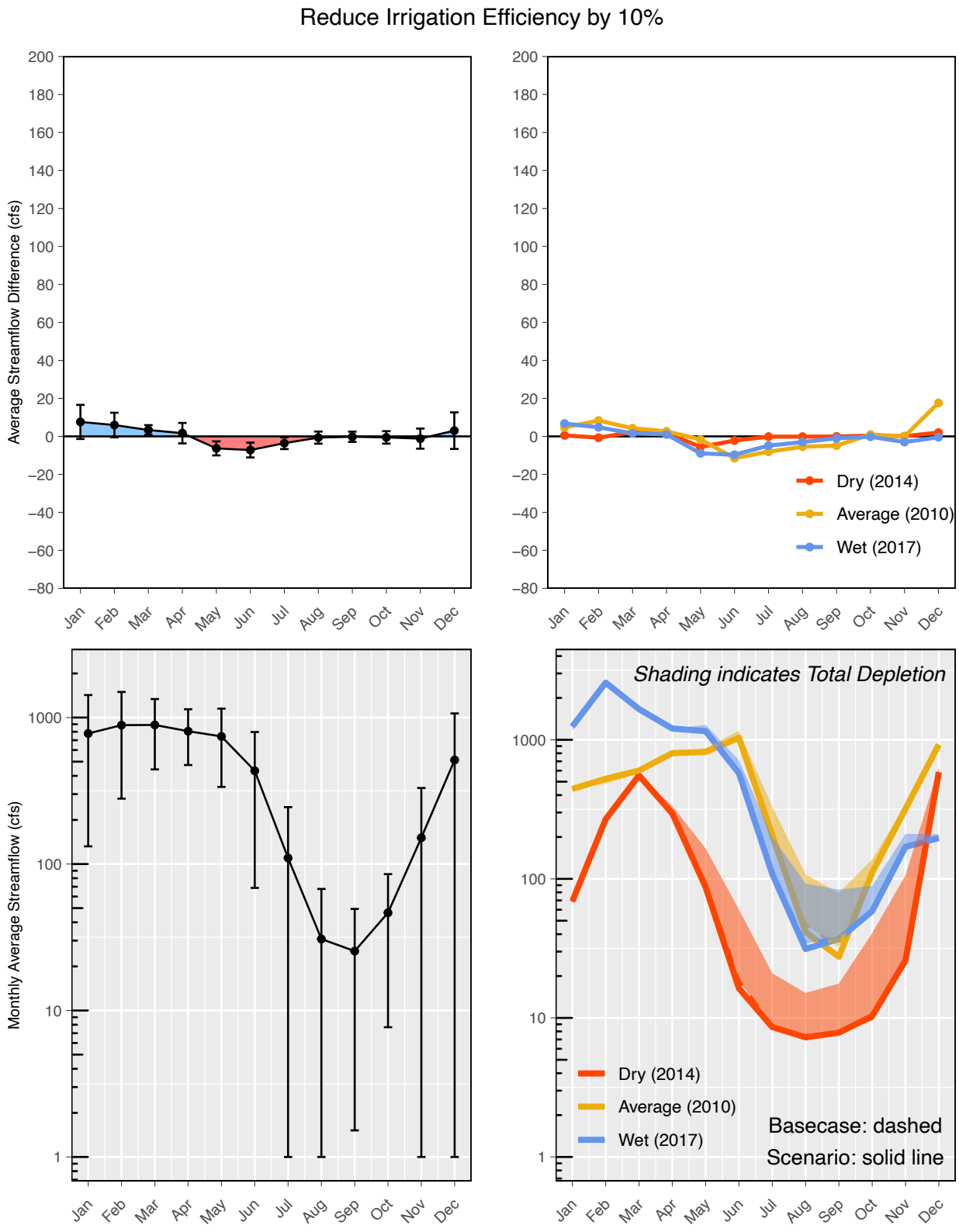

MAR and ILR with limited surface diversions at low flows
Average Streamflow Difference (cfs)
200
180
160
140
120
100
80
60
40
20
0
−20
−40
−60
−80
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Dry (2014)
Average (2010)
Wet (2017)
Monthly Average Streamflow (cfs)
1000
100
10
1
Shading indicates Total Depletion
Basecase: dashed
Scenario: solid line

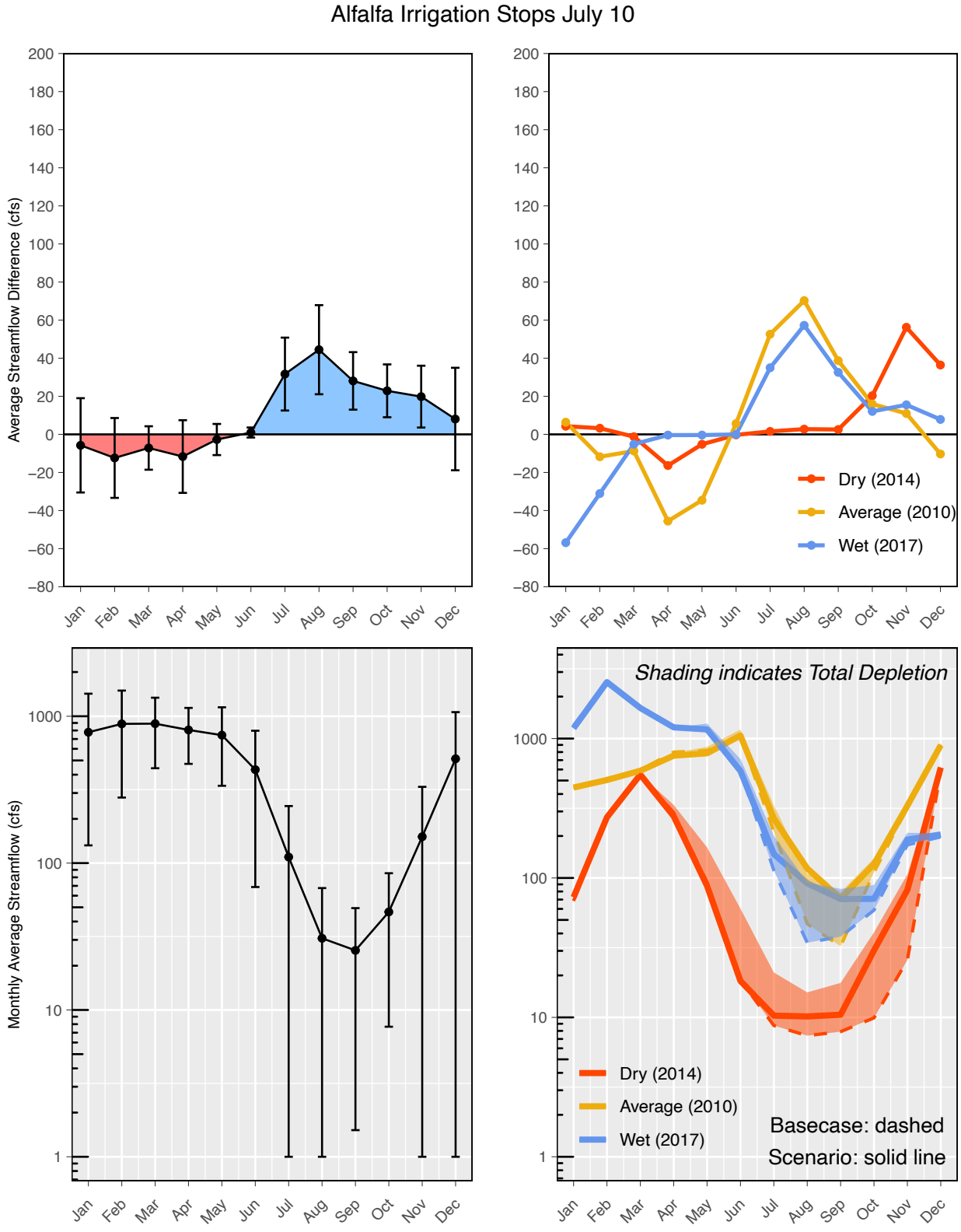

80% of Historical Irrigation Demand
Average Streamflow Difference (cfs)
200
180
160
140
120
100
80
60
40
20
0
−20
−40
−60
−80
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Dry (2014)
Average (2010)
Wet (2017)
Monthly Average Streamflow (cfs)
1000
100
10
1
Shading indicates Total Depletion
Basecase: dashed
Scenario: solid line

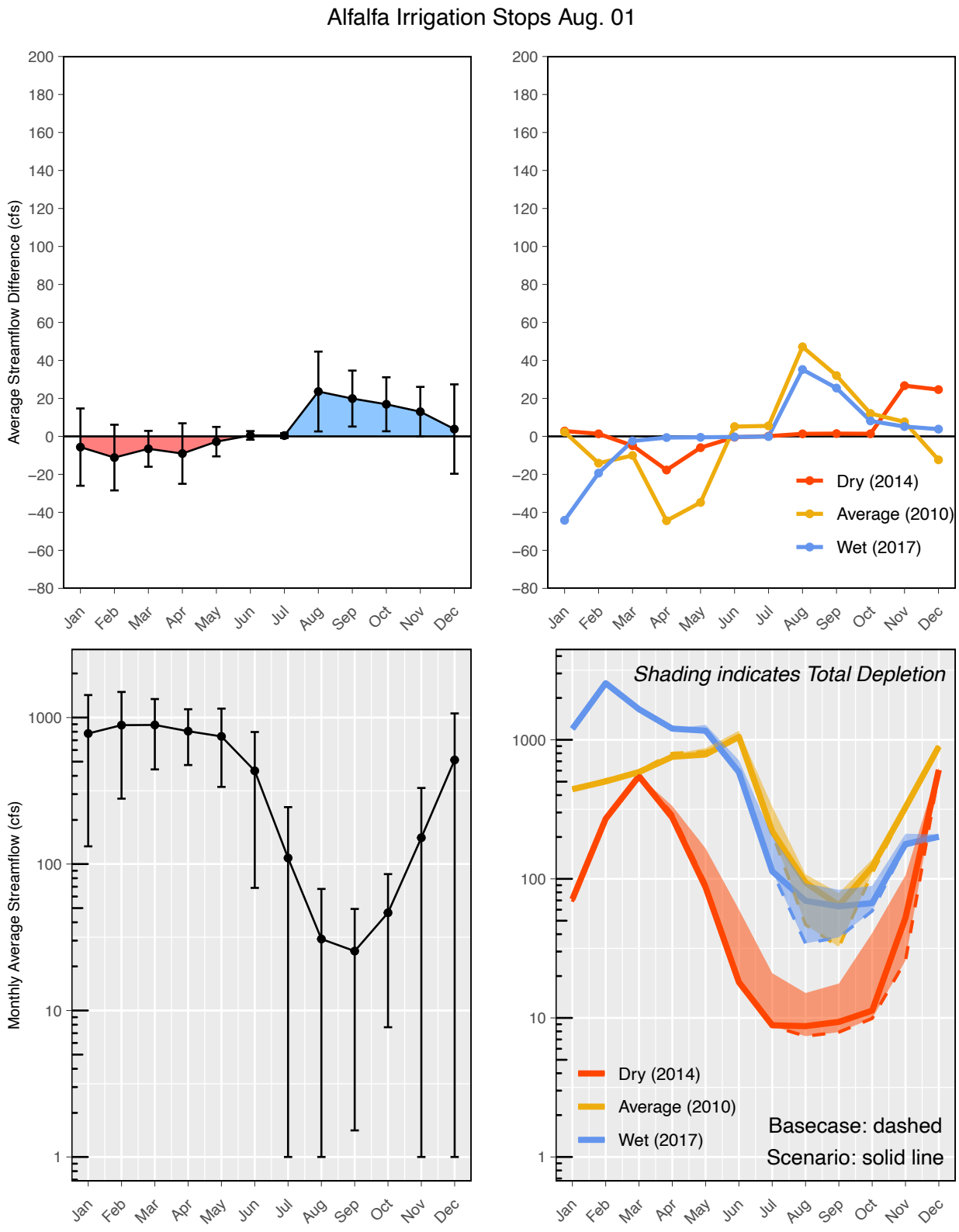

90% of Historical Irrigation Demand
Average Streamflow Difference (cfs)
200
180
160
140
120
100
80
60
40
20
0
−20
−40
−60
−80
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Dry (2014)
Average (2010)
Wet (2017)
Monthly Average Streamflow (cfs)
1000
100
10
1
Shading indicates Total Depletion
Basecase: dashed
Scenario: solid line

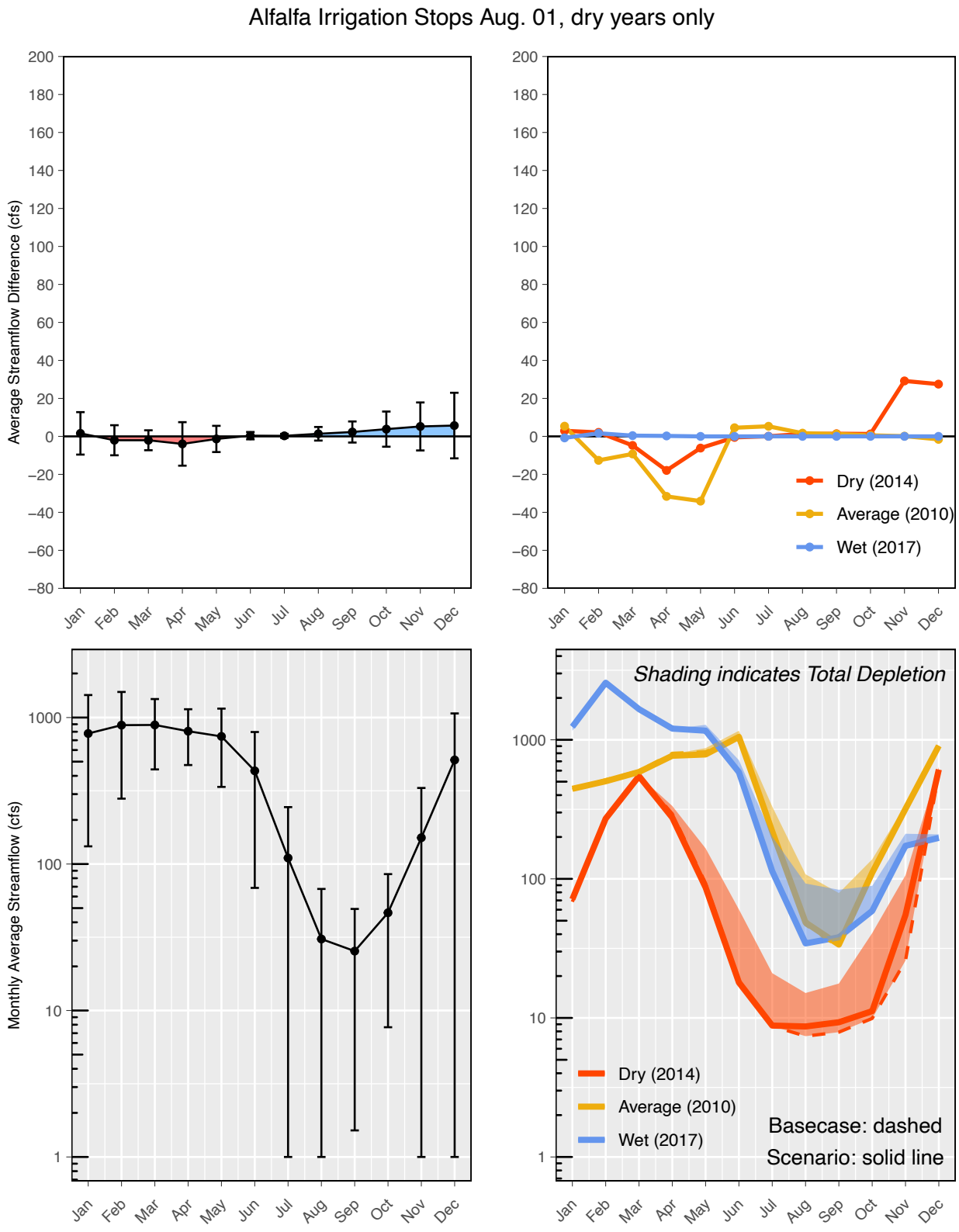

Improve Irrigation Efficiency by 10%
Average Streamflow Difference (cfs)
200
180
160
140
120
100
80
60
40
20
0
−20
−40
−60
−80
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Dry (2014)
Average (2010)
Wet (2017)
Monthly Average Streamflow (cfs)
1000
100
10
1
Shading indicates Total Depletion
Basecase: dashed
Scenario: solid line

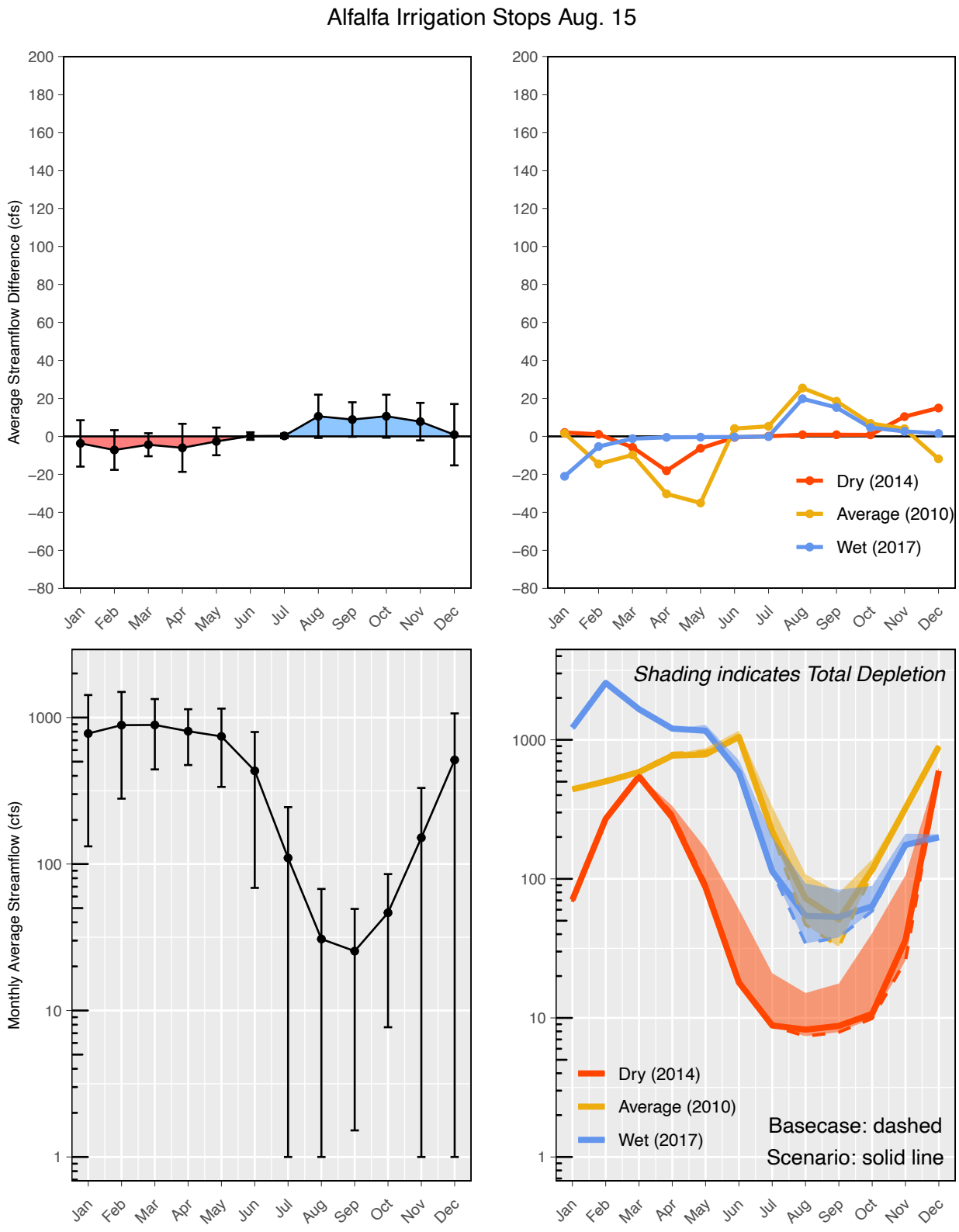

Improve Irrigation Efficiency by 20%
Average Streamflow Difference (cfs)
200
180
160
140
120
100
80
60
40
20
0
−20
−40
−60
−80
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Dry (2014)
Average (2010)
Wet (2017)
Monthly Average Streamflow (cfs)
1000
100
10
1
Shading indicates Total Depletion
Basecase: dashed
Scenario: solid line

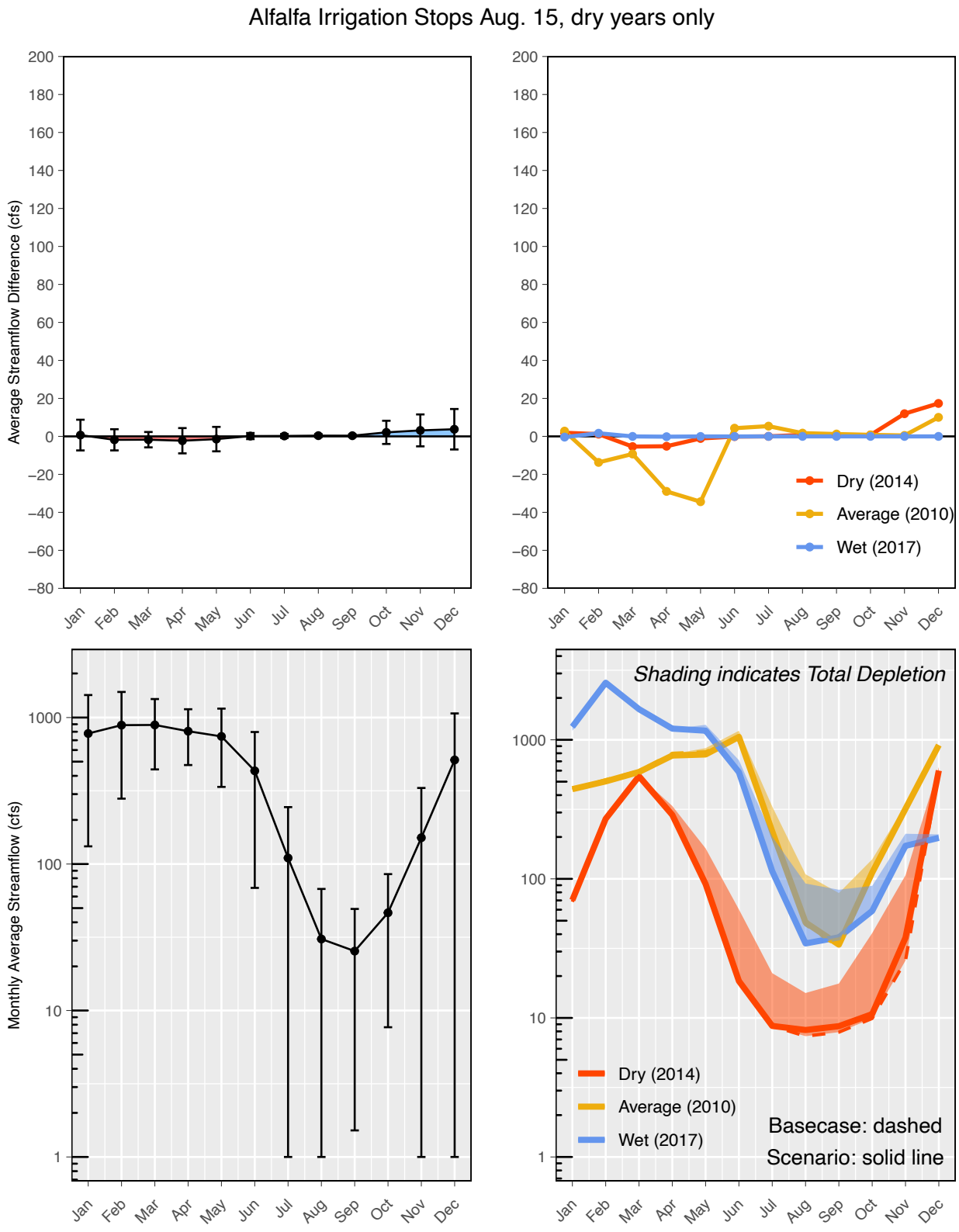

Reduce Irrigation Efficiency by 10%
Average Streamflow Difference (cfs)
200
180
160
140
120
100
80
60
40
20
0
−20
−40
−60
−80
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Dry (2014)
Average (2010)
Wet (2017)
Monthly Average Streamflow (cfs)
1000
100
10
1
Shading indicates Total Depletion
Basecase: dashed
Scenario: solid line

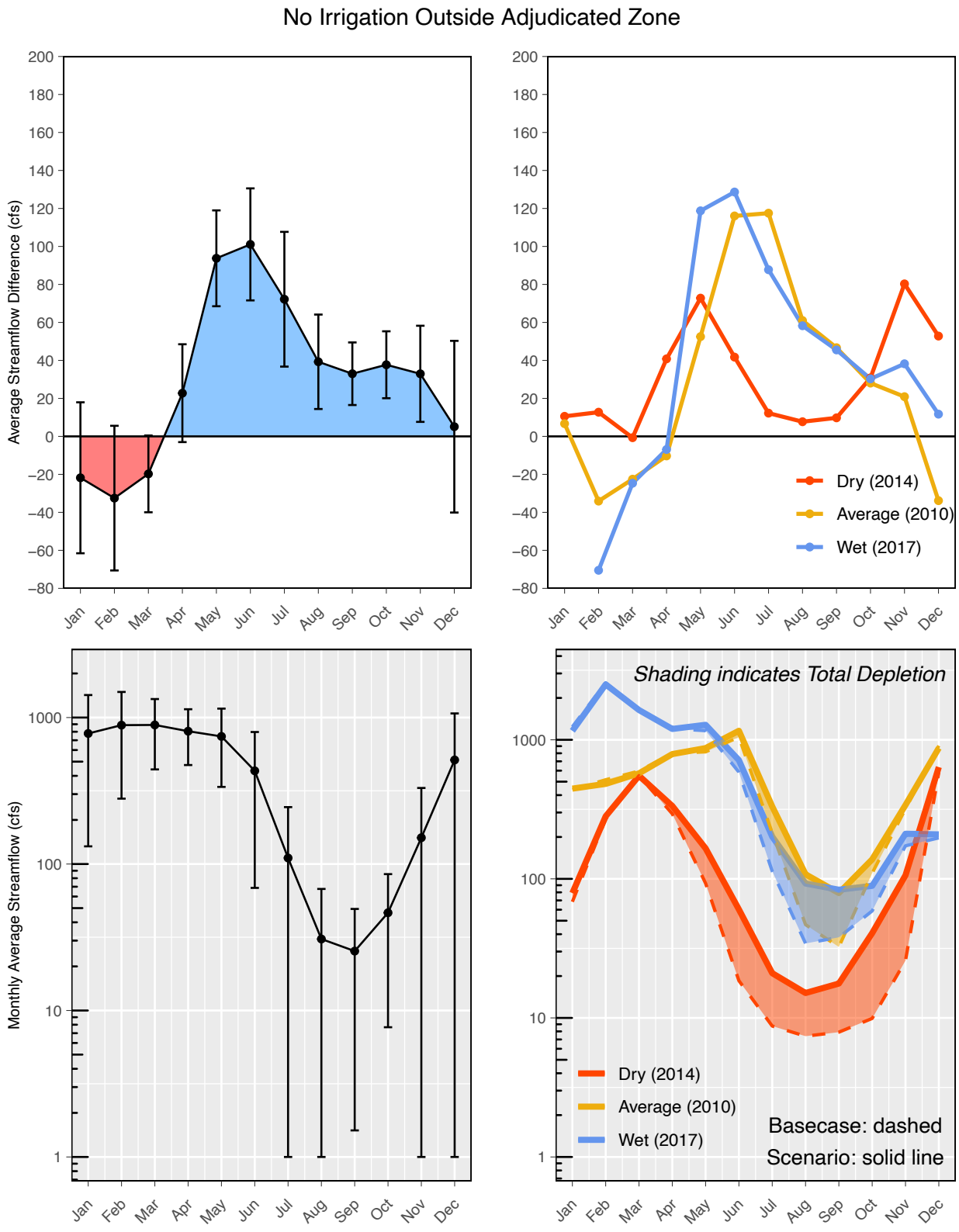

Alfalfa Irrigation Stops July 10
Average Streamflow Difference (cfs)
200
180
160
140
120
100
80
60
40
20
0
−20
−40
−60
−80
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Dry (2014)
Average (2010)
Wet (2017)
Monthly Average Streamflow (cfs)
1000
100
10
1
Shading indicates Total Depletion
Basecase: dashed
Scenario: solid line

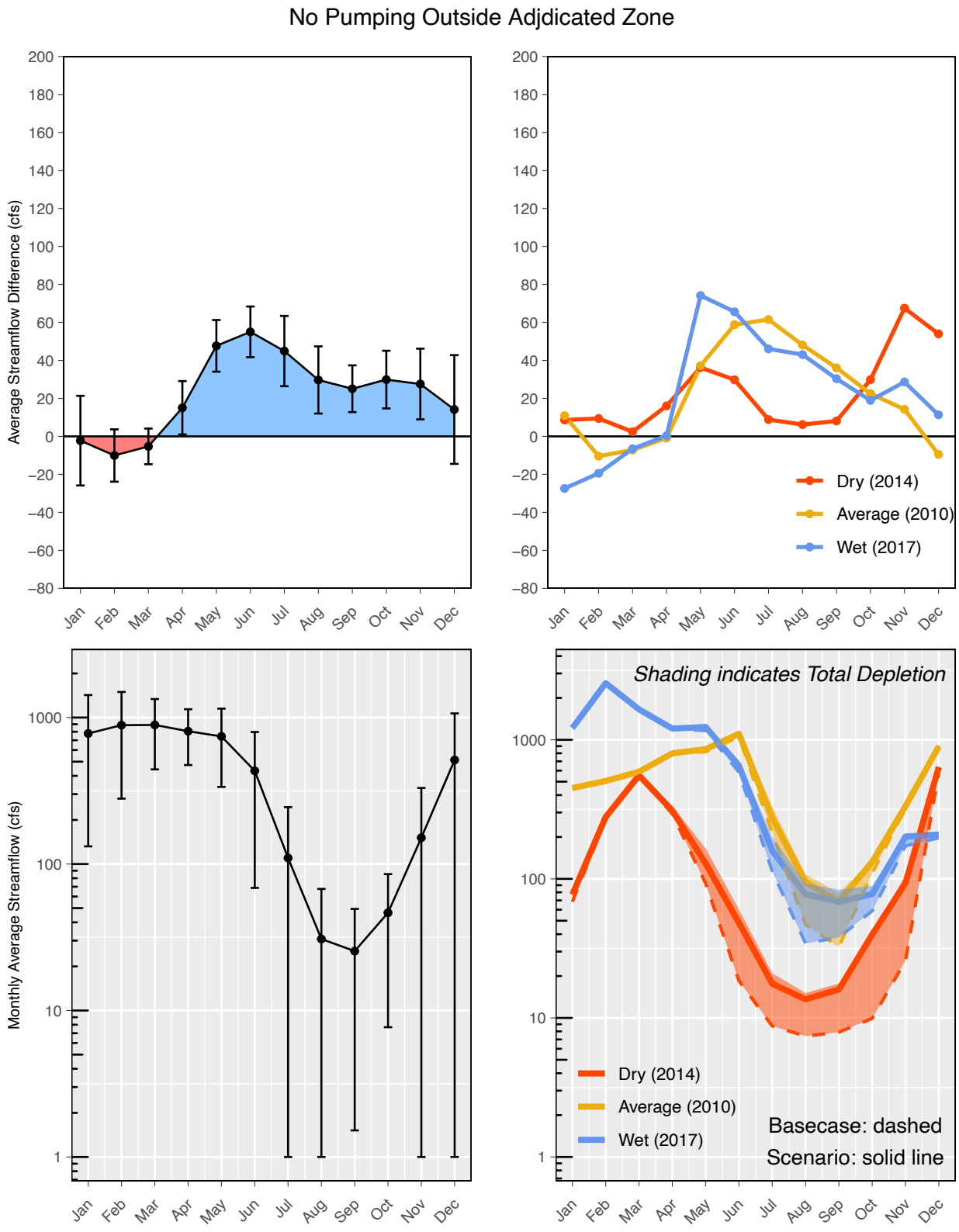

Alfalfa Irrigation Stops Aug. 01
Average Streamflow Difference (cfs)
Monthly Average Streamflow (cfs)
Dry (2014)
Average (2010)
Wet (2017)
Shading indicates Total Depletion
Basecase: dashed
Scenario: solid line
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec

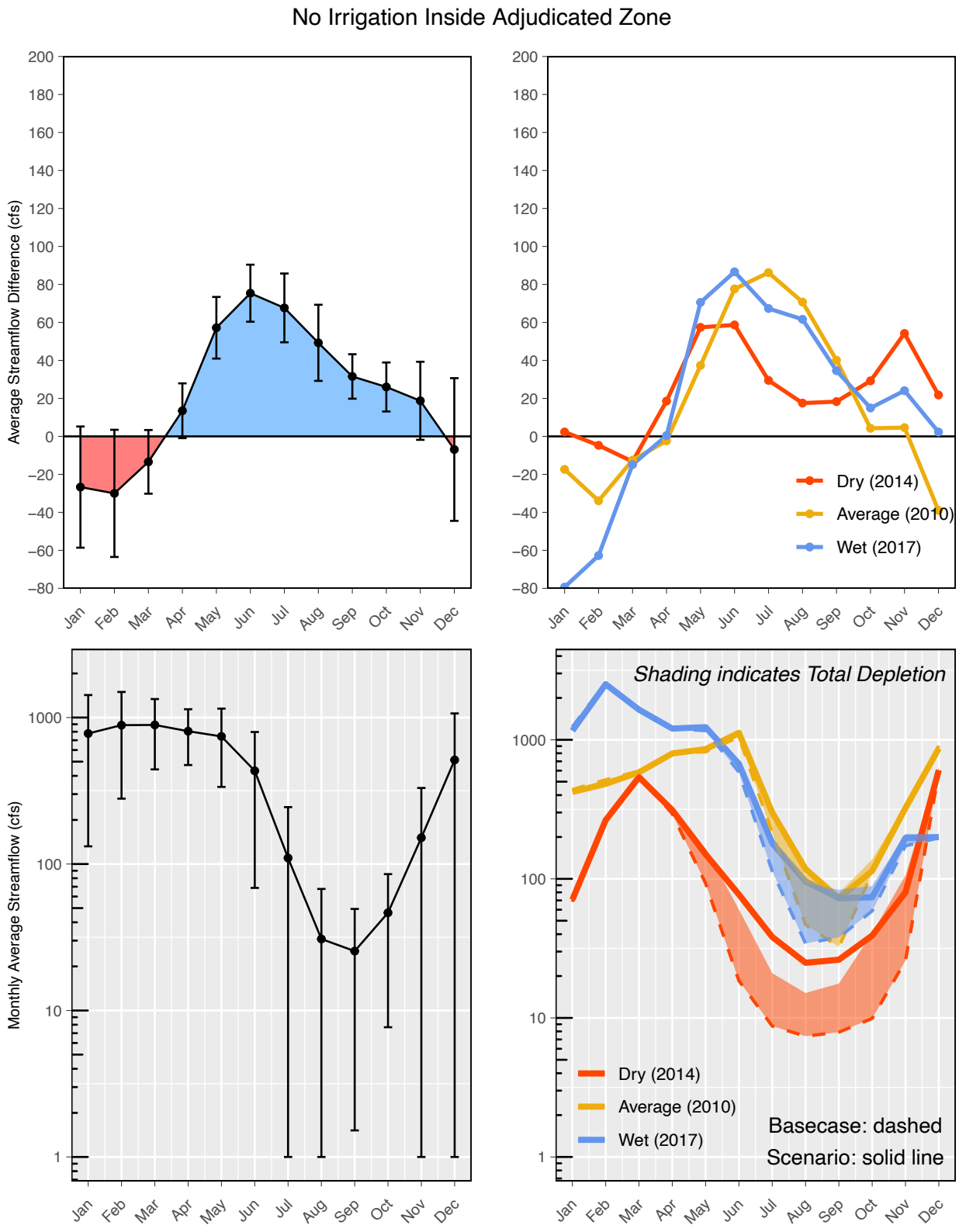

Alfalfa Irrigation Stops Aug. 01, dry years only
Average Streamflow Difference (cfs)
200
180
160
140
120
100
80
60
40
20
0
−20
−40
−60
−80
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Dry (2014)
Average (2010)
Wet (2017)
Monthly Average Streamflow (cfs)
1000
100
10
1
Shading indicates Total Depletion
Basecase: dashed
Scenario: solid line


Alfalfa Irrigation Stops Aug. 15
Average Streamflow Difference (cfs)
200
180
160
140
120
100
80
60
40
20
0
−20
−40
−60
−80
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Dry (2014)
Average (2010)
Wet (2017)
Monthly Average Streamflow (cfs)
1000
100
10
1
Shading indicates Total Depletion
Basecase: dashed
Scenario: solid line


Alfalfa Irrigation Stops Aug. 15, dry years only
Average Streamflow Difference (cfs)
200
180
160
140
120
100
80
60
40
20
0
−20
−40
−60
−80
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Dry (2014)
Average (2010)
Wet (2017)
Monthly Average Streamflow (cfs)
1000
100
10
1
Shading indicates Total Depletion
Basecase: dashed
Scenario: solid line


No Irrigation Outside Adjudicated Zone
Average Streamflow Difference (cfs)
Monthly Average Streamflow (cfs)
Dry (2014)
Average (2010)
Wet (2017)
Shading indicates Total Depletion
Basecase: dashed
Scenario: solid line
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec


No Pumping Outside Adjdicated Zone
Average Streamflow Difference (cfs)
200
180
160
140
120
100
80
60
40
20
0
−20
−40
−60
−80
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Dry (2014)
Average (2010)
Wet (2017)
Monthly Average Streamflow (cfs)
1000
100
10
1
Shading indicates Total Depletion
Basecase: dashed
Scenario: solid line


No Irrigation Inside Adjudicated Zone
Average Streamflow Difference (cfs)
Monthly Average Streamflow (cfs)
Dry (2014)
Average (2010)
Wet (2017)
Shading indicates Total Depletion
Basecase: dashed
Scenario: solid line
Jan
Feb
Mar
Apr
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Jun
Jul
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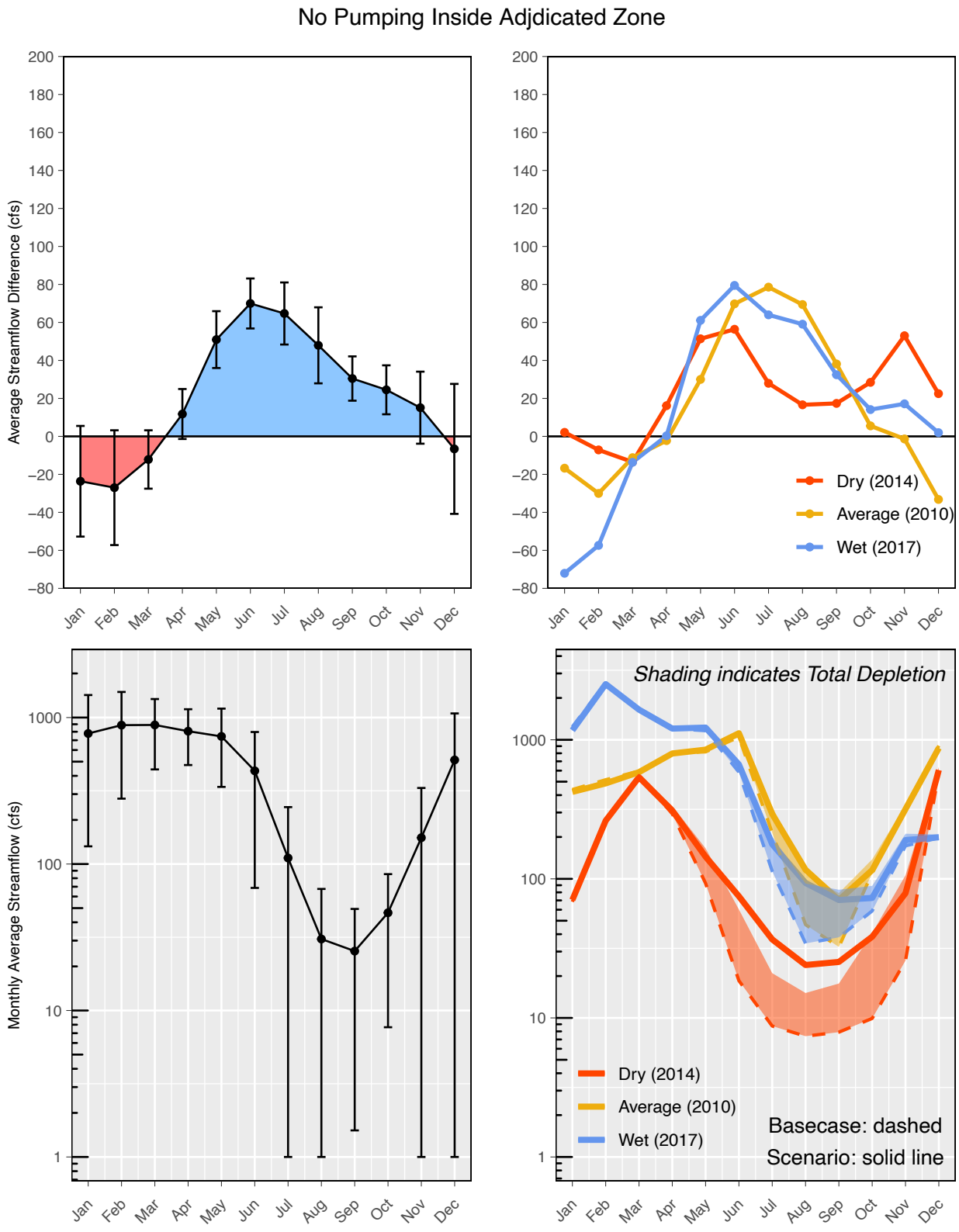
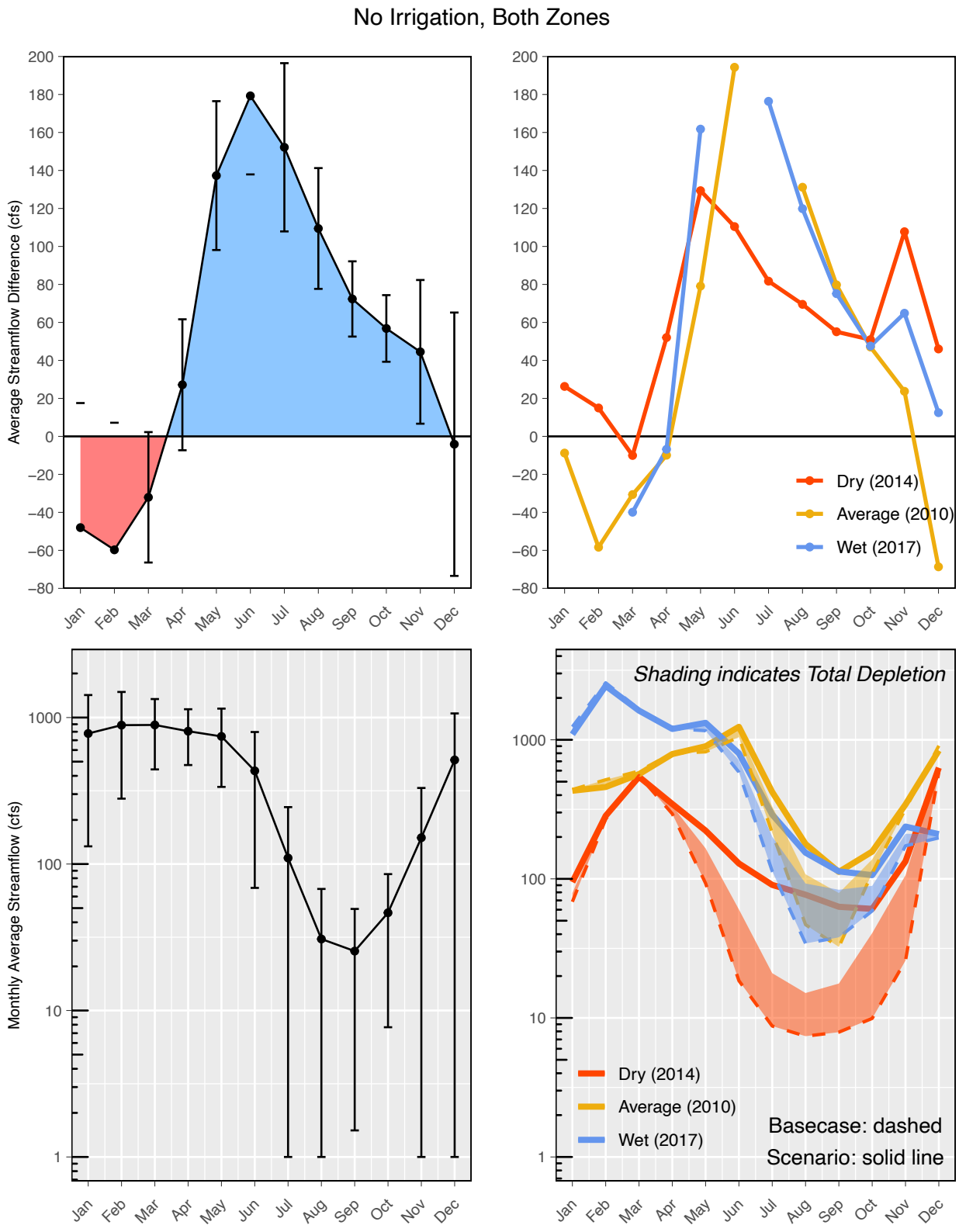
Sep
Oct
Nov
Dec


No Pumping Inside Adjdicated Zone
Average Streamflow Difference (cfs)
200
180
160
140
120
100
80
60
40
20
0
−20
−40
−60
−80
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Dry (2014)
Average (2010)
Wet (2017)
Monthly Average Streamflow (cfs)
1000
100
10
1
Shading indicates Total Depletion
Basecase: dashed
Scenario: solid line


No Irrigation, Both Zones
Average Streamflow Difference (cfs)
Monthly Average Streamflow (cfs)
Dry (2014)
Average (2010)
Wet (2017)
Shading indicates Total Depletion
Basecase: dashed
Scenario: solid line
Jan
Feb
Mar
Apr
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Jun
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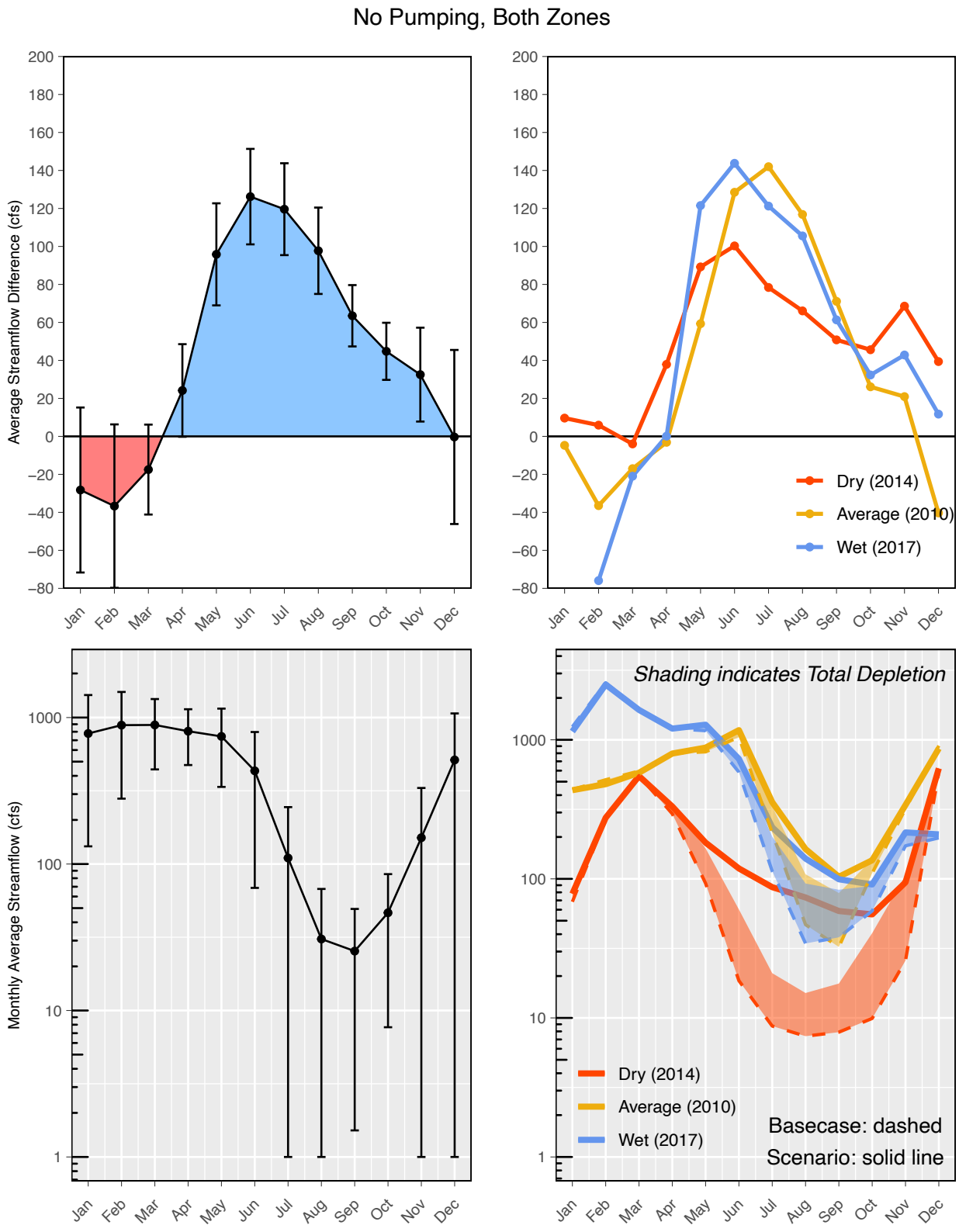
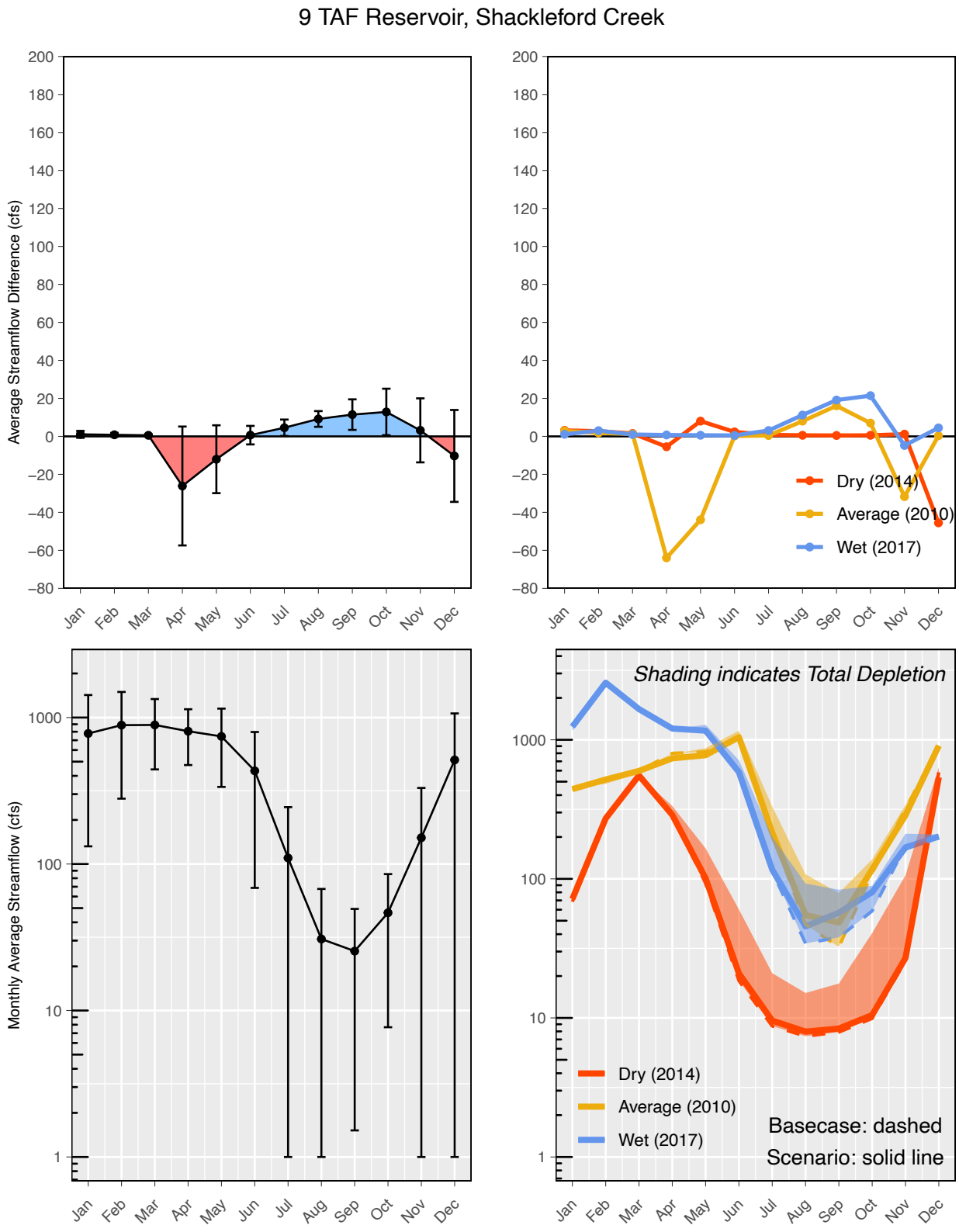
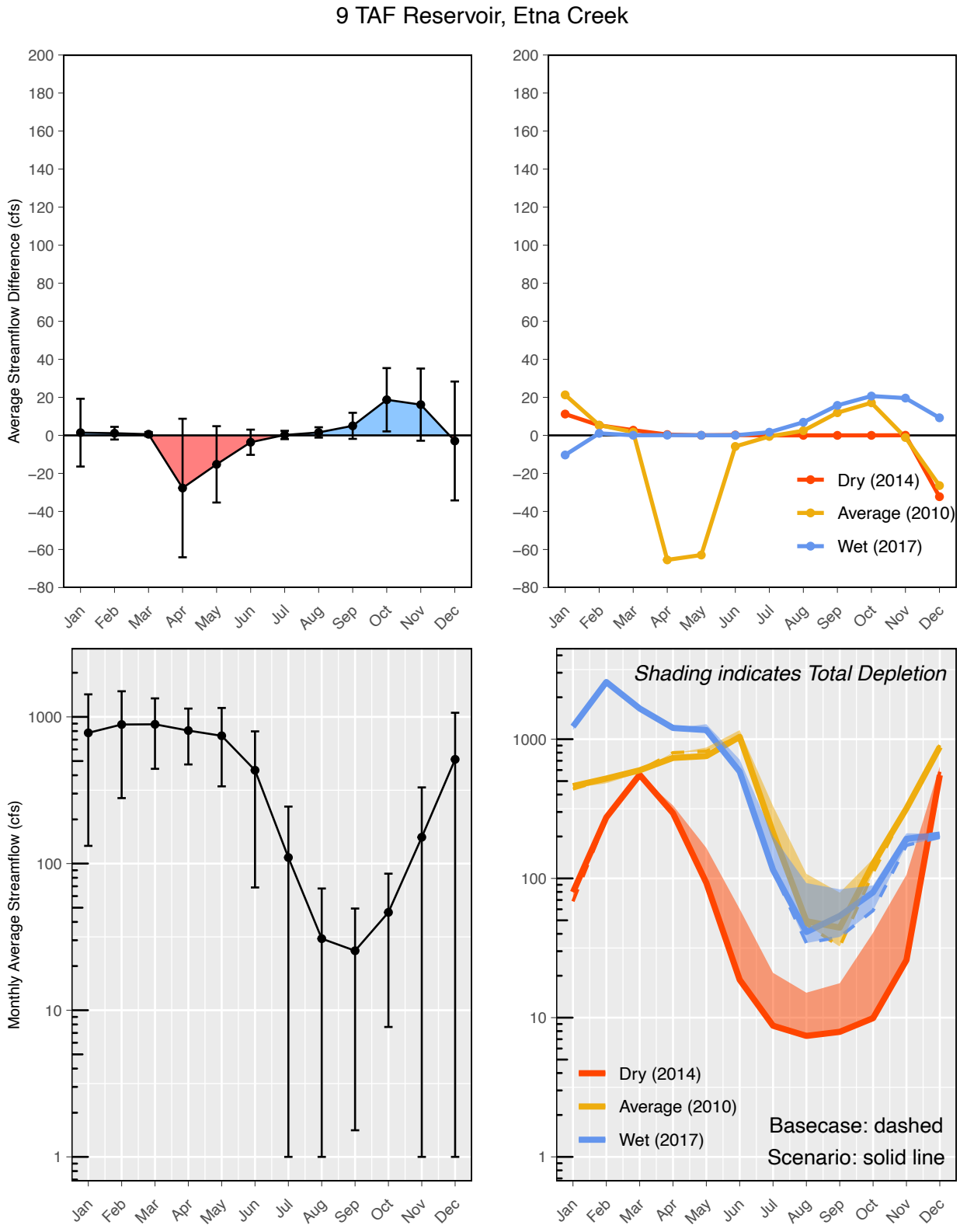
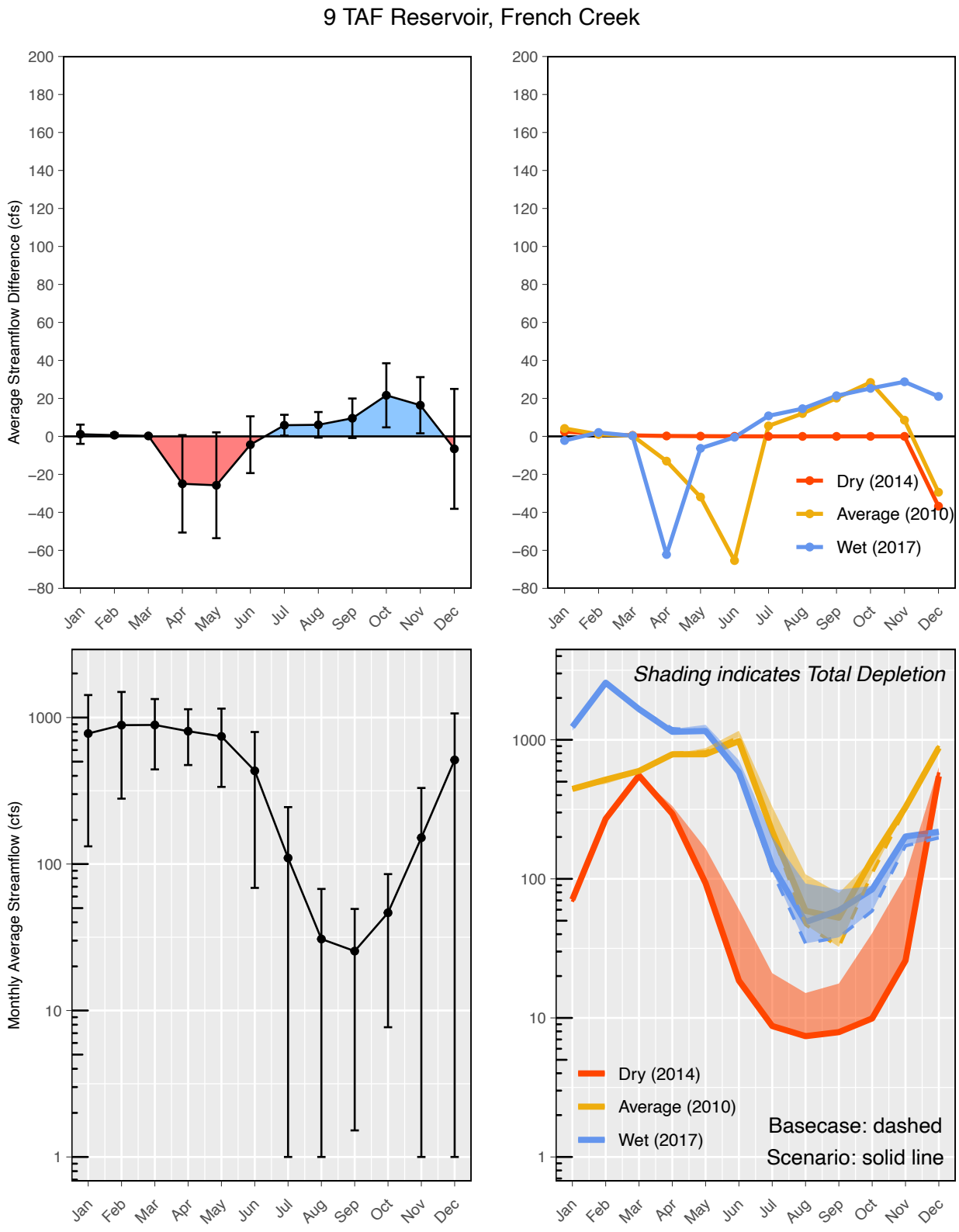
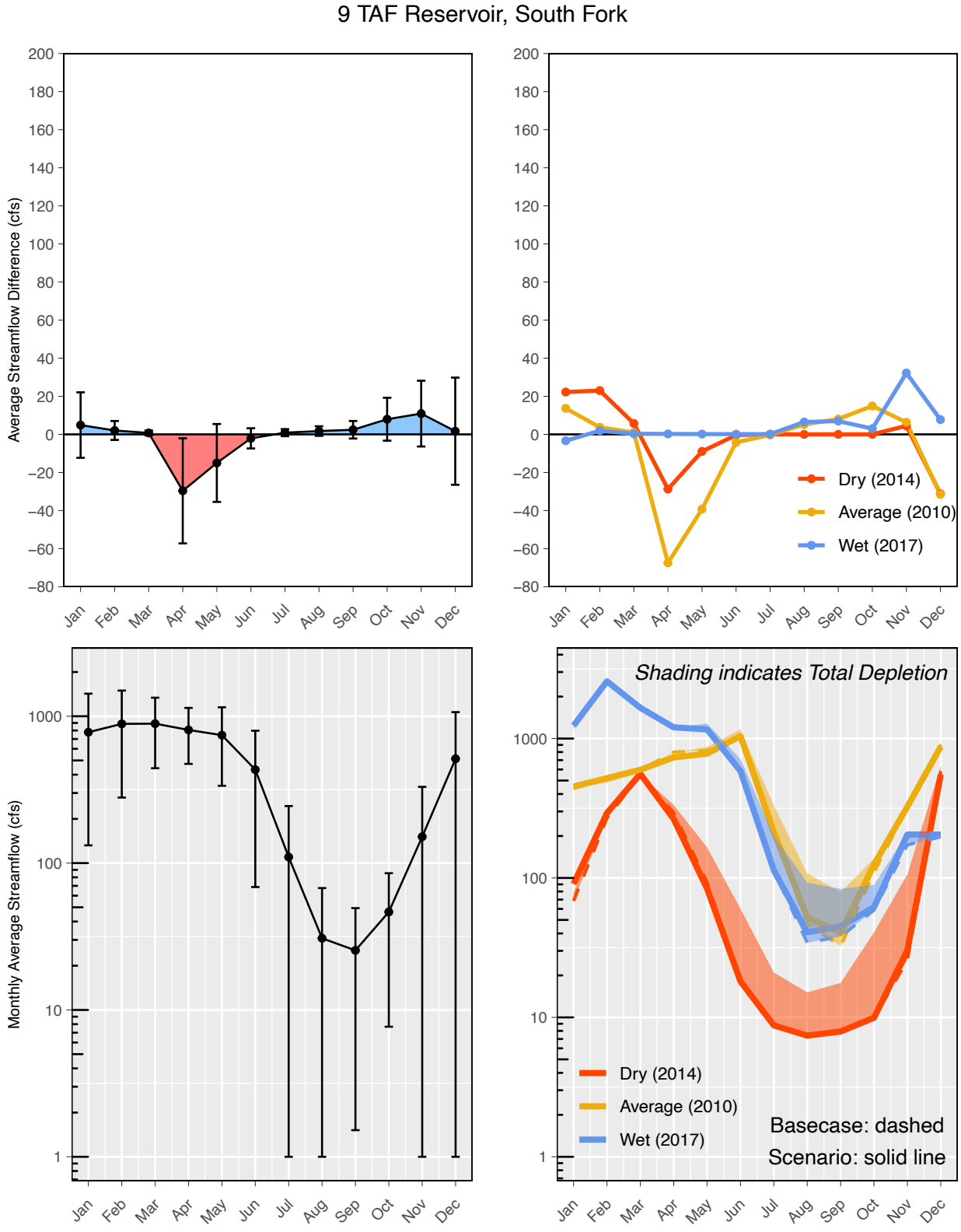
Oct
Nov
Dec

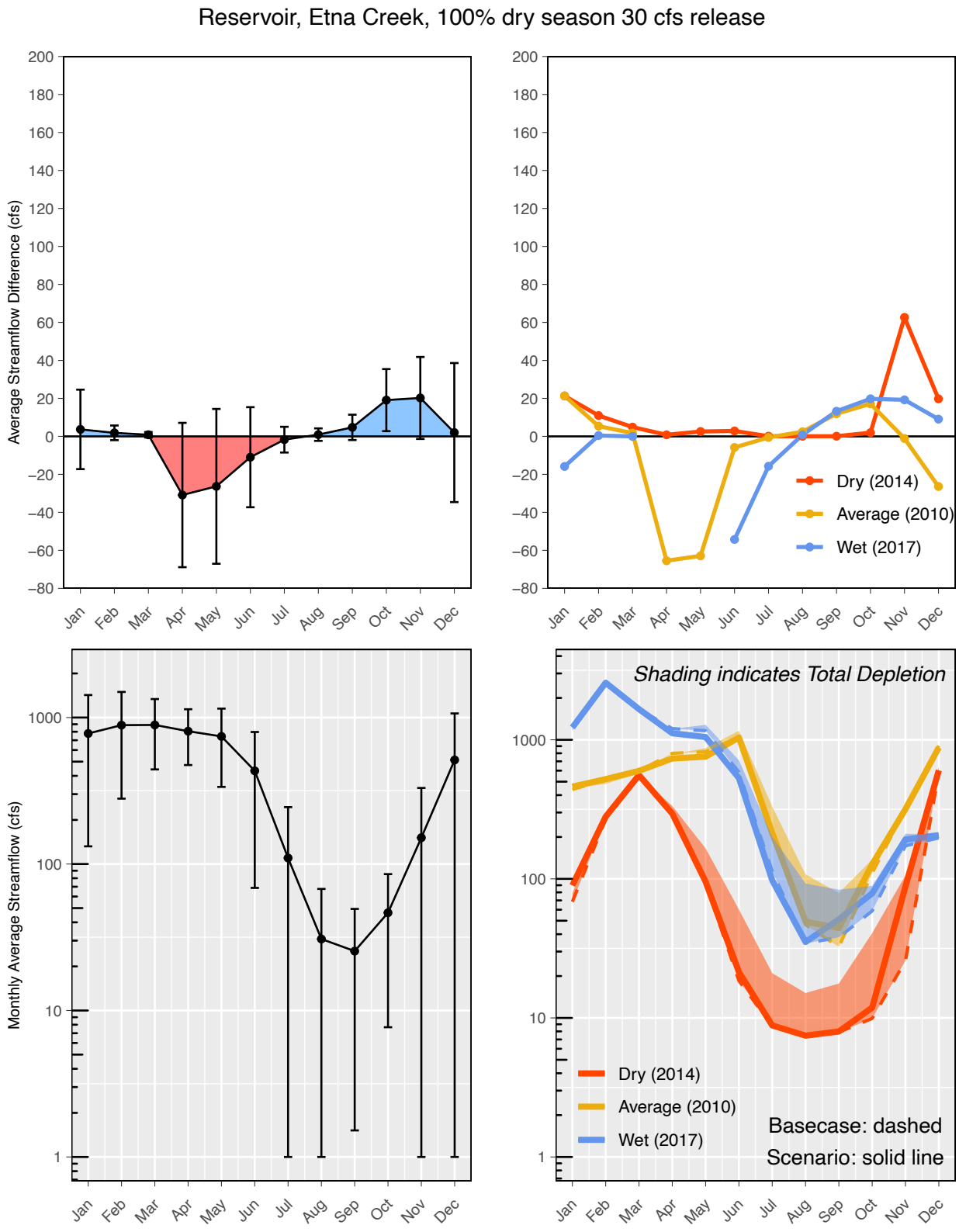

No Pumping, Both Zones
Average Streamflow Difference (cfs)
Monthly Average Streamflow (cfs)
Dry (2014)
Average (2010)
Wet (2017)
Shading indicates Total Depletion
Basecase: dashed
Scenario: solid line
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec

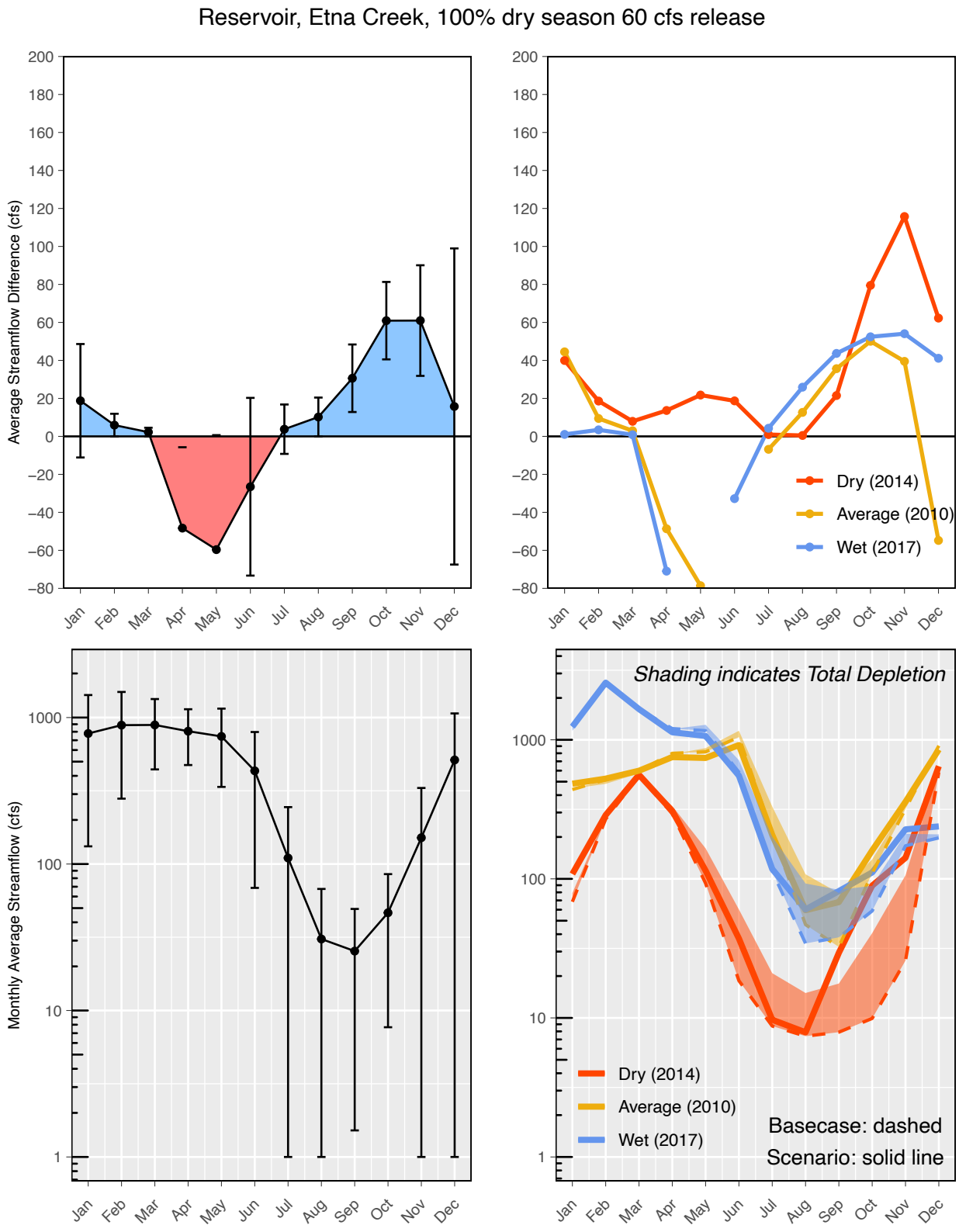

9 TAF Reservoir, Shackleford Creek
Average Streamflow Difference (cfs)
200
180
160
140
120
100
80
60
40
20
0
−20
−40
−60
−80
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Dry (2014)
Average (2010)
Wet (2017)
Monthly Average Streamflow (cfs)
1000
100
10
1
Shading indicates Total Depletion
Basecase: dashed
Scenario: solid line


9 TAF Reservoir, Etna Creek
Average Streamflow Difference (cfs)
Monthly Average Streamflow (cfs)
Dry (2014)
Average (2010)
Wet (2017)
Shading indicates Total Depletion
Basecase: dashed
Scenario: solid line
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec


9 TAF Reservoir, French Creek
Average Streamflow Difference (cfs)
Monthly Average Streamflow (cfs)
Dry (2014)
Average (2010)
Wet (2017)
Shading indicates Total Depletion
Basecase: dashed
Scenario: solid line
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec


9 TAF Reservoir, South Fork
Average Streamflow Difference (cfs)
200
180
160
140
120
100
80
60
40
20
0
−20
−40
−60
−80
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Dry (2014)
Average (2010)
Wet (2017)
Monthly Average Streamflow (cfs)
1000
100
10
1
Shading indicates Total Depletion
Basecase: dashed
Scenario: solid line


Reservoir, Etna Creek, 100% dry season 30 cfs release
Average Streamflow Difference (cfs)
Monthly Average Streamflow (cfs)
Dry (2014)
Average (2010)
Wet (2017)
Shading indicates Total Depletion
Basecase: dashed
Scenario: solid line
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec


Reservoir, Etna Creek, 100% dry season 60 cfs release
Average Streamflow Difference (cfs)
Monthly Average Streamflow (cfs)
Dry (2014)
Average (2010)
Wet (2017)
Shading indicates Total Depletion
Basecase: dashed
Scenario: solid line
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec

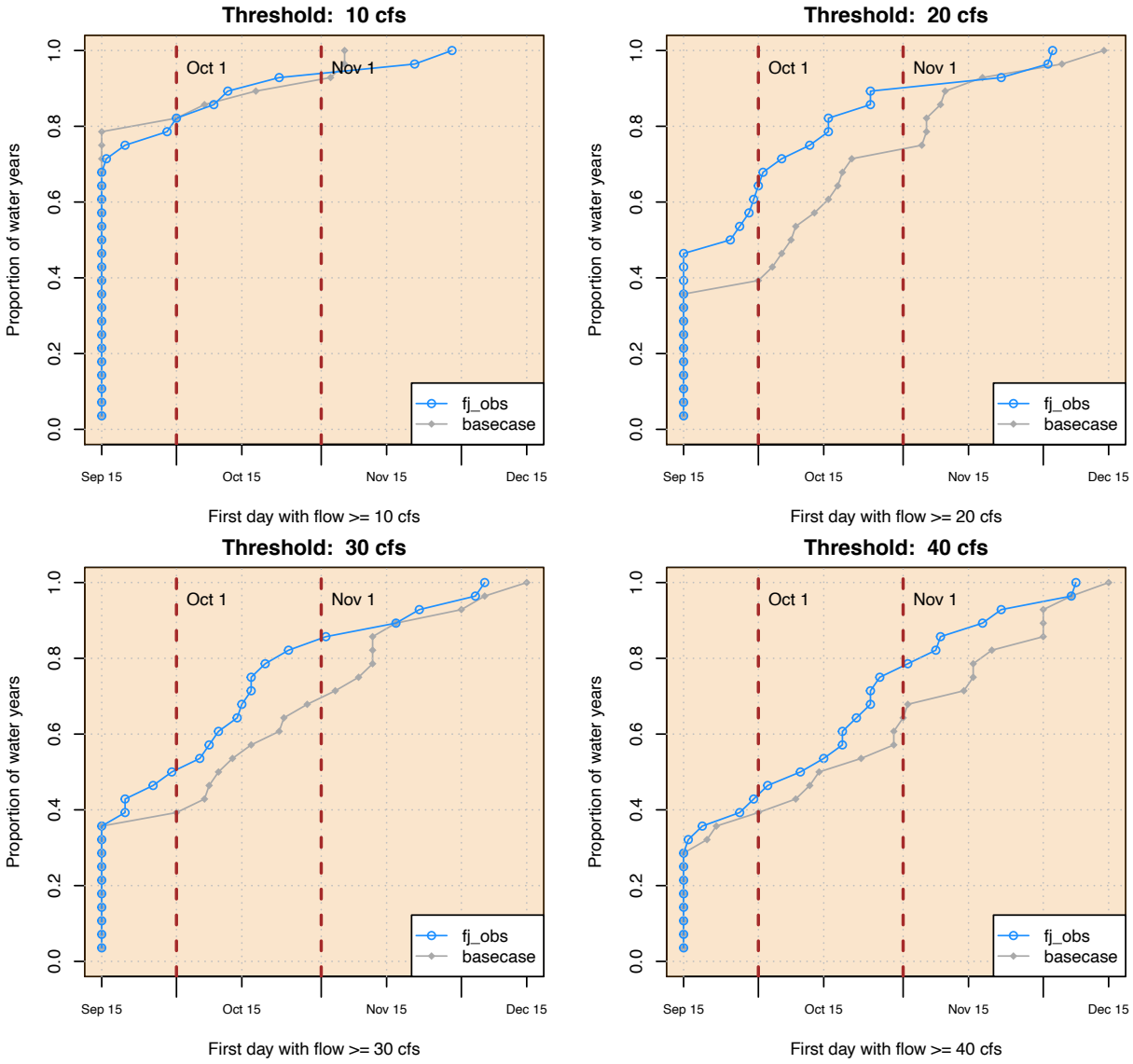
Rising flows in the fall ("reconnection" date distribution)

In the late summer and early fall, the Scott River can be dry, or running so low as to be impassable for spawning salmon. In these years, the "reconnection date" of the river is an important metric of ecosystem services: did the river become passable for salmon early enough in the spawning season?

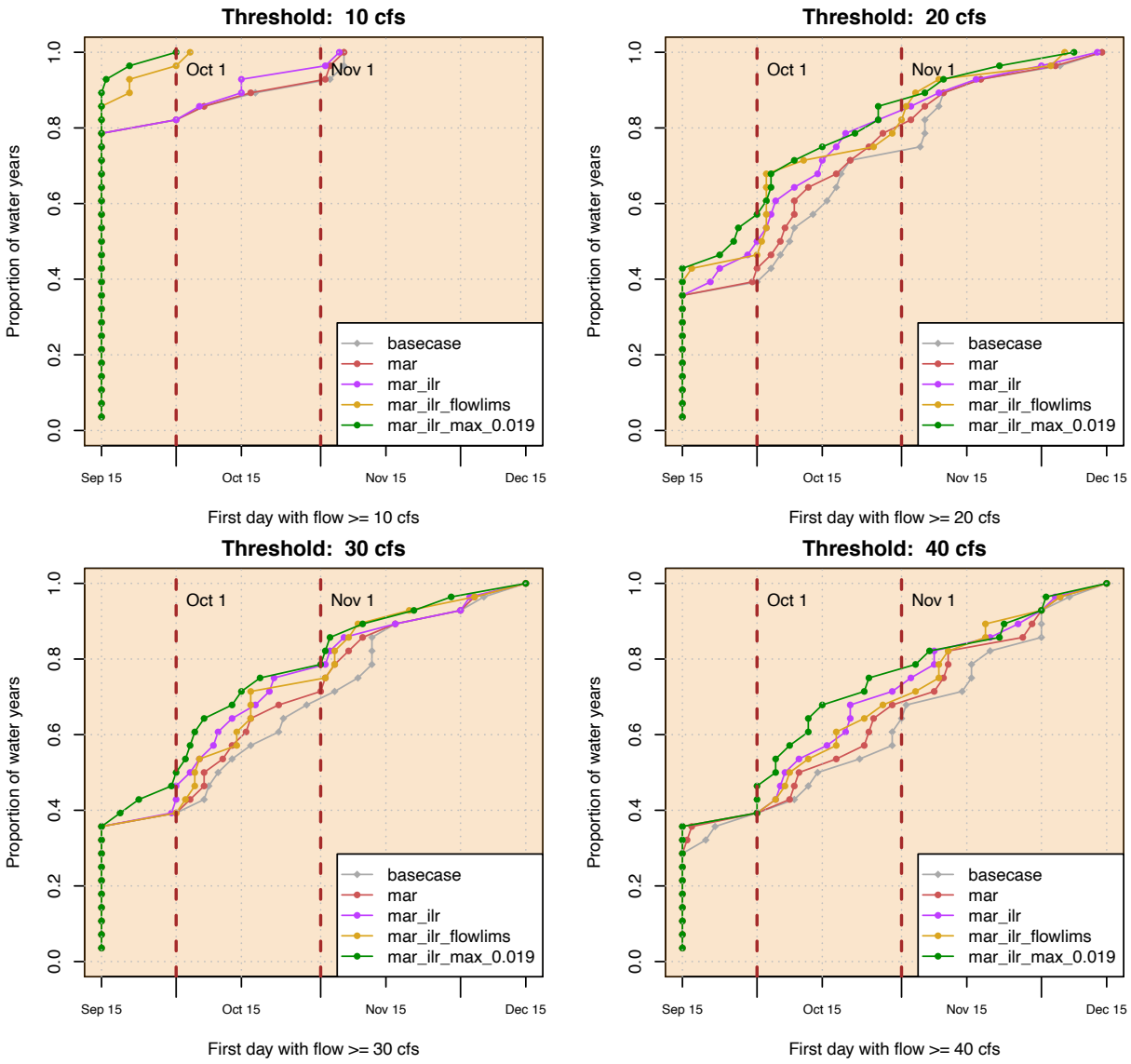
These results show the distribution of threshold-crossing dates of flow at the Fort Jones Gauge, or the first date in the fall season on which the flow exceeded a threshold. This threshold-crossing metric is assumed to be a proxy for reconnection dates. Multiple thresholds are depicted (10, 20, 30 and 40 cfs) to indicate uncertainty in the exact threshold of "reconnection" of different parts of the lower Scott River stream system.

In general, scenarios in which more water years rise above the threshold earlier indicate more favorable hydrologic conditions (or, more dots on the left side of the plots is better). See explanatory graphs at the beginning of this appendix for more information.

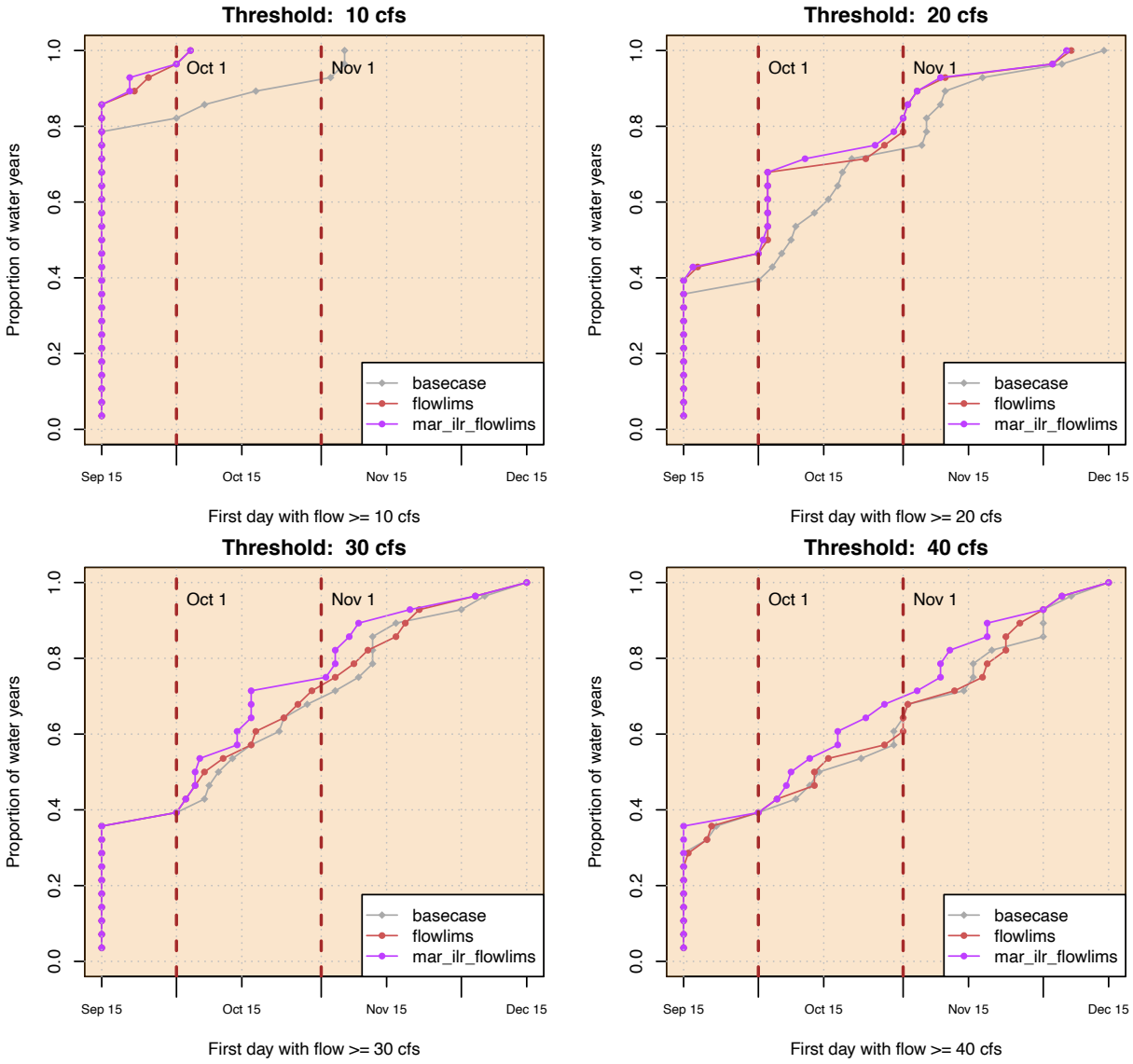
Observed and Simulated Historical FJ Flow



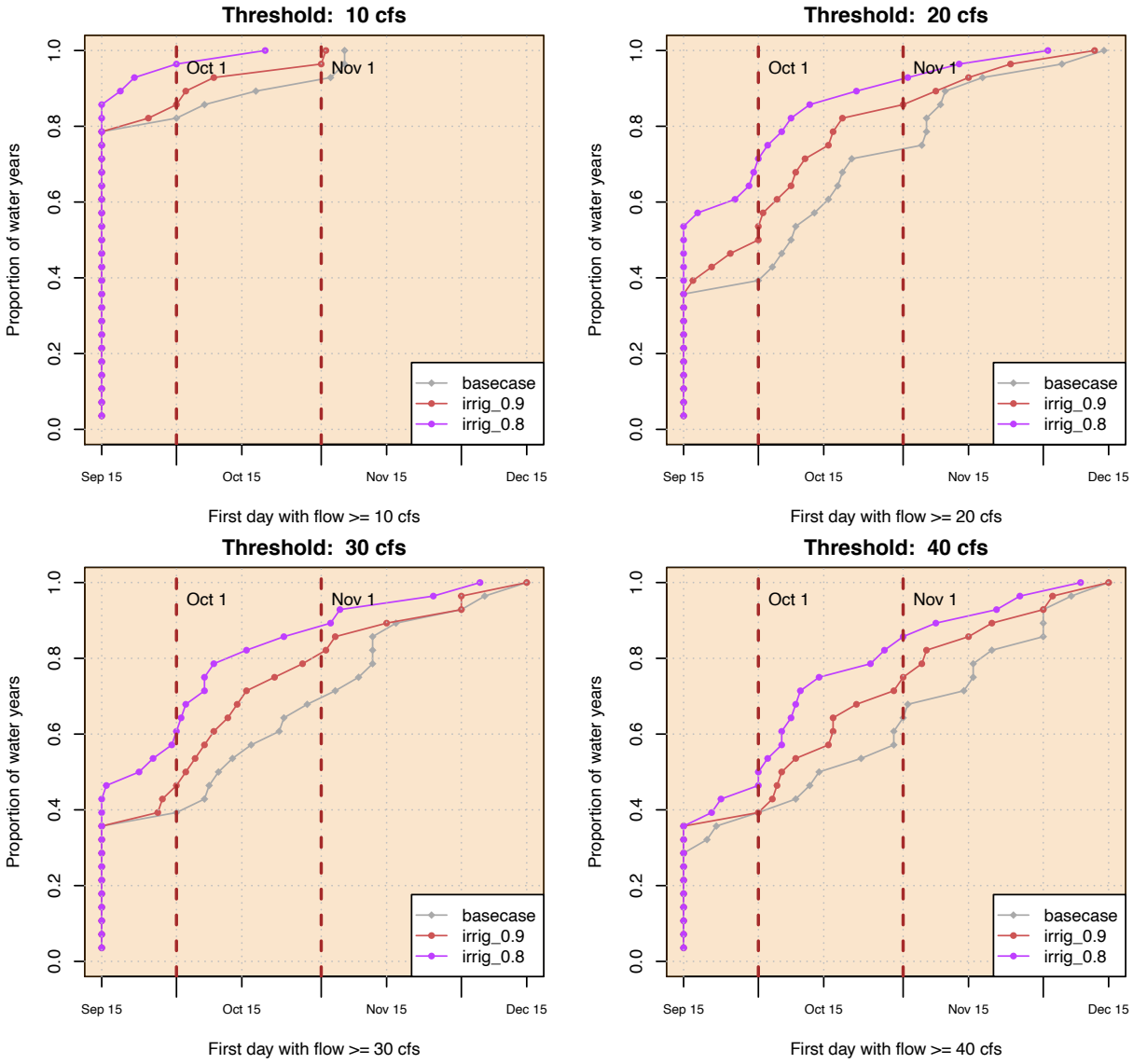
Recharge Scenarios



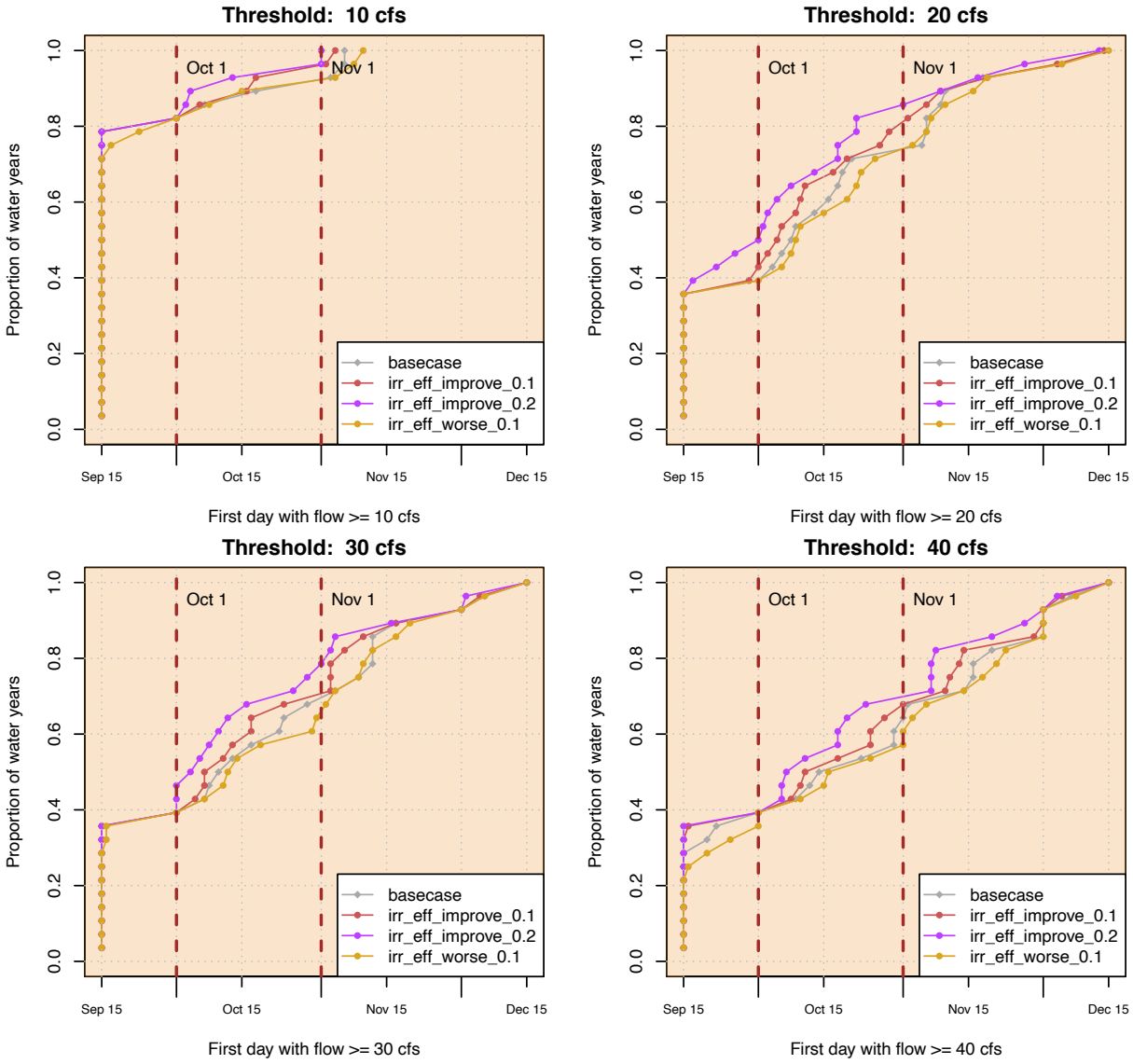
Tributary Diversion Limits at Low FLows



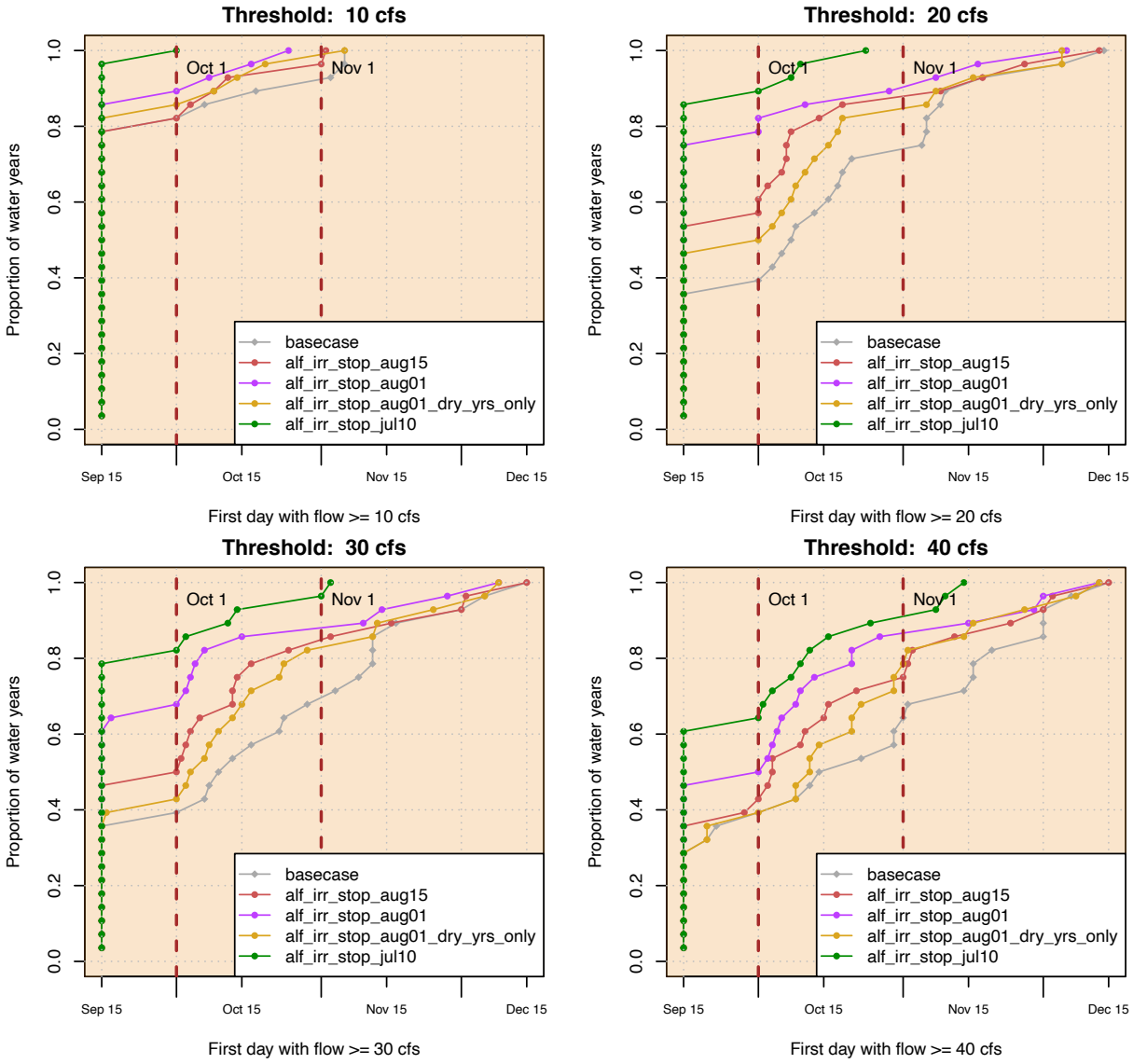
Irrigation Demand



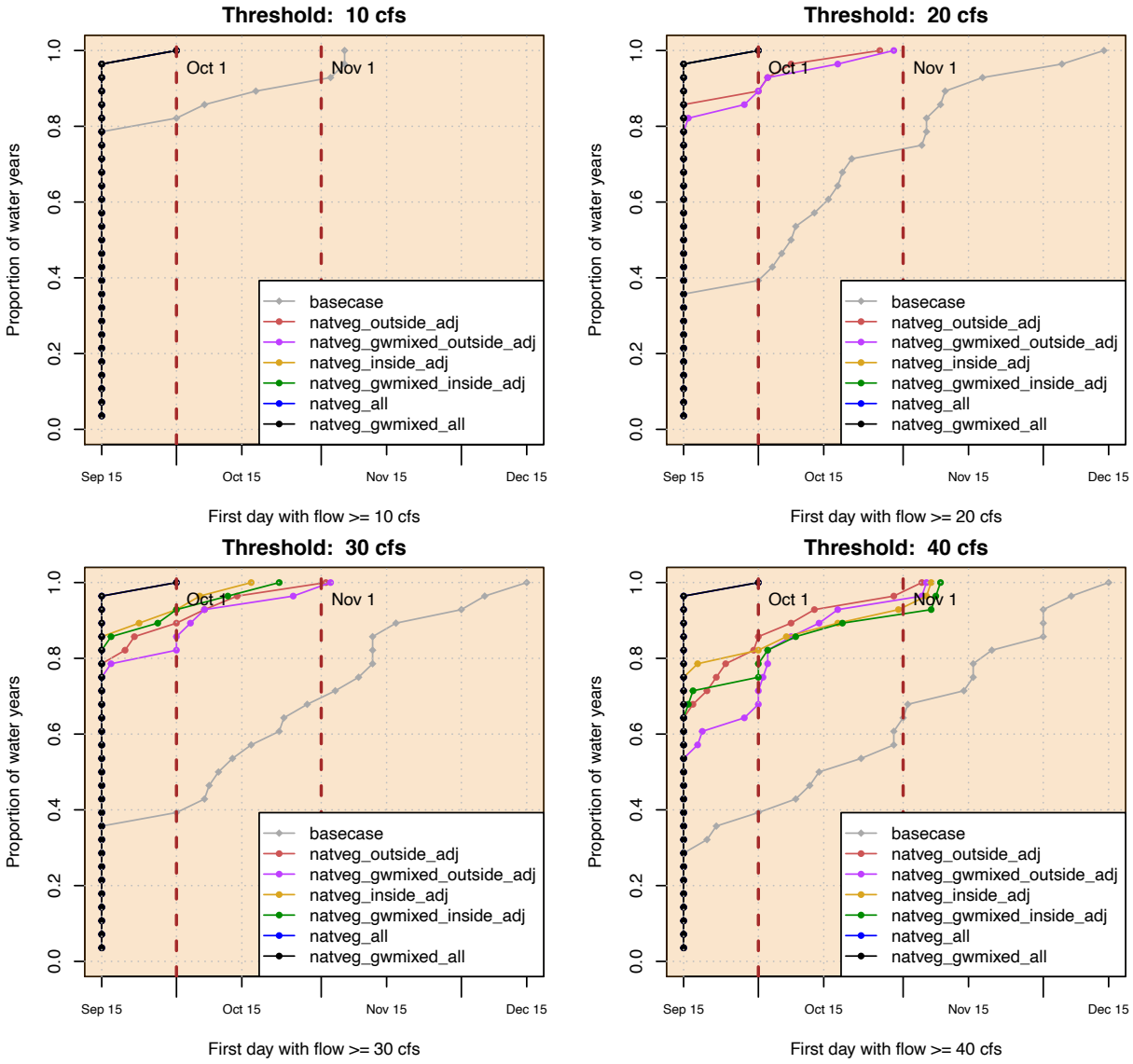
Irrigation Efficiency



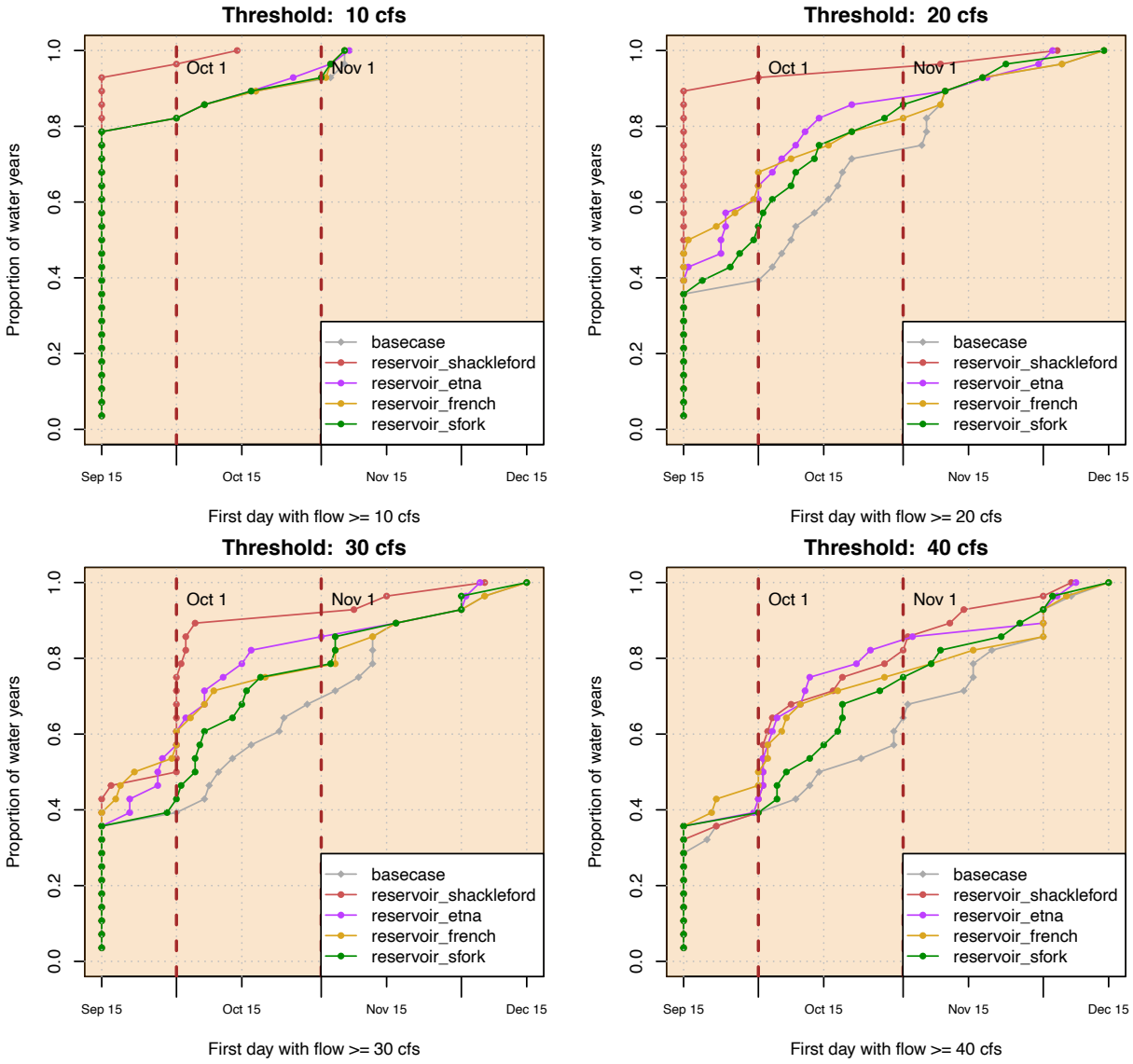
Alfalfa Irrigation Schedule



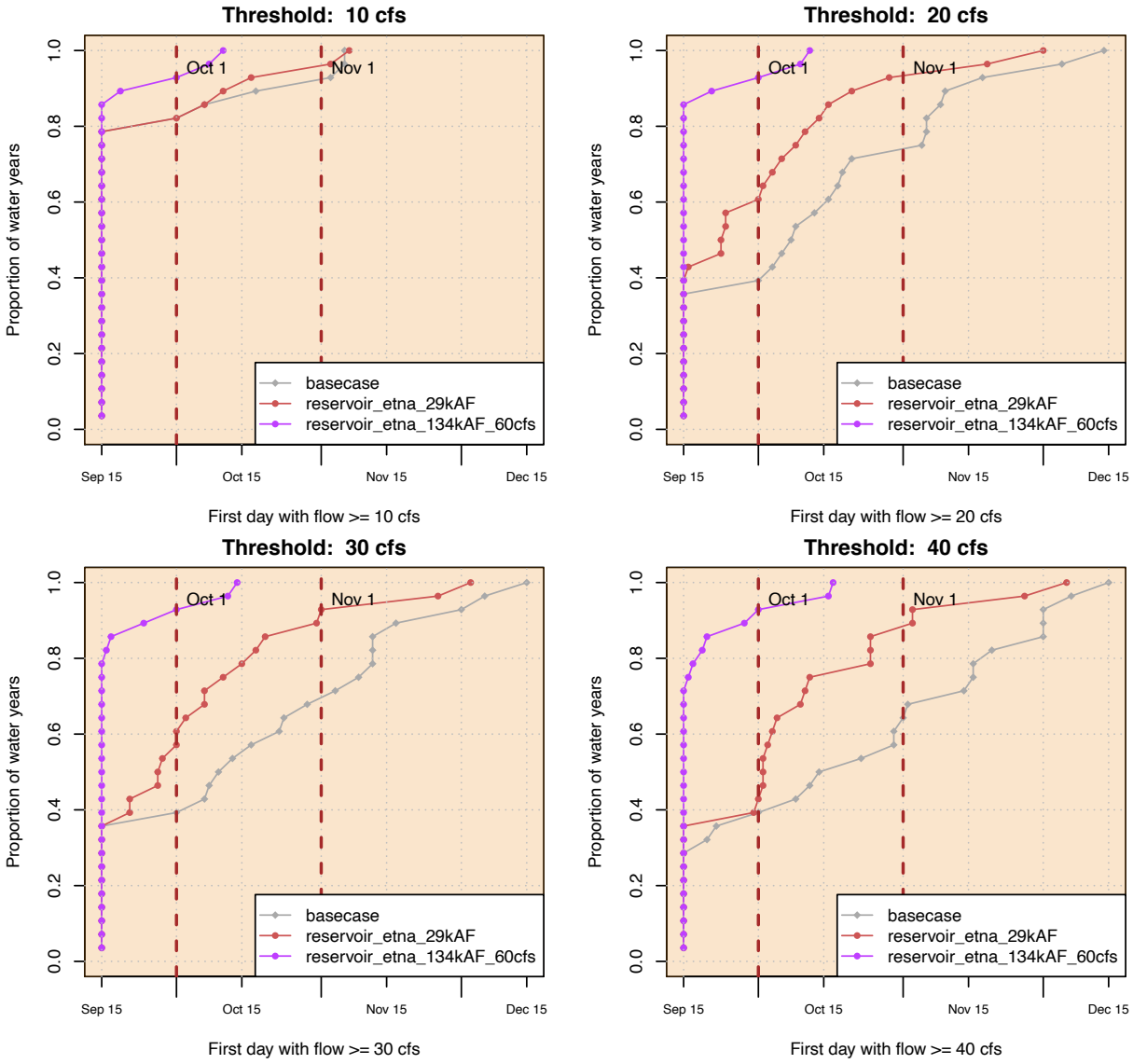
Land Use Change (Attribution Study)



Small Reservoir



100% Reliable Reservoir (30 or 60 cfs release)



Declining flows in the summer ("disconnection" date distribution)

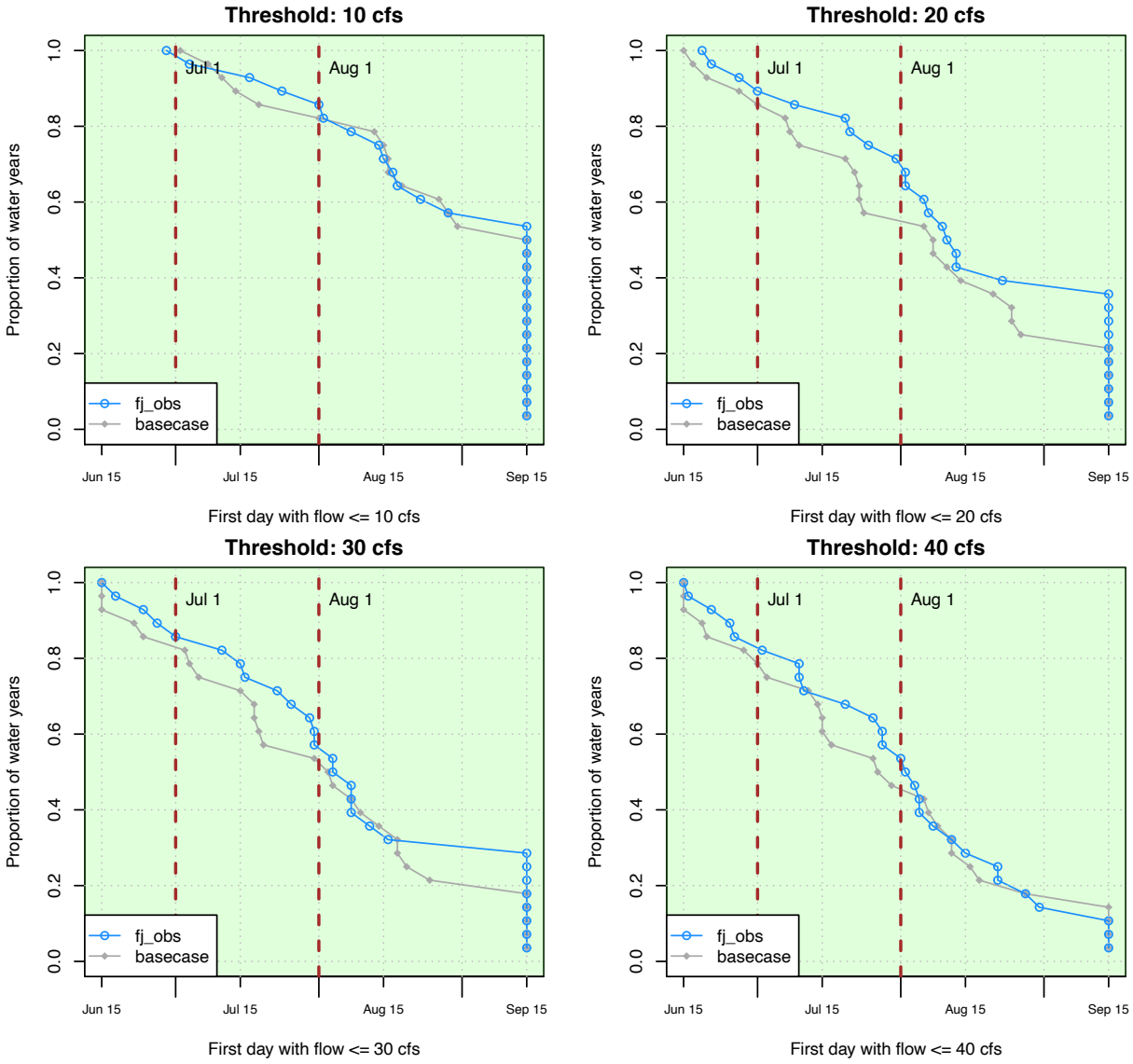
Over the course of the late spring and summer, the Scott River decreases gradually from snowmelt-influenced high flows to summer baseflow. Earlier decline in summer flows is believed to correspond to poorer habitat conditions for juvenile salmonids.

In particular, the "disconnection date" of the river is an important metric of ecosystem services: was the river flow high enough for long enough to allow juvenile salmonids to migrate out of the watershed towards the ocean?

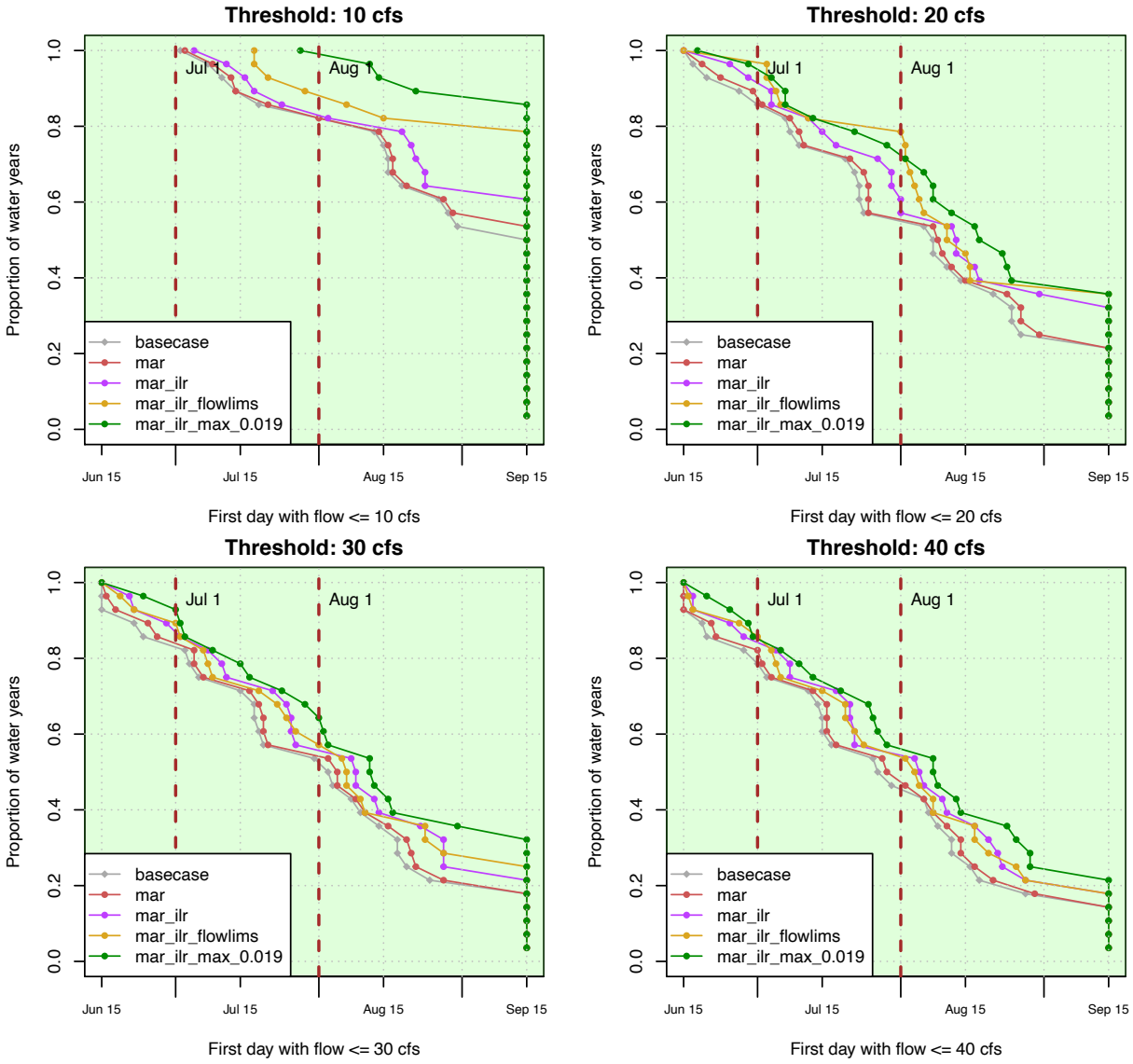
These results show the distribution of threshold-crossing dates of flow at the Fort Jones Gauge, or the first date in the summer season on which the flow fell below a threshold. This threshold-crossing metric is assumed to be a proxy for disconnection dates. Multiple thresholds are depicted (10, 20, 30 and 40 cfs) to indicate uncertainty in the exact threshold of "disconnection" of different parts of the lower Scott River stream system.

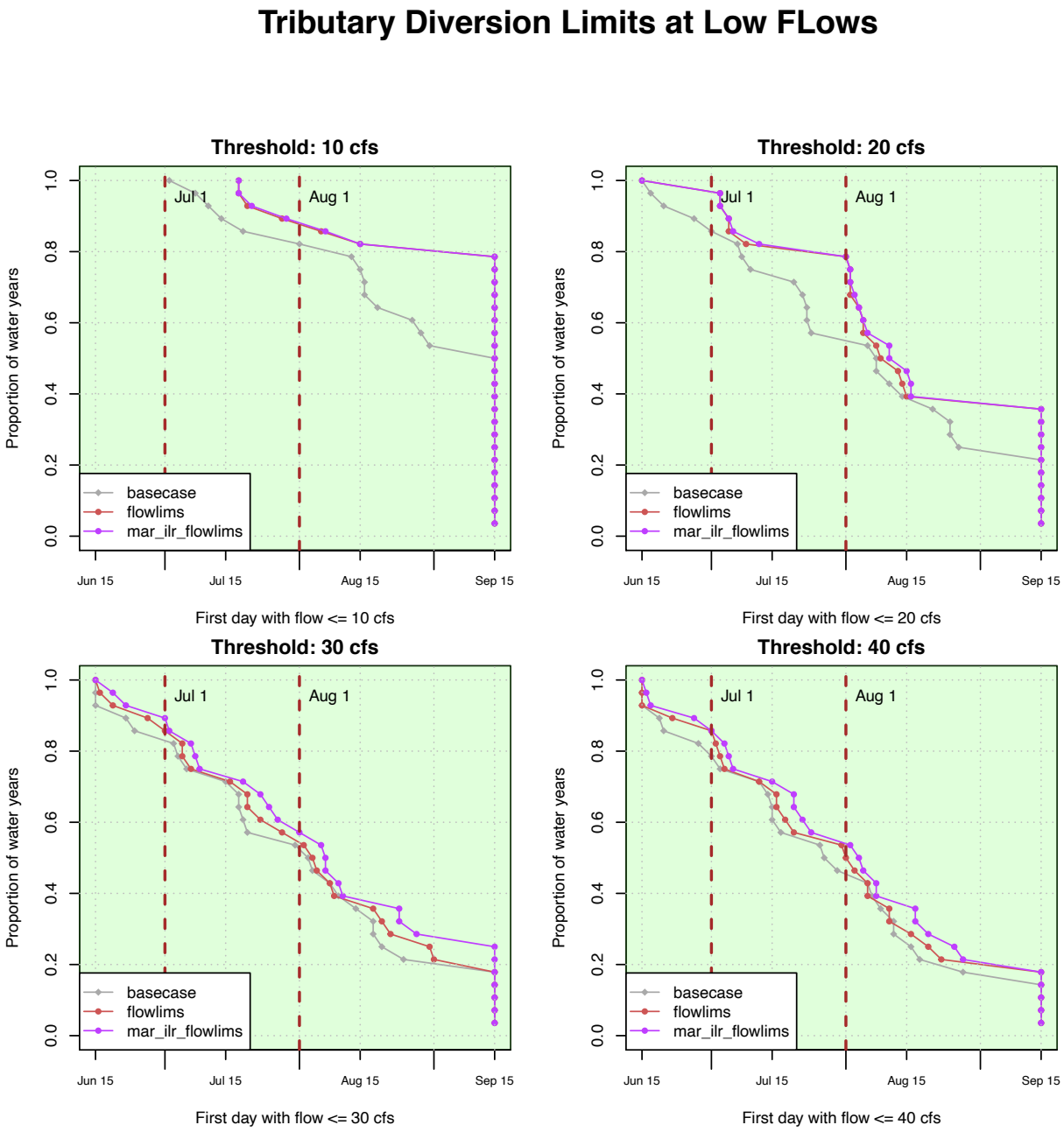
In general, scenarios in which more water years fall below the threshold later indicate more favorable hydrologic conditions (or, more dots on the right side of the plots is better). See explanatory graphs at the beginning of this appendix for more information.

Observed and Simulated Historical FJ Flow

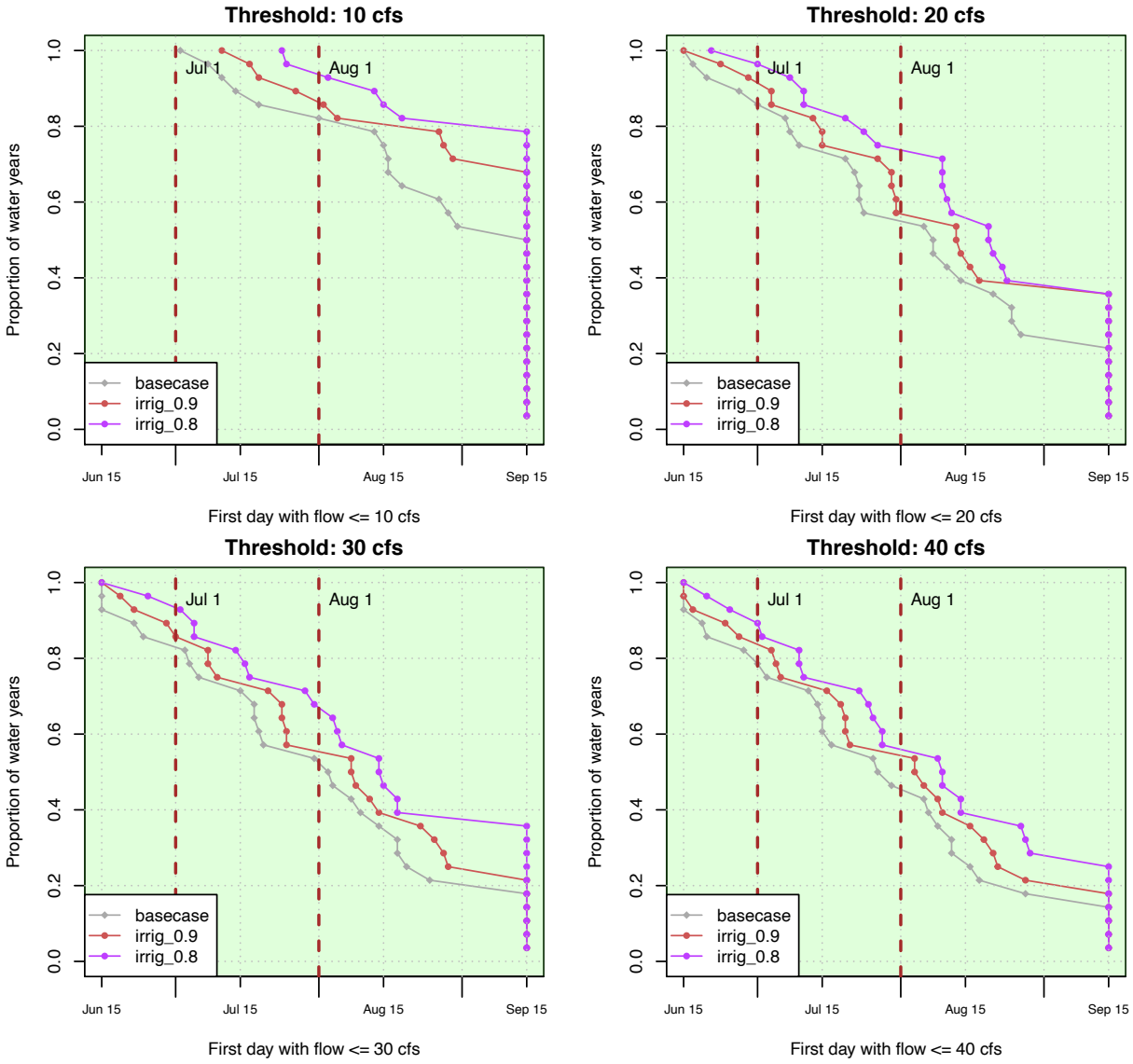


Recharge Scenarios

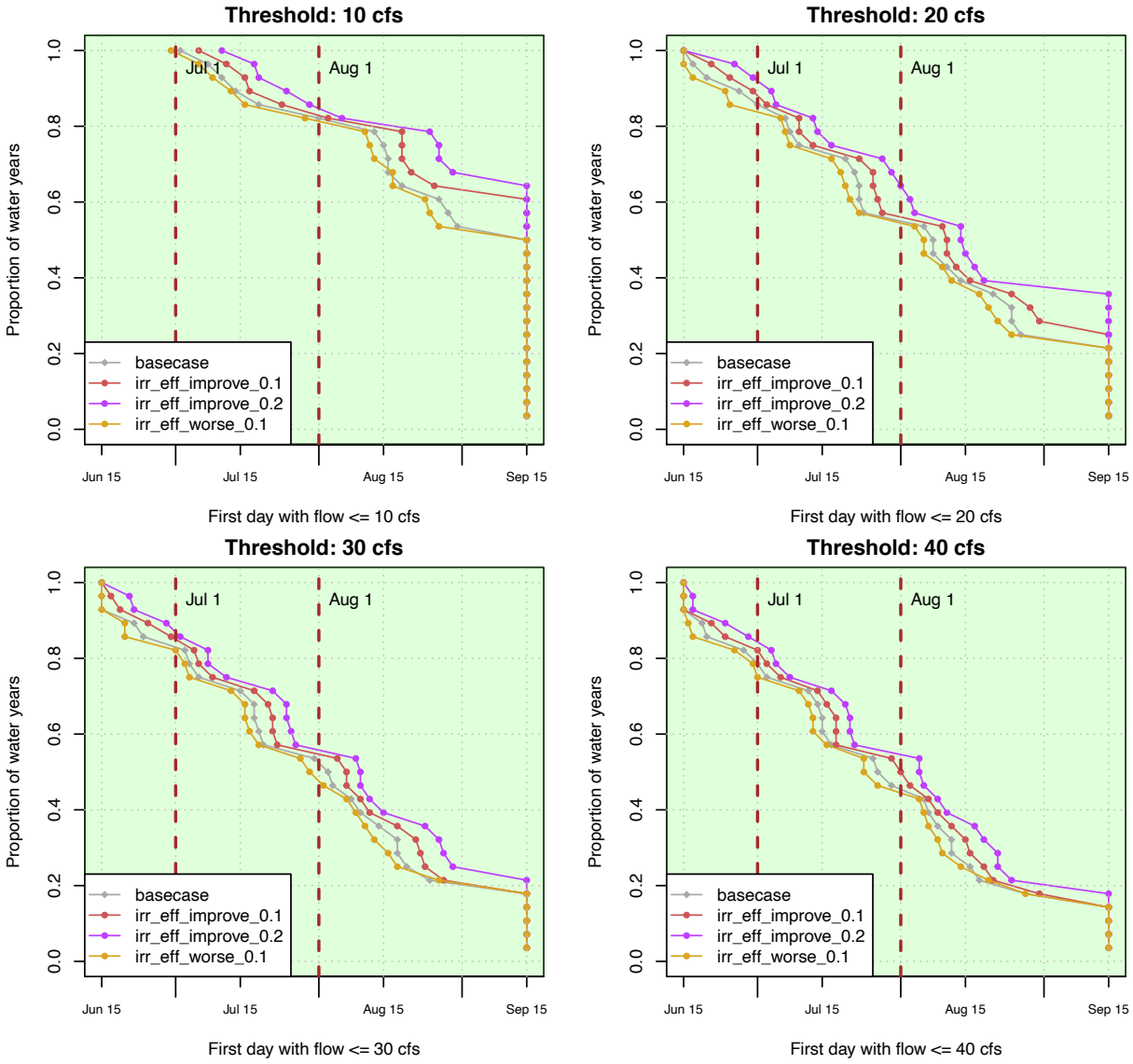



Tributary Diversion Limits at Low FLows
Threshold: 10 cfs
Threshold: 20 cfs
Threshold: 30 cfs
Threshold: 40 cfs
Proportion of water years
0.0
0.2
0.4
0.6
0.8
1.0
Jul 1
Aug 1
basecase
flowlims
mar_ilr_flowlims
Jun 15
Jul 15
Aug 15
Sep 15
First day with flow <= 10 cfs
First day with flow <= 20 cfs
First day with flow <= 30 cfs
First day with flow <= 40 cfs

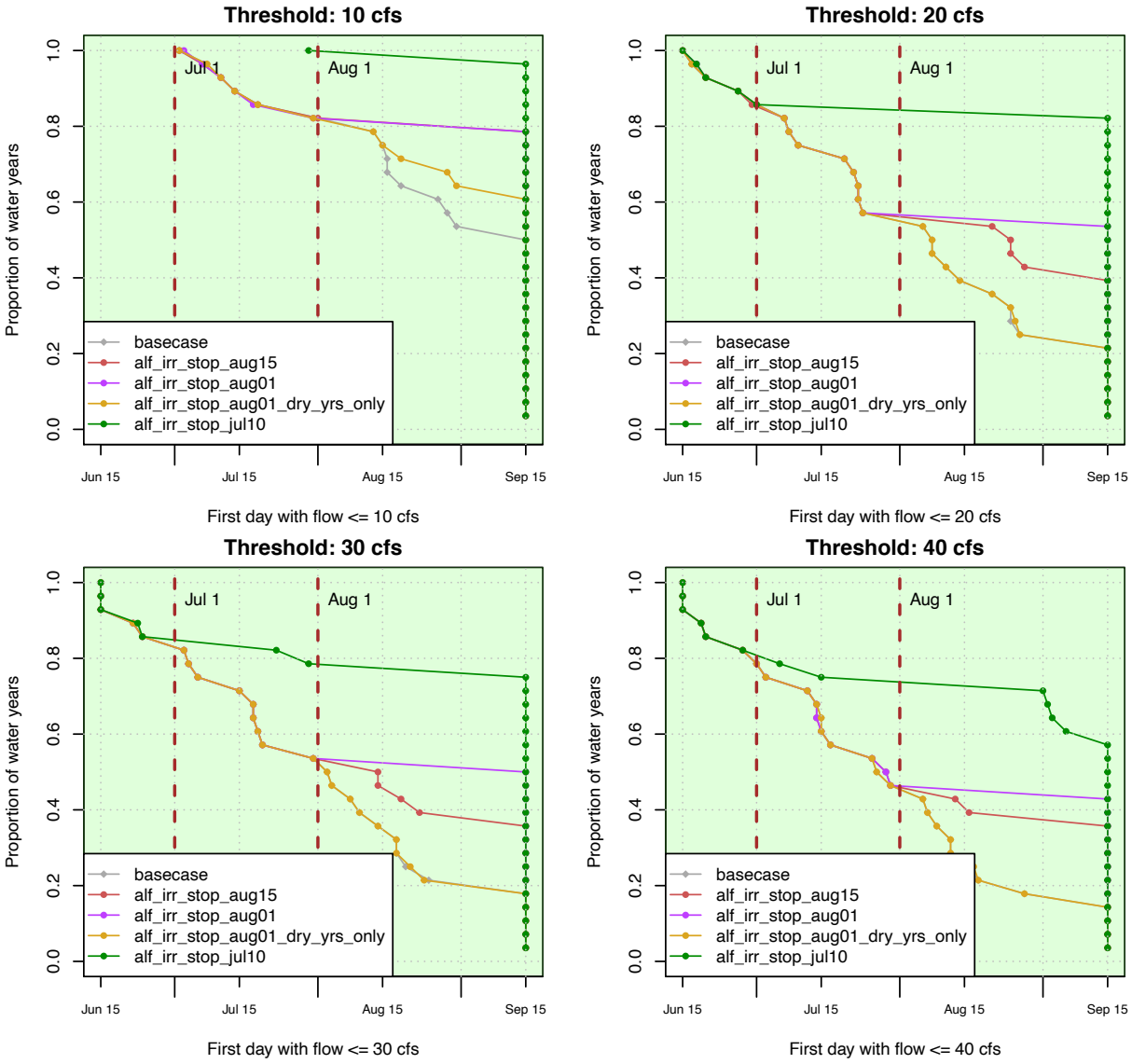
Irrigation Demand



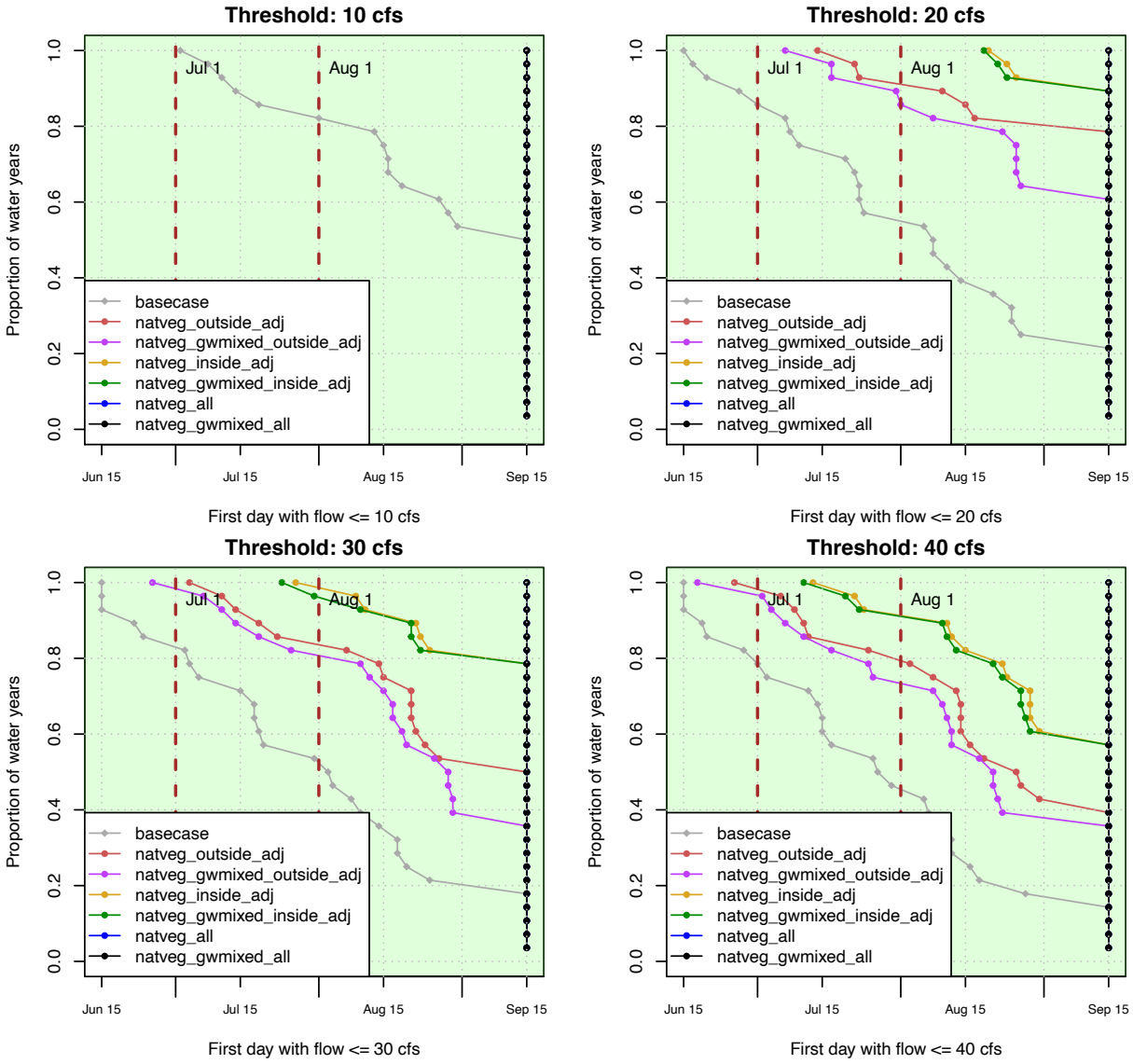
Irrigation Efficiency



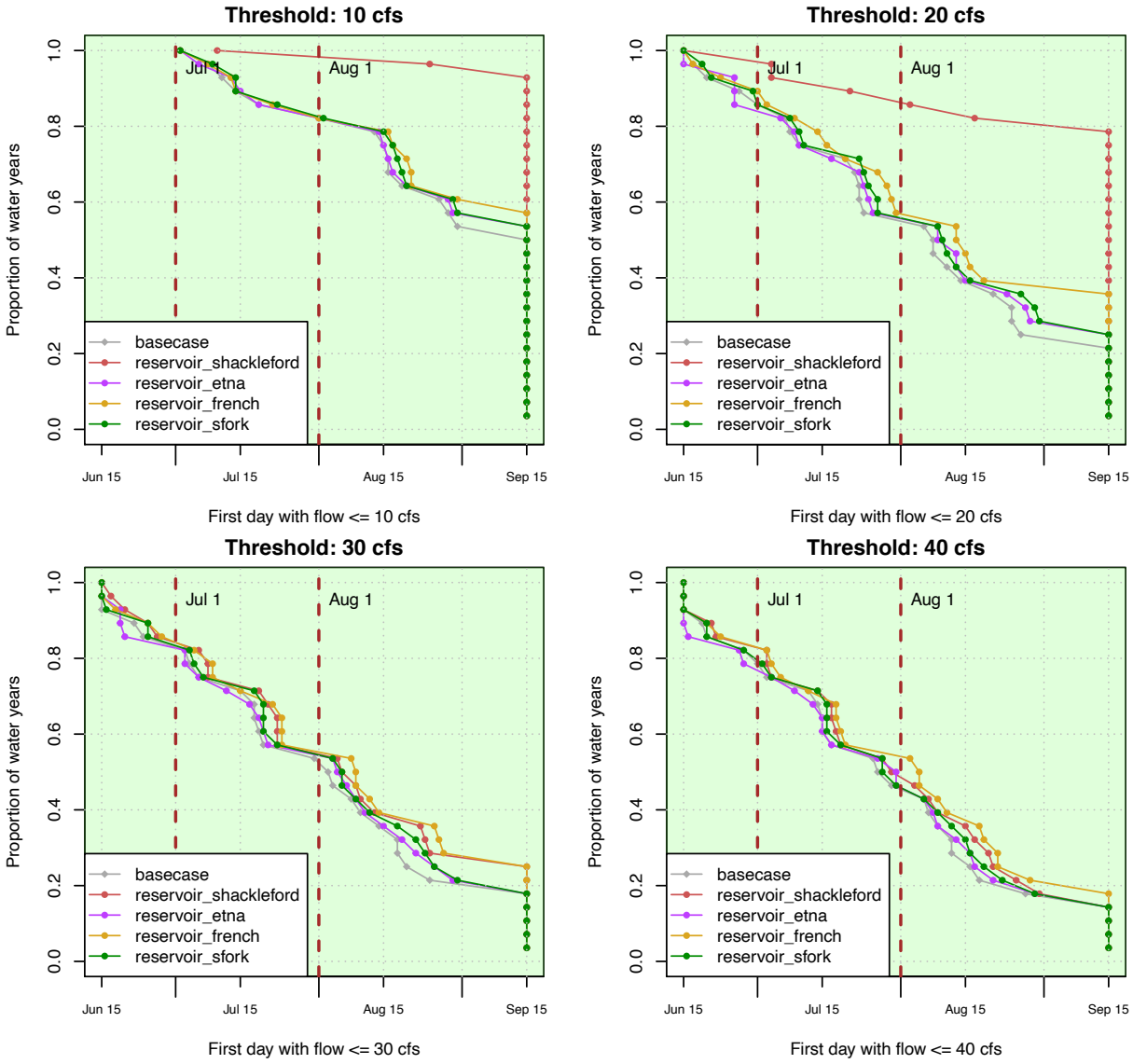
Alfalfa Irrigation Schedule



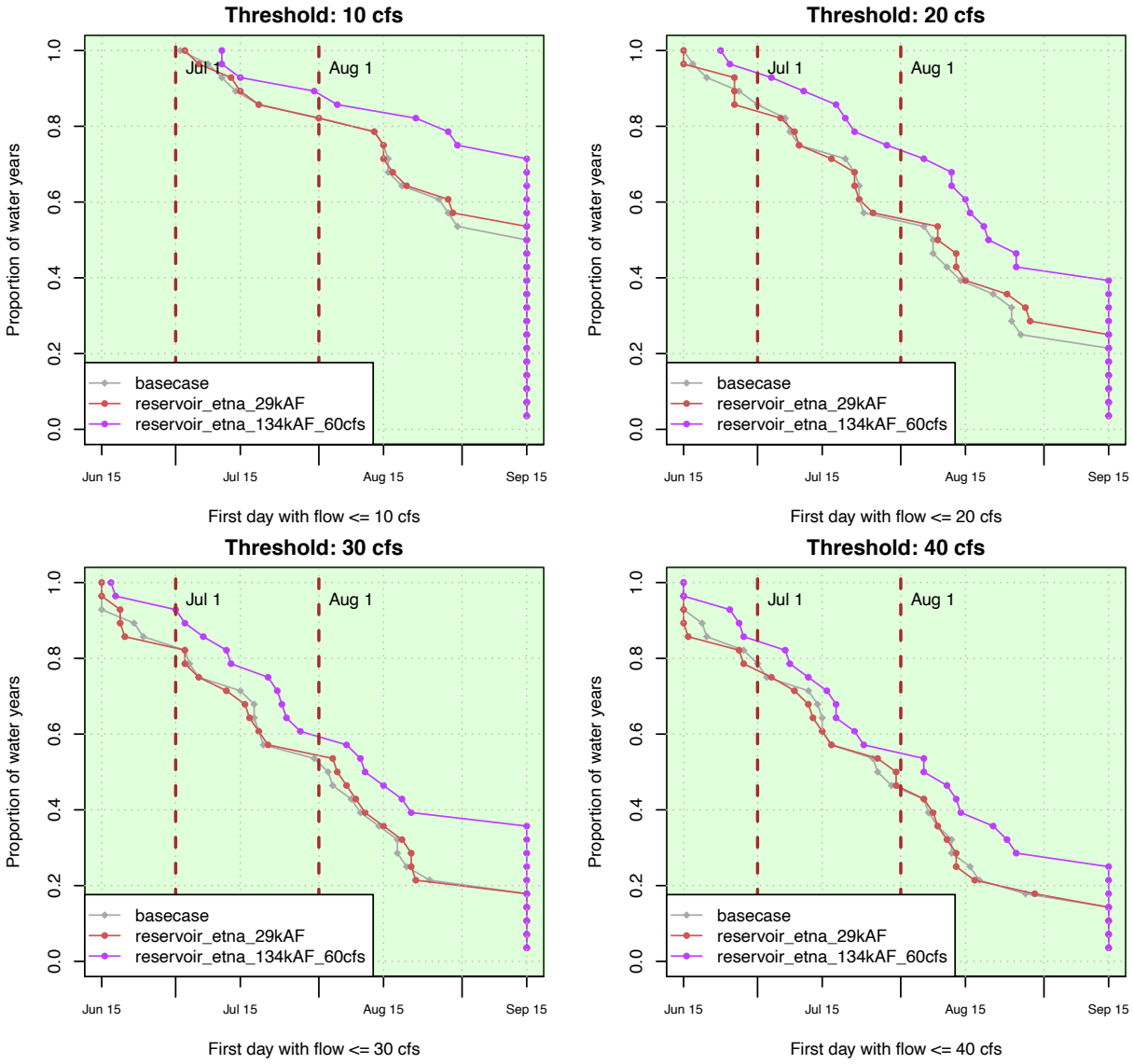
Land Use Change (Attribution Study)



Small Reservoir



100% Reliable Reservoir (30 or 60 cfs release)

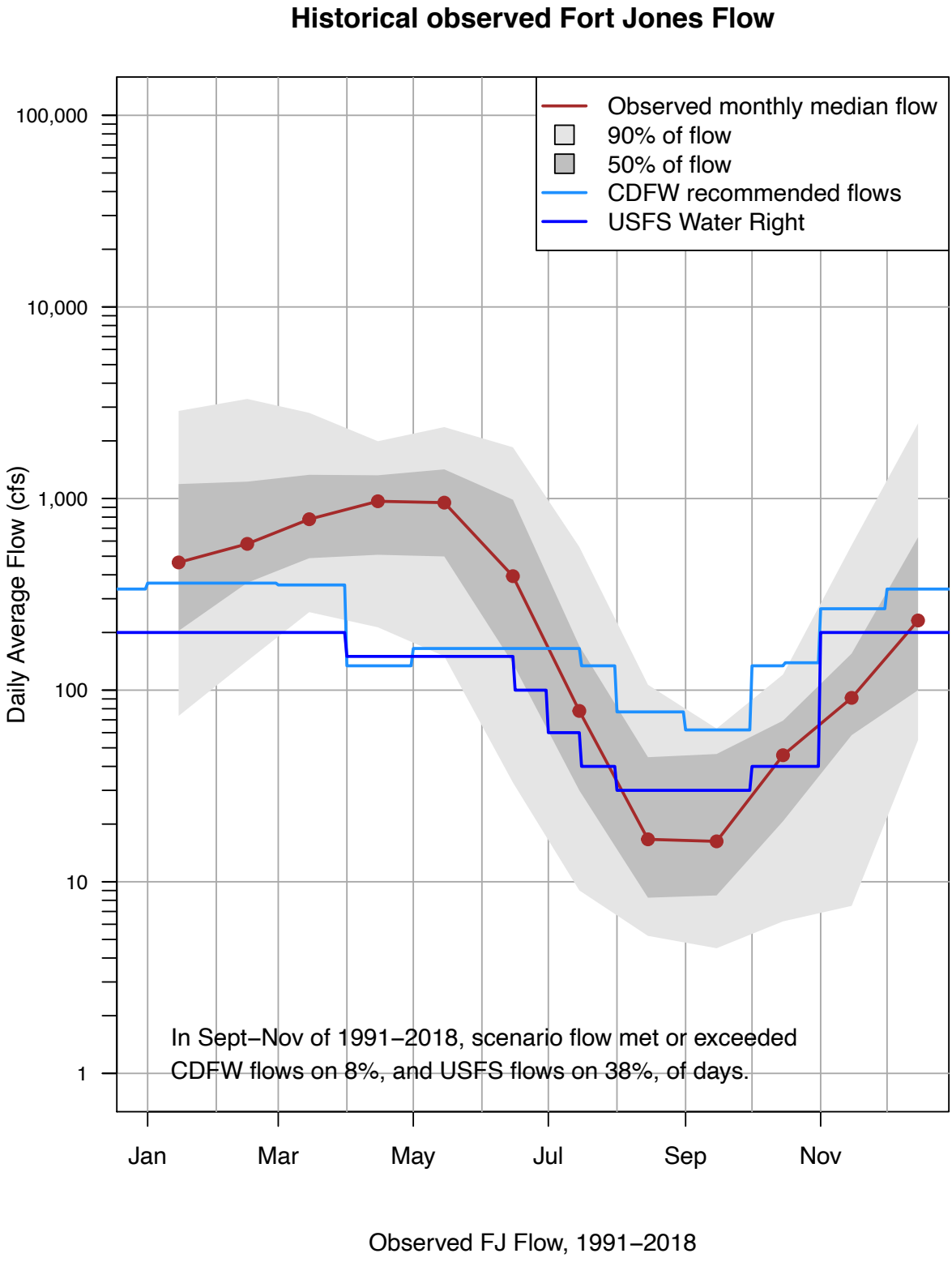


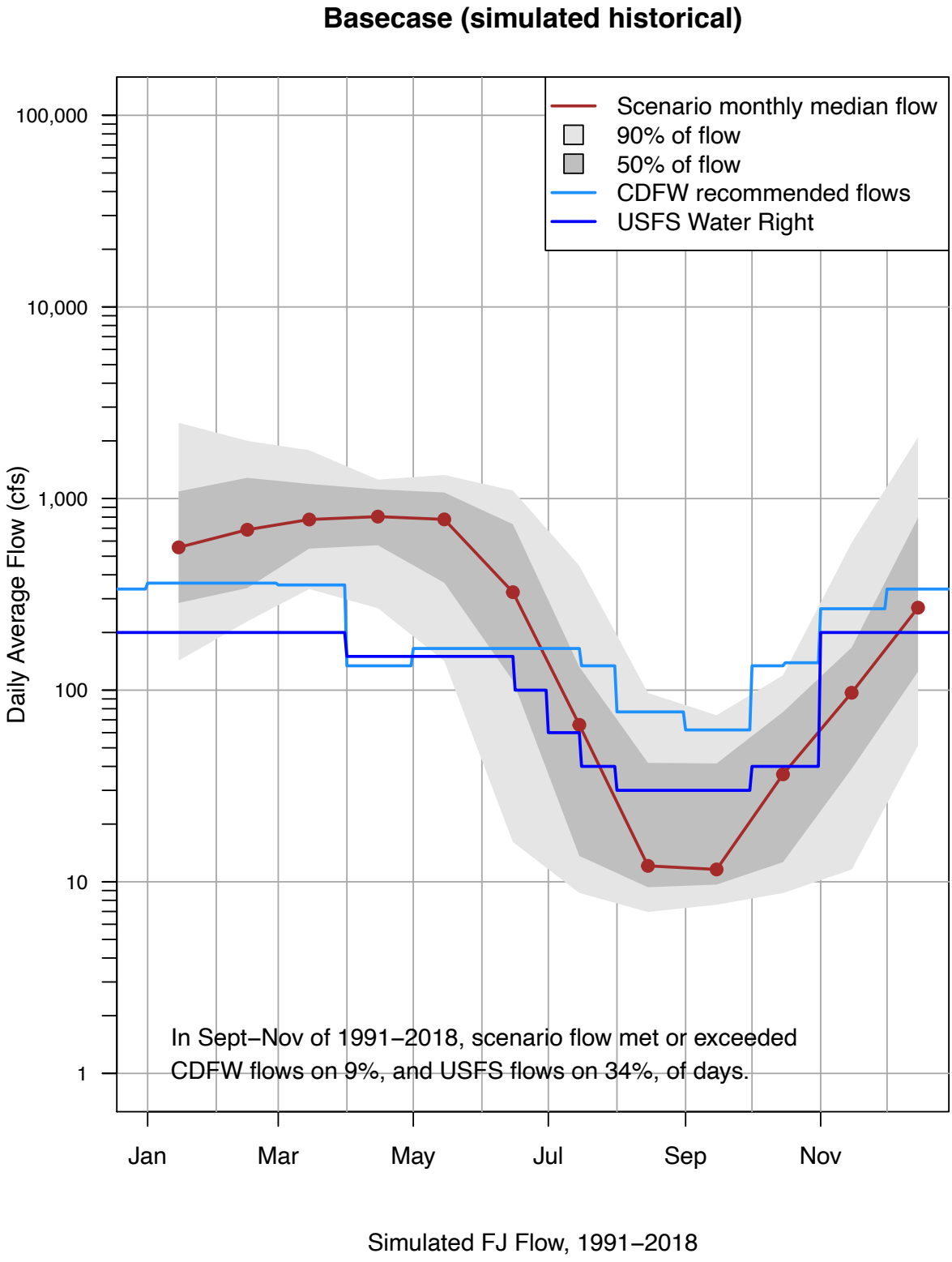
Percentile Flows and Flow Regime Comparison

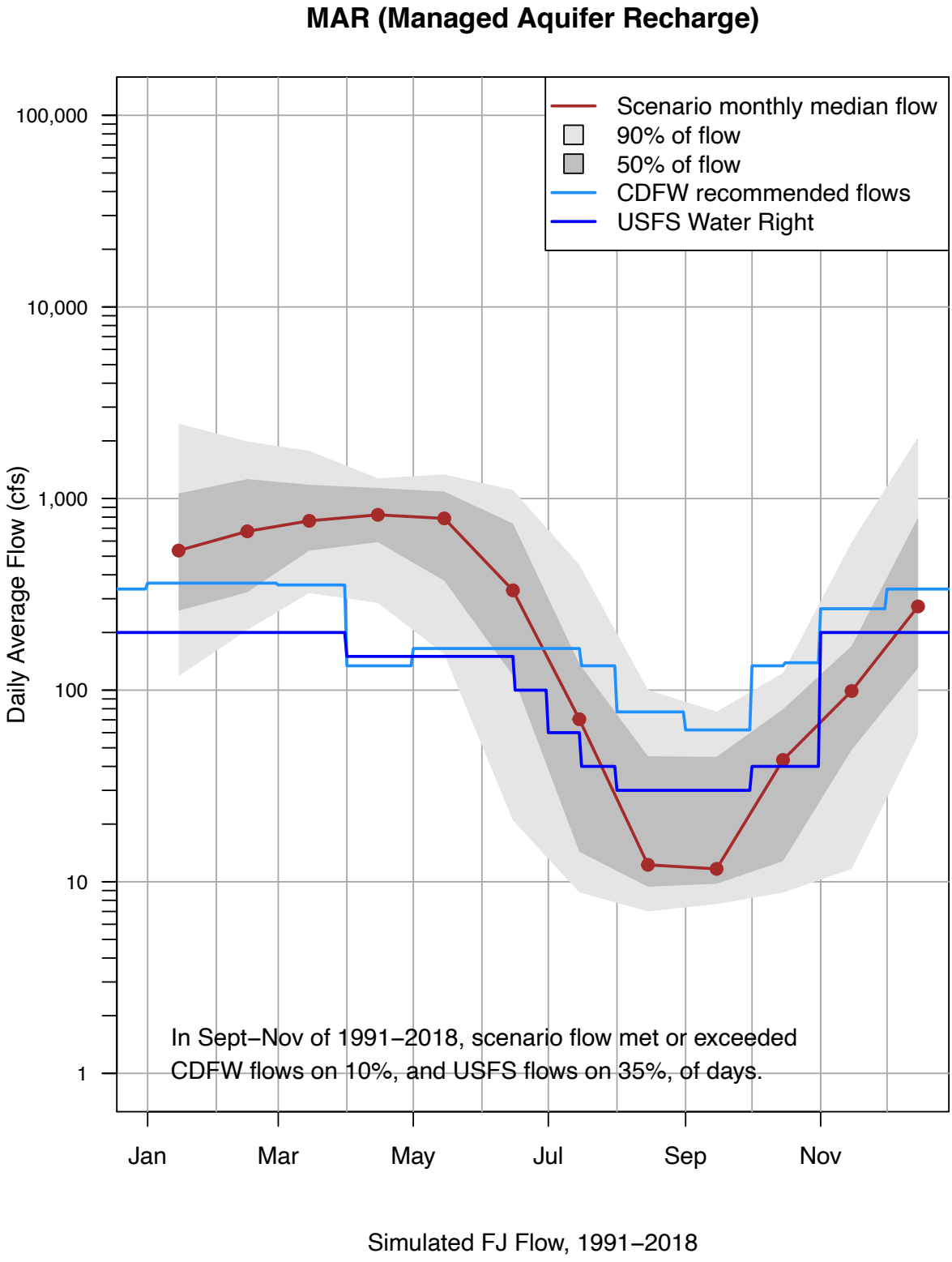
The goal of these plots is to 1) visualize the variability in Fort Jones flow in each model scenario, and 2) compare the flow to two proscribed flow regimes.

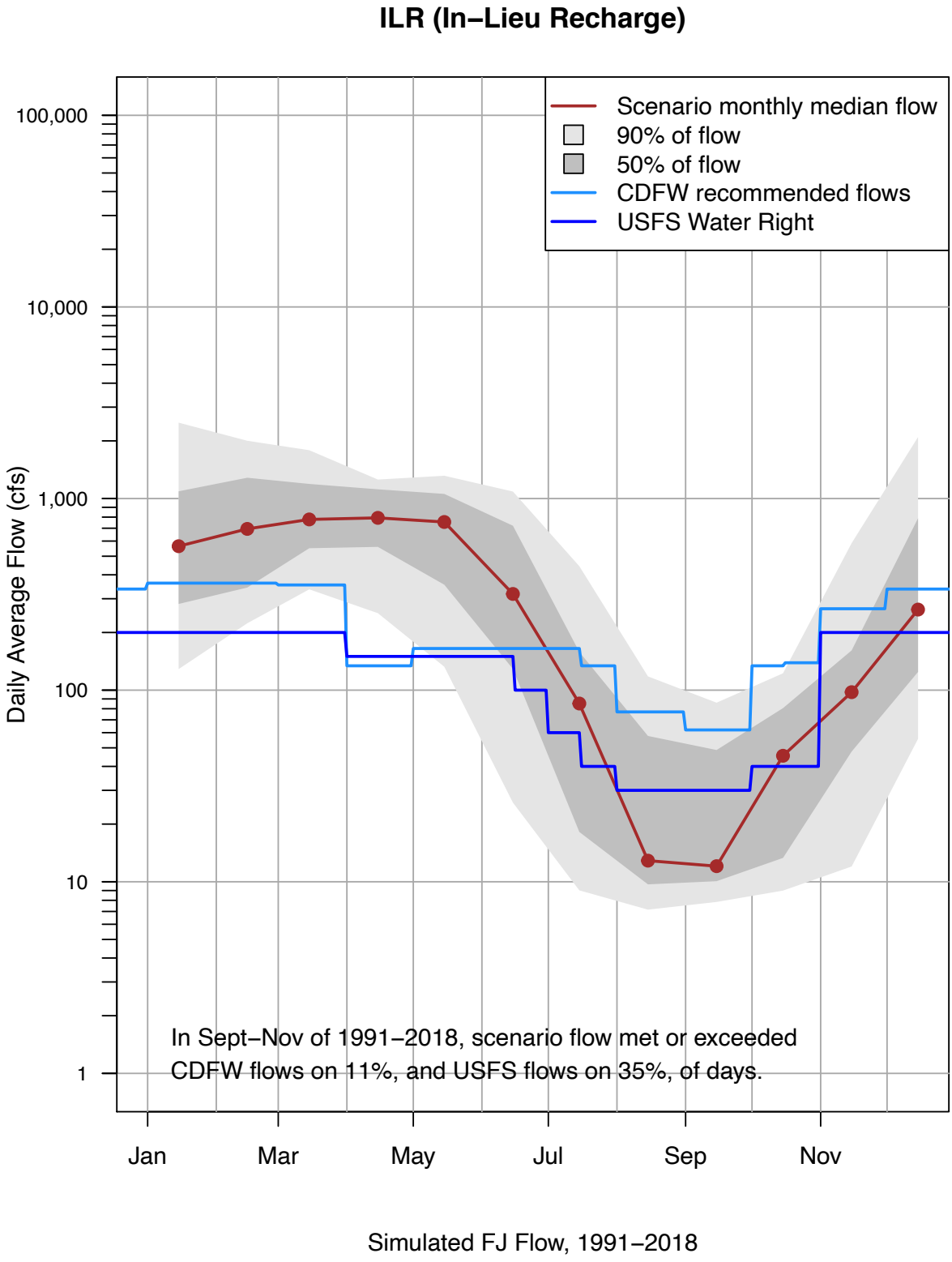
- Brown dots and line: The brown dots indicate the median flow recorded on all days falling in a given month in the 28-year model period (e.g., the median flow of all days of all the Januaries 1991-2018). That means that flow exceeds this brown line on approximately 50% of days in a given scenario.
- Gray shading: The dark gray shading captures the area from the 25th to the 75th percentiles of flow in a given month, and the light gray shading encompasses the 5th to the 95th percentiles. This means that that flow in a given scenario falls within the dark gray area on 50%, and within the light gray area on 90%, of days.
- Blue lines: The light blue line shows the flow regime published in the 2017 California Department of Fish and Wildlife (CDFW) report "Interim Instream Flow Criteria for the Protection of Fishery Resources in the Scott River Watershed, Siskiyou County". The dark blue line shows the flow regime for the United States Forest Service (USFS) water right as quantified in the Scott River Adjudication of 1980 (Decree No. 30662).

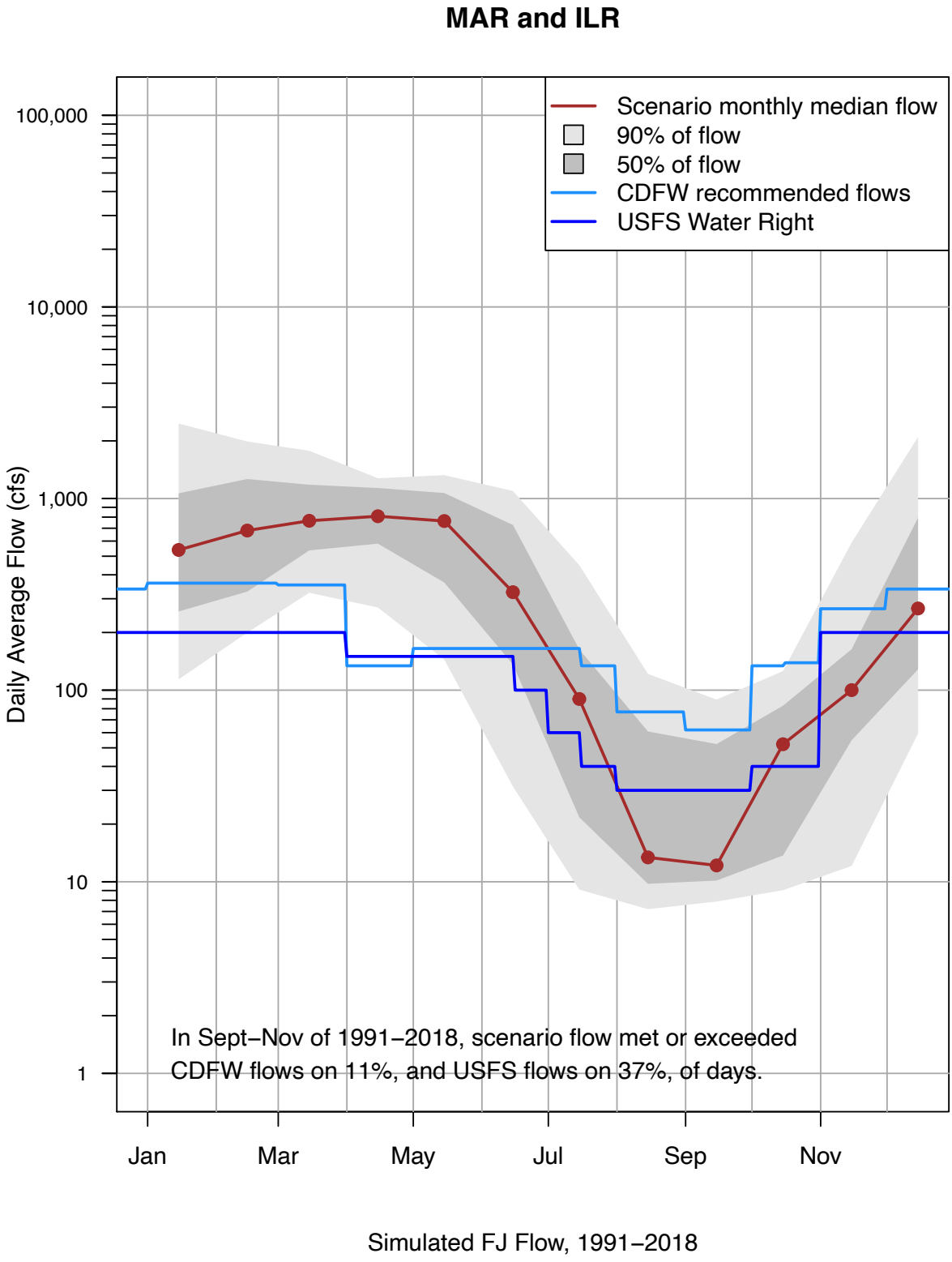
At the bottom of each plot, a note indicates the percentage of days in the critical low flow window (Sept. 1-Nov. 30, for all water years 1991-2018) on which each threshold was met.

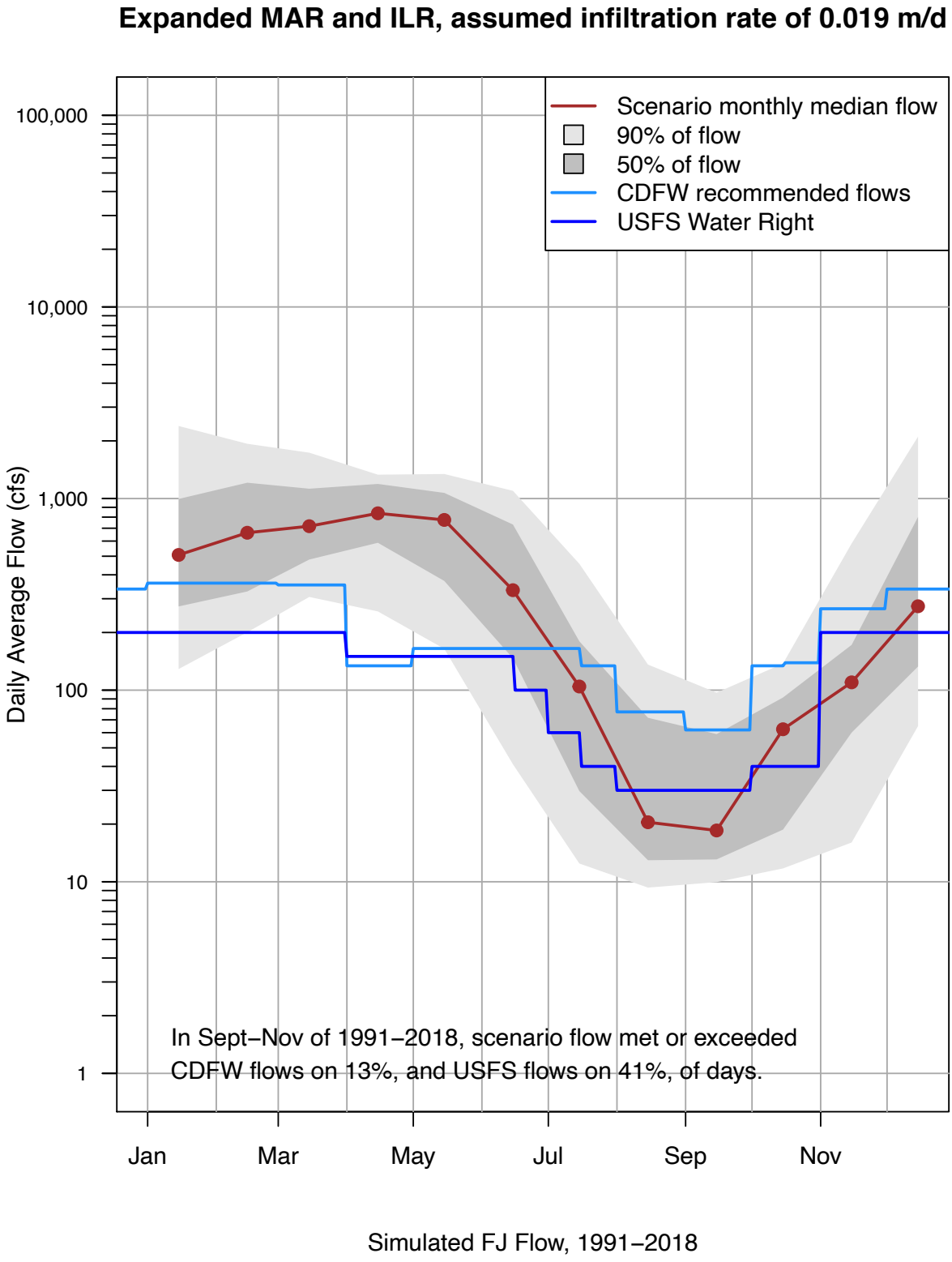

Historical observed Fort Jones Flow
Observed monthly median flow
90% of flow
50% of flow
CDFW recommended flows
USFS Water Right
100,000
10,000
1,000
100
10
1
Daily Average Flow (cfs)
Jan
Mar
May
Jul
Sep
Nov
In Sept–Nov of 1991–2018, scenario flow met or exceeded
CDFW flows on 8%, and USFS flows on 38%, of days.
Observed FJ Flow, 1991–2018

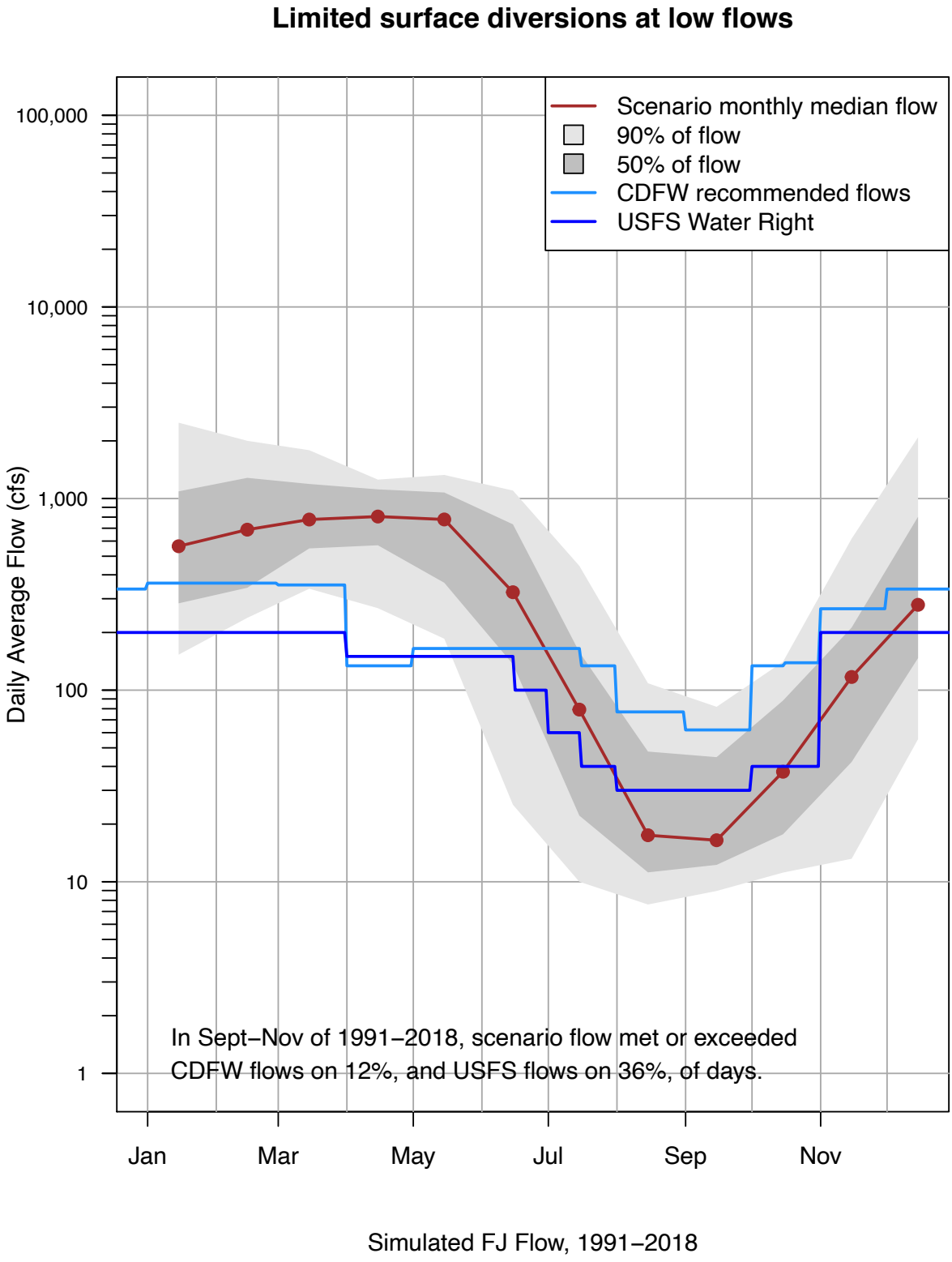

Basecase (simulated historical)
Scenario monthly median flow
90% of flow
50% of flow
CDFW recommended flows
USFS Water Right
100,000
10,000
1,000
100
10
1
Daily Average Flow (cfs)
In Sept–Nov of 1991–2018, scenario flow met or exceeded
CDFW flows on 9%, and USFS flows on 34%, of days.
Jan
Mar
May
Jul
Sep
Nov
Simulated FJ Flow, 1991–2018

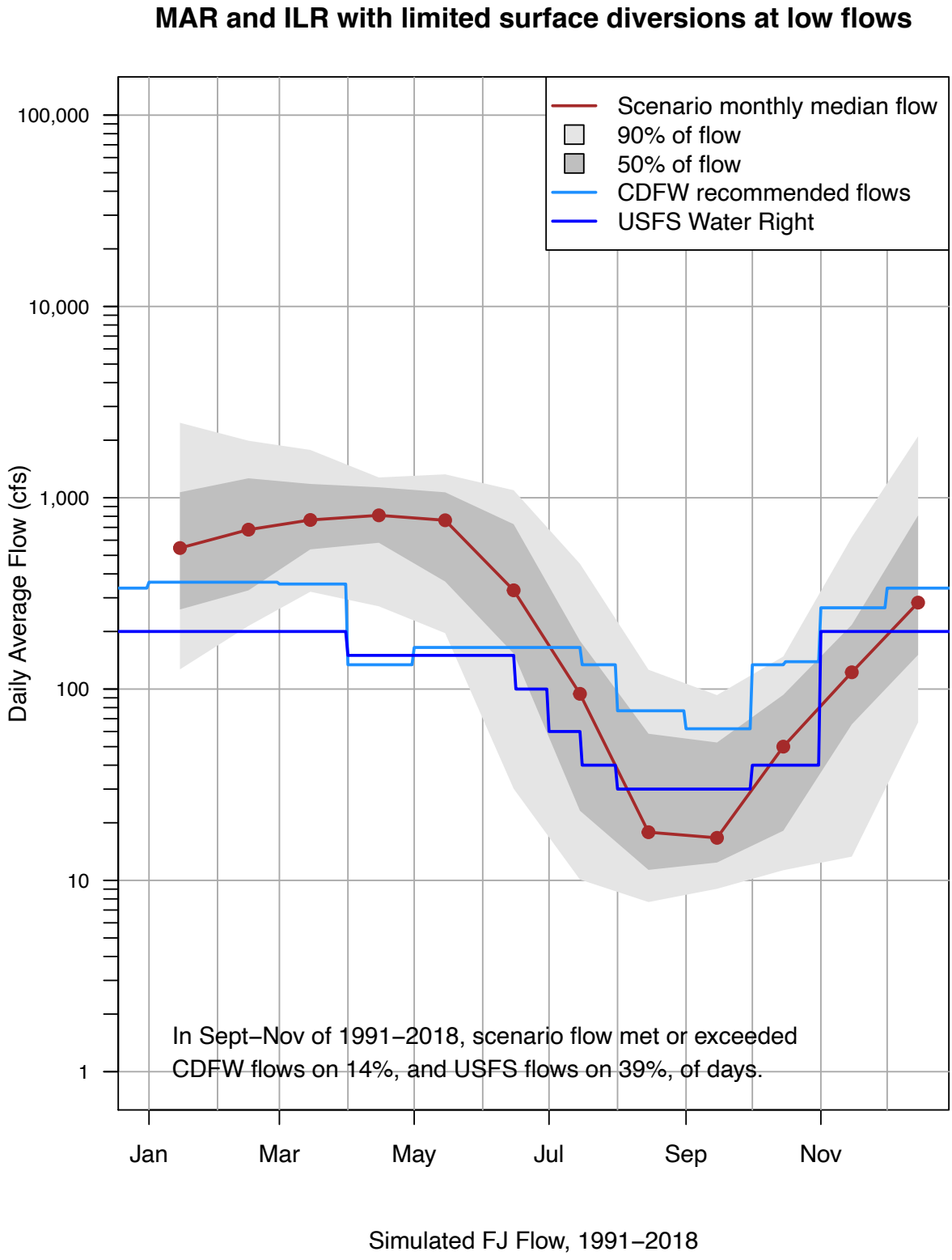

MAR (Managed Aquifer Recharge)
Scenario monthly median flow
90% of flow
50% of flow
CDFW recommended flows
USFS Water Right
100,000
10,000
1,000
100
10
1
Daily Average Flow (cfs)
In Sept–Nov of 1991–2018, scenario flow met or exceeded
CDFW flows on 10%, and USFS flows on 35%, of days.
Jan
Mar
May
Jul
Sep
Nov
Simulated FJ Flow, 1991–2018

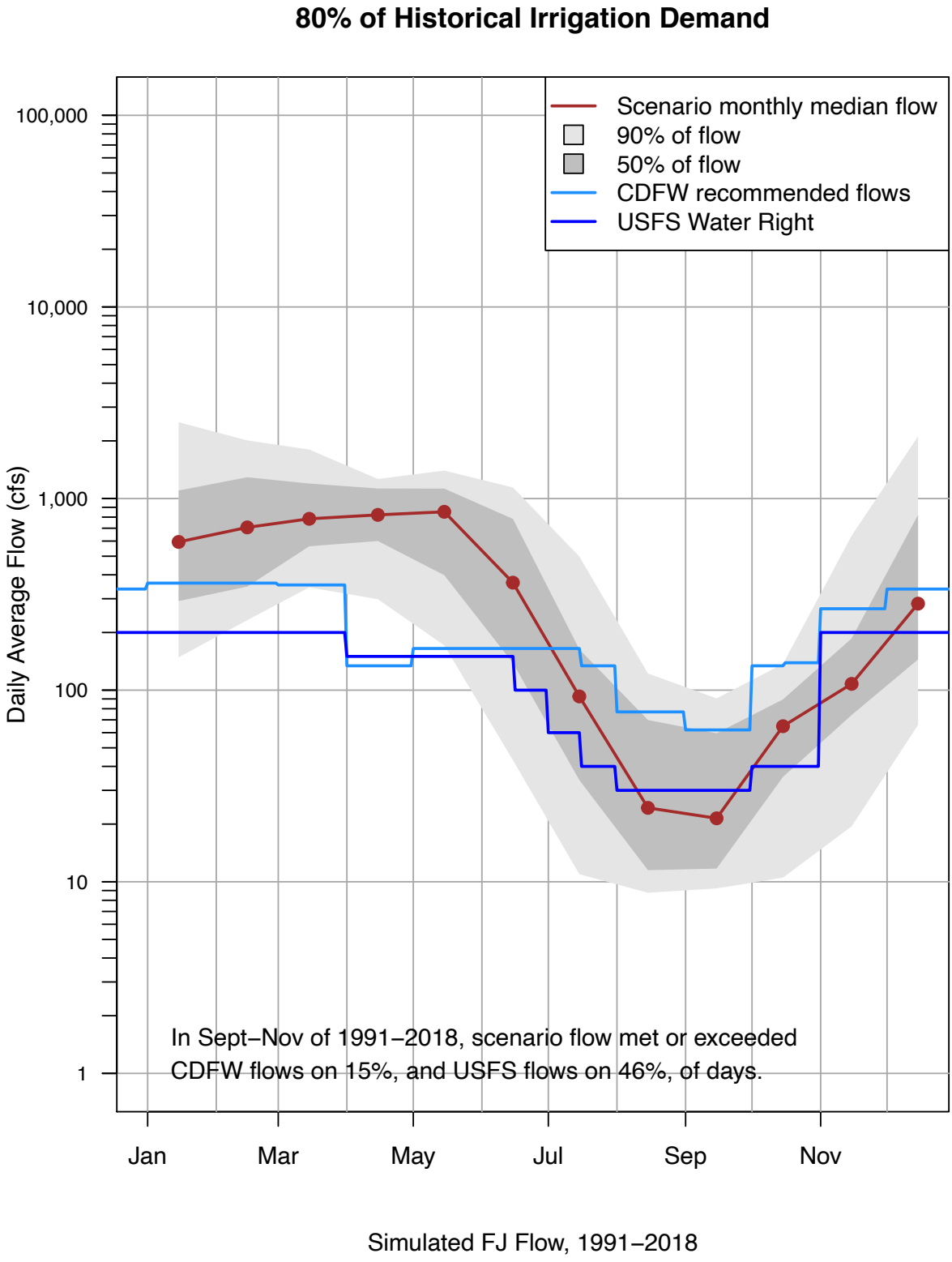

ILR (In–Lieu Recharge)
Scenario monthly median flow
90% of flow
50% of flow
CDFW recommended flows
USFS Water Right
100,000
10,000
1,000
100
10
1
Daily Average Flow (cfs)
In Sept–Nov of 1991–2018, scenario flow met or exceeded
CDFW flows on 11%, and USFS flows on 35%, of days.
Jan
Mar
May
Jul
Sep
Nov
Simulated FJ Flow, 1991–2018

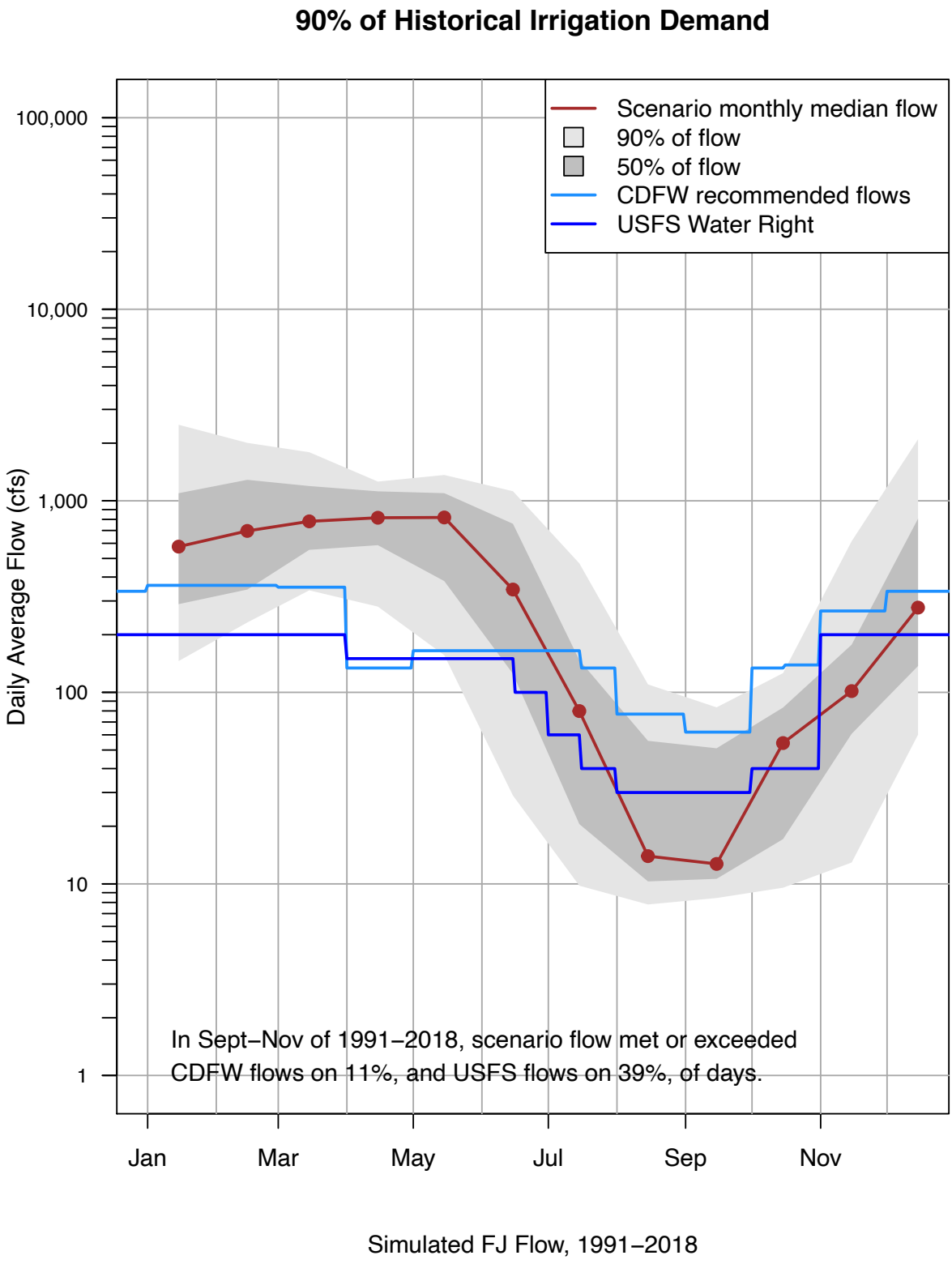

MAR and ILR
Scenario monthly median flow
90% of flow
50% of flow
CDFW recommended flows
USFS Water Right
100,000
10,000
1,000
100
10
1
Daily Average Flow (cfs)
In Sept–Nov of 1991–2018, scenario flow met or exceeded
CDFW flows on 11%, and USFS flows on 37%, of days.
Jan
Mar
May
Jul
Sep
Nov
Simulated FJ Flow, 1991–2018

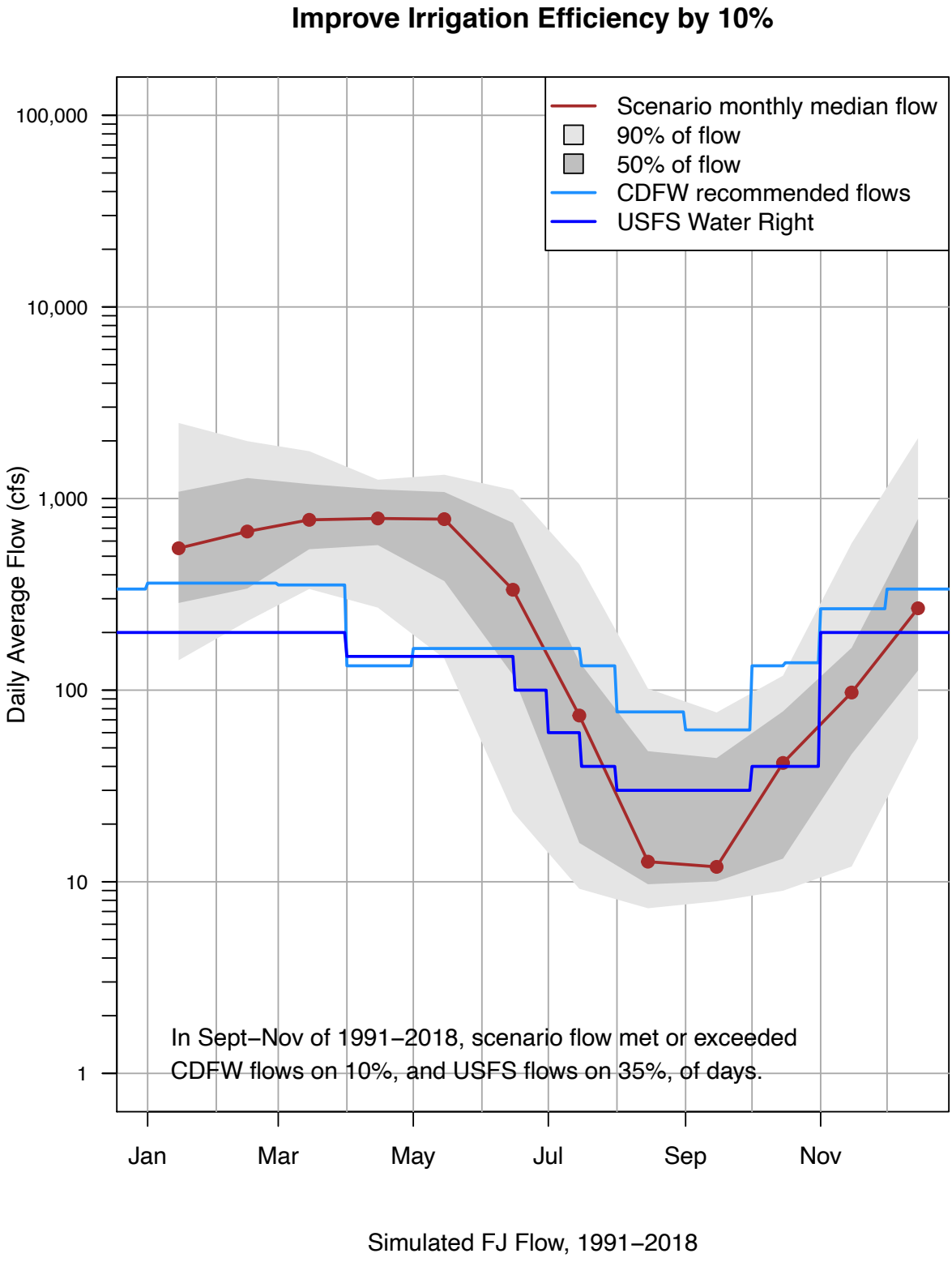

Expanded MAR and ILR, assumed infiltration rate of 0.019 m/d
Scenario monthly median flow
90% of flow
50% of flow
CDFW recommended flows
USFS Water Right
100,000
10,000
1,000
100
10
1
Daily Average Flow (cfs)
In Sept–Nov of 1991–2018, scenario flow met or exceeded
CDFW flows on 13%, and USFS flows on 41%, of days.
Jan
Mar
May
Jul
Sep
Nov
Simulated FJ Flow, 1991–2018

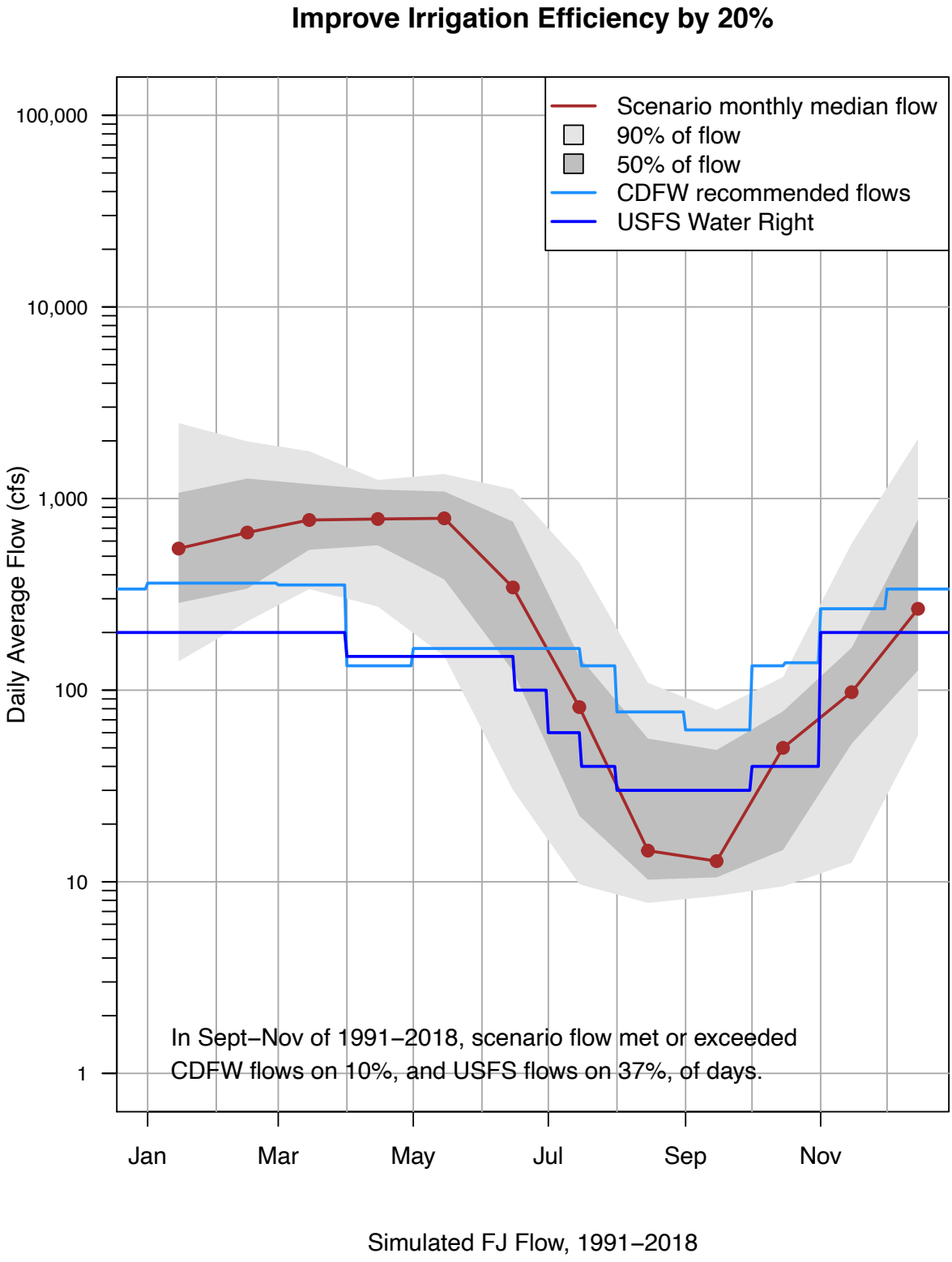

Limited surface diversions at low flows
Scenario monthly median flow
90% of flow
50% of flow
CDFW recommended flows
USFS Water Right
100,000
10,000
1,000
100
10
1
Daily Average Flow (cfs)
In Sept–Nov of 1991–2018, scenario flow met or exceeded
CDFW flows on 12%, and USFS flows on 36%, of days.
Jan
Mar
May
Jul
Sep
Nov
Simulated FJ Flow, 1991–2018

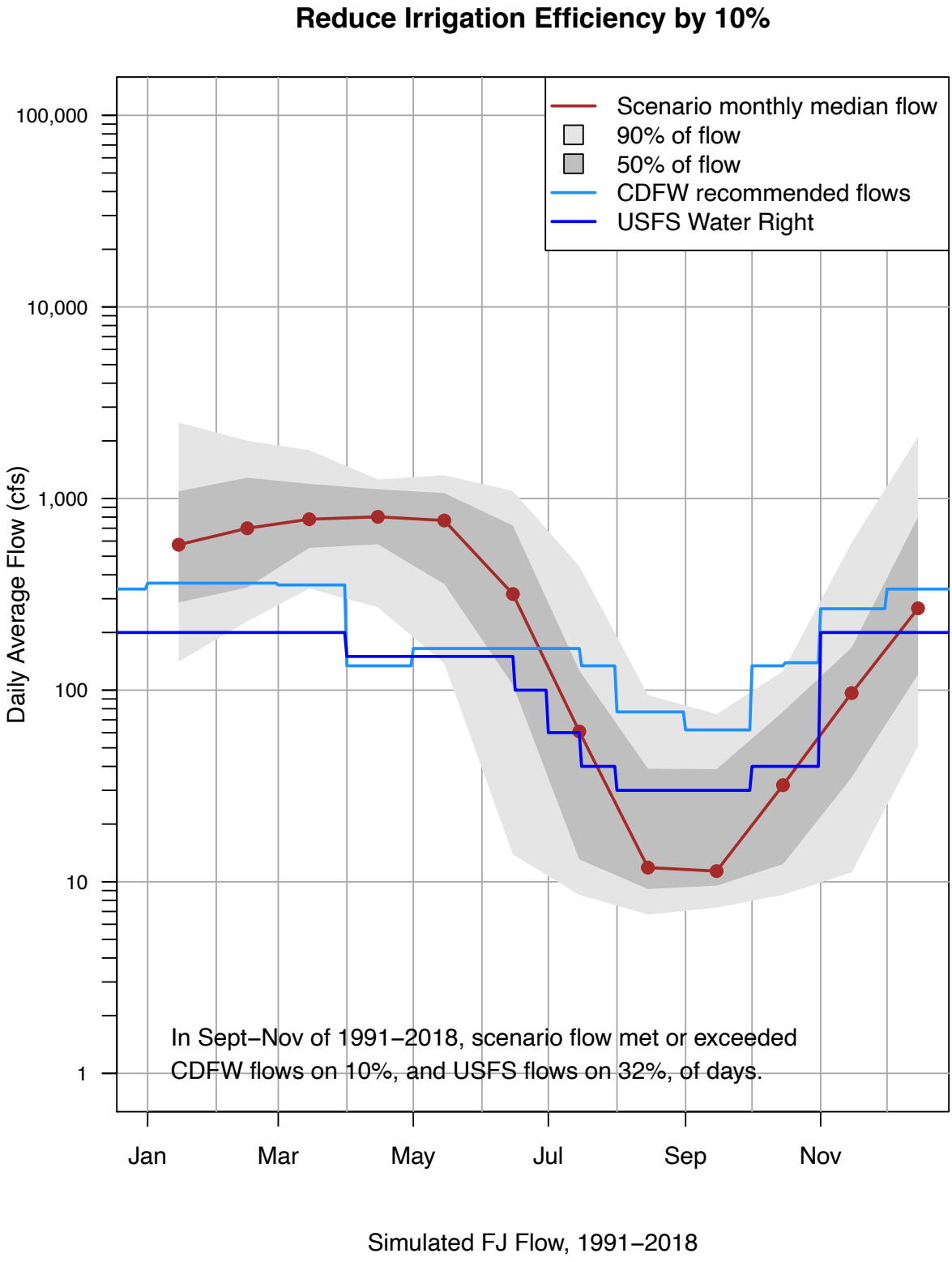

MAR and ILR with limited surface diversions at low flows
Scenario monthly median flow
90% of flow
50% of flow
CDFW recommended flows
USFS Water Right
100,000
10,000
1,000
100
10
1
Daily Average Flow (cfs)
In Sept–Nov of 1991–2018, scenario flow met or exceeded
CDFW flows on 14%, and USFS flows on 39%, of days.
Jan
Mar
May
Jul
Sep
Nov
Simulated FJ Flow, 1991–2018

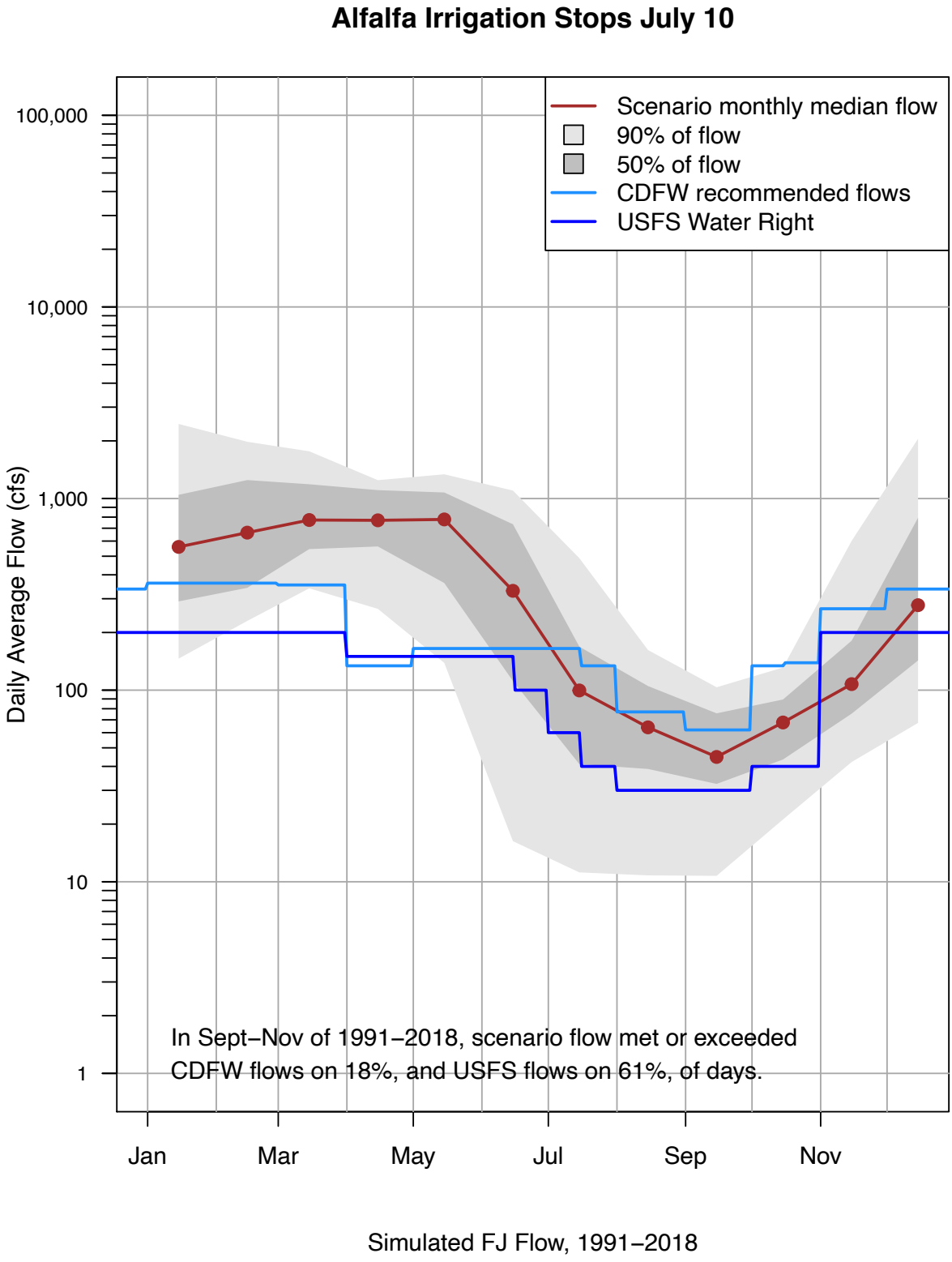

80% of Historical Irrigation Demand
Scenario monthly median flow
90% of flow
50% of flow
CDFW recommended flows
USFS Water Right
100,000
10,000
1,000
100
10
1
Daily Average Flow (cfs)
In Sept–Nov of 1991–2018, scenario flow met or exceeded
CDFW flows on 15%, and USFS flows on 46%, of days.
Jan
Mar
May
Jul
Sep
Nov
Simulated FJ Flow, 1991–2018

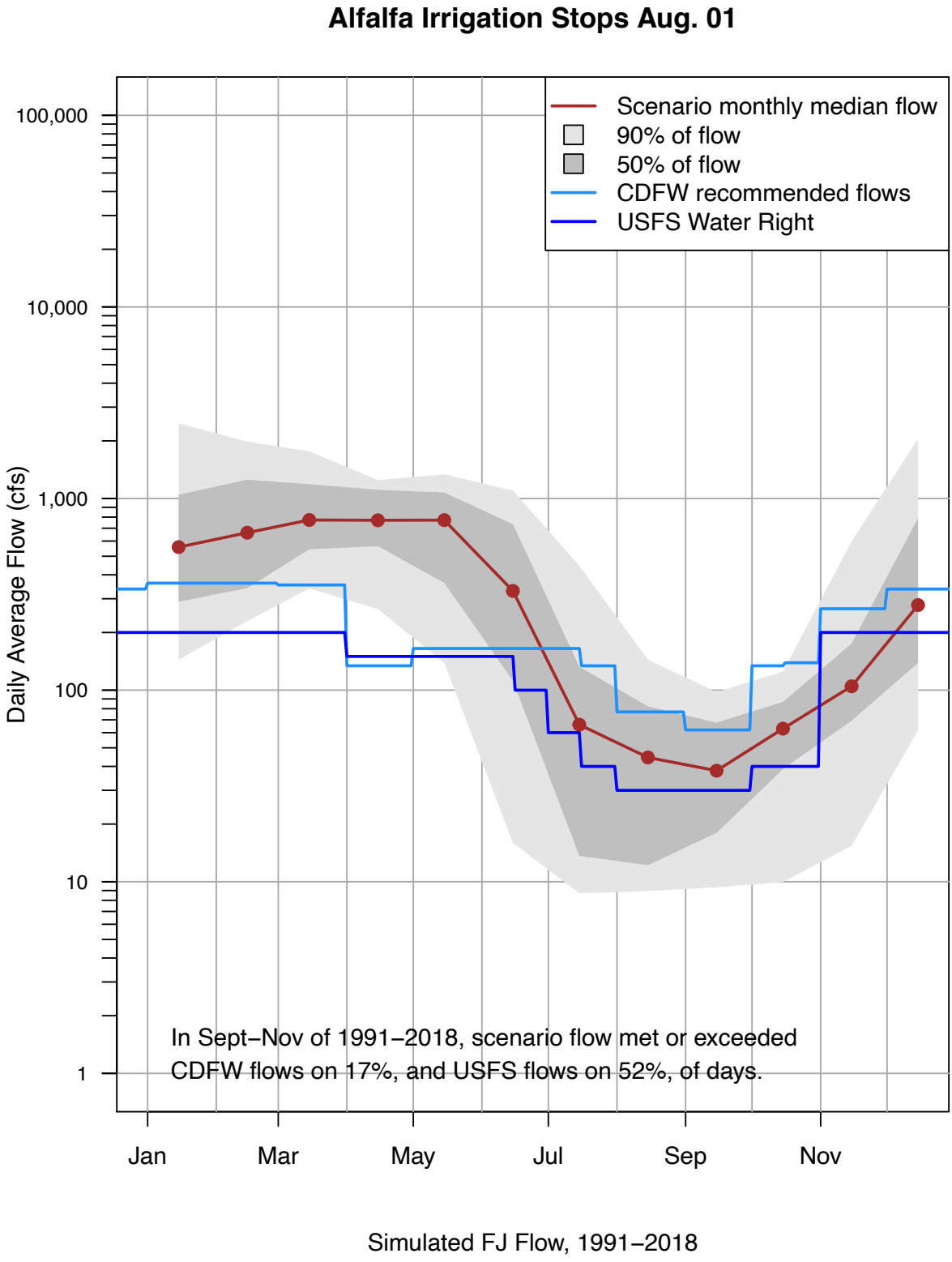

90% of Historical Irrigation Demand
Scenario monthly median flow
90% of flow
50% of flow
CDFW recommended flows
USFS Water Right
100,000
10,000
1,000
100
10
1
Daily Average Flow (cfs)
In Sept–Nov of 1991–2018, scenario flow met or exceeded
CDFW flows on 11%, and USFS flows on 39%, of days.
Jan
Mar
May
Jul
Sep
Nov
Simulated FJ Flow, 1991–2018

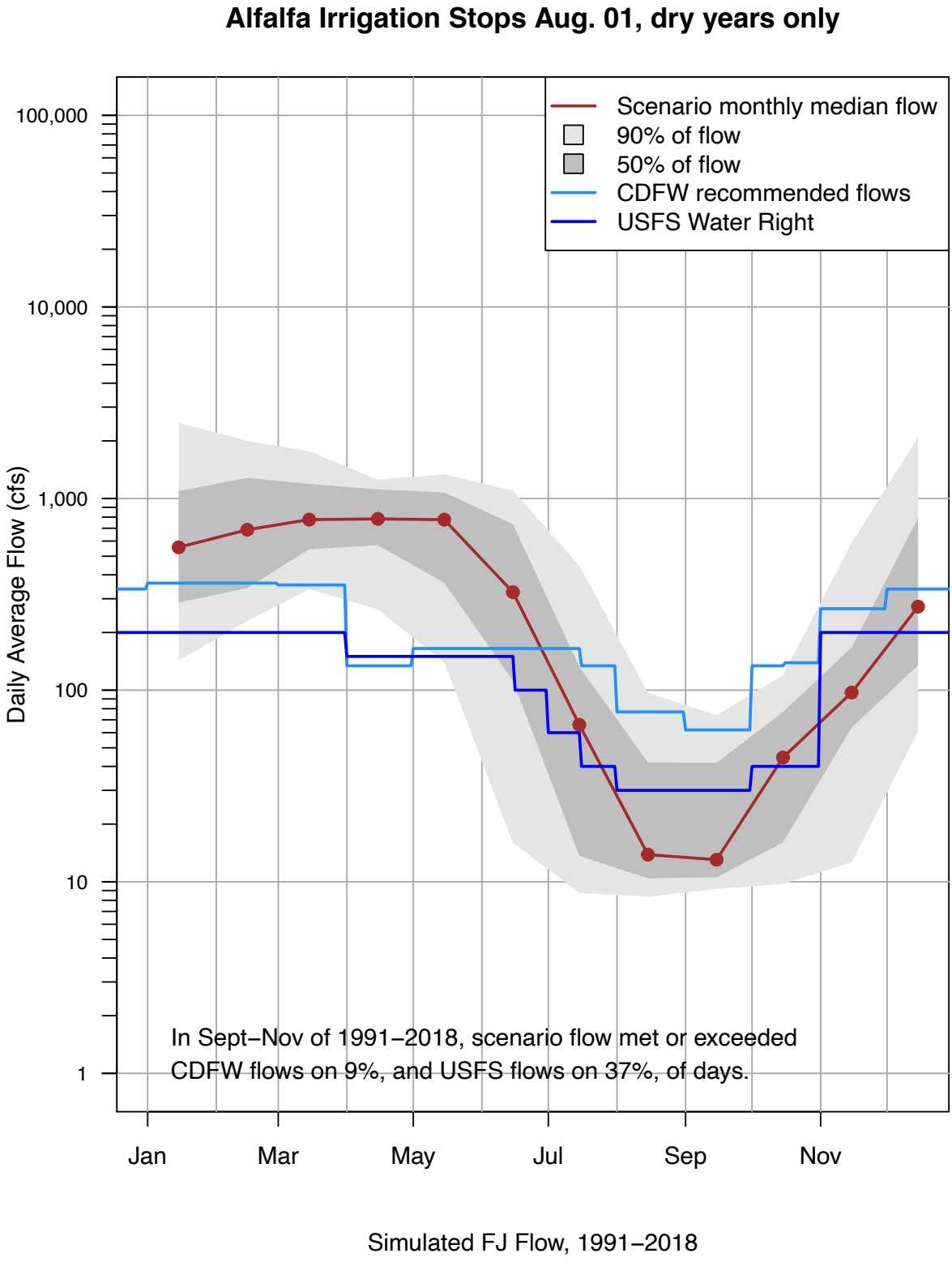

Improve Irrigation Efficiency by 10%
Scenario monthly median flow
90% of flow
50% of flow
CDFW recommended flows
USFS Water Right
100,000
10,000
1,000
100
10
1
Daily Average Flow (cfs)
In Sept–Nov of 1991–2018, scenario flow met or exceeded
CDFW flows on 10%, and USFS flows on 35%, of days.
Jan
Mar
May
Jul
Sep
Nov
Simulated FJ Flow, 1991–2018

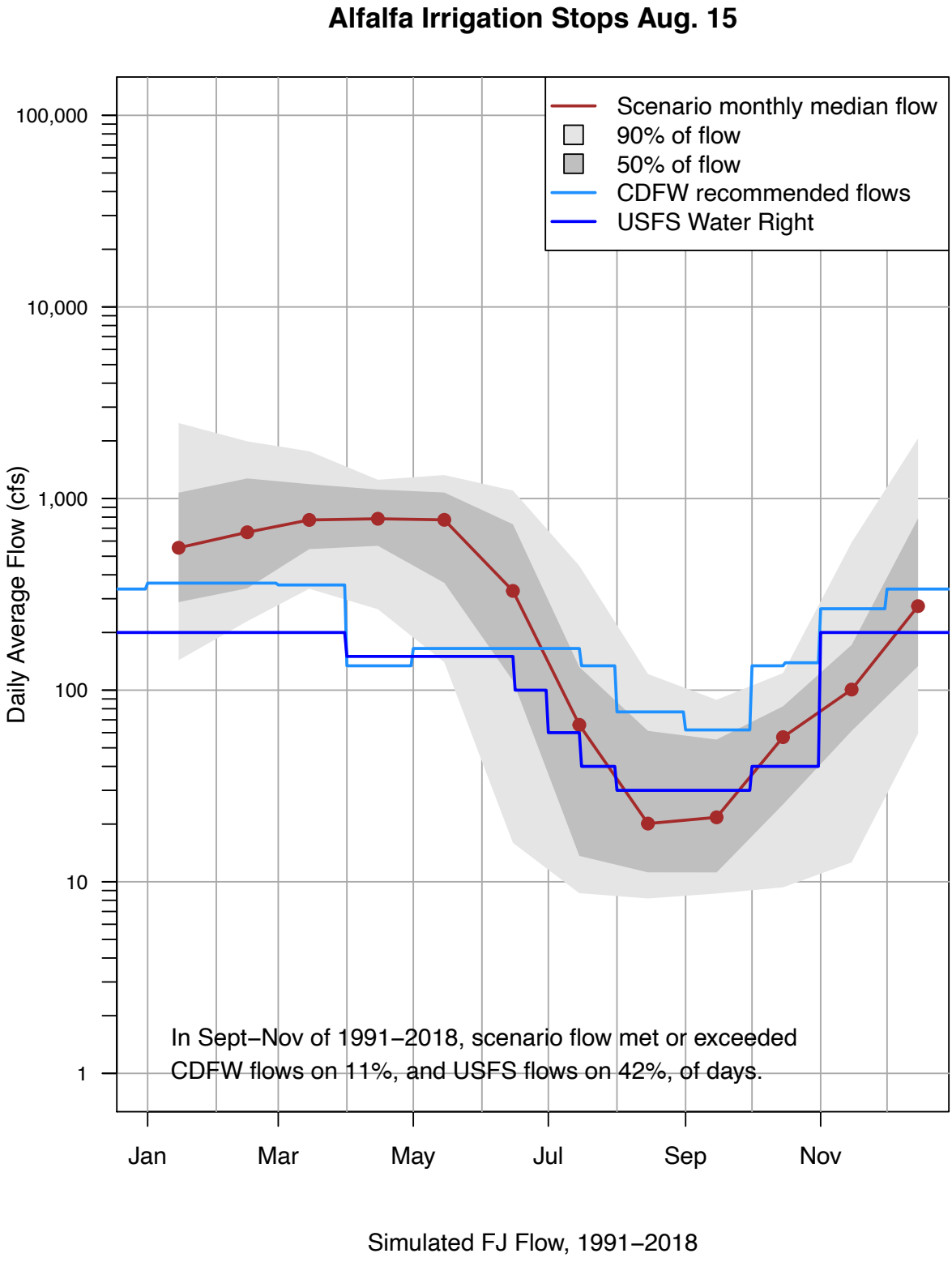

Improve Irrigation Efficiency by 20%
Scenario monthly median flow
90% of flow
50% of flow
CDFW recommended flows
USFS Water Right
100,000
10,000
1,000
100
10
1
Daily Average Flow (cfs)
In Sept–Nov of 1991–2018, scenario flow met or exceeded
CDFW flows on 10%, and USFS flows on 37%, of days.
Jan
Mar
May
Jul
Sep
Nov
Simulated FJ Flow, 1991–2018

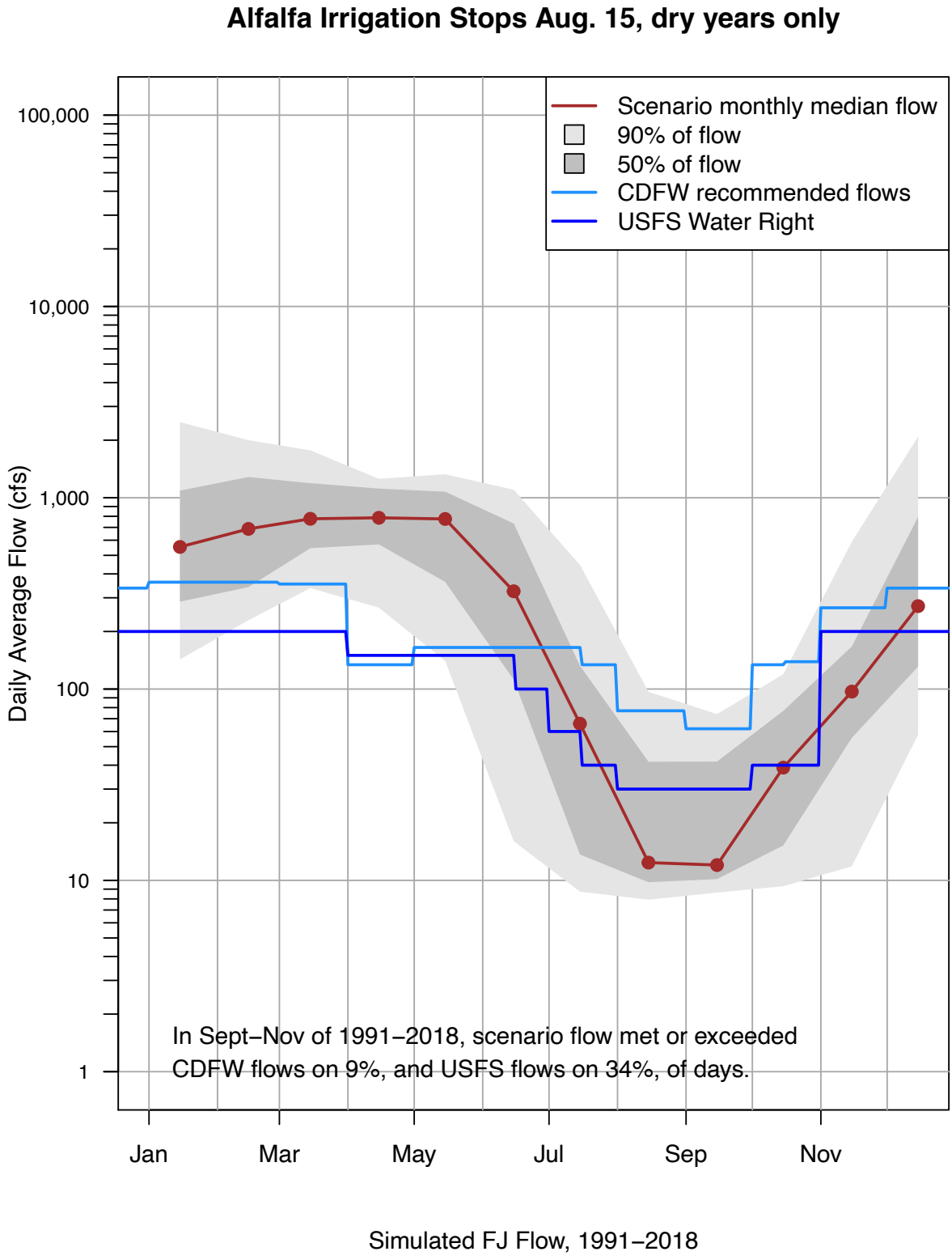

Reduce Irrigation Efficiency by 10%
Scenario monthly median flow
90% of flow
50% of flow
CDFW recommended flows
USFS Water Right
100,000
10,000
1,000
100
10
1
Daily Average Flow (cfs)
In Sept–Nov of 1991–2018, scenario flow met or exceeded
CDFW flows on 10%, and USFS flows on 32%, of days.
Jan
Mar
May
Jul
Sep
Nov
Simulated FJ Flow, 1991–2018

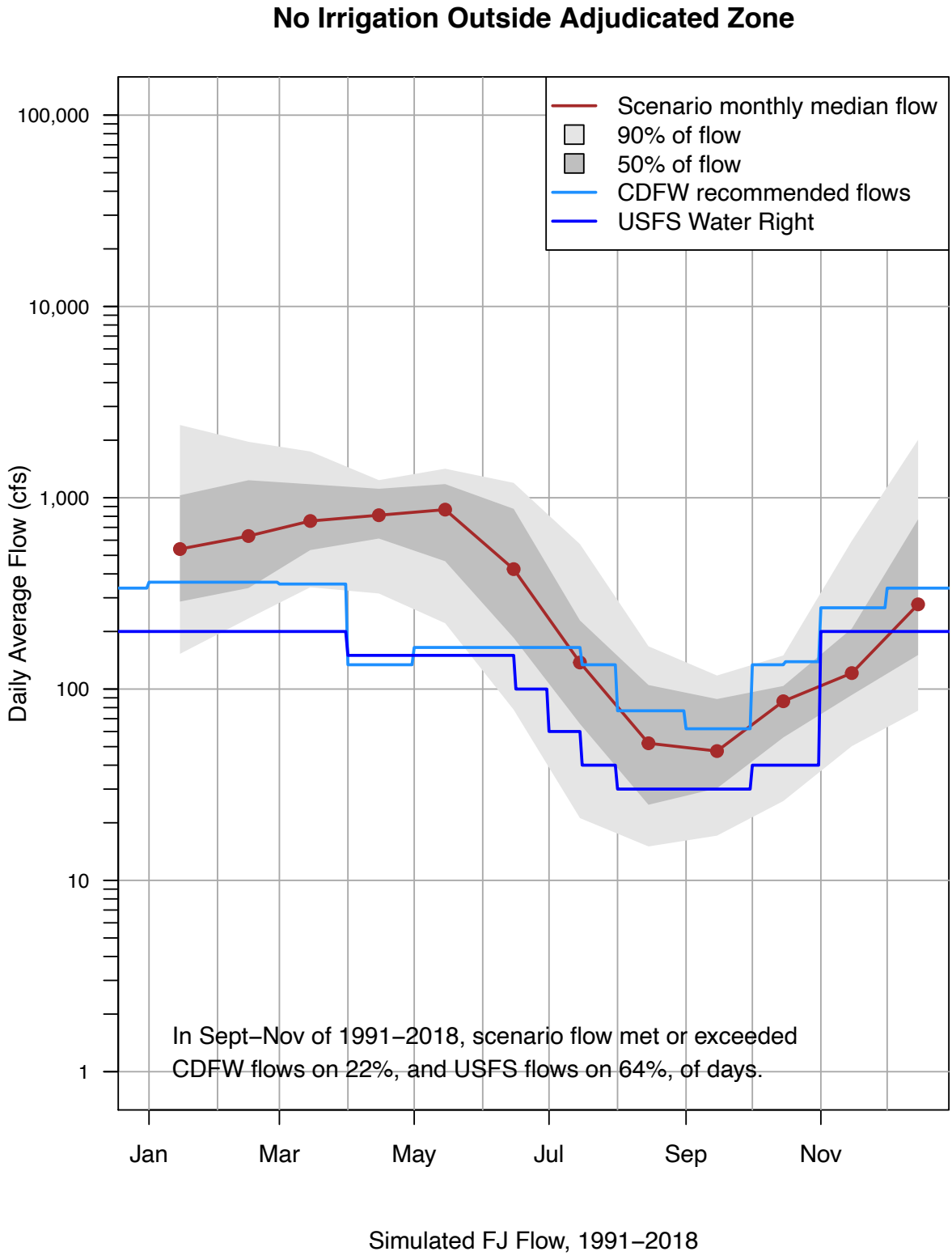

Alfalfa Irrigation Stops July 10
Scenario monthly median flow
90% of flow
50% of flow
CDFW recommended flows
USFS Water Right
100,000
10,000
1,000
100
10
1
Daily Average Flow (cfs)
In Sept–Nov of 1991–2018, scenario flow met or exceeded
CDFW flows on 18%, and USFS flows on 61%, of days.
Jan
Mar
May
Jul
Sep
Nov
Simulated FJ Flow, 1991–2018

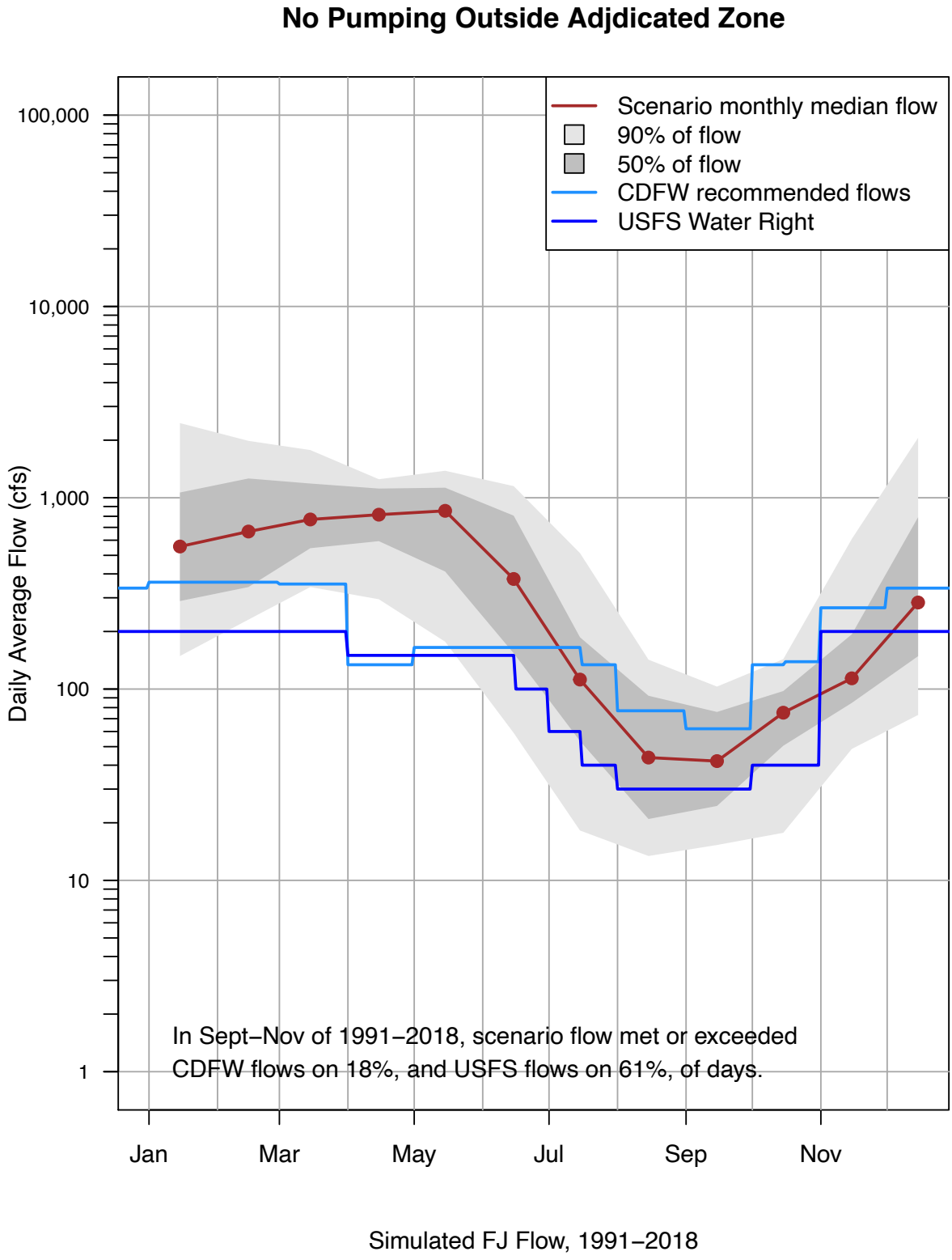

Alfalfa Irrigation Stops Aug. 01
Scenario monthly median flow
90% of flow
50% of flow
CDFW recommended flows
USFS Water Right
100,000
10,000
1,000
100
10
1
Daily Average Flow (cfs)
Jan
Mar
May
Jul
Sep
Nov
In Sept–Nov of 1991–2018, scenario flow met or exceeded
CDFW flows on 17%, and USFS flows on 52%, of days.
Simulated FJ Flow, 1991–2018

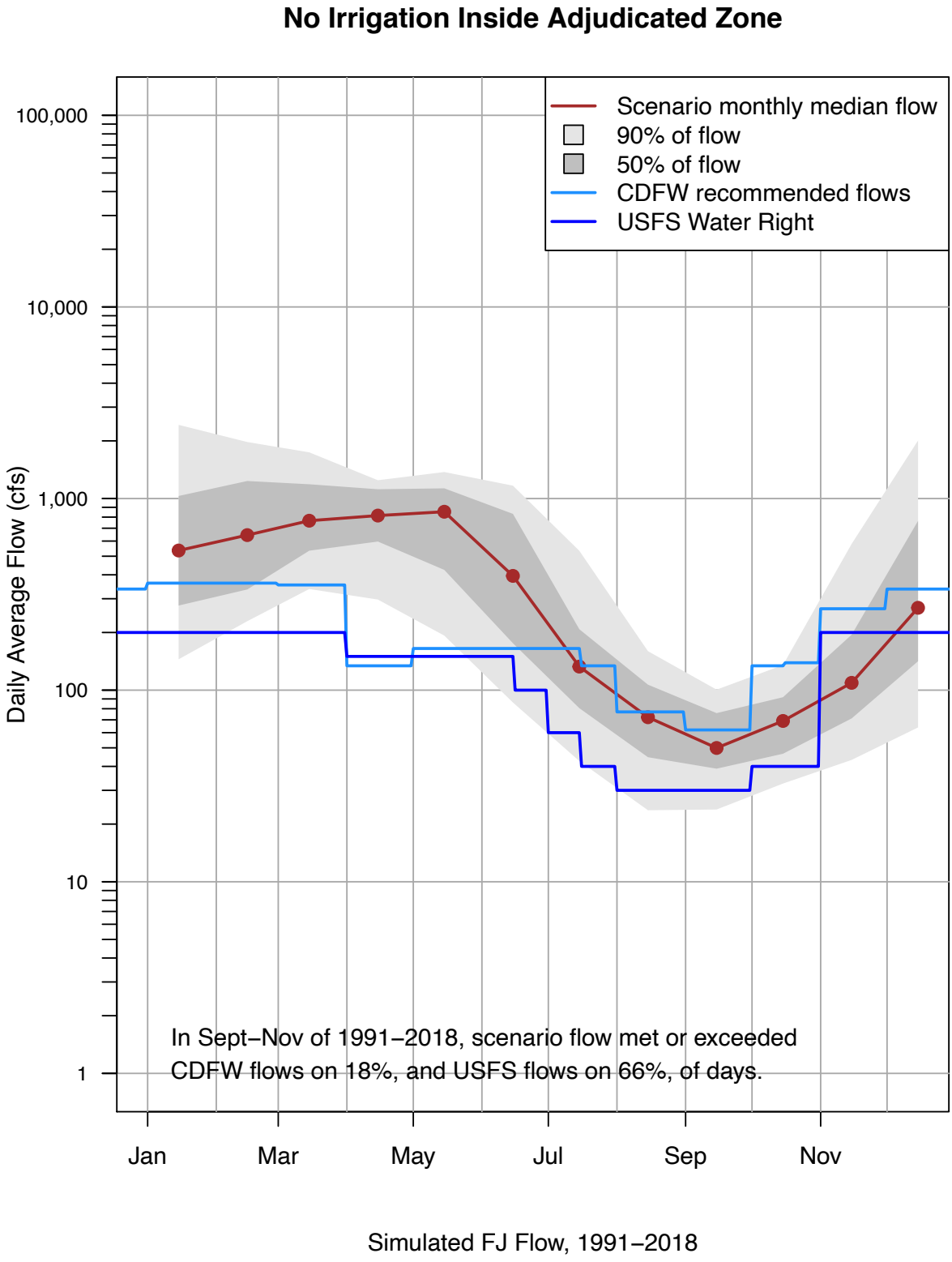

Alfalfa Irrigation Stops Aug. 01, dry years only
Scenario monthly median flow
90% of flow
50% of flow
CDFW recommended flows
USFS Water Right
100,000
10,000
1,000
100
10
1
Daily Average Flow (cfs)
Jan
Mar
May
Jul
Sep
Nov
In Sept–Nov of 1991–2018, scenario flow met or exceeded
CDFW flows on 9%, and USFS flows on 37%, of days.
Simulated FJ Flow, 1991–2018

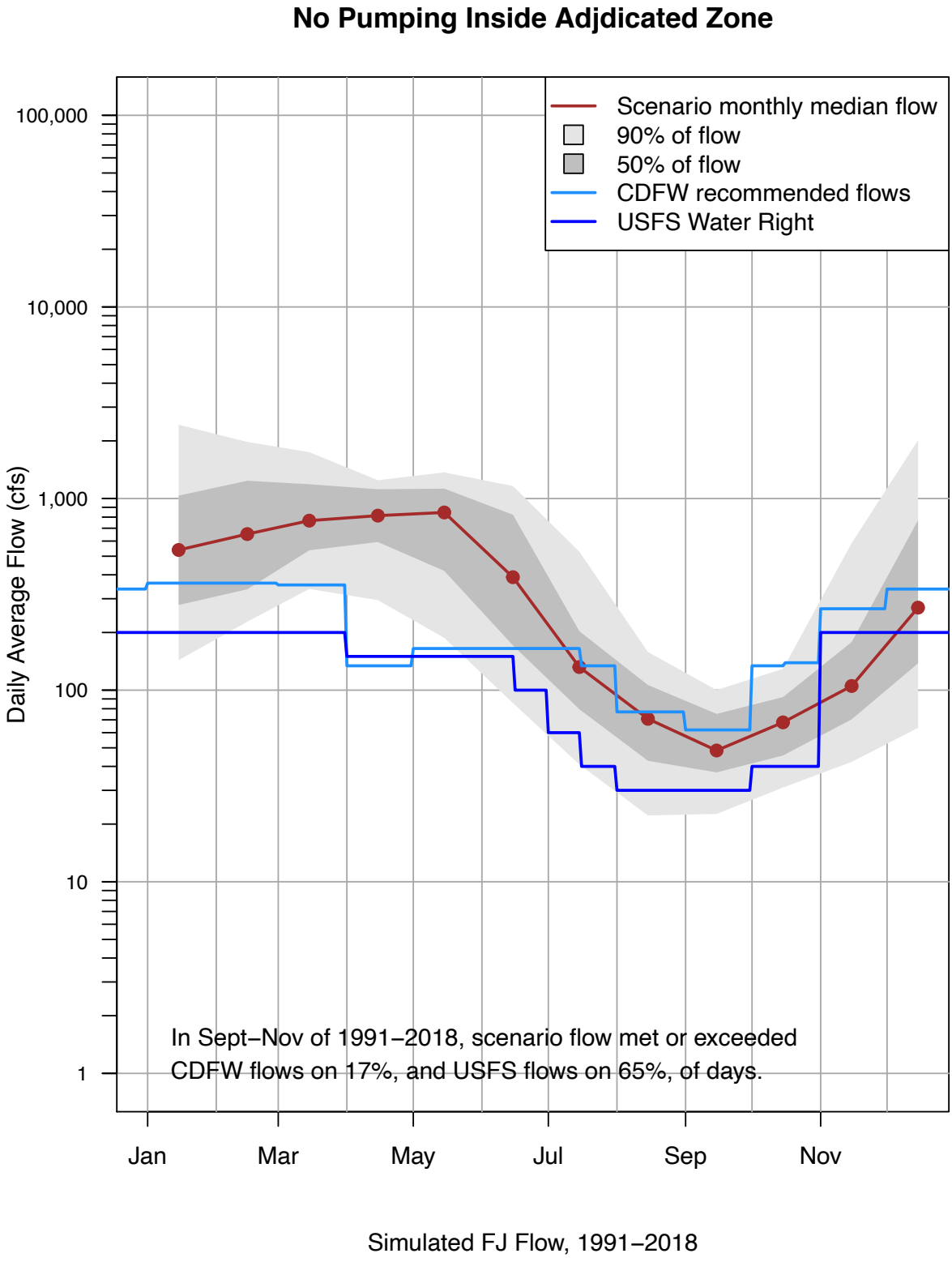

Alfalfa Irrigation Stops Aug. 15
Scenario monthly median flow
90% of flow
50% of flow
CDFW recommended flows
USFS Water Right
100,000
10,000
1,000
100
10
1
Daily Average Flow (cfs)
In Sept–Nov of 1991–2018, scenario flow met or exceeded
CDFW flows on 11%, and USFS flows on 42%, of days.
Jan
Mar
May
Jul
Sep
Nov
Simulated FJ Flow, 1991–2018

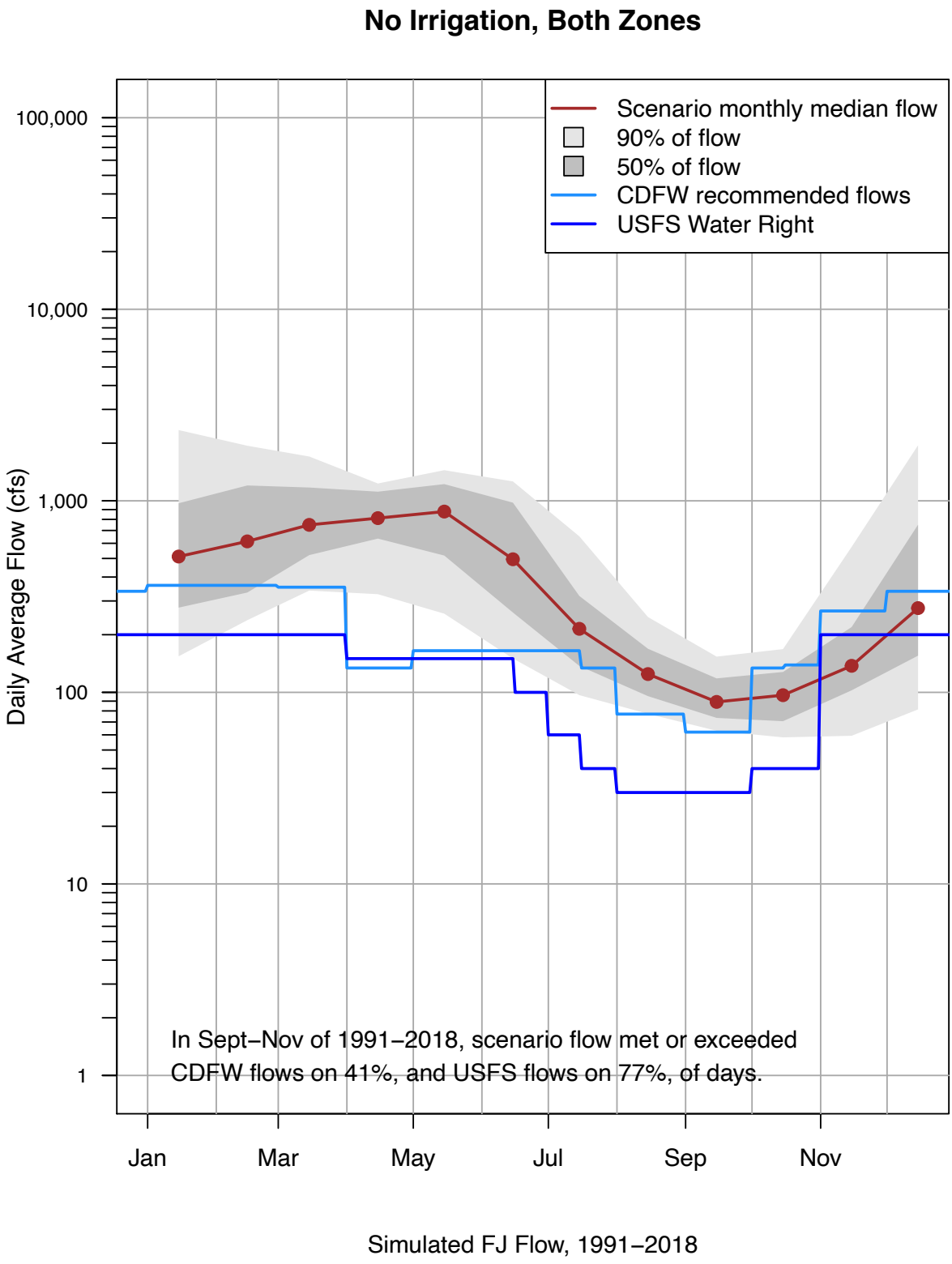

Alfalfa Irrigation Stops Aug. 15, dry years only
Scenario monthly median flow
90% of flow
50% of flow
CDFW recommended flows
USFS Water Right
100,000
10,000
1,000
100
10
1
Daily Average Flow (cfs)
In Sept–Nov of 1991–2018, scenario flow met or exceeded
CDFW flows on 9%, and USFS flows on 34%, of days.
Jan
Mar
May
Jul
Sep
Nov
Simulated FJ Flow, 1991–2018

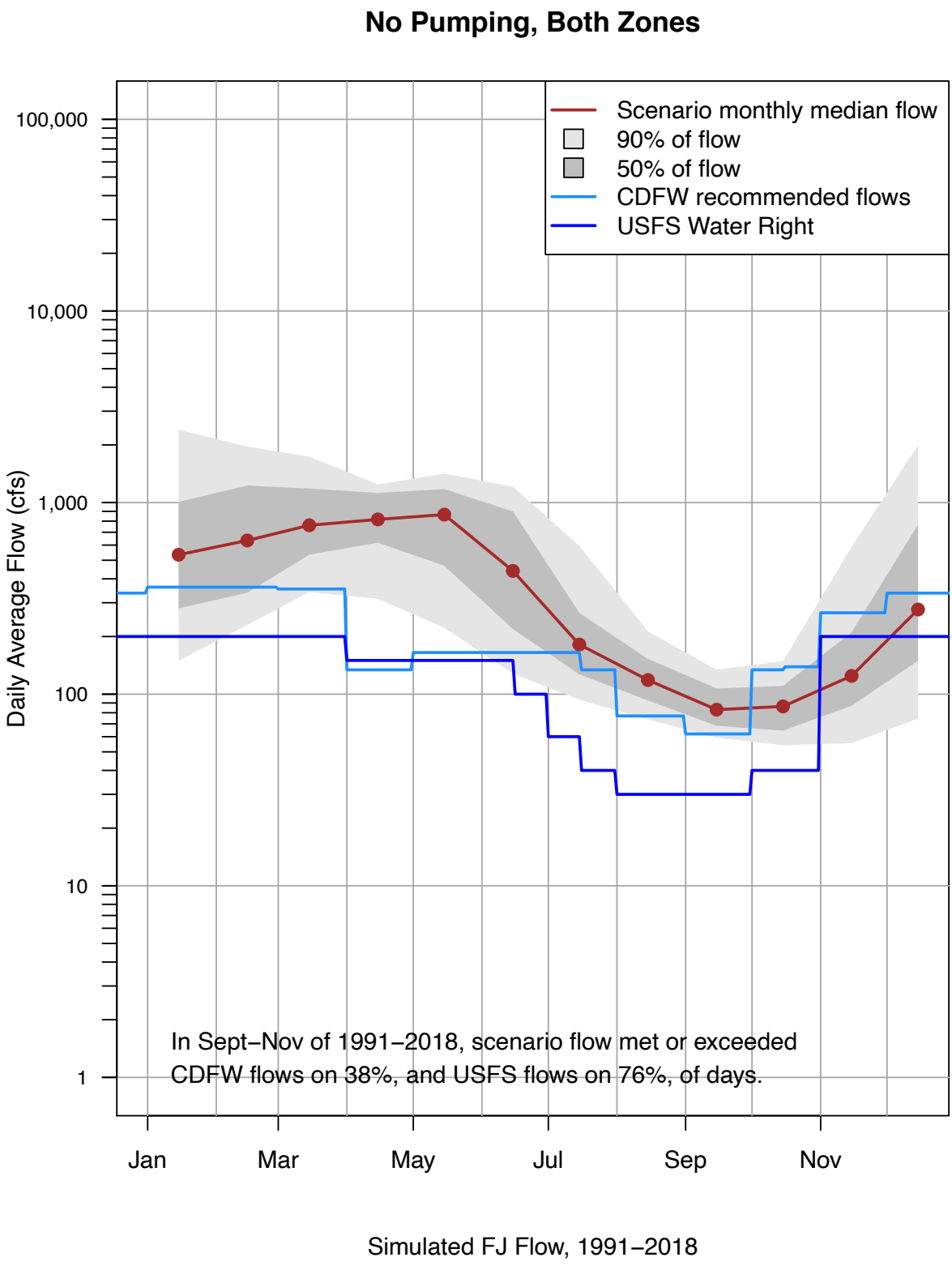

No Irrigation Outside Adjudicated Zone
Scenario monthly median flow
90% of flow
50% of flow
CDFW recommended flows
USFS Water Right
100,000
10,000
1,000
100
10
1
Daily Average Flow (cfs)
In Sept–Nov of 1991–2018, scenario flow met or exceeded
CDFW flows on 22%, and USFS flows on 64%, of days.
Jan
Mar
May
Jul
Sep
Nov
Simulated FJ Flow, 1991–2018

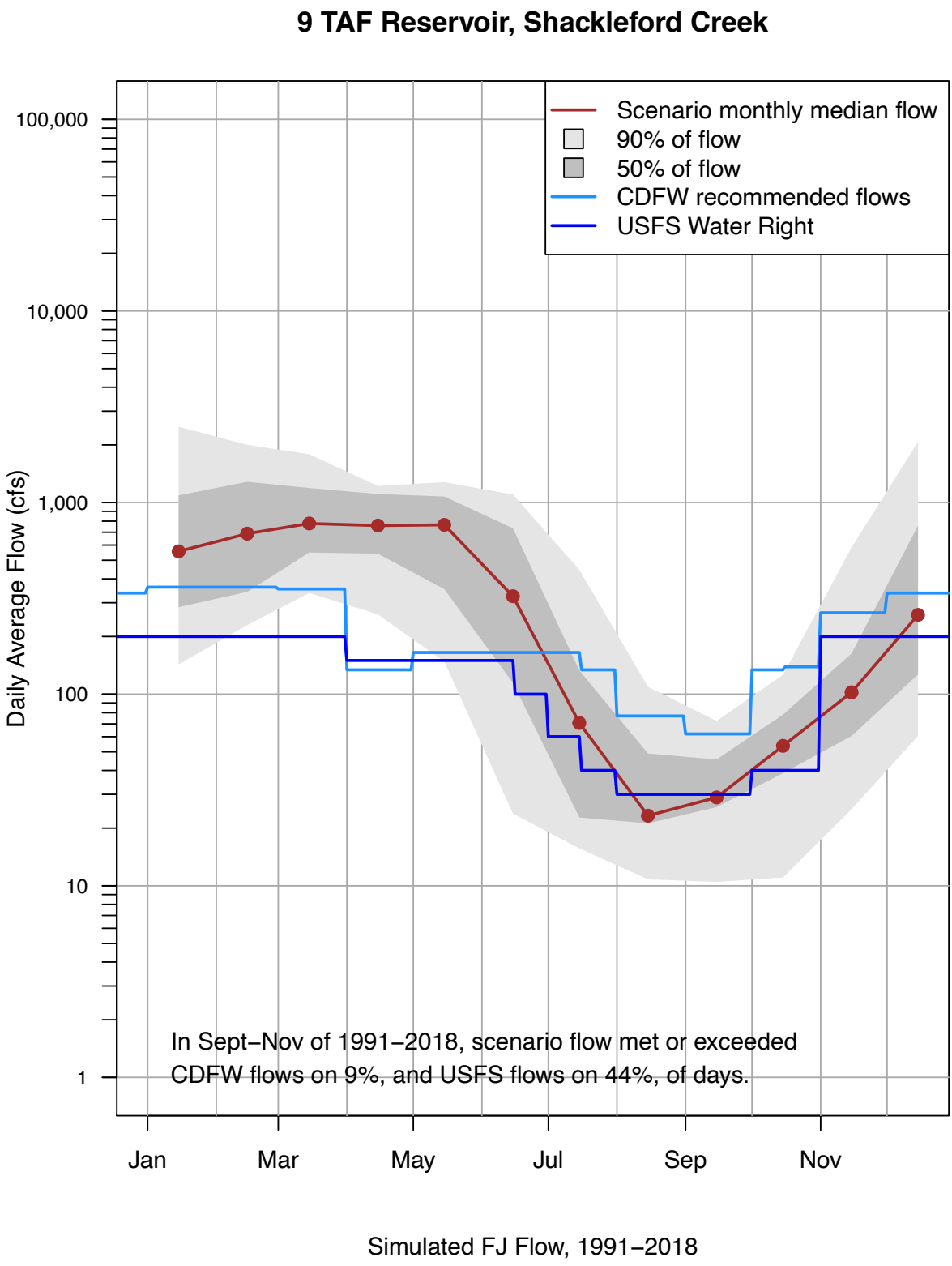

No Pumping Outside Adjdicated Zone
Scenario monthly median flow
90% of flow
50% of flow
CDFW recommended flows
USFS Water Right
100,000
10,000
1,000
100
10
1
Daily Average Flow (cfs)
In Sept–Nov of 1991–2018, scenario flow met or exceeded
CDFW flows on 18%, and USFS flows on 61%, of days.
Jan
Mar
May
Jul
Sep
Nov
Simulated FJ Flow, 1991–2018

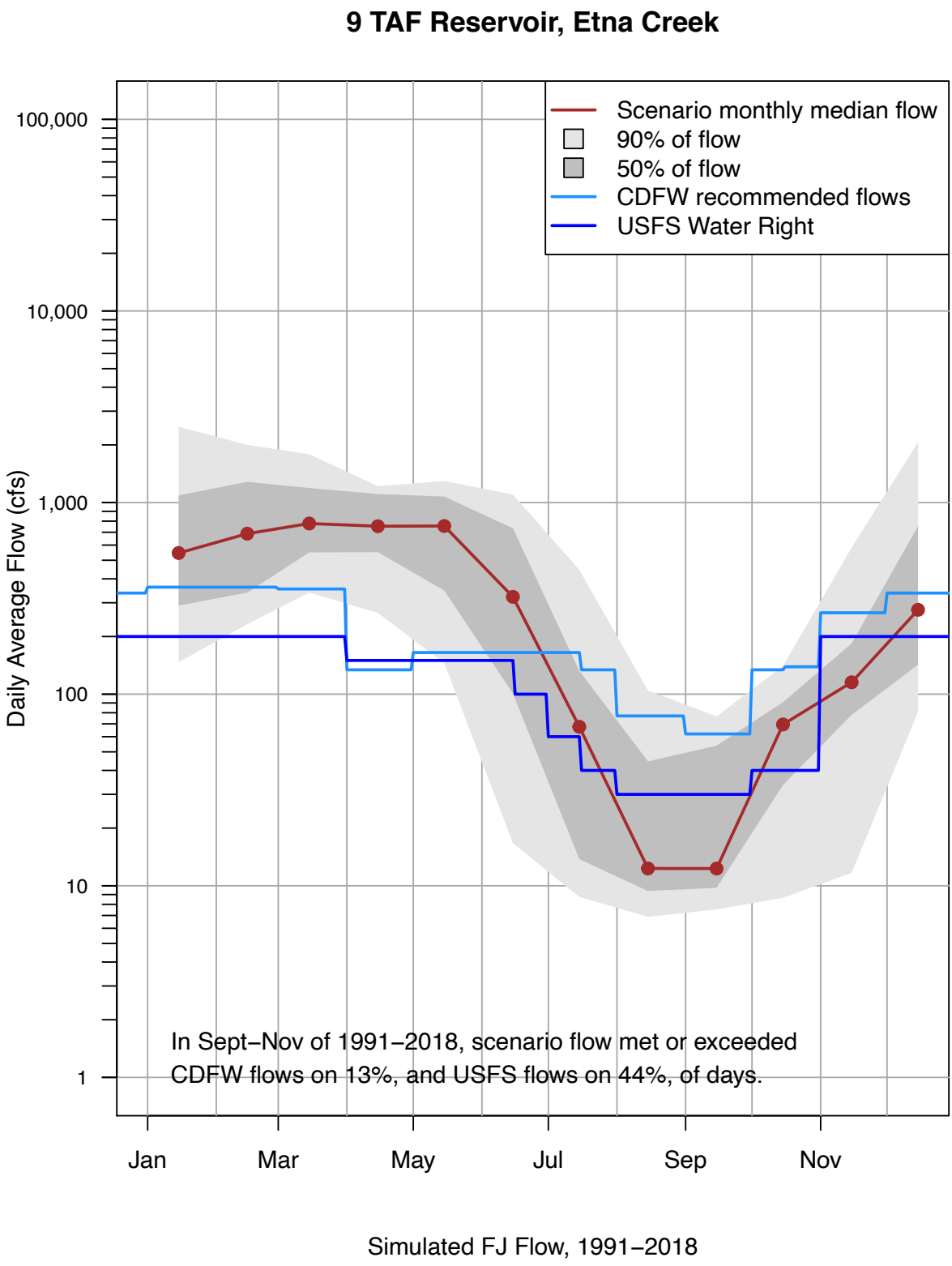

No Irrigation Inside Adjudicated Zone
Scenario monthly median flow
90% of flow
50% of flow
CDFW recommended flows
USFS Water Right
100,000
10,000
1,000
100
10
1
Daily Average Flow (cfs)
In Sept–Nov of 1991–2018, scenario flow met or exceeded
CDFW flows on 18%, and USFS flows on 66%, of days.
Jan
Mar
May
Jul
Sep
Nov
Simulated FJ Flow, 1991–2018

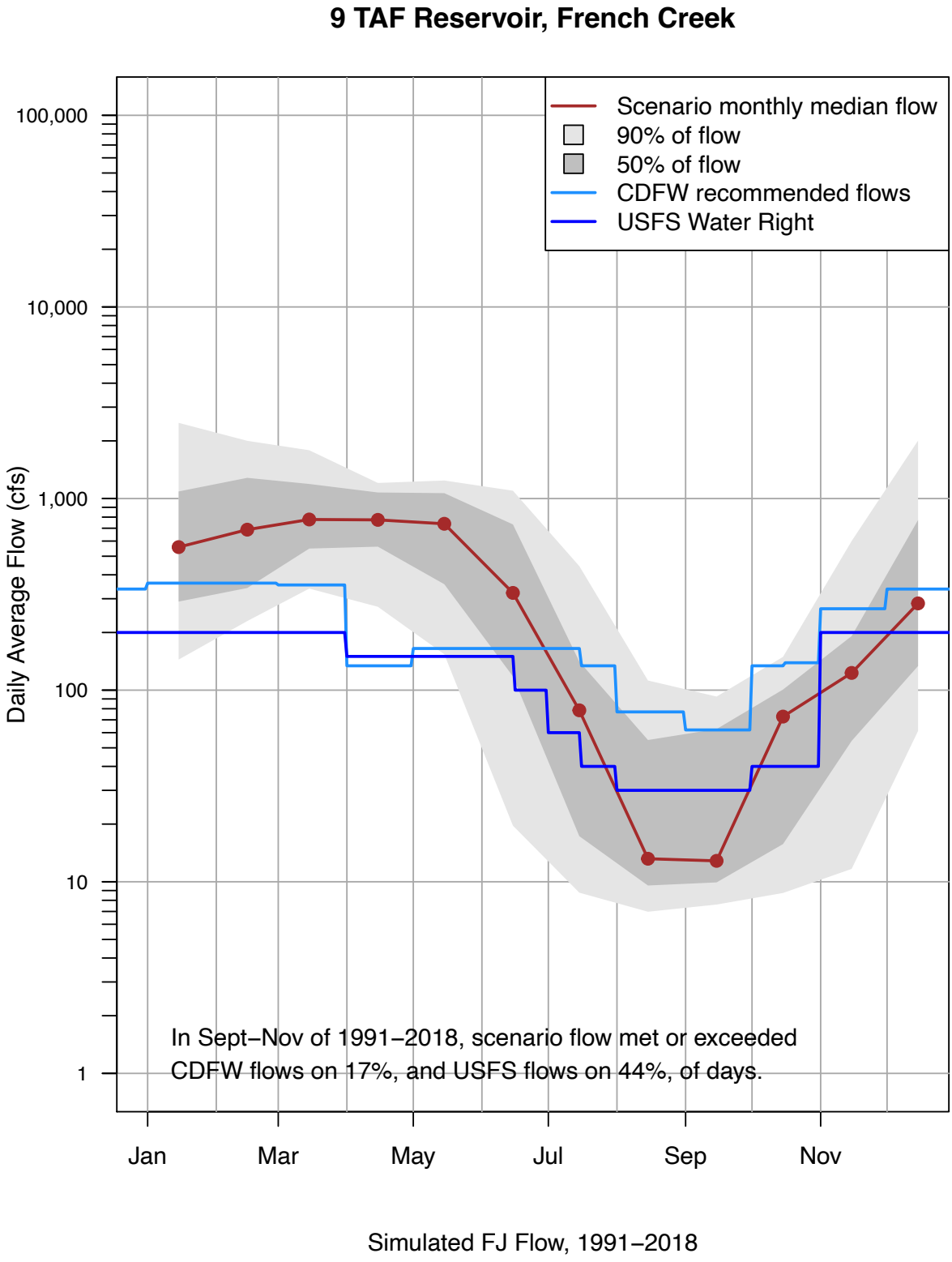

No Pumping Inside Adjdicated Zone
Scenario monthly median flow
90% of flow
50% of flow
CDFW recommended flows
USFS Water Right
100,000
10,000
1,000
100
10
1
Daily Average Flow (cfs)
In Sept–Nov of 1991–2018, scenario flow met or exceeded
CDFW flows on 17%, and USFS flows on 65%, of days.
Jan
Mar
May
Jul
Sep
Nov
Simulated FJ Flow, 1991–2018

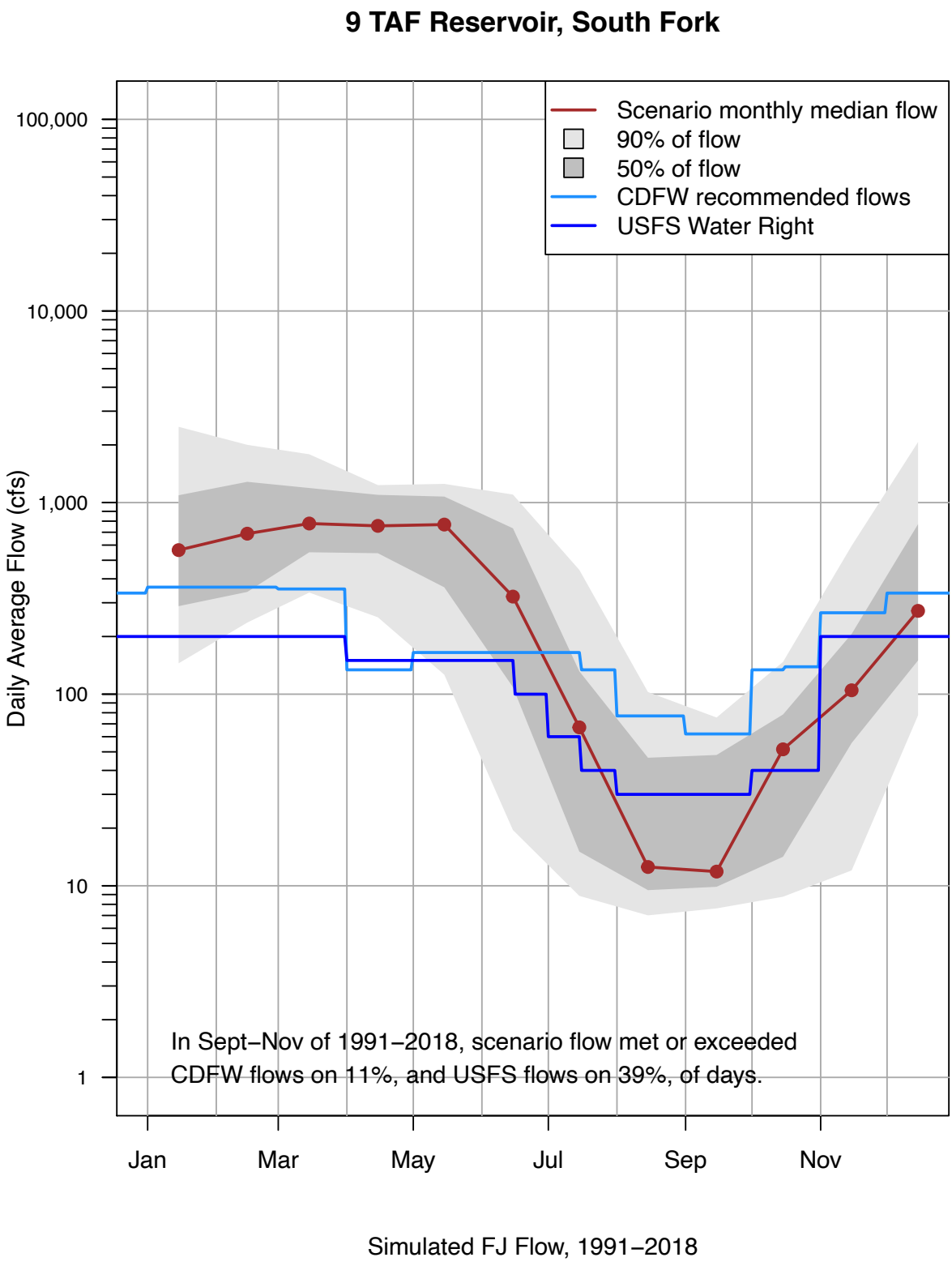

No Irrigation, Both Zones
Scenario monthly median flow
90% of flow
50% of flow
CDFW recommended flows
USFS Water Right
100,000
10,000
1,000
100
10
1
Daily Average Flow (cfs)
In Sept–Nov of 1991–2018, scenario flow met or exceeded
CDFW flows on 41%, and USFS flows on 77%, of days.
Jan
Mar
May
Jul
Sep
Nov
Simulated FJ Flow, 1991–2018

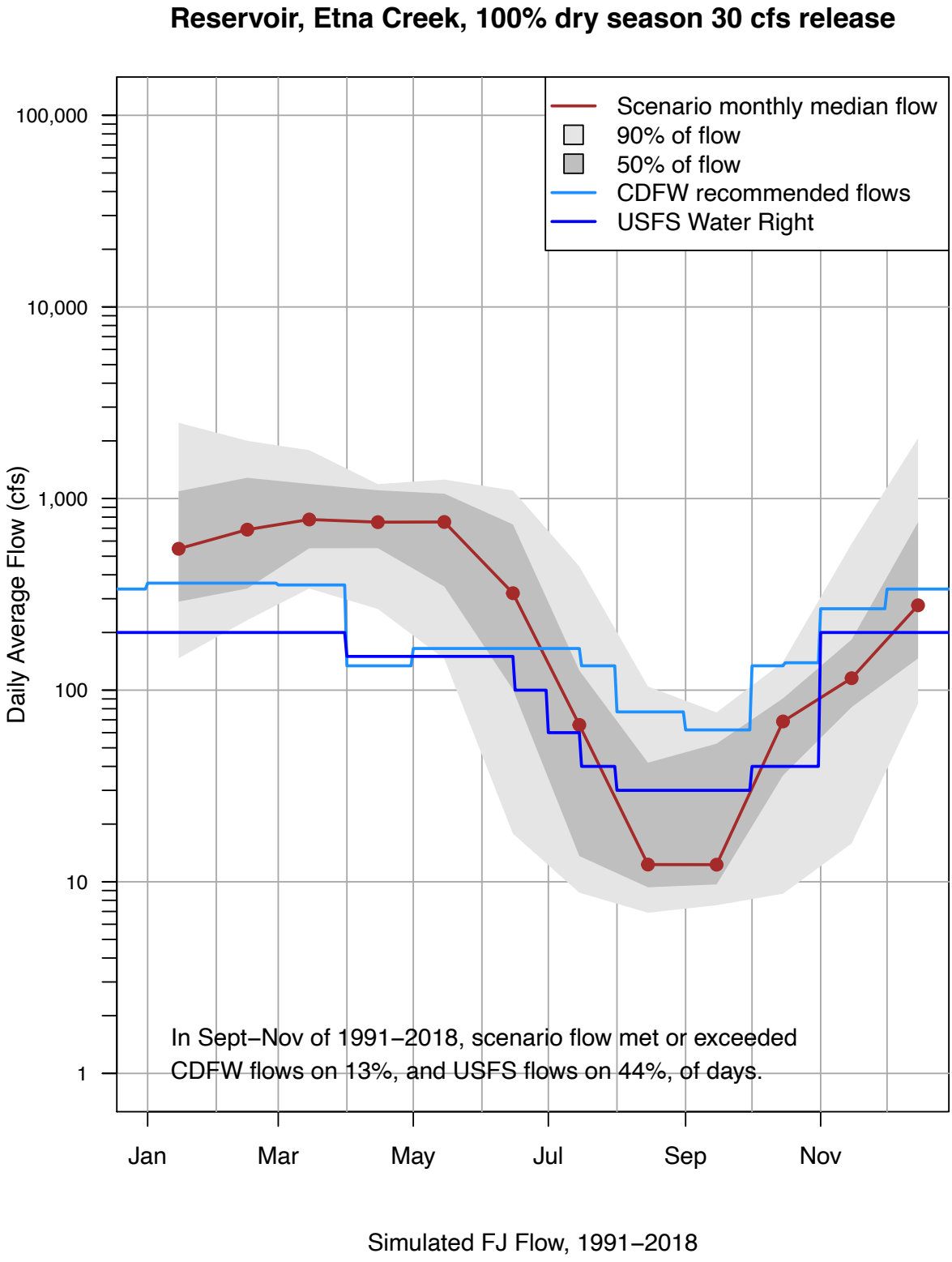

No Pumping, Both Zones
Scenario monthly median flow
90% of flow
50% of flow
CDFW recommended flows
USFS Water Right
100,000
10,000
1,000
100
10
1
Daily Average Flow (cfs)
In Sept–Nov of 1991–2018, scenario flow met or exceeded
CDFW flows on 38%, and USFS flows on 76%, of days.
Jan
Mar
May
Jul
Sep
Nov
Simulated FJ Flow, 1991–2018

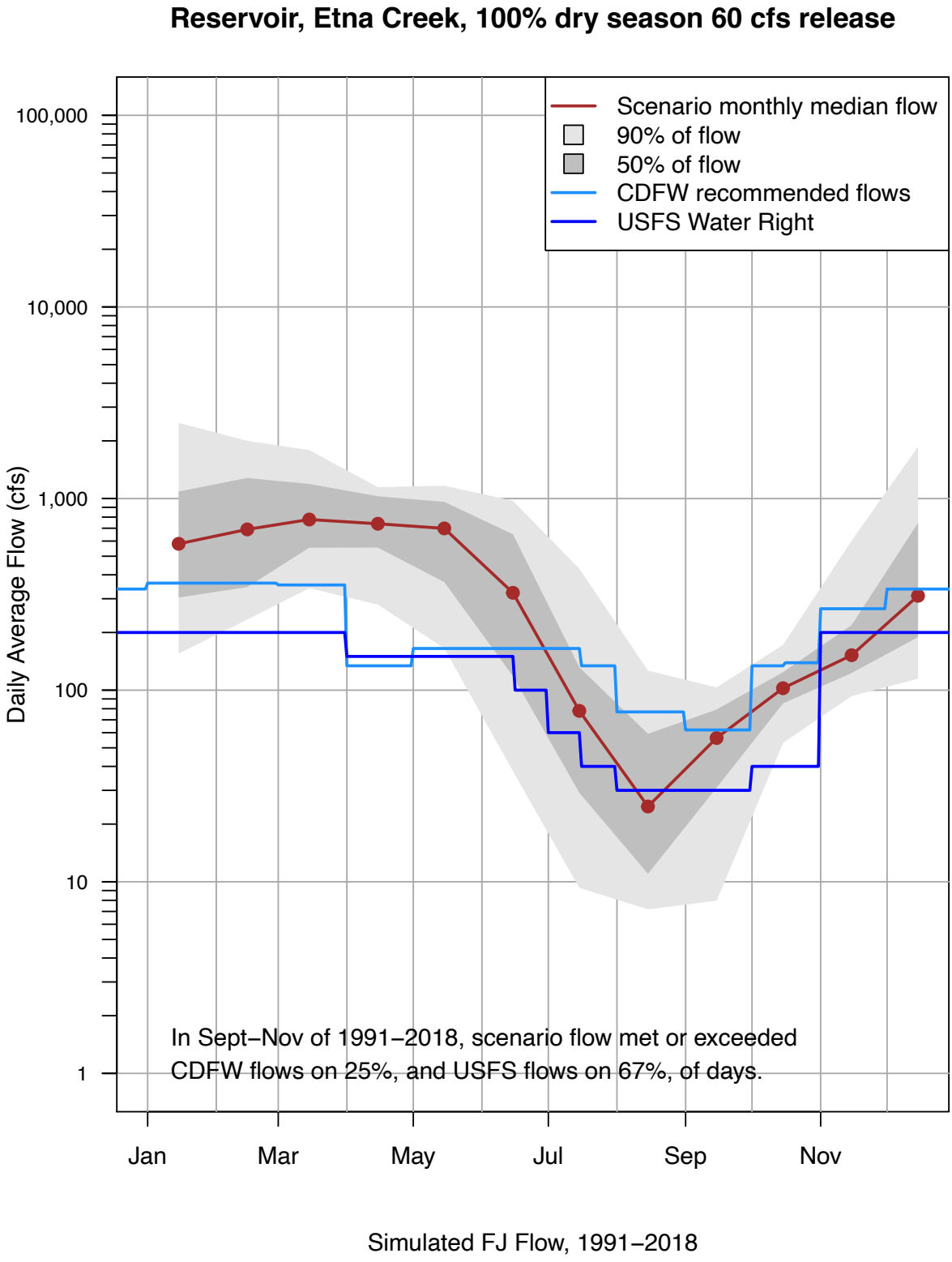

9 TAF Reservoir, Shackleford Creek
Scenario monthly median flow
90% of flow
50% of flow
CDFW recommended flows
USFS Water Right
100,000
10,000
1,000
100
10
1
Daily Average Flow (cfs)
Jan
Mar
May
Jul
Sep
Nov
In Sept–Nov of 1991–2018, scenario flow met or exceeded
CDFW flows on 9%, and USFS flows on 44%, of days.
Simulated FJ Flow, 1991–2018


9 TAF Reservoir, Etna Creek
Scenario monthly median flow
90% of flow
50% of flow
CDFW recommended flows
USFS Water Right
100,000
10,000
1,000
100
10
1
Daily Average Flow (cfs)
In Sept–Nov of 1991–2018, scenario flow met or exceeded
CDFW flows on 13%, and USFS flows on 44%, of days.
Jan
Mar
May
Jul
Sep
Nov
Simulated FJ Flow, 1991–2018


9 TAF Reservoir, French Creek
Scenario monthly median flow
90% of flow
50% of flow
CDFW recommended flows
USFS Water Right
100,000
10,000
1,000
100
10
1
Daily Average Flow (cfs)
In Sept–Nov of 1991–2018, scenario flow met or exceeded
CDFW flows on 17%, and USFS flows on 44%, of days.
Jan
Mar
May
Jul
Sep
Nov
Simulated FJ Flow, 1991–2018


9 TAF Reservoir, South Fork
Scenario monthly median flow
90% of flow
50% of flow
CDFW recommended flows
USFS Water Right
100,000
10,000
1,000
100
10
1
Daily Average Flow (cfs)
Jan
Mar
May
Jul
Sep
Nov
In Sept–Nov of 1991–2018, scenario flow met or exceeded
CDFW flows on 11%, and USFS flows on 39%, of days.
Simulated FJ Flow, 1991–2018


Reservoir, Etna Creek, 100% dry season 30 cfs release
Scenario monthly median flow
90% of flow
50% of flow
CDFW recommended flows
USFS Water Right
100,000
10,000
1,000
100
10
1
Daily Average Flow (cfs)
Jan
Mar
May
Jul
Sep
Nov
In Sept–Nov of 1991–2018, scenario flow met or exceeded
CDFW flows on 13%, and USFS flows on 44%, of days.
Simulated FJ Flow, 1991–2018


Reservoir, Etna Creek, 100% dry season 60 cfs release
Scenario monthly median flow
90% of flow
50% of flow
CDFW recommended flows
USFS Water Right
100,000
10,000
1,000
100
10
1
Daily Average Flow (cfs)
Jan
Mar
May
Jul
Sep
Nov
In Sept–Nov of 1991–2018, scenario flow met or exceeded
CDFW flows on 25%, and USFS flows on 67%, of days.
Simulated FJ Flow, 1991–2018