Developing a coordinated instream flow strategy for California

CABW - October 18, 2016

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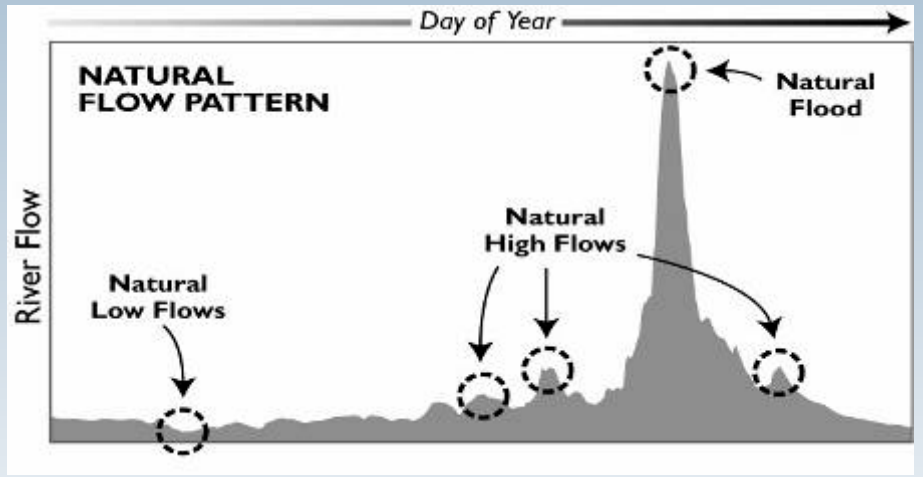

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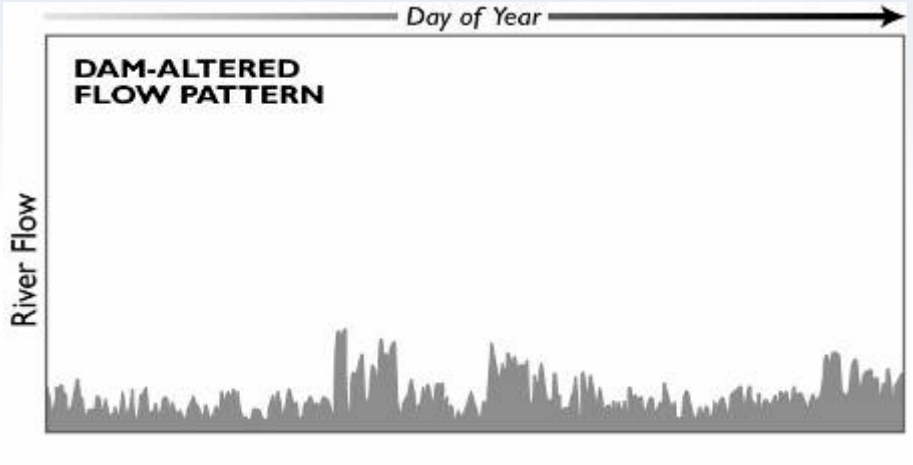
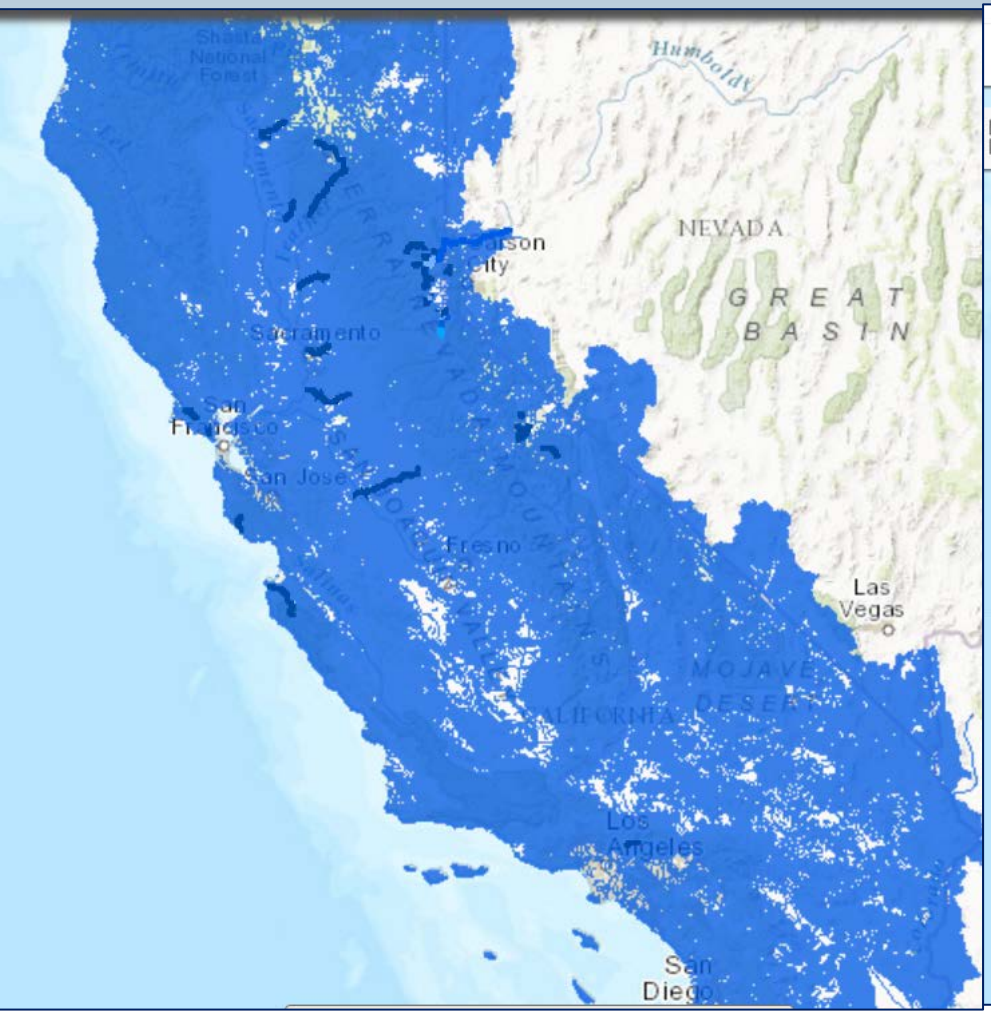


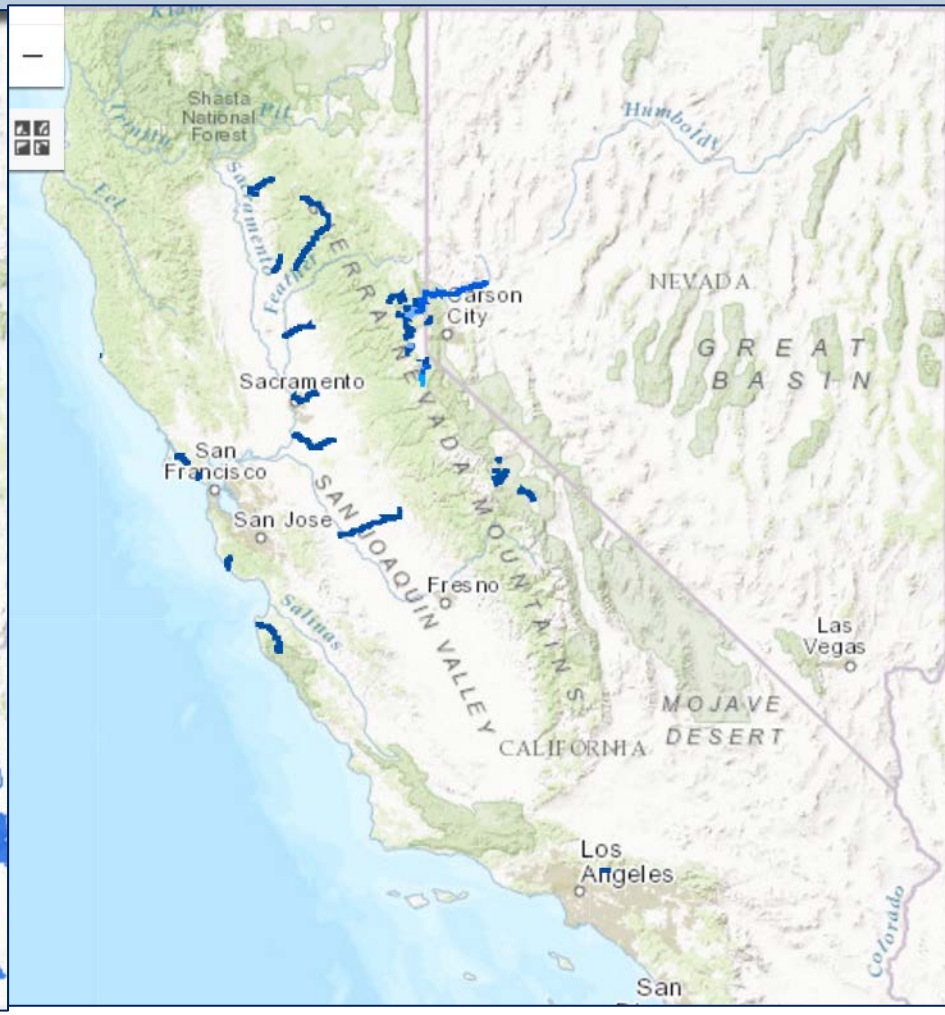
This is the same volume!

California Streams



DFW's Biogeographic Information and Observation System (BIOS)

Instream Flow Recommendations



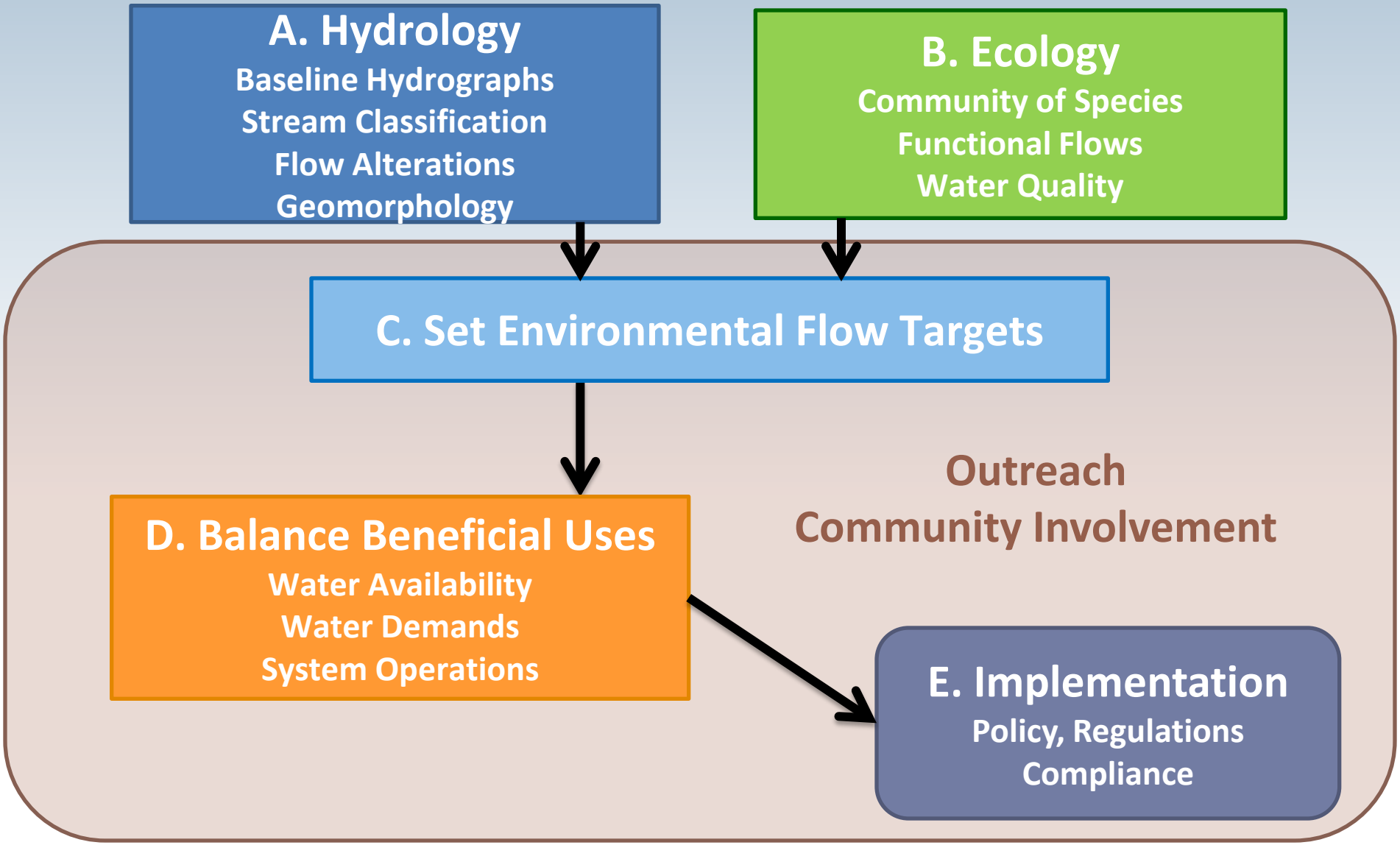
DFW's Instream Flow Program

Goal

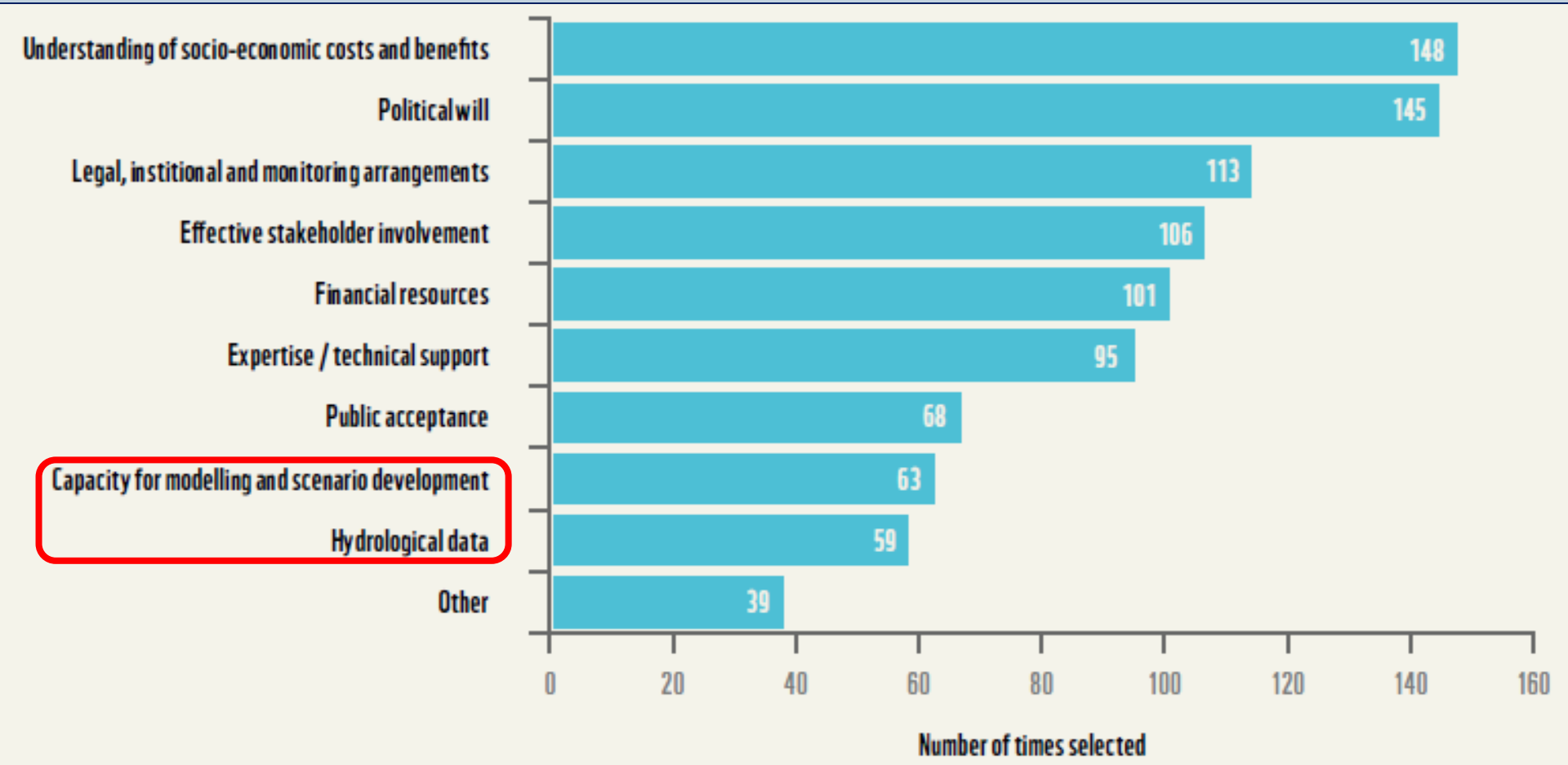
Integrated, flexible approach to establishing flow targets statewide

- Build on existing assessment frameworks
- Provide guidance on type of method based on
  - Stream class
  - Desired outcomes
  - Most common types of alteration
- Clear management context

California Environmental Flows Framework



Barriers to Implementation:
It's Not a Lack of Scientific Knowledge



Moore (2004) *Perceptions and interpretations of environmental flows and implications for future water resource management: A survey study*, Masters Thesis, Department of Water and Environmental Studies, Linköping University, Sweden.

Aim to survive drought and recover in wetter years

Unregulated Rivers

– Flow provided by conditions on extraction

– In droughts, irrigators on rosters or bans

Regulated Rivers

– Planned Environmental Water

– Held Environmental Water

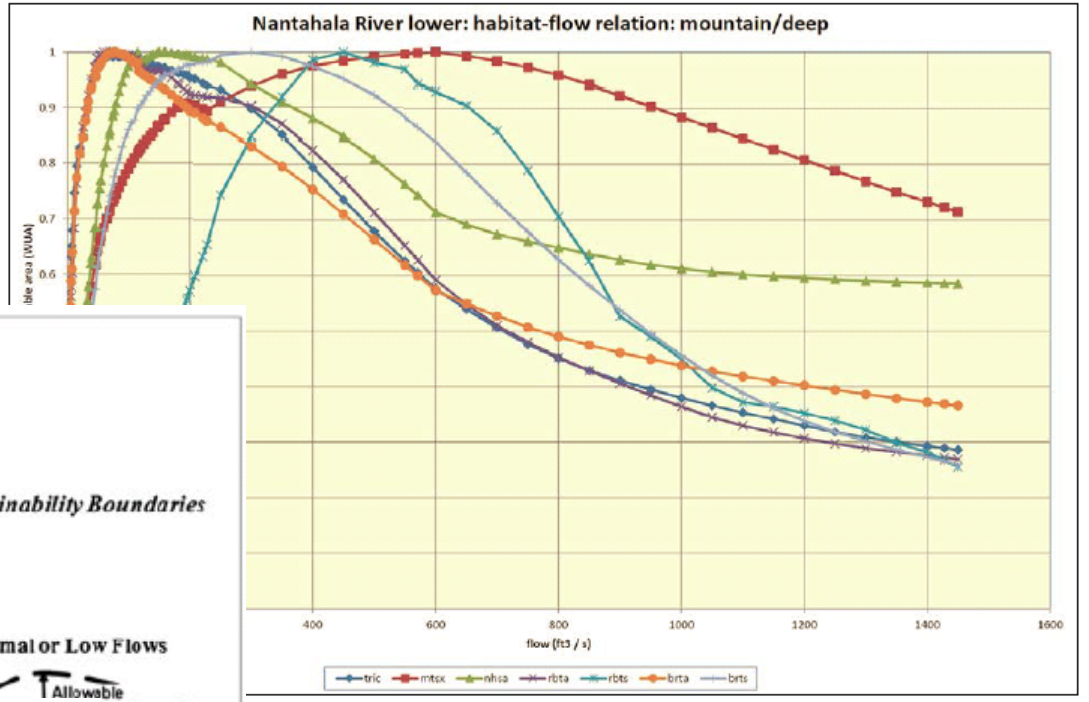
Use

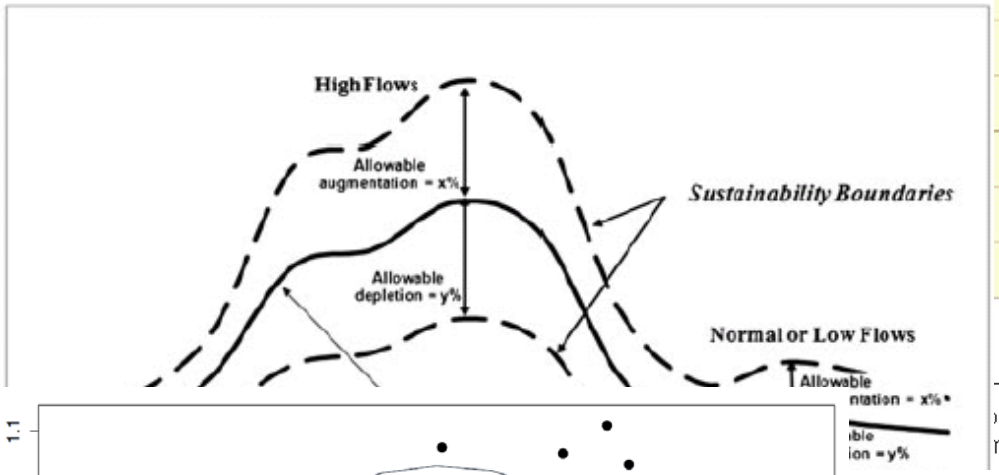
Which locations

Carryover for next year

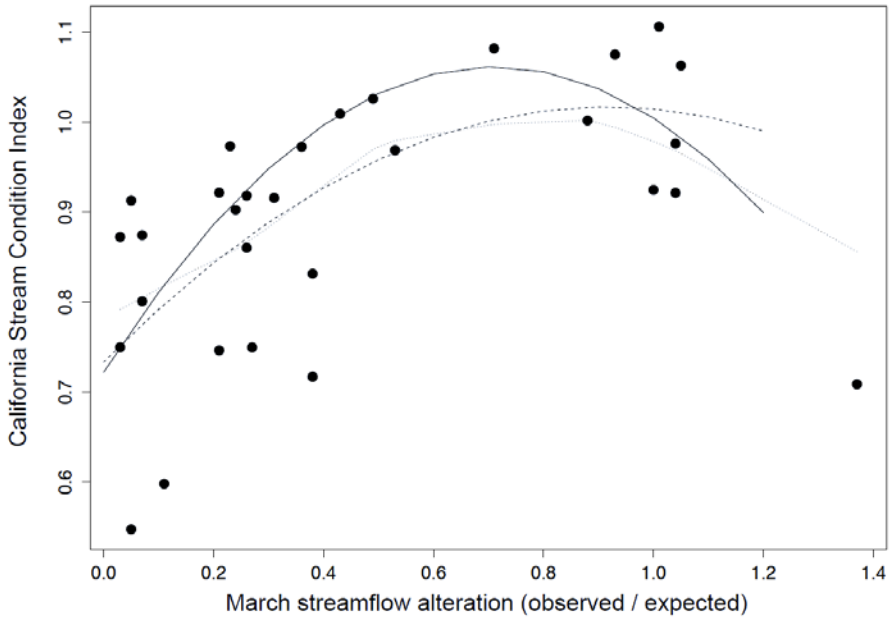
Sell

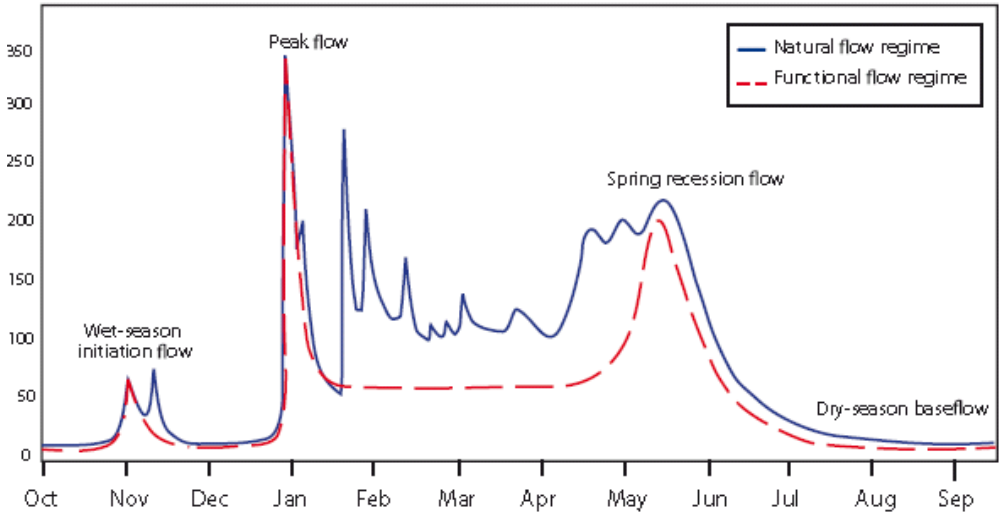
Many Technical Approaches





f WUA habitat-discharge relation (mountain-deep species/life stages)
n PHABSIM modeling.





ELOHA -Carlisle et al. 2015

Functional Flows - Yarnell et al. 2015

Key Components

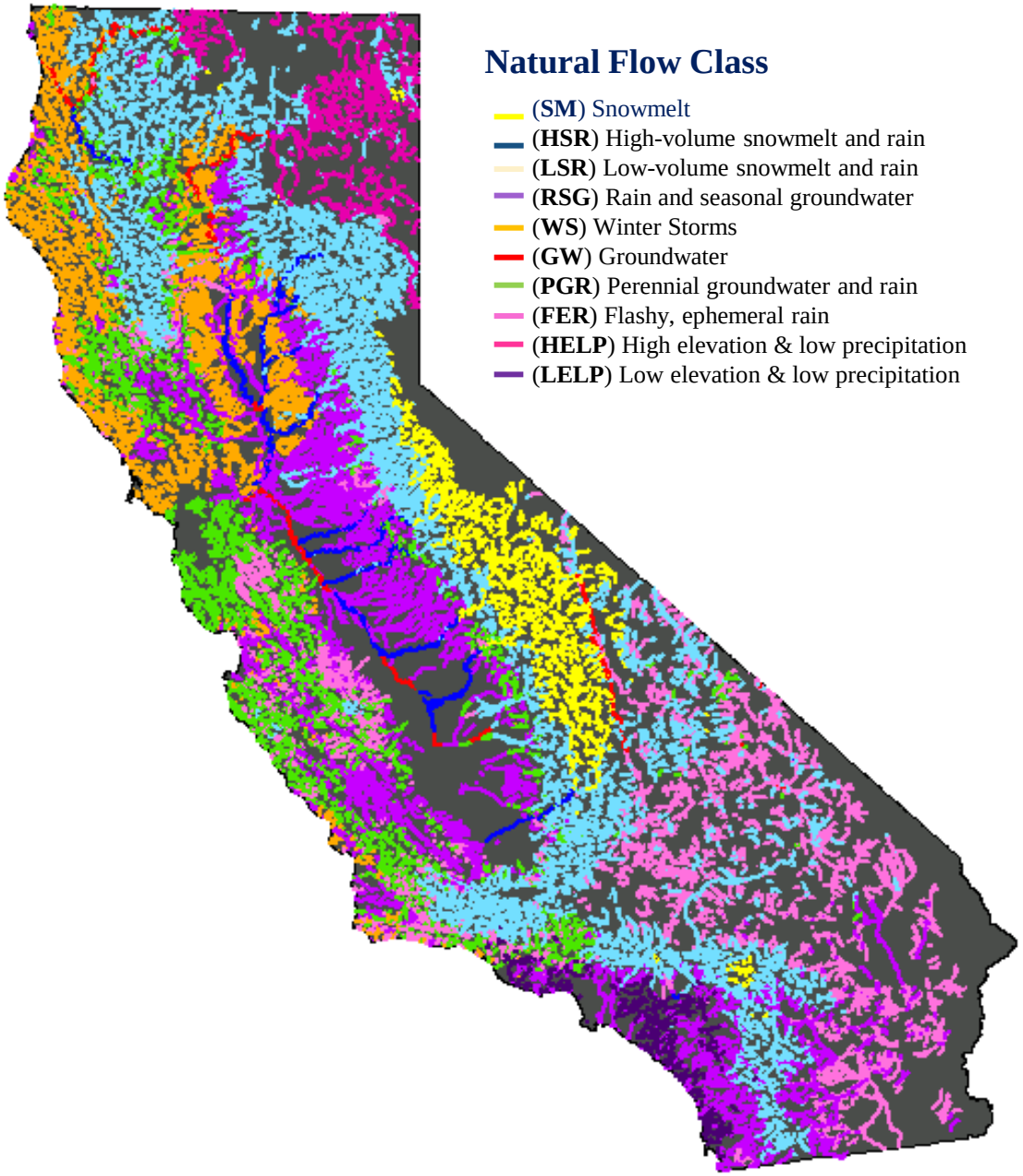
Define the problem:

- What is the system type?
- What are the desired biological outcomes?
- What is the relevant spatial scale?
- What is the hydrologic foundation and main type of alteration?
- What is the Management context?
- Are there additional stressors (altered geomorphology, temperature, water quality)?

What is the system type?

Stream classification

- Catchment Properties
- Rainfall Patterns
- Geology
- Soil Properties

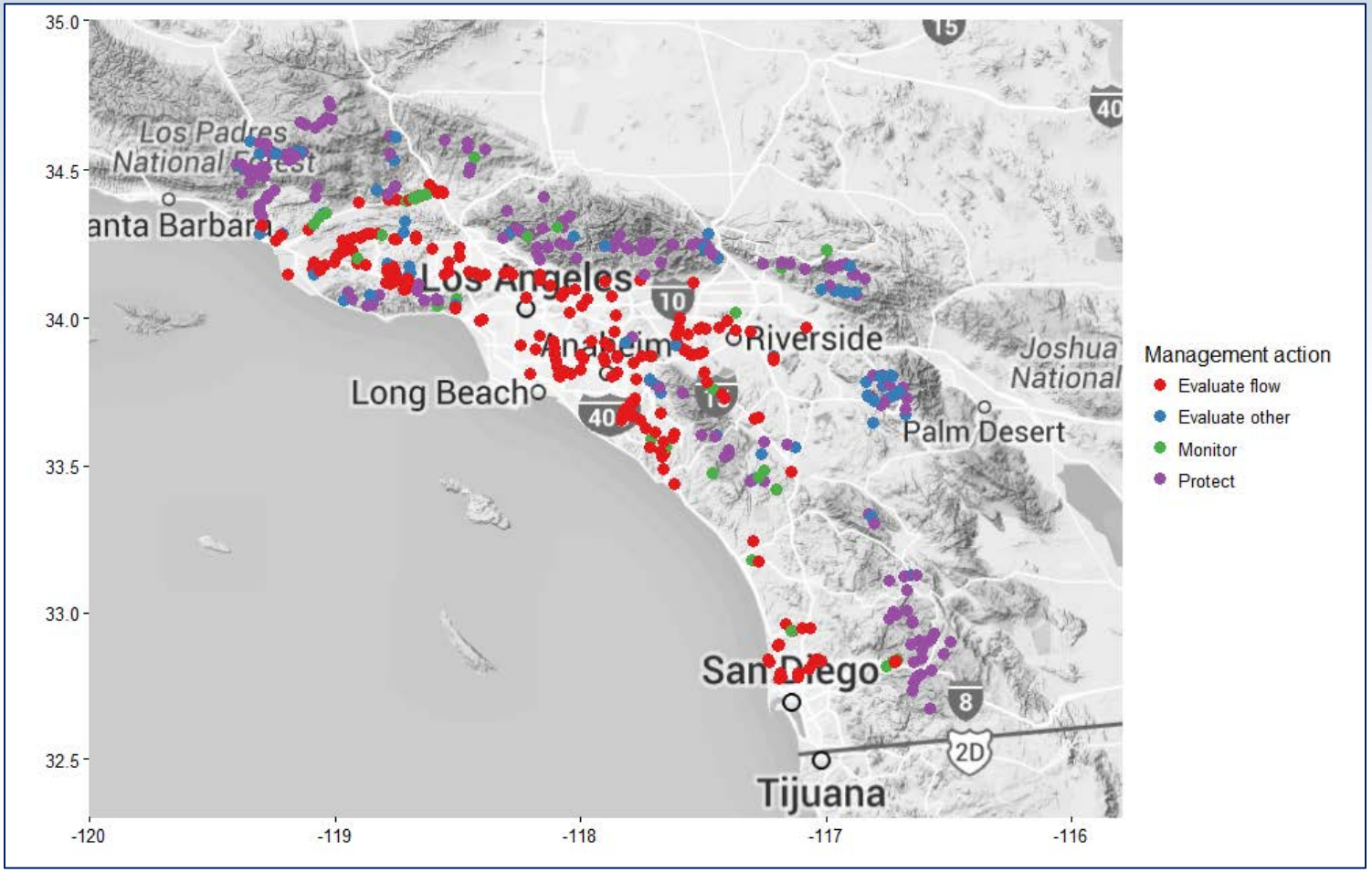


What are the desired biological outcomes?

- What does success look like?
- What do we care about?
- Informed by science, but ultimately based on values

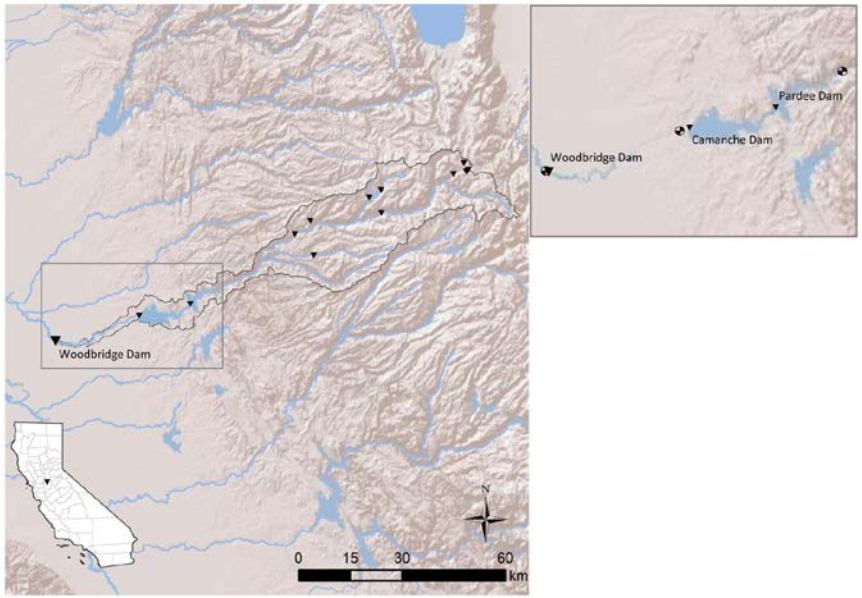
What is the relevant spatial scale?

- Region? Watershed? Reach?



Hydrologic foundation

Woodbridge Dam



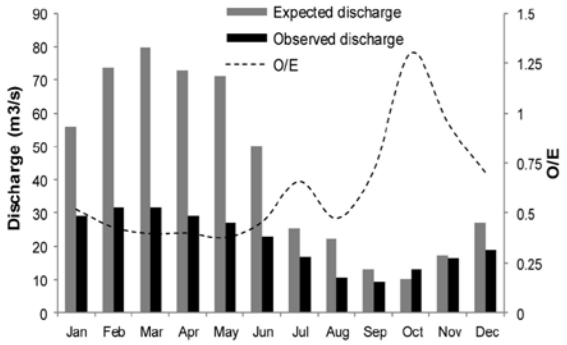


Figure 4.8 Expected (E; modeled) and observed mean monthly flow below Woodbridge Dam on the Mokelumne River.

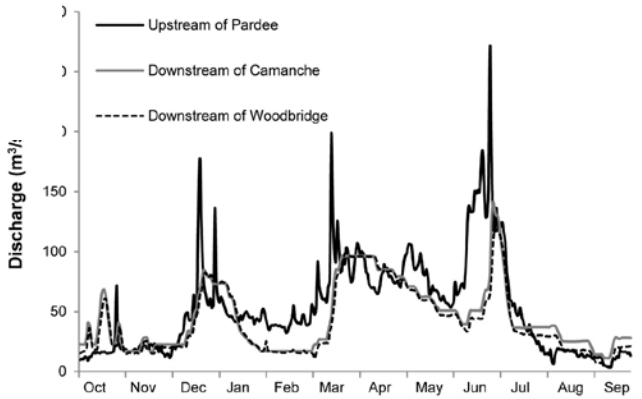
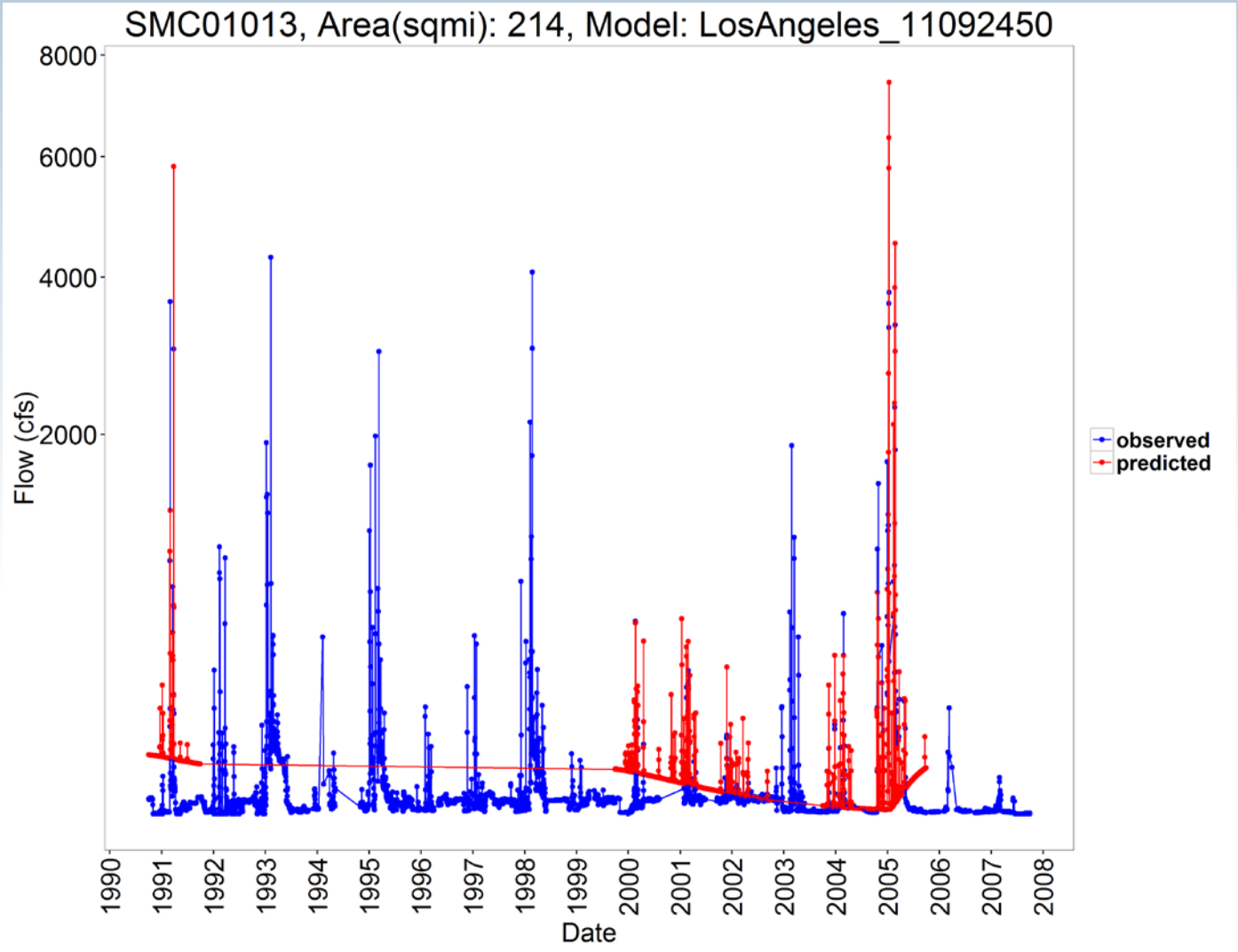


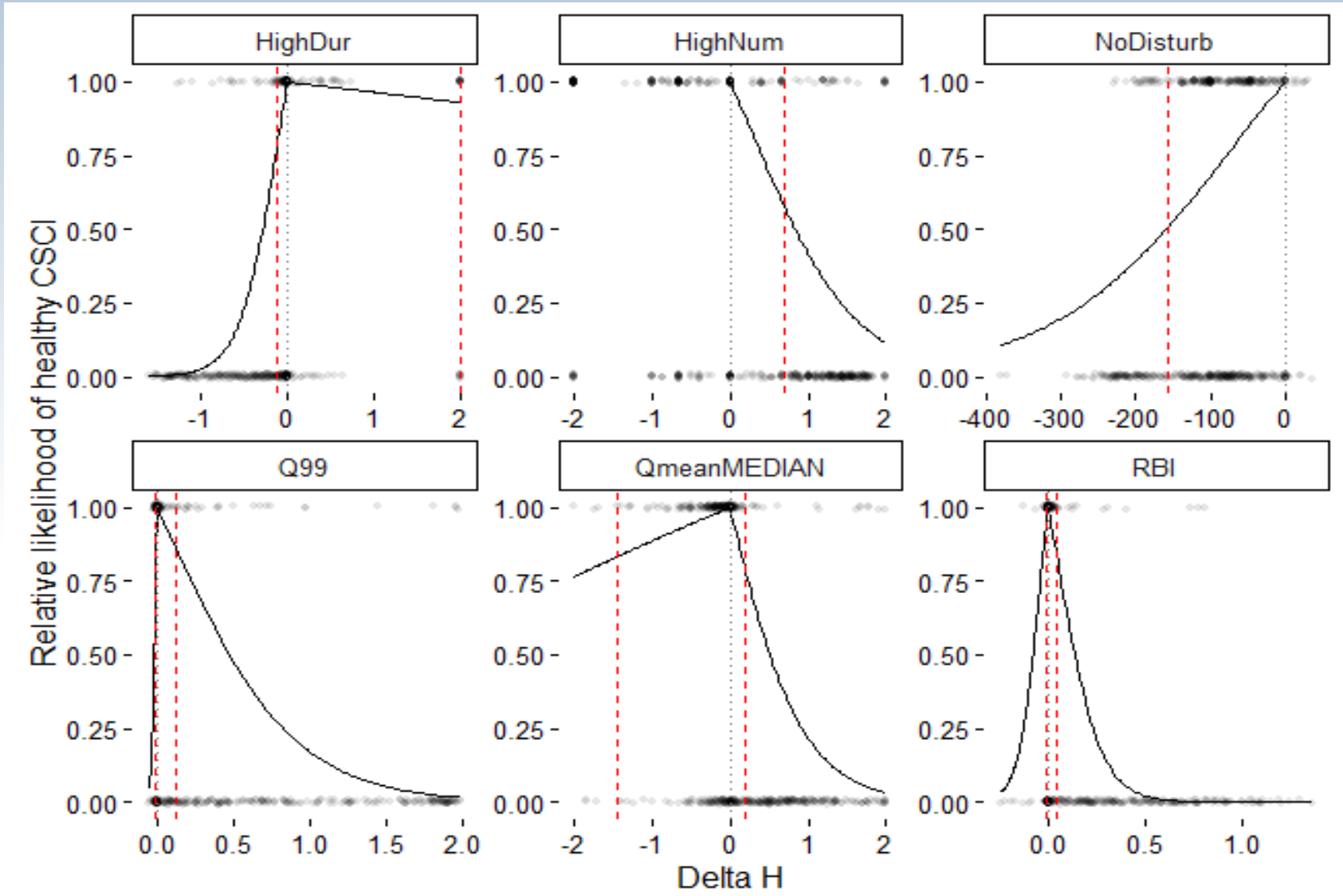
Figure 4.7 Observed daily discharge in the Mokelumne River for 2010 water year, above Pardee Dam, downstream of Camanche Dam, and below Woodbridge Dam.

Approach depends on context

Southern CA: urbanization



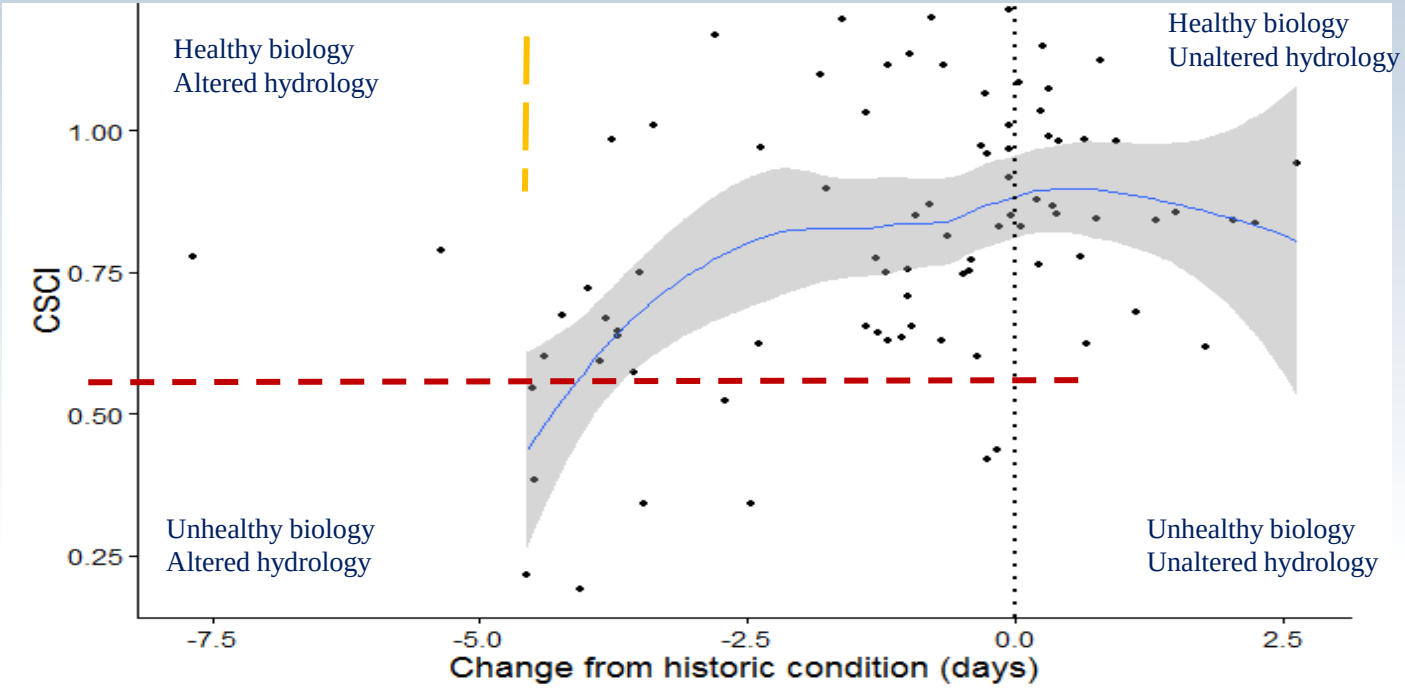
Relating hydrology to biology



Implications for Management

Naturally resilient
- monitor

Protect these areas

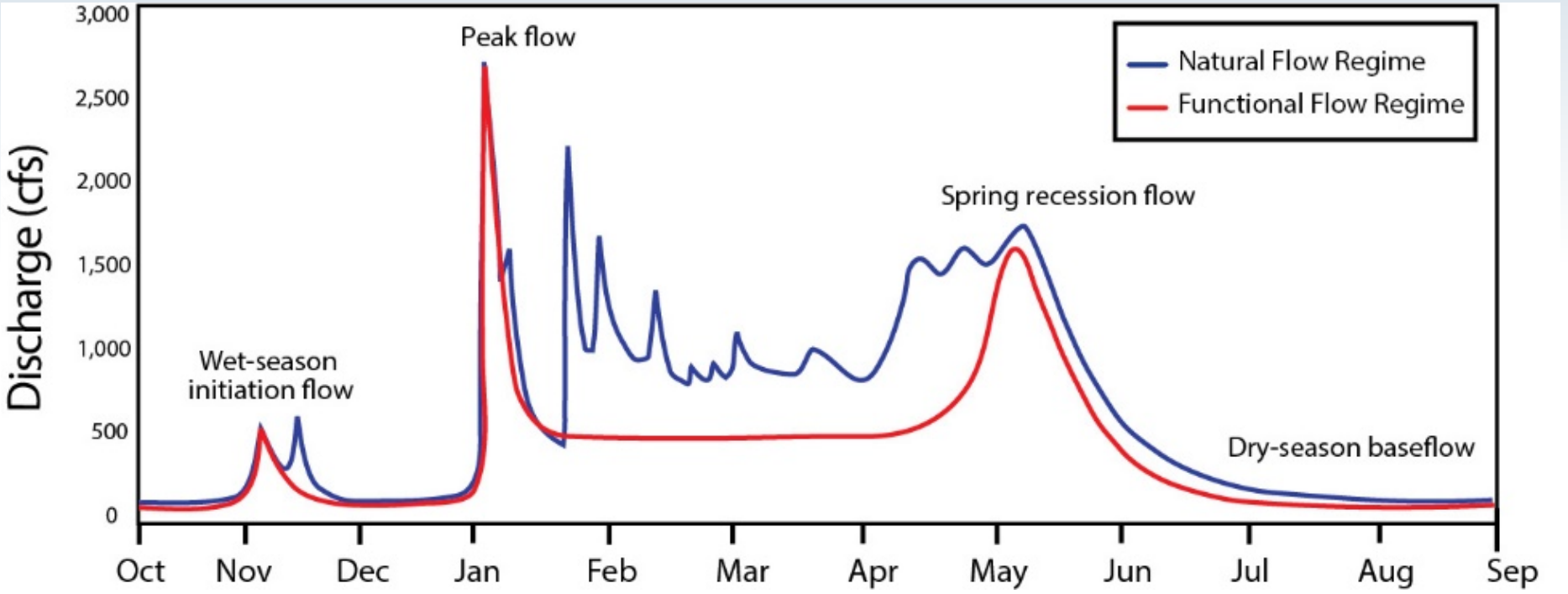


Priorities for flow management
- Evaluate need for targets

Evaluate other stressors

Sierra: Functional Flows Approach

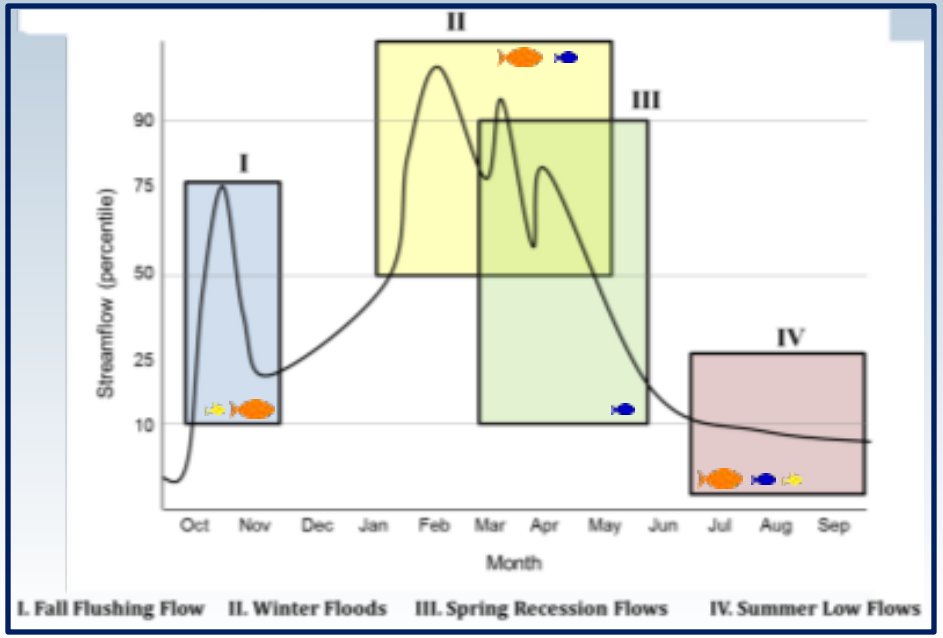
- "Functional Flow" = hydrograph component that provides a distinct geomorphic, ecologic or biogeochemical function
- Reflective of natural patterns that occur in space & time



Yarnell et al. 2015

Functionality in Practice

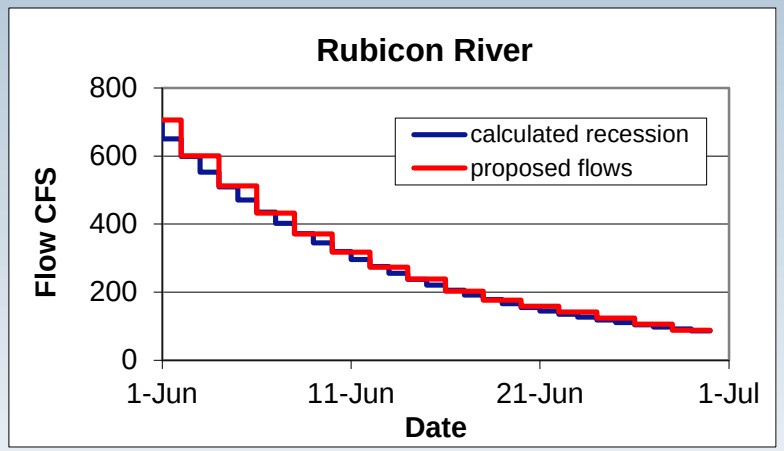
- Develop a standard hydrograph for a hydrologic basin type (Lane et al. 2016, Stein et al. 2016)
- Magnitude, duration set by statistical variability of unimpaired system
- Timing set by aquatic species needs
- Flow targets set based on water year type



J. Lund, S. Sandoval, B.Gray, P. Moyle, R. Frank, B. Lane, S. Yarnell, E. Stein, H. Dahlke, T. Grantham, R. Lusardi, N. Santos, A. Bell, A. Willis, SWRCB. 2016.

Application in Regulated Systems

- Start the recession from spill at 700 cfs when gain control of the system
- Decrease flows at rates similar to the natural rates (8-5%/day)
- Limit steps to <20%/day
- Reach the minimum instream flow within 45 days
- “Flow Recession Calculator” in Excel



Calculated Recession Flows			Flow Schedule	
Day	Flow	Step % change	Flow	Step % change
1	700	--	700	--
2	644	0.080	600	0.143
3	594	0.079	600	0.000
4	547	0.078	600	0.000
5	466	0.077	500	0.167
…	…	…	…	…
42	40	0.052	40	0.000
43	38	0.051	35	0.125
44	36	0.051	35	0.000
45	35	0.050	35	0.000

Yarnell et al. 2016

Next steps

- Collaborative approach
  - TNC, UC Davis, UC Berkeley, SCCWRP, USGS, others?
- Framework for choosing the best approach to set in-stream quantitative flow targets
  - Utilize a combination of technical approaches
  - Apply different methods for different stream types and alteration
  - Flexible implementation