A coordinated approach for developing statewide environmental flow regulations in California

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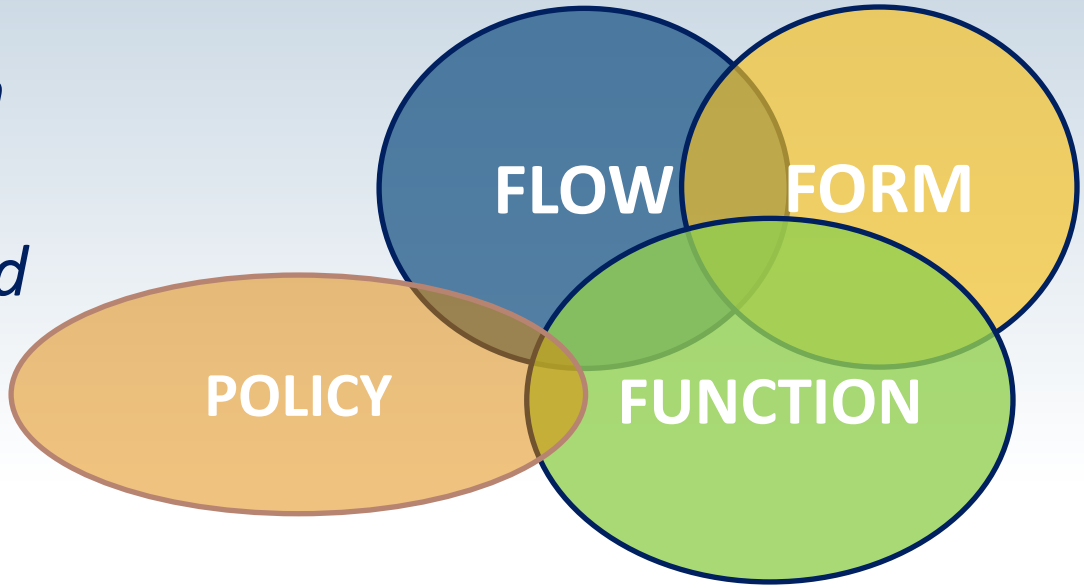

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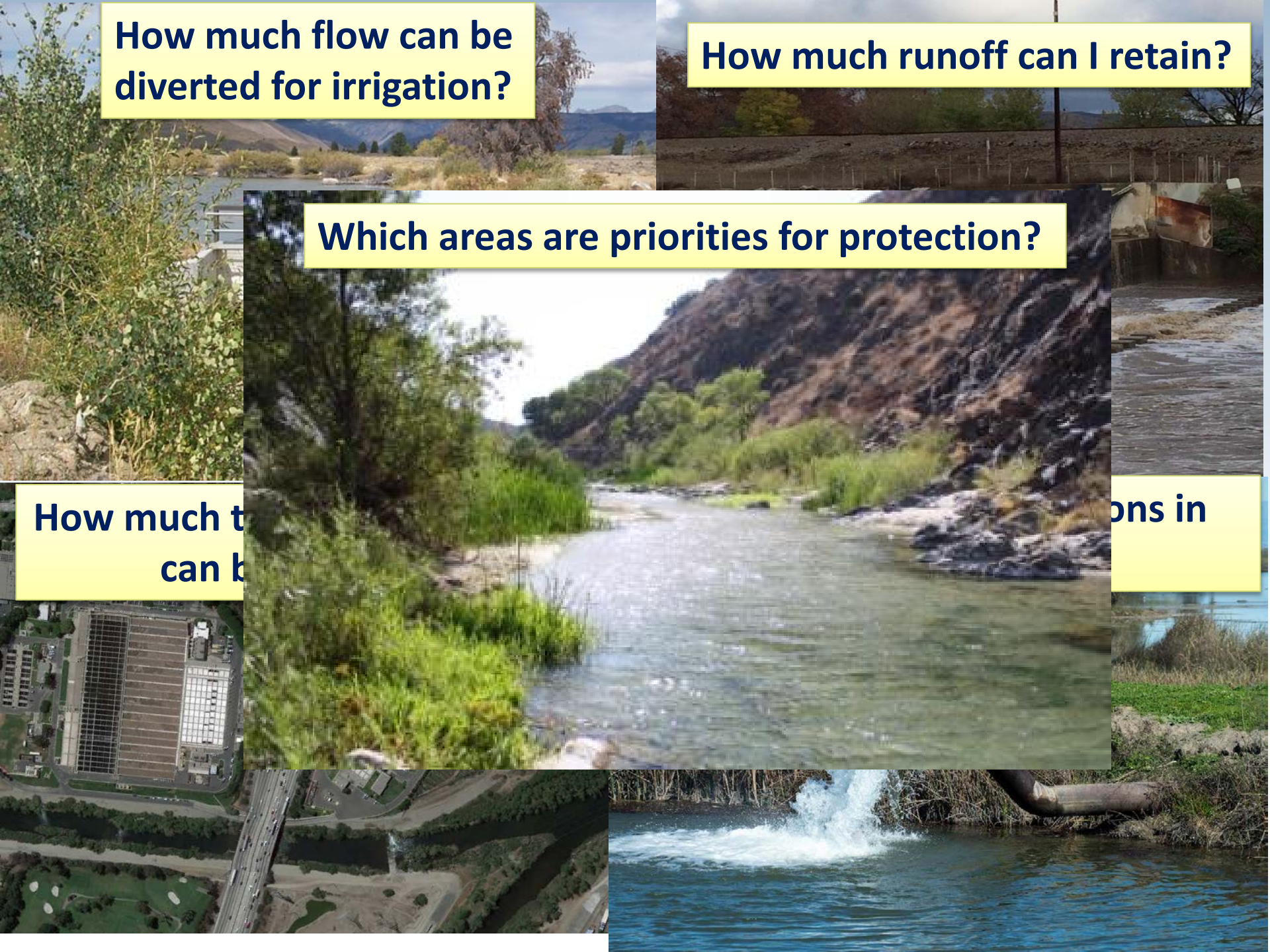
USGS
science for a changing world

SCCWRP
Established 1969

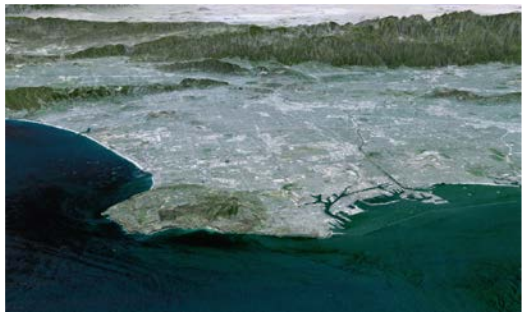

How much flow can be diverted for irrigation?
How much runoff can I retain?
Which areas are priorities for protection?
How much t
can b
ons in

Why is it So Hard?

- California is a very complex/diverse state

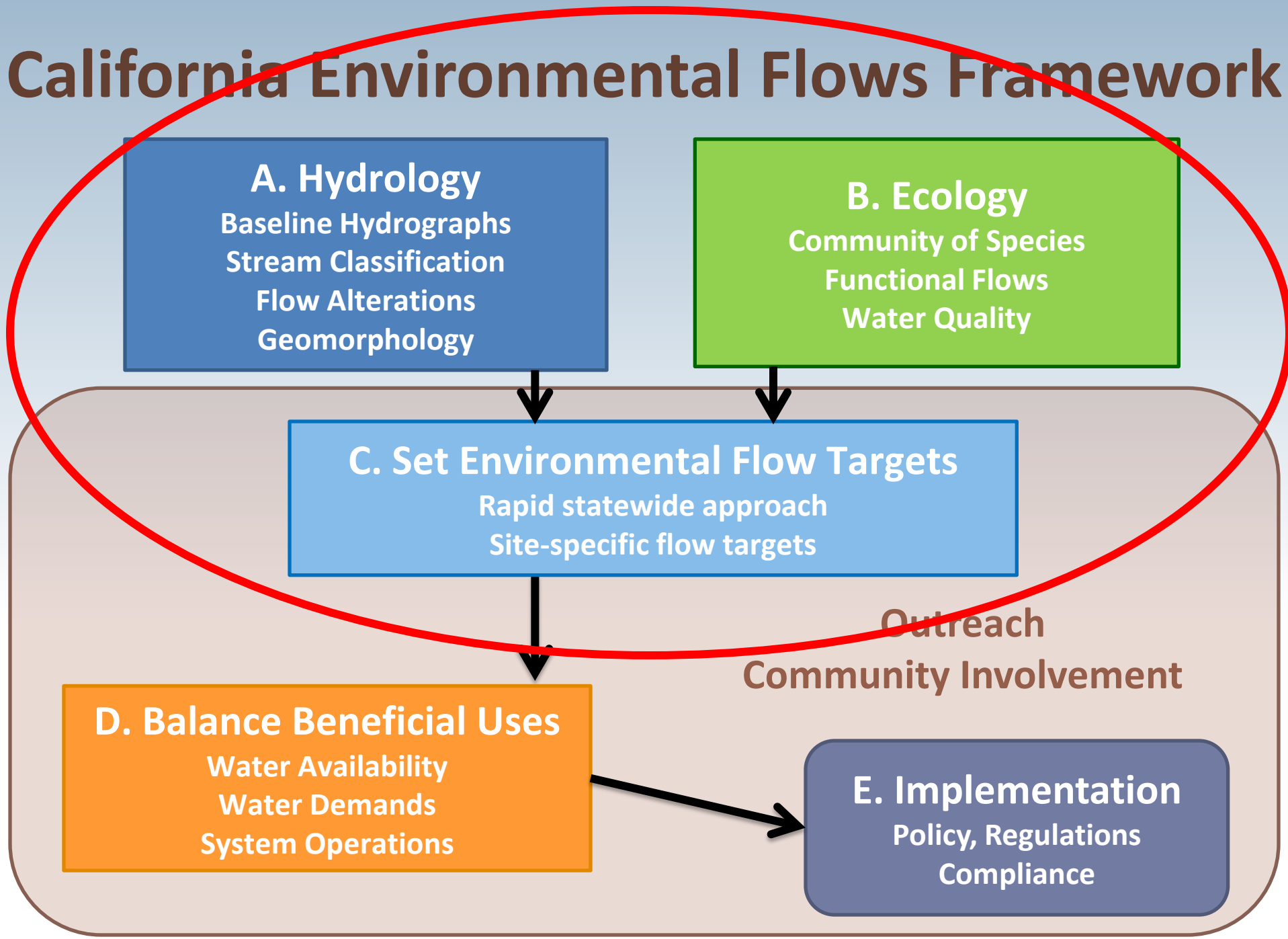


- Hard to balance environmental flow needs with a broad range of other demands


- No mechanism for coordination and information sharing among agencies and with the public

California Environmental Flows Framework



Environmental flow goals

- Set instream flow standards
- Assess vulnerability of streams to future changes
  - Prioritize areas for restoration/management
- Evaluate/inform management actions
  - e.g., reservoir operations, water withdrawals)
- Causal assessment of observed biological impairment

Statewide approach

- Statewide interim flow recommendations
  - Rapid
  - Comprehensive across species, locations
  - Coarse resolution
  - One approach
- Framework for setting site-specific e-flows
  - Increased complexity
  - Tailored to species and/or location
  - Objectives-based
  - Multiple approaches

Statewide flow targets using rapid approach

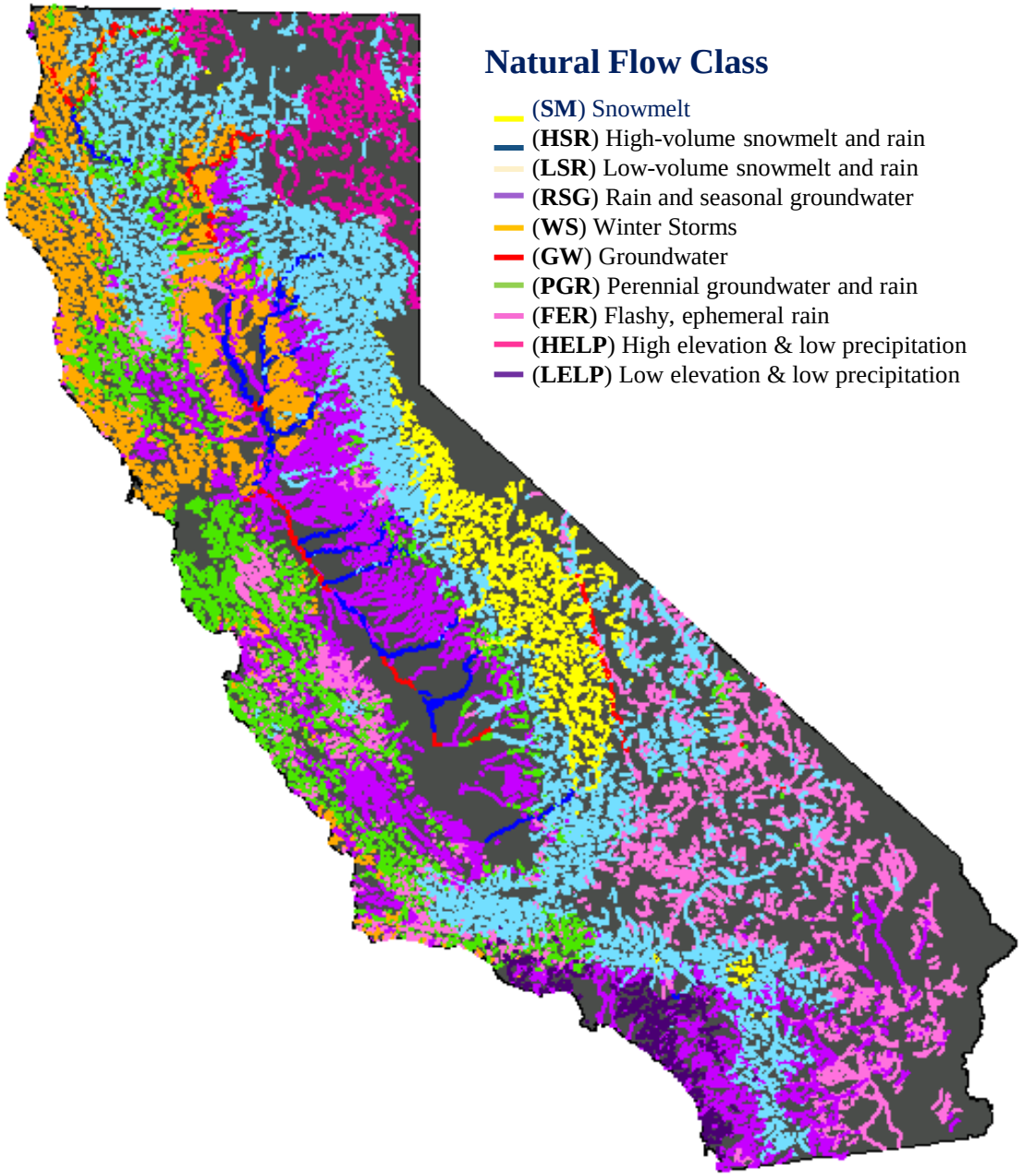
- Stream classification
- Dimensionless hydrographs
- Functional flow metrics and ecological endpoints
- E-flow targets: rapid, comprehensive, coarse

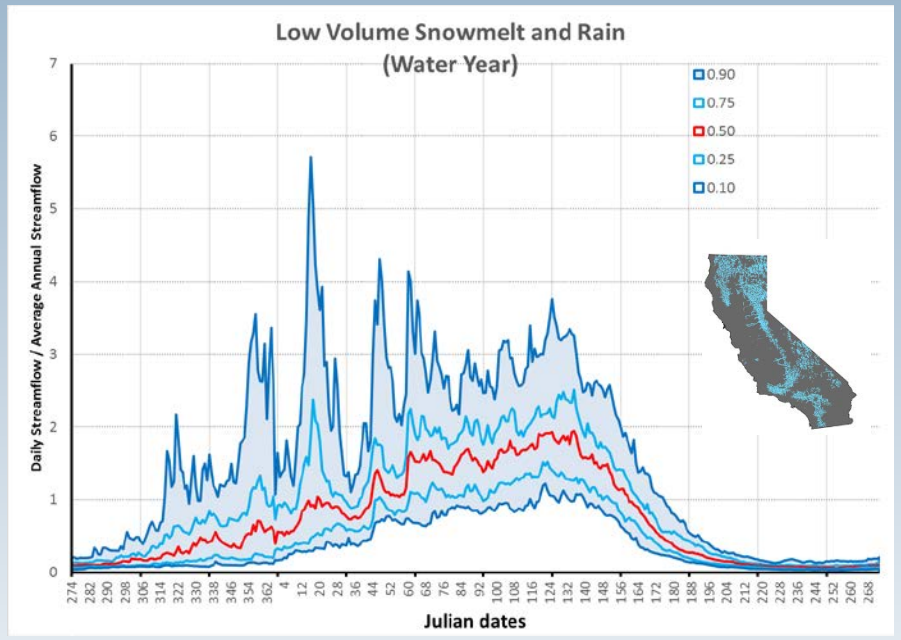
Criteria for Rapid Approach

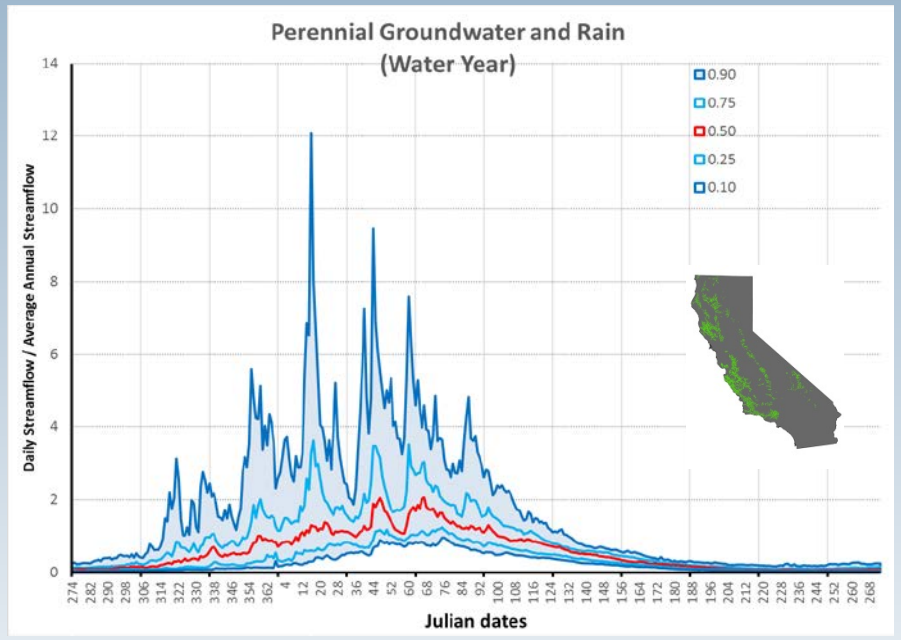
1. Rapid (3-4 months of technical time)
2. Explainable/understandable (explain in 5 minutes)
3. Scientifically defensible
4. Ecologically relevant
5. Implementable
6. Easy/cheap to monitor
7. Scalable and consistent for other basins

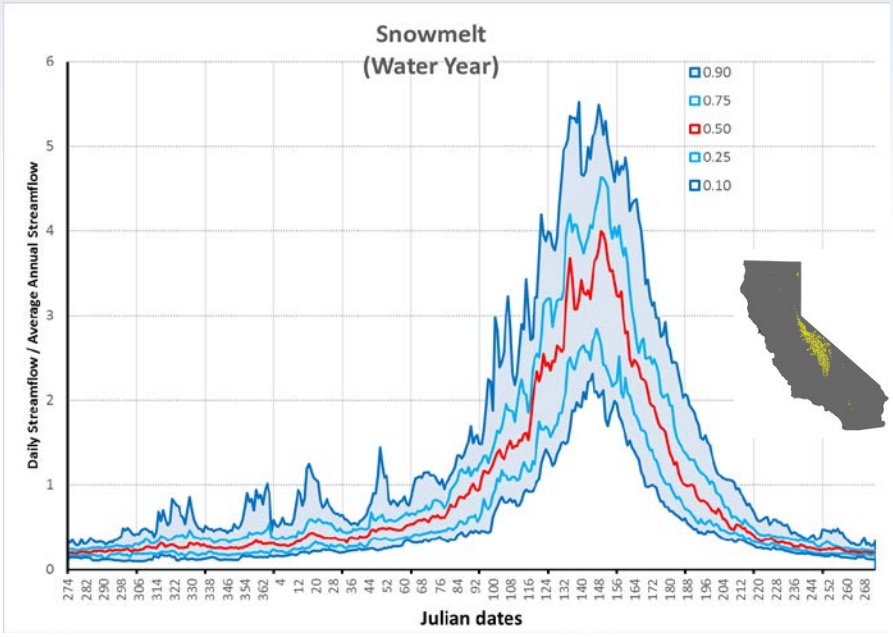
Stream Classification

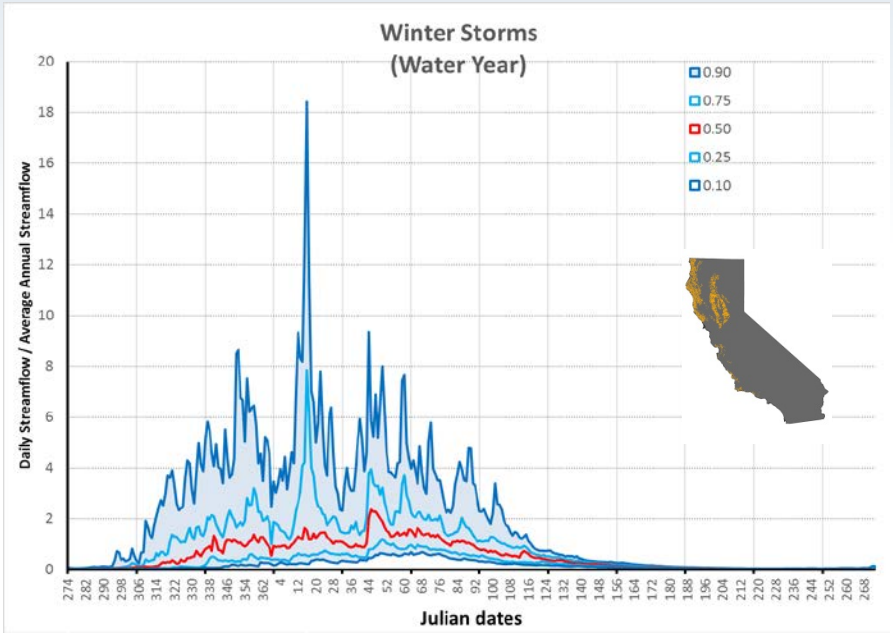
- Catchment Properties
- Rainfall Patterns
- Geology
- Soil Properties

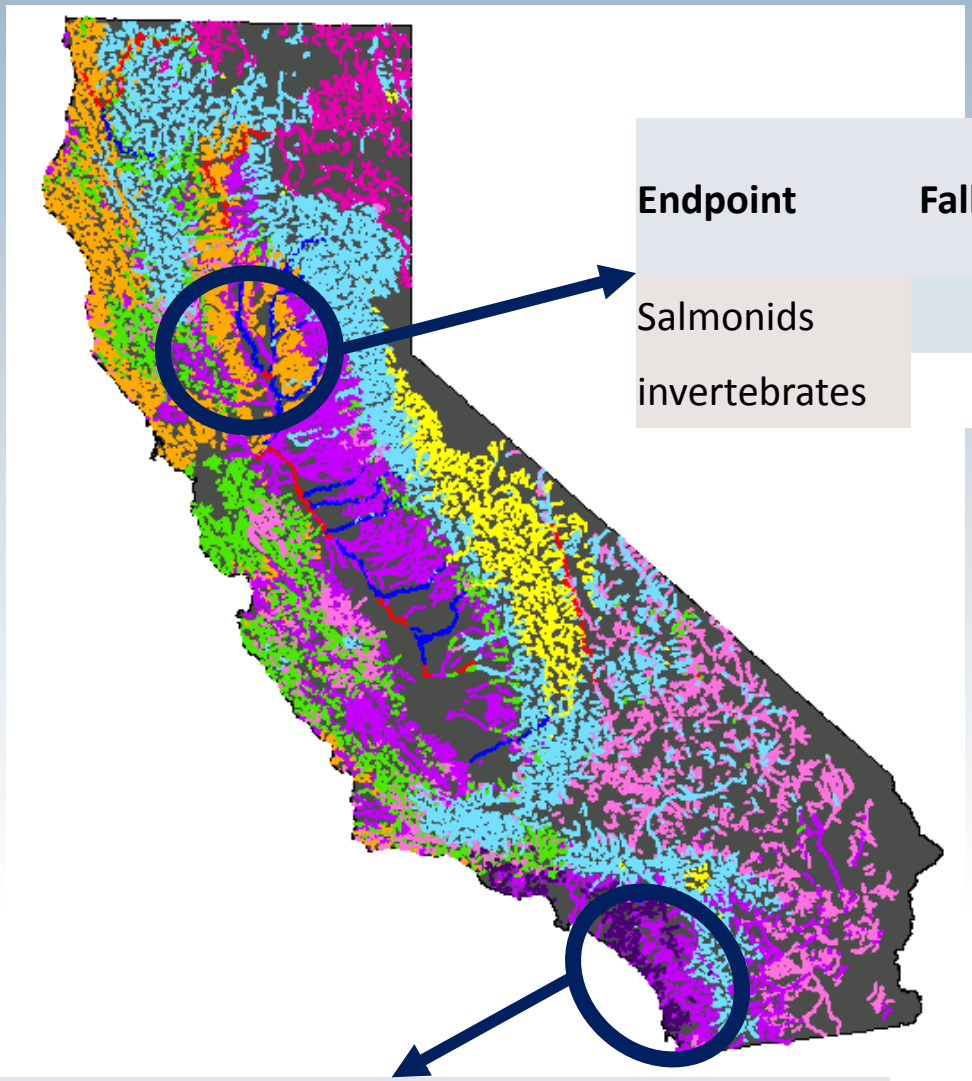



Low Volume Snowmelt and Rain
(Water Year)
0.90
0.75
0.50
0.25
0.10
Daily Streamflow / Average Annual Streamflow
Julian dates


Perennial Groundwater and Rain
(Water Year)
0.90
0.75
0.50
0.25
0.10
Daily Streamflow / Average Annual Streamflow
Julian dates


Snowmelt
(Water Year)
0.90
0.75
0.50
0.25
0.10
Daily Streamflow / Average Annual Streamflow
Julian dates


Winter Storms
(Water Year)
0.90
0.75
0.50
0.25
0.10
Daily Streamflow / Average Annual Streamflow
Julian dates



Endpoint	Fall flows	Winter peaks	spring recession	summer baseflow
Salmonids				
invertebrates				

Endpoint	Fall flows	Winter peaks	spring recession	summer baseflow
amphibians				
riparian habitat				

- Choose ecological endpoints for each stream class based on literature review
- Ecological endpoints and flow metrics vary by stream class
- Relationships based on hypotheses, not detailed analyses

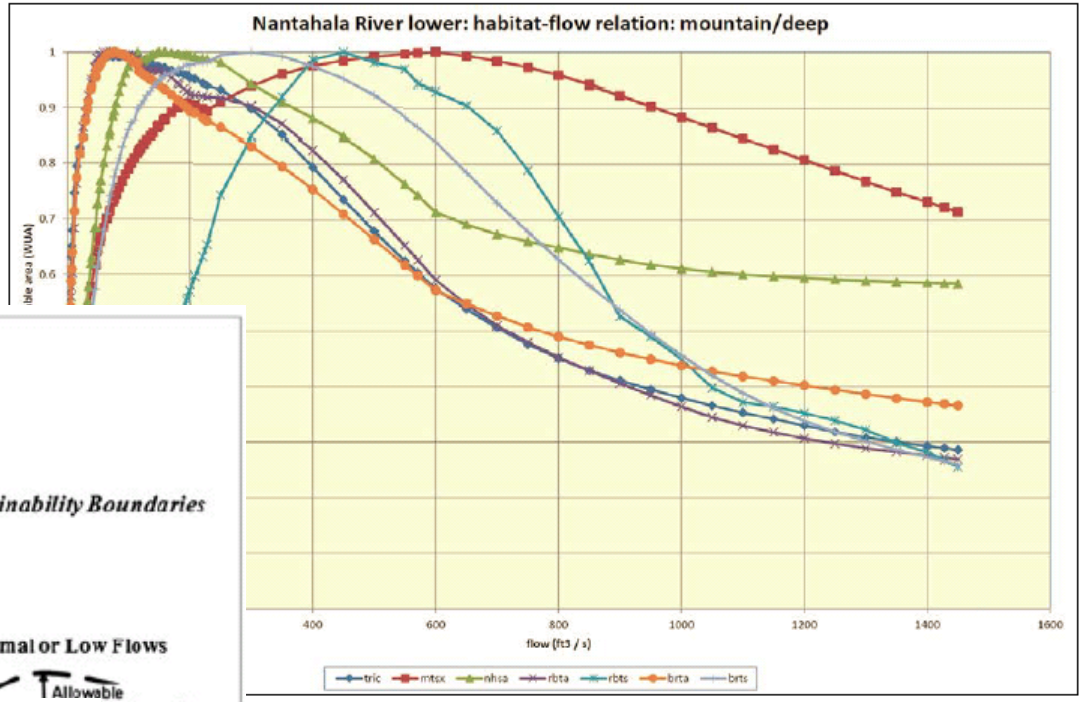
Statewide rapid approach: Products

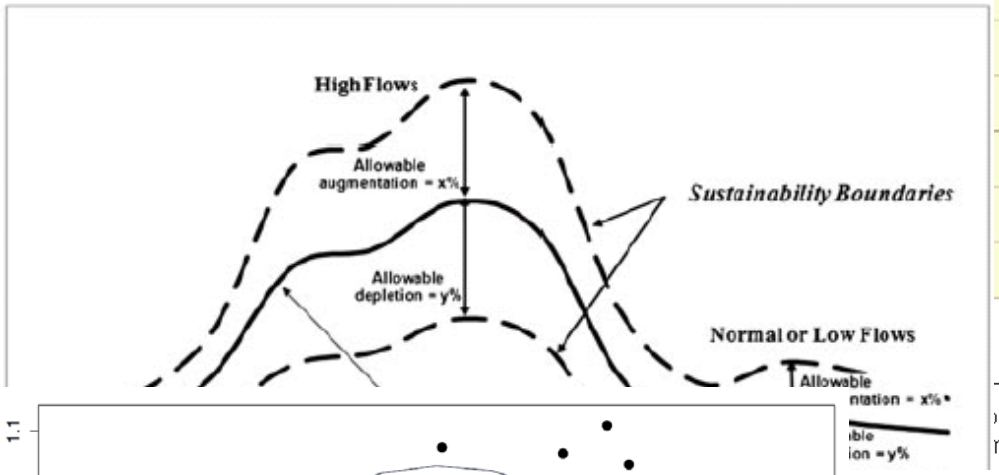
- Statewide stream classification
- One or more dimensionless hydrograph per stream class
- Ecological endpoints and functional flow metrics for each hydrograph
- E-flow targets for each flow metric based on reference hydrology and hypotheses

Site specific e-flows where necessary

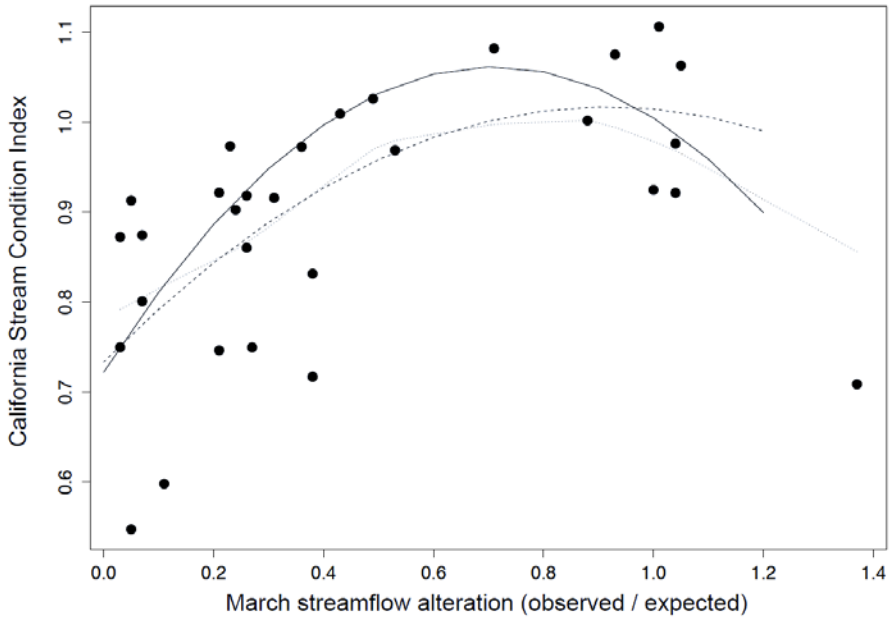
- Assess available methodologies
- Define ecological and management context
- Tailor approach to hydrologic alteration, stream class, management needs, biological outcomes
- E-flow targets: specific, objectives-based

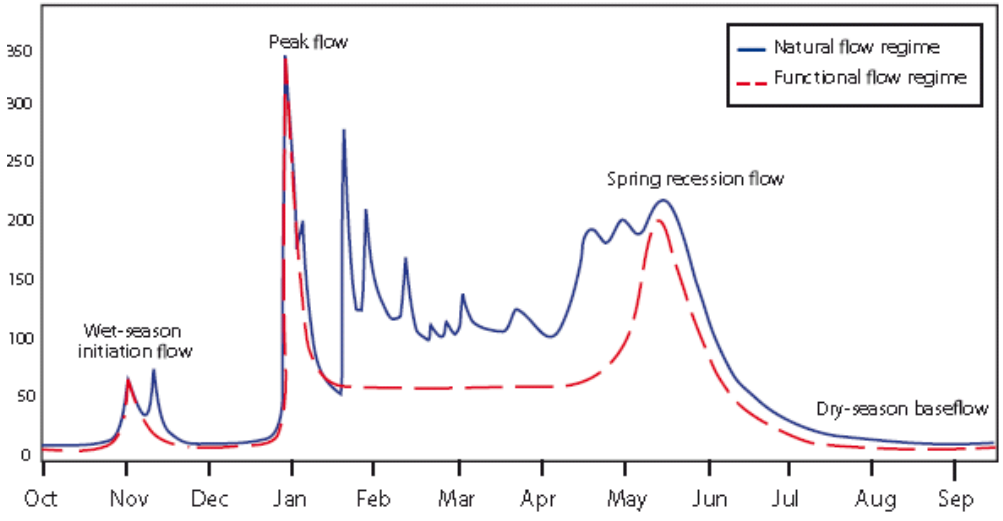
Many Technical Approaches





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

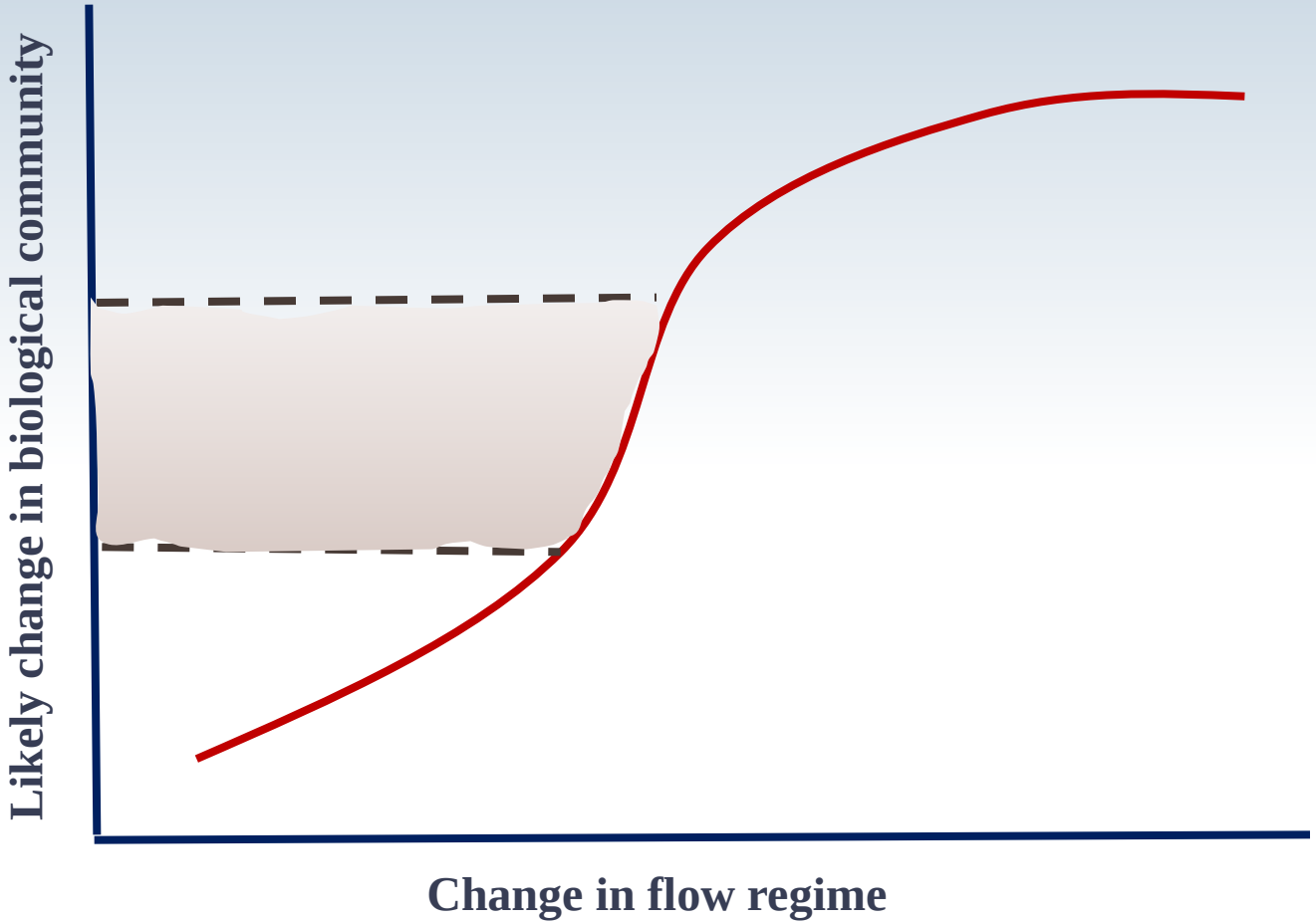




ELOHA -Carlisle et al. 2015

Functional Flows - Yarnell et al. 2015

Setting Flow Targets to Inform Management Decisions



Site-specific approach: Products

- Guidance for implementing rapid and site-specific e-flow recommendations
- California E-flows users' manual
- Website clearinghouse for recommended approaches, key data layers, case studies
- Geodatabase of proposed e-flow targets for each stream class

Need for a Coordinated Framework

Many programs are attempting to set environmental flows

- Different systems
- Different endpoints
- Different management needs

- Poor coordination
- Challenge in sharing data
- Uncertainty in which methods are most appropriate
- Inefficiencies/redundancy in developing requirements
- Difficulty in communicating to the public

Next steps

- Finalize stream classes
- Continue dimensionless hydrographs
- Develop ecological endpoints and functional flow metrics for each stream class
- Identify additional partners and funding