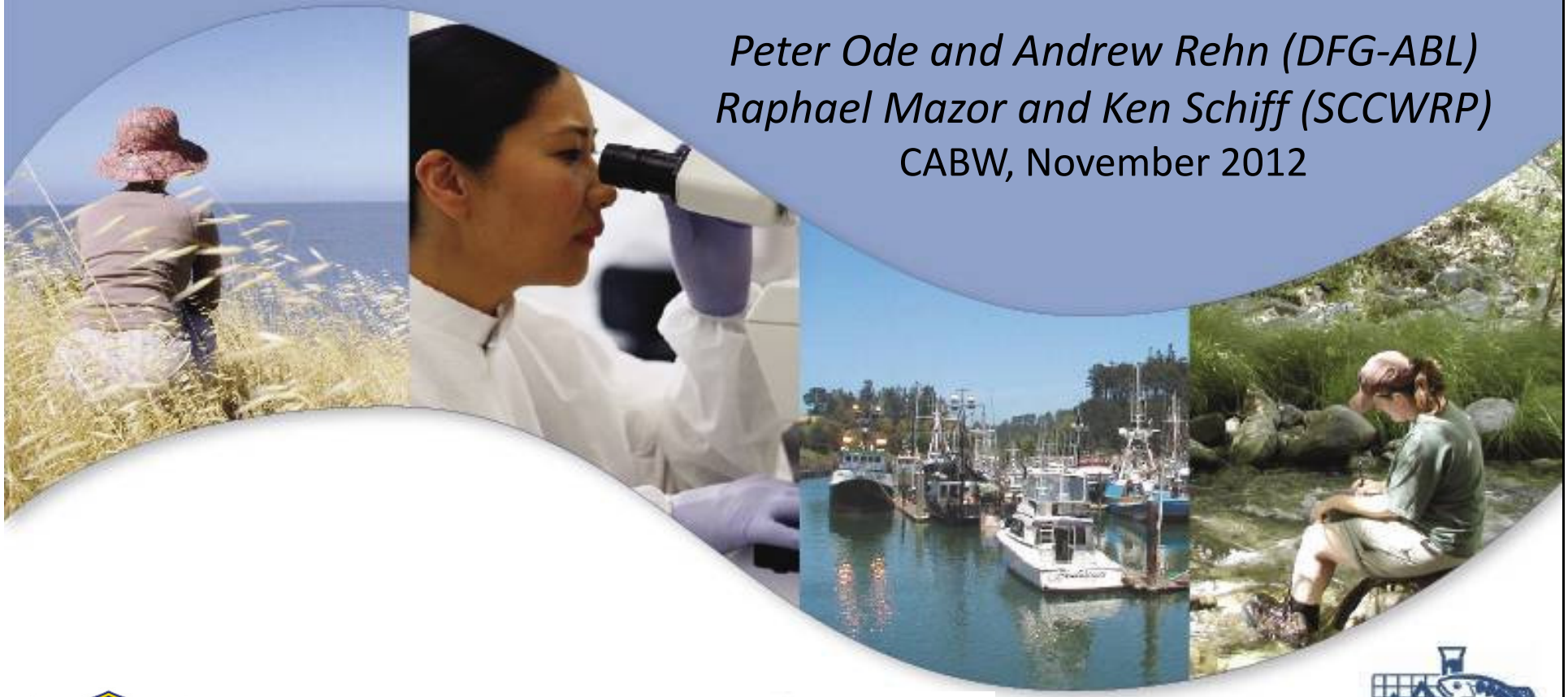
Building the Technical Foundation for Biological Objectives

Peter Ode and Andrew Rehn (DFG-ABL)
Raphael Mazor and Ken Schiff (SCCWRP)
CABW, November 2012



CALIFORNIA DEPARTMENT OF FISH&GAME

Aquatic Bioassessment Laboratory

SCCWRP Established 1969

Water Boards

SWAMP Surface Water Ambient Monitoring Program

- **Technical Foundation** (Peter Ode/ Rafi Mazor – DFG, SCCWRP)
- **Regulatory Framework** (Karen Larsen, State Water Board)
- **Causal Analysis** (David Gillett, SCCWRP)
- **Stakeholder Process** (Brock Bernstein)
- **Open Discussion**

- **Measuring Stressor Distributions** (Andy Rehn, DFG)
- **Tools for Assessing Stream/Wetland Condition** (Eric Stein, SCCWRP)
- **SWAMP's Lab SOP for BMIs** (Melinda Woodard, QA Team)

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Technical Foundation

Part I – Laying the groundwork (20)

Part II – Creating the scoring tools (40)

Part III – Supporting Implementation (20)

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Technical Team

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Larry Brown, *USGS*

Jason May, *USGS*

David Herbst, *SNARL*

Peter Ode, *DFG-WPCL/ABL*

Ken Schiff, *SCCWRP*

David Gillett, *SCCWRP*

Eric Stein, *SCCWRP*

Betty Fetscher, *SCCWRP*

Kevin Lunde, *SF Water Board*

Why Develop Ecological Indicators?

- Global paradigm shift toward ecological indicators
- Provide direct evidence about resources we are trying to protect
- More relevant measures of impacts and BMP effectiveness
- Links resource protection across multiple agencies by focus on ultimate policy goals

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CA's Ecological Indicators

Multiple Indicators – BMIs, algae, (fish), riparian vegetation

Multiple waterbody types – large rivers, non-perennial streams, lakes, wetlands

Start with invertebrates and perennial streams

invertebrates:

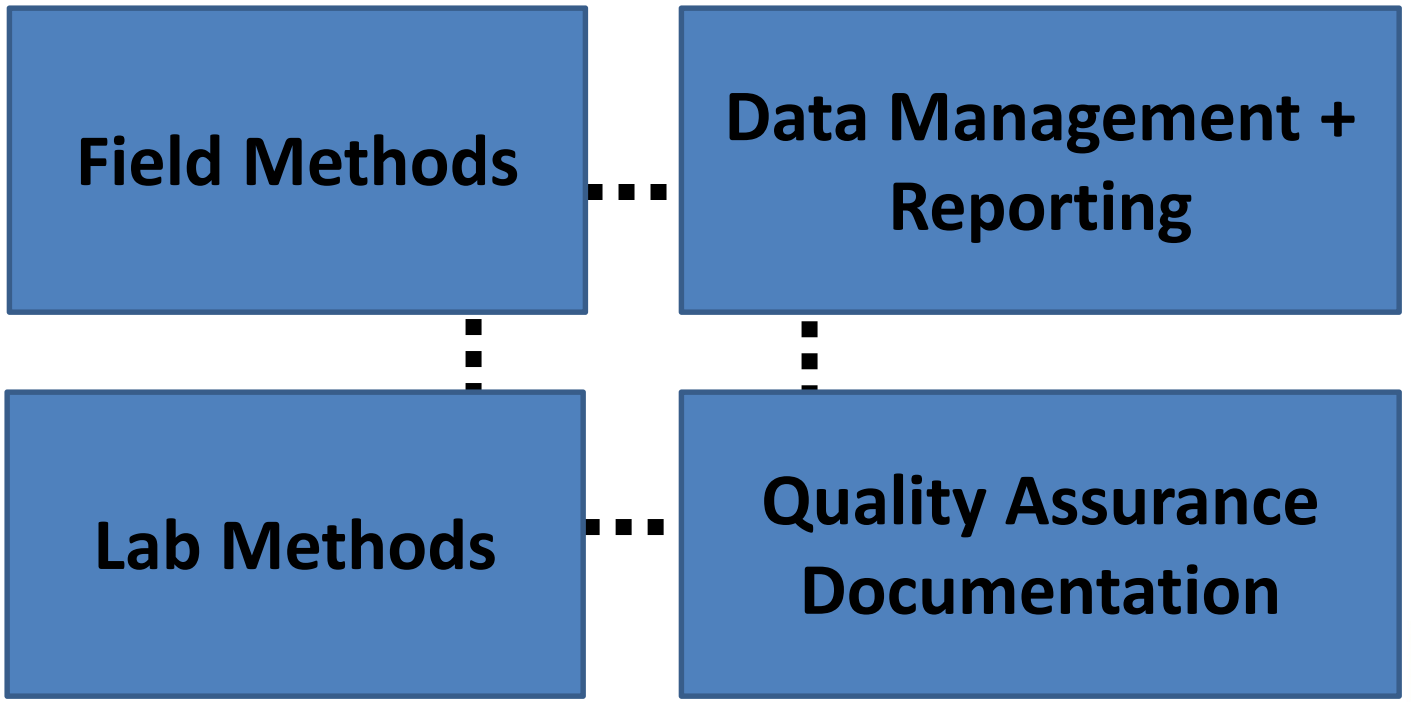
the backbone of bioassessment

- ***Abundant***
- ***Diverse***
- ***Informative***
- ***Adorable***


How do we convert a list of species into a condition score?
NABS (www.benthos.org)

Standardized Bioassessment Infrastructure Elements

Surface Water Ambient Monitoring Program (SWAMP)



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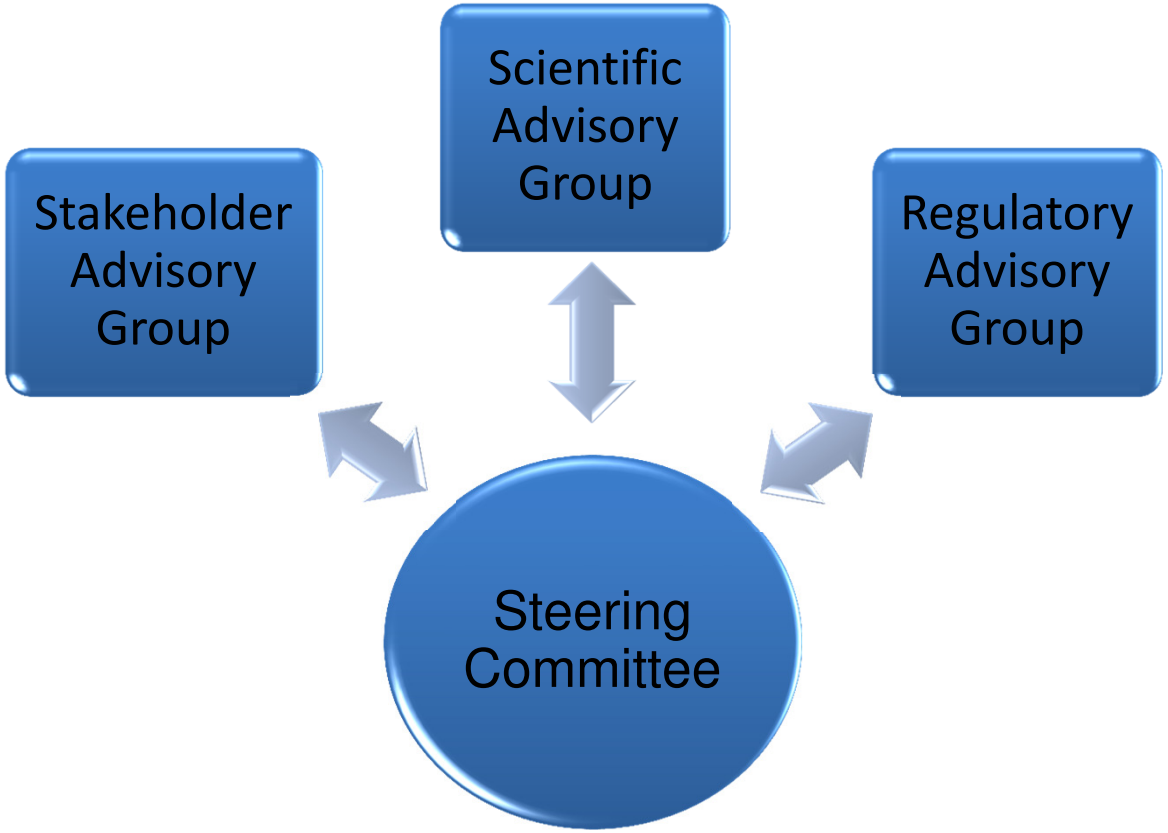
Biological Objectives Workgroups

> 20 meetings, excellent feedback



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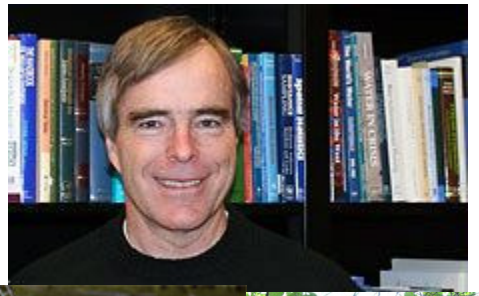
Scientific Advisory Panel



Charles Hawkins, *Utah State University*
Dave Buchwalter, *North Carolina State*
Rick Hafele, *Oregon DEQ (retired)*
Chris Konrad, *USGS*
LeRoy Poff, *Colorado State*
John VanSickle*, *EPA (retired)*
Lester Yuan*, *EPA*

*not pictured

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Scoring Tools Depend on Reference Sites

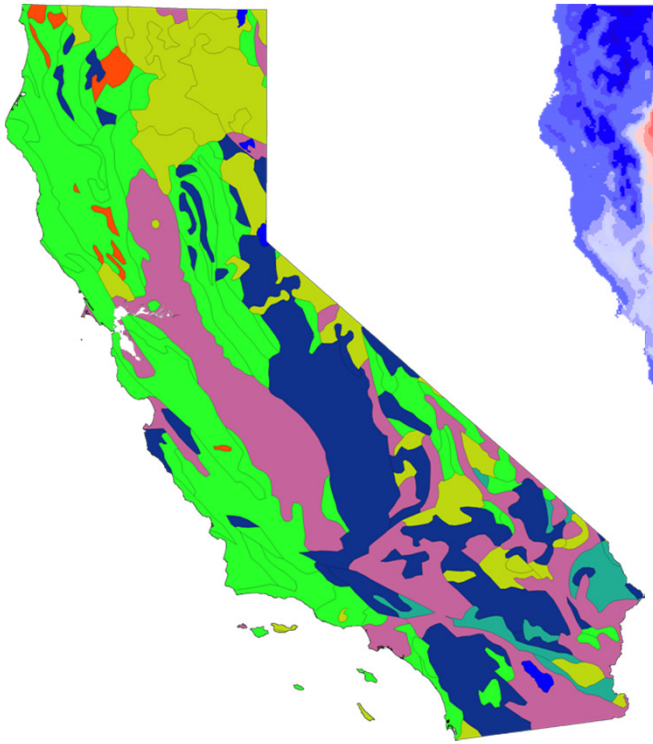
(sites with low levels of disturbance)

"What should the biology look like at a test site?"

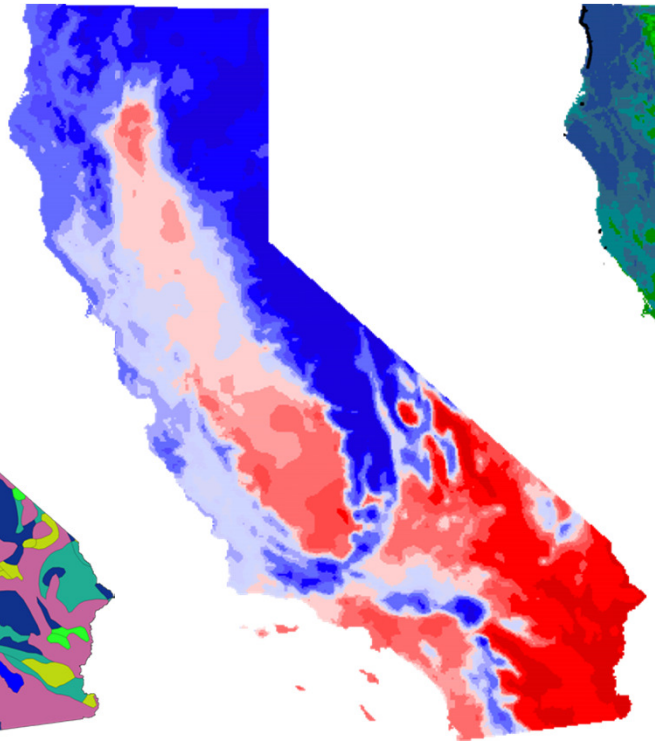
Technical Challenges:

Strong natural gradients result in natural variation in biological expectations

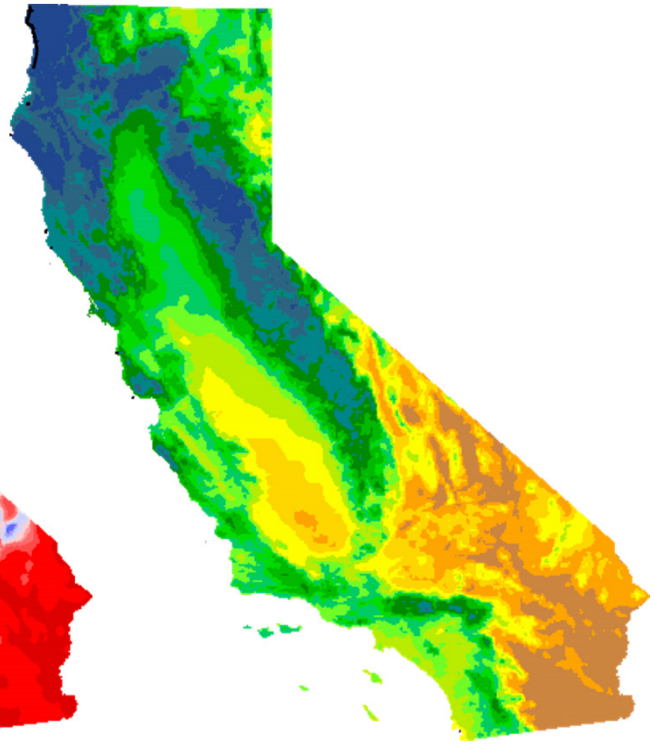
Geology



Temperature

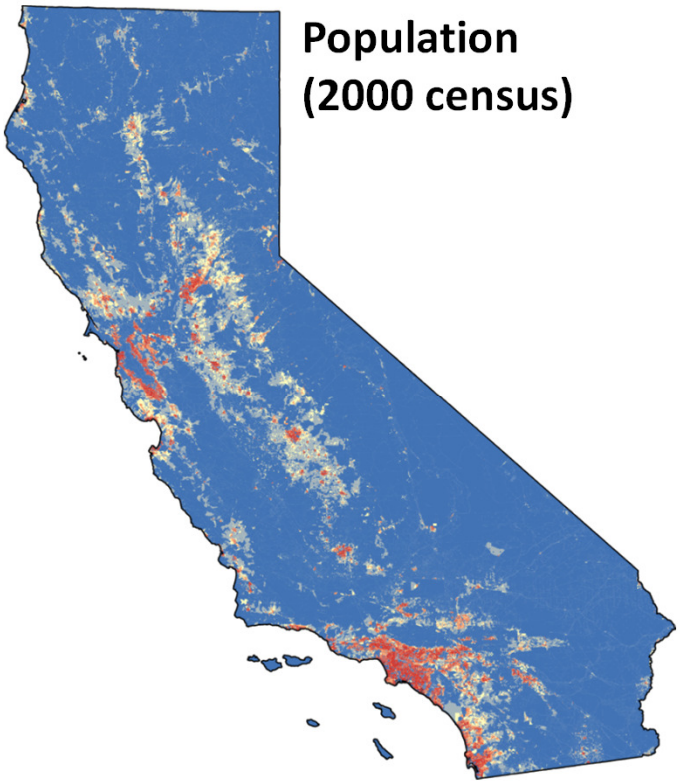


Precipitation

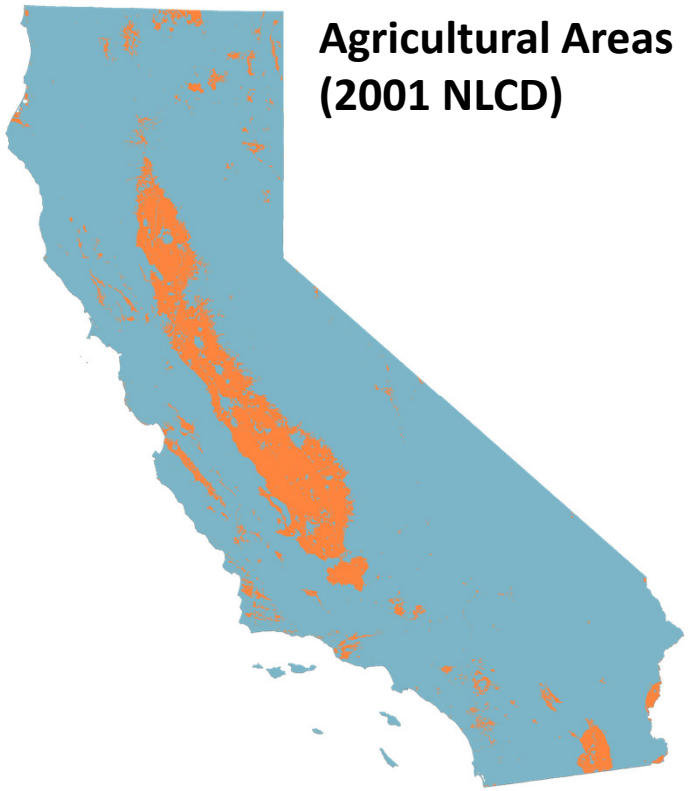


Technical Challenges:

Intense development can create regional gaps



Population
(2000 census)



Agricultural Areas
(2001 NLCD)

Reference Sites for Biocriteria

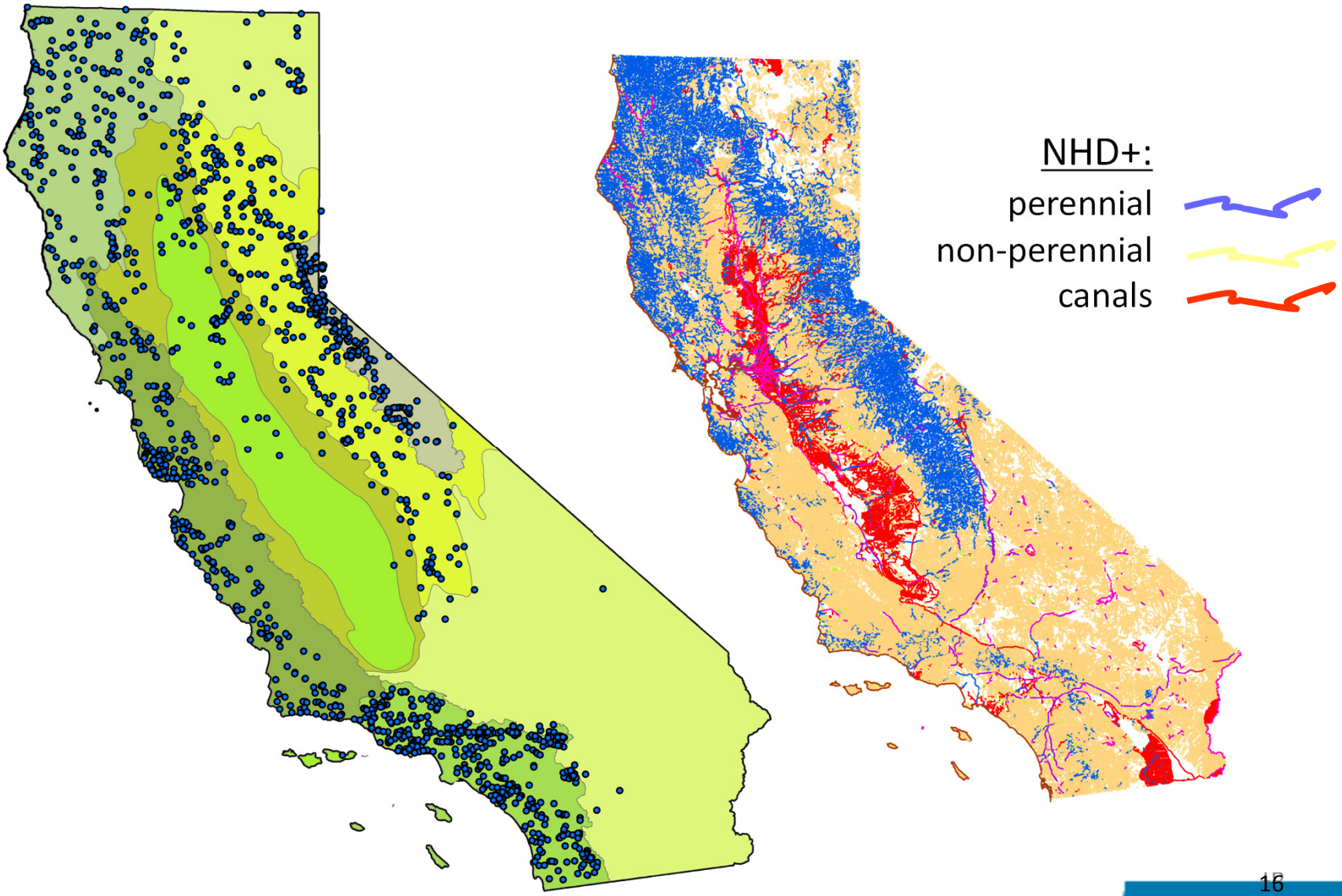
Selecting for site quality and representativeness

Challenge: Very few (if any) pristine streams exist; site selection process has to maximize representativeness while minimizing amount of disturbance at reference sites

Performance Objectives:

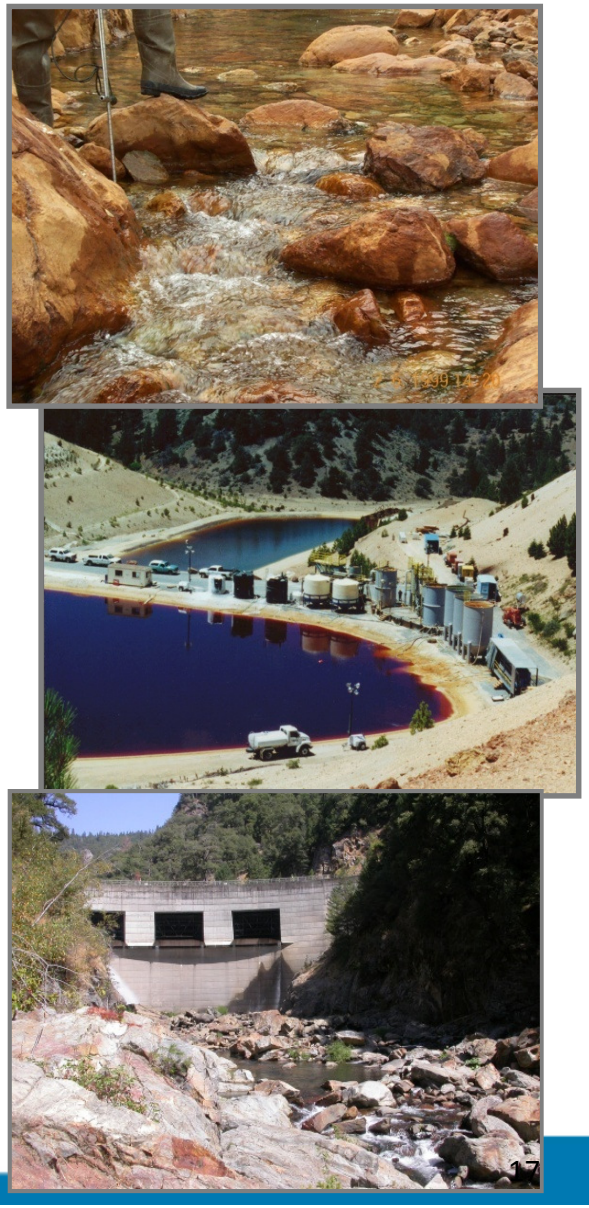
1. Reference pool represents the majority of CA streams
2. Biological "quality" is maintained at reference sites

Assemble Data from > 2400 sites



Reference sites have few sources of human stress

- **Infrastructure**: roads, railroads
- **Population**
- **Hydromodification**
  - manmade channels, canals, pipelines
- **Landuse**
  - Ag/Urban development
  - Timber Harvest, Grazing
- Fire history, dams, mines
- 303d list, known discharges
- Invasive invertebrates, plants
- Instream and riparian habitat
- Water chemistry

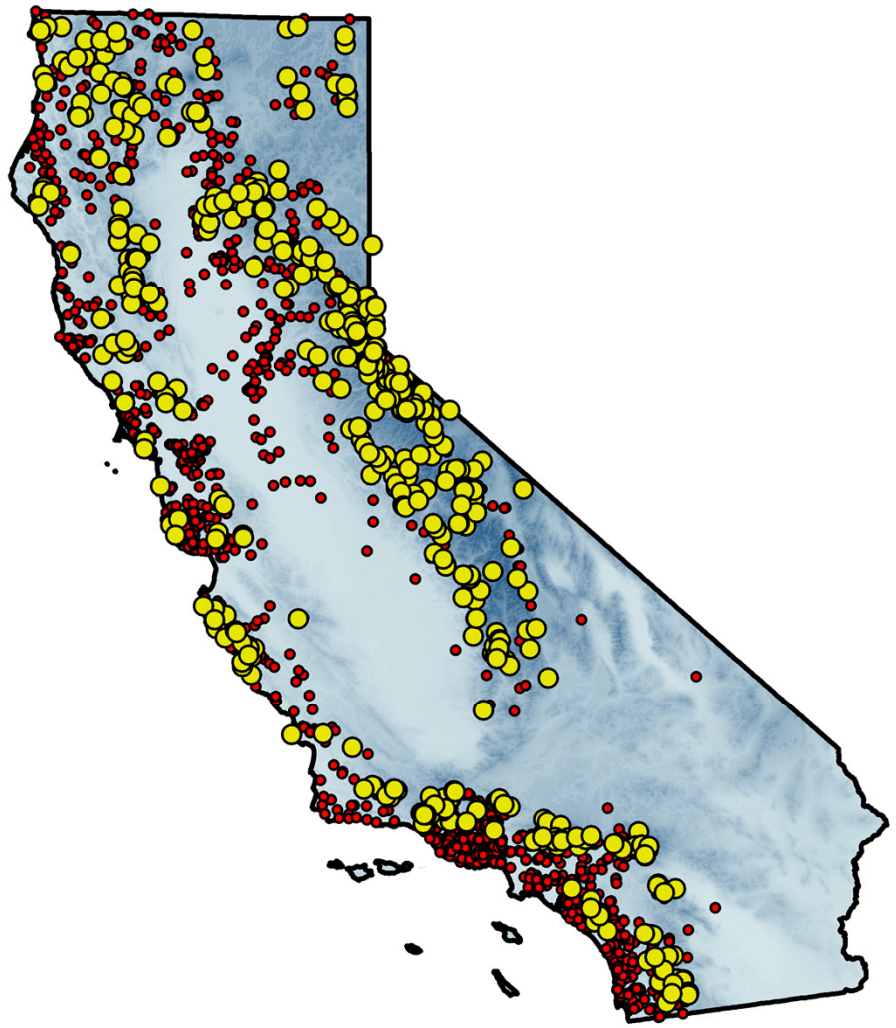


Thresholds are comparable or stricter than other CA indices and include many more criteria

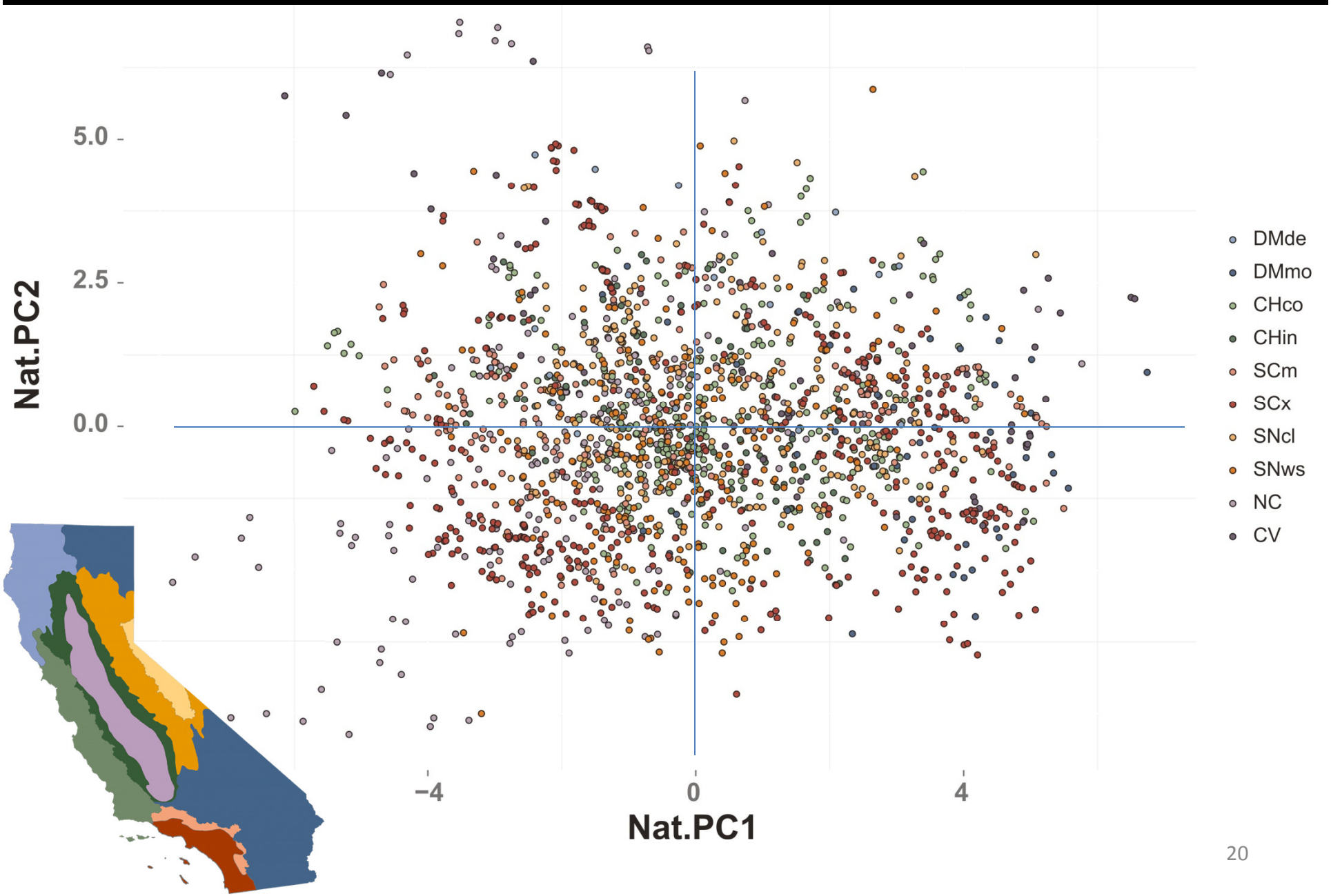
Metric	Bio-Objectives	South Coast IBI	North Coast IBI
Local Disturbance (W1_Hall)	**1.5**	-	-
% Agricultural	**3,3,10**	**5**	5
% Urban	**3,3,10**	**3**	3
% Ag + Urban	**5,5,10**		
% Code 21	**7,7,10**	**in urban**	**in urban**
Road Dens (km/km^2)	**1.5**	**2.0**	**1.5/ 2.0**
Paved Road X-ings (#/ws)	**5/10/50**		
Nearest Dams	**>10 km**	-	-
Active Producing Mines	**0** (5k)	-	-
% Canals & Pipelines	**10**	-	-
Gravel Mine Density	**0.1** (r5k)		
Conductivity	**<2000 uS, + <99%, >1%**		
BPJ Screen	**X**	**X**	**X**

Very good geographic coverage

REGION	n
North Coast	75
Central Valley	1
Coastal Chaparral	57
Interior Chaparral	33
South Coast Mountains	85
South Coast Xeric	34
Western Sierra	131
Central Lahontan	114
Deserts + Modoc	27
TOTAL	**586**



Multivariate view of natural diversity



Strong environmental representativeness

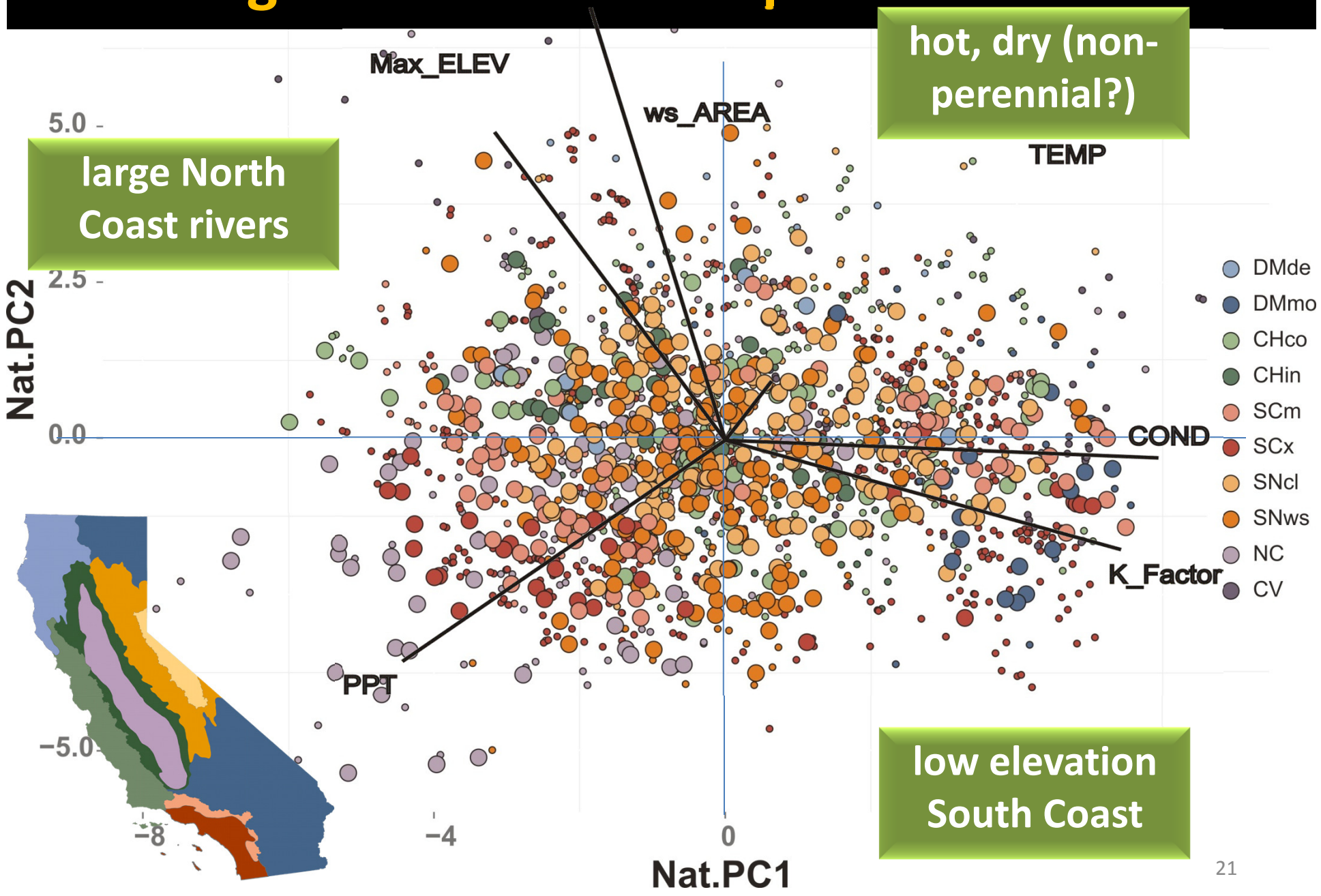



photo courtesy John Sandberg

Part III – Supporting Implementation
(technical support for policy decisions)

- Setting Impairment Thresholds
- Ensuring statewide consistency
- Applicability: Objective approaches for setting limits to the tools
- Summary and What's Next

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Desirable Qualities of Regulatory Thresholds

- **Objective**
- **Balance false positives and false negatives** – should be protective of resource, but not over-sensitive
- **Incorporate uncertainty of site score**

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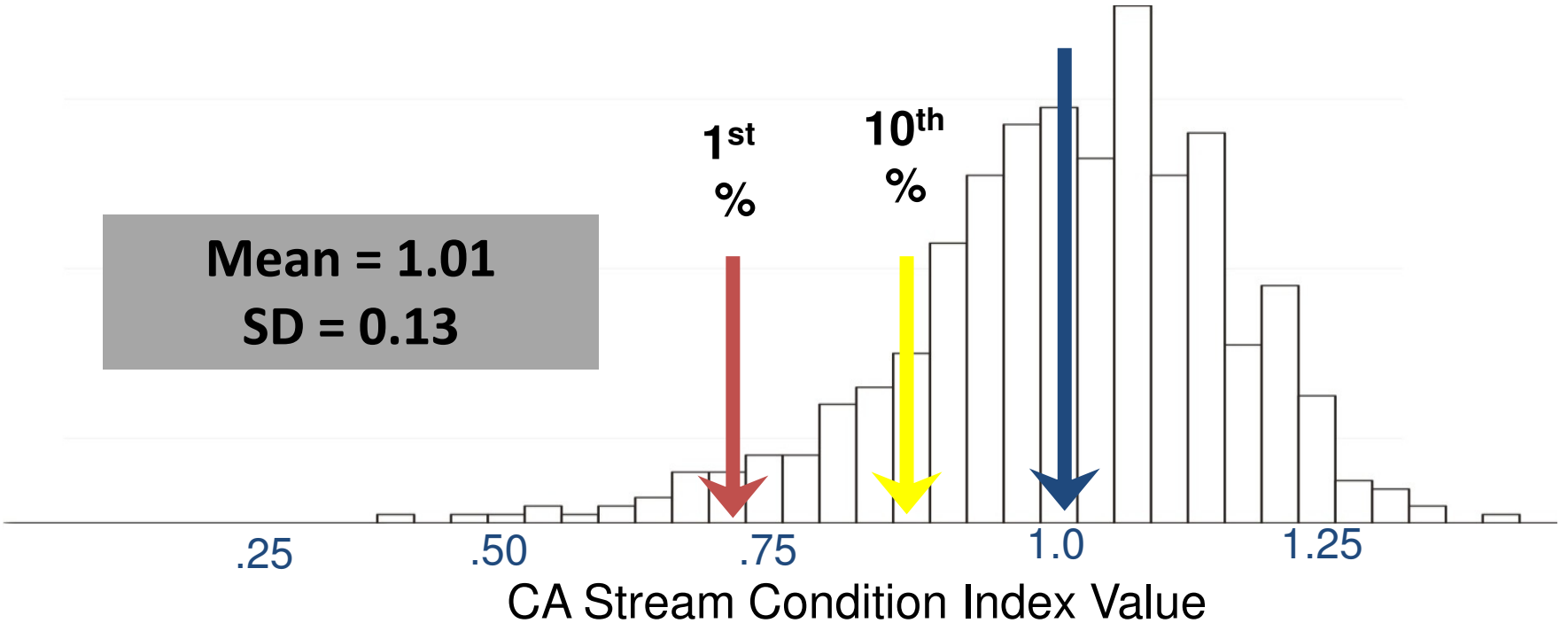
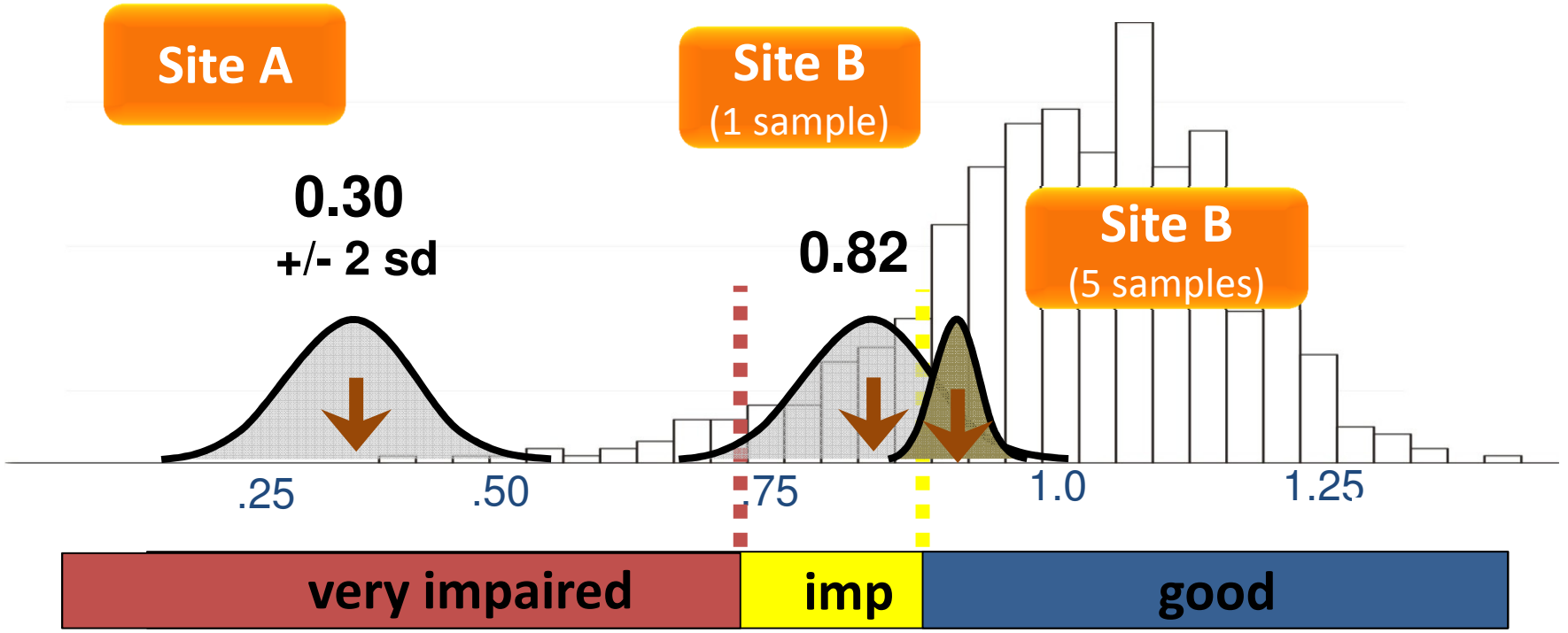
Distribution based thresholds:



very impaired **impaired** **good**

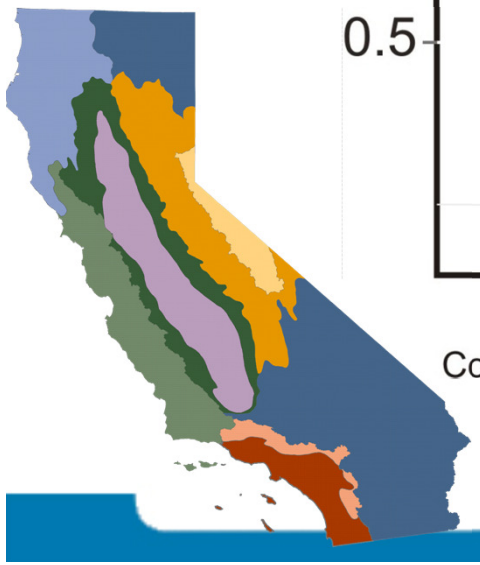
Incorporating Test Site Uncertainty

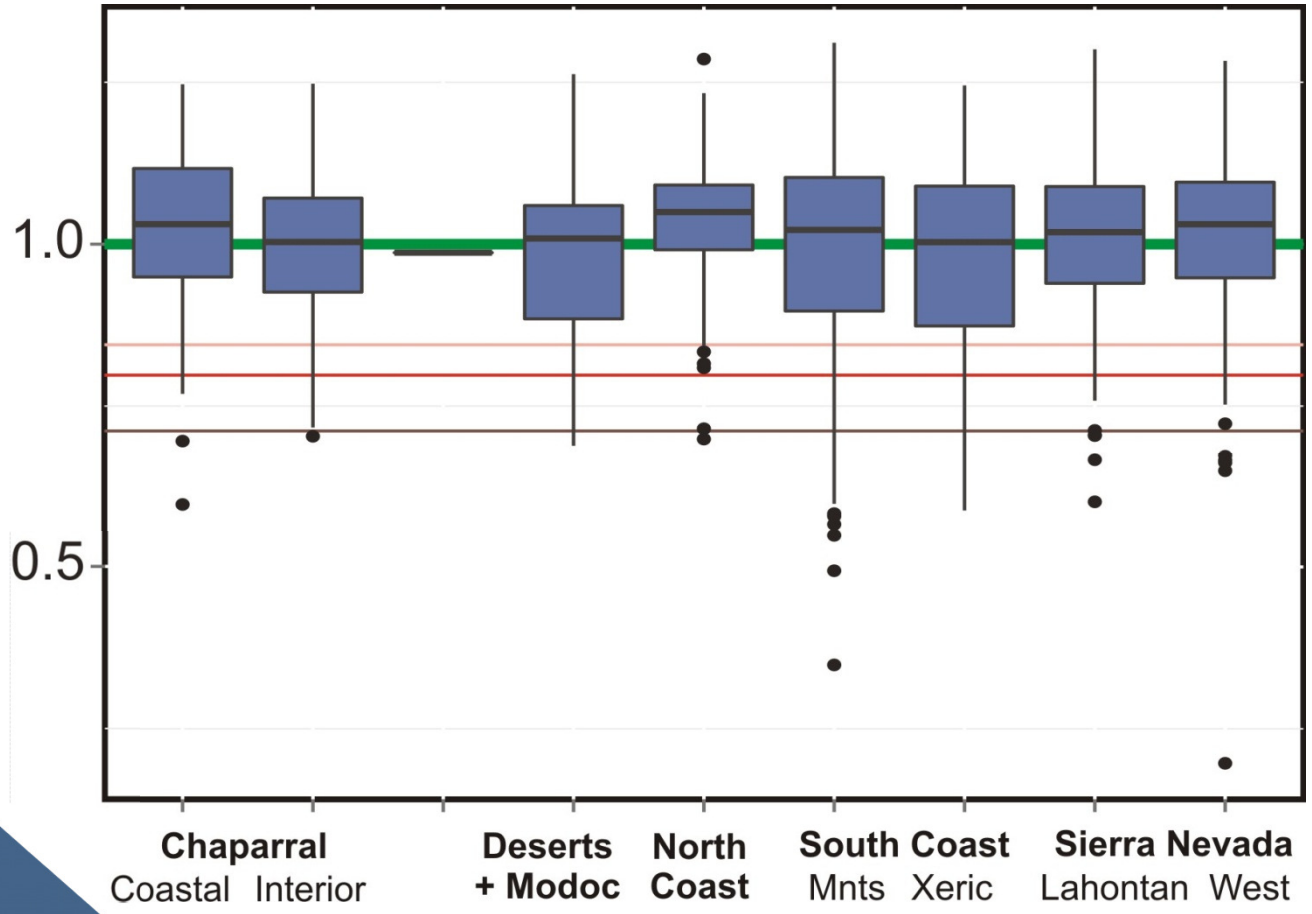
Use within-site error rate to account for uncertainty around test site score



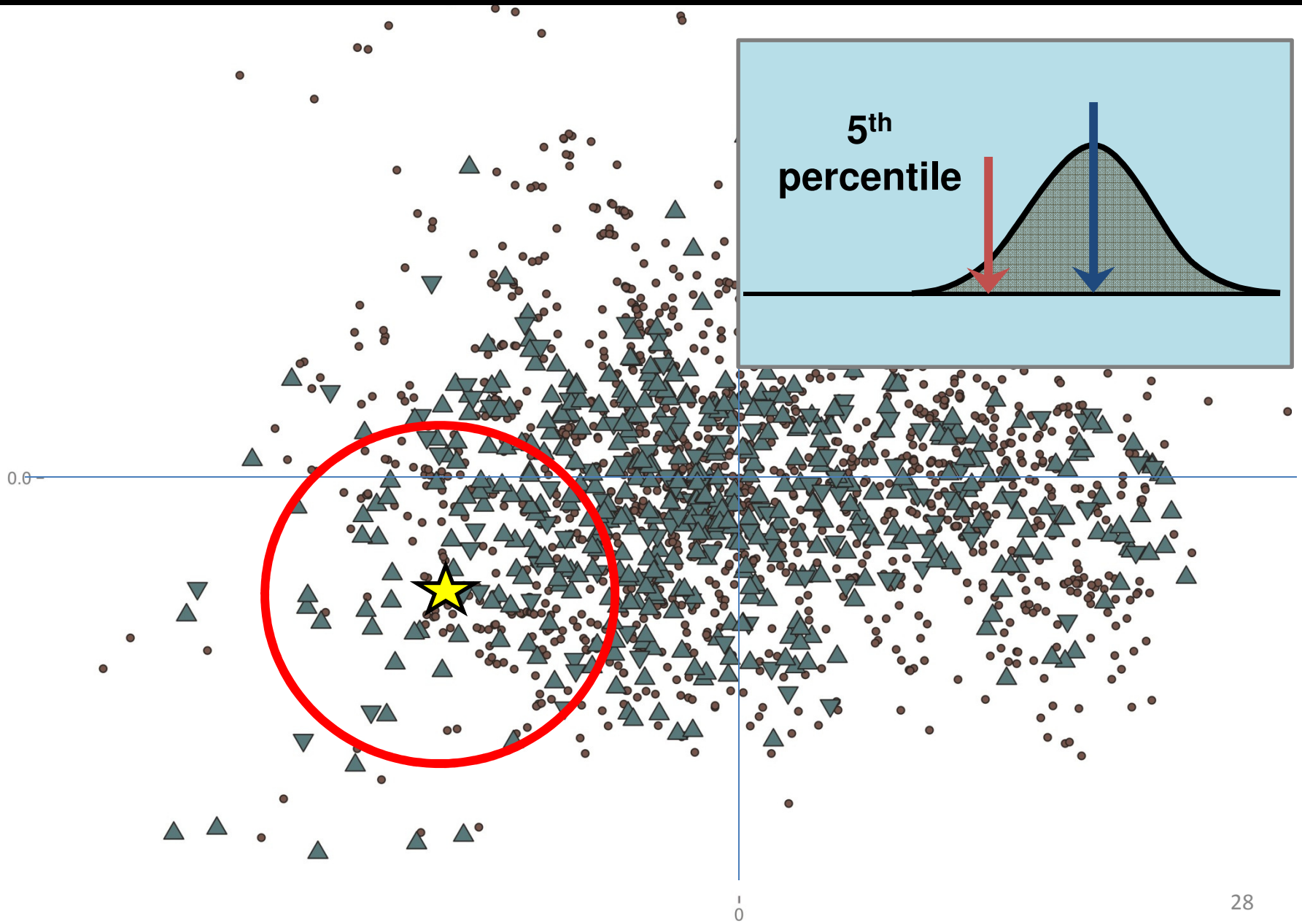
more certainty with multiple samples

Ensuring Regionally Consistent Thresholds





Enhancing threshold consistency



Where can we apply the CSCI?

- **Categorical** = exception classes in policy
  - Excepted regions (e.g., Central Valley)
  - Excepted waterbody types (e.g., modified channels)

- **Quantitative Approaches**

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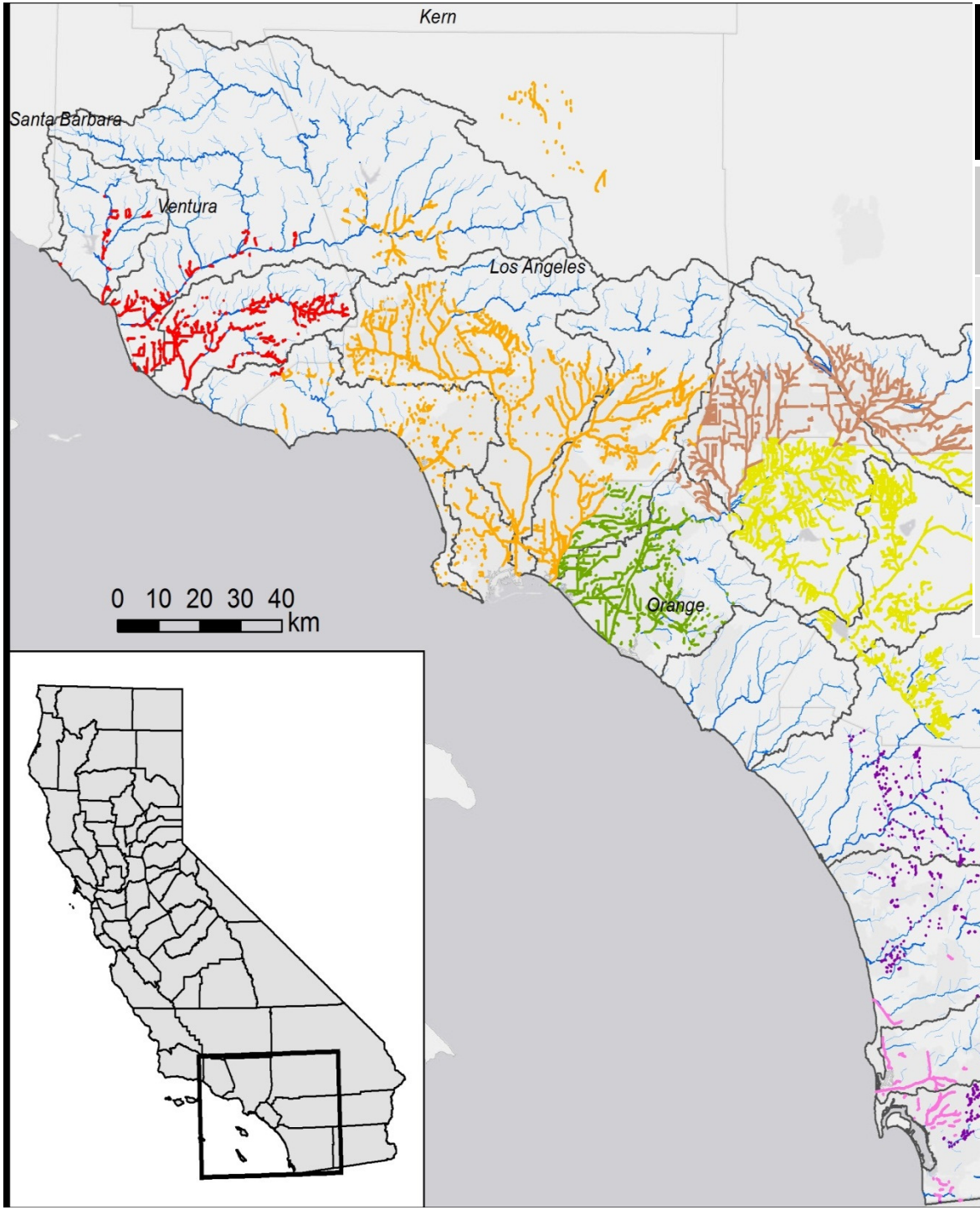
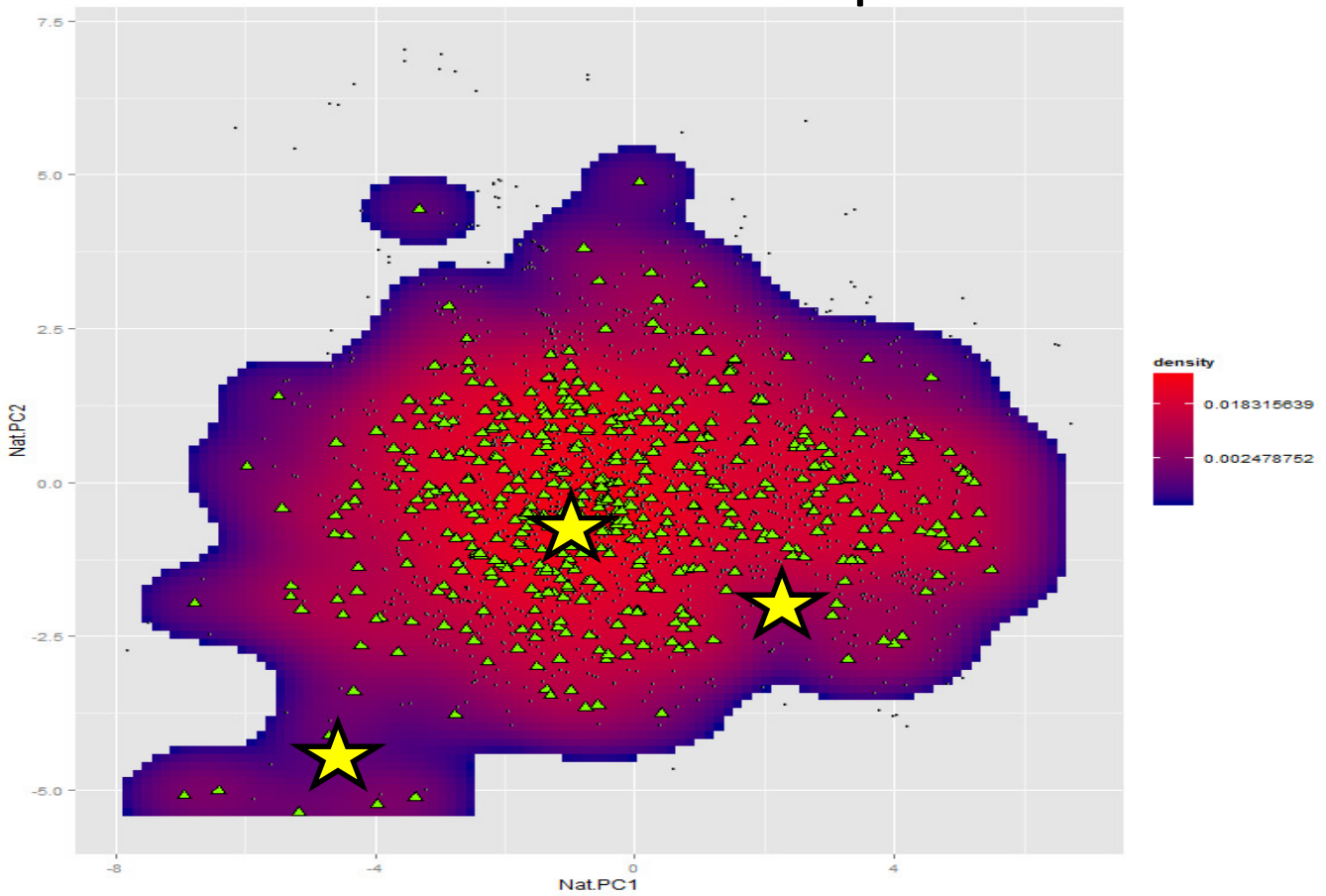


Hardscape Classification	% of So Cal Stream Miles
Concrete Walls and Bottom	3.2%
Concrete Walls, Unlined Bottom	3.6%
Unlined, But Straightened	16.6%
Natural Watercourse	76.3%

Quantitative Approaches:

"is a test site within the experience of the model in environmental space?"



Could be used to establish exceptions for truly unique environmental settings

Applicability of the CSCI in exception class settings

- We can still use the CSCI as a ruler, but we won't regulate based a reference-based threshold
- Could use "best attainable" approach instead of "reference" to set expectation, or use to compare among sites

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Automation and Documentation

STANDARD METHODS … available on SWAMP website

AUTOMATE calculations

- Package GIS layers
- Make standard calculation and reporting tools available via **CEDEN**

Document, document, document

- Journal articles
- Website 101 and FAQ
- Website appendices

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Questions?