

California Dreamin': A vision for more effective use of biological data in water resource management

Peter Ode

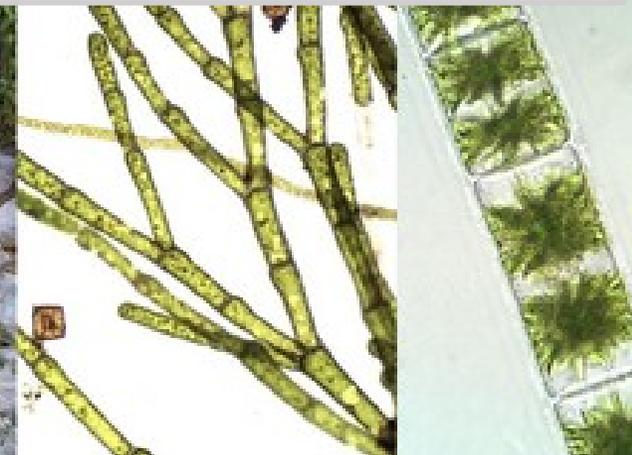
Aquatic Bioassessment Laboratory
CA Department of Fish and Wildlife





Bioassessment = direct measurement of aquatic ecosystem health from resident biota (fish, invertebrates, algae, riparian vegetation, etc.)

- Ecological indicators respond to many different kinds of waterbody stressors
- Integrate impacts over time and throughout a watershed



SWAMP's investments are expanding and refining CA's bioassessment capabilities



- **Standard methods** – field, lab, data management, quality assurance, scoring tools, etc.
- **Multiple indicators** – BMIs, benthic algae, riparian vegetation, fish?, non-traditional indicators
- **Multiple waterbodies** – wadeable streams, non-perennial streams, large rivers, lakes, depressional wetlands, springs/seeps
- **Causal assessment** – developing rapid screening approaches

*Using biological integrity to help set targets for policies related to major stressors (hydrologic alteration, physical habitat integrity, nutrient enrichment)

Focus on ecological condition will help manage aquatic resources in face of disturbance

Building the baseline

- **Reference program** (RCMP, sites with low levels of disturbance)
- **Perennial Streams Assessment** (PSA, random locations)
- 1000's of sites with baseline data on chemistry, physical habitat and biology

Technical advances – defining the expected state, deviation from it and its causes

➤ *Provides basis for objective detection, quantification and prediction of impacts of disturbance (e.g., drought, climate change, fires, etc.)*

Vision for bioassessment in California

Measures of ecological integrity are fully integrated into California's natural resource management programs; California **prioritizes this information** to **protect and restore** its waterbodies and watersheds.



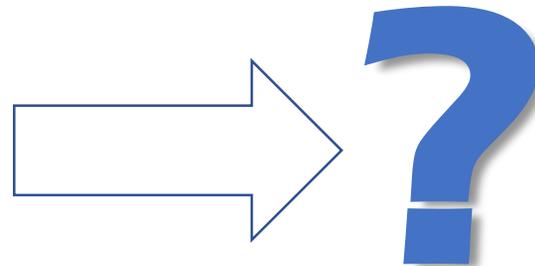
What's holding us back?

CA has made progress on many of the technical elements,
but still not close to achieving the vision

Make bioassessment
information:

- more accurate
- more reliable
- more interpretable

Technical Challenges



the "Vision"

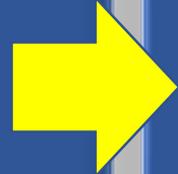
Ecological data used to
make better decisions

What's holding us back?

CA has made progress on many of the technical elements,
but still not close to achieving the vision

Make bioassessment
information:

- more accurate
- more reliable
- more interpretable



Make bioassessment
information easier
for managers to use



Technical Hurdles

Non-Technical Hurdles

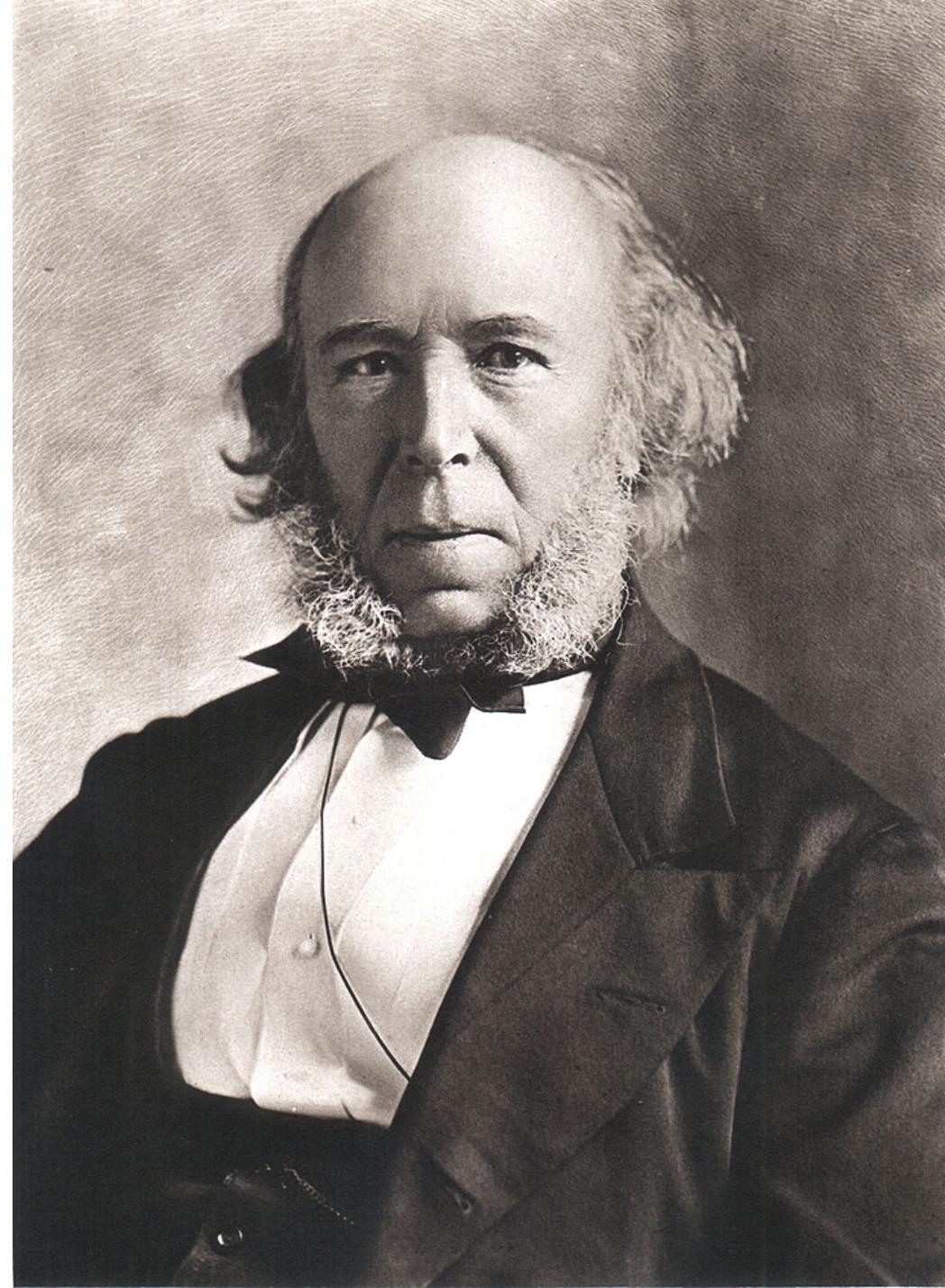
the "Vision"

Ecological data used to
make better decisions

What to do with all my
environmental information?

*When a man's knowledge is not in
order, the more of it he has the
greater will be his confusion.*

- Herbert Spencer



Success will require thinking about waterbody health at multiple spatial scales

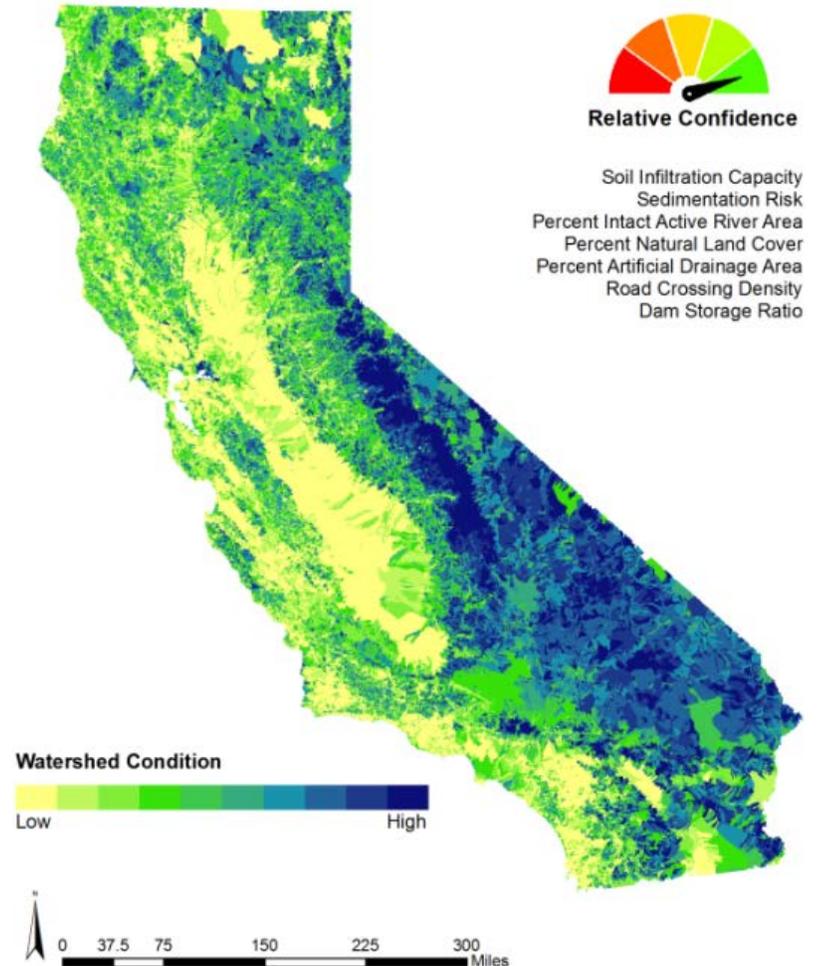
- Addressing ecological questions often requires a search for spatial patterns at different scales
- Few tools for communicating with managers in this way
- Working on tools to improve this

Part I: Tools to help interpret data within a spatial context

Part II: Tools to integrate ecological data with other information about environmental health

Success requires interagency coordination

- Need frameworks for interpreting watershed health and vulnerability
- Need better tools for coordinating and communicating priorities and strategies for protection and remediation (and tracking progress)

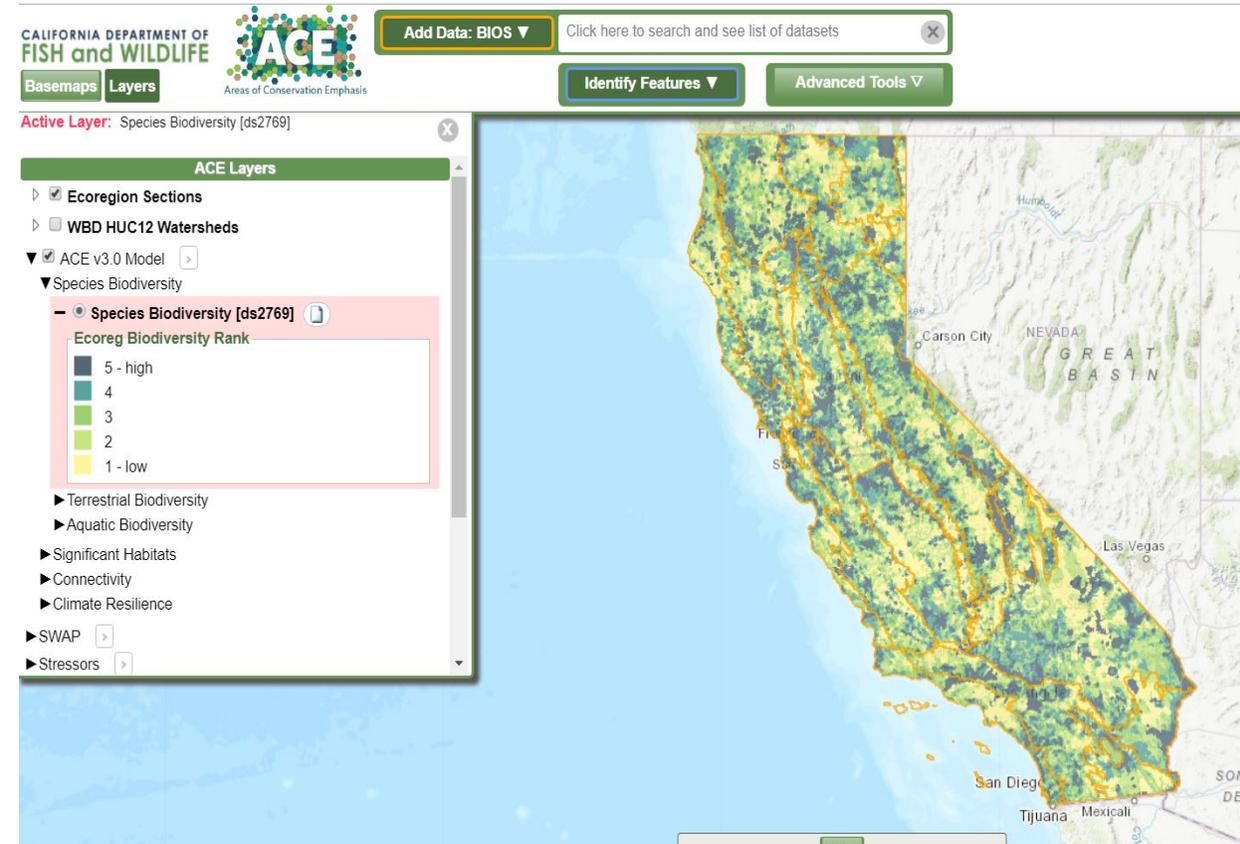


CA Department of Fish and Wildlife

– summaries and synthesis of biological data

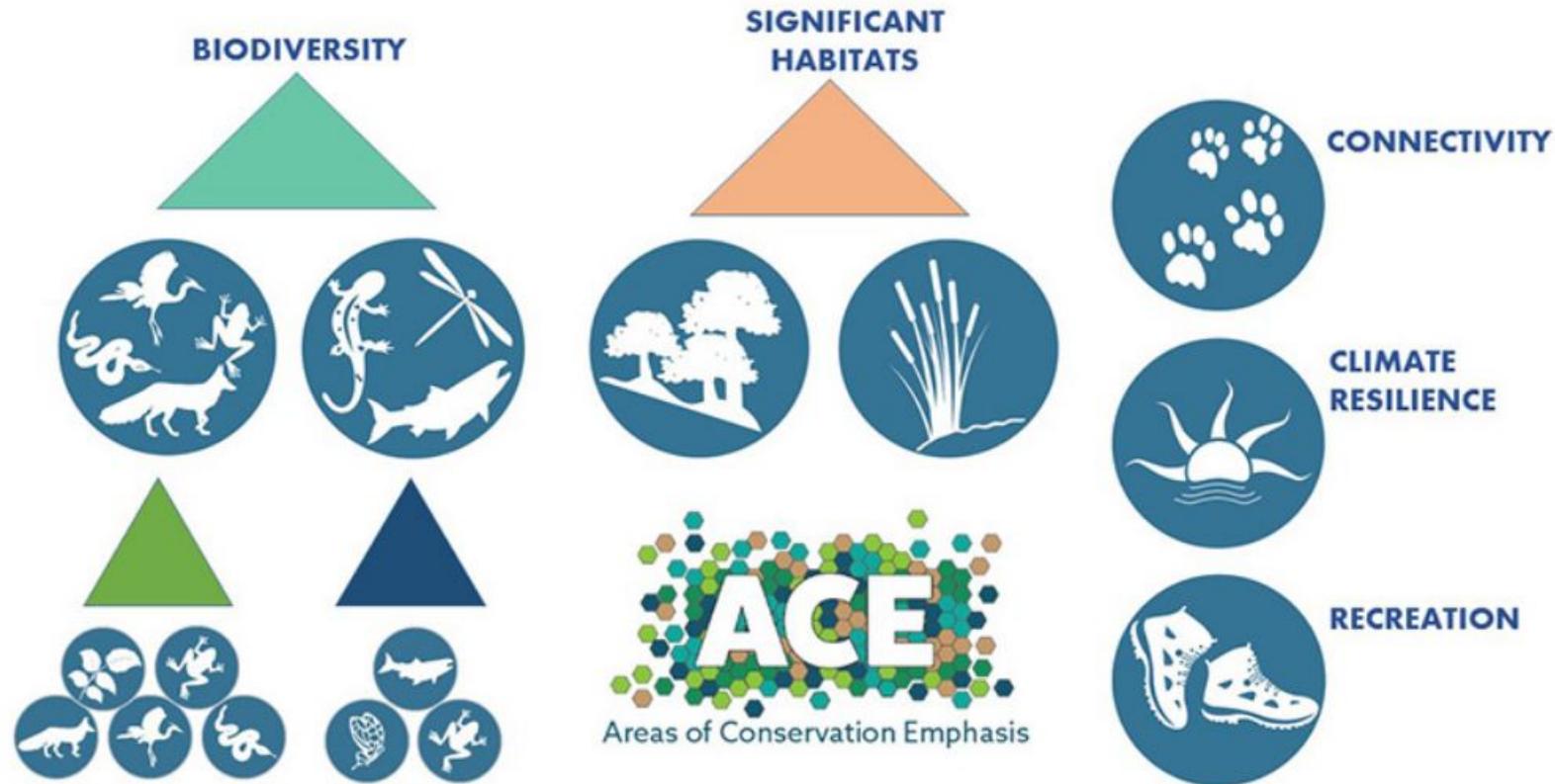


- **BIOS** – Biological Information Observation System
- **CNDDDB** – California Natural Diversity Database
- **ACE – III** – Areas of Conservation Emphasis





Areas of Conservation Emphasis (ACE – III)



USEPA Healthy Watershed Initiative

WQMC – Healthy Watersheds Partnership

EPA HWI website

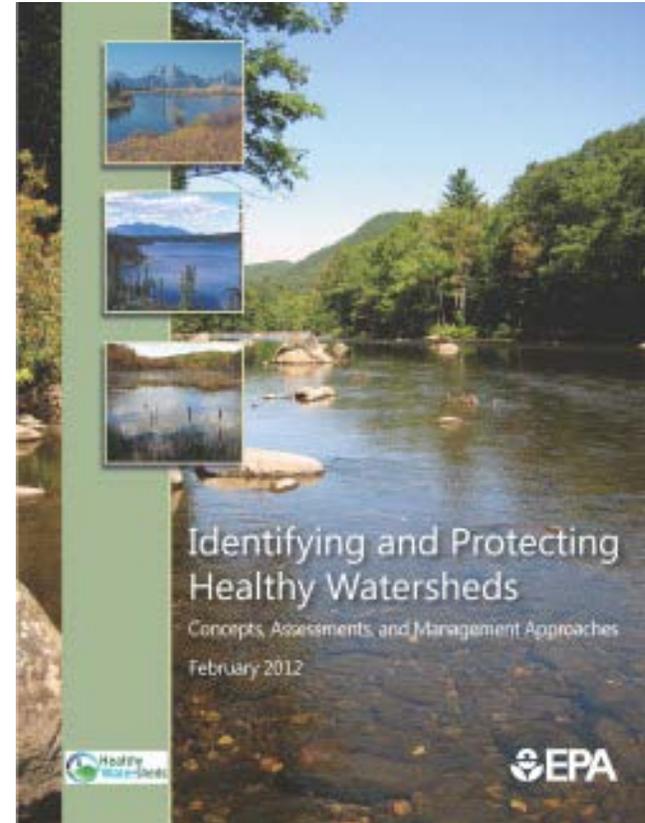
www.epa.gov/healthywatersheds

Goals of the Initiative

- Protect and maintain healthy watersheds, and increase their numbers over time.
- Raise the visibility and importance of protecting high quality waters.

Demonstrations

California, Alabama, Wisconsin





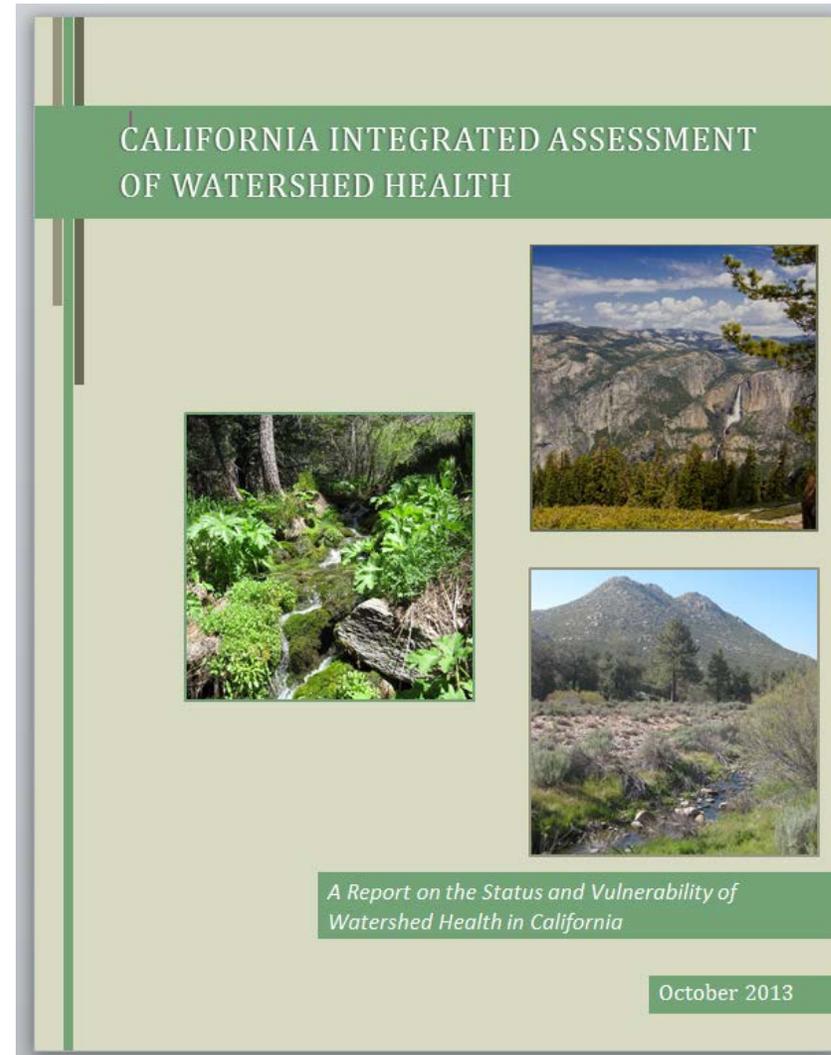
California Integrated Assessment of Watershed Health

Project initiated in 2011

Final report released October 2013

Funded by US EPA with technical support from The Cadmus Group

http://www.mywaterquality.ca.gov/monitoring_council/healthy_streams/docs/ca_hw_report_111213.pdf

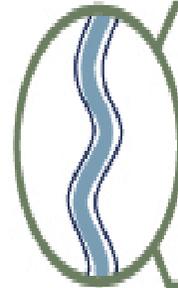


HWI's six indicators of watershed health



Landscape Condition

Patterns of natural land cover, natural disturbance regimes, lateral and longitudinal connectivity of the aquatic environment, and continuity of landscape processes.



Geomorphic Condition

Stream channels with natural geomorphic dynamics.



Habitat

Aquatic, wetland, riparian, floodplain, lake, and shoreline habitat. Hydrologic connectivity.



Water Quality

Chemical and physical characteristics of water.



Hydrology

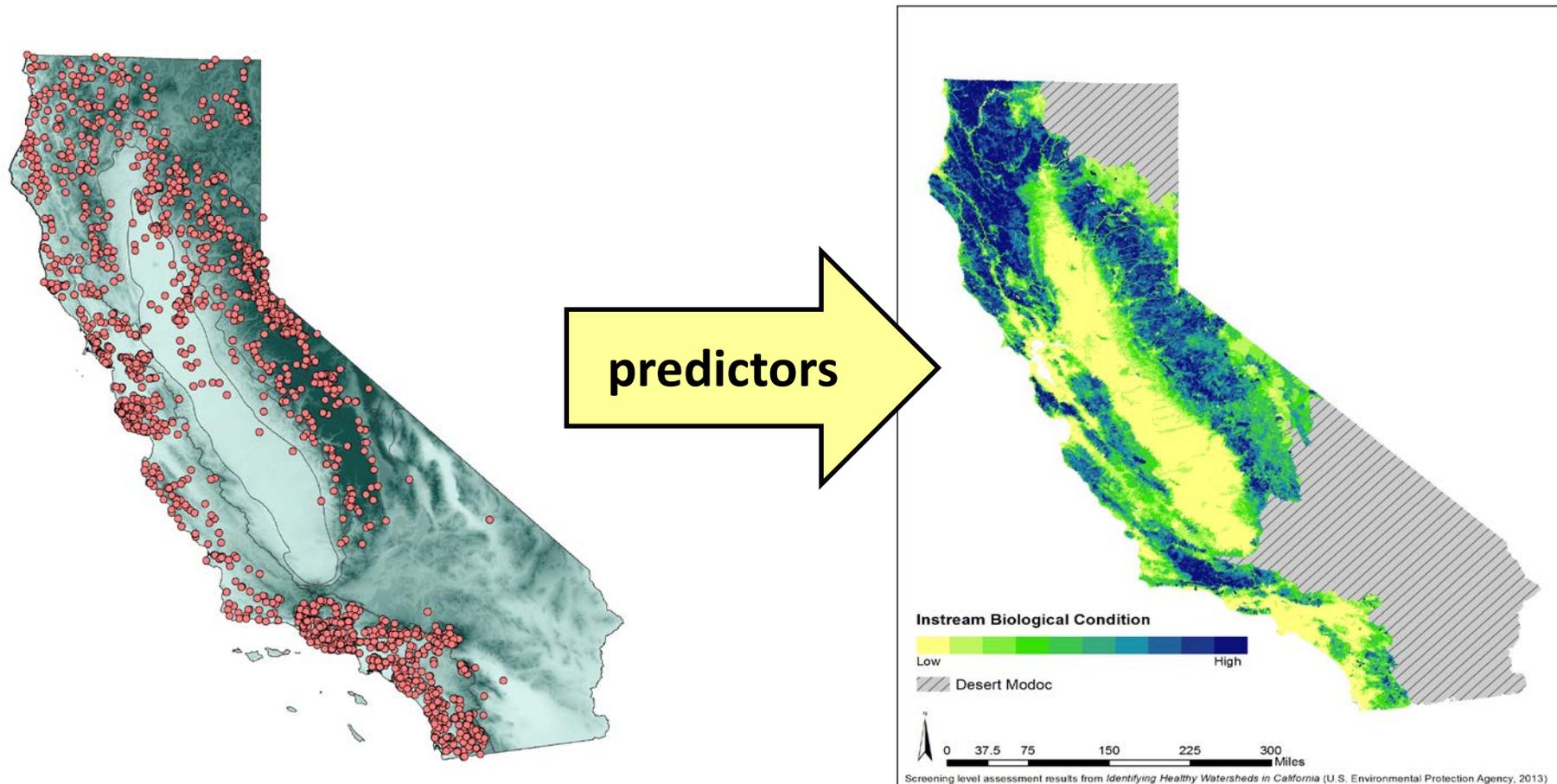
Hydrologic regime: Quantity and timing of flow or water level fluctuation. Highly dependent on the natural flow (disturbance) regime and hydrologic connectivity, including surface-ground water interactions.



Biological Condition

Biological community diversity, composition, relative abundance, trophic structure, condition, and sensitive species.

Example: Boosted Regression Tree (BRT) models of California Stream Condition Index scores



Model output = predicted BMI condition for each NHD catchment

Combine indicators into indices describing ecosystem health and ecological vulnerability

Watershed Condition

Percent Natural Land Cover

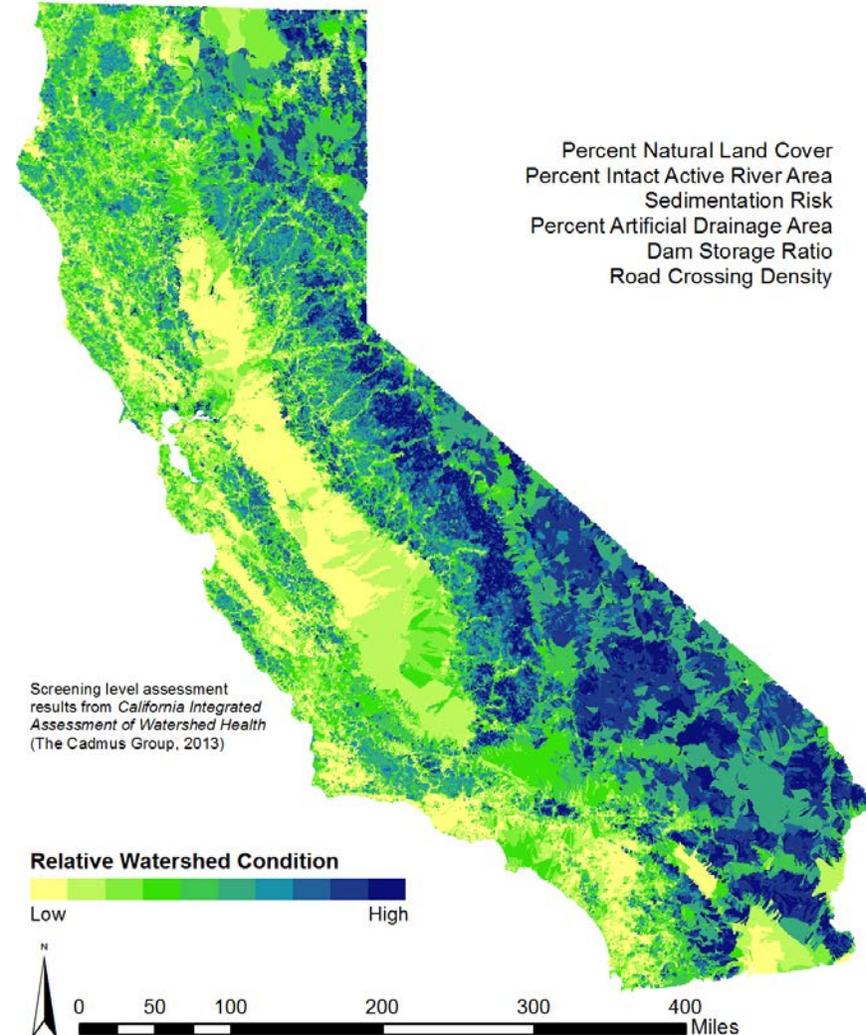
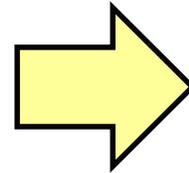
Percent Intact Active River Area

Sedimentation Risk

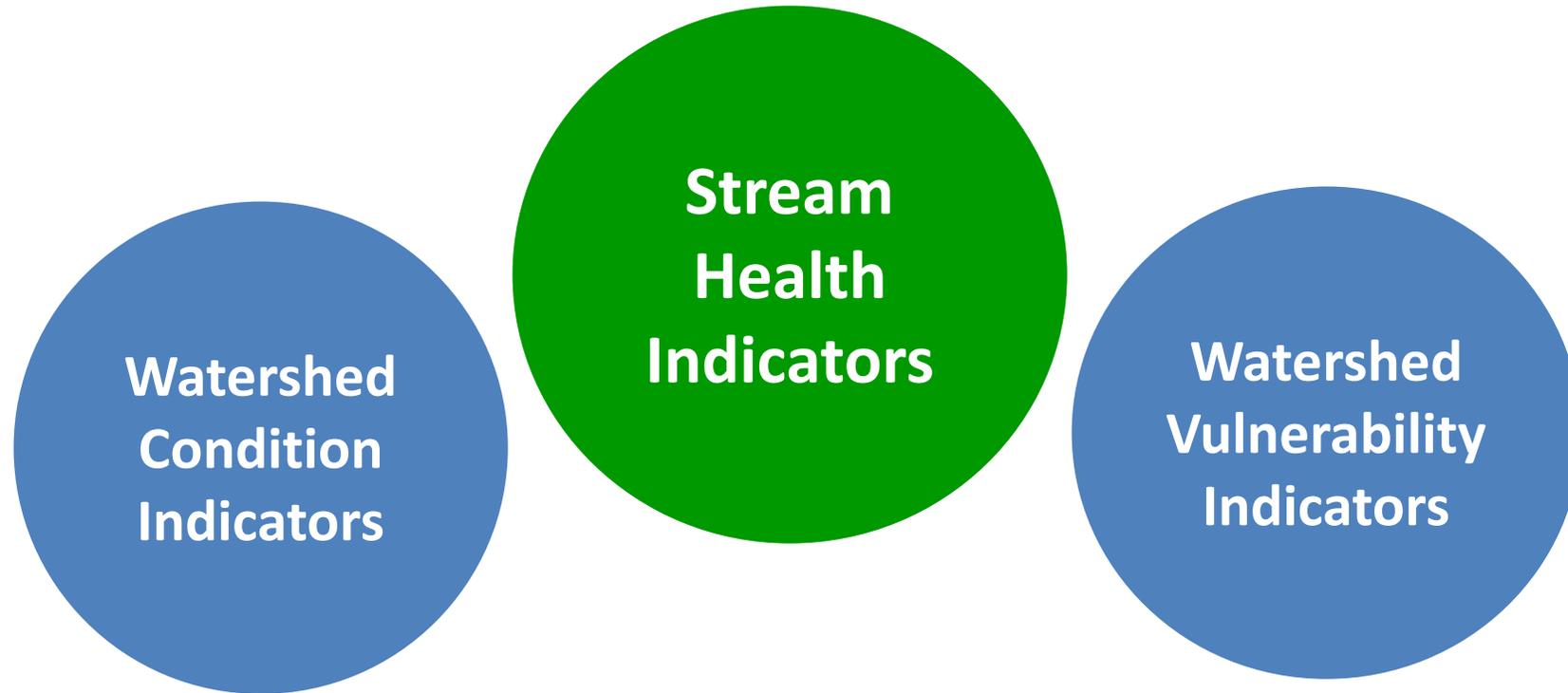
Percent Artificial Drainage Area

Dam Storage Ratio

Road Crossing Density



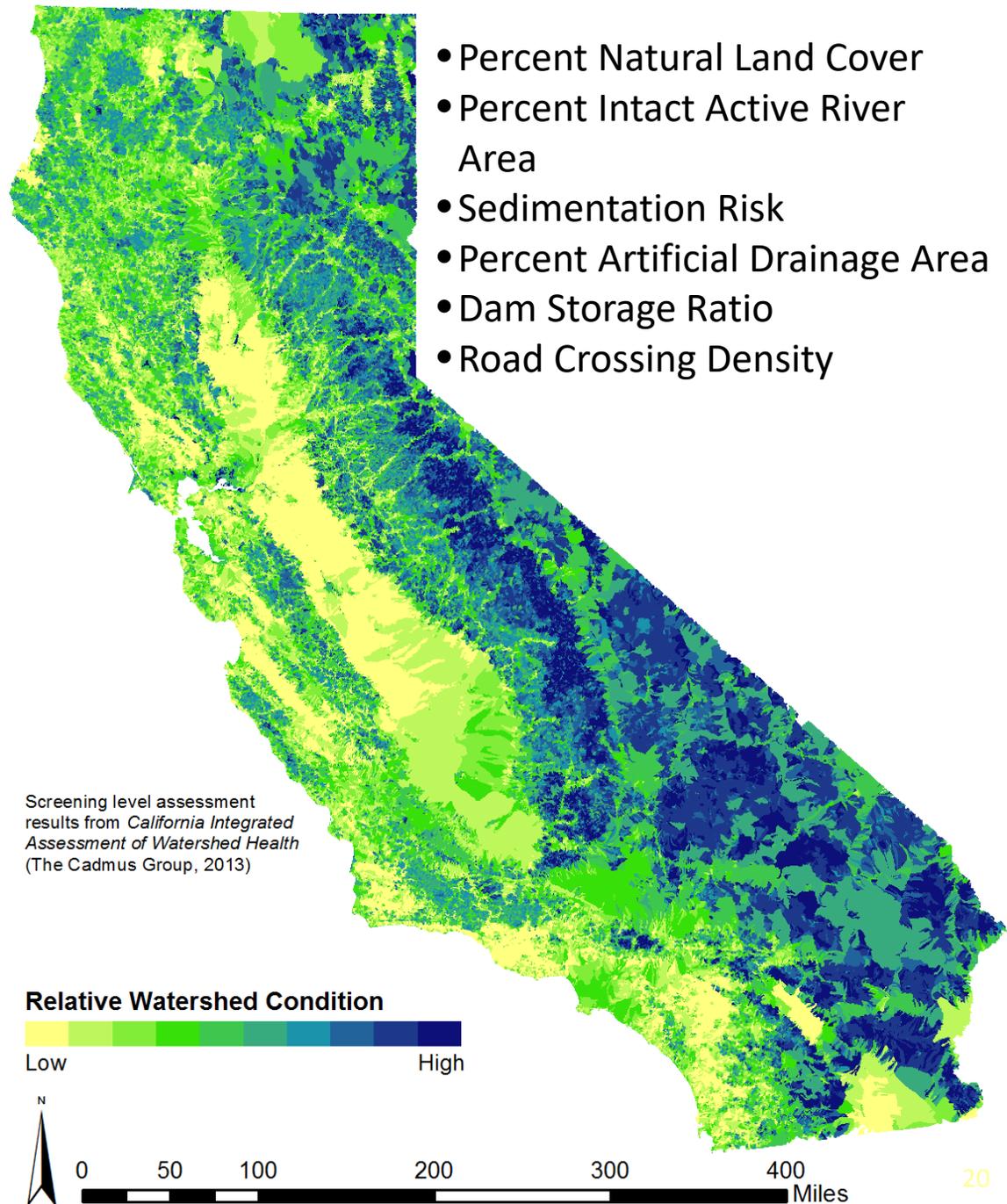
Three indicator groups



Structural influences + risk factors help interpret measures of stream/watershed health and vulnerability

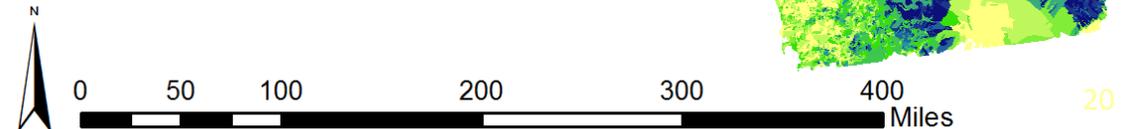
Relative Watershed Condition Index

- Percent Natural Land Cover
- Percent Intact Active River Area
- Sedimentation Risk
- Percent Artificial Drainage Area
- Dam Storage Ratio
- Road Crossing Density



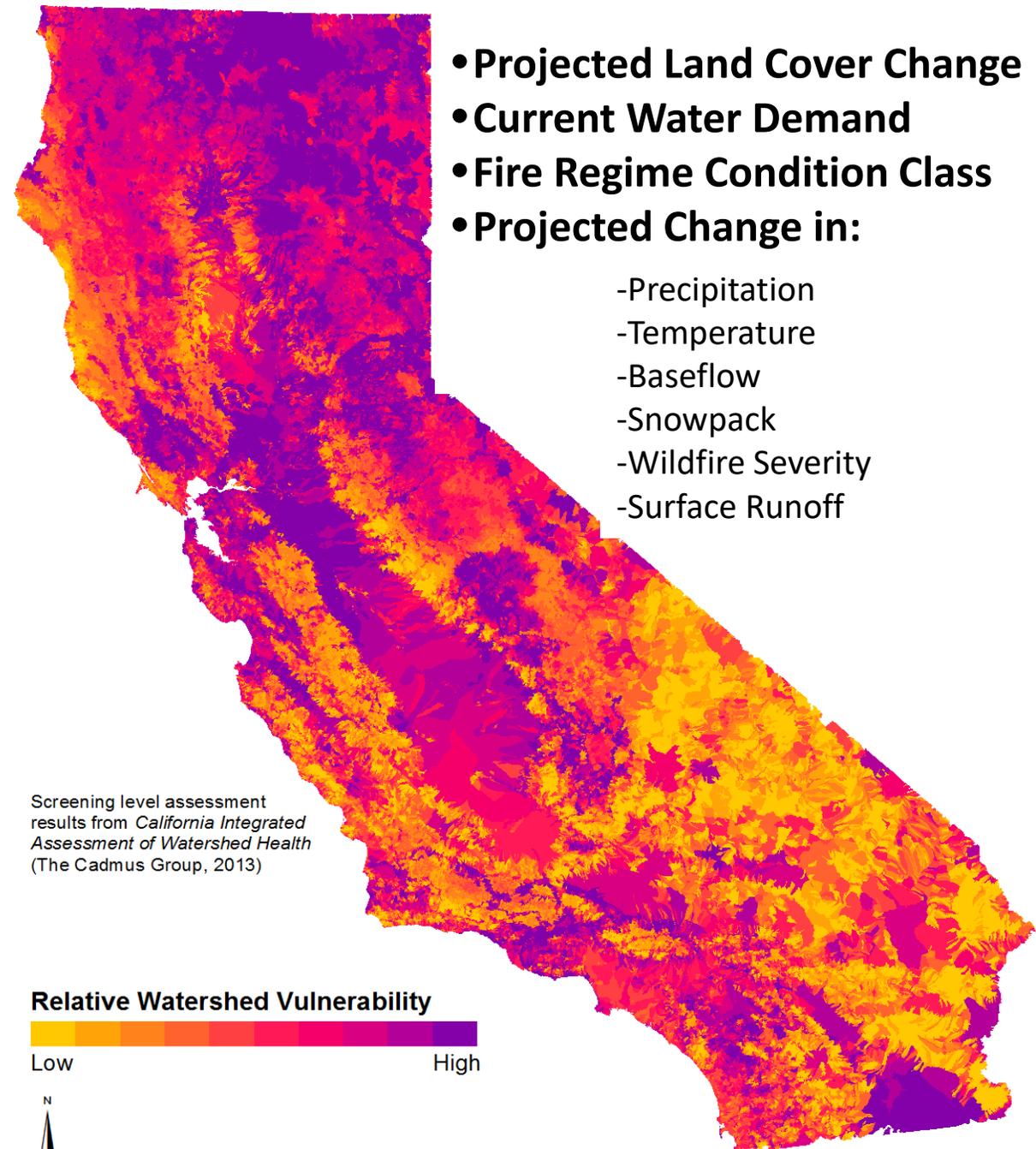
Screening level assessment results from *California Integrated Assessment of Watershed Health* (The Cadmus Group, 2013)

Relative Watershed Condition
Low High



Relative Watershed Vulnerability Index

- Projected Land Cover Change
- Current Water Demand
- Fire Regime Condition Class
- Projected Change in:
 - Precipitation
 - Temperature
 - Baseflow
 - Snowpack
 - Wildfire Severity
 - Surface Runoff



Screening level assessment results from *California Integrated Assessment of Watershed Health* (The Cadmus Group, 2013)

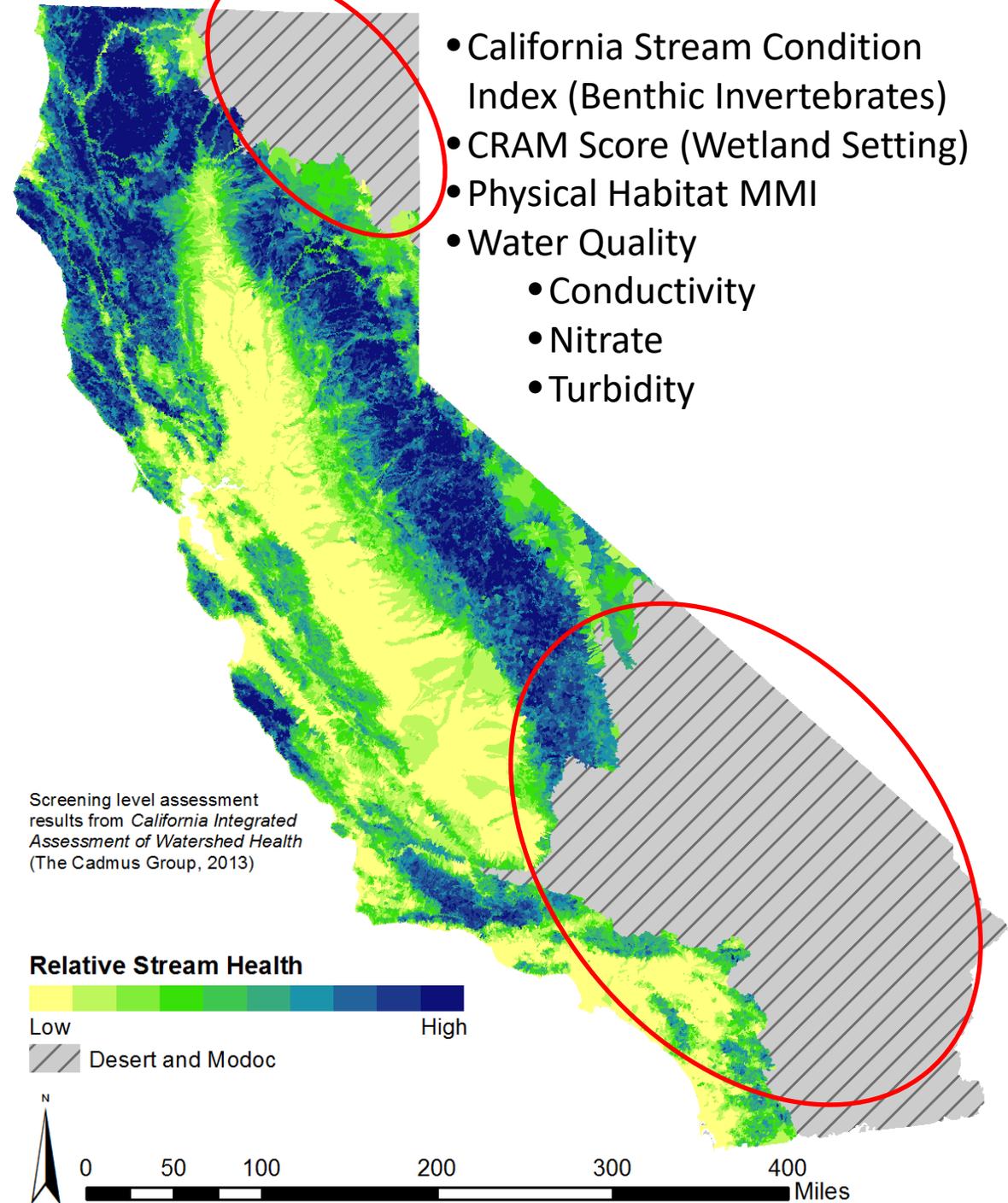
Relative Watershed Vulnerability
Low High



0 50 100 200 300 400 Miles

Relative Stream Health Index*

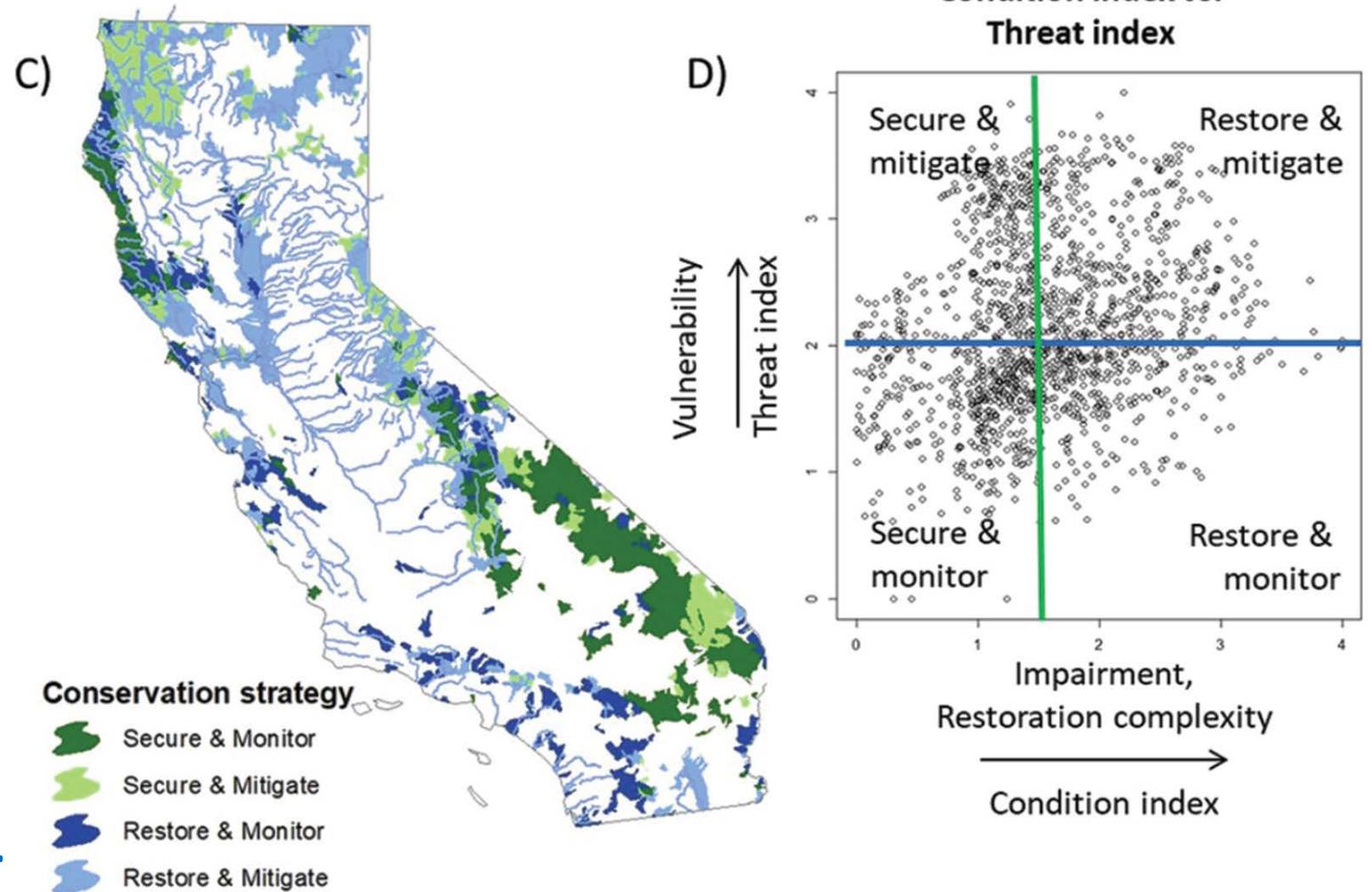
 = areas unassessed due to data limitations

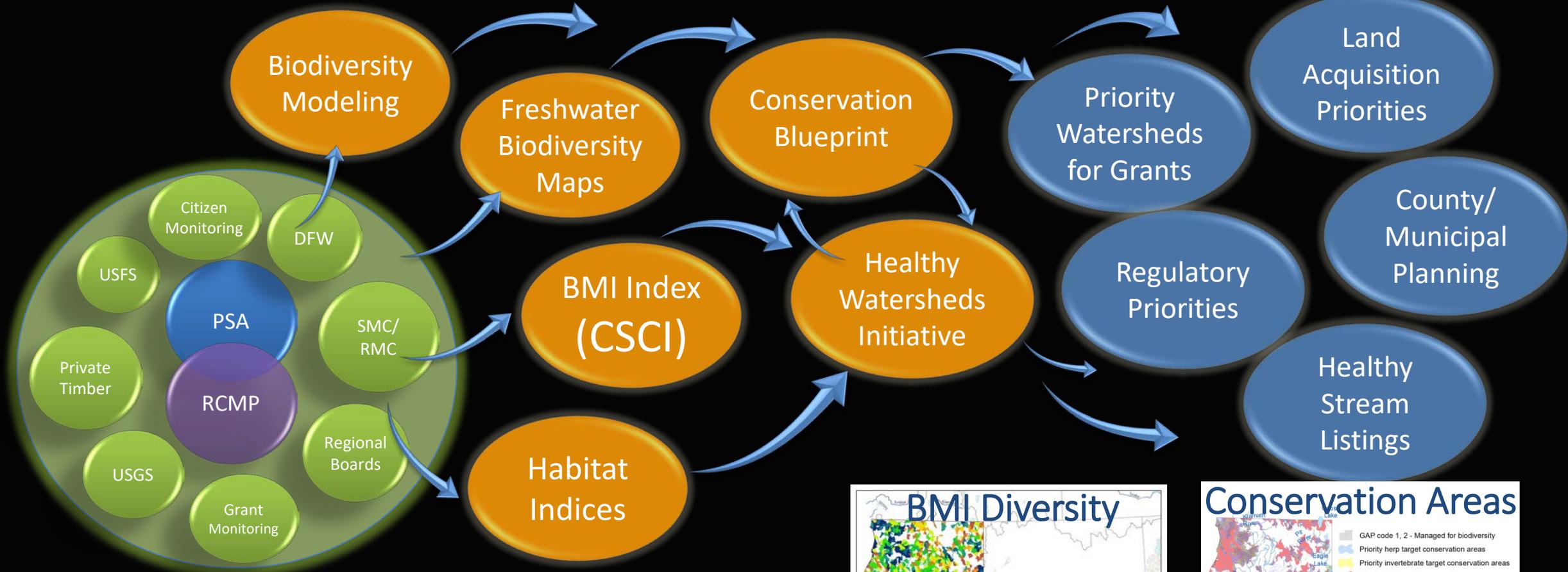


Freshwater Conservation Blueprint for CA

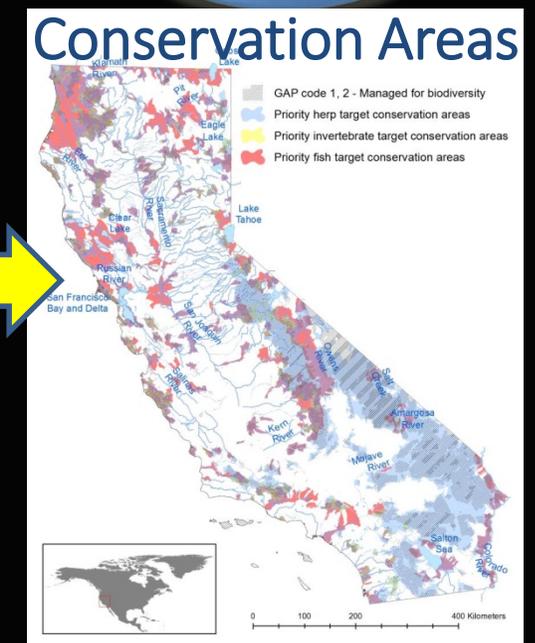
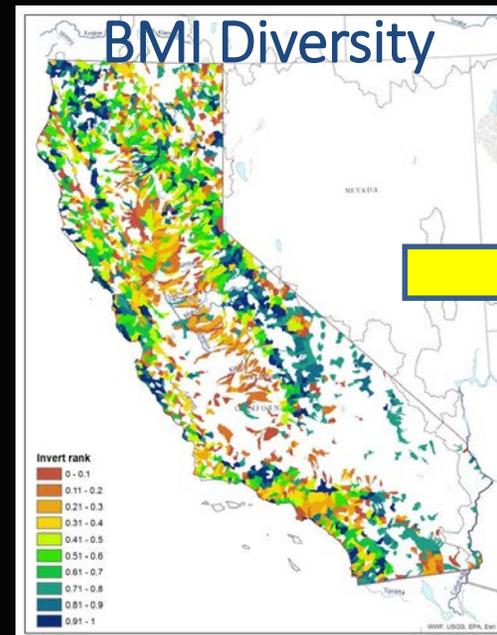
Phase II: Combine condition and vulnerability to inform conservation strategies

We need a lot more synthesis tools like these.





A conservation plan for CA's freshwater diversity



- *Jeanette Howard*
- *Kurt Fesenmyer*

Thank you



Limitations of current version

- Relative ranking of indicators only
- High variability in confidence of indicators
- Limited information about biodiversity or conservation value (but new data now available)

Keeping the ball rolling (Part I)

1. Need mechanism to test and improve models

- Predictions can be tested with adaptive monitoring approaches
 - *Where do models predict well or poorly?*
- Add ability to incorporate condition (e.g., CSCI can determine intact vs. altered)

2. Need mechanism to add/revise data

- biodiversity, conservation value
- non-perennial streams,
- hydrologic alteration
- additional landuse stressors (grazing, timber harvest)

Keeping the ball rolling (Part II)

3. How to make it useful

- Support custom assessments
 - Select indicators for different applications
 - Weight indicators
- Develop technical capacity to update models and deliver data (at State Water Board or DFW?)