Prioritizing management goals for stream biological integrity within the context of landscape constraints

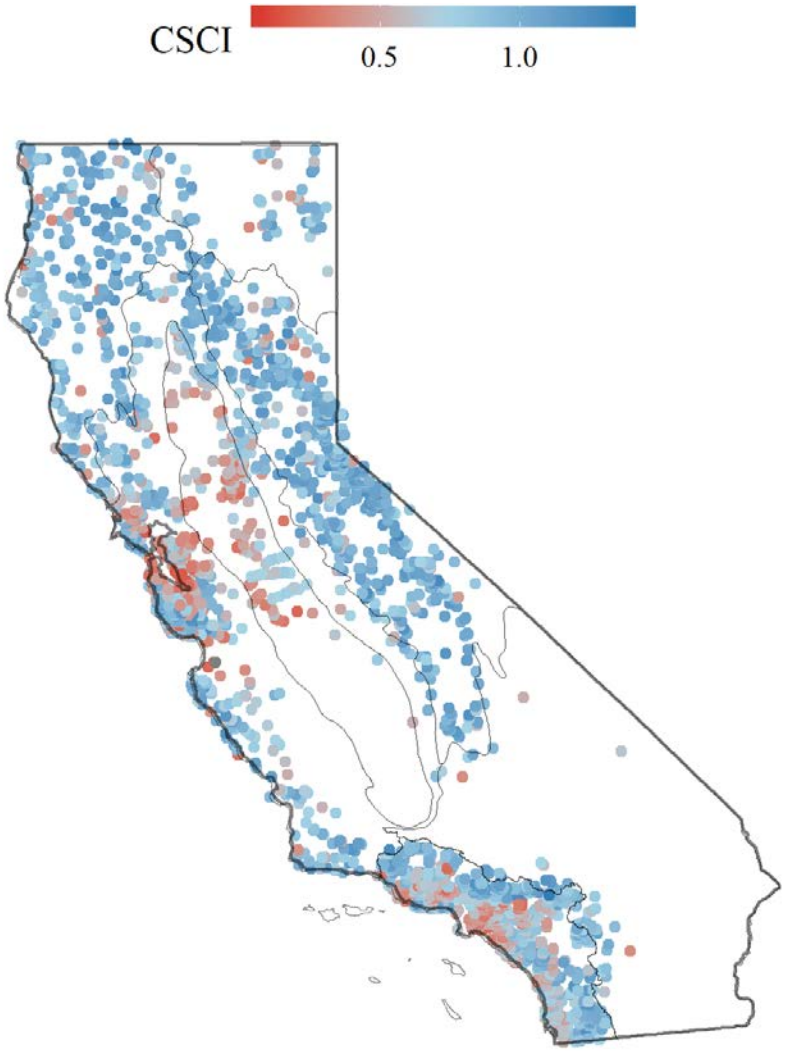
June 21, 2018

Presentation to the SWAMP Science Symposium

Marcus W. Beck (marcusb@sccwrp.org)
Raphael D. Mazor
Scott Johnson
Karin Wisenbaker
Josh Westfall
Pete D. Ode
Ryan Hill
Chad Loflen
Martha Sutula
Eric Stein

Statewide biological assessment is ongoing

- Bioassessment of stream health informed by extensive sampling, SWAMP data
- California Stream Condition Index (CSCI, Mazor et al. 2016) describes deviation from reference
- Consistent meaning across regions



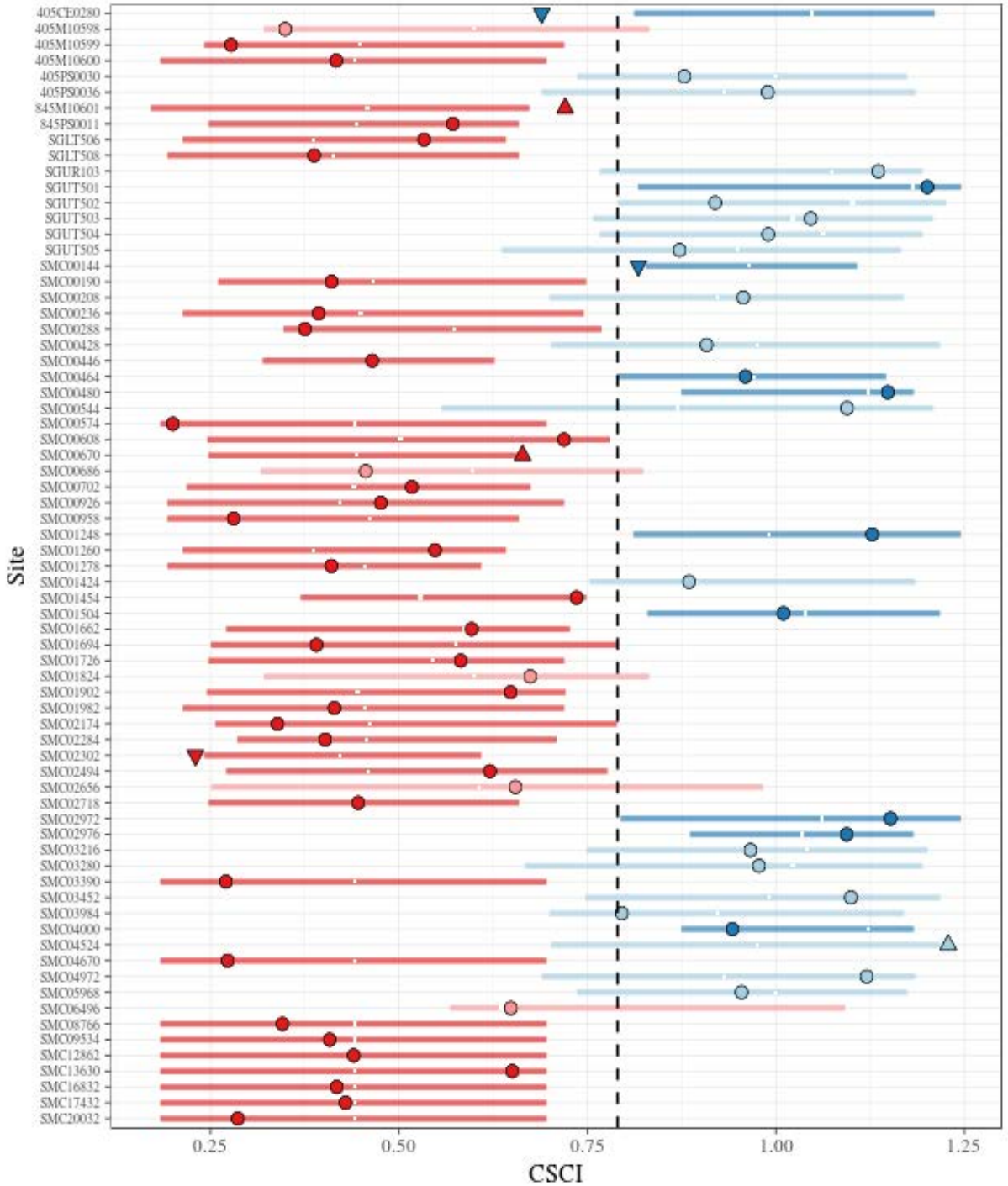
Challenges with applying bioassessment data to management

In a perfect world:

- Restore low scoring sites
- Protect high scoring sites

Reality:

- Limited resources, not all sites are created equal
- “Unmanageable” stressors can limit management outcomes
- Need to develop watershed-scale solutions to problems measured at the site scale
- Management needs defined in regional contexts



Managers need context to set priorities

- Lots of sampling
- Many low-scoring sites
- Which ones to fix?

Relative site score

▽ under scoring ○ expected △ over scoring

Stream reach class

likely constrained
possibly unconstrained
possibly constrained
likely unconstrained

Landscape models and data viz can help apply assessment tools

- ***Developed landscapes:*** Locations where watershed development is likely to limit bioassessment index (e.g., CSCI) scores

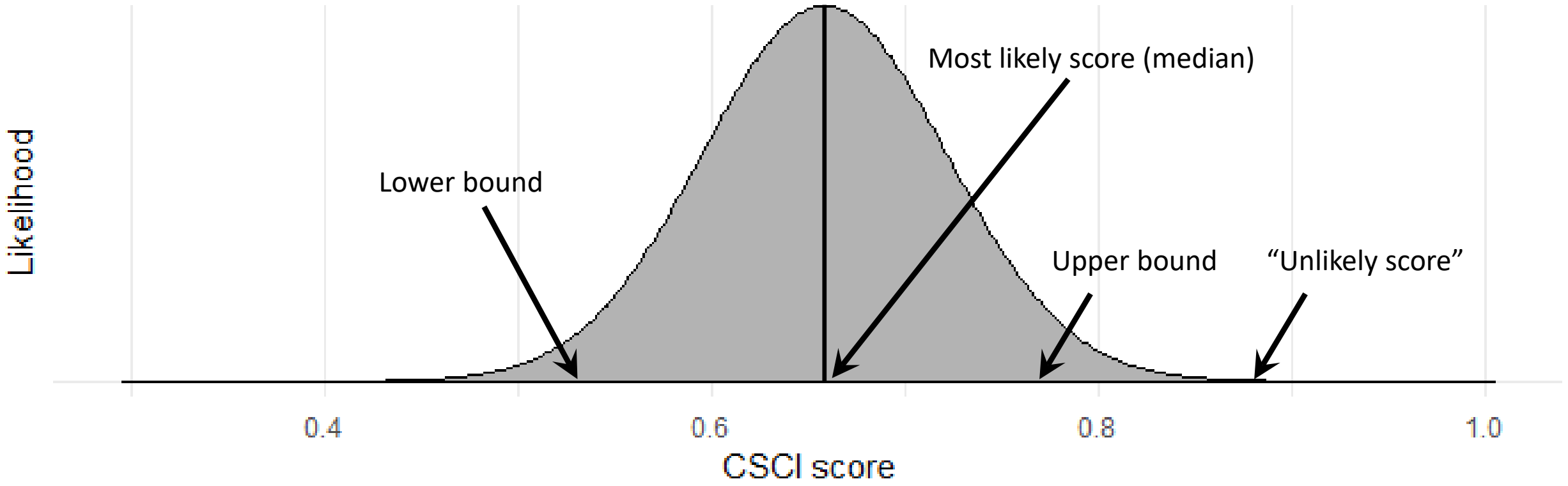
- We can:

  - Develop **landscape models** to predict the range of conditions that are expected given landscape constraints

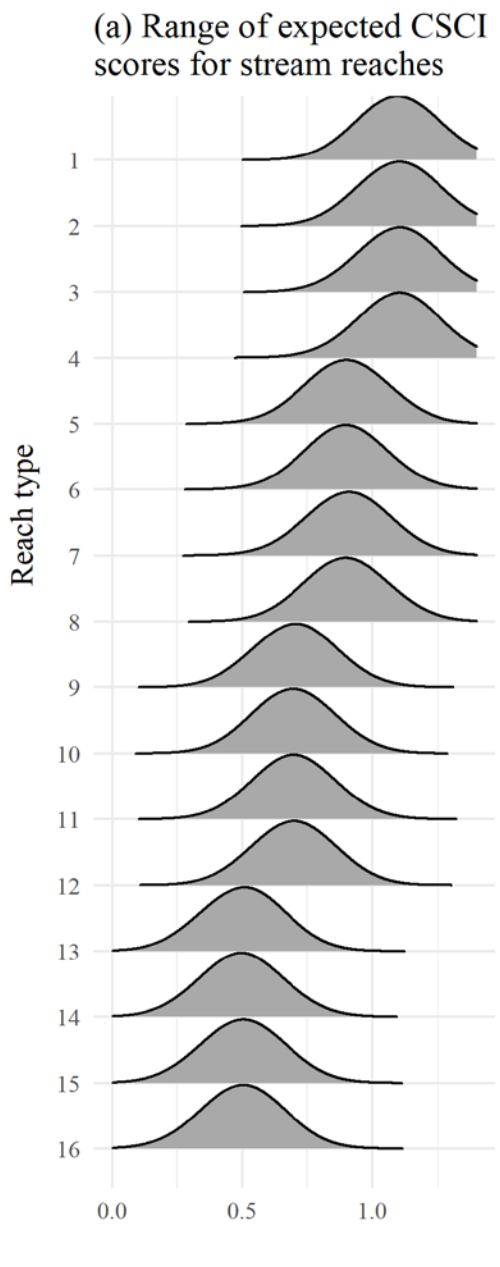
  - Integrate the landscape models with **data viz** tools to help managers prioritize regional decisions

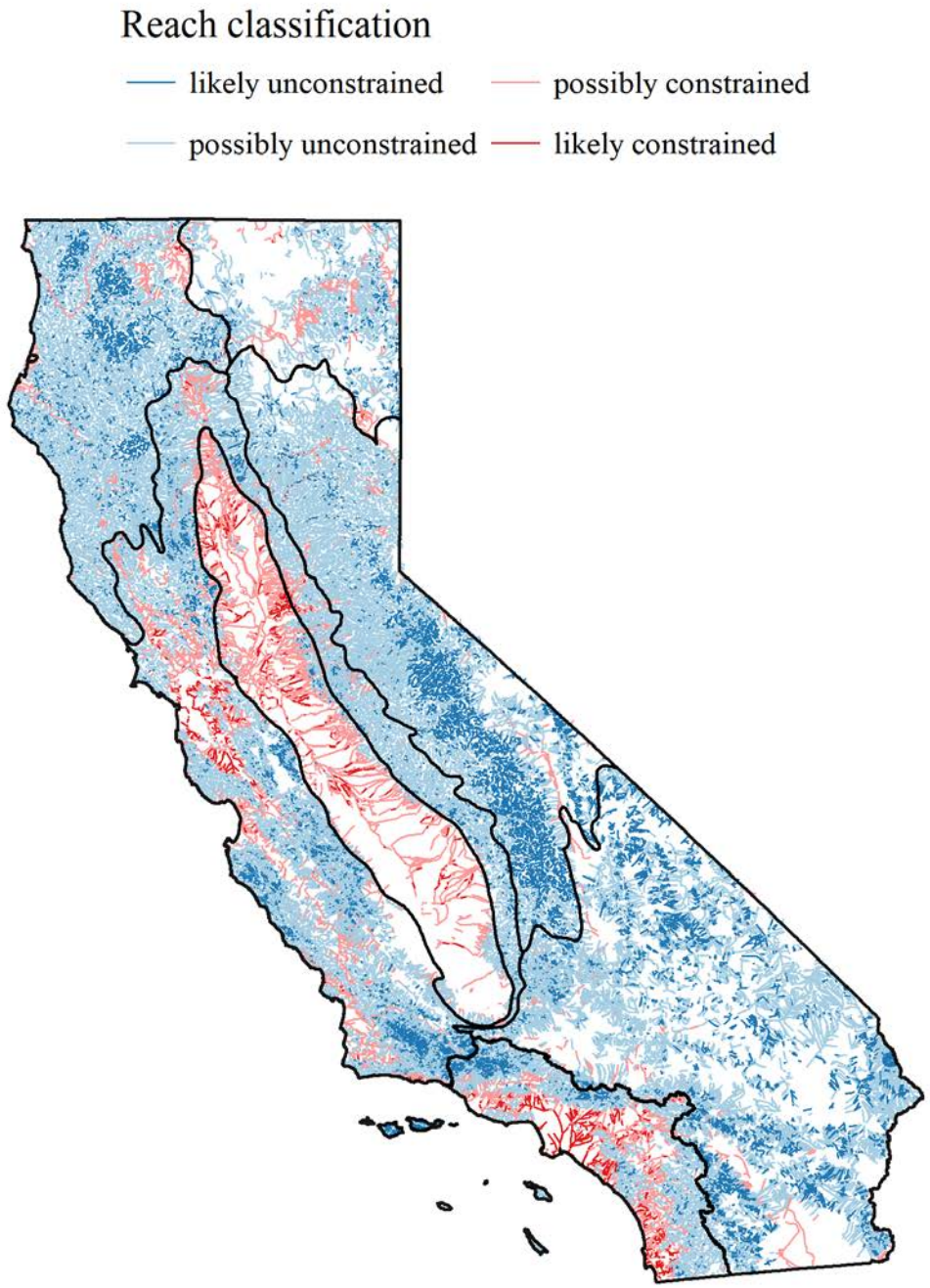
What we get from the model:

- For each stream reach, a range of modelled biological expectations given landscape constraints



How are reaches classified using the model?

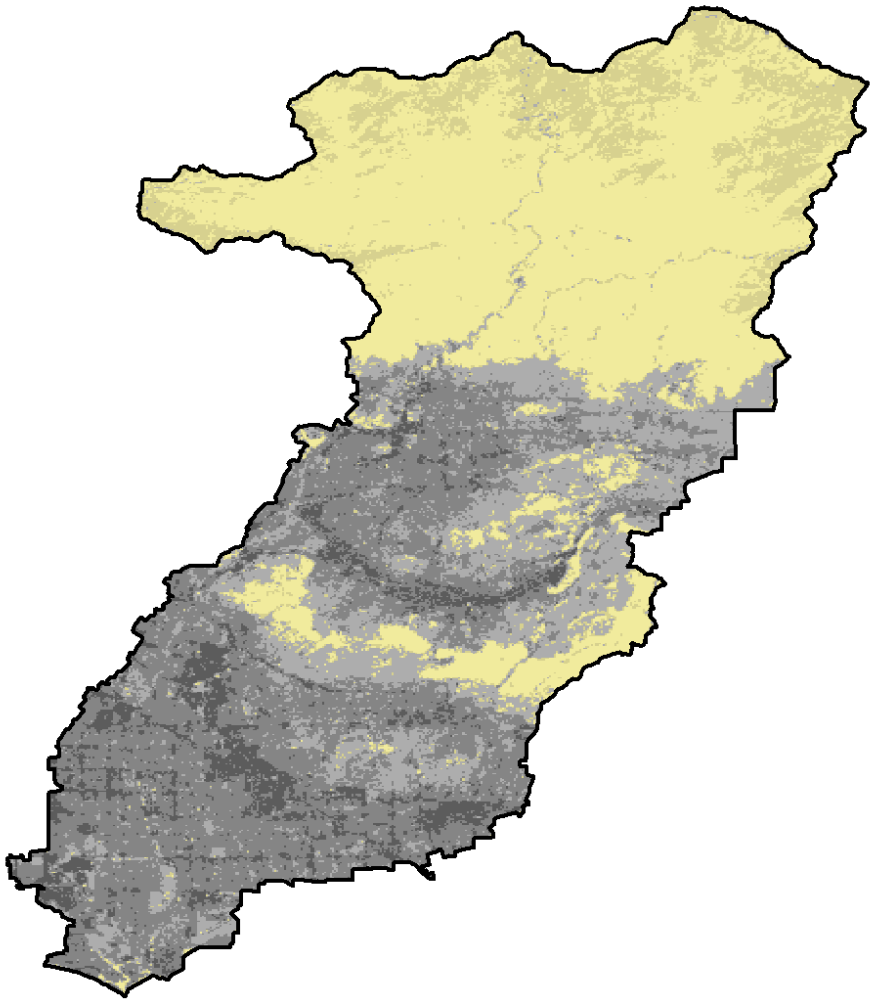


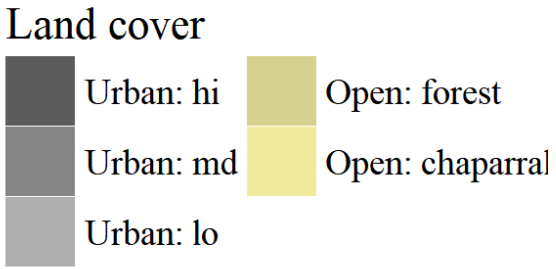


Landscape models provide reach contexts

- Likely constrained: 3%
- Possibly constrained: 23%
- Possibly unconstrained: 67%
- Likely constrained: 7%

Models support local managers





Case study from highly urbanized San Gabriel River watershed

San Gabriel-SCAPE
Stream
Classification
And
Prioritization
Explorer tool

SCAPE: Stream Classification And Priority Explorer

aquatic bioassay & consulting laboratories, inc
www.aquaticbioassay.com

SWAMP
Surface Water Ambient Monitoring Program

CSCI reference threshold:

1% (0.63) | 10% (0.79) | 30% (0.92)

Confidence range (+/-):

More certain (0.45) | Less certain (0.05)

Show individual samples at each site:

Instructions | (1) View maps | (2) View reach summary | (3) Tabulate reach summary | (4) Set reach priorities | (5) View priorities

These maps show stream reach classifications and CSCI scores at monitoring stations. The **left map** shows the predicted median CSCI score for a reach and observed CSCI score at a station from field data. The **right map** shows the CSCI score expectation for a reach and the relative CSCI score at a station for the expectation (over scoring as **up triangle**, expected as **circle**, under scoring as **down triangle**). See the plot tab (step 2) for more details on how expectations and relative site scores are determined. The toggle switch controls how the CSCI scores at the stations (points) on the left map are displayed. The observed scores from field samples are shown when the switch is off and the differences between the observed scores and the stream reach median expectations are shown when the switch is on.

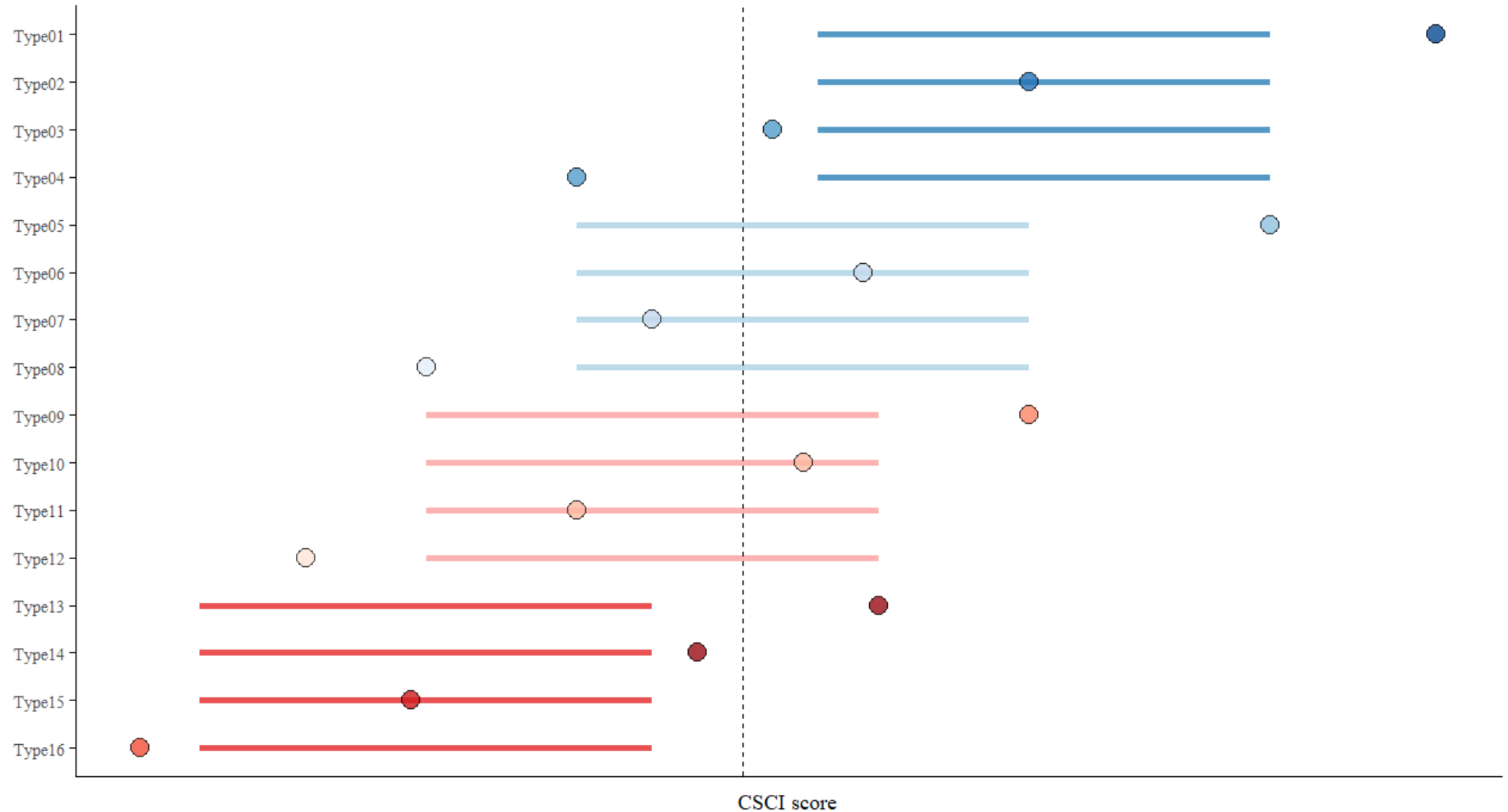
http://shiny.sccwrp.org/scape/

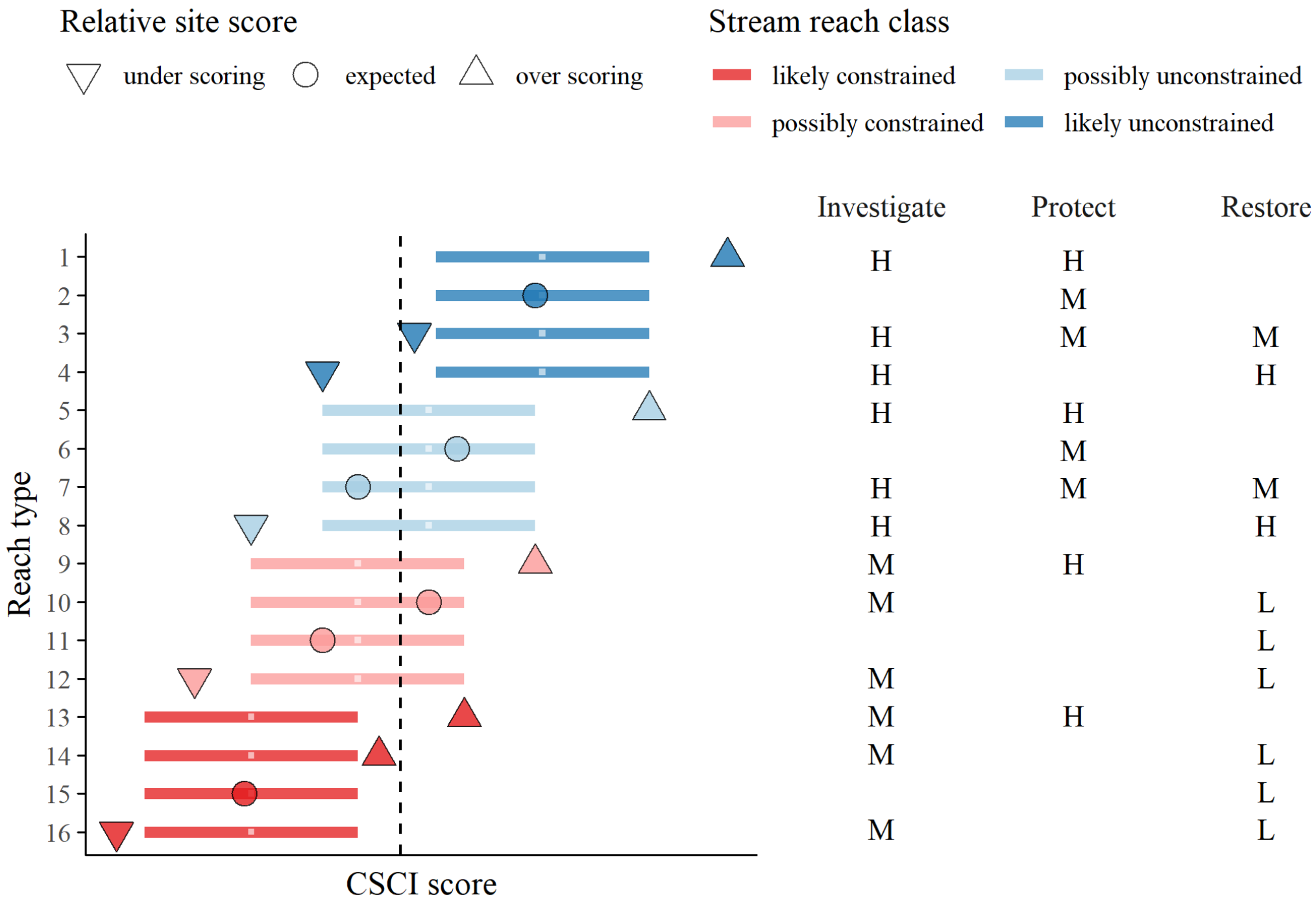
Prioritizing actions based on observed scores and landscape context

All reaches are subject to baseline monitoring and management. But where do you want to do more?

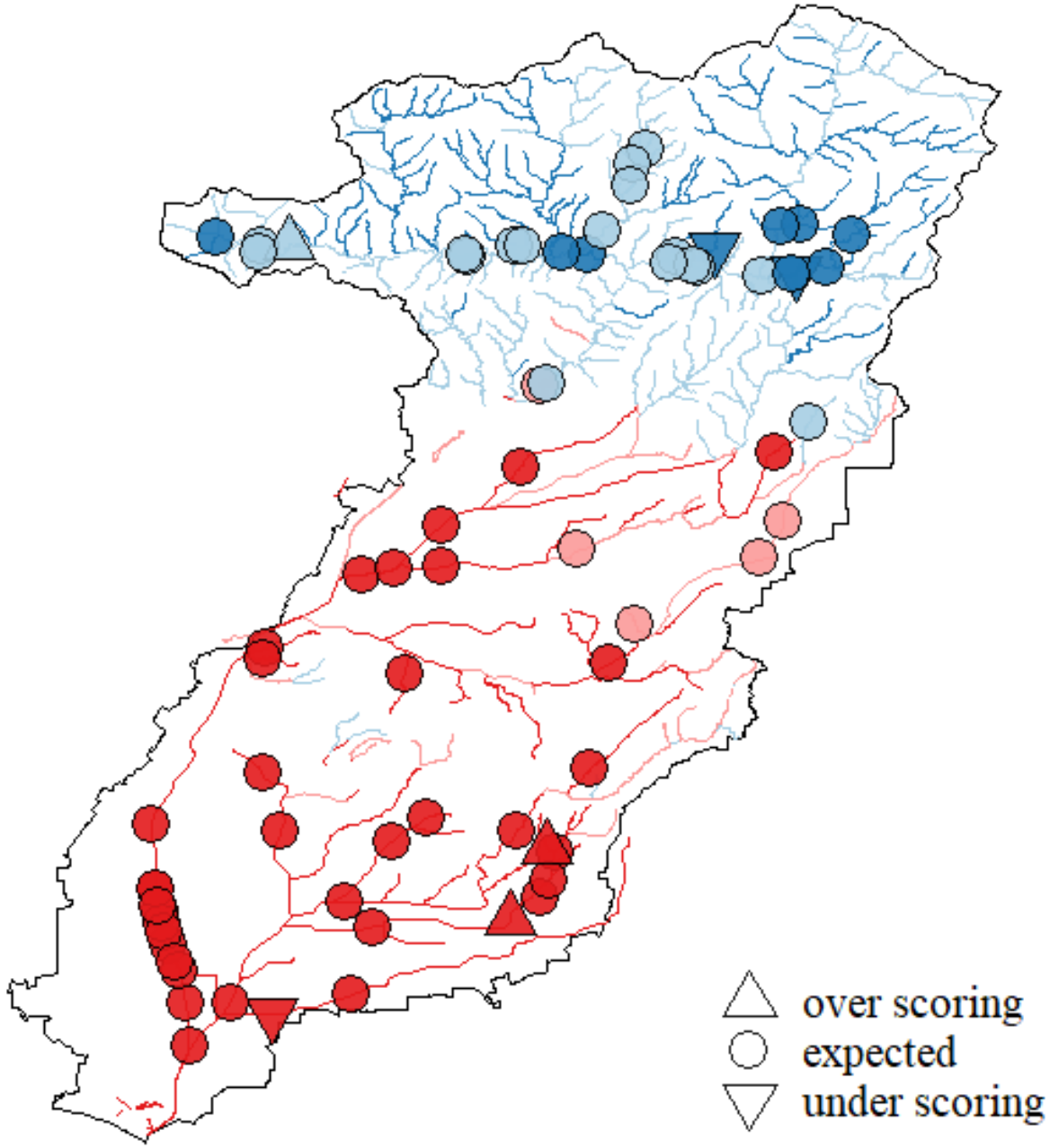
Action	Example activity	Example high-priority site	Example low-priority site
Investigate	Higher frequency of sampling. Evaluate additional data (e.g., habitat).	Sites scoring outside prediction interval	Sites scoring as expected
Protect	Extra scrutiny for proposed impacts.	Unconstrained sites	Constrained sites
Restore	Make funding recommendations. Prioritize TMDL development.	Low-scoring unconstrained sites.	Low-scoring constrained sites.

Compare observed and expected scores to prioritize different actions



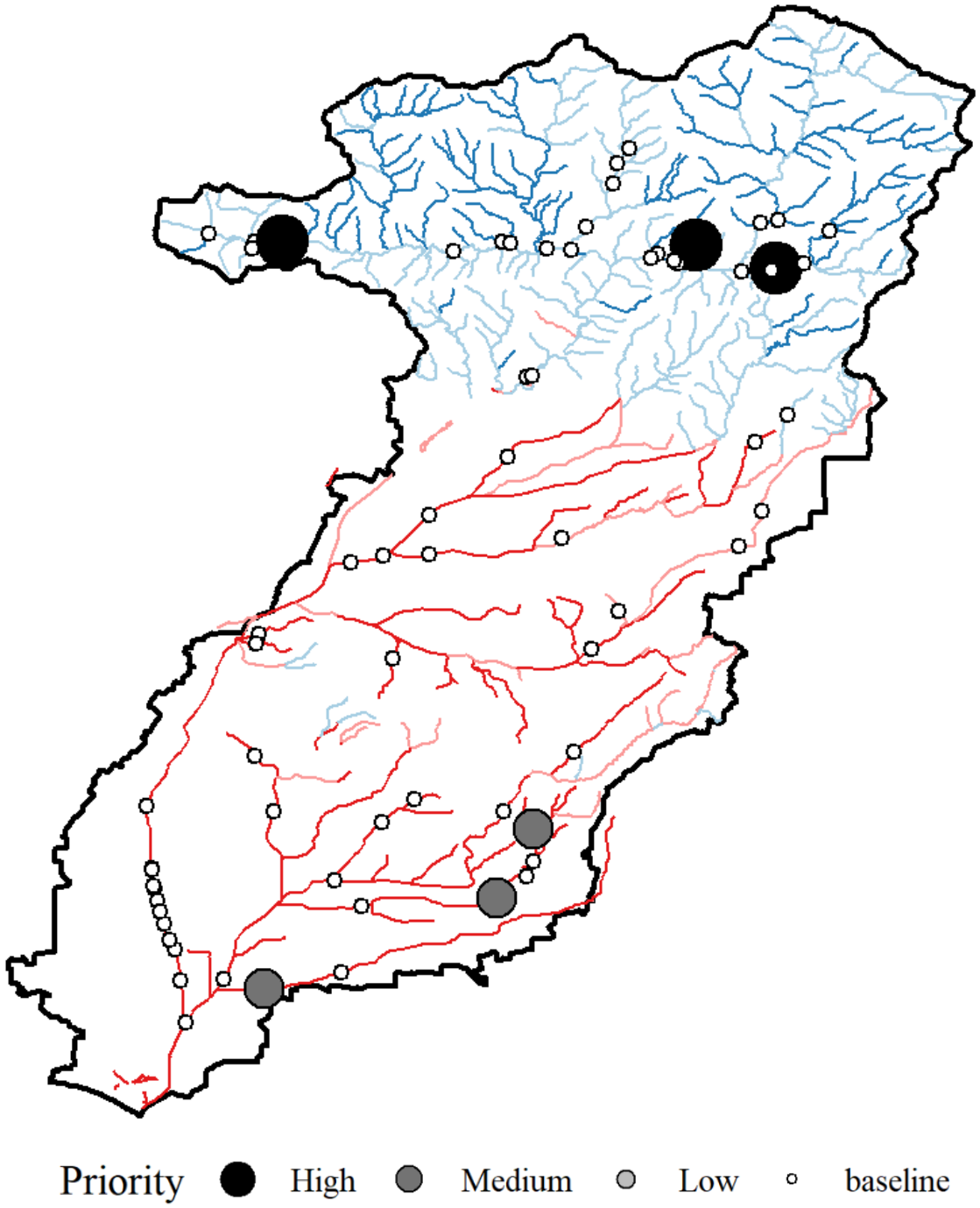


Reach type	Investigate	Protect	Restore
1	H	H	
2		M	
3	H	M	M
4	H		H
5	H	H	
6		M	
7	H	M	M
8	H		H
9	M	H	
10	M		L
11			L
12	M		L
13	M	H	
14	M		L
15			L
16	M		L



Relative site scores given stream class:

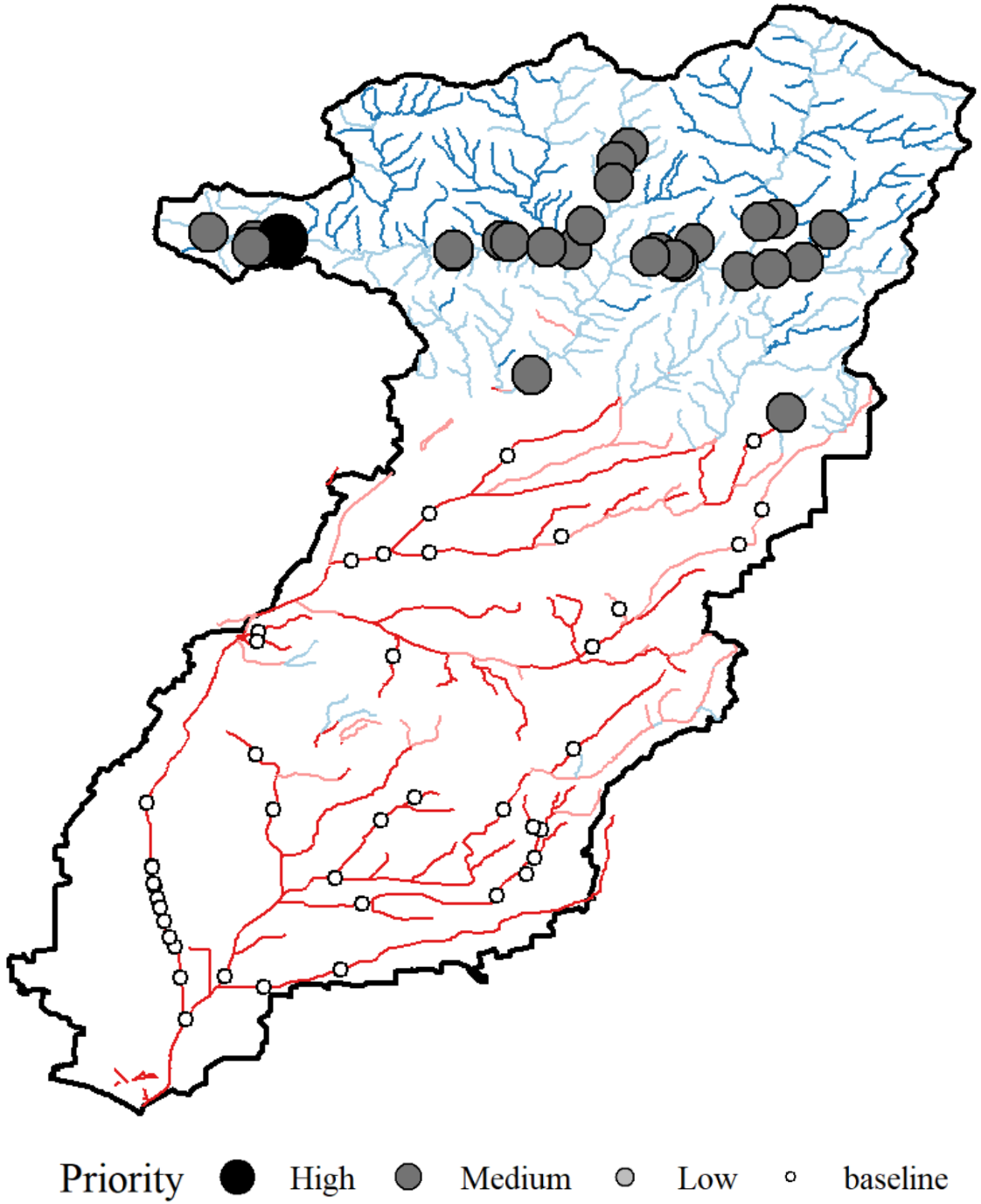
Linked to management recommendations



Investigate

Unusually high- or low-scoring sites

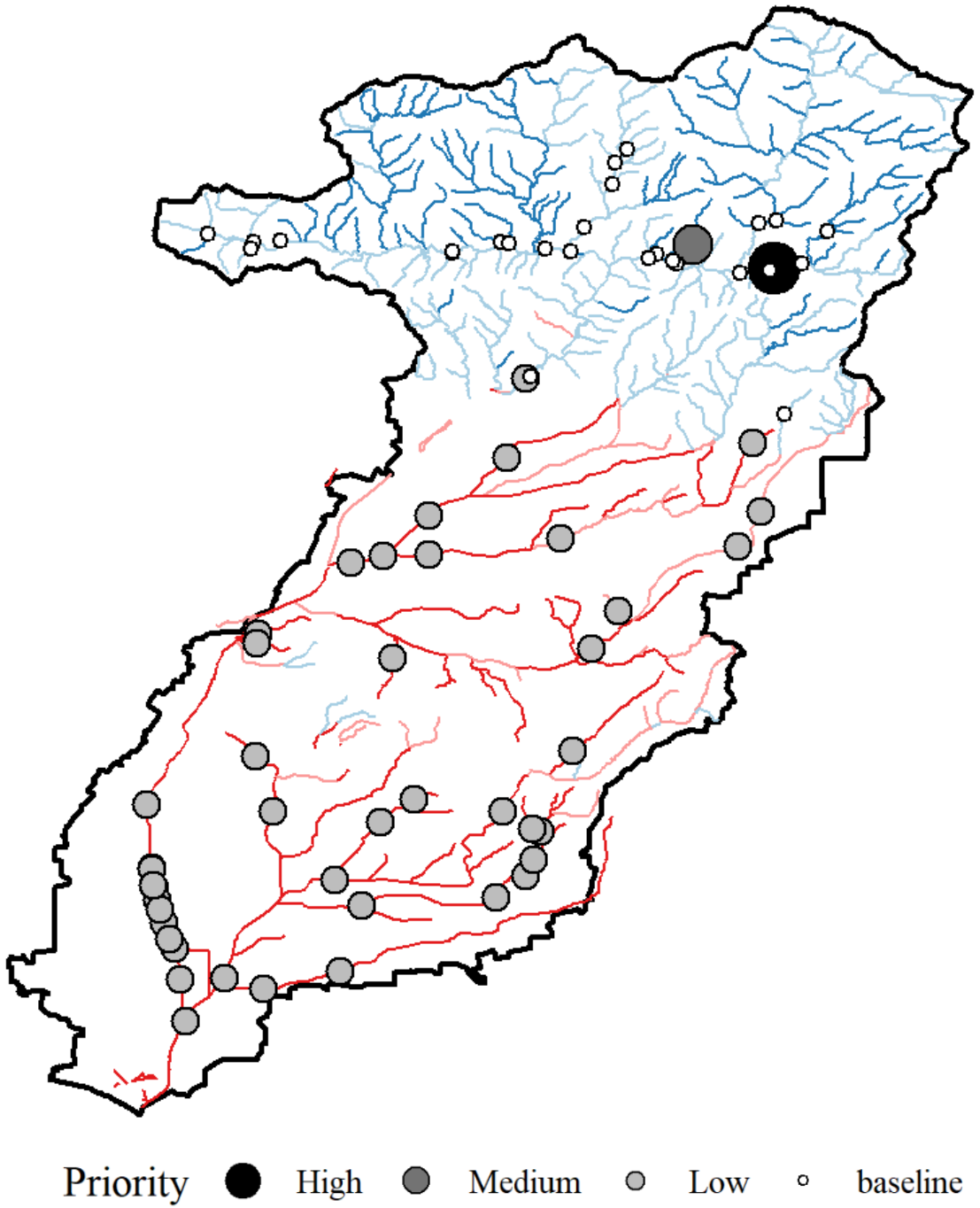
- Upper watershed lower tributaries identified
- Follow-up with additional sampling, more habitat and water chemistry data



Protect

Recommend additional review when evaluating projects:

- High priority for unconstrained streams scoring higher than expected
- Medium priority for unconstrained streams scoring as expected



Restore

Highest priority:

- Unconstrained and below objective

Medium priority:

- Unconstrained and below expectations, but above objective

Lowest priority:

- Constrained and below objective

Caveats on purposes and goals

- We want to create maps and models to provide a ***screening tool*** that starts a conversation, ***not to create a regulatory designation***.
- The maps and models alone are ***not a UAA*** but may help ***prioritize where they may be needed***.
- Analyses are ***associative*** and based on ***observed*** condition, and they can only indirectly inform constraints, restoration potential, or impacts of future management.
- We are trying to predict ***biological condition***, not locations where ***channel modification*** has occurred.
- More interest in ***predicting condition,*** not ***explaining mechanisms of impairment***

Conclusions and next steps

- Landscape models and SCAPE provide a mechanism to **link context to managers**
  - **Leverage existing SWAMP data** to estimate extent of streams that are unlikely to meet objectives
  - Identify sites and regions to **prioritize decisions**
  - **More informed use** of limited resources!

- Statewide model means **application to other regions**
  - Context varies by location
  - Work with local stakeholders to **define priorities**
  - SCAPE as a tool to **generate discussion**

Questions?

http://shiny.sccwrp.org/scape/

Special thanks to:

Ryan Hill – EPA ORD

Chad Loflen – SD Regional WQ Control Board

Jessie Maxfield – CA Water Resources Control Board

Lori Webber – CA Water Resources Control Board

Terry Flemming – EPA Region IX