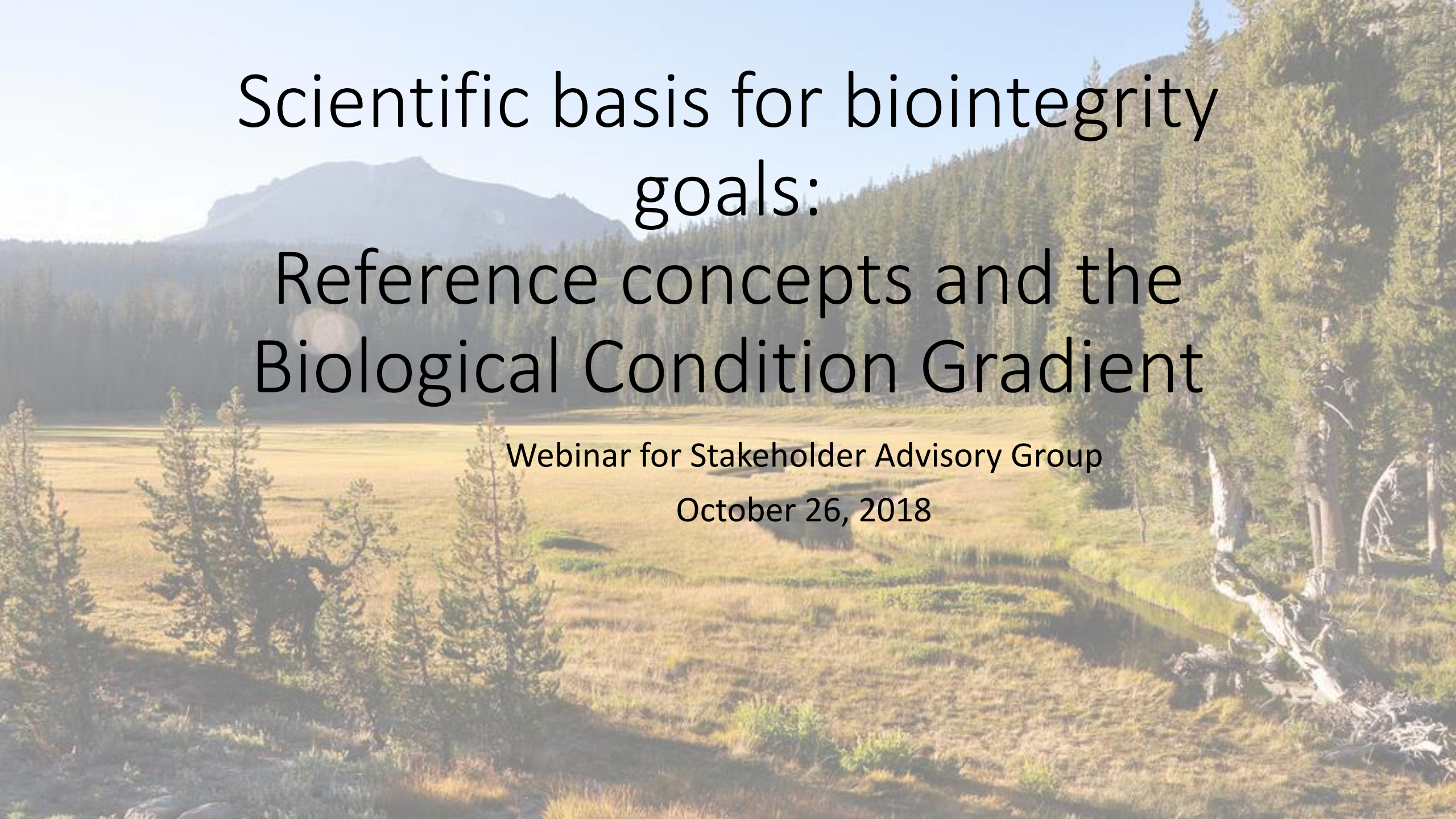


Scientific basis for biointegrity goals: Reference concepts and the Biological Condition Gradient

Webinar for Stakeholder Advisory Group

October 26, 2018

What is a “biointegrity goal”?

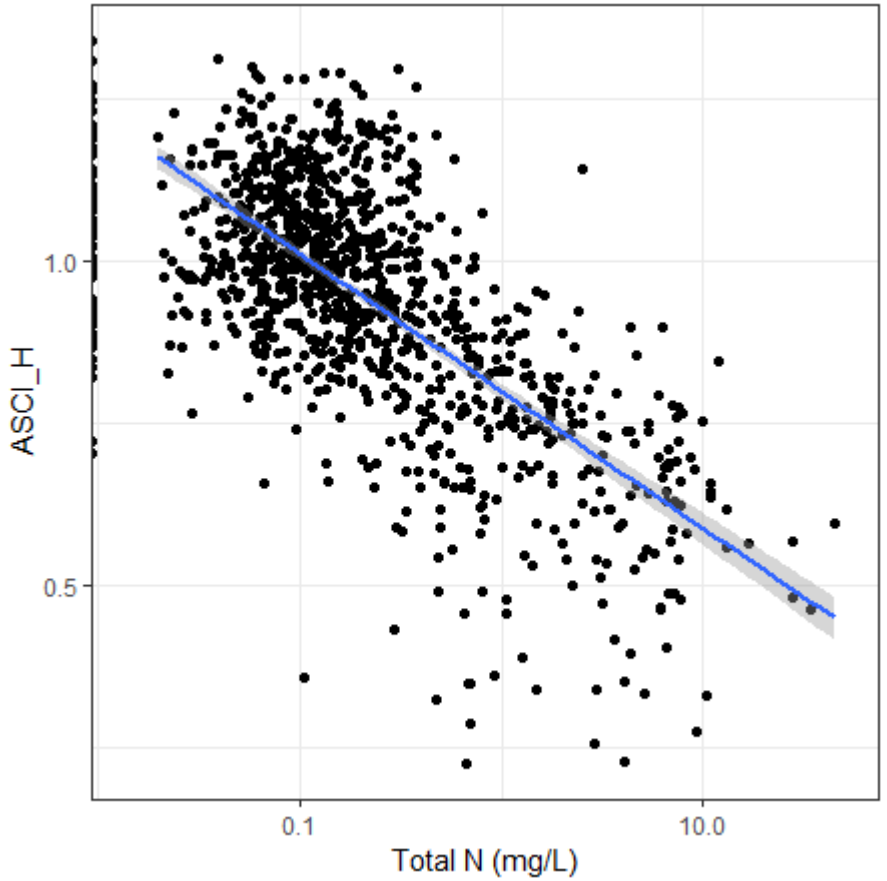
- A “goal” is an ecological state of a stream that corresponds to sufficient support for ALU. Examples:
  - Largely natural
  - Similar to reference
  - No more than a minor loss of diversity
- We can derive numbers and thresholds for biointegrity indices that correspond to these goals
  - Goals may be used to set narrative or numeric objectives
- Depending on needs and context, we can set different goals for different streams

Principles and assumptions

- Bioassessment indices are a direct way to measure support for several aquatic life uses (CLD, WRM, SPWN, and others)
- Multiple measures provide more comprehensive evidence of ALU support
- CSCI and ASCIs are the standard way to measure biointegrity in most California wadeable streams
  - Additional and alternative measures (e.g., fish) may be appropriate in certain circumstances

Goals for biointegrity policy… and beyond

- Biointegrity goals needed for biological objectives, assessing management effectiveness, and other activities
- But also needed for setting biostimulatory thresholds!



Two approaches to setting goals for biointegrity

1. Reference variability (percentile of reference)

2. Expert opinion (Biological Condition Gradient, BCG)

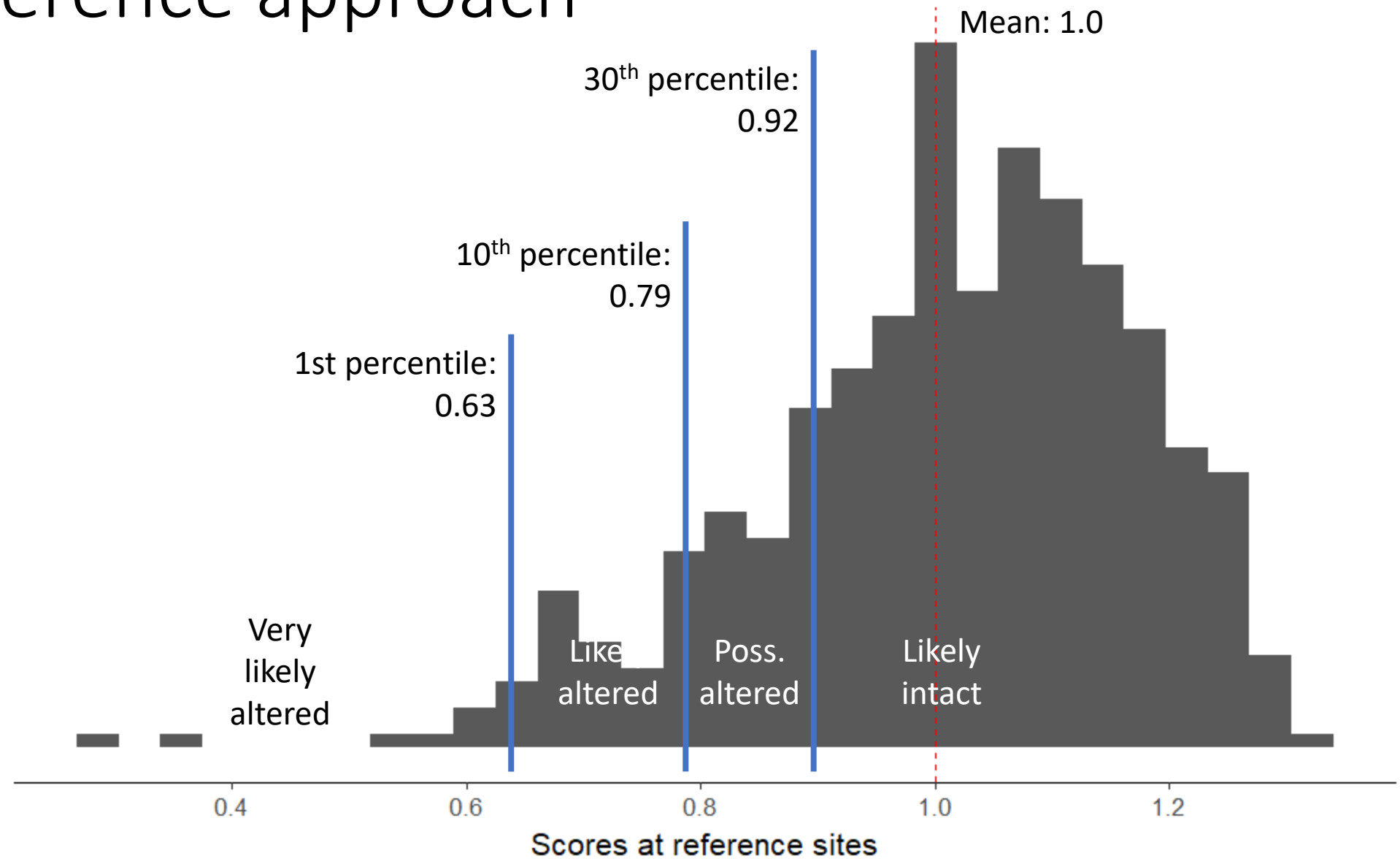
Two approaches to setting goals for biointegrity

1. Reference variability (percentile of reference)
   - WB staff prefers this approach for setting goals

2. Expert opinion (Biological Condition Gradient, BCG)
   - WB staff want to use the BCG to communicate and interpret scores

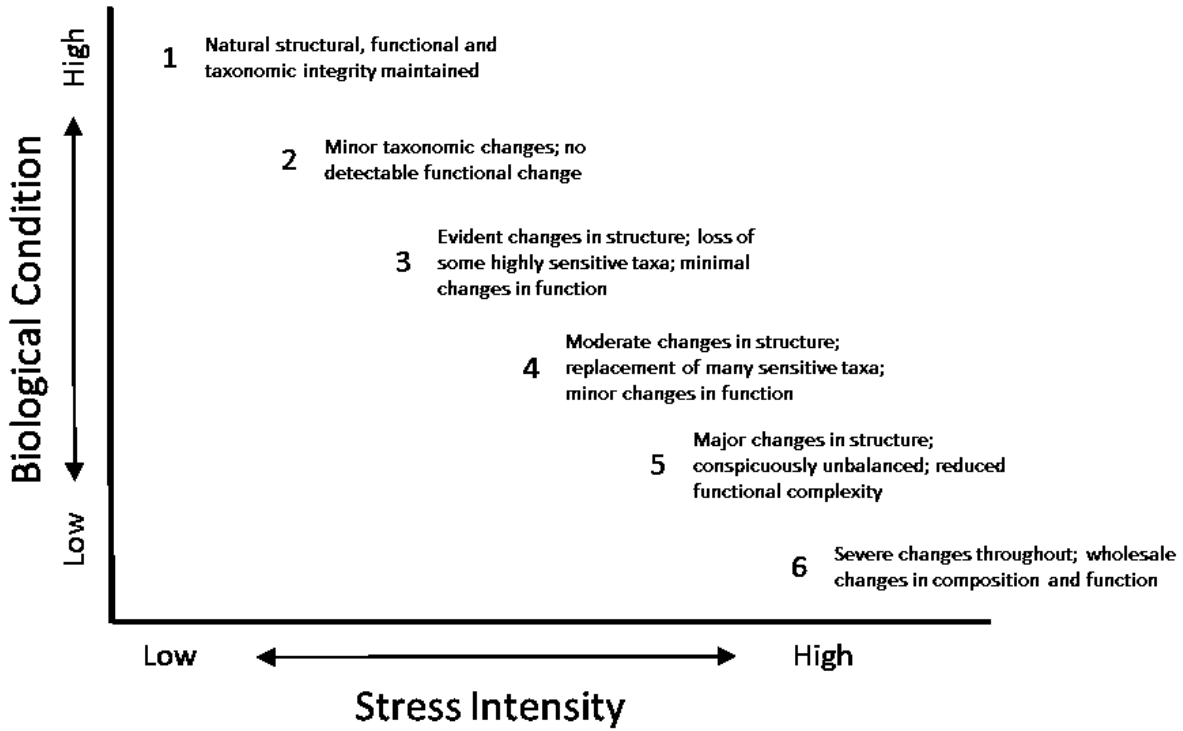
- *Neither approach is inherently stricter, or will lead to higher/lower numeric thresholds.*
- *Both approaches can be used to set criteria, with or without tiering/modified uses*

Reference approach



BCG approach

Standard narratives of condition-classes, adapted to California by panel of experts



Still reference based, but relies on expert opinion rather than statistical calculation of deviation from reference

BCG approach

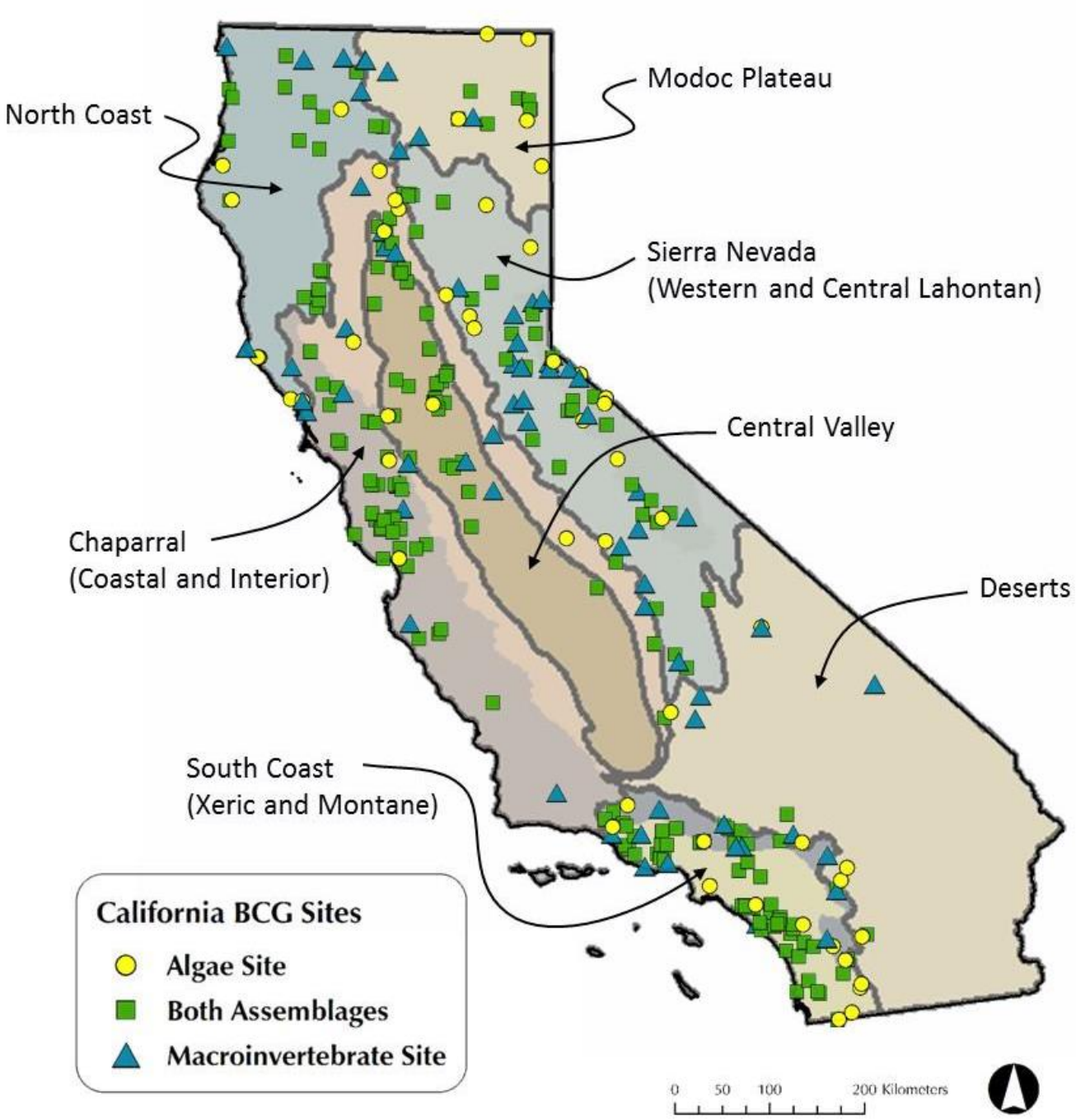
Standard narratives of condition-classes, adapted to California by panel of experts

Bin	Description
1	Natural or native condition
2	Minimal alteration in structure or function
3	Evident changes in structure, minimal loss of function
4	Moderate changes in structure, minor loss of function
5	Moderate changes in structure and function
6	Severe changes in structure and major loss of function

Still reference based, but relies on expert opinion rather than statistical calculation of deviation from reference

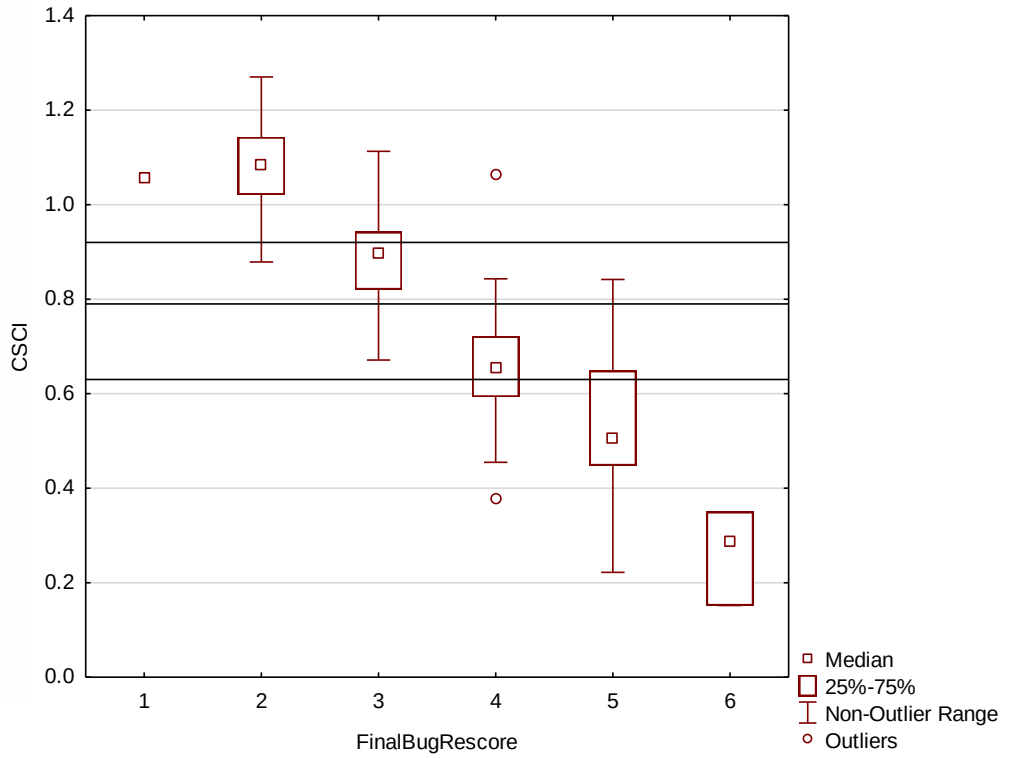
Process for developing a BCG model

- Assemble panels of expert ecologists (2 panels for bugs, algae)
- Ask panels to adapt national definitions to California
  - Describe biological characteristics of each “bin”
  - Ascribe tolerance values to taxa
- Create a dataset of 250 sites across the state, representing different ecoregions and exposures to stress
- Panels assign sites to bins
- Crosswalk bins to observed index scores (probability-odds models)
- Identify scores associated with high likelihood of bin membership

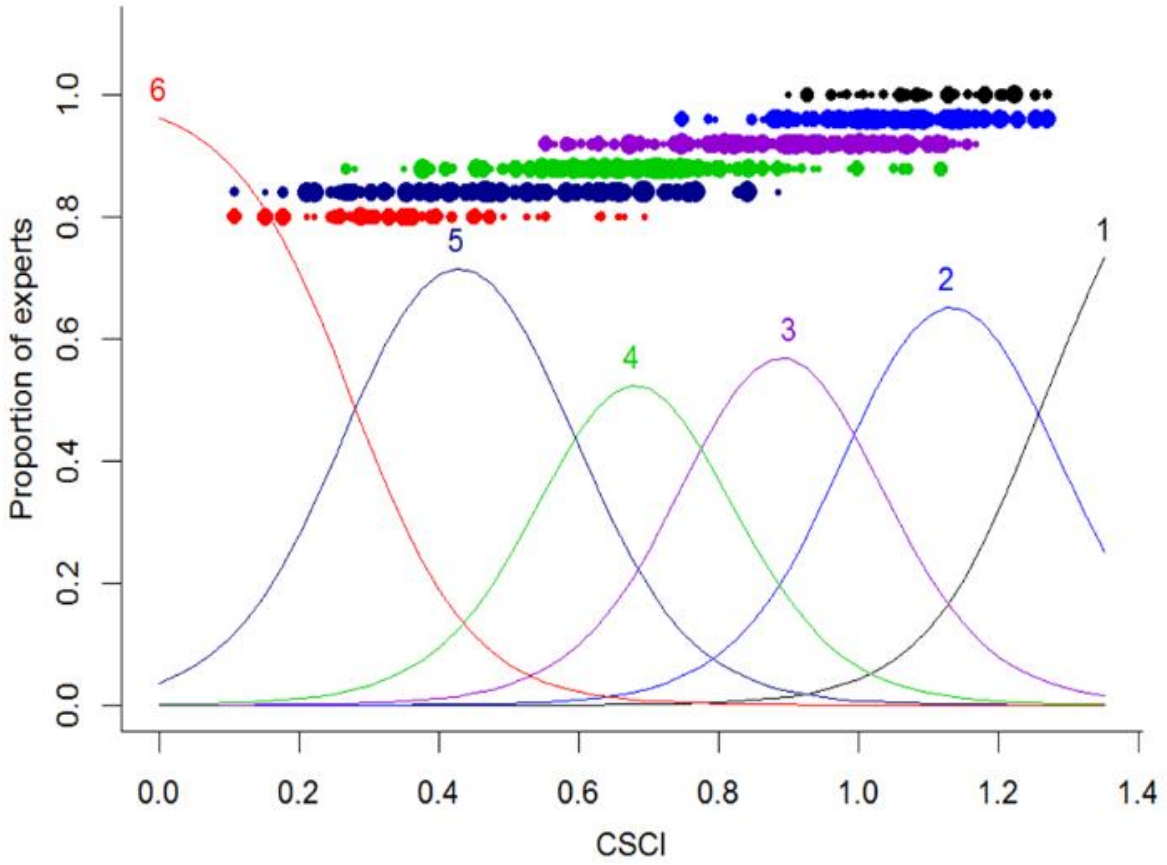


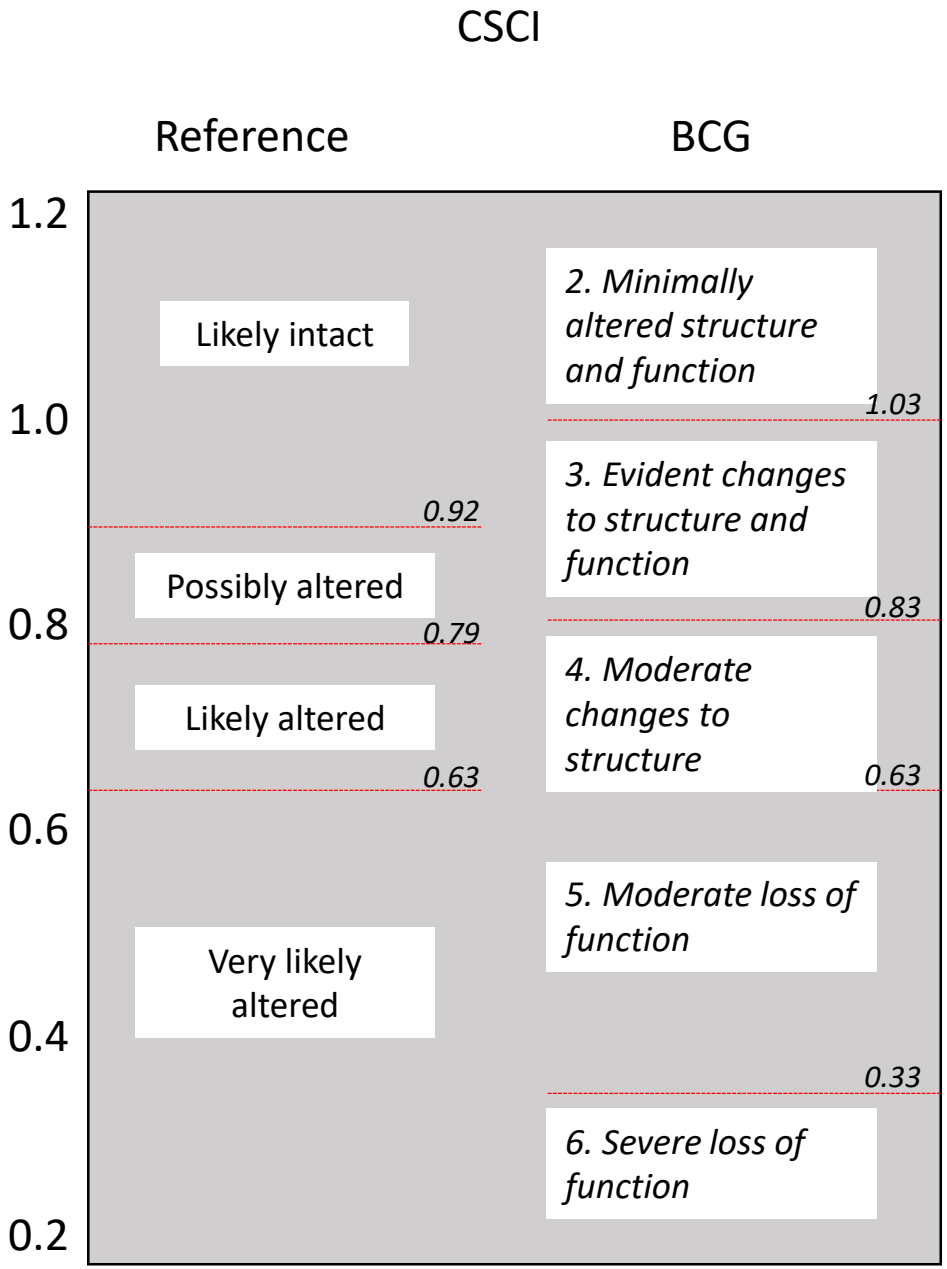
Large statewide development data set

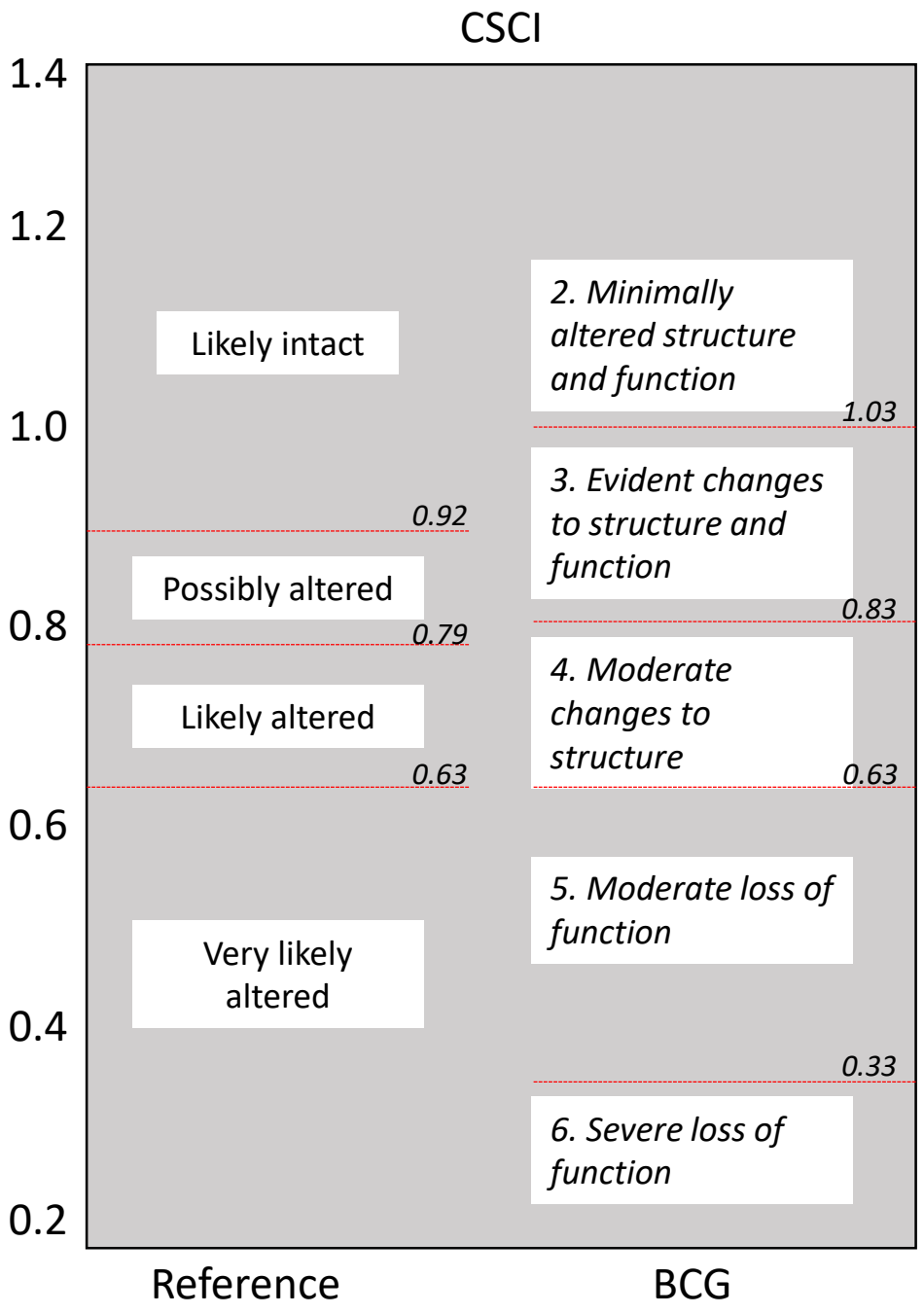
Panels reviewed mostly the same sites (80%)

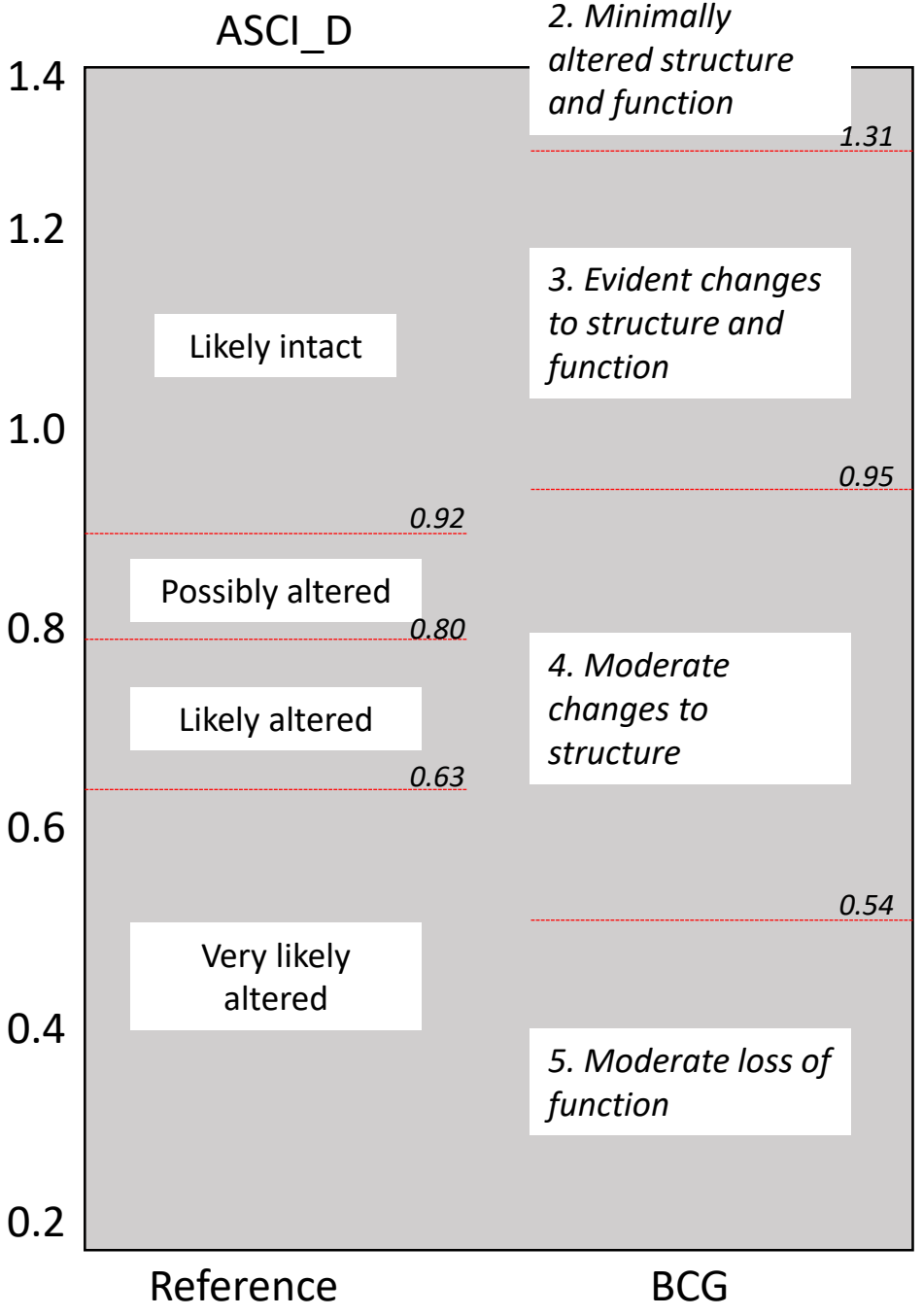


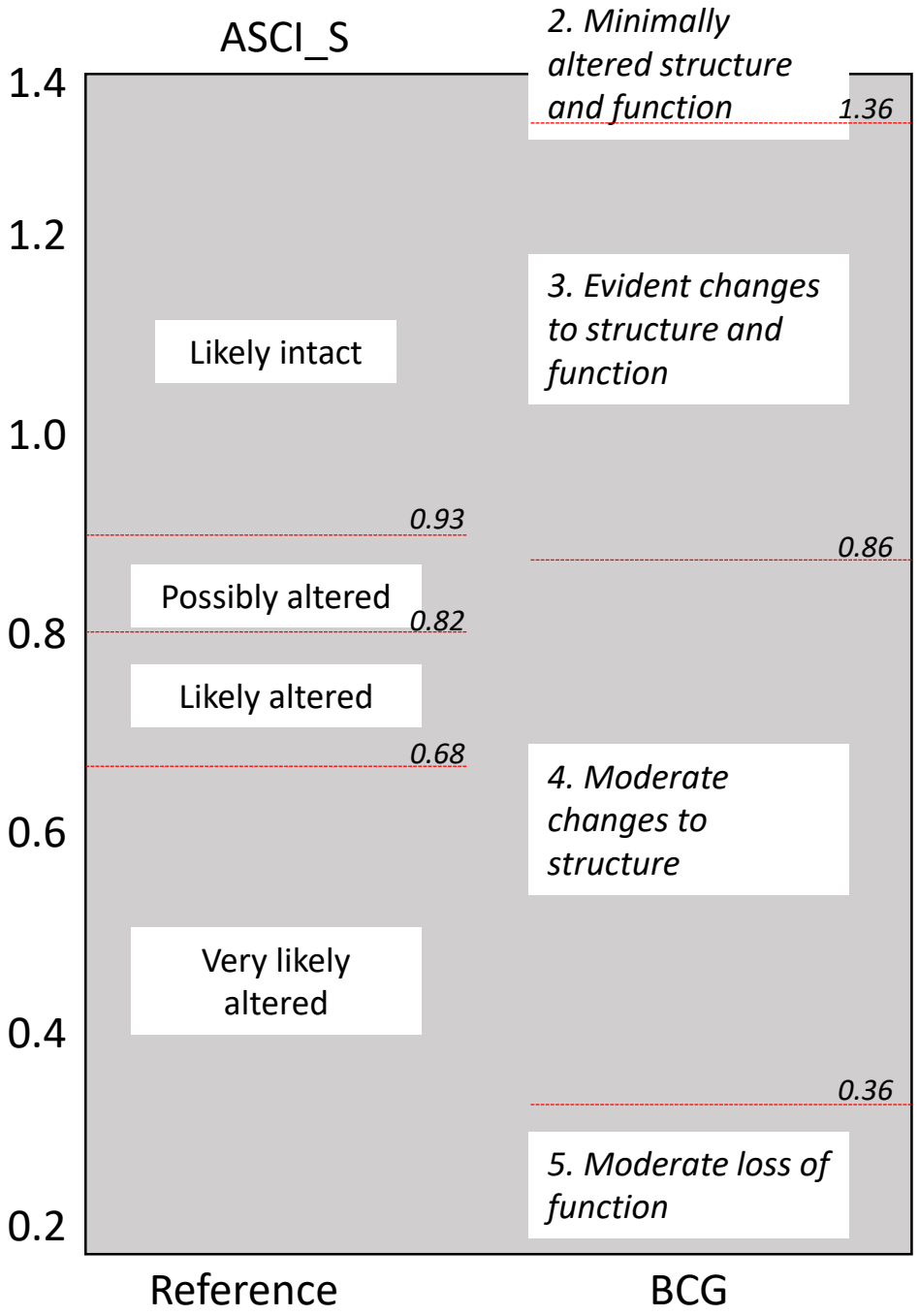
BCG: Models crosswalk to ranges of index scores

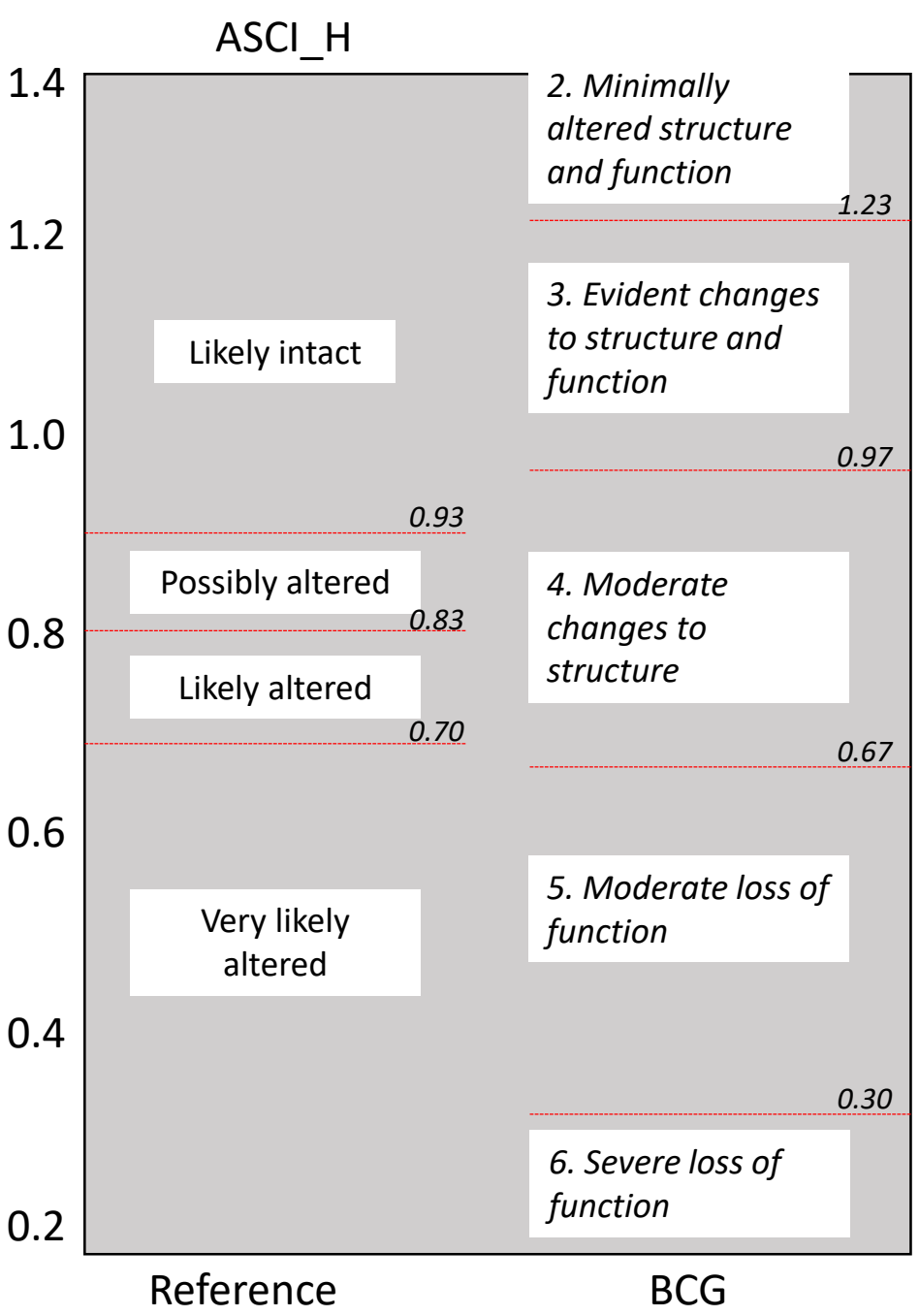





CSCI
1.4
1.2
1.0
0.8
0.6
0.4
0.2
Likely intact
Possibly altered
Likely altered
Very likely altered
2. Minimally altered structure and function
3. Evident changes to structure and function
4. Moderate changes to structure
5. Moderate loss of function
6. Severe loss of function
1.03
0.92
0.83
0.79
0.63
0.63
0.33
Reference
BCG


ASCI_D
1.4
1.2
1.0
0.8
0.6
0.4
0.2
Likely intact
Possibly altered
Likely altered
Very likely altered
2. Minimally altered structure and function
3. Evident changes to structure and function
4. Moderate changes to structure
5. Moderate loss of function
1.31
0.95
0.92
0.80
0.63
0.54
Reference
BCG


ASCI_S
1.4
1.2
1.0
0.8
0.6
0.4
0.2
2. Minimally altered structure and function
1.36
3. Evident changes to structure and function
Likely intact
0.93
0.86
Possibly altered
0.82
Likely altered
0.68
4. Moderate changes to structure
Very likely altered
0.36
5. Moderate loss of function
Reference
BCG


ASCI_H
1.4
1.2
1.0
0.8
0.6
0.4
0.2
2. Minimally altered structure and function
1.23
3. Evident changes to structure and function
Likely intact
0.97
0.93
Possibly altered
0.83
4. Moderate changes to structure
Likely altered
0.70
0.67
5. Moderate loss of function
Very likely altered
0.30
6. Severe loss of function
Reference
BCG

Scores associated with goals

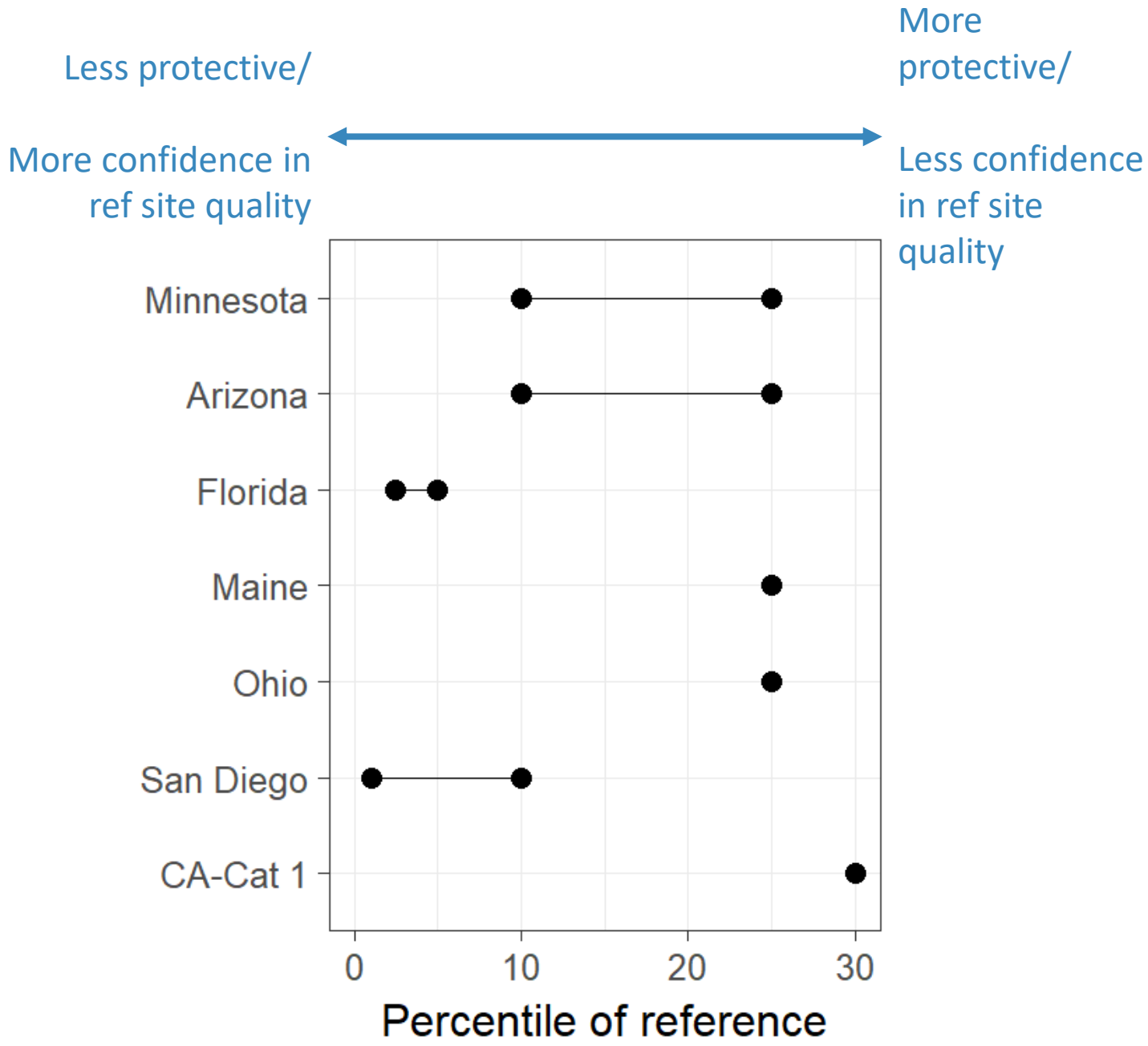
Goal	CSCI	ASCI-D	ASCI-S	ASCI-H
Ref-30	0.92	0.92	0.93	0.93
Ref-10	0.79	0.80	0.82	0.83
Ref-01	0.63	0.63	0.68	0.70
BCG2	1.025	1.310	1.360	1.230
BCG3	0.825	0.950	0.860	0.970
BCG4	0.625	0.540	0.360	0.670
BCG5	0.325	NA	NA	0.300

BCG2: Numbers are *really high*
BCG5: Couldn't even model scores for ASCI-D, ASCI-S
BCG3 to BCG4: A very wide interval ASCI-D, ASCI-S (~0.4 to 0.5 points) vs. others (0.3 points)

Both approaches have been used (or evaluated) for bio/nutrient criteria in other states

- Ref proposed for Reg 9's bio-objectives, Category 1 listings

- MN, FL use BCG3 for most streams, BCG4 for modified uses.



Choices for biostimulatory, biointegrity policies

It’s necessary to select a goal for many applications of biointegrity indices. Different goals may be appropriate for different purposes.

- WB staff have indicated that they want to use reference approach to setting goals, but use BCG to help interpret and communicate meaning of index scores.
- Ref-10 has widespread use already.

Current status

- Expert panel has completed data review.
- CSCI model complete. ASCI models being re-tweaked for final version of indices.
- Draft manuscript distributed currently under review by advisory groups