# Biostimulatory-Biointegrity Project Regulatory Advisory Group Meeting

February 15, 2017

1 – 4 pm

# Context for Today's Meeting

- California State Water Board staff was directed to combine the Biostimulatory substances and Biointegrity projects for wadeable streams
- Governance of this process remains the same
  - We have merged the regulatory advisory groups, kicking off the combined RG today
  - An independent Science Panel will continue to provide ongoing peer review of science that will be used in policy development
- Technical team, led by SCCWRP, has been reformulating science plan to accommodate the combined projects

# Meeting Goals

- Brief you on State Water Board's Biostimulatory- Biointegrity Project
  - State Water Board staff vision for the project
  - Overview of "revised" science plan supporting this project
    - Update on ongoing projects
    - Highlight new projects (ASCI, Channels in Developed Landscapes)
    - Discuss in detail any particular component of interest
  - Describe timelines for review of technical work elements, including timing of stakeholder and science panel meetings.
- Discuss interest and process for Regional Board participation in "Channels in Developed Landscapes)

# “Amendment to the Water Quality Control Plans for Inland Surface Waters, Enclosed Bays, and Estuaries of California to Establish a Biostimulatory Substances Objective and Program to Implement “Biological Integrity”

# Why Combine the Biointegrity and Biostimulatory (Nutrient) Projects?

- Approaches to Develop Biointegrity and Biostimulatory Objectives have a Lot of commonality
  - Chemistry data alone insufficient to protect aquatic life;
  - Biological indicators to assess beneficial use support
  - Link biological indicators to stressor management
    - Causal assessment (biointegrity)
    - Develop default nutrient targets (biostimulatory)
- State investment in bioassessment and indices makes this integration straightforward
  - Eutrophication assessment relies entirely on bioassessment protocols

*Combine for "seamless" policy and streamlined implementation*

# Revised Goals of Joint Project

- Develop Objective for biostimulatory substances
  - Numeric or narrative
  - Protect aquatic life Beneficial Uses (BUs)
- Develop Implementation Program for biostimulatory substances
  - Source by source
  - Coordinated watershed approach
- Develop Statewide plan for assessing Biological Integrity in surface waters
- Establish methods to identify, maintain, and protect wadeable streams with high biological integrity.

# Preferred Option Under Consideration by Water Board Staff

- Establish CSCI and ASCI "assessment endpoints" as primary lines of evidence to assess wadeable stream beneficial use support
  - Identify and protect high quality waters
  - Use CSCI and ASCI assessment endpoints to establish default numeric targets for nutrients and eutrophication indicators (statewide), with option to refine under a "watershed approach"

# Process of Engagement Of Advisory Groups Similar to Biointegrity and NNE Governance

- Regulatory Group (RG)
  - February 15th webinar
  - Full day in March/April
- Stakeholder Advisory Group (SAG)
  - Full day March 17, 2017 in Costa Mesa
- Science Panel
  - updated membership to include biointegrity and eutrophication, statistical modeling expertise, drawing from previous panel membership (details on next slide)
  - First Panel meeting tentatively April 19-20, 2017 in Costa Mesa, focused on reviewing revised science plan

# Proposed Biostimulatory-Biointegrity Panel Membership

- Stream Algal Ecology and Bioassessment: Jan Stevenson, Professor, Michigan State University **(NNE**)
- Benthic Invertebrate Ecology and Bioassessment: Charles Hawkins, Utah State University **(Biointegrity)**
- Stream Biogeochemistry and Ecology: Cliff Dahm, Professor Emeritus, University of New Mexico **(NNE)**
- Biogeochemical modeling approaches: Ken Reckhow, Professor Emeritus, Duke University **(NNE)**
- Statistical Approaches to Stress-Response Modeling: Lester Yuan, EPA Office of Science and Technology **(Biointegrity)**
- Nutrient Management/Implementation Strategies: Paul Stacey, Great Bay National Estuarine Research Reserve **(NNE)**

# Tentative Timeline

| Task | Description | Target Dates |
|---|---|---|
| **Focus Group Outreach** | Discuss with focus group stakeholders | February - June 2016 |
| **Project Outreach with Regulatory Group (RG) and Stakeholder Advisory Group (SAG)** | Update the RG, SAG, and Science Panel members of the biostimulatory substances project and the RG and SAG of the bio-integrity project on technical science and the merging of the two projects. | December 2016 |
| **Early Public Outreach and/or Scoping Document and Meetings** | Scoping Document and Meetings to satisfy the State Water Board's regulations implementing CEQA. | November 2017 |
| **Draft projects & SED** | Develop Draft Biostimulatory Substances/Biological Integrity Amendment language & Draft Supplemental Environmental Documentation | Winter 2018 |
| **Public Comment** | Release Draft Amendment and SED for public comment | Spring 2019 |
| **Public Hearing** | Public Hearing to receive oral comments | Summer 2019 |
| **State Water Board Response to Comments** | Develop written responses to oral and written comments | Fall 2019 |
| **Board Adoption** | Board meeting to consider adoption | Winter 2019 |

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# Background and Context

- NNE and Biointegrity science supporting policy had been on parallel paths
  - Each had its own science plan
- Policies have been merged
  - Need a combined science plan
- Need to vet new science plan with advisory groups
  - Draft available for your review and feedback Friday Feb 17, 2017
- First Science Panel meeting in April 2017 will vet this plan

# INTRODUCTIONS -TECHNICAL TEAM

SCCWRP

Martha Sutula
Eric Stein
Raphael Mazor
Susanna Theroux
Ken Schiff

CDFW

Pete Ode
Andy Rehn

Tetra Tech

Michael Paul
Benjamin Jessup
Jeroen Gerritsen

# Revised Science Plan Supporting Combined Policy: Overview of Presentation

- Describe conceptual approach and update on new and existing work elements
  - Biological condition gradient model
  - Algal Stream Condition Index (ASCI)
  - Eutrophication synthesis
- Describe in detail new work element
  - Channels in Developed Landscapes (NEW)

# Water Board Staff Preferred Option Frames A Refined Approach to Science

- CSCI and ASCI become measures of aquatic life and related beneficial uses
- Establish "assessment endpoints" for CSCI and ASCI as primary lines of evidence to assess wadeable stream beneficial use support
- These assessment endpoints become goals used to establish numeric targets for….
  - Nutrients and biostimulatory indicators (now)
  - Other stressors (later)
- Establish default biostimulatory targets statewide, with option to refine with "watershed approach"

# Vision for Biostimulatory-Biointegrity Numeric Guidance

| Numeric Biointegrity Assessment Endpoints | Numeric Biostimulatory Targets |
| --- | --- |
| CSCI and ASCI | Existing Objective or Guidance:<br><br>DO, pH, Cyanotoxins |
| | Nutrients, Organic Matter |

How do support decisions on assessment endpoints and biostimulatory numeric targets?

# Elements of the Science Plan

1. Conduct and synthesize science supporting development of numeric guidance for wadeable streams

   1.1 Develop biological indices indicative of aquatic life use support

   1.2 Determine the numeric range of biological indices that correspond to attainment of beneficial uses

   1.3. Determine the numeric range of stream nutrients and intermediate eutrophication response indicators that correspond to attainment of beneficial uses

2. Implementation plan technical support

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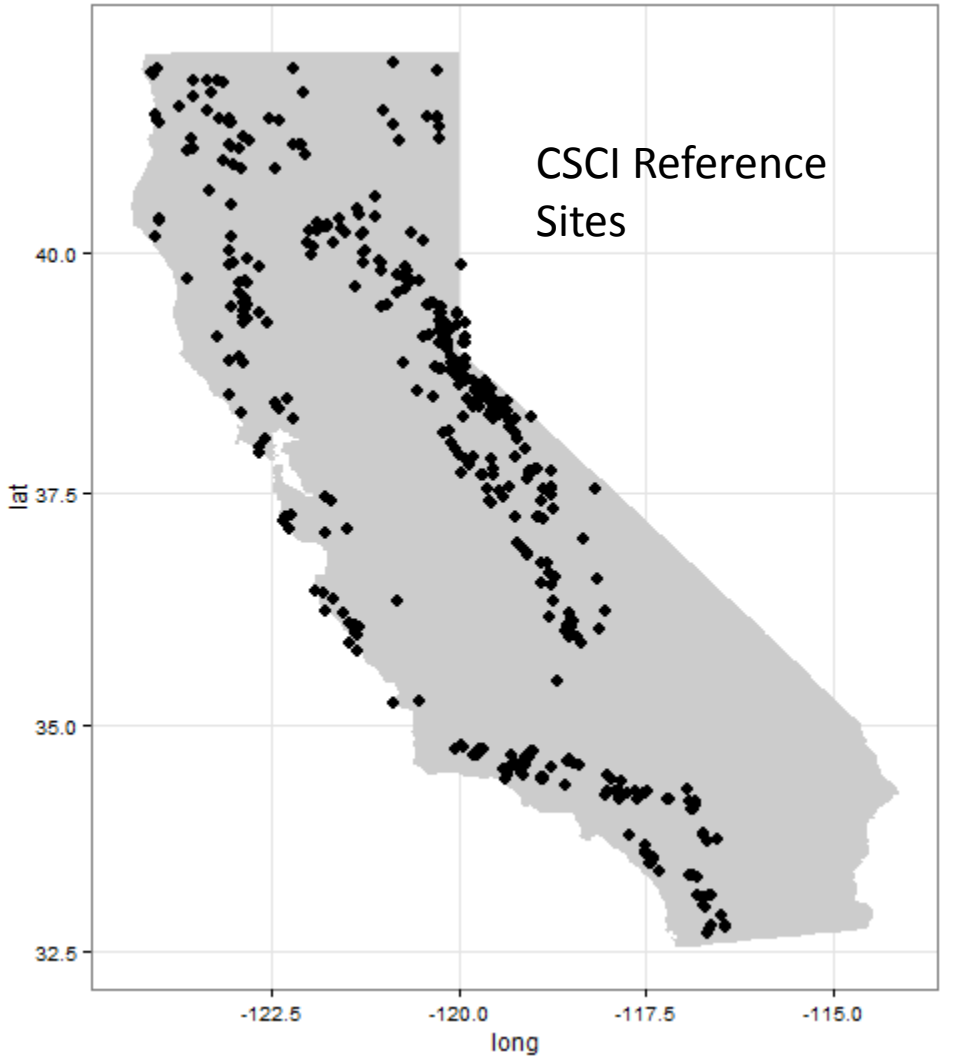
# The California Stream Condition Index (CSCI) for benthic macroinvertebrates

- A predictive index developed for consistent statewide applicability
  - Establishes site-specific expectations, based on natural gradients (and expected reference) at each site
  - Consistent interpretation statewide, such that a score in SoCal means the same thing as a score in NorCal
- Calibrated with 472 reference sites from regions around the state



# The California Algal Stream Condition Index (ASCI) Is Now Under Development

- Approach consistent with that of CSCI
  - Calibrated with reference sites from all regions of the state
  - Establishes site-specific expectations
  - Statewide applicability/interpretability
- Complement to CSCI
  - Independent measures
  - because algae are less sensitive to habitat and more responsive to water chemistry

*RG Interest in Presentation on Approach and Update on Progress?*

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2. Implementation plan technical support

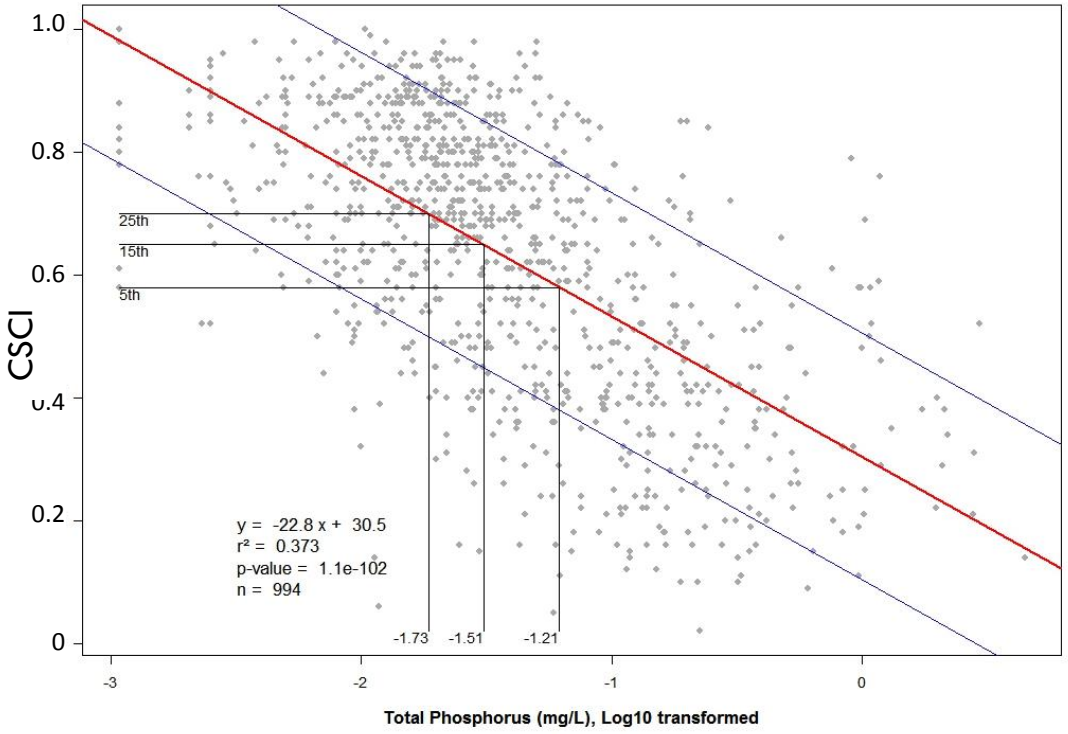
    2.1 Identify and map channels in developed landscapes

# Determine the Assessment Endpoints for CSCI and ASCI that correspond to attainment of beneficial uses

Approaches that Could Be Used to Establish Assessment Endpoints

- Percentile of Reference (We can already do this; Mazor et al. 2016)
- Biological Condition Gradient (BCG) expert synthesis

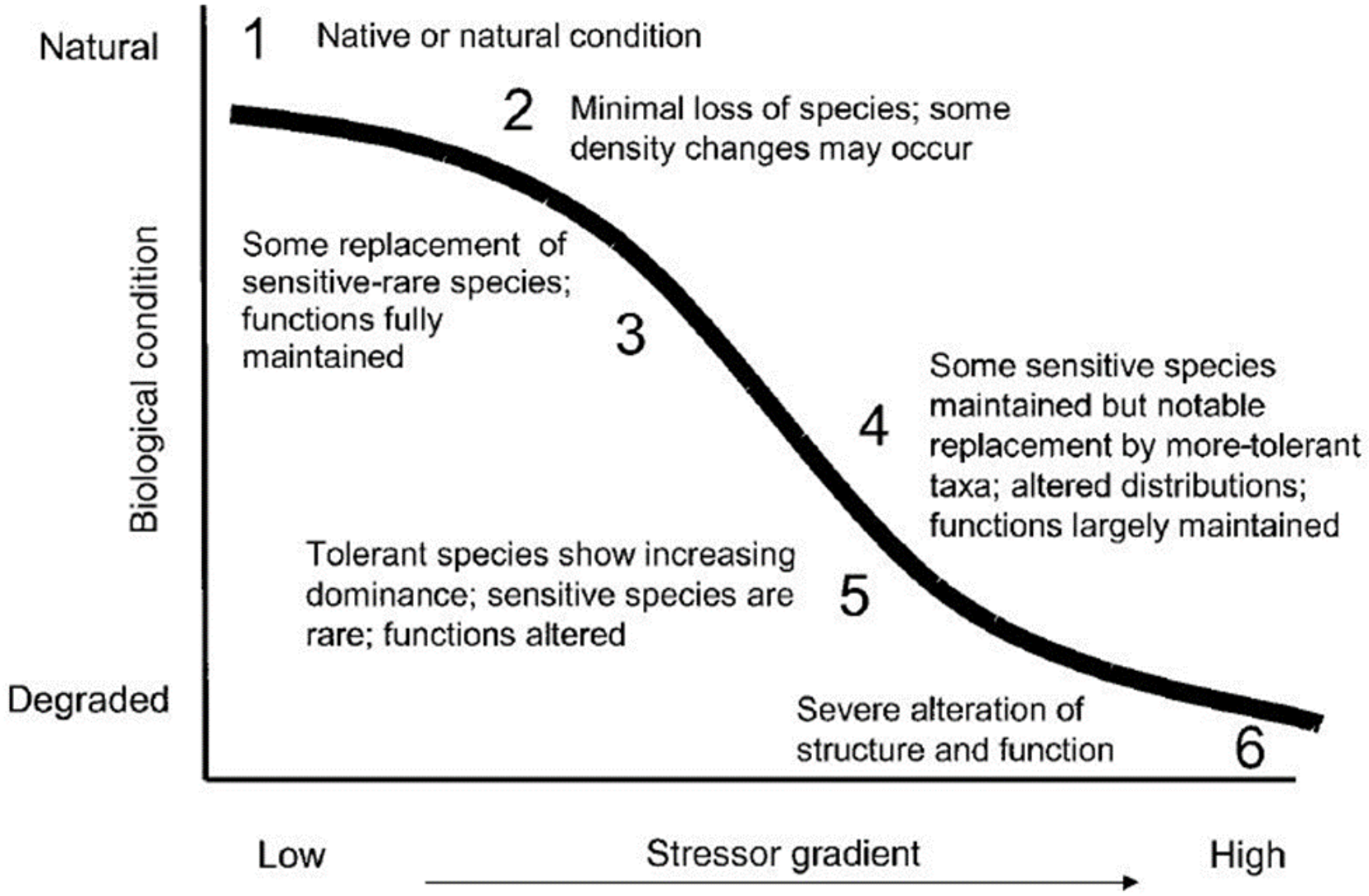
# Motivation for BCG




- "What does a value of 0.63 for the CSCI mean?"
  - It is 15$^{th}$ percentile of reference.
- "But, what does that mean ecologically?"
  - It is no longer like reference.
- "I think I'd like to know what that means – what's been lost."

# Alternative: Biological Condition Gradient Model

***The Biological Condition Gradient:*** *as stress increases, community composition changes in predictable ways*




*Davies and Jackson (2006)*

# Motivation for BCG

- California has powerful biological indices for assessment BUT numeric values do not communicate the ecological change associated with an index

  …THEREFORE we want to use the BCG calibration effort to do that.

- BCG models convey, in ecological terms, the breadth and depth of ecological change in a way numbers often cannot.

# What it involves: Expert Interpretation of Taxonomic Information to Infer Condition

Sample XYZ

Biogeographic Info

Taxon Abundances

Experience and Knowledge

Levels of Biological Condition

Natural structural, functional, and taxonomic integrity is preserved.

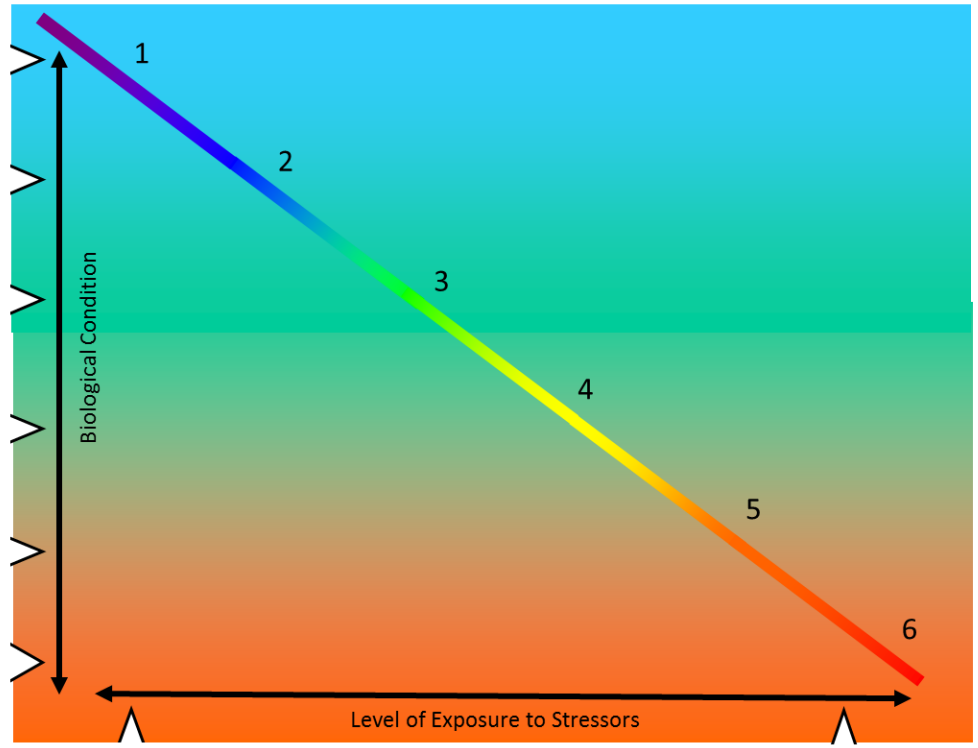
Structure & function similar to natural community with some additional taxa & biomass; ecosystem level functions are fully maintained.

Evident changes in structure due to loss of some rare native taxa; shifts in relative abundance; ecosystem level functions fully maintained.

Moderate changes in structure due to replacement of some sensitive ubiquitous taxa by more tolerant taxa; ecosystem functions largely maintained.

Sensitive taxa markedly diminished; conspicuously unbalanced distribution of major taxonomic groups; ecosystem function shows reduced complexity & redundancy.

Extreme changes in structure and ecosystem function; wholesale changes in taxonomic composition; extreme alterations from normal densities.




Watershed, habitat, flow regime and water chemistry as naturally occurs.

Chemistry, habitat, and/or flow regime severely altered from natural conditions.

# Key output at the end of Workshops

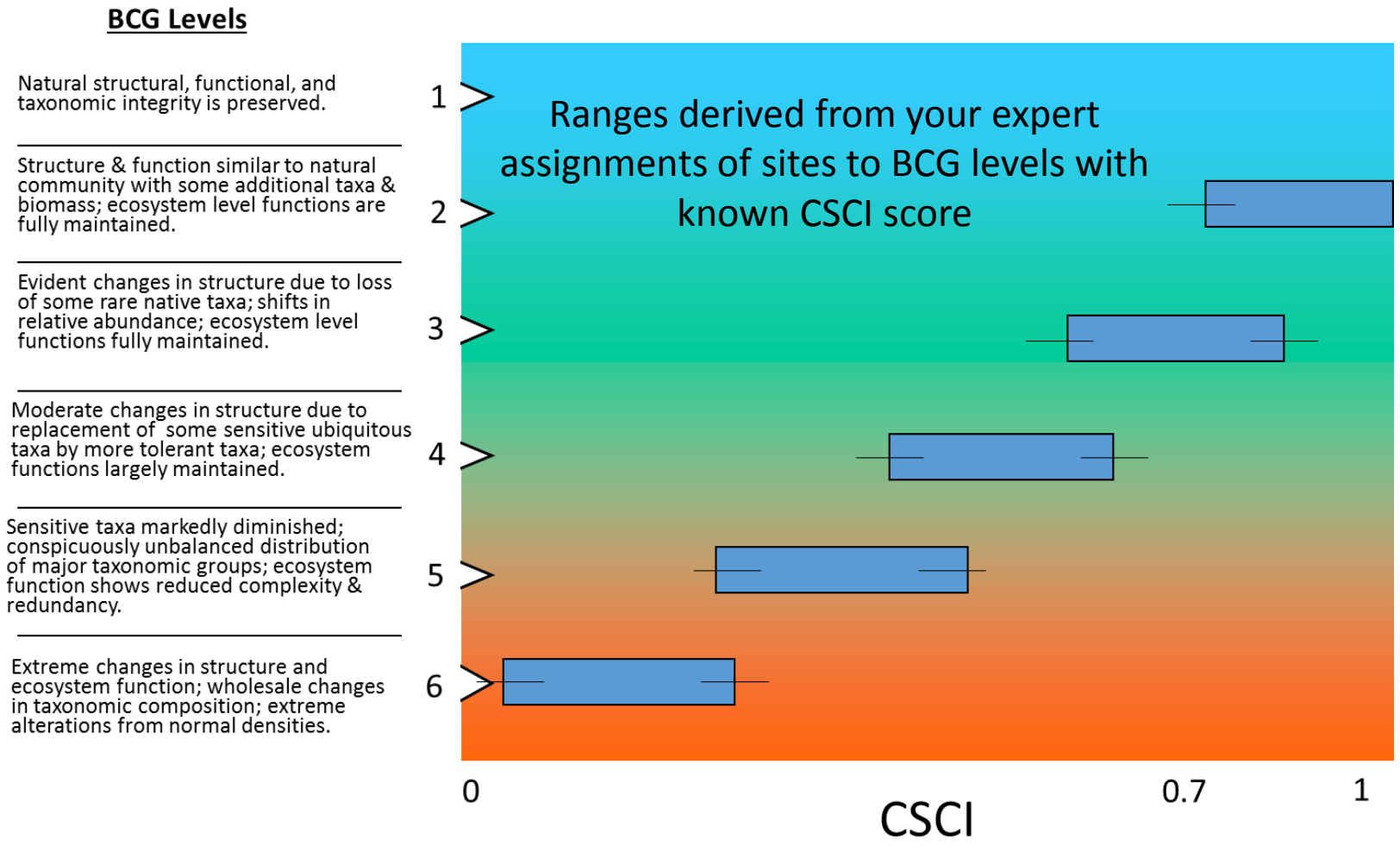
- Sites with CSCI scores
- Sites with ASCI scores
- Expert consensus BCG level assignment for those same sites
- Expert interpretation of why those assignments were made

| Site X | CSCI | Expert 1 | Expert 2 | Expert 3 | Expert 4 | Consensus |
|---|---|---|---|---|---|---|
| First Vote | | 5 | 4 | 5 | 5 | |
| Revote | 0.3 | 5 | 5 | 5 | 5 | 5 |

*"The sample is a BCG level 5 because it is lacking sensitive taxa (no attribute 2 and few 3s), is dominated by tolerant taxa (55% attribute 5s), and shows an imbalance of functional groups. It is not a level 6 because there is at least 1 attribute 3 and richness shows some diversity (>15 taxa). This agrees with a CSCI score of 0.30."*

# Use Output to Describe BCG Binned Ranges of CSCI and ASCI

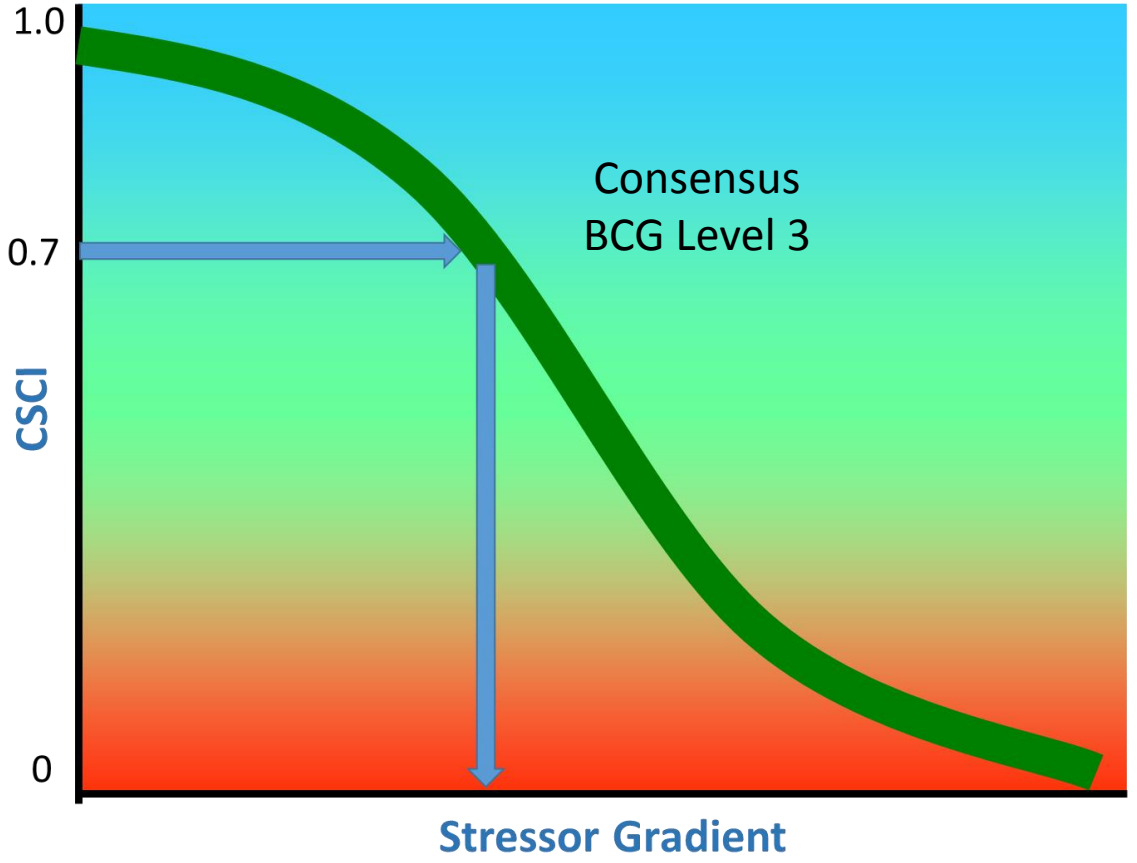
- What is the distribution of CSCI or ASCI scores by BCG category?
- How is the CSCI or ASCI translated into degrees of biological impact?



# How BCG Can Be Used: Support Policy Decisions on **CSCI and ASCI Assessment Endpoints**

BCG can provide you with the justification for the staff report

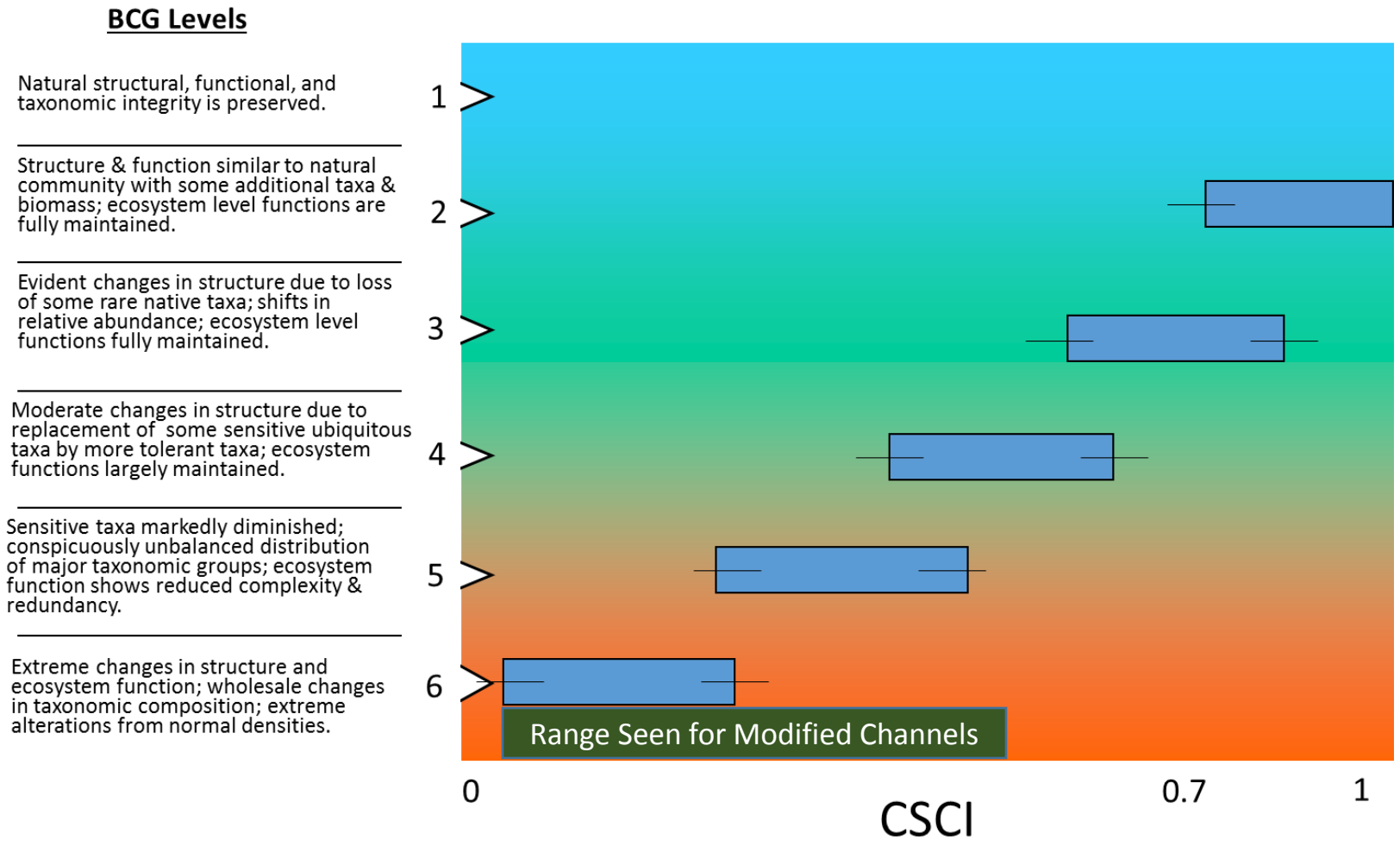
- A CSCI of 0.7 is where we see a threshold in stressor response.
- "That CSCI score is associated with a loss of many sensitive taxa and is just above where tolerant taxa may begin replacing these taxa. Functional alteration often begins below this as well."




(Nutrients, Toxics, Hydromod, etc.)

# It Could Help Inform Conversations on Modified Channels

- What are the best conditions of modified streams?
- What ecological characteristics can the best of those maintain?
- How does that inform management options/action?



# What Is the Status of the BCG?

- We've held 2 introductory webinars
- Completed methods and scoring reconciliation workshops in December and January
- Wrapping up final rescoring and working toward synthesis of findings
- Will provide update on findings in late spring….
  - But we need to get farther along on ASCI first before reporting!

# Products of BCG Expert Calibration

- Report/manuscript that maps CSCI and ASCI indices to bins of ecological condition, from very high to very low
  - Oral findings – Summer 2017
  - Report anticipated fall 2017

# Elements of the Science Plan

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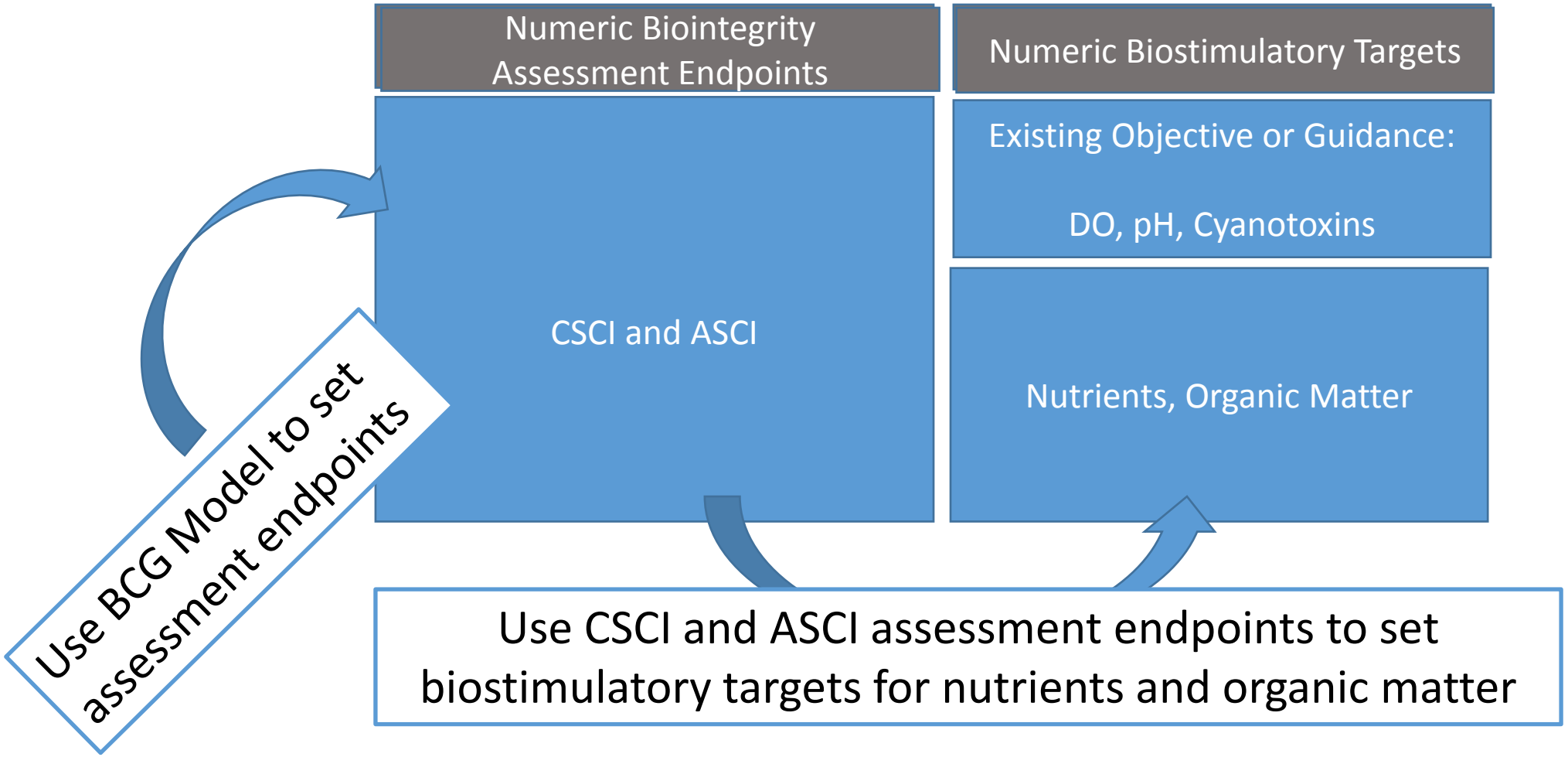
BIOINTEGRITY

BIOSTIMULATORY

# Vision for Biostimulatory-Biointegrity Numeric Guidance



# EUTROPHICATION SYNTHESIS KEY COMPONENTS

- Conceptual model

- Review of candidate indicators and causal assessment metrics

- Synthesis of science supporting decisions on nutrient targets
  - Statistical models that can be used to link assessment endpoints to nutrient and organic matter indicators, in order to set "default" targets

*End Game: Technical document that can be cited in staff report as the basis for biostimulatory numeric guidance and implementation plan.*

# Stream Eutrophication Conceptual Model

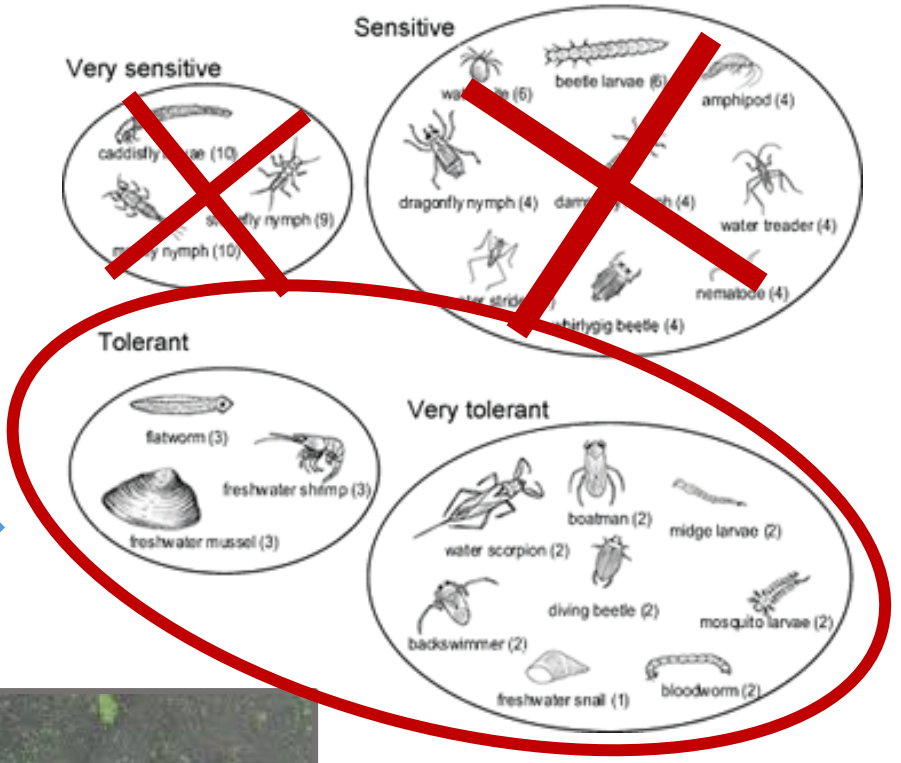
↑ **N, P**

*nutrient enrichment*

*excessive growth of primary producers (algae and/or higher plants)*

*shifts in algal community composition*

*also **directly** impact food webs*




*from multiple standpoints, eutrophication alters aquatic life*

# Candidate Eutrophication Response Indicators, by Pathway

## Routinely Monitored

- *Altered Aquatic Diversity, Food Webs*
  - CSCI, ASCI
- *Organic Matter accumulation*
  - ✓ benthic algal chlorophyll *a*,
  - ✓ benthic ash-free dry mass (AFDM)
  - ✓ algal & macrophyte percent cover

## Not Routinely Sampled

- *Altered Water Quality*
  - ✓ dissolved oxygen/pH
  - algal toxins
  - turbidity
  - trihalomethanes

✓ **Denotes DIAGNOSTIC for biostimulatory conditions**

# Benthic Invertebrate and Algal Attributes can Provide "Eutrophication" Metrics for Rapid Causal Assessment

"Functional Traits" Indicative Pathways of Impairment, for Example..

- Organic matter enrichment
- DO and pH tolerance
- Toxicity or tolerance for nutrient species (Nitrate, phosphate)

Long-term goals is to build this into a "dashboard" of output from bioassessment results (rapid causal assessment)

- But for eutrophication synthesis, this will be a curated list

No numeric targets, but can provide <u>supporting lines of evidence AND guide choice of restoration and BMPs</u>

# View of Indicators and Assessment Endpoints for Eutrophication

Assessment Endpoints to Protect Biointegrity From Biostimulatory Conditions for:

CSCI and ASCI

Benthic Chl-a/AFDM
DO and pH

Causal Assessment Metrics

Preliminary Diagnosis Through Causal Assessment, e.g.:

- If organic matter indicators do not meet endpoints, but CSCI/ASCI do, then site is not impaired
- If CSCI/ASCI AND organic matter/DO indicators do not meet assessment endpoints, then site is causal for biostimulatory
- If CSCI/ASCI do not meet endpoints but organic matter or DO indicators do, then ID other stressors
  - Causal assessment metrics point to relevant pathway (toxics, etc.)

# Eutrophication Synthesis Key Components

- Conceptual model

- Review of candidate indicators and causal assessment metrics
  - Synthesis of science supporting decisions on assessment endpoints

- Synthesis of science supporting decisions on nutrient targets
  - Statistical models that can be used to link assessment endpoints to nutrient concentrations, in order to set "default" targets

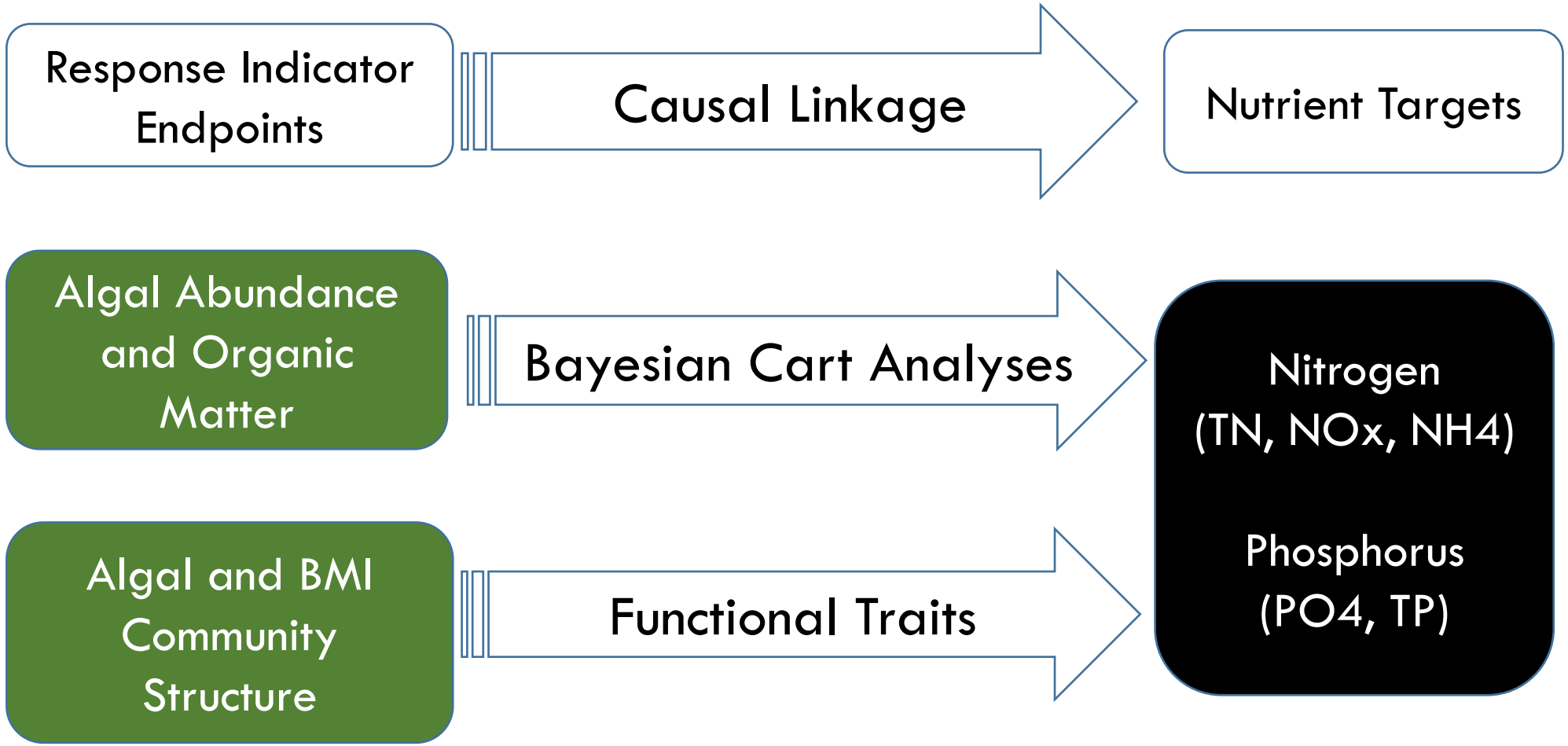
# Picking Up the Thread of the Conversation on Modeling

- We started with the NNE benthic spreadsheet tool (Tetra Tech 2006)
  - Incorporate co-factors to estimate site-specific N and P concentrations, based on mechanistic relationships

- Betty Fetscher showed that tool had poor predictive performance in wadeable streams (Fetscher et al. 2014)
  - Not surprising, since it wasn't calibrated with local data

- We tried statistical modeling, incorporating those same mechanistic relationships

# August 2015 Webinar: Modeling Relationship Between Potential Response Indicators and Nutrients




*From August 26, 2015 NNE Webinar*

# What Did We Learn From Statewide B-CART Models Relating Nutrient and Site-Specific Factors to Organic Matter

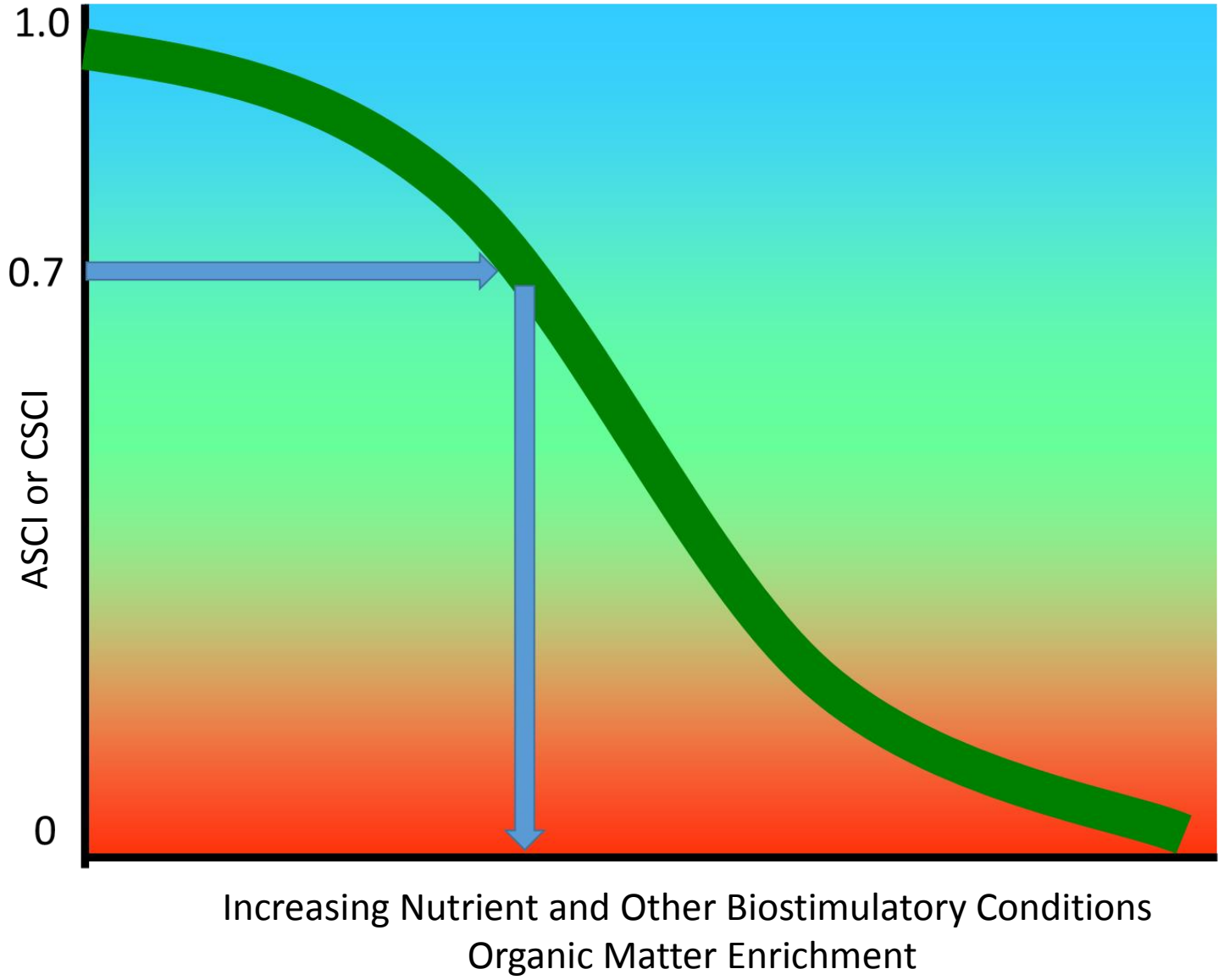
- Models including anthropogenic disturbance variables performed better than those just using natural gradients
- Models relying solely on site-specific factors "mechanistic" for eutrophication performed mediocre
  - Not strongly defensible method to establish "site-specific nutrient targets

Take Home Message:

- Creation of models to establish "site-specific nutrient targets" is appropriate at watershed or waterbody-specific, not statewide scale
- Move away from mechanistic modeling at statewide scale

# If Not Mechanistic Models, then What?

- Recognize that biological condition can degrade along gradient of increasing nutrients, other biostimulatory conditions, and organic matter enrichment (OM)
- Use statistical models to define ranges of nutrient and OM that have probability of being protective, at a statewide scale



# Account for Biostimulatory conditions at Watershed Scale

Can Establish Assessment Endpoints to Protect Biointegrity From Biostimulatory Conditions:

CSCI and ASCI

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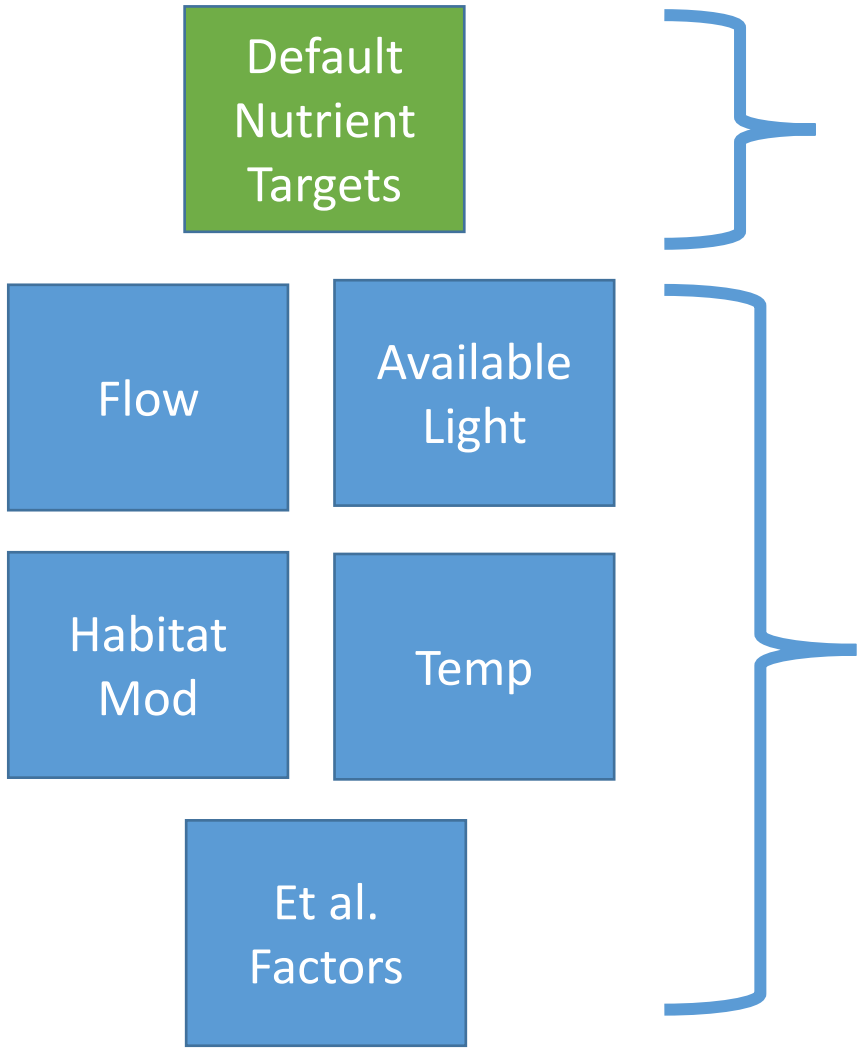
Benthic Chl-a/AFDM

DO and pH

---

Causal Assessment Metrics

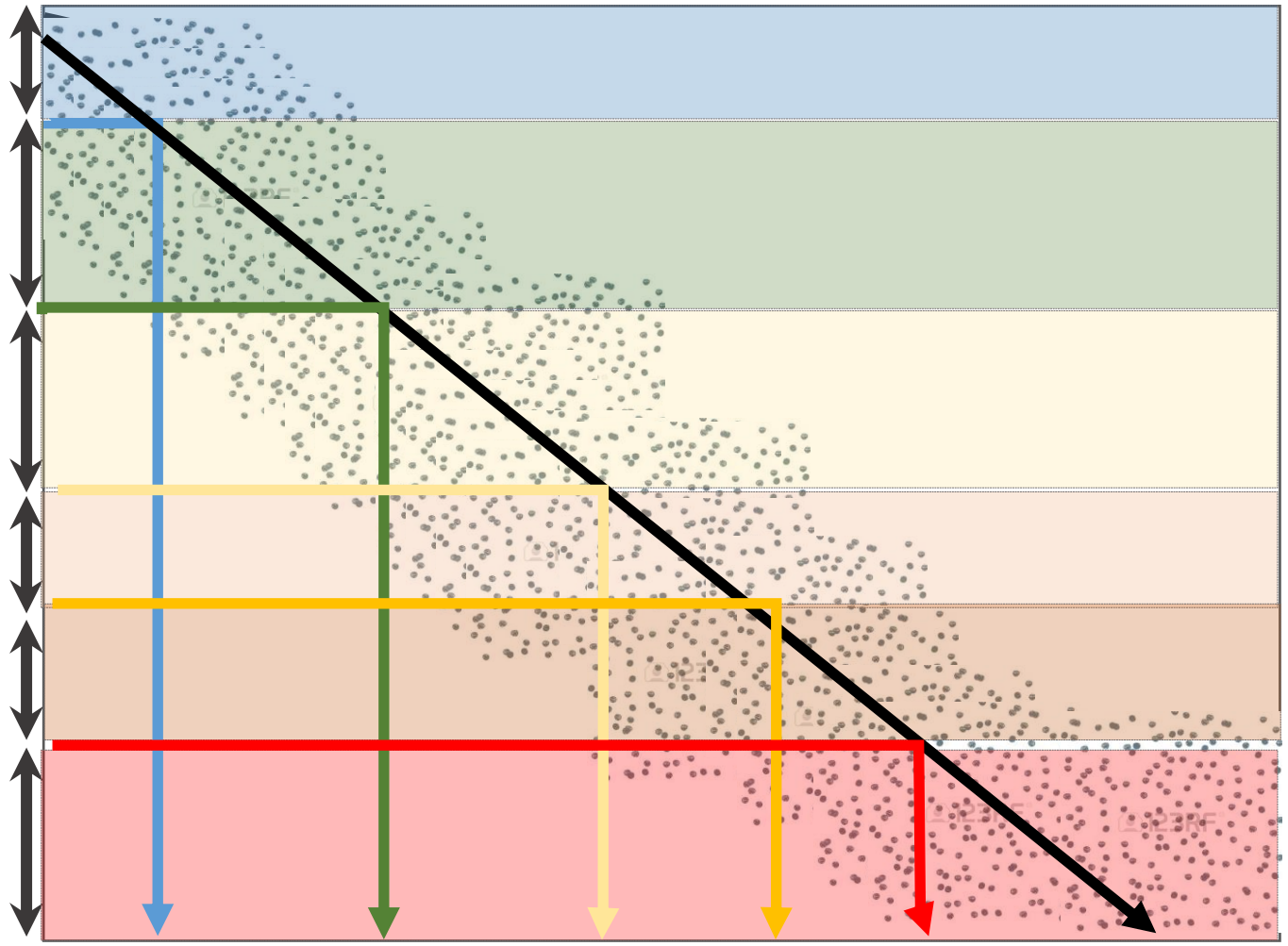



Can set “default” nutrient targets statewide…..

But use watershed approach to account for other factors to reach biological assessment endpoints…..

# Use Statistical models to Map BCG Binned Indices to Nutrients and Organic Matter Indicators

*BCG- binned ranges of CSCI or ASCI*



# Statistical Model Approaches to link CSCI and ASCI to Nutrients and Organic Matter

Recommend regression approaches, with two possible types, depending on policy question

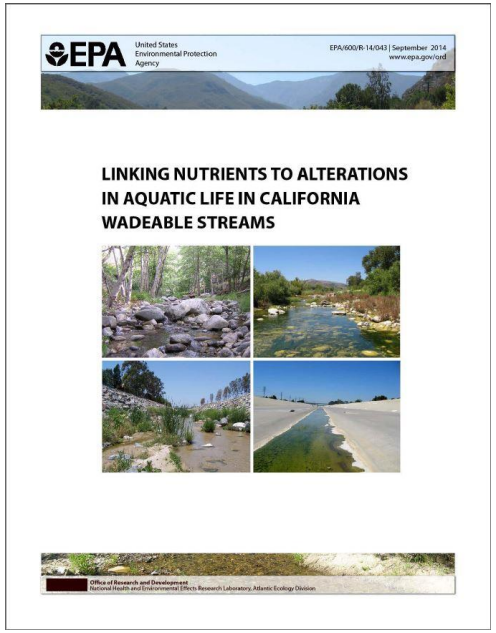
- Nonlinear (e.g. Quantile) regression
  *"What are the ranges and uncertainty in TN concentration associated with a BCG-binned ranges of ASCI?"*
- Logistic regression
  *"What is the benthic chl-a concentration and associated error that has a probability of 0.5 of CSCI falling below X?"*

We intend to engage Science Panel on early discussion of appropriate approaches

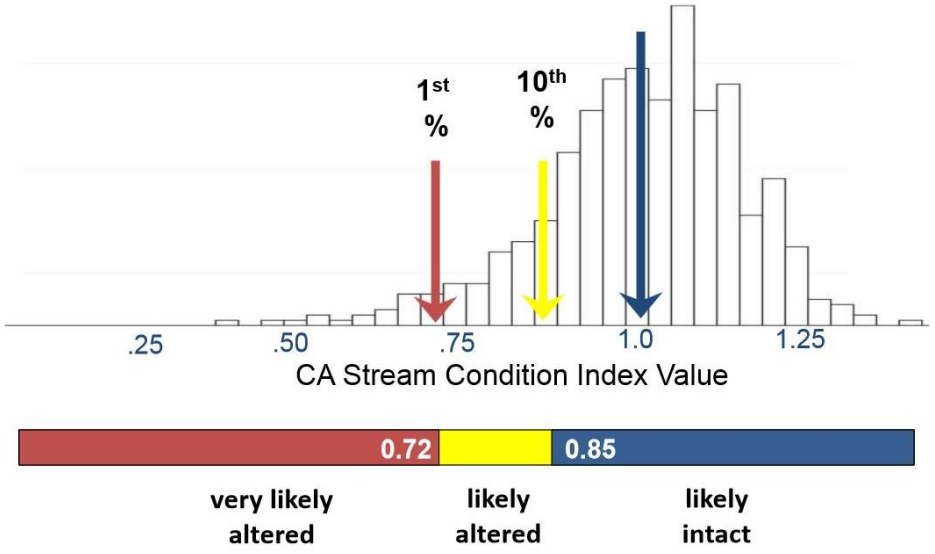
# Synthesizing Information to Support Decisions on Assessment Default Nutrient and Organic Matter Thresholds

Compare "BCG-binned" ranges of TN, TP and organic matter indicators to ranges from two other approaches:

*EPA ORD report "statistically-derived" thresholds*




*Percentile of Reference*



# Products of Eutrophication synthesis

- Report/ that provides:
  - Conceptual model of eutrophication in wadeable streams and linkages to beneficial use impacts
  - General review of candidate eutrophication indicators, including BMI and algal community metrics that are causal for eutrophication pathways
  - Statistical models linking CSCI and ASCI to nutrient concentrations and intermediate eutrophication response, in BCG-binned ranges
  - Synthesis and Recommendations for their use
- Draft report expected winter 2017, but interactions with science panel would already occur this spring 2017.

# How is the Biostimulatory Component of the Science Plan Really Different from Previous Version?

- Conceptual model
  - Same as previous NNE workplan
- Review of candidate indicators to support decisions on assessment endpoints
  - Same foundation, but increased emphasis on causal assessment metrics (but not for the purposes of establishing assessment endpoints)
- Synthesis of science supporting decisions on nutrient targets
  - Same concept that statistical models that can be used to link assessment endpoints to nutrient concentrations, in order to set "default" targets
  - Move away from mechanistic "site specific targets" as a goal for statewide statistical models

# RECAP-TIMING OF PRODUCTS: ELEMENT 1

**Feb 2017**

– Updated Science Plan

**July 2017**

- Oral presentation on findings (ASCI, BCG)

**September 2017**

- Draft reports (ASCI, BCG)
- Oral findings (eutrophication synthesis with statistical models linking to nutrients/OM)

**November 2017**

- Draft report (eutro synthesis with statistical models linking to nutrients/OM)

**January 2018**

- Revised reports (ASCI, BCG, eutrophication synthesis)

# Elements of the Science Plan

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   1.3. Determine the range of stream nutrients and intermediate eutrophication response indicators that correspond to attainment of beneficial uses

2. **Implementation plan technical support**

# Implementation Plan

- Number of technical elements funded to support biointegrity and biostimulatory policy implementation
  - We want to recognize in Science Panel that this work has been completed or is underway
  - Other elements have yet to be identified and funded, pending more specific policy options under consideration
- Opportunities for RG and SAG to identify needed science and co-fund/contribute

# SWAMP, State Water Board and SMC Have Already Been Strong Partners in Progress Made

- Completed
  - Regional study biological conditions in engineered channels
  - Pilot study on spatial representativeness
- Funded and in progress
  - **Channels in Developed Landscapes– Talk about today**
  - Pilot demonstrations of "watershed approach", Santa Margarita River watershed
- Future

  Streamlined causal assessment

  [Identify these needs on an ongoing basis, with your input]

# Science Panel Charge Topics (For April 19-20, 2017 Meeting)

1. Appropriateness and suggested refinements to the Biostimulatory-Biointegrity Science Plan (Sutula et al., 2017, Appendix1)
2. Appropriateness and suggested refinements to the ASCI Work Plan (Theroux at al., 2016, Appendix 2)
3. Statistical Models to Link CSCI and ASCI assessment endpoints to numeric targets for nutrients and organic matter abundance.

# Next Steps on Science Plan and Science Panel Charge

Science Plan and Science Panel Charge Questions

- Distribute Friday February 17, 2017
- Comments to Jessie Maxfield by March 10, 2017

# Questions?

# Comments?

# Meeting Goals For Today?

- Brief you on State Water Board's Biostimulatory- Biointegrity Project
  - State Water Board staff vision for project
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    - Update on ongoing projects
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    - Discuss in detail any particular component of interest
  - Describe timelines for review of technical work elements, including timing of stakeholder and science panel meetings.
- Discuss interest and process for Regional Board participation in "Channels in Developed Landscapes)

## Tentative Schedule for SAG Meetings:

**January 2017 and ongoing** – Webinars - implementation related work plans and updates

**Feb/March 2017- Meeting (South**)

- Interim Updates, Science Plan and Panel Charge

**July 2017- Meeting (North)**

- Oral findings (ASCI, BCG)

**September 2017 – Meeting (South)**

- Draft reports (ASCI, BCG)
- Oral findings (eutrophication synthesis statistical models linking to nutrients/OM)

**November 2017 – Meeting (North)**

- Revised reports (ASCI, BCG)
- Draft report (eutro synthesis & linkage to nutrients/OM)

## Tentative Schedule for Science Panel Meetings

**January 2017 – Webinar orientation**

**March 2017- Meeting (South**)

- Science Plan
- Interim updates (ASCI, BCG, eutrophication synthesis)

**October 2017 – Meeting (South)**

- Draft reports (ASCI, BCG)
- Oral findings (eutrophication synthesis statistical models linking to nutrients and OM indicators)

**January 2018– Meeting (South)**

- Revised reports (ASCI, BCG)
- Written report (eutrophication synthesis and linkage to nutrients)
- Implementation Science

# Given Timing of SAP and SAG Meetings, A Few Questions for the RG:

- What is the best frequency and format for RG meetings?
  - Webinars?
  - Full day meetings?
- For science-related topics, do you want to meet together or separate from stakeholders?
- How involved do you want to be going forward?
  - Just be briefed
  - Help craft/write portions of the policy?

# Questions? Comments?

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