California Stream Nutrient Objectives Stakeholder Meeting

May 15 2015

Southern California Coastal Water Research Project (SCCWRP)

At the Last Stakeholder Meeting and In the Intervening Period..

- We received your feedback on the Wadeable Streams Science Plan
  - Want to touch back on your comments today
- You asked for the wadeable streams data used for analyses
  - You were provided with a copy of those data
- Finalized Science Panel members, developed an agenda and draft meeting charge today
  - Get your comments on draft meeting charge, agenda today
- You asked for interim updates on technical activities, focused discussion on the use of Biological Condition Gradient models in nutrient criteria
  - We will spend some updating you and give you a detailed presentation on the BCG

Goals for the Meeting

- Provide brief updates on status of policy and technical program elements;
- Summarize SAG comments on the Science Plan and describe what changes have been made or are pending in response to SAG comments;
- Provide an overview of recent experiences in using BCG models to support nutrient criteria development and present proposed California BCG workplan;
- Discuss possible approaches to classifying modified channels and how to incorporate nutrient management activities into Science Plan;
- Review and suggest revisions to the Science Panel Charge and Agenda.

Summary of Phase I Schedule

No.	Task	Targeted Date for Completion
1	Outreach	March 2017
2	Conceptual Approaches to Nutrient Objectives, Water body Definition & Classification	June 2015
3	Conduct and Synthesize Science to Support Numeric Guidance in Wadeable Streams	June 2016
4	Implementation Plan Development	March 2017
5	Implementation Plan Technical Support	Ongoing
6	Rulemaking	2017

Update on Technical Elements

State Water Board Nutrient Control Plan Phases Nutrient Objectives by Waterbody Type

Phase I:

- Establish NNE as the default approach to establishing nutrient water quality objectives
- Establish numeric guidance for wadeable streams

Science Supporting Approach to Nutrient Objectives in California

Purpose: Establish rationale for State Water Board's approach to nutrient objectives as default for all waterbody types

- Broad problem statement, generalized conceptual model of "the problem" and applicable waterbody classes
- Approaches to nutrient objectives
- History of nutrient objective development in California
- Rationale for "combined criteria" approach

Report in progress, draft available for stakeholder review in August 2015

Elements of the Science Plan

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

   1.1 Establish a conceptual model linking response indicators to beneficial use support, nutrient and stream co-factors

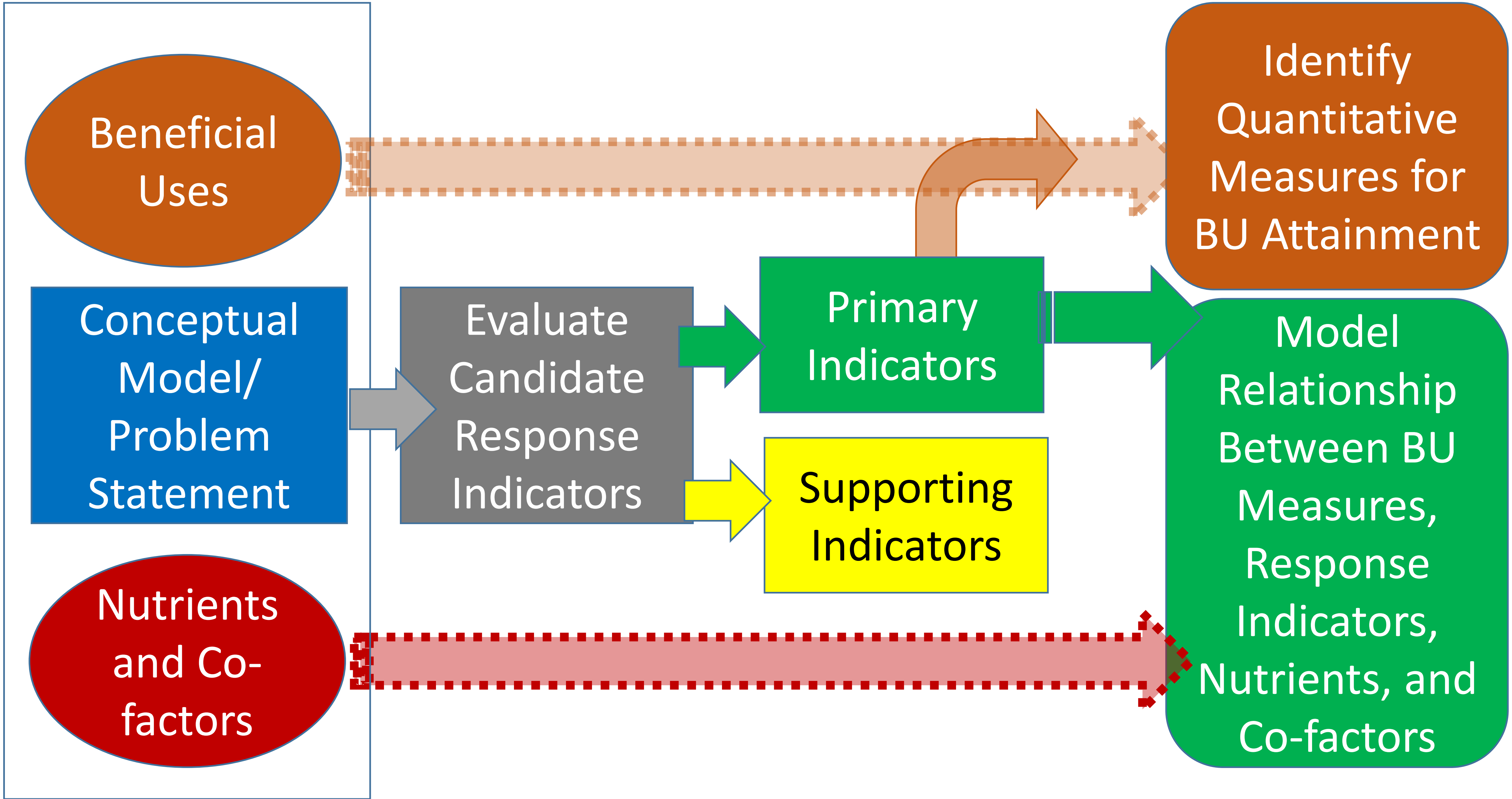
   1.2 Identify response indicators representative of wadeable stream beneficial use

   1.3 Determine the numeric range of stream nutrient and response indicators that correspond to attainment of beneficial use

   1.4 Develop basic statistical models linking indicators of algal abundance and organic matter accumulation to nutrients in wadeable streams

2. Implementation plan technical support

Building a Scientific Foundation for NNE



Elements 1.1. and 1.2: Conceptual Model and Review of Candidate Response Indicators in Wadeable Streams

Purpose: Establish rationale for selection of response indicators that will serve to assess wadeable stream beneficial use support

- Wadeable stream conceptual model, with linkages to beneficial uses
- Review of indicators vis-à-vis evaluation criteria
- Recommended indicators as either <u>primary</u> or <u>supporting lines</u> of evidence

<u>*Refining and updating foundation laid by Tetra Tech (2006), report in progress, available for stakeholder review in August 2015*</u>

Response Indicators Literature Review

Goal: to evaluate and identify primary and supporting response indicators based on most recent science

Suitability criteria for the indicators:

- clear link to beneficial uses
- has predictive relationship with nutrient concentrations/loads & other factors that regulate eutrophication response
- measurement process is scientifically sound/practical
- shows a *trend* in response to eutrophication with an acceptable signal to noise ratio
- either already routinely collected by State programs, or can be added relatively easily

Stream Eutrophication Conceptual Model

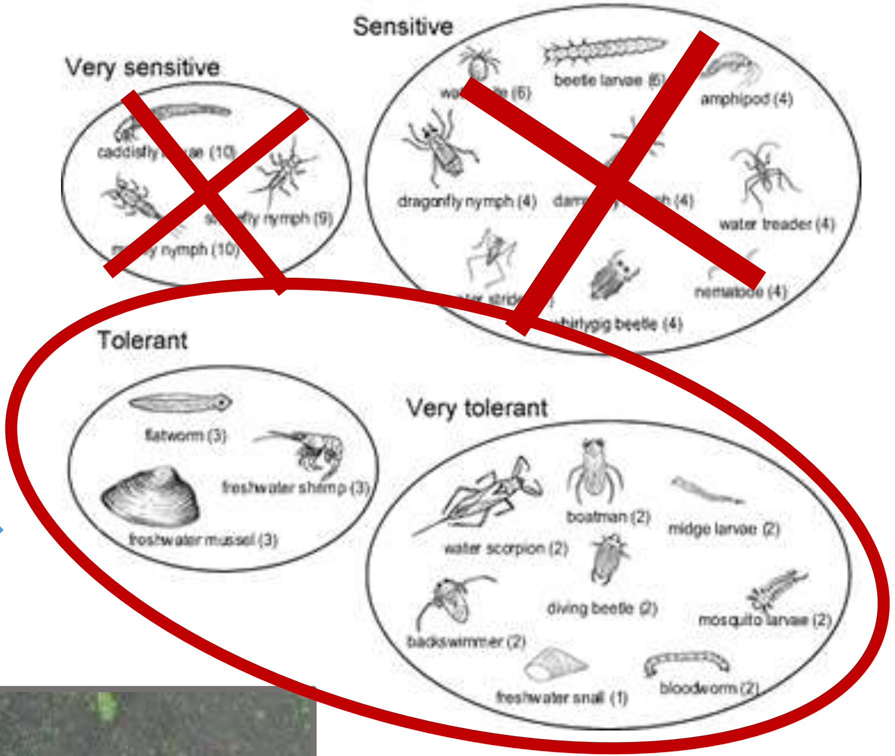
↑ N, P

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

Nutrient Response Pathways: Relationships with **Multiple** Beneficial Use Types

Beneficial Use	Altered Aquatic Life Diversity	Altered Food Web	Unaesthetic Blooms	*Water Quality:* Reduced DO	*Water Quality:* Algal Toxins *et al.* Metabolites	*Water Quality:* Increased Turbidity
COLD	X	X		X	X	X
WARM	X	X		X	X	
SPWN	X	X		X	X	
MIGR	X	X		X	X	
RARE	X	X		X	X	

adapted from Tetra Tech (2006)

Candidate Response Indicators, by Pathway

Routinely Monitored

- *Altered Aquatic Diversity, Food Webs, Aesthetics & Water Quality*
  - benthic and planktonic algal chlorophyll *a*
  - benthic ash-free dry mass (AFDM)
  - algal & macrophyte percent cover
  - benthic diatoms, soft algae & cyanobacteria community metrics

Not Routinely Sampled

- *Altered Water Quality*
  - dissolved oxygen; pH
  - Freshwater HABs, algal toxins
  - turbidity
  - Trihalomethanes

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2. Implementation plan technical support

1.3 Determine the numeric range of stream nutrient and response indicators that correspond to attainment of beneficial uses

1.3.1 Determine nutrient and biomass **thresholds** of effects on aquatic life response indicators

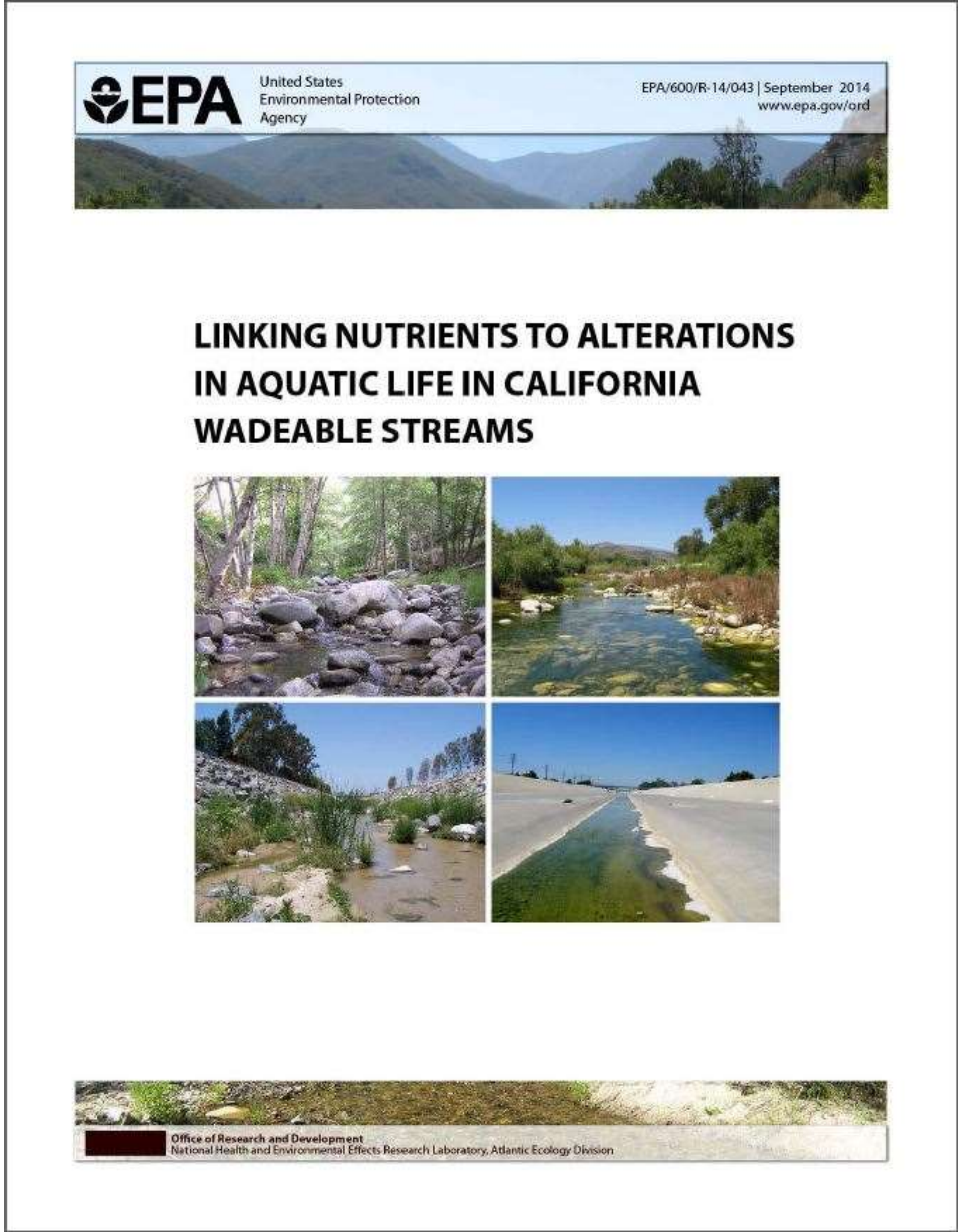
1.3.2 Estimate levels of algal abundance and nutrient concentrations associated with attainment of a quantitative "goal" based on a **Reference percentile**

1.3.3 Develop a **Biological Condition Gradient (BCG)** to link nutrients/biomass to stream ecological condition

1.3.1 Determine nutrient and biomass **thresholds** of effects on aquatic life response indicators

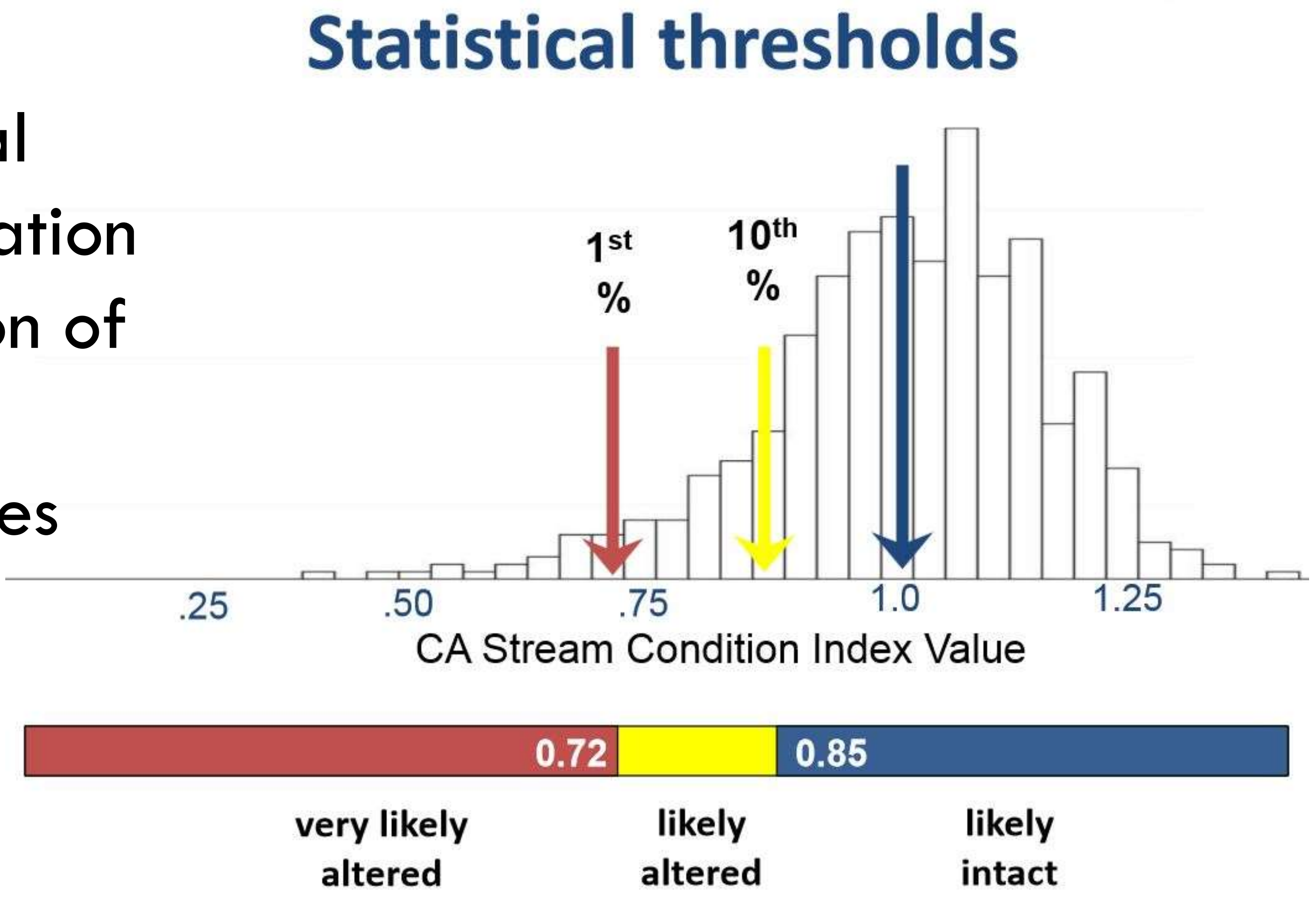
COMPLETE

Fetscher, A.E., M. Sutula, A. Sengupta, and N.E. Detenbeck. Linking nutrients to alterations in aquatic life in California wadeable streams. U.S. Environmental Protection Agency, Washington, DC (NTIS EPA/600/R-14/043), 2014.



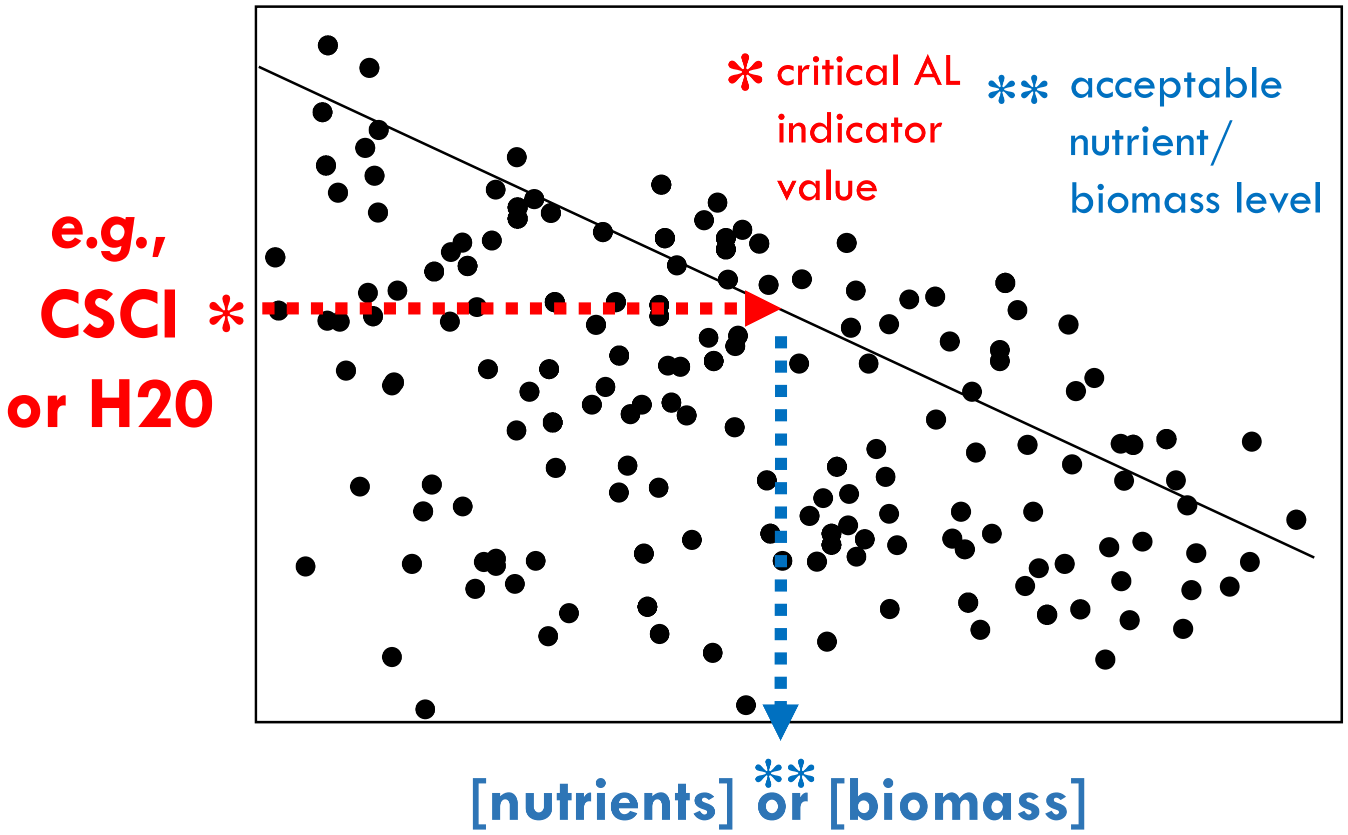
Element 1.2 Reference Approach

Establish BU attainment goal based on deviation from distribution of scores among "Reference" sites



Apply Regional Percentile of Reference Condition to Regression Models

The goal for a stream biotic index (based on deviation from Reference) can then be interpolated to a nutrient or algal abundance level



Draft report in internal review, available for stakeholder review in August 2015

1.3 Determine the numeric range of stream nutrient and response indicators that correspond to attainment of beneficial uses

1.3.1 Determine nutrient and biomass **thresholds** of effects on aquatic life response indicators

1.3.2 Estimate levels of algal abundance and nutrient concentrations associated with attainment of a quantitative “goal” based on a **Reference percentile**

1.3.3 Develop a **Biological Condition Gradient (BCG)** to link nutrients/biomass to stream ecological condition

— 12- 16 months from project start date, TBD

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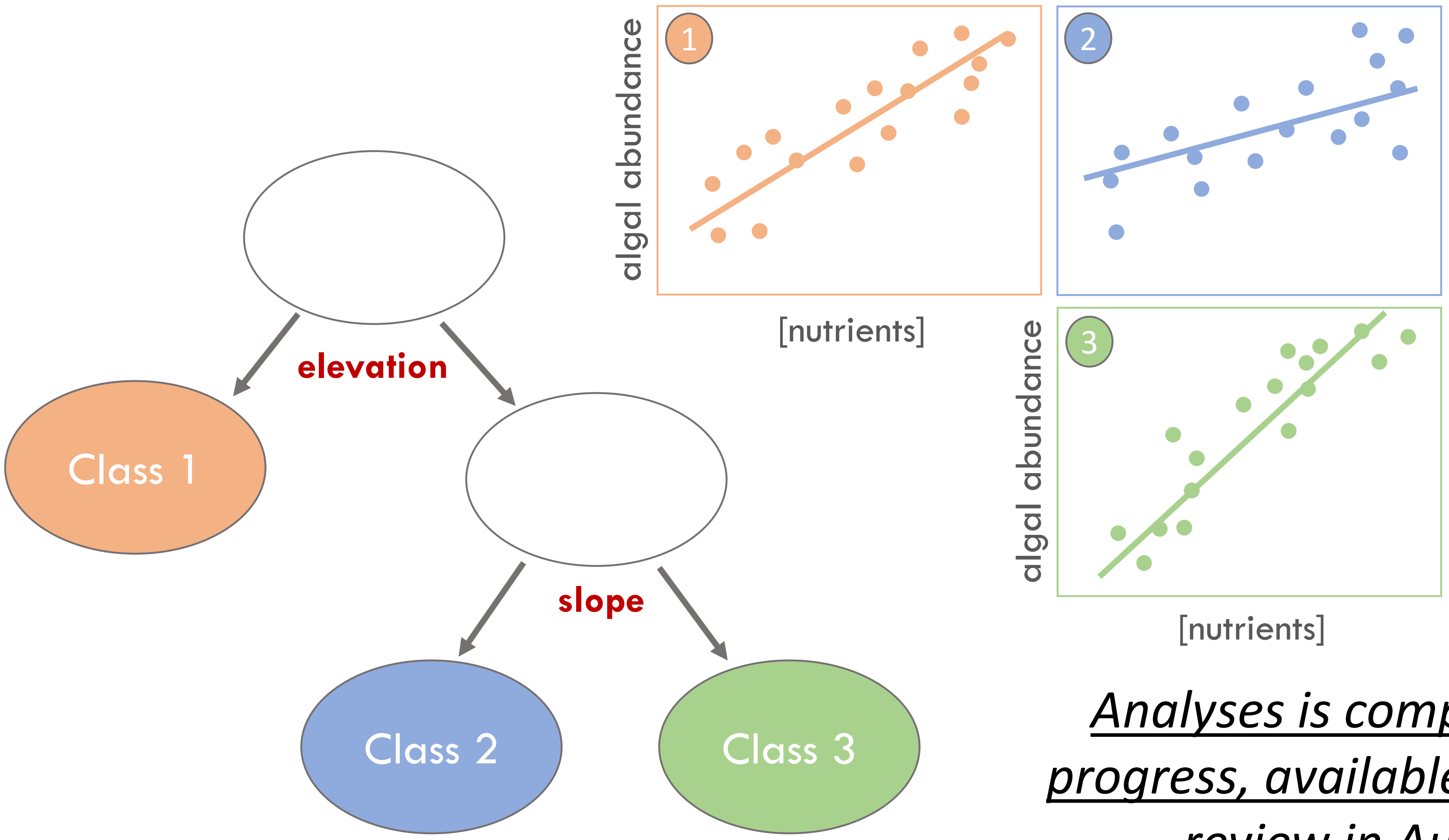
Approach: Bayesian Classification and Regression Trees (B-CART)

- Models primary producer abundance response to nutrients
  - **chlorophyll *a***
  - **AFDM**
  - **macroalgal % cover**

- Uses site-specific factors (natural gradients) to assign sites to classes

- Yields simplified set of regression models to predict algal biomass by site "class", along with a set of rules to define the classes

B-CART End Result



Models predicting biomass from nutrients, customized for site classes defined by natural gradients
→ facilitates derivation of site-specific nutrient targets

Analyses is complete, report in progress, available for stakeholder review in August 2015

Overview of Status of Technical Elements

Element	Status and estimated completion date
Review of approaches to nutrient objectives, California waterbody classification	Report in progress, for stakeholders to review August 2015, draft final December 2015
1.1 and 1.2 Conceptual model and review of response indicators	Report in progress, for stakeholders to review August 2015, draft final December 2015
1.3 Synthesize science supporting endpoints	
1.3.1 Thresholds in biological response	EPA-ORD Technical Report Complete
1.3.2 Regression models based on percentile of reference	Draft complete and in internal review, for stakeholders to review in August 2015, draft final December 2015
1.3.3 Biological condition gradient expert synthesis	Project to begin July 2015, with draft report in Fall 2016
1.4 Nutrient –algal abundance statistical models	In draft, for stakeholders to review August 2015, draft final in December 2015

Confirmed Science Panel Members

Cliff Dahm	Stream Ecology/Biogeochemistry	University of New Mexico
R. Jan Stevenson	Stream Ecology/Biogeochemistry	Michigan State Univ.
Ken Reckhow	Modeling	Duke University (Emeritus)
Paul Stacey	Nutrient Management	Great Bay National Estuarine Research Reserve

Schedule for Science Panel Meetings and Overarching Charge

Spring 2015:	Review of Wadeable Stream Science Plan and other Foundational Science
Spring 2016:	Review of Science Plan Products and Perspectives on Use in Policy Context
Fall 2016:	Review of Revised Products and Perspectives on Use of Science in Policy Context

Wrap Up on Progress on Technical Elements

- Majority of technical elements supporting “default” policy will be done by Fall 2015, with exception of BCG expert synthesis (Fall 2016)
- Science Panel review of available technical elements as early as December 2015
  - —When is the best time for the next Science Panel meeting?
- It will be hard to understand how they fit together and their relative importance until:
  - —BCG expert synthesis is complete (summer 2016)
  - —Implementation guidance is more completely developed

Policy Update

Implementation Plan Development Approach & Schedule

January – June 2015:	Focus group meetings with sectors; development of draft implementation plan options
June- Sept 2015:	Discussion of draft implementation plan options with Regulatory Workgroup and Water Board upper management; revise and repeat
Spring 2016:	Discussion of draft implementation plan with Regulatory Workgroup and Water Board upper management
	Presentation of initial options on implementation to Science Panel
Summer 2016:	Presentation of proposed implementation plan to stakeholders
Fall 2016:	Science Panel feedback on final science products and proposed use in implementation plan

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Stakeholder Comments Received From:

- CASA
- LA County Sanitation District
- CASQA

Three Major Types of Comments, Provided as General Comments or Direct Edits

- Elements that were explicitly missing in the Science Plan

- Reservations, comments, questions, caveats about how science would/should be used in policy

- Clarification in language used

Today we will be focusing on the first two categories; let me know if you think that further clarifications are needed in the revised Science Plan Draft

How Are These Comments Used?

- No formal response to comments is being provided
  - —Verbal response to <u>general</u> comments today
- Modifications to science plan
  - —Used clarifications in language when appropriate
- Considering whether/how to incorporate “missing elements”
  - —We will touch on some of these today
- Comments have been provided to Science Panel

Comments re: Elements Not Specifically Addressed in Science Plan

- Modified channels not specifically addressed
- Nutrient management not specifically addressed
- Desire to link algal abundance indicators to DO and pH

We will have a specific discussion about these later today

Linking Algal Abundance to DO, pH

- DO is a function of a baseline of water column and sediment oxygen demand, plus daily fluctuations imposed by live algal biomass

- We can mechanistically model diurnal relationship between DO (and pH) to live algal biomass, but….

  - —Does not account for baseline of oxygen demand, which can be substantial, bringing DO and pH below protective values

  - —Does not account for die-off of live algae, which can contribute to baseline

  - —For this reason, dynamic modeling of nutrient linkages to DO is difficult

- What's more, we do not have data that can be used to further explore these relationships statistically

Other General Comments- General

- Science Plan doesn't reflect intent to have a conversation about the numbers, rather than use the numbers directly in policy
- Believe that Tier Aquatic Life Uses should be explicitly considered as an option in the State Water Board workplan and draft science plan
- Worry that that BCG could also be used to develop biointegrity thresholds; should just be applied to nutrients
- Documentation is needed to describe stream type classification/criteria
- Suggested data caveat "There are certain limitations of the available statewide dataset, which could result in uncertainty, and may lead to a range of results from the analyses."
- It would be helpful if it was clear that reach or watershed specific models and analysis are preferred over regional or statewide statistical models where feasible.

Other General Comments: Indicator Selection

- Don’t limit the focus of response indicators to biological community at the expense of measures like DO and pH
- H20 was found to be inferior for statewide application; seems more causative than correlative
- Should focus on those indicators that are more directly and specifically linked to nutrient impacts
- Should focus on indicators more specifically linked to beneficial uses, even if they don’t have a causal link to nutrients
- Along with DO and pH, algal abundance is a more reliable link to beneficial uses than community structure

Other General Comments: Endpoints and Targets

- Establish a separate administrative task for an open discussion with the Science Panel that allows for input on the final synthesis
- Not clear how percentile of reference relates to beneficial use protection; should be considered as a separate analyses and not linked to threshold development
- Statistical methods should not be the main approach; BCG and expert opinion are the best for setting default values
- Thresholds for algal biomass have already been derived through expert process (referring to Tetra Tech 2006).
- Problem with setting default targets is that burden of proof to move from default is high

Questions?

Comments?

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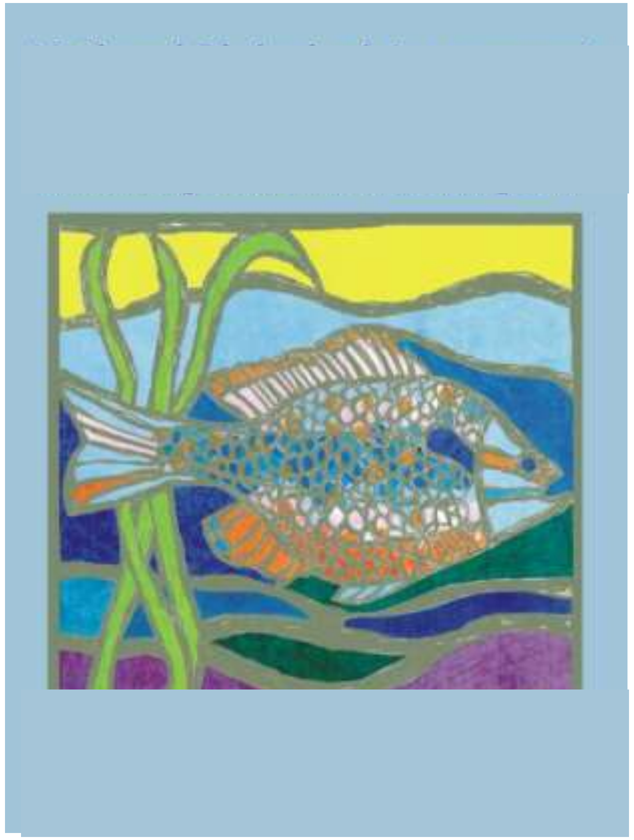


The Biological Condition Gradient

Jeroen Gerritsen, Michael Paul

15 May 2015

CWA
Section 101(a)
Objective

To Restore & Maintain the Chemical, Physical, & *Biological Integrity* of the Nation's Waters

101(a)(2): interim goal:
protection and propagation of fish, shellfish and wildlife, wherever attainable

Biological Integrity

QUANTITATIVE MEASURES

The ability of an aquatic ecosystem to support and maintain a balanced, integrated and adaptive community of organisms having a species composition, diversity, and functional organization comparable to that of natural habitats within a region

REFERENCE

CLASSIFICATION

With increased human disturbance, we see widespread changes:

- Sensitive organisms: Organisms that are sensitive to pollution are likely to die (esp. sessile).
- Tolerant organisms: Organisms that are tolerant to pollution become more abundant.
- Diversity: A decrease in the number of species.
- Dominance: One or few kinds of organisms make up a large portion of the total.

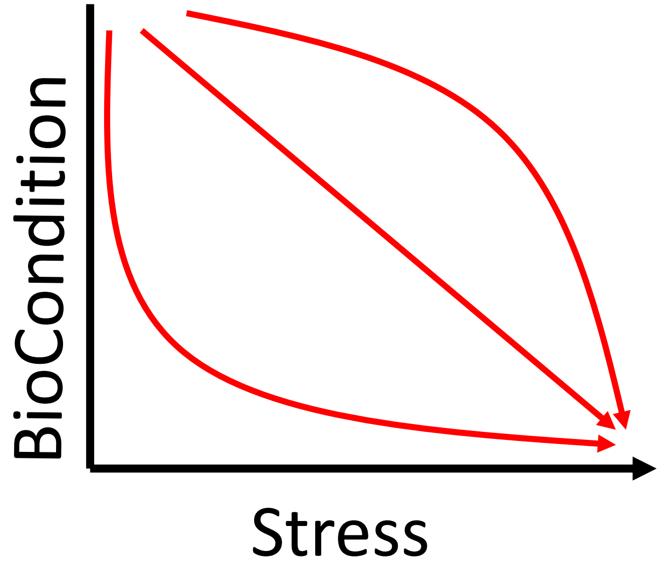
Measurements in support of criteria?

- Goals, endpoints, standards all include values: What are we protecting?
- Science does not yield goals or values
- Shifting baselines?
- What is a scientifically/biologically meaningful difference?
- Does a score of 50 mean the same from state to state?

The Biological Condition Gradient (BCG)

A scientific framework for identifying biological response to anthropogenic stress.

- Longstanding, accepted science
- Measurable and predictable
- Based on bioassessments
- Generalized scale
- Fixed anchor to minimize shifting baseline
- Biologically meaningful thresholds



The BCG: biological response to increasing stress

Levels of Biological Condition

Natural structural, functional, and taxonomic integrity is preserved.

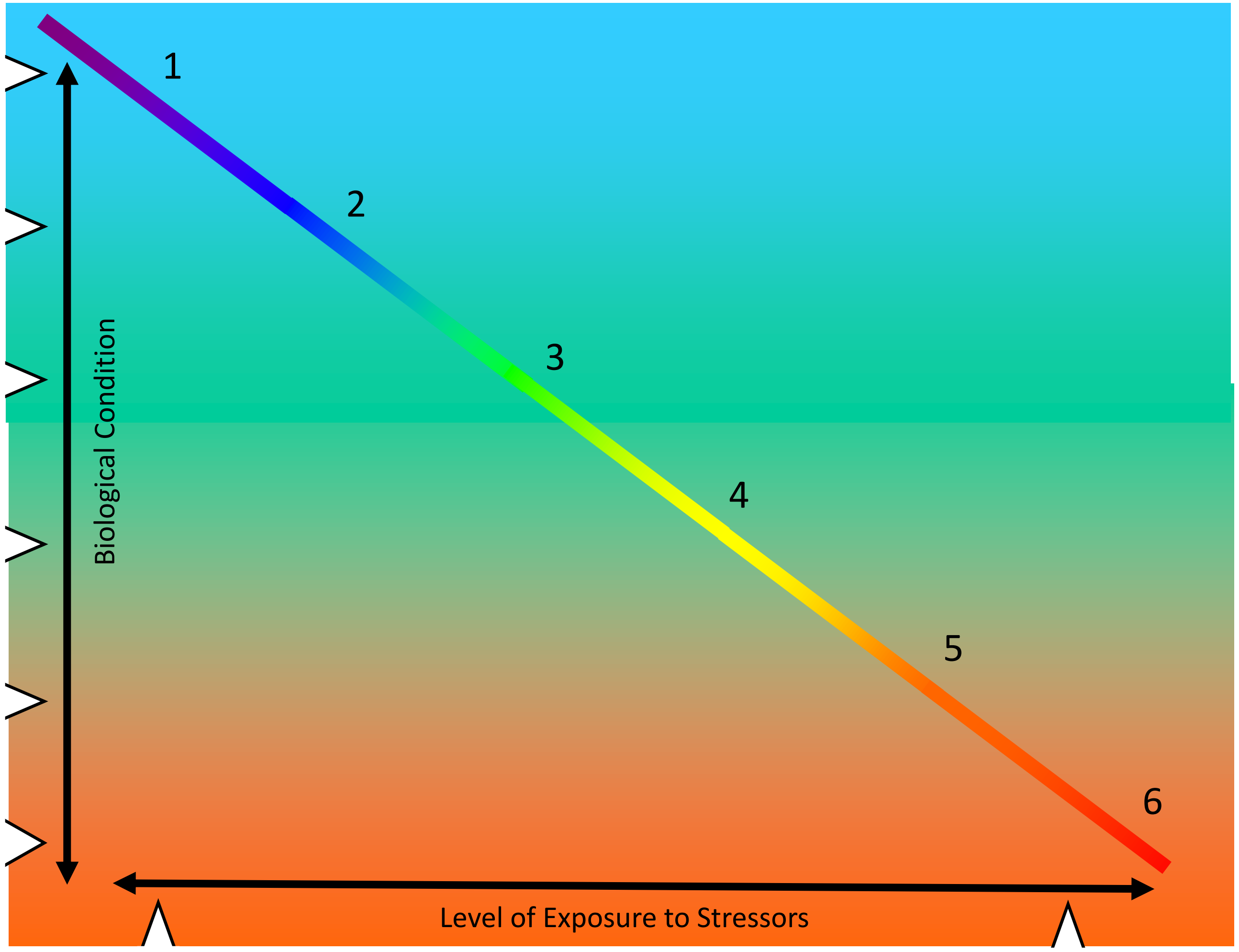
Structure & function similar to natural community with some additional taxa & biomass; ecosystem level functions are fully maintained.

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.

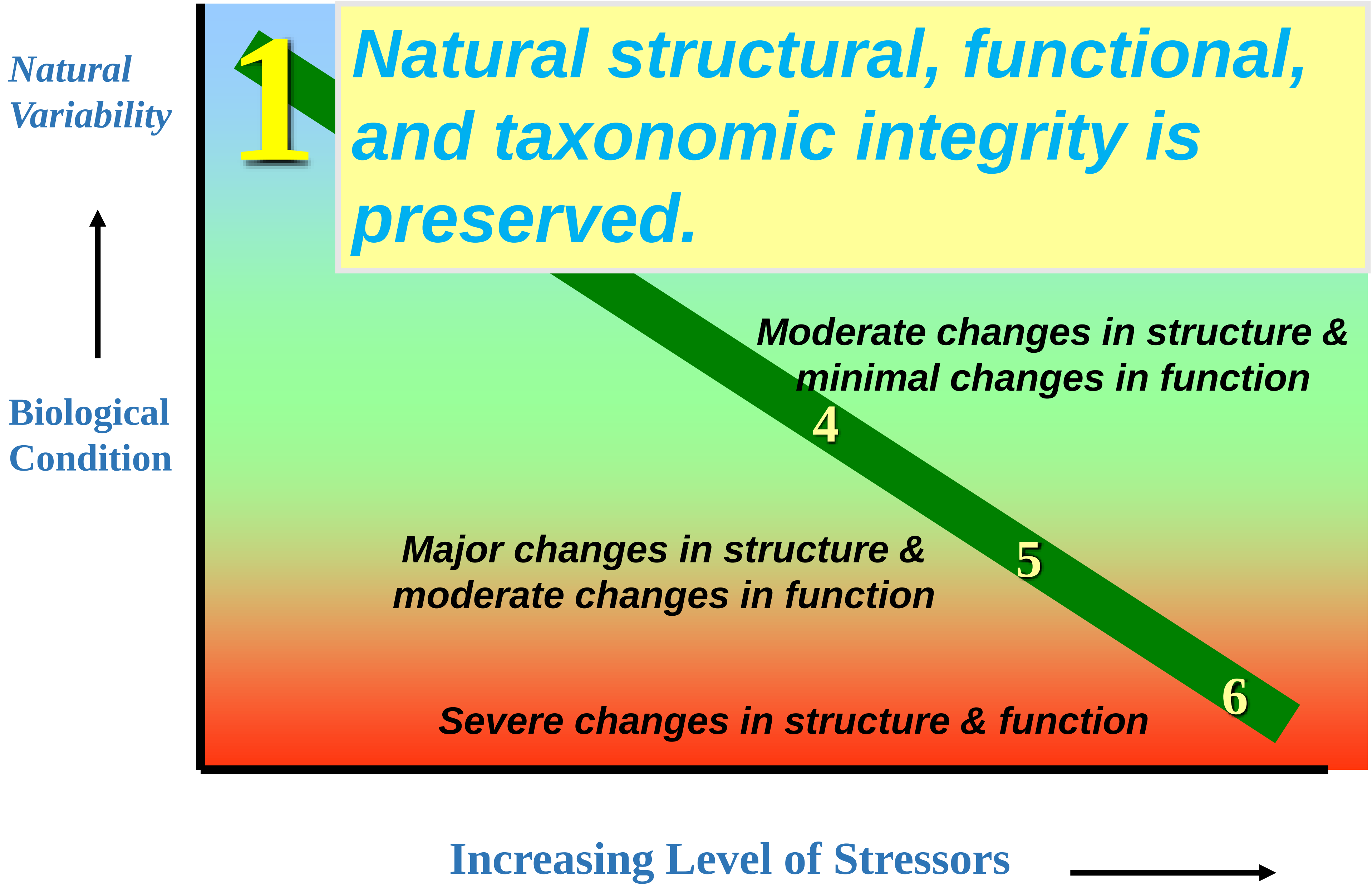
Extreme changes in structure and ecosystem function; wholesale changes in taxonomic composition; extreme alterations from normal densities.



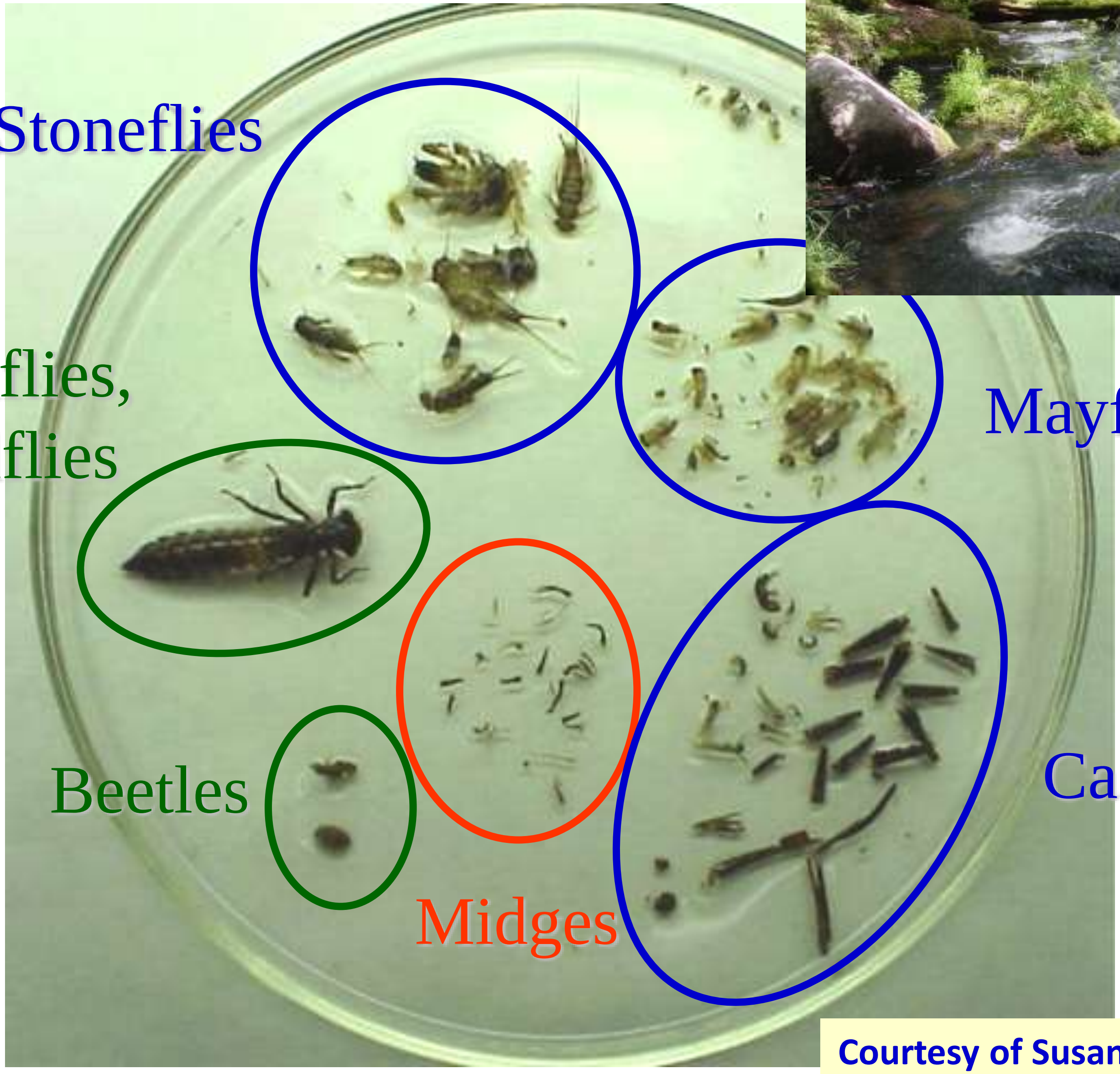
Watershed, habitat, flow regime and water chemistry as naturally occurs.

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

The Biological Condition Gradient

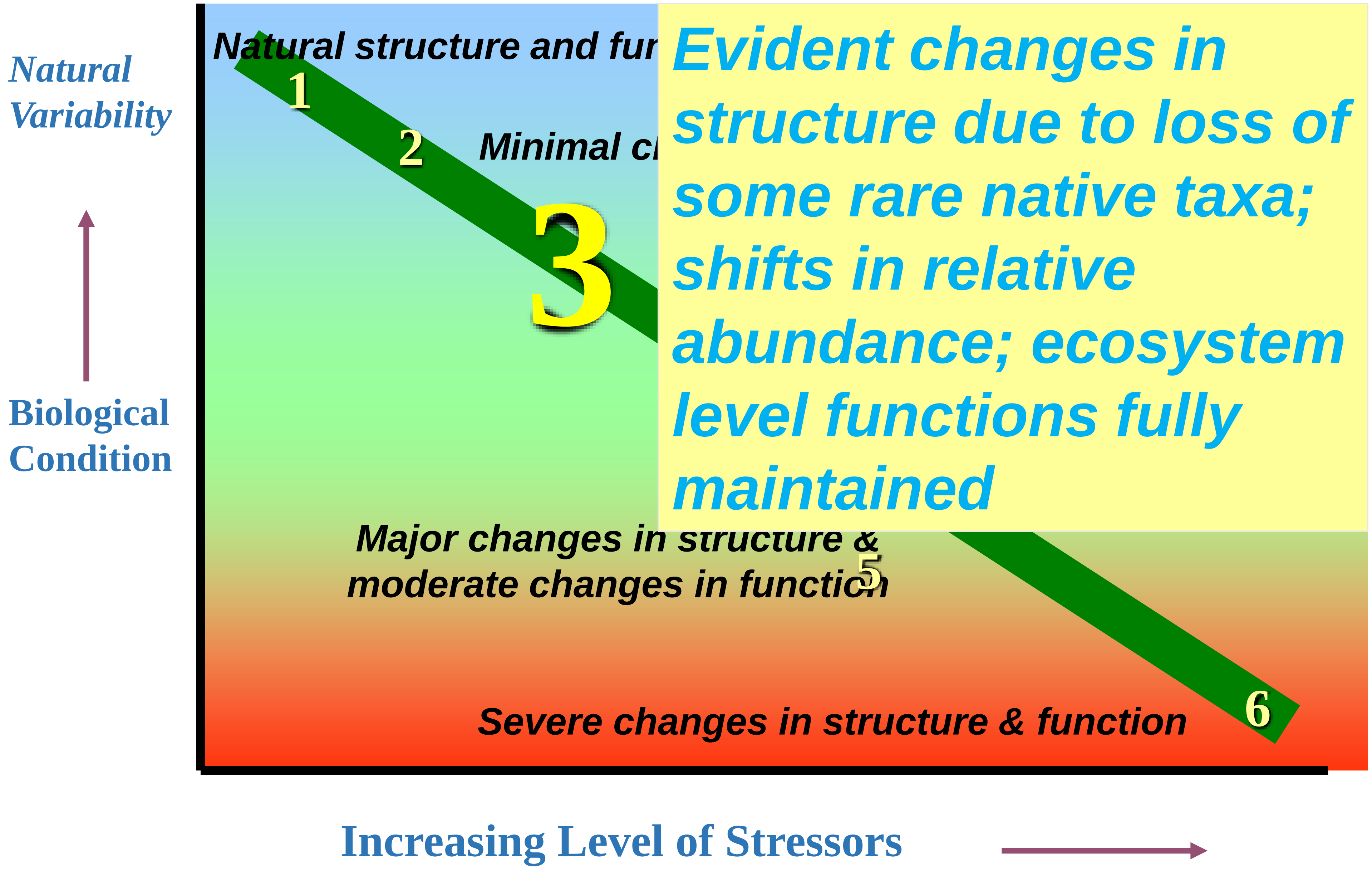


Undisturbed/ minimally disturbed (Maine)

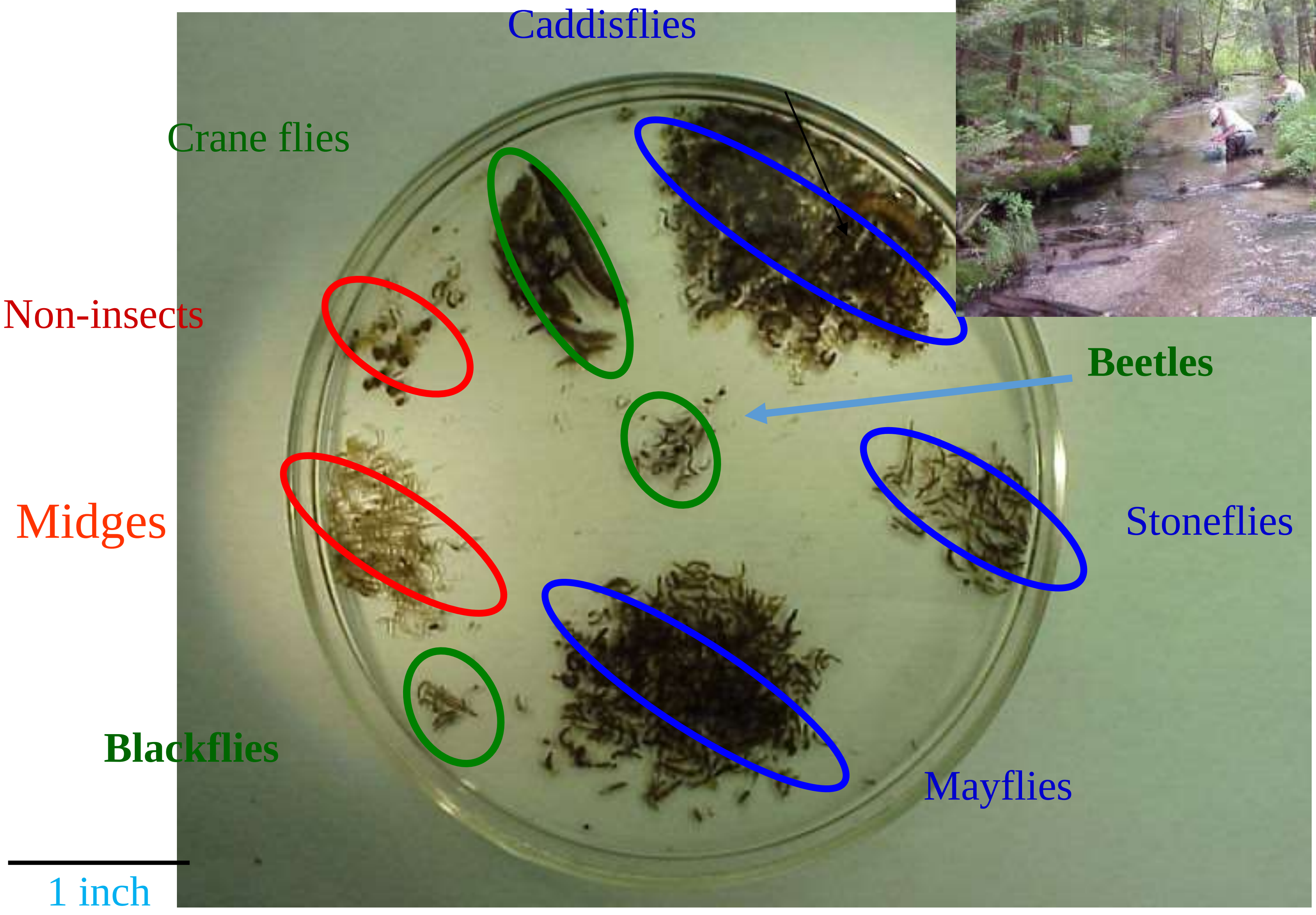


Courtesy of Susan Davies, ME DEP

The Biological Condition Gradient

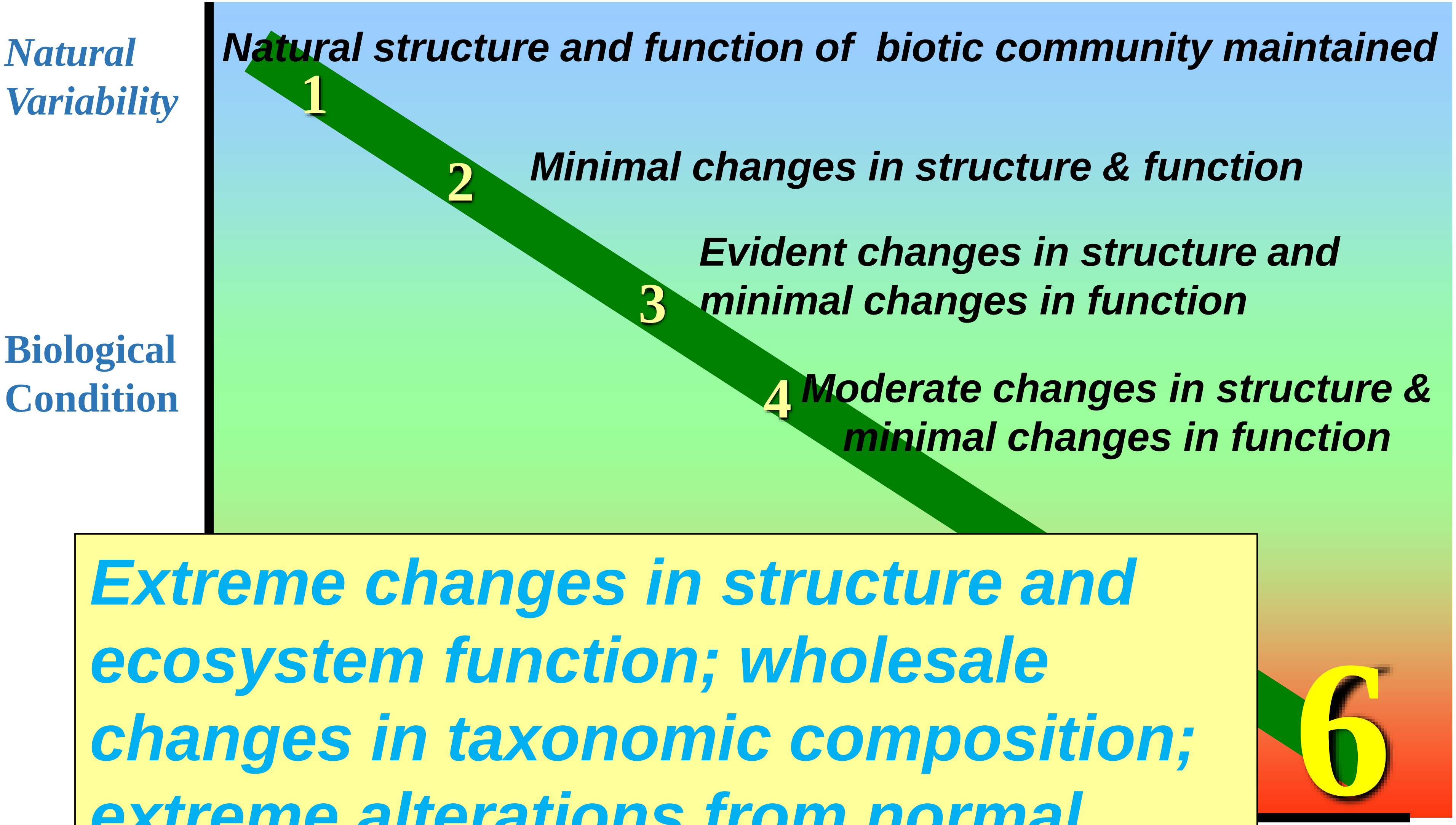


Nutrient enriched



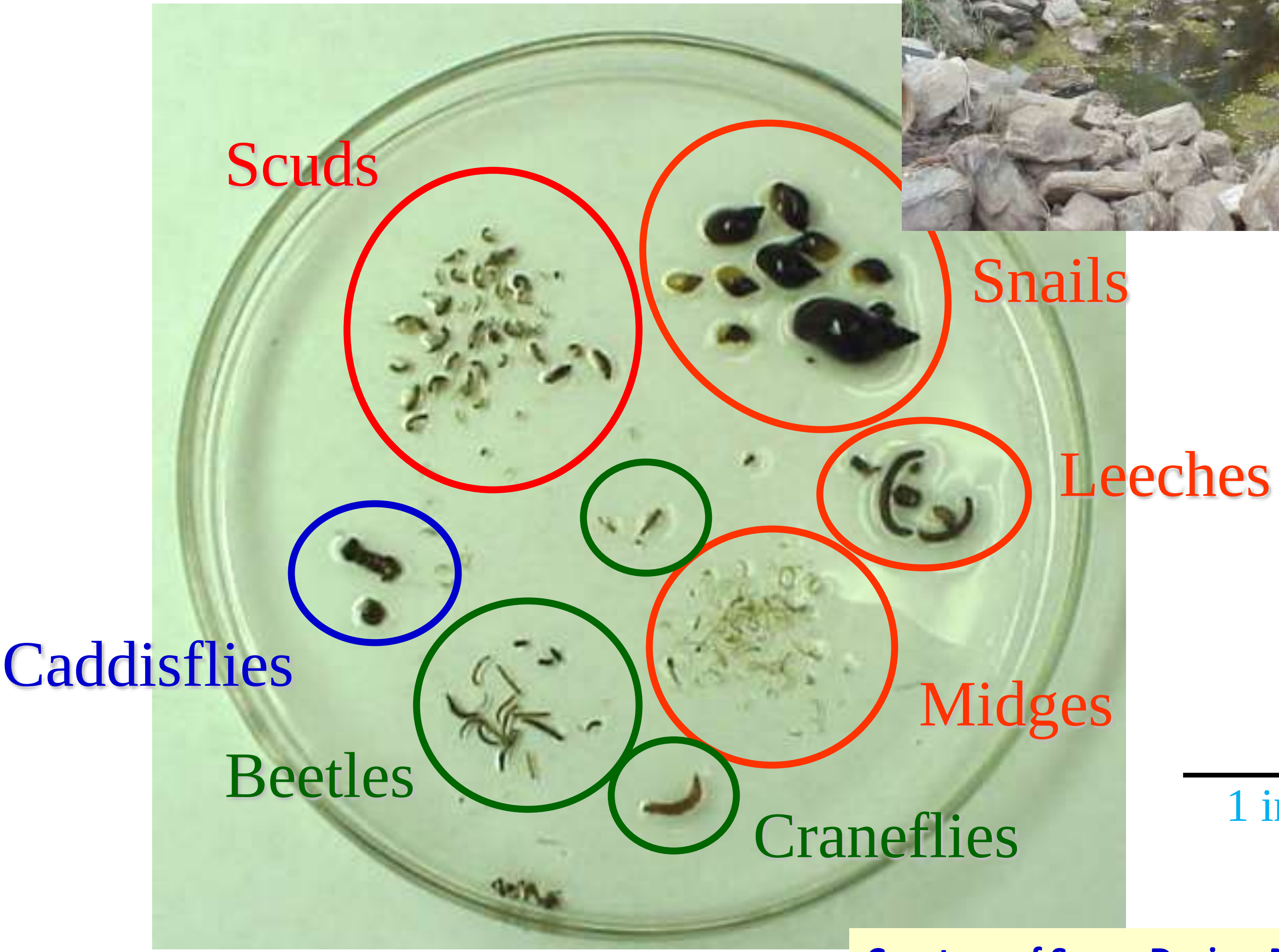
Courtesy of Susan Davies, ME DEP

The Biological Condition Gradient



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

Stream below large shopping mall



1 inch

Courtesy of Susan Davies, ME DEP

Basic idea

- What do we expect to see?
  - Species, abundances
  - Habitats
  - Biotopes
  - Interactions
- What do we **not** expect to see?
  - What is missing?
  - What is present that shouldn't be?

BCG Properties

- Universal assessment scale: pristine to severely degraded in discrete levels; defined by expert consensus
- Not dependent on present-day least stressed (Best that is left)
- Levels can be discriminated and their differences are biologically meaningful
- Discrete levels are framework for assessment and management:
  - Criteria setting
  - Define restoration goals
- Communicates condition to stakeholders
- Conceptual: narrative description of levels of condition
- Quantitative: multiple attribute decision model

Biological Attributes

- **Taxonomic composition**
  - I) Documented, sensitive, long-lived or endemic taxa
  - II) Highly sensitive or specialist taxa
  - III) Sensitive and common taxa
  - IV) Taxa of broad, intermediate tolerance
  - V) Tolerant taxa
  - VI) Non-native taxa
- **VII) Organism condition**
- **VIII) Ecosystem function**
- **Spatial attributes**
  - IX) Extent of detrimental effects
  - X) Ecosystem connectivity

Development and Calibration

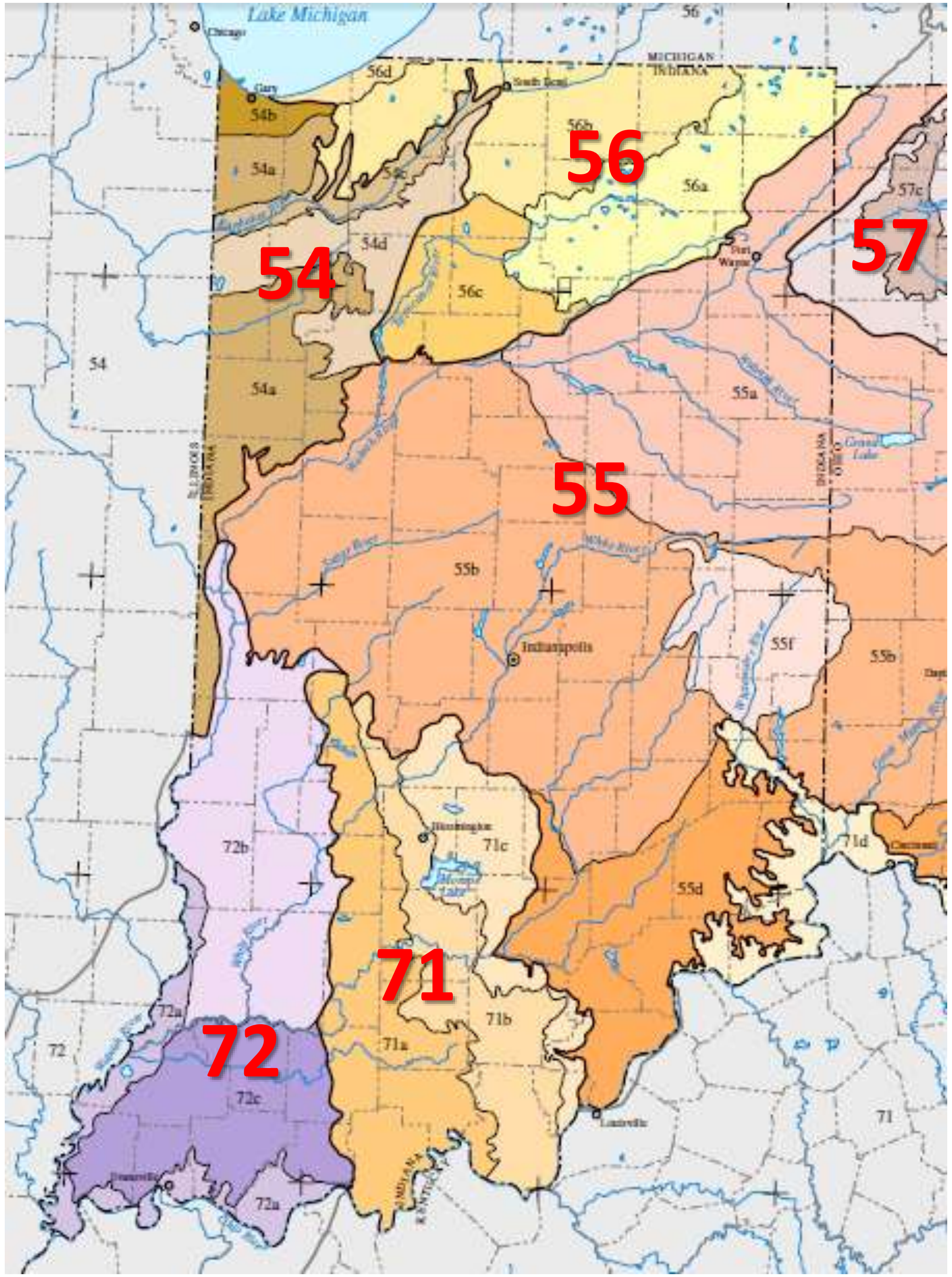
Describe conceptual model for region; convert to quantitative application

- Regionalization (complete for California)
- Identify attributes and taxa that contribute
  - Existing knowledge of tolerance, traits
  - Empirical support from monitoring database
- Describe regional stressors and pristine
- Expert assignment of sites to BCG levels
  - Narrative descriptions of levels
- Quantitative rules from expert assignments

1. Regionalization (Indiana)

Three meaningful regions (fish):

- Northern: So. Michigan / No. Indiana Drift Plains (56) + Central Corn Belt Plains (54)
- Central: Eastern Corn Belt Plains (55) + Interior Plateau (71)
- Southwest: Interior River Lowlands (72)

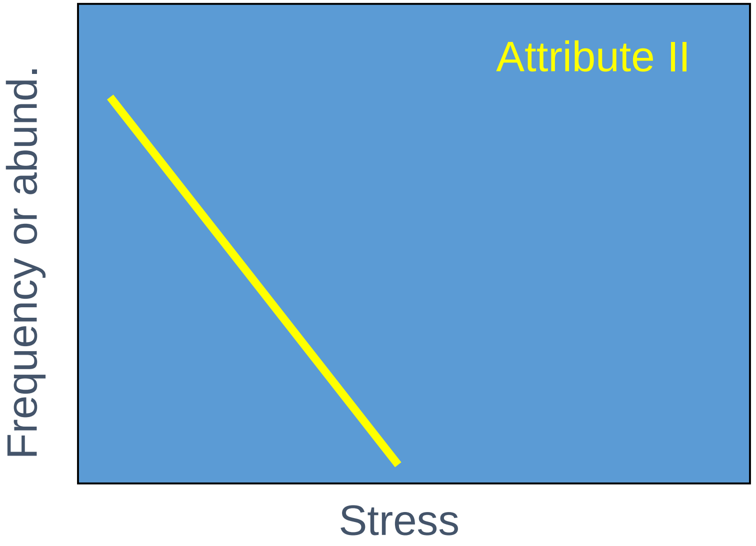


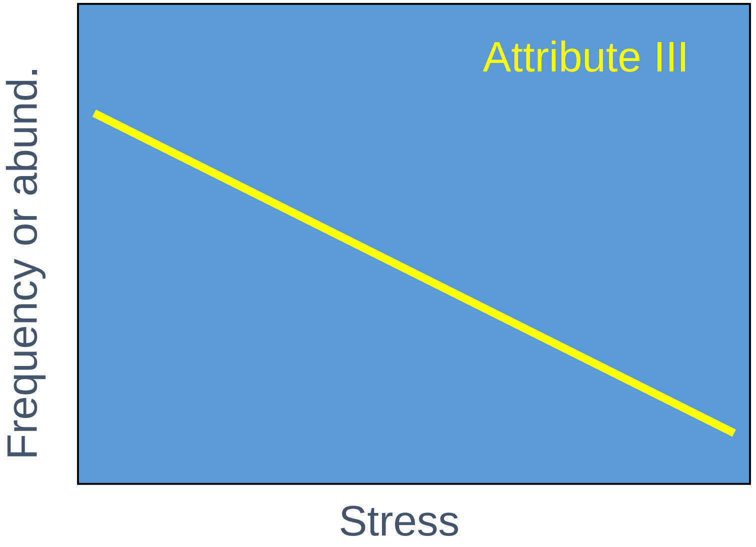
2. Identify attributes: Sensitive Taxa

- Attribute II: Highly sensitive taxa: optimum in best sites, narrow tolerance. First to disappear

- Attribute III:Intermediate - sensitive taxa: Sensitive but more tolerant: optimum in best sites, but also occur in poorer sites

- Attribute I: rare-endemic taxa – are they necessarily sensitive?



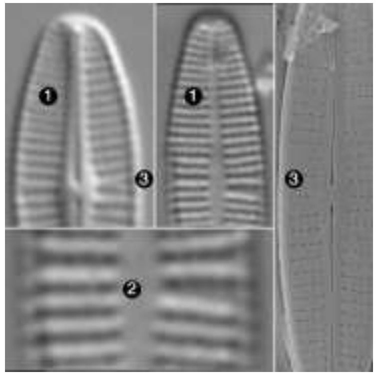


Attributes and metrics

New Jersey diatoms

Sensitive taxa
Achnanthidium rivulare
Achnanthes subhudsonis var. kraeuselii
Achnanthidium deflexum
Achnanthidium altergracillima
Fragilaria capucina
Sellaphora pupula
Eunotia formica

Attribute 2 taxa: most sensitive; the first to disappear



Achnanthidium rivulare

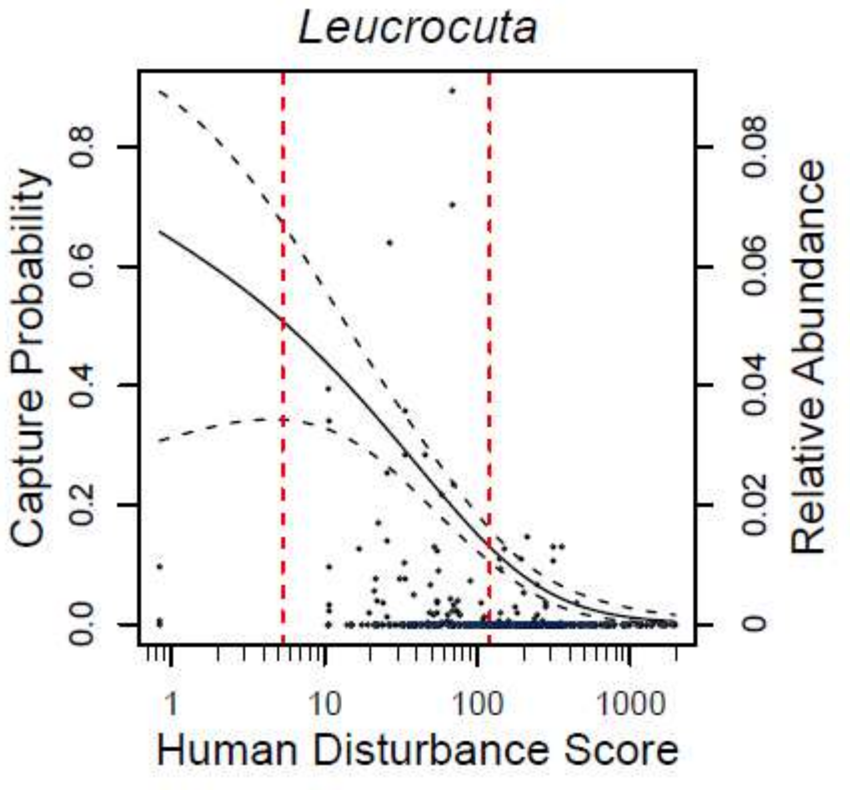
Attribute 3 taxa: moderately sensitive

Eunotia formica

Fragilaria capucina

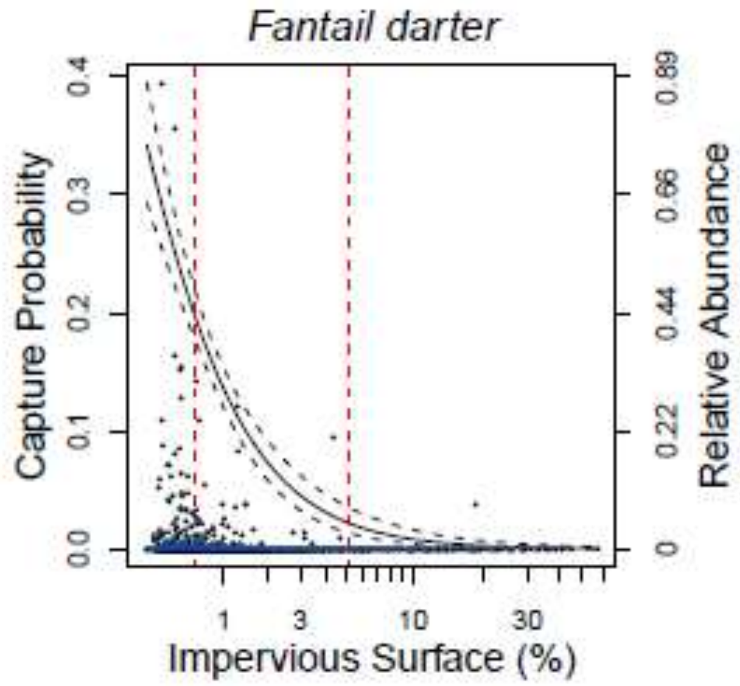
Supplemental information: Models of response from monitoring data

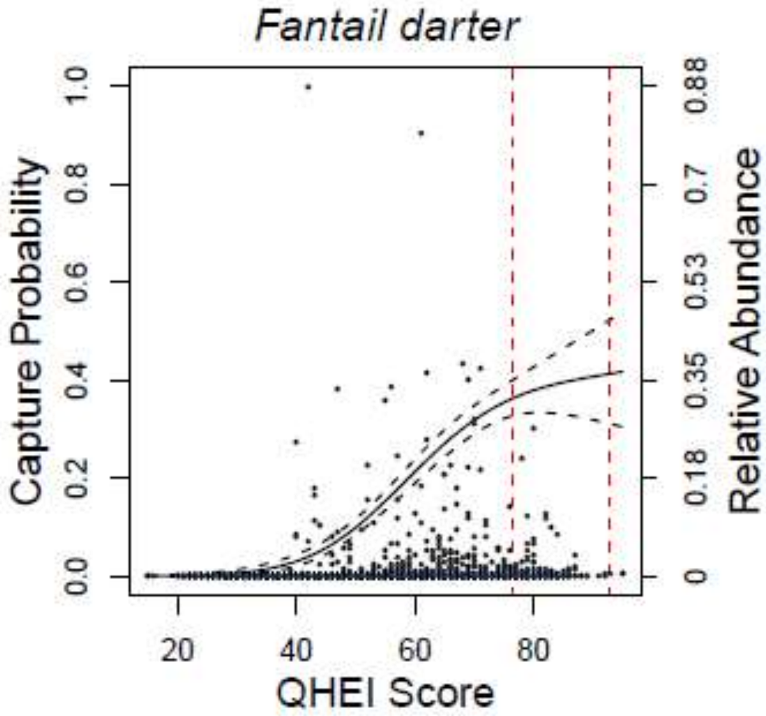
- Points: actual data of relative abundance
- Curve: capture probability (Generalized additive model fit and confidence interval)
- 5% capture probability and 50% probability (red dashed lines) represent tolerance and optimum



(Northern Alabama)

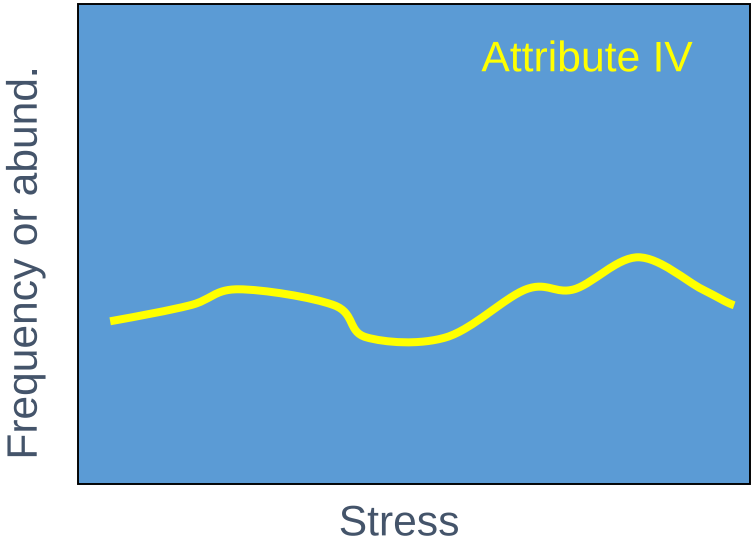
Intolerant fish (Indiana)



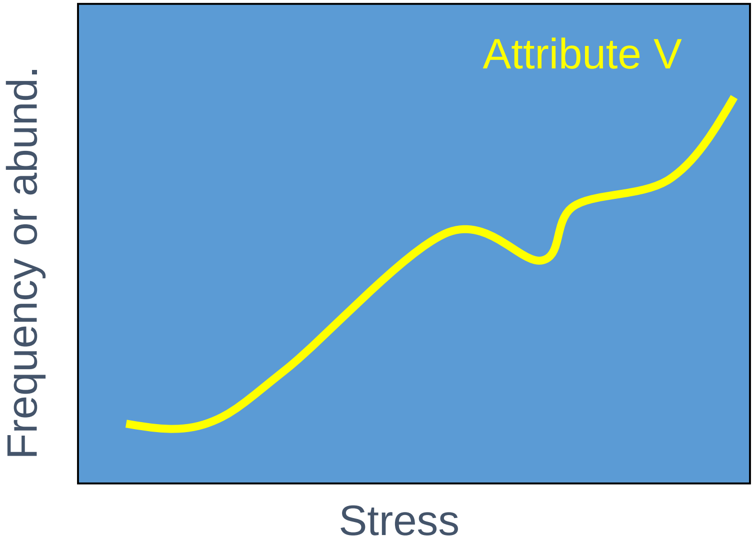


Tolerant Taxa

- Attribute IV: intermediate tolerance, found anywhere

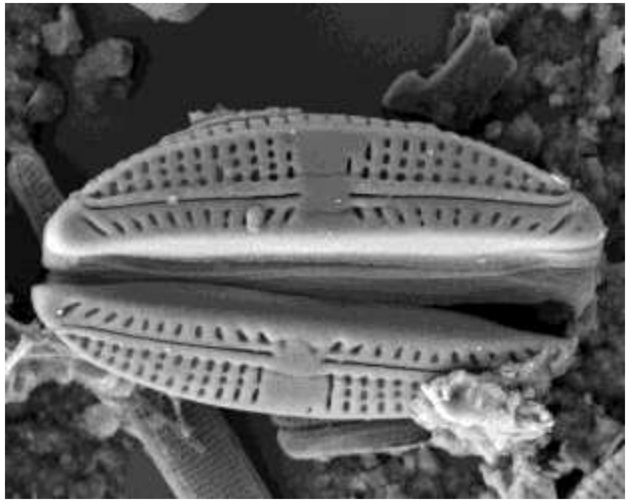


- Attribute V: tolerant taxa; optimum in worst sites, broad tolerance. Last survivors

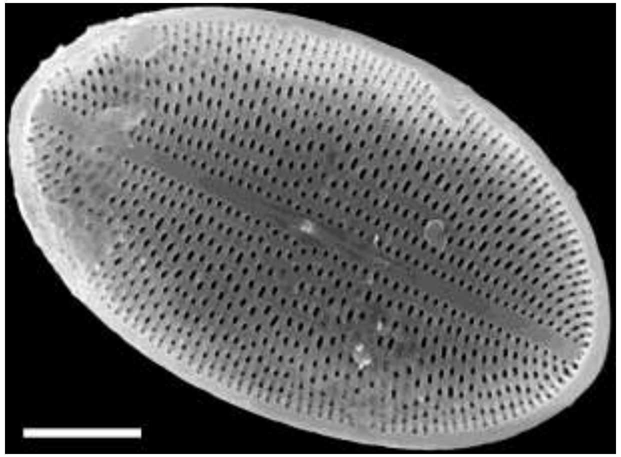


New Jersey diatoms

Attribute 4 taxa: broadly tolerant
Planothidium frequentissimum
Cocconeis placentula var. lineata
Amphora pediculus
Nitzschia dissipata
Caloneis bacillum
Planothidium lanceolatum



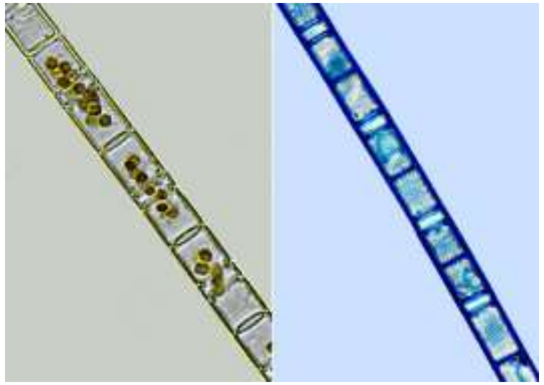
Amphora pediculus



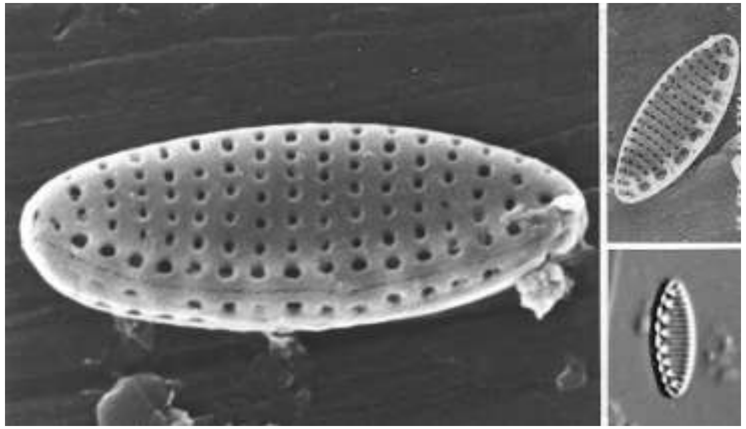
Cocconeis placentula var. lineata

New Jersey diatoms

Highly tolerant taxa
Rhoicosphenia abbreviata
Navicula gregaria
Nitzschia amphibia
Sellaphora seminulum
Melosira varians
Navicula minima
Nitzschia inconspicua

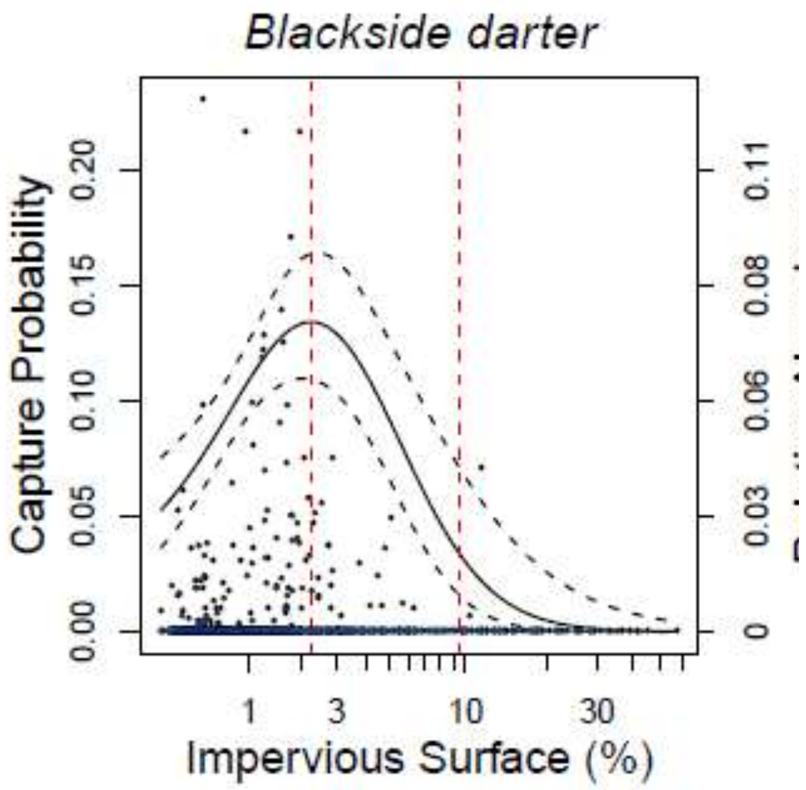


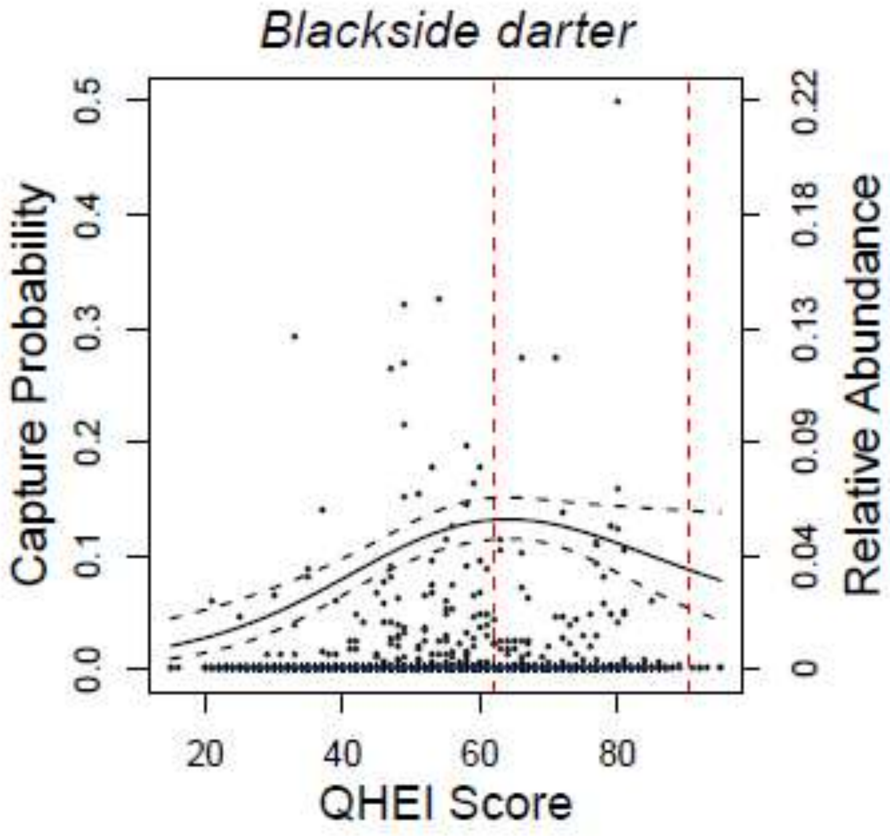
Melosira varians



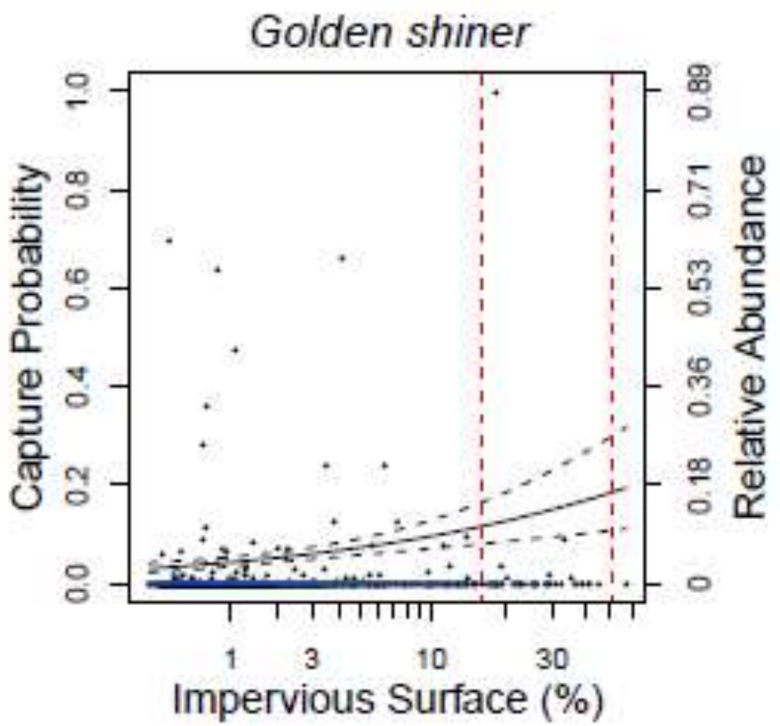
Nitzschia inconspicua

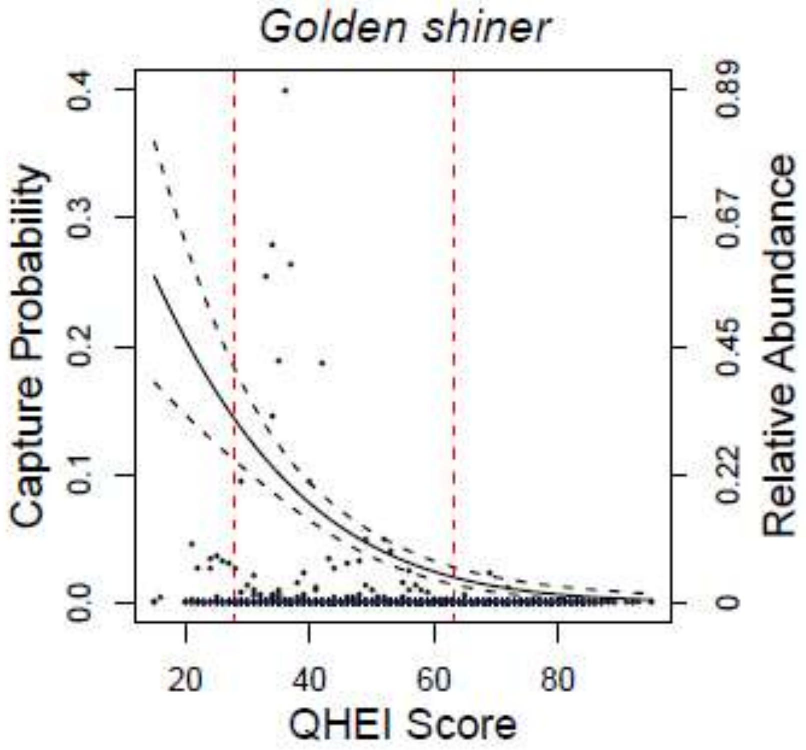
Intermediate tolerant fish (Indiana)





Tolerant fish (Indiana)





3. Describe undisturbed

- Reference sites are not necessarily undisturbed!
- Capture critical information for decisions
- Be aware of shifting baselines

Evidence for natural baseline

- Present-day conditions (may not qualify)
- Historical reconstruction
  - Historical documents (descriptions, journals, charts, aerial images)
  - Fish/shellfish landings records
  - Museum collections
  - Archeological evidence (middens, other digs)
  - Paleo evidence (diatoms, forams, pollen)

4. Develop decision rules

- Panel members assign sites to BCG levels using biological information; narrative description
- Record reasons why, e.g., “not enough sensitive taxa”
- Conceptual uncertainty at boundaries of Levels
  - Panelists unwilling to make “hard” boundary rules between categories, e.g., “a Level 3 site must always have at least 5 Attribute 3 taxa”
  - Tend to use strength of evidence, using multiple attributes for decisions

Maryland Piedmont invertebrate rules

<table>
<tr><th>Metric \ BCG Level</th><th>2</th><th colspan="2">3</th><th>4</th><th>5</th></tr>
<tr><td>Total Taxa, richness</td><td>≥13-22</td><td colspan="2">≥13-22</td><td>≥10-20</td><td>≥6-10</td></tr>
<tr><td>Att II, % of taxa</td><td>≥5-10%</td><td>--</td><td>≥0-2 (n)</td><td>--</td><td>--</td></tr>
<tr><td>Att II, % abundance</td><td>≥ 2-5%</td><td colspan="2">--</td><td>--</td><td>--</td></tr>
<tr><td>Att II + III, % of taxa</td><td>≥ 45-55%</td><td>≥ 20-30%</td><td>≥ 40-50%</td><td>≥ 15-25%</td><td>--</td></tr>
<tr><td>Att II + III, % abundance</td><td>≥ 55-65%</td><td colspan="2">≥ 35-45%</td><td>≥ 5-15%</td><td>--</td></tr>
<tr><td>Att V , % abundance</td><td>≤ 10-20%</td><td>≤ 35-45</td><td>≤ 45-55</td><td>≤ 65-75%</td><td>≤ 80-90%</td></tr>
<tr><td>Dominant Att V Taxon, % abundance</td><td>--</td><td>≤ 15-25%</td><td>--</td><td>≤ 55-65%</td><td>≤ 65-75%</td></tr>
</table>

4. Quantitative BCG models

- Direct: decision model from expert-derived logic train
- Calibrate other index (IBI) models to BCG concepts (Ohio EPA, PA wetlands)
- Discriminant function models (Maine DEP)
  - Requires sizable training set of expert-assigned sites
- Bayesian models (USGS; Kashuba et al. 2012)

Boundaries

2m

Tall persons

180 cm

Not tall persons

A person measuring 179.9 cm is not tall; one at 180.1 cm is tall.

1m

0

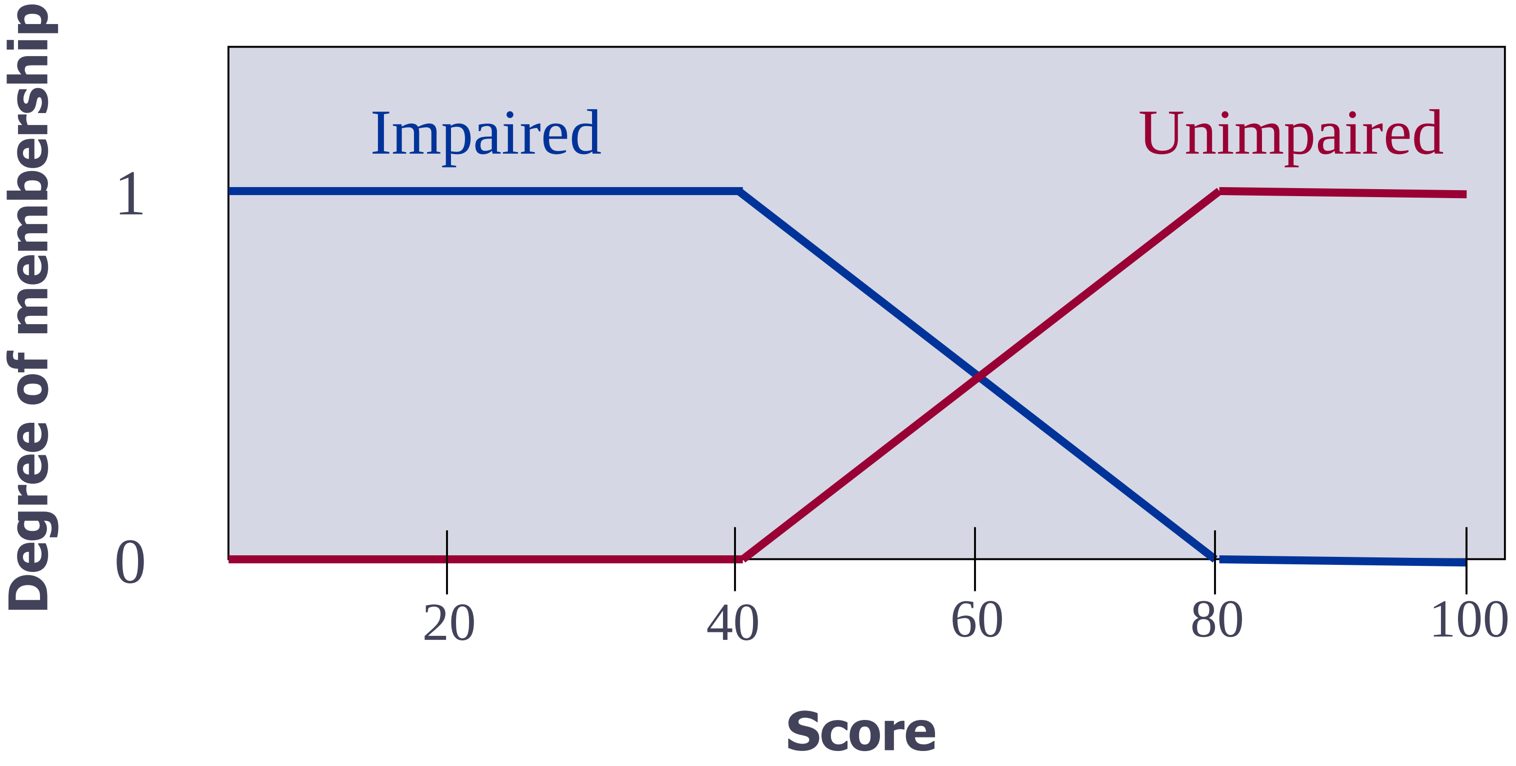
Wes Unseld, NBA Hall-of-Famer & U.S. Sen. Barbara Mikulski

Set Theory

- A “fuzzy set” is not either/or, but has uncertain boundaries, i.e., a membership function with values in the interval [0,1].
- Logic and operations using fuzzy sets result in degrees of truth of a proposition, just as membership in a set.

“Fuzzy logic is a precise logic of imprecision and approximate reasoning” Zadeh 2008

Membership functions



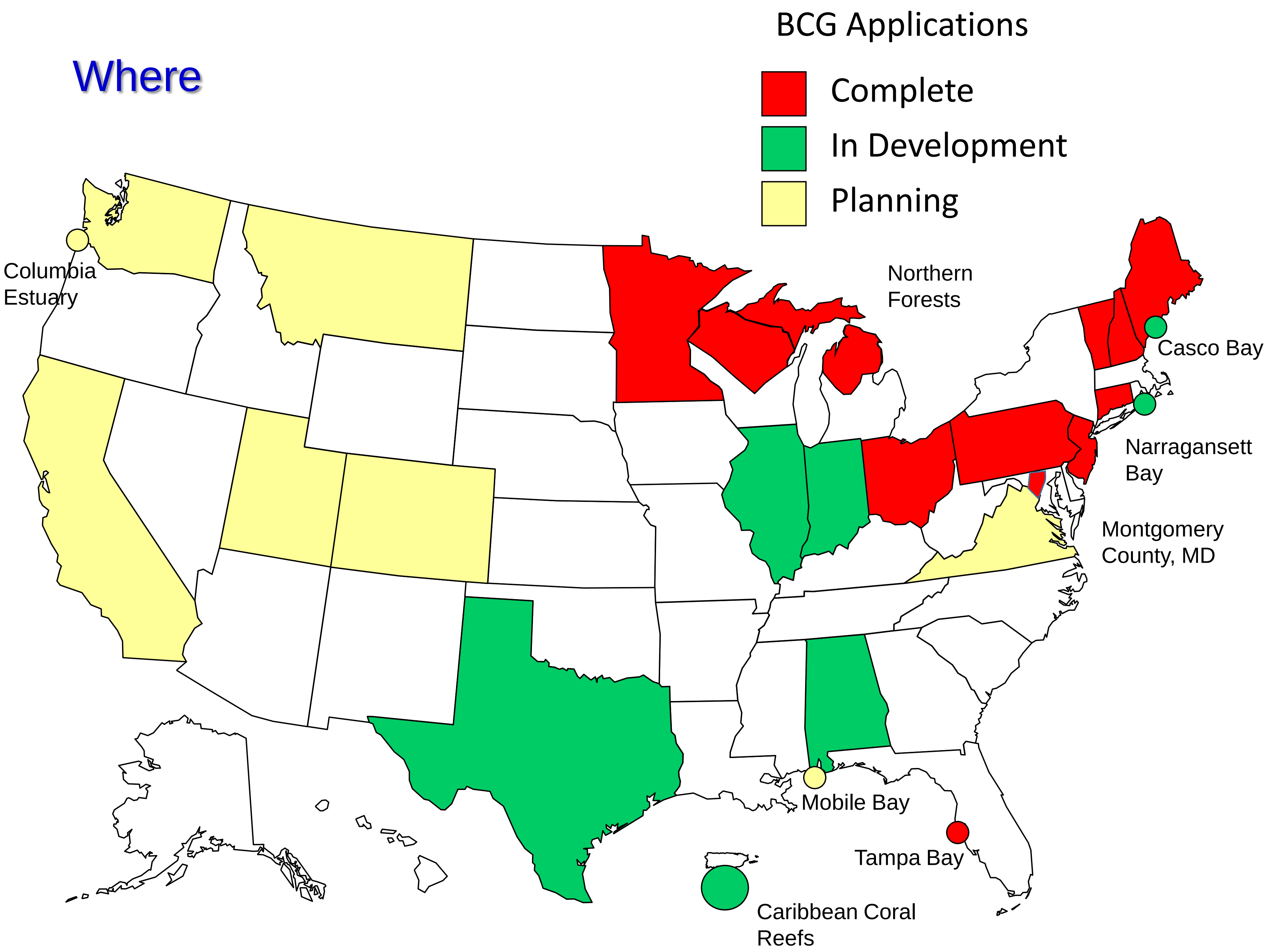
Set theory models for BCG

- Numeric, transparent rules derived from expert judgment
  - Experts’ decisions are codified as rules – no need to reconvene
  - Transparency: logic of development can be followed; rules can be changed
- Rules, metrics can be nonlinear, nonmonotonic
- Incorporates uncertainty of boundaries
- Robust to missing information
- Overcome disadvantages of common indexes
  - Eclipsing
  - Arbitrary weighting

Applications

BCG and Water Quality Standards

Where

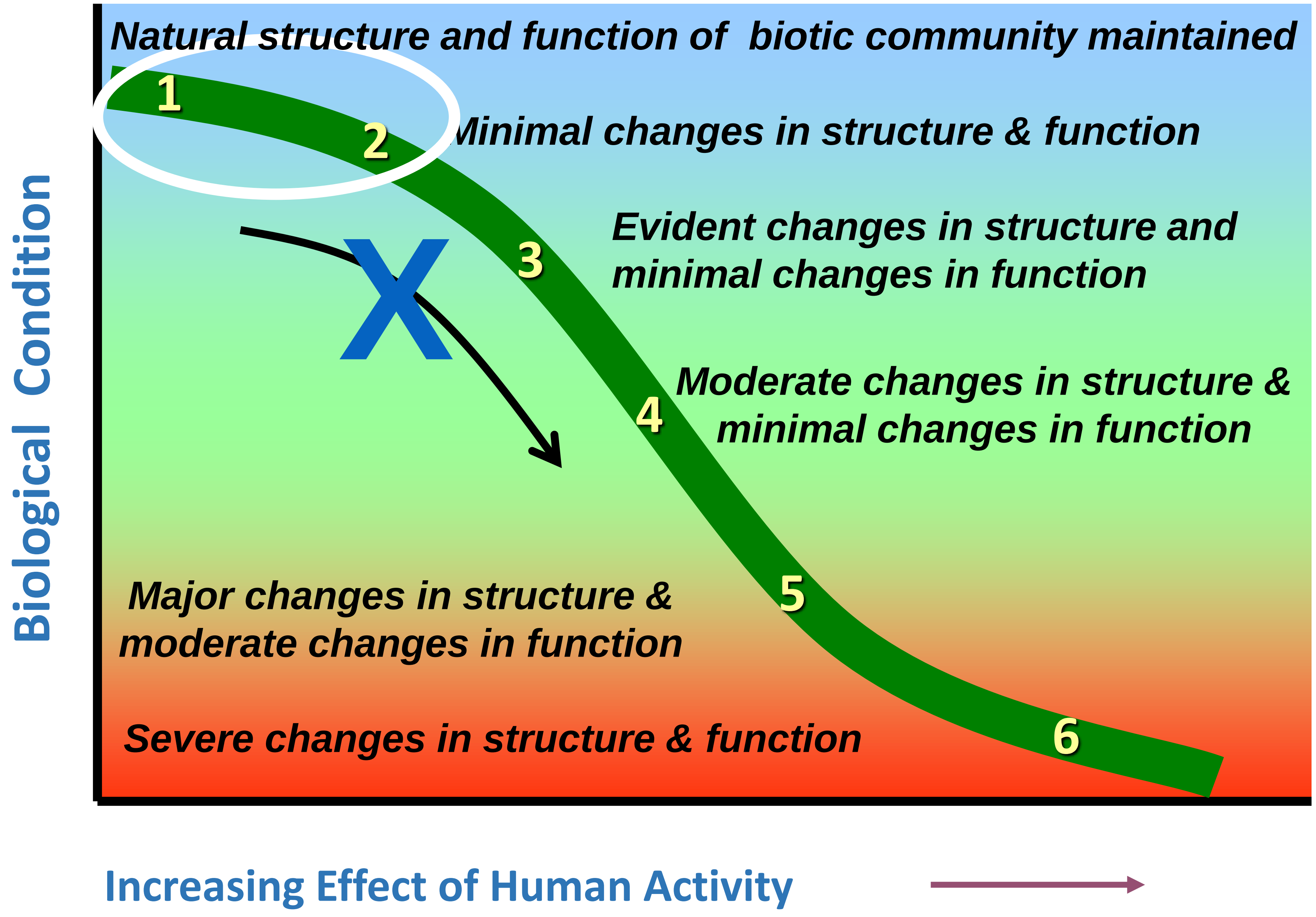

BCG Applications
Complete
In Development
Planning
Columbia Estuary
Northern Forests
Casco Bay
Narragansett Bay
Montgomery County, MD
Mobile Bay
Tampa Bay
Caribbean Coral Reefs

Assemblages

- Stream benthic macroinvertebrates: Maine, New England, Vermont, Connecticut, New Jersey, Pennsylvania, Ohio, Minnesota, Northern Midwest forests, Northern Piedmont, Alabama, Illinois*
- Stream fish: Connecticut, Ohio, Minnesota, Northern Midwest forests, Northern Piedmont, Alabama, Illinois*, Indiana *
- Lake fish: Minnesota
- Stream diatoms: Maine, New Jersey, California?
- Estuary biotopes: Tampa Bay, Narragansett Bay *
- Corals and reef fish: Puerto Rico*

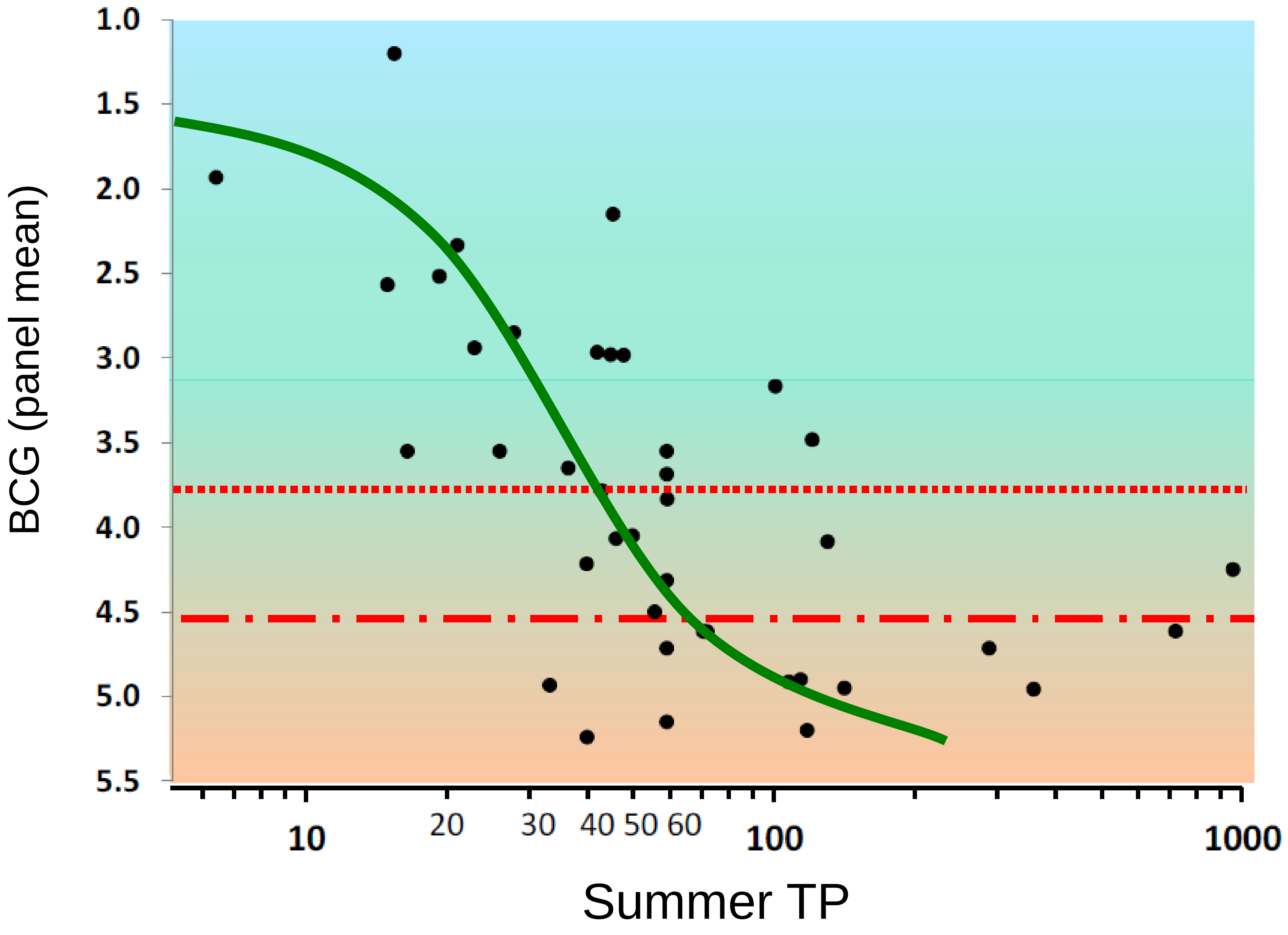
* In development

Biological Condition Gradient-Protect HQ Waters

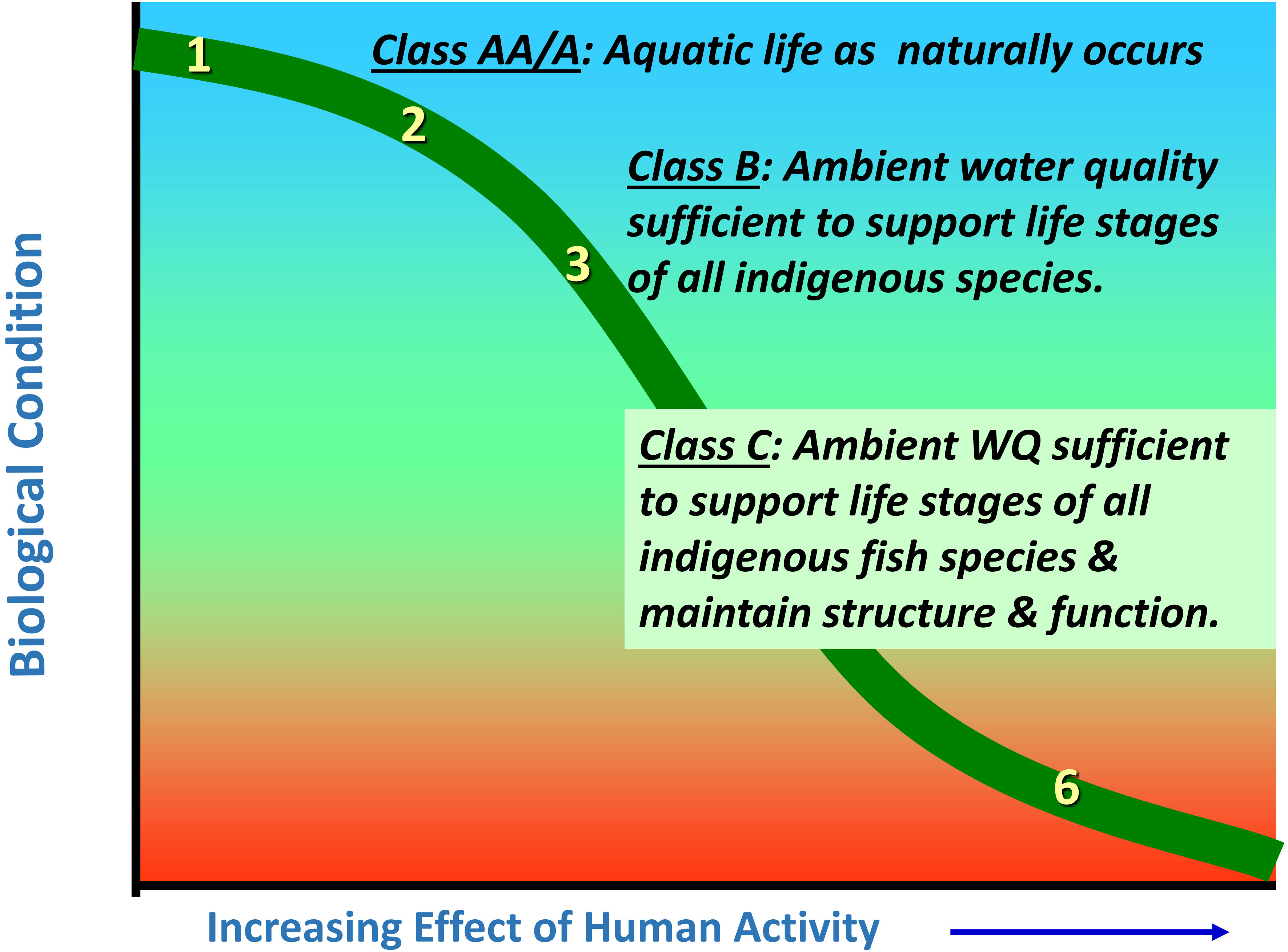


NJ diatoms:

Comparison of BCG categories versus observed Summer TP [µg/L]



Designated Aquatic Life Uses: Maine Example



Maine Water Quality Re-Classification History

- **1990-2003 UPGRADES = 1,441 miles**
  - Class C to Class B= 68 miles
  - Class B to Class A= 798 miles
  - Class B to Class AA= 59 miles
  - Class A to Class AA= 346 miles

Reasons

- Trout; Atlantic salmon protection
- Tribal petitions
- Point-source improvement; dam removal

- **1998-2003 DOWNGRADES = 5 miles**
  - Class B to Class C (UAA due to impoundment + point sources)

How can BCG help?

States and Tribes can use biological Information to refine (or “tier”) aquatic life uses

- Levels of condition: detectable and have biological meaning
- Avoids “shifting baseline”; levels are on conceptual universal scale with a fixed anchor point
- Framework for assessment, management and criteria
    - Interpretation and communication
    - Tiered criteria
- Rule-based quantitative BCG is transparent and avoids common index problems

CA BCG Workplan

Tasks

Follows the BCG Process

1. Identify Experts
2. Data Management and Distribution
3. Introduction to BCG and Site Classification – Workshop 1
4. Prepare data for expert scoring
5. Expert Scoring and reconciliation
6. Develop a crosswalk from condition classification to assessment index endpoints

Tasks 1 and 2 – Identify Experts and Data Management and Distribution

Identify Experts

- Algal experts : ~6 with expertise in diatom/soft algae ecology
- Stream invertebrate experts: ~10 with invertebrate ecology expertise

Data Management and Distribution

- Assemble and compile biological data – raw counts and metrics
- Include associated classification information and sample metadata
- Compile or construct existing species specific tolerance information and/or species response/tolerance plots

Task 3 - Introduction to BCG Protocol and Site Classification – Workshop 1

2 day workshop for algae and invertebrate experts

- Introduction to BCG
- Trial Site Ranking Run (3-5 sites spanning stressor range within one class)
    - Assigning sites to BCG levels
    - Convene and discuss
- Consensus on classification
    - Use existing classifications
    - Explain to panelists and discuss
- Define attributes and discuss taxa assignments
    - Grounding external experience in regional data

Task 4 - Prepare data for expert scoring

Assemble biological data for 150-200 sites along the stressor gradient

- Taxonomic data, summary metrics, sample metadata, classification information, and natural environmental gradient data. No stressor information.

Generate biological data for 20-30 sites per class

- Gradient of stress but stressor level is blind to experts

Task 5 - Expert scoring and reconciliation – Workshop 2

Experts assign sites to BCG levels

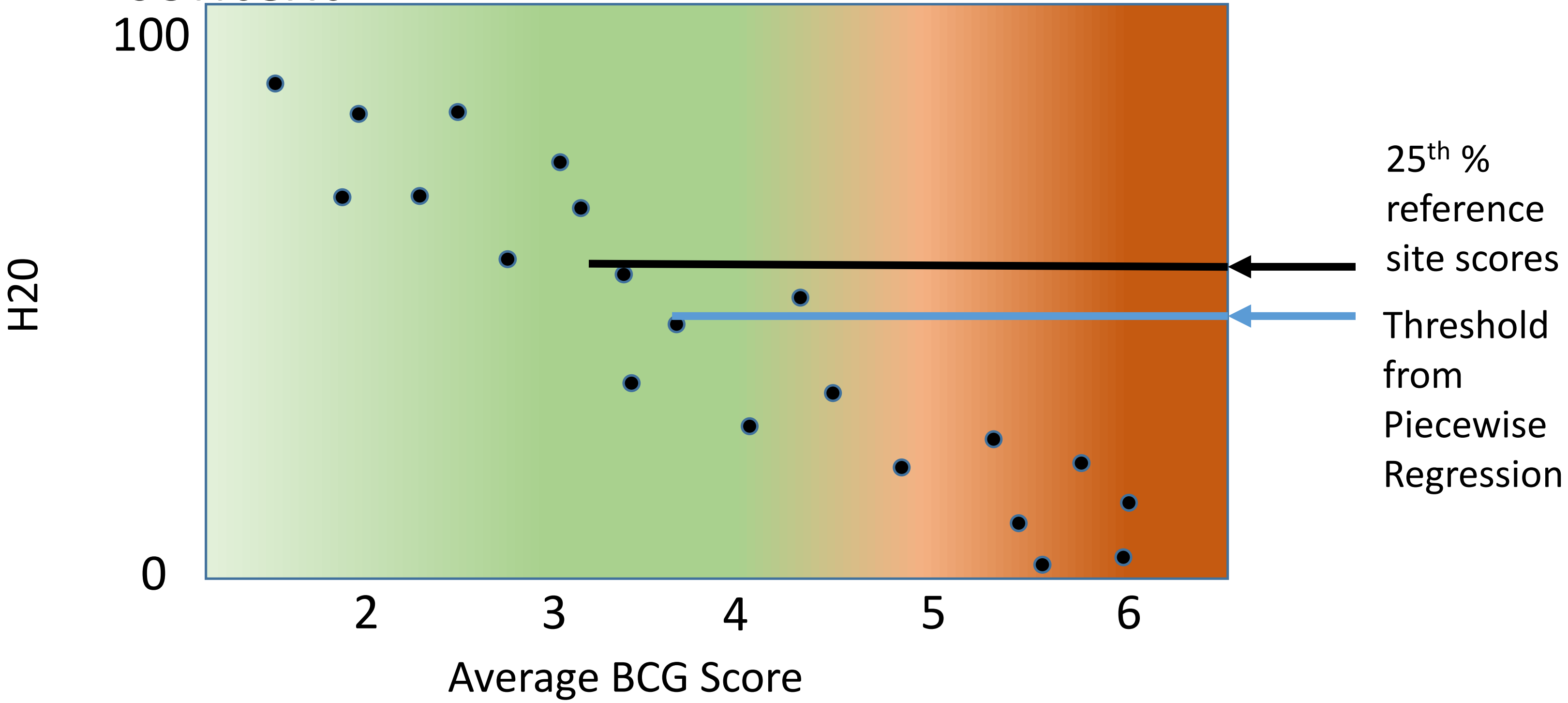
Record reasoning behind scoring

Second 2-3 day workshop

- Discuss scoring
- Reconcile scores
- Identify decision rules

Task 5 - Develop crosswalk

- Map biotic response/nutrient thresholds to BCG scores
- Translate assessment endpoints into BCG context



Goals for the Meeting

- Provide brief updates on status of policy and technical program elements;
- Summarize SAG comments on the Science Plan and describe what changes have been made or are pending in response to SAG comments;
- Provide an overview of recent experiences in using BCG models to support nutrient criteria development and present proposed California BCG workplan;
- Discuss possible approaches to classifying modified channels and how to incorporate nutrient management activities into Science Plan
- Review and suggest revisions to the Science Panel Charge and Agenda.

Context

- Stakeholders commented that the wadeable stream science plan was silent on “modified channels”
- State Water Board is determining how to proceed
  - —Consulting with both regulatory and stakeholder advisory groups
- Starting the conversation today to get your input on approaches to define “modified”
- It is okay to discuss concepts on how one might define modified streams with the group, but it’s the State Boards decision.

Modified - Urban

Modified – Agriculture/Grazing

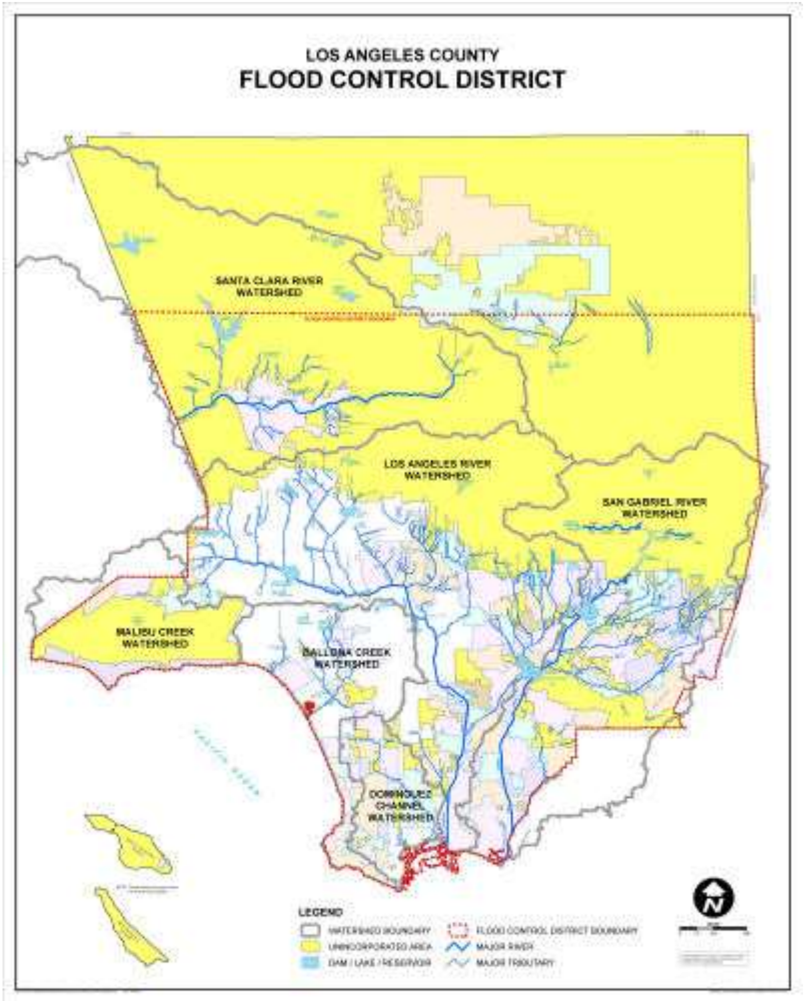
Guiding Principles

- Defining “Modification” a policy rather than a science question
- Developed is easier to define than modified
  - —May be more accurate
- Simple preferred over complex
  - —Reproducible and easy to understand
  - —Doable in the short term
- Easy to define expectation (science) but hard to define achievability (policy)

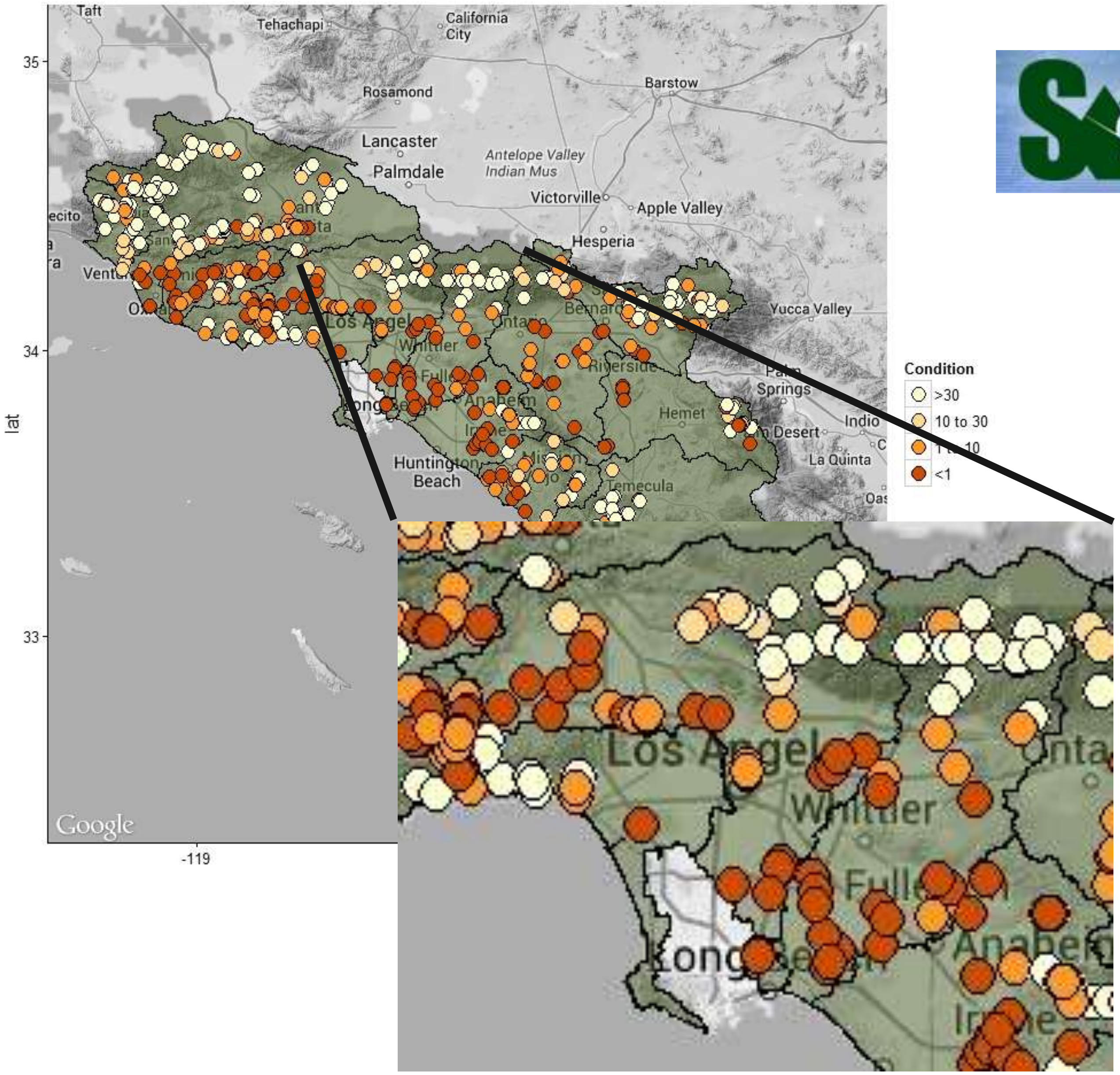
Approaches for Identifying and Mapping Modified Streams

- Direct observation
  - Most reliable
  - Unlikely to be comprehensive
- Extrapolation from monitoring programs
  - Based on observations
  - Requires extrapolation to areas not visited
- GIS modeling
  - Can provide comprehensive coverage
  - Requires most assumptions
  - Accuracy heavily dependent on calibration data

Direct Observation & Mapping



Extrapolation for Monitoring Locations

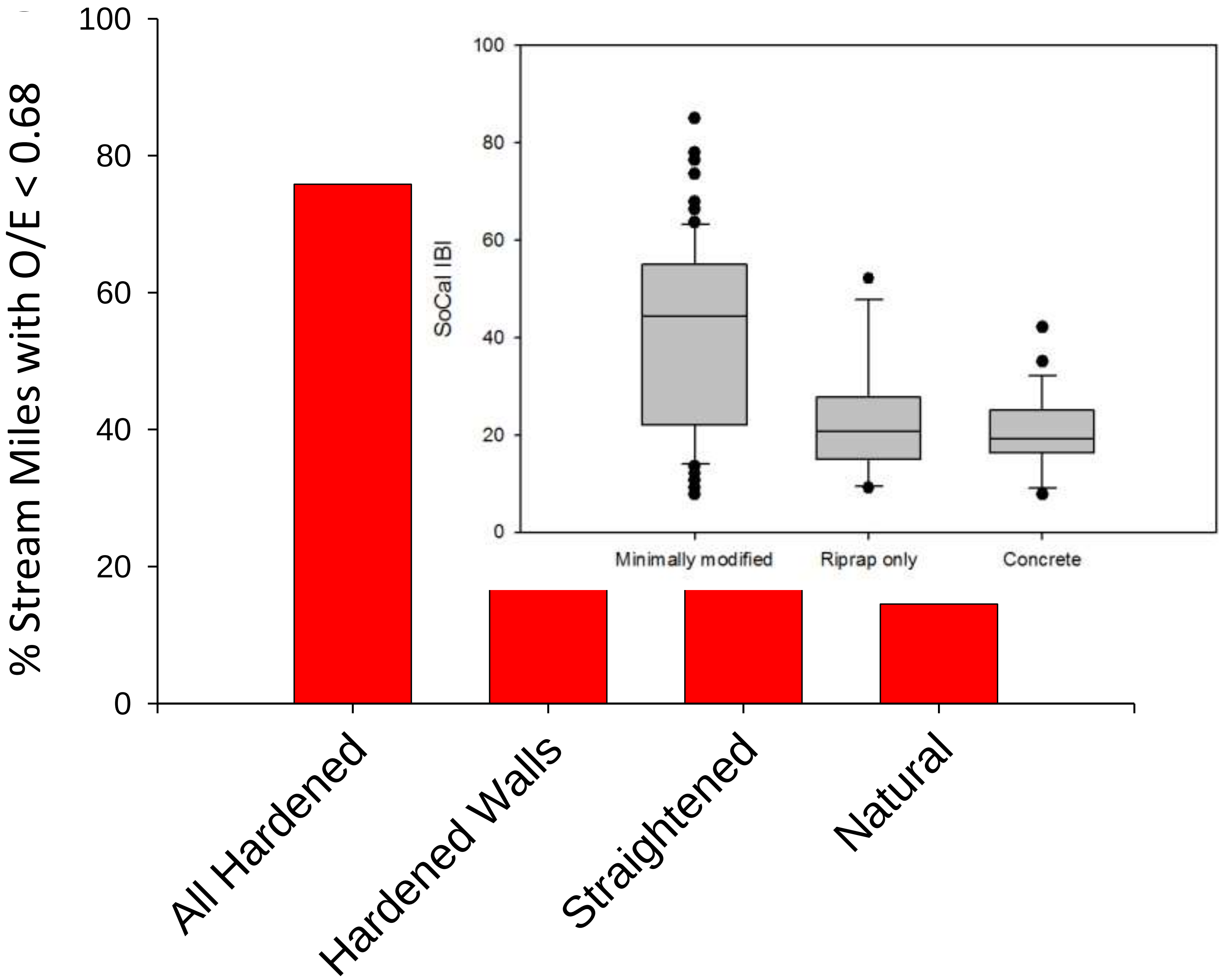


Southern California
STORMWATER MONITORING
Coalition

SMC Pilot Study

Hardened Channel Inventory Based on Probability Sites

Hardscape Classification	All Stream	SMC Mountain	SMC Xeric
Concrete Walls and Bottom	5%	0%	7%
Concrete Walls, Soft Bottom	5%	0%	7%
Unlined, But Straightened	14%	1%	20%
Natural Watercourse	77%	99%	66%


% Stream Miles with O/E < 0.68
100
80
60
40
20
0
All Hardened
Hardened Walls
Straightened
Natural
SoCal IBI
100
80
60
40
20
0
Minimally modified
Riprap only
Concrete

GIS-based based approach for classifying stream reaches by land cover/land use is the most “Simple”

- **What it is –** technical approach that could be used to categorize streams based on land use/land cover activities
  - Can accommodate simple rules-based classification
  - Easily modified with different input data or thresholds

- **What it isn’t –** a proposal for thresholds or classification variables to be specified in policy

2 approaches for spatial analysis

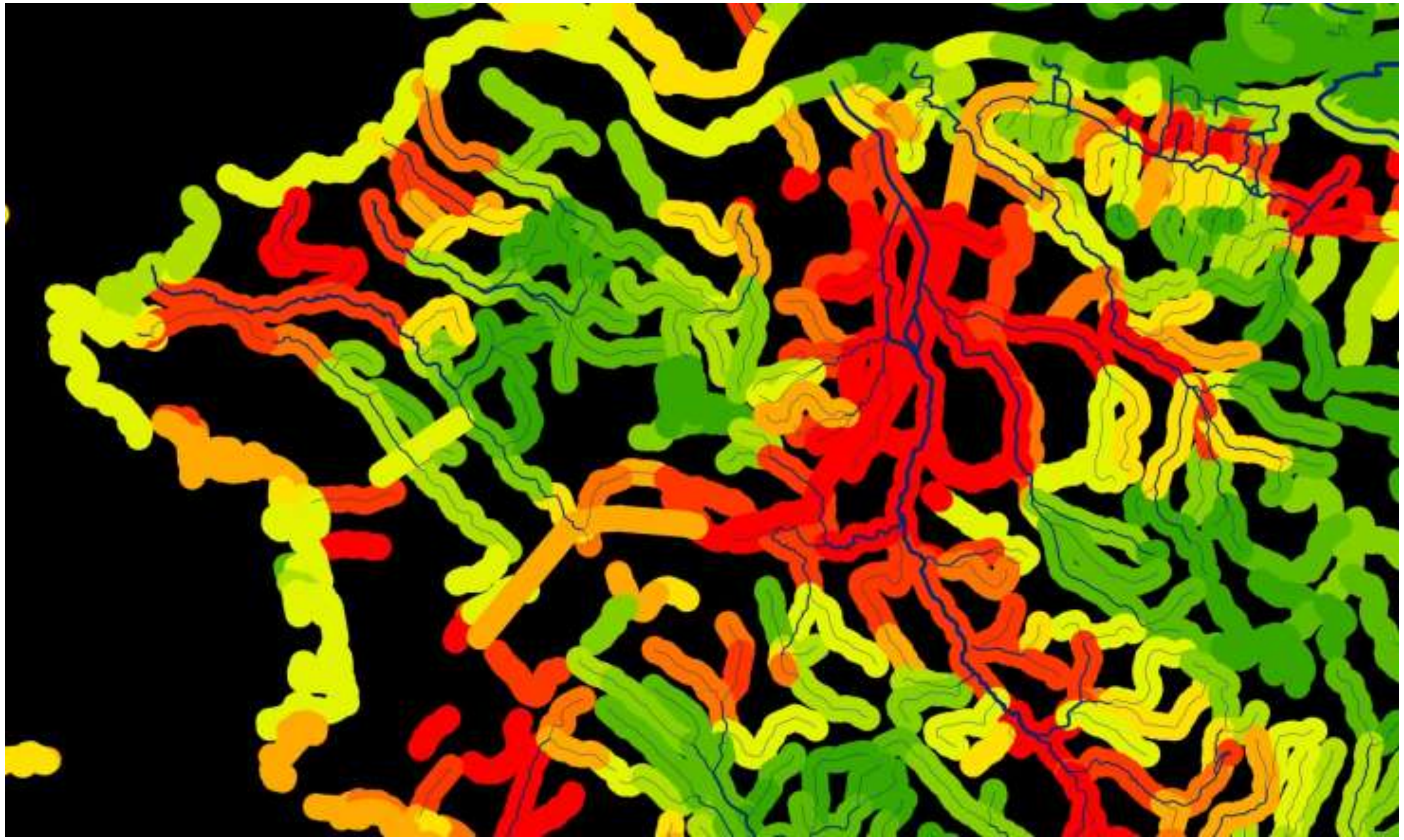
1. Based on near-channel landuse
2. Based on watershed/catchment landuse

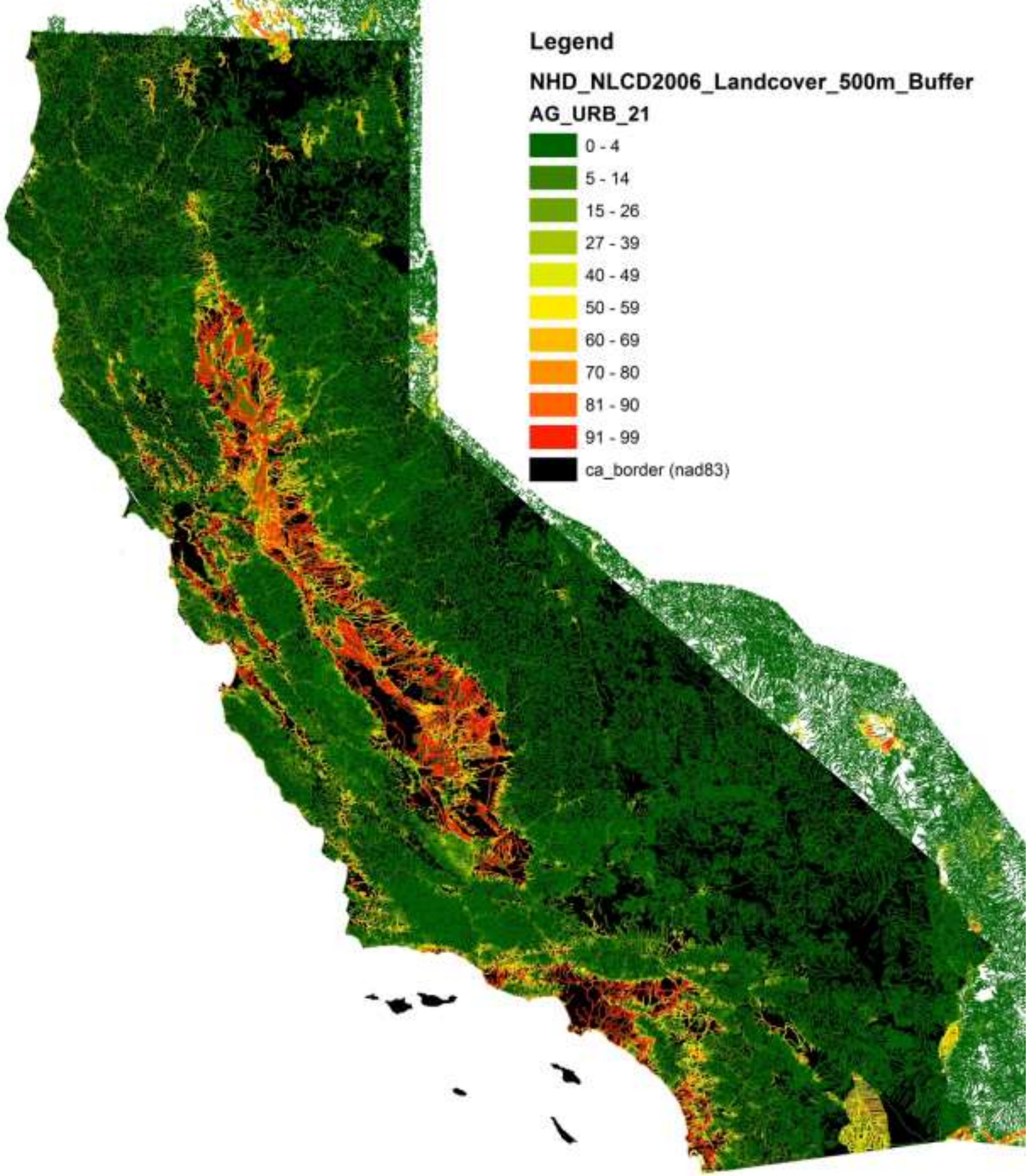
Examples use simple land use/land cover parameters, could accommodate more complexity if desired (i.e., different combinations of land uses, thresholds, hybrid versions)

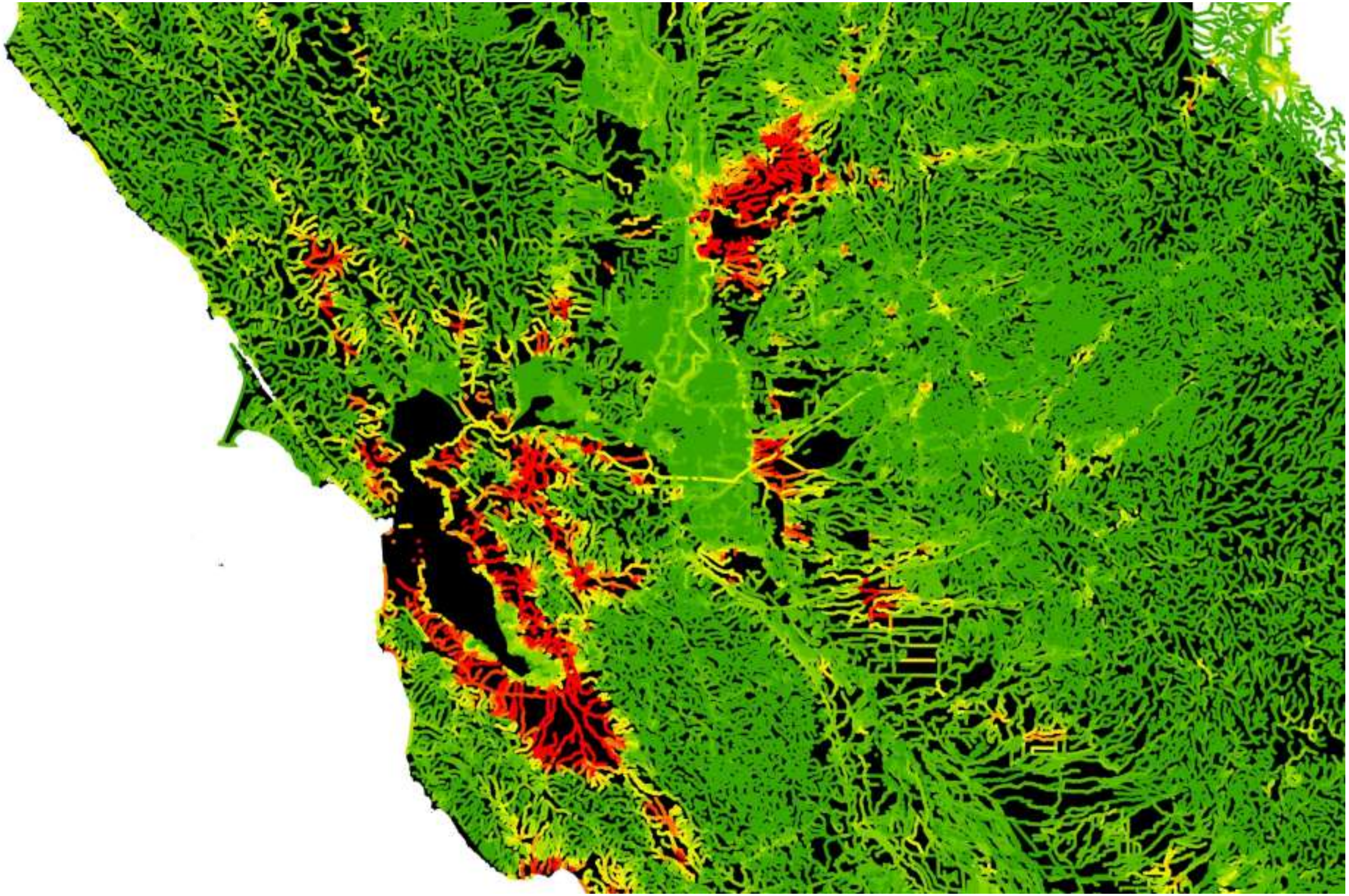
Option 1: Near-channel Land use

30m 2006 NLCD to buffer (2011 available soon)

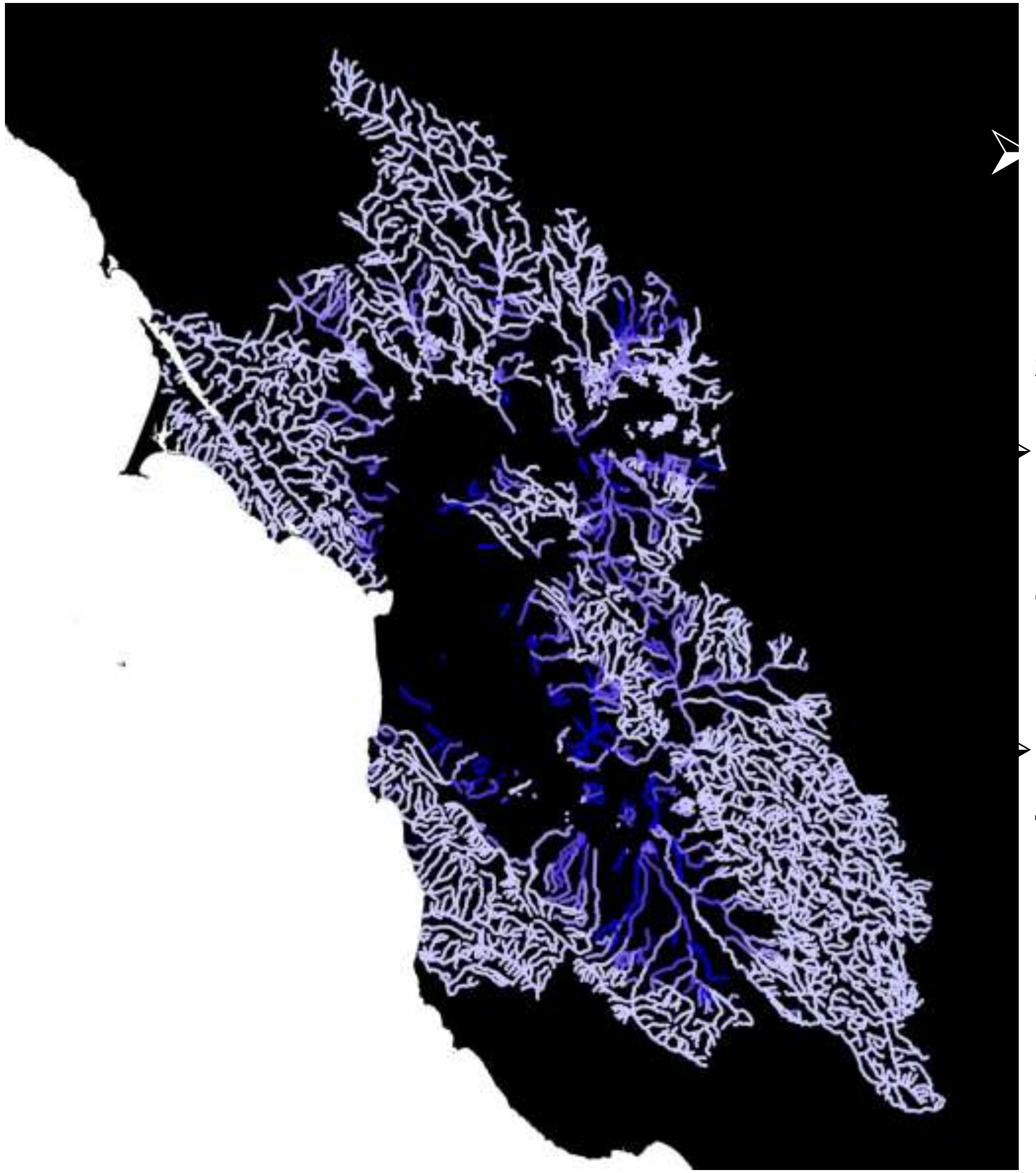
- Average % urban + code 21 for each NHD segment



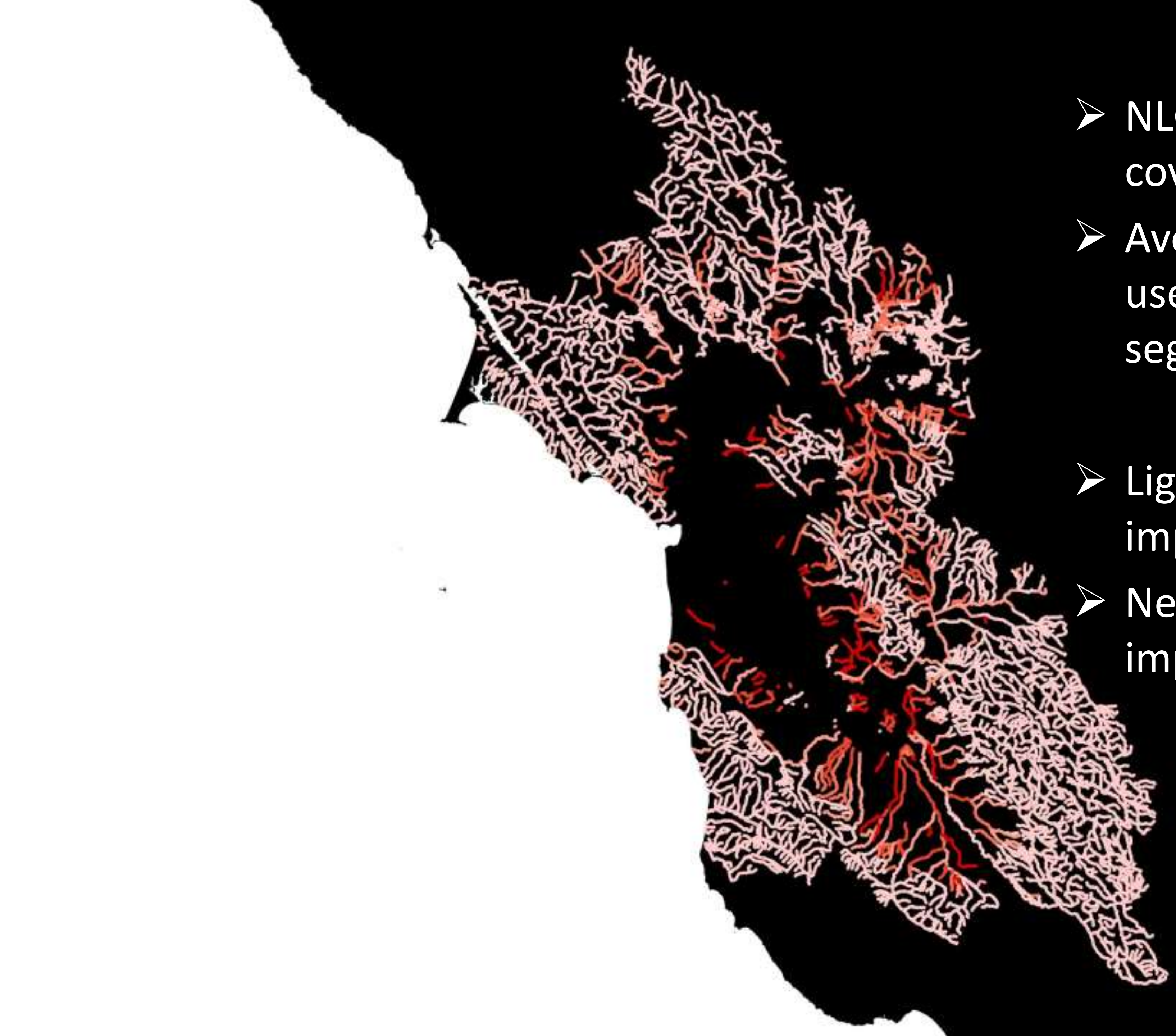

Legend
NHD_NLCD2006_Landcover_500m_Buffer
AG_URB_21
0 - 4
5 - 14
15 - 26
27 - 39
40 - 49
50 - 59
60 - 69
70 - 80
81 - 90
91 - 99
ca_border (nad83)



Option 2: Watershed Land use



- Example: Average % impervious (or other) in upstream basin for each stream segment
- Nested catchments are aggregated so that higher order watersheds contain all lower order sheds
- Upstream landuse summed for each segment



- NLCD 2006 impervious cover clipped to basins
- Average % impervious used to color stream segments in each basin

- Lightest color < 4% impervious,
- Next lightest < 10% impervious

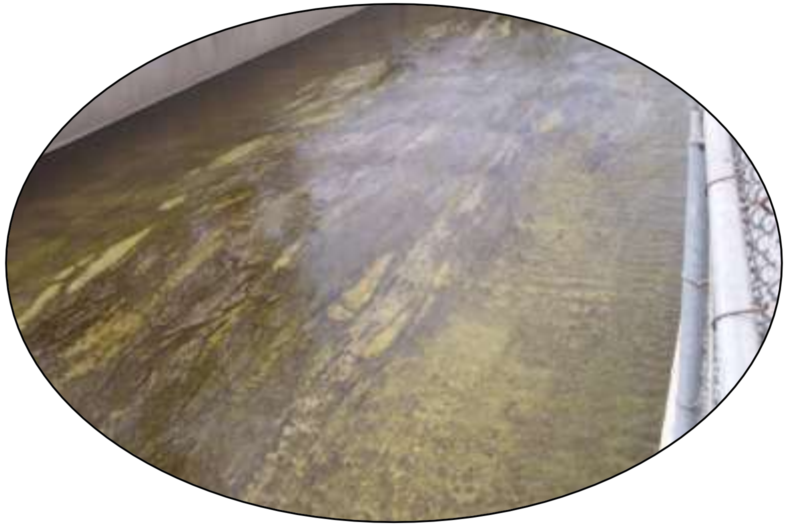
Take Home Message for Today

- Water Board staff recognize that defining “modified” is a policy decision

- They are consulting with the Regulatory Workgroup before they can bring ideas to the table

- Technical activities specific to modified channels can move forward when this guidance is provided

Discussion



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Goal for Discussion

- Present draft panel charge, agenda, and read ahead materials for meeting #1
- Get your feedback and provide opportunity to modify to assure that your issues have an opportunity to be heard.

Draft Meeting Goal and Charge

Goal: Review the overarching Science Plan to support the State Water Board's approach to nutrient objectives and management

Charge:

What refinements or additional elements to the Science Plan does the Panel suggest to improve scientific support for the State Water Board staff's work plan (SWRCB 2014)? What specific refinements or elements would aid in directly addressing stakeholder concerns or issues?

Agenda

Day 1:

- Regulatory context (Rasmussen)
- Overview of foundational science and proposed science plan (SCCWRP and Tetra Tech)
- Stakeholder comments on Science Plan (Bernstein and Sector Leads)
- Closed panel

Day 2:

- Closed panel
- Panel findings

Read Ahead Materials:
Red Designates Things Added to the List

- State Water Resources Control Board 2014. Proposed Work plan for Development of a Nutrient Control Program. www.waterboards.ca.gov/plans_policies/nutrients.shtml
- State Water Resources Control Board 2011. CEQA Scoping Meeting for Proposed Nutrient Policy. www.waterboards.ca.gov/plans_policies/nutrients.shtml
- Wadeable Streams Science Plan March 2015
- ACCESS to all stakeholder presentations, including proposed BCG workplan
- Compiled stakeholder comments on Science Plan & summary of general comments
- EPA-ORD report
- Fetscher et al. 2014 IBI journal article.
- Tetra Tech 2006

Next Steps

June 2-3rd, 2015	Please RSVP to christinas@sccwrp.org
Summer 2015	Webinars on interim technical products, reports distributed when available
	BCG project kick-off and written comments on BCG workplan
Aug-Sept 2015	Stakeholder feedback on first round of technical products
Fall 2015 TBD	Stakeholder meeting to discussed revised technical products
Late Fall 2015 TBD	Next science panel meeting
Winter 2015	Webinar update on BCG
To Be Announced	Focus groups by sector to discuss implementation options