SCCWRP Science Supporting Nutrient Management

SWRCB Is Developing Nutrient Objectives

SWRCB Staff are considering narrative objective, with numeric guidance phased by waterbody type

Phase I (2016): Establish narrative approach applicable to all waterbodies and numeric guidance for **wadeable streams**

Phase II (2017): **Lakes**

Phase III: (2019): **Estuaries and non-wadeable rivers**

Nutrient Objectives Are Scientifically Challenging

- Nutrients are required to support life
  - How much is too much?
- Direct effects (e.g. toxicity) are often less important than indirect effects
  - Indirect effects occur at much lower levels than toxic effects
- Ambient concentrations can sometimes give false positives or negatives
- Need a different approach

SWRCB Staff Favor Ecological Response Approach

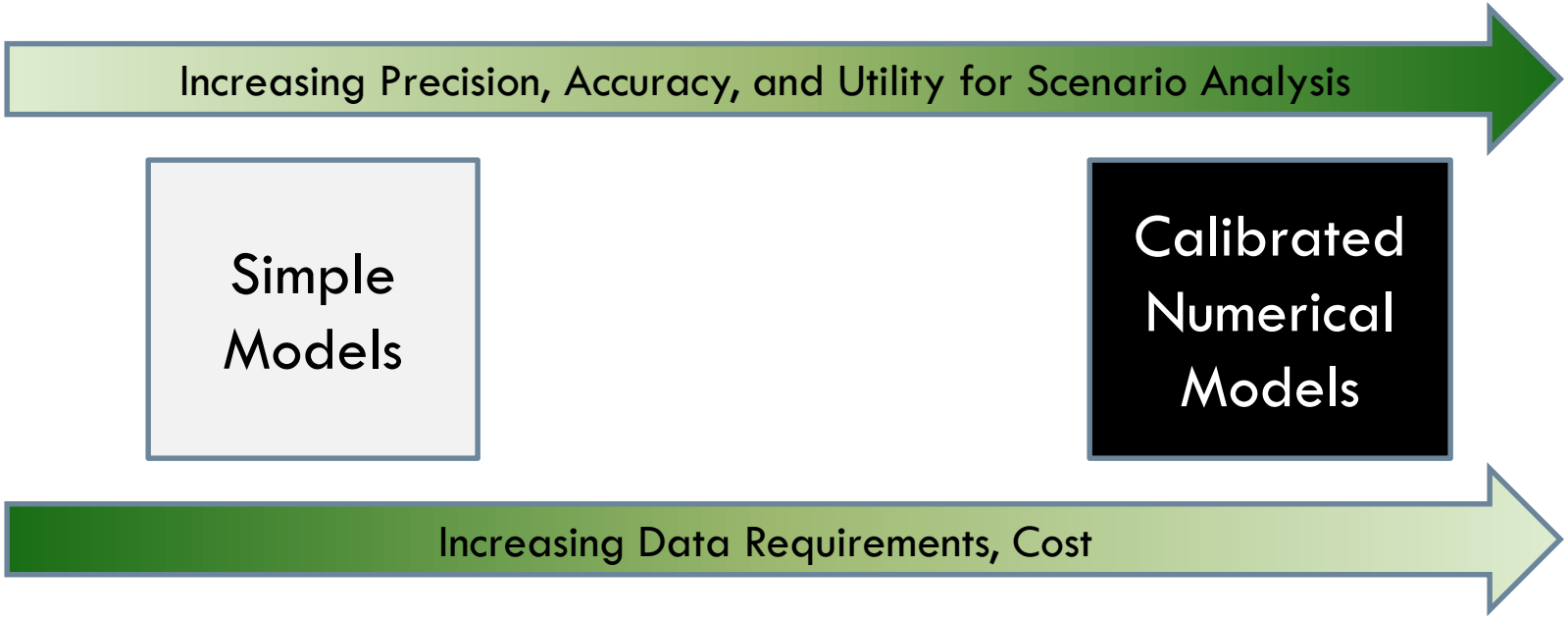
- Coined as "nutrient numeric endpoint (NNE) approach"
- Consists of two major components
  - Response indicators with numeric endpoints for waterbody assessment
  - Models to link response indicator numeric endpoints to nutrient targets (e.g. permits, TMDLs, etc.)

Algae & Aquatic Plants

Dissolved Oxygen, pH

Models to Link to Nutrient Management: Two Book Ends

- Calibrated numerical models
  - Site-specific, high precision, requires considerable expertise and expensive data
- Simple models
  - Regional or statewide, lower precision, low cost and expertise

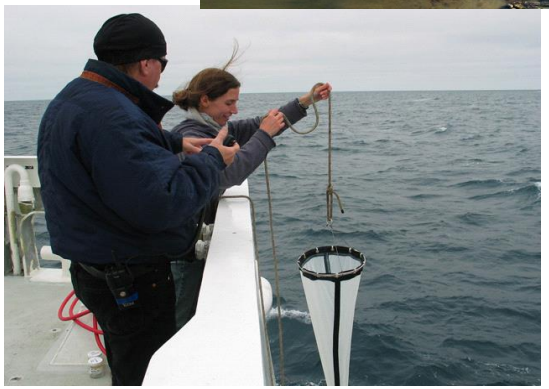


State Offering Simple Models to Set "Default" Nutrient Targets

- Translates response indicator numeric endpoints to site-specific nutrient targets
  - Accounts for site-specific factors that control response to nutrients (canopy cover, temperature, etc.)
- "Default" nutrient targets resulting from model are a starting point for conversations on permits and TMDLs
- Flexibility offered to stakeholders to develop more sophisticated models if required
- Models available for wadeable stream and lakes

SCCWRP Is Conducting Research Supporting Nutrient Objectives across Waterbody Types

- Wadeable Streams
- Estuaries
- Coastal Waters
- Lakes



Recently Completed EPA-ORD Study Provides a Scientific Foundation for Wadeable Streams

Goals:

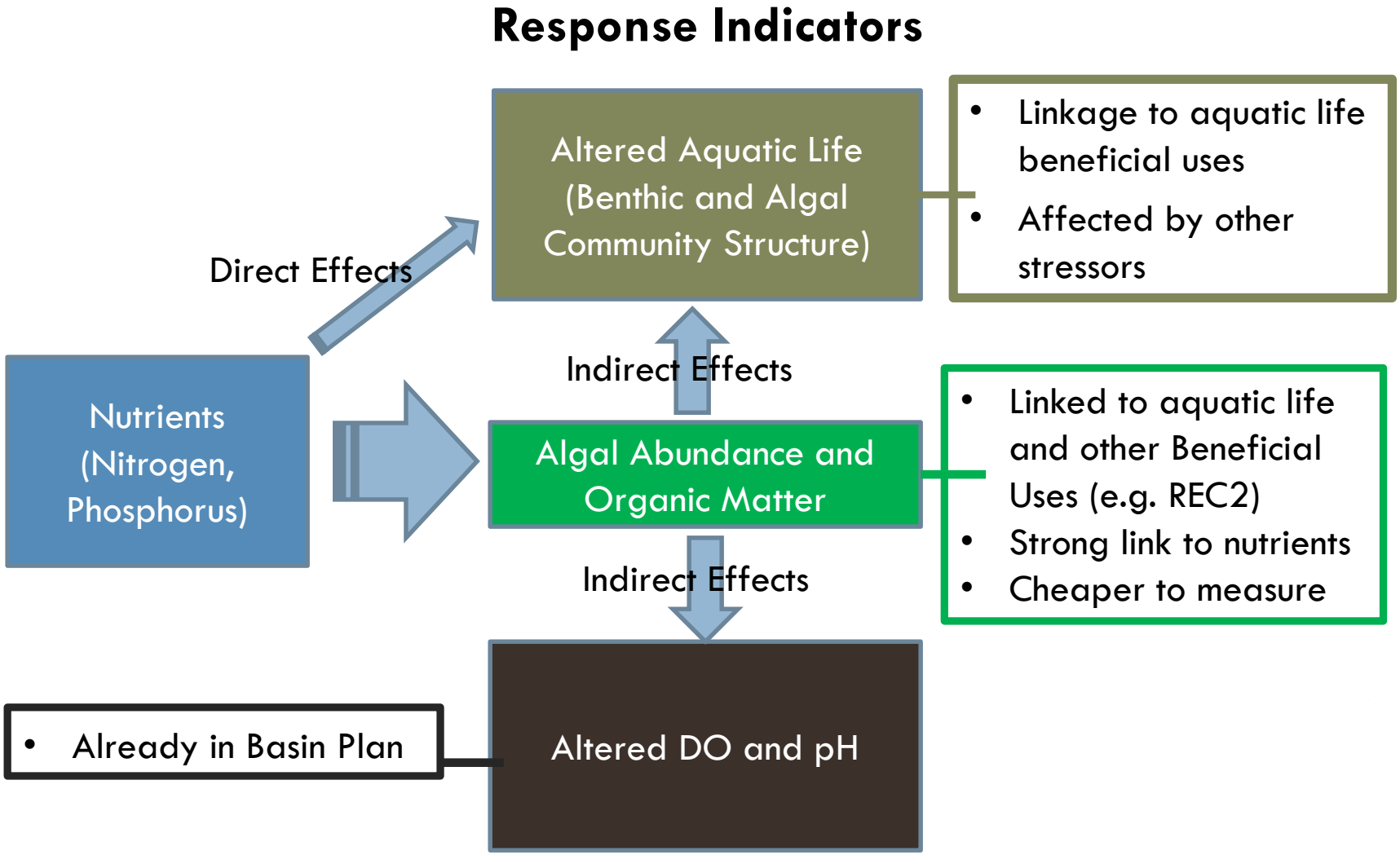
1. Identify **appropriate response indicators**

2. Identify **thresholds of adverse effects of response indicators** on aquatic life to support decision on regulatory endpoints

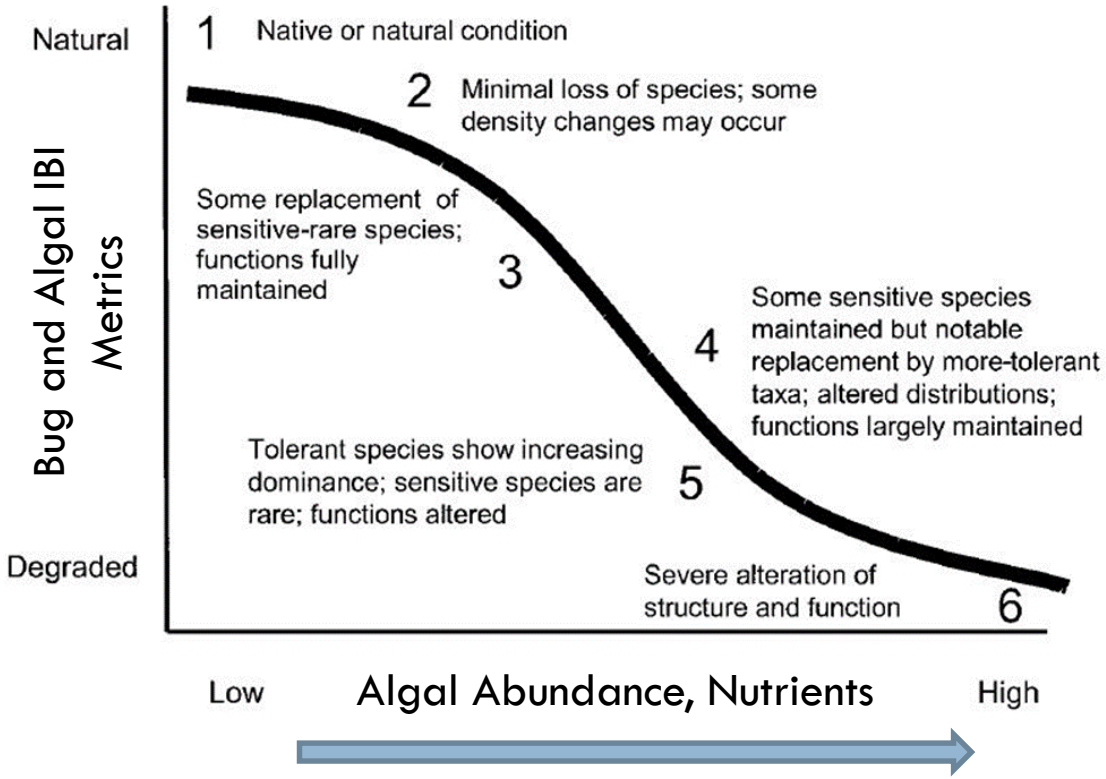
   – **Relative to reference and ambient concentrations of those indicators** in wadeable streams

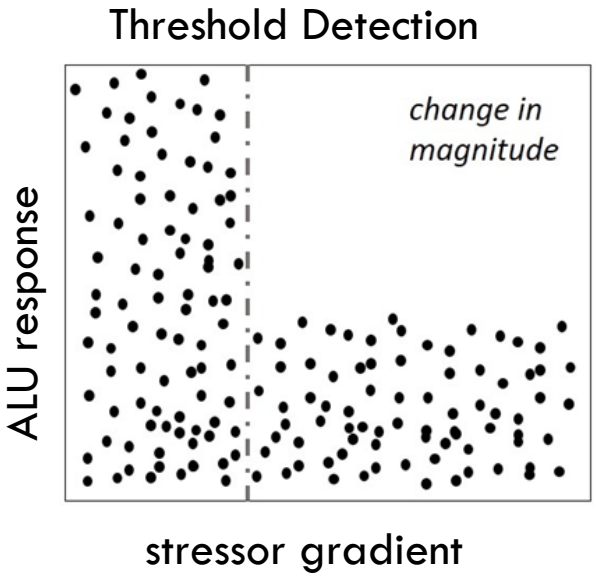
3. **Validate the simple model** for wadeable streams and recommend avenues for refinement

What Are The Appropriate Response Indicators in Wadeable Streams?



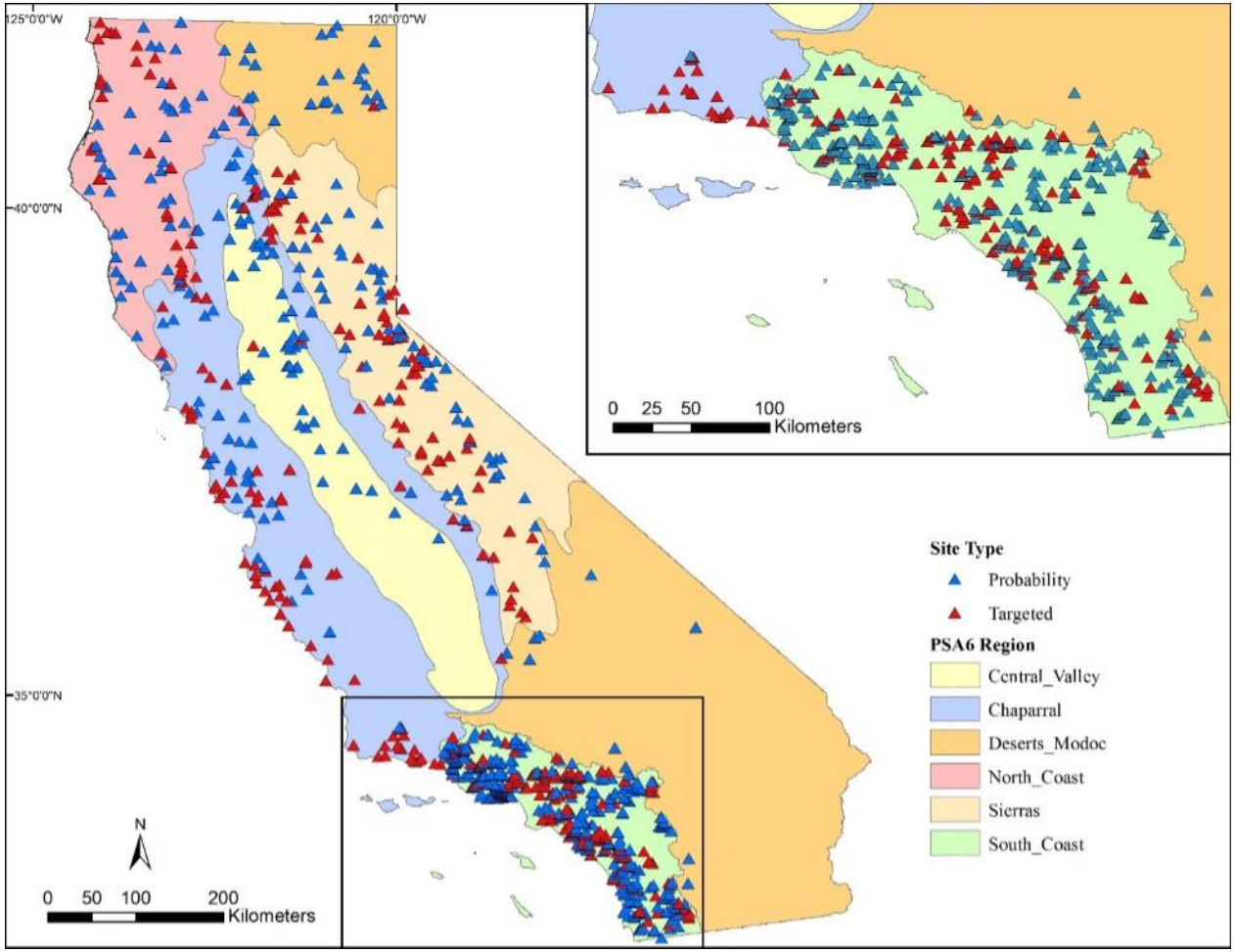
Identify Ecological Thresholds Along Biological Condition Gradient





Stream Bioassessment Program Provides Robust Dataset for Analysis

Available data from combined surveys (>1,000 wadeable stream reaches)



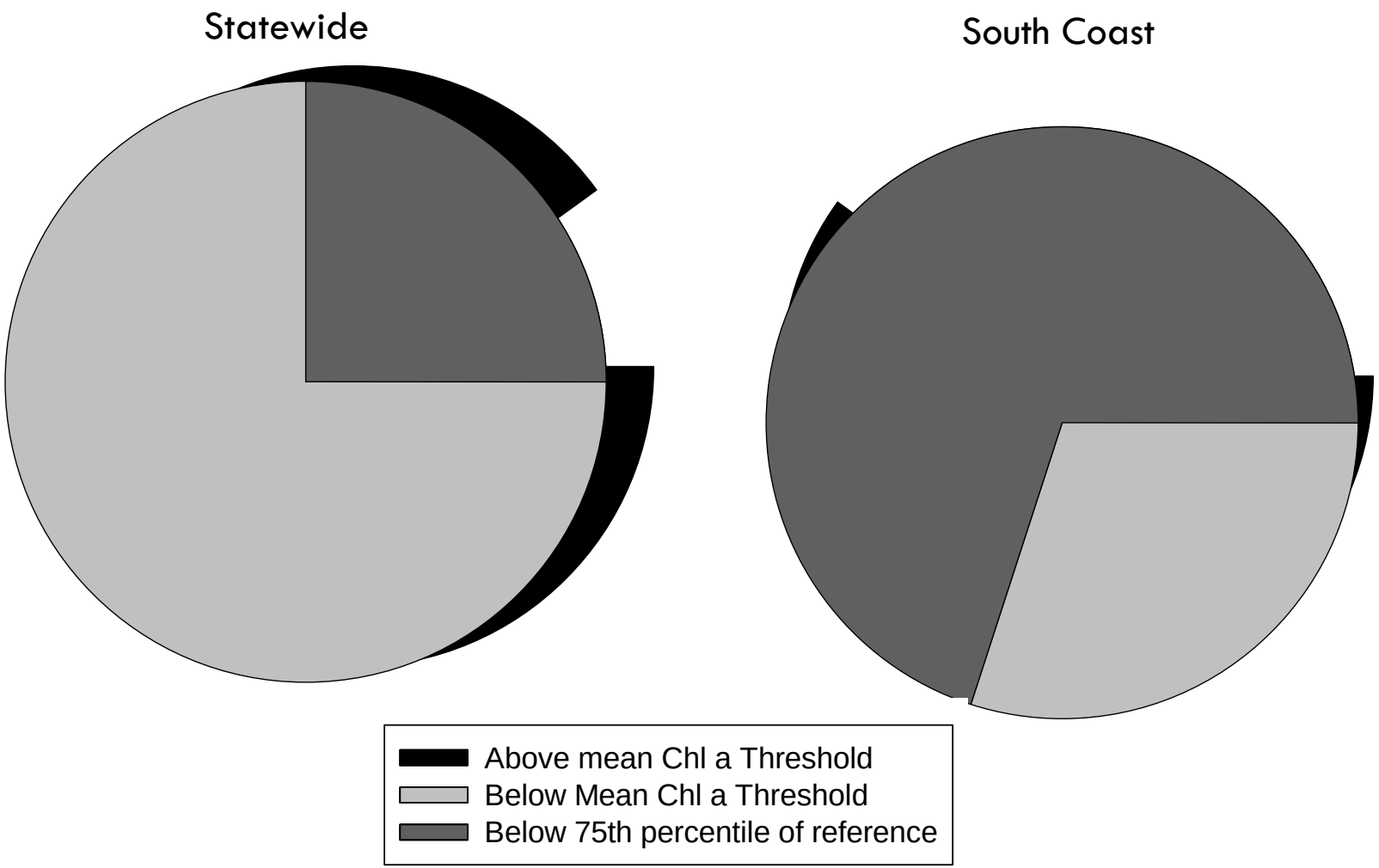
EPA-ORD Study Approach: Indicators and Thresholds

- Compile and expand on existing stream bioassessment data to include additional landscape variables
- Investigate relationship of stress (algal abundance, nutrients) on response (benthic invertebrate & algal community metrics)
  - Narrow down list of 10+ algal abundance metrics available through stream algal bioassessment program
- Identify ecological thresholds in those relationships
- Estimate distribution of algal abundance indicators and nutrients at ambient and reference sites
  - Provide context for thresholds detected

Identified Indicators Strongly Correlated to Aquatic life

- **Benthic chlorophyll a (Live Biomass)**
  - Mean thresholds 20-40 mg m^{-2}
- **Ash free dry mass (All Organic Matter)**
  - Mean thresholds 10-40 g m^{-2}
- **Total nitrogen and phosphorus**
  - Mean thresholds of 0.05-0.1 mg L^{-1} TP and 0.4-0.8 mg L^{-1} TN
- No thresholds found for percent cover—though this indicator still has utility for REC-2

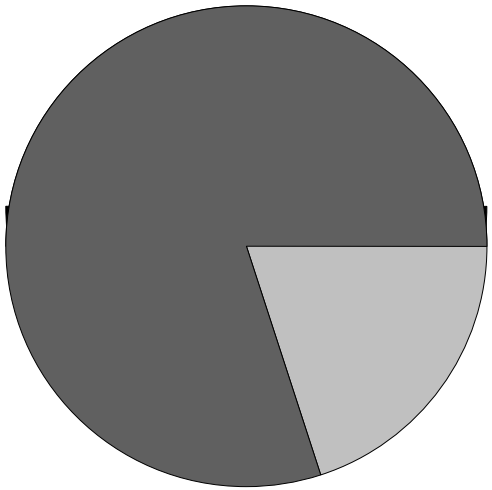
Only 10% of State Stream Miles Above Mean Threshold for Chlorophyll a, but 40% of South Coast



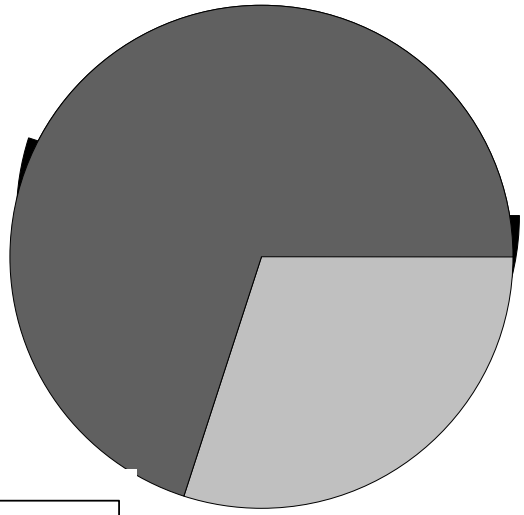
Similar Story for Nitrogen & Phosphorus

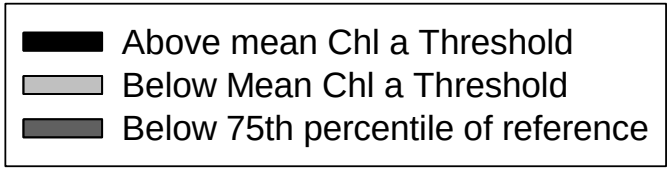
45-50% of South Coast Stream Miles Above Mean TN and TP Threshold

Total Nitrogen



Total Phosphorus

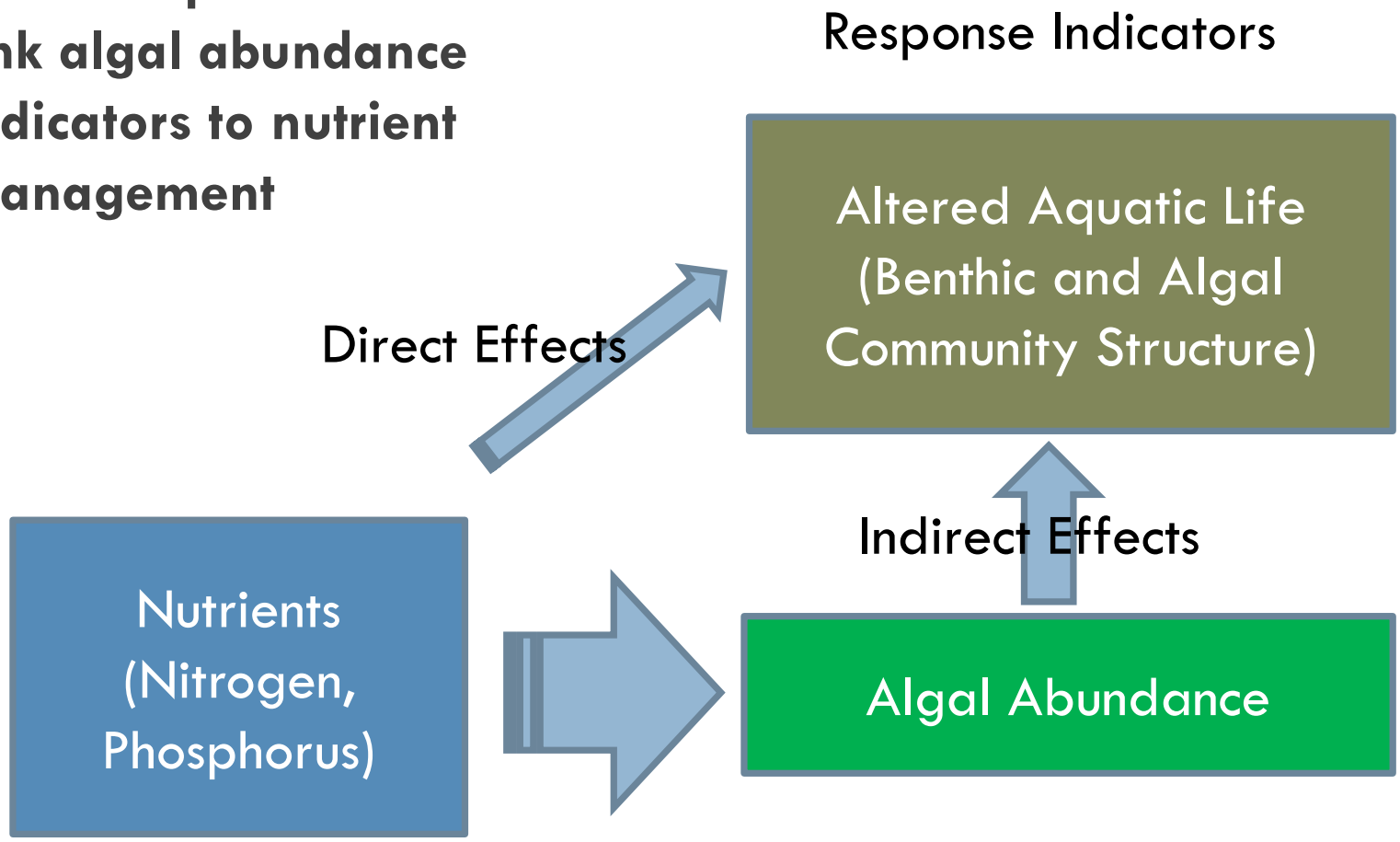




And….Thresholds for Nitrogen and Phosphorus Are Below What is Easily Achievable Via Treatment Technology

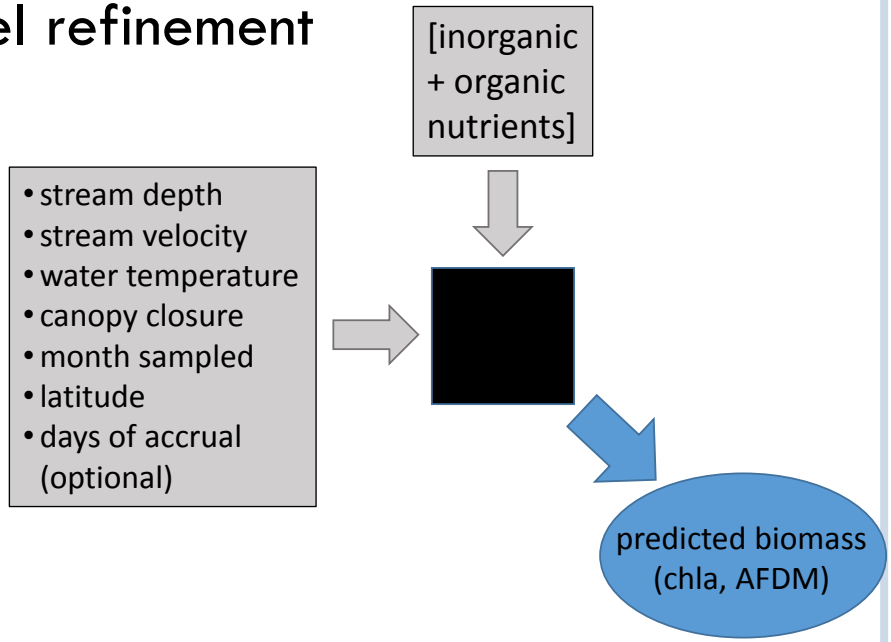
But NNE Approach calls for Biotic Indicators, not Nutrients, To Be Used for Assessment

Need simple models to link algal abundance indicators to nutrient management



Validation of Simple Model (NNE Benthic Biomass Tool): Approach

- Run model for stream bioassessment data set
  - Compare observed vs. predicted biomass values
- Explore sources of bias and error in model predictions
- Recommend avenues for model refinement



Validation of NNE Benthic Biomass (Simple) Model

- Validation work shows that SWRCB model needs refinement
  - Models fits range from $R^2 = 0.1\text{-}0.26$
- Work is now underway to make those refinements
  - Accounting for landscape variability is key

SCCWRP Research Will Provide two Options for Setting "Default" Nutrient Targets

- Refined simple models to provide "default" nutrient targets
- TN and TP concentrations resulting from threshold analysis

Should these be used, in what circumstances, and how?

Next Steps and timing

- Drafting technical work plan to govern wadeable stream science
  - Vet with advisory groups and Science Panel by fall 2015
- Additional analyses synthesis on response indicators and thresholds
  - Tie to biological condition gradient
- Refinement of simple models

Expect to "wrap up" science by early 2015

Great Time to Engage

- First Statewide Stakeholder Group meeting June 13, 2014
- EPA-ORD report in CTAG review
- Opportunity to input on science plan and implementation issues moving forward