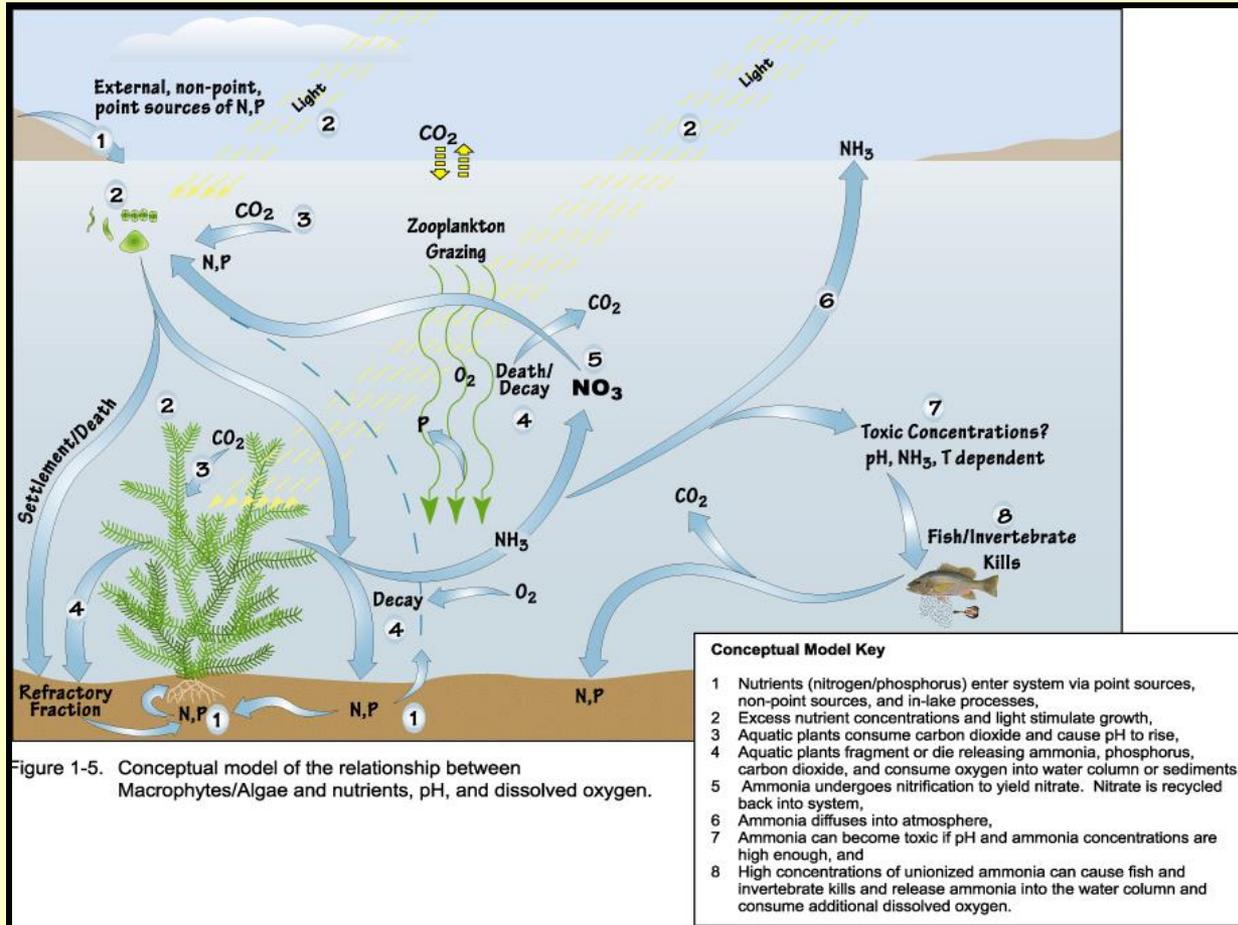


Region IX Nutrient Criteria Program



National Nutrient Coordinators Meeting
September 21, 2004
Washington, DC

Nutrients: Unique Problems for Criteria Development

- ❖ **Nutrients occur naturally, levels depend on geology and biochemistry**
- ❖ **Too little nutrients may be a problem as well as too much**
- ❖ **Nutrients themselves generally don't cause impairment, it's secondary impacts such as algal growth, impacts on DO that cause concern**
- ❖ **Impact depends on other factors, such as light and residence time**

Two Extremes for Criteria Development

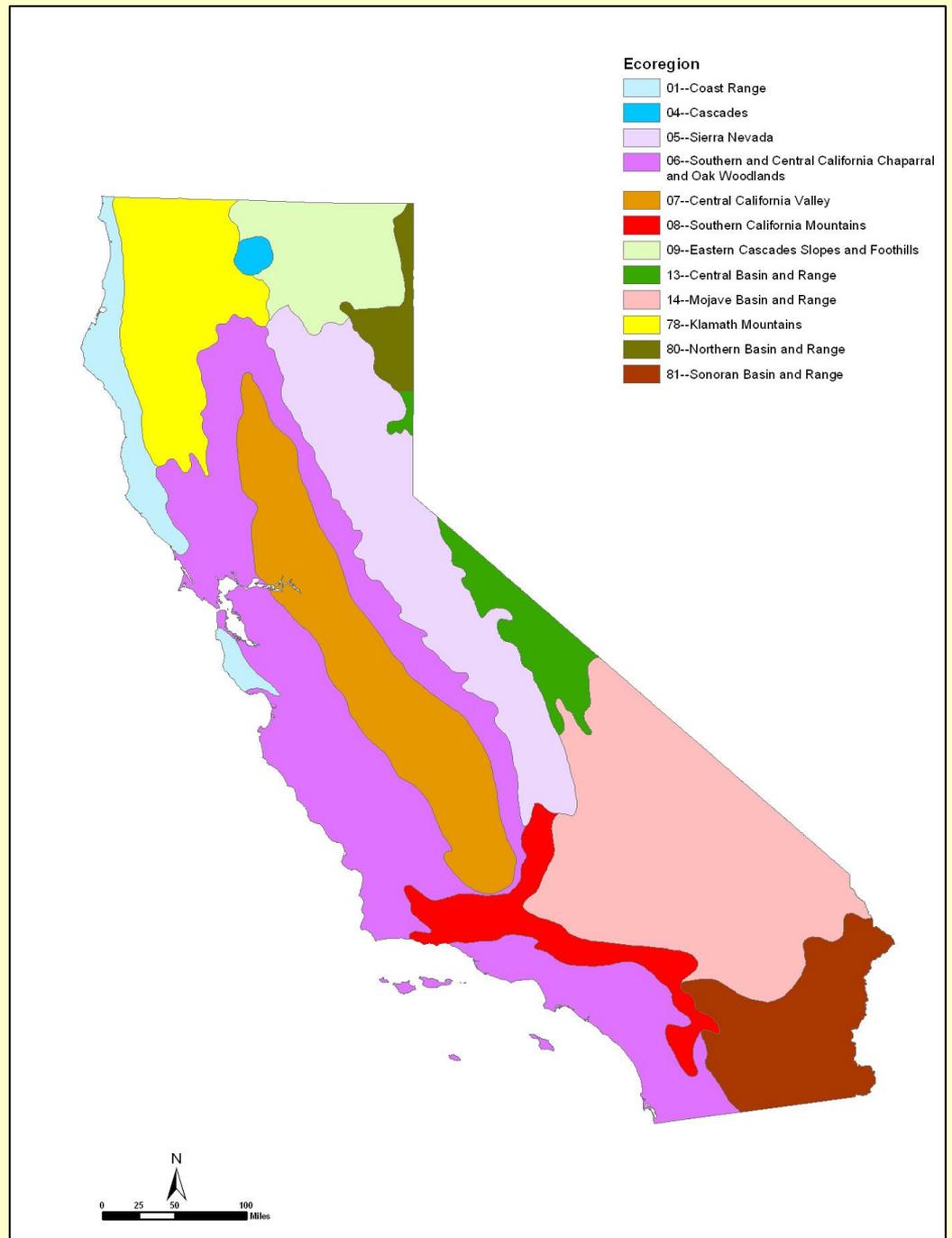
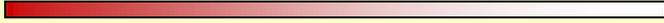
❖ **Site-specific study:**

- ✓ **Ideal: reflects characteristics and uses of a waterbody**
- ✓ **But, LOE is infeasible**

❖ **Arbitrary statistical criterion:**

- ✓ **Simple, easy to apply**
- ✓ **But, high risk (and cost) of classifying supporting waters as impaired**

California Ecoregions



The Importance of “getting it right”

| Ecoregion | Stream Total Phosphorus (approx. mg/L) | | | | |
|-----------|--|------------------|---------------|---------------|------------------------|
| | 304(a) Criterion | Reference 75% | % > 304(a) | STORET 25% | % > 304(a) |
| 1 | 0.010 | 0.03 | 70 | 0.01 | 70 |
| 5 | 0.015 | 0.04 | 85 | 0.02 | 85 |
| 6 | 0.030 | 0.09 | 70 | 0.06 | 88 |
| 8 | 0.011 | na | na | 0.002 | 44 |
| 9 | 0.030 | 0.13 | 67 | na | na |
| 14 | 0.010 | 0.03 | 47 | 0.03 | 80 |
| 22 | 0.015 | 0.07 | 62 | 0.02 | 97 |
| 23 | 0.011 | 0.06 | 85 | 0.005 | 85 |
| 24 | 0.018 | 0.07 | 56 | na | na |
| 78 | 0.032 | 0.05 | 28 | 0.12 | 98 ₅ |

Middle Ground: Tiered Approach

- ❖ Rather than using a single number criterion over a large geographic area, identify sites that are clearly unimpaired (Tier I), clearly impaired (Tier III), or in a gray area between (Tier II), where additional tools are used to assess impairment
- ❖ Approach falls between the extremes
 - ✓ Use simple analyses, but recognize site-specific characteristics
 - ✓ Identify where more detailed analyses needed
- ❖ Tier II assessment has the potential to relate nutrient levels to support or impairment of beneficial uses

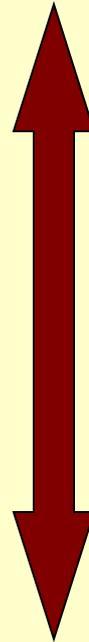
Modified Strategy for Developing Criteria

- ❖ **Focus on an individual ecoregion, not aggregated ecoregion**
- ❖ **Greater emphasis on biological responses to link to protection of beneficial uses**
- ❖ **Use statistical and simulation models to provide better estimates of reference loads/concentrations**
- ❖ **Use models to predict biological & chemical responses relevant to uses**

Criteria Exist to Prevent Impairment of Uses

Concept

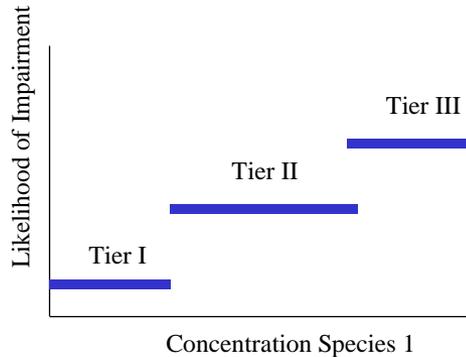
- ❖ Designated Use
- ❖ Condition compatible w/ use
- ❖ Nutrient regime to attain condition
- ❖ Mitigating factors for site
- ❖ Criteria



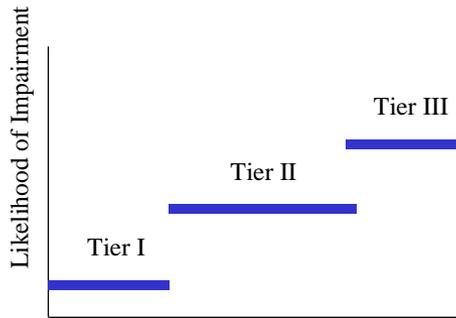
Example

- ❖ Aquatic Life support
- ❖ Benthic algal biomass density limit
- ❖ Nutrient linkage (N:P response)
- ❖ Riparian cover, velocity
- ❖ Nutrient limits for site and uses

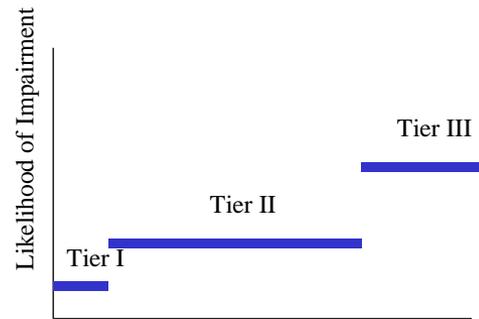
Form of the Standard



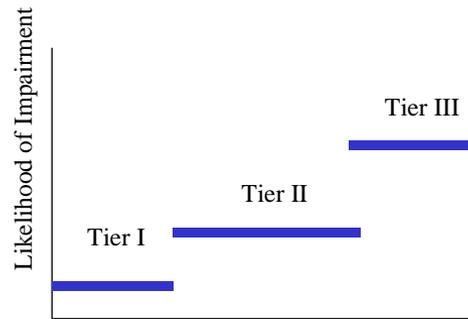
Concentration Species 1



Concentration Species 2



Primary Biological Response 1

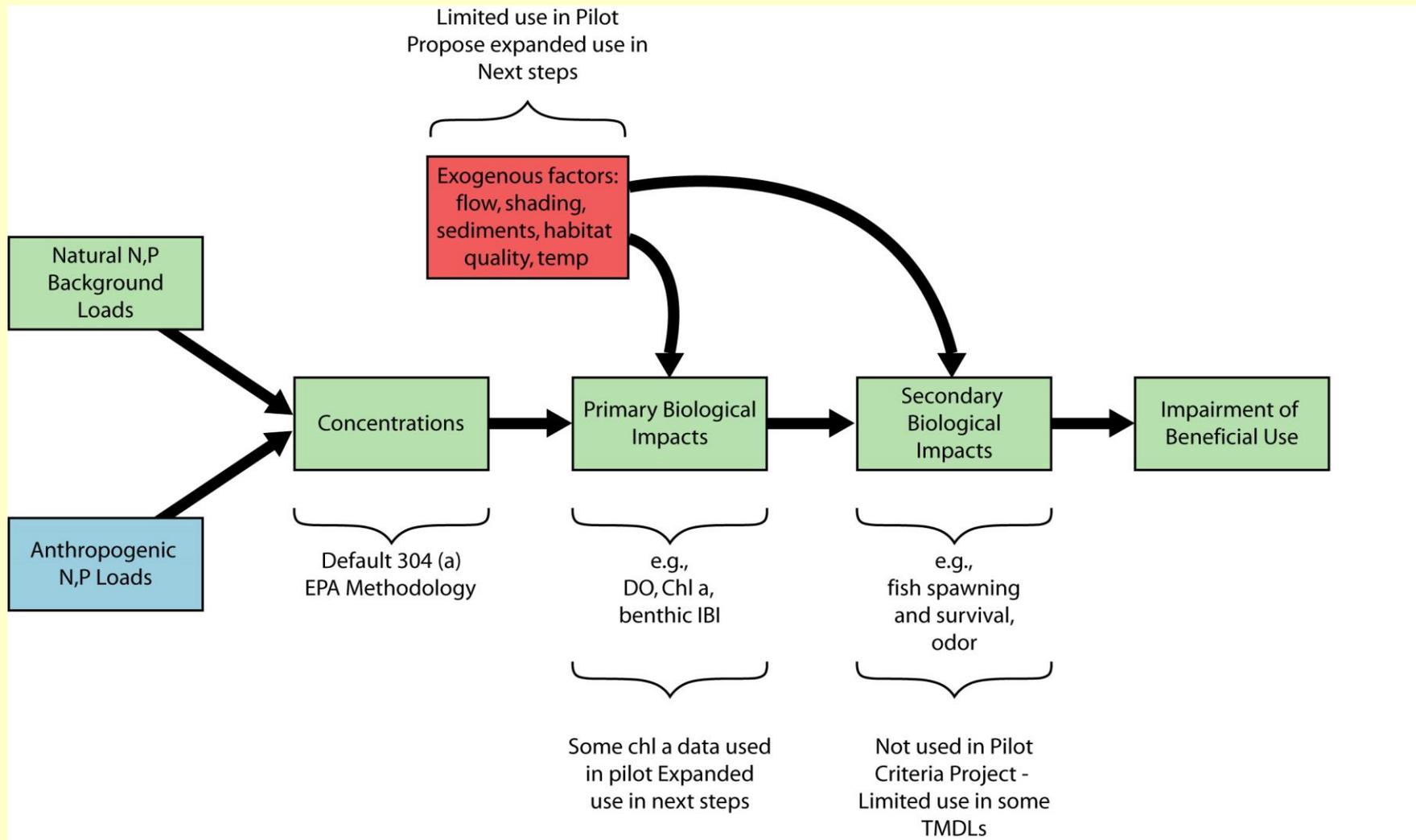


Primary Biological Response 2

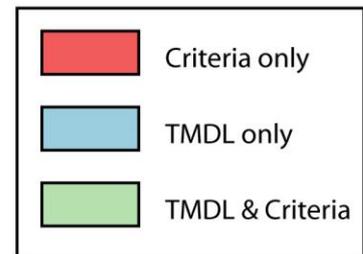
- ❖ Includes chemical and biological parameters
- ❖ Multiple parameters need to be considered simultaneously
- ❖ Tier II assessment determines whether combination of factors constitutes impairment

Consequences of Classification

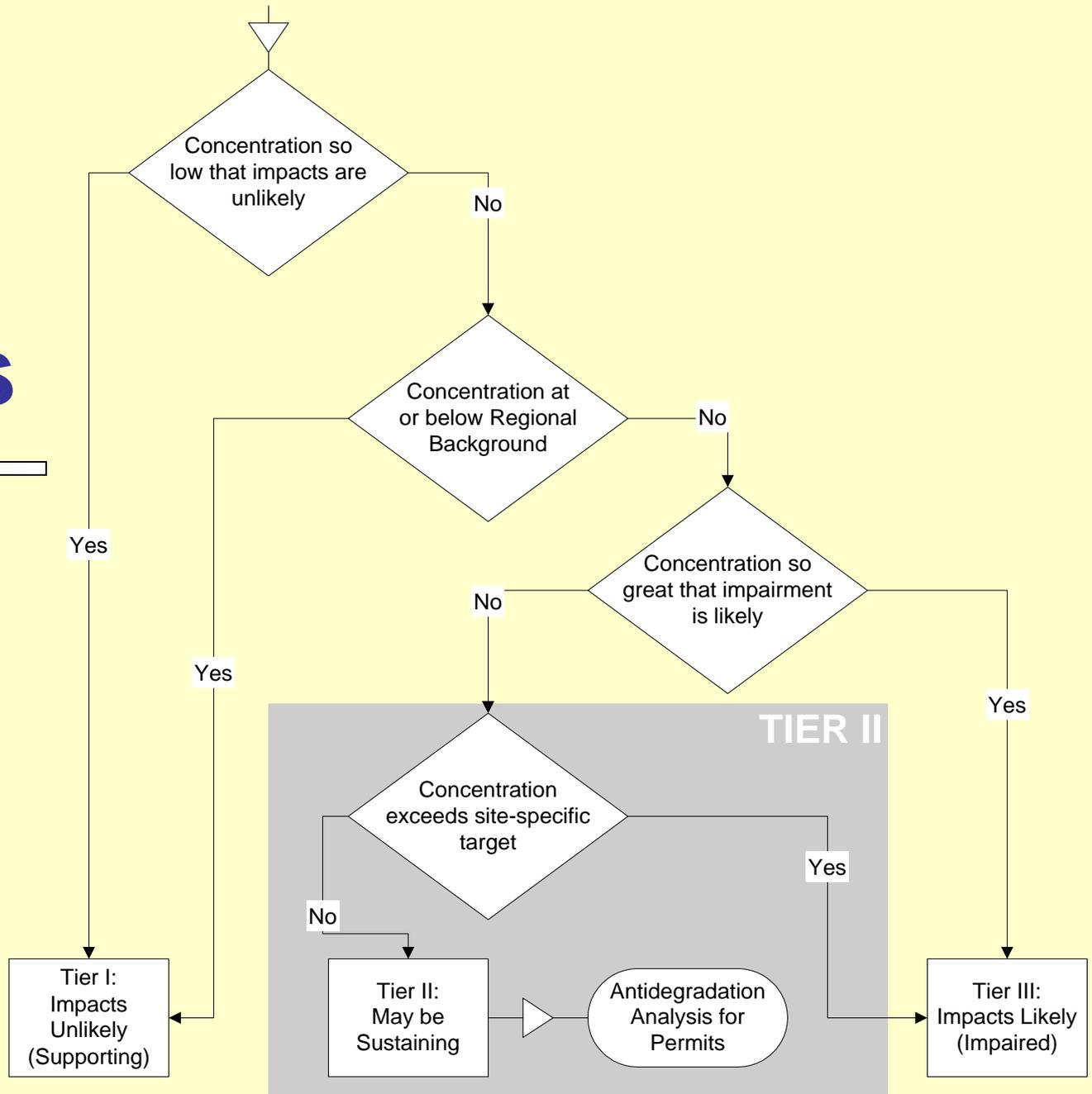
- ❖ **Tier I: No action needed**
- ❖ **Tier II: Further study to determine whether beneficial uses are threatened**
 - ✓ **Site specific factors influencing response**
 - ✓ **Potential anti-degradation analysis**
- ❖ **Tier III: Nutrient load reduction may be needed; possible permit load caps and TMDLs**



Relationship of Data & Analysis Elements for
Development of Nutrient Criteria and
TMDLs for a Specific Water Body



Sorting the Tiers



Tier I/II Breakpoint

- ❖ **Concentration (or load) causing no adverse impact on uses**
- ❖ **At or below a percentile of natural background (presumptive approach)**
 - ✓ **Existing statistical approach**
 - ✓ **Modeling analysis of natural cover/geology**

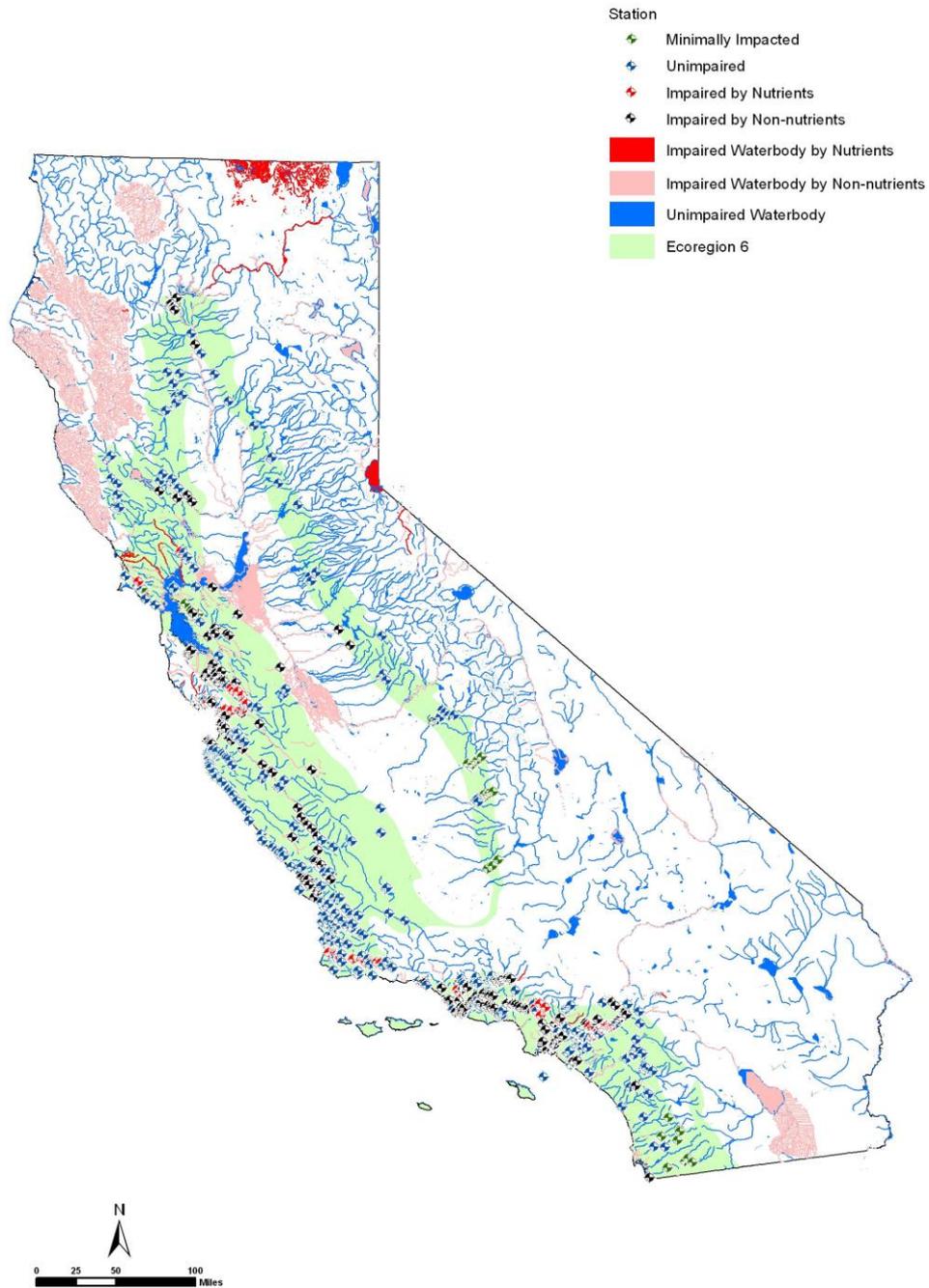
Tier II/III Breakpoint

- ❖ **Concentration (or load) that presents a clear risk to support of a specific use**
 - ✓ **Scientific consensus**
 - ✓ **Modeling analysis**
 - ✓ **Concentrations at known impaired sites**
- ❖ **Set high enough so that misclassification of impairment is at an acceptably low rate**

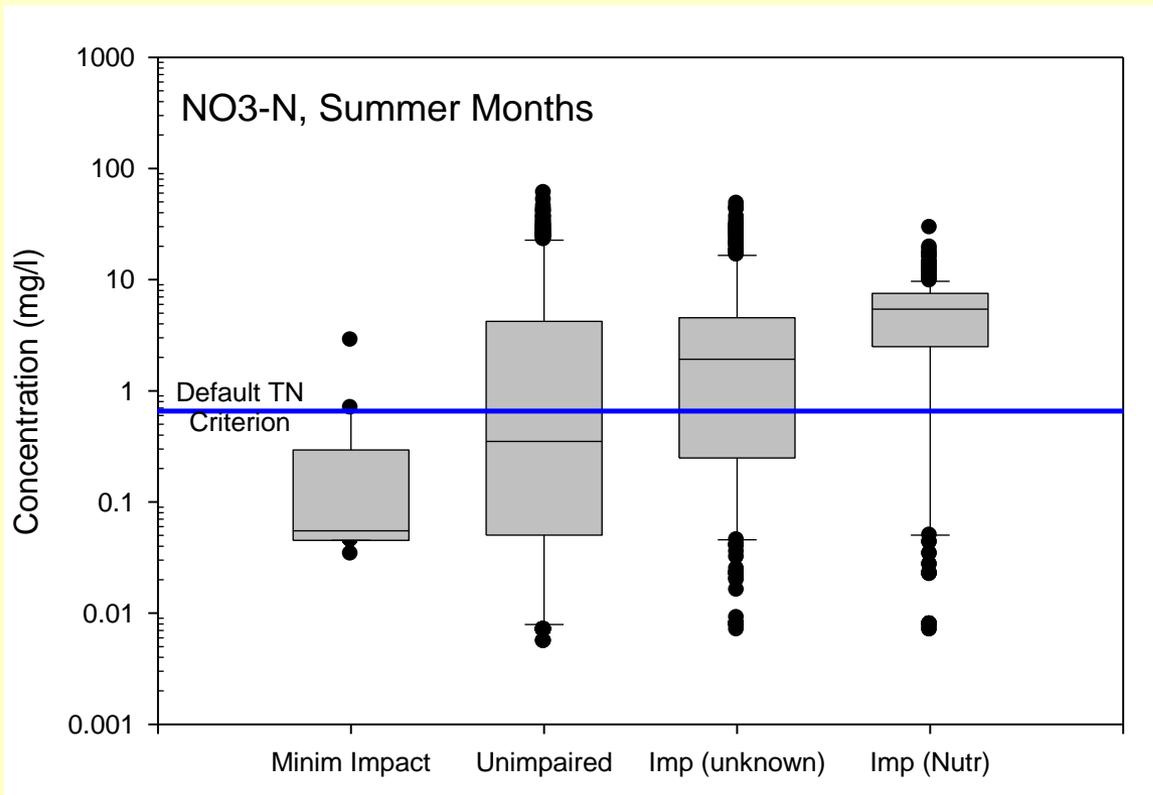
Supporting Toolbox

- ❖ **Detailed empirical analyses by Subecoregion**
- ❖ **Tools to relate nutrient concentrations to endpoints that impact designated uses**
- ❖ **Tools to evaluate first-cut site-specific modifications to criteria within Tier II**

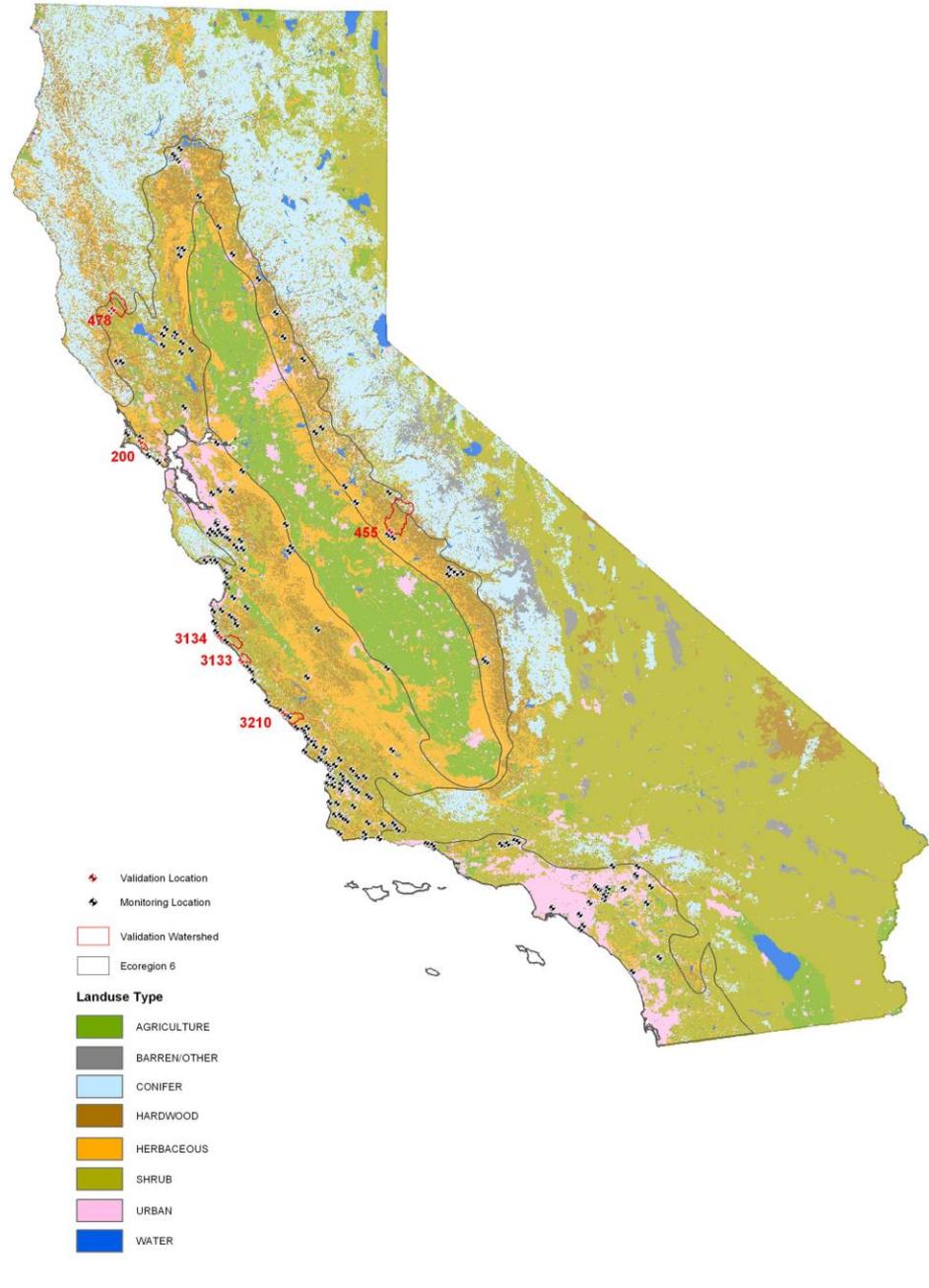
Empirical Data Analysis: Station Classification



Empirical Data Analysis for Ecoregion 6: NO₃ Levels in Streams by Impairment Classification of Water Body

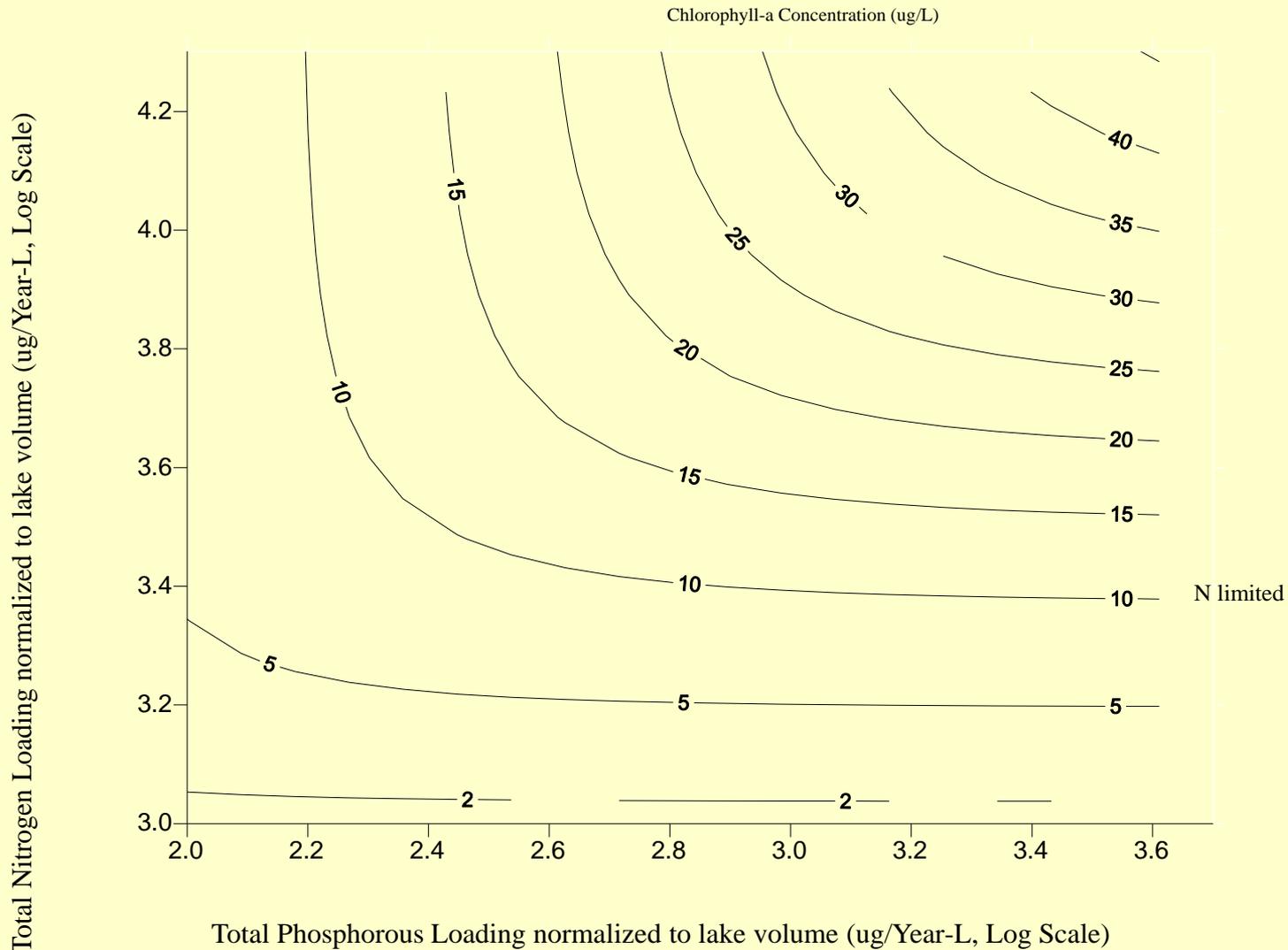


Modeling Natural Background with SWAT



- ❖ **SWAT (Surface Water Assessment Tool) was used to estimate nutrient loads and concentrations in streams.**
- ❖ **Designed for use without calibration.**
- ❖ **Modified for California climate and vegetation.**
- ❖ **A set of eight, relatively unimpaired watersheds was used for validation testing.**
- ❖ **Goal: To identify landscape stratification features as directed by RTAG**

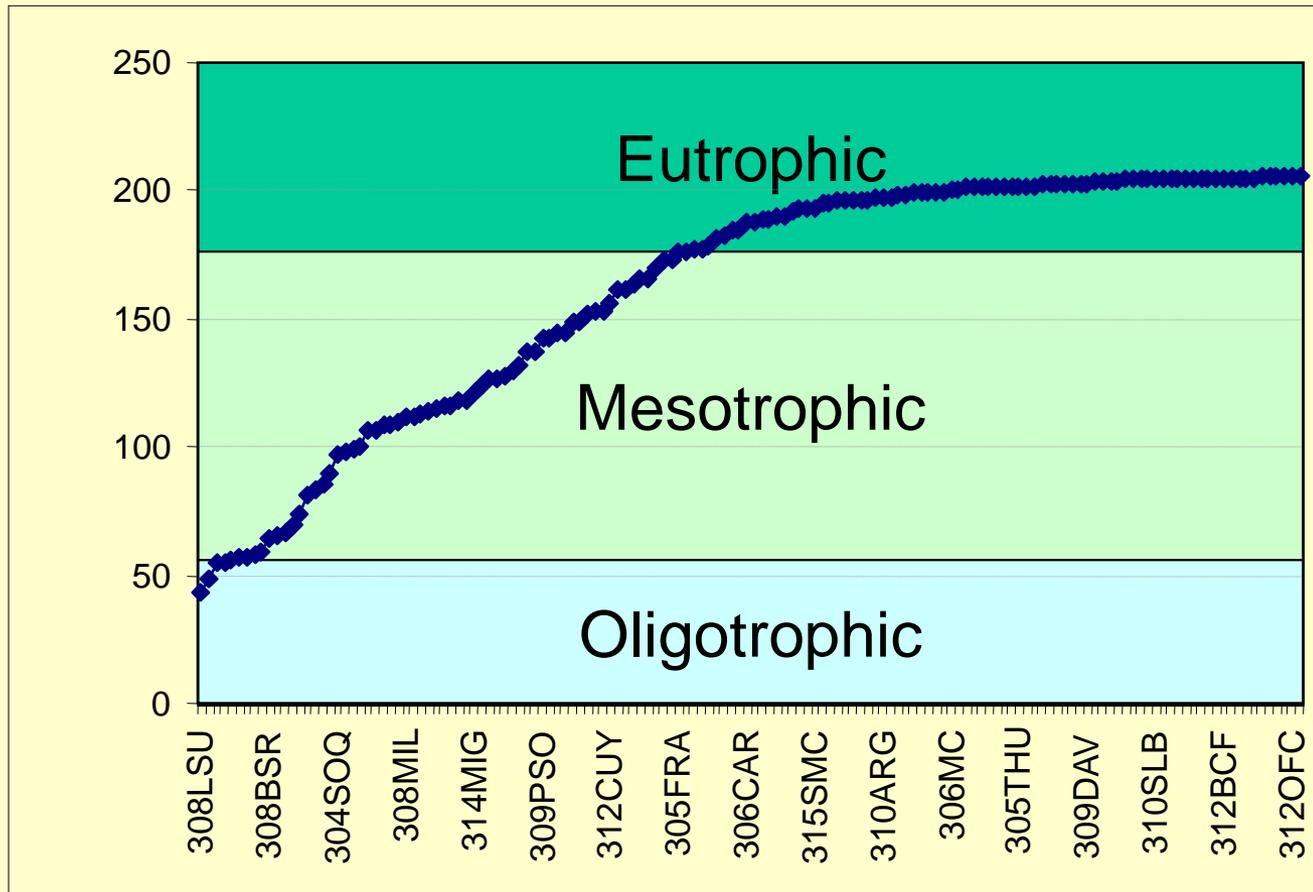
BATHTUB Model of Lake Response



Stream Periphyton Response

(equations adopted from QUAL2K)

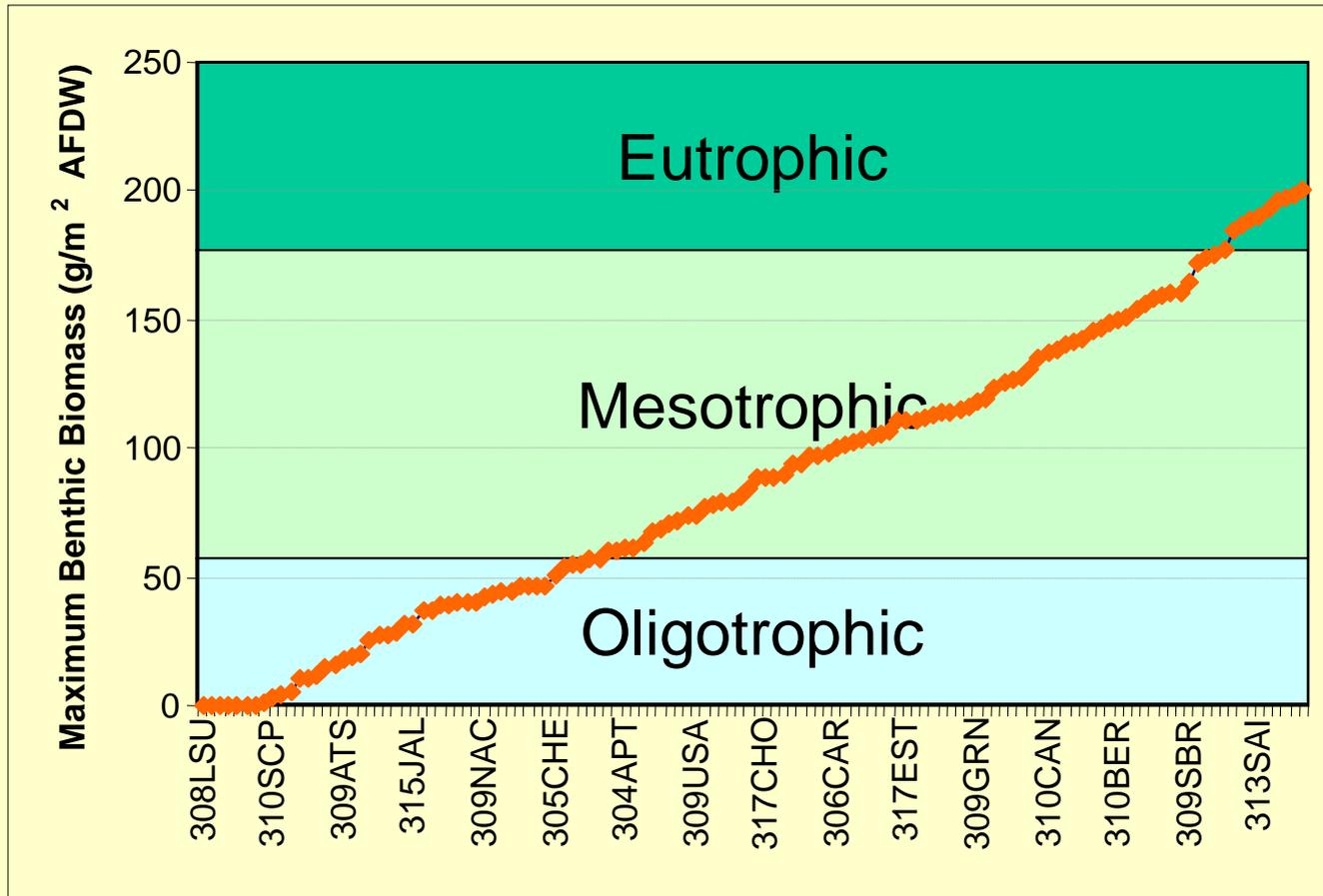
RB 3 Sites as a function of nutrients



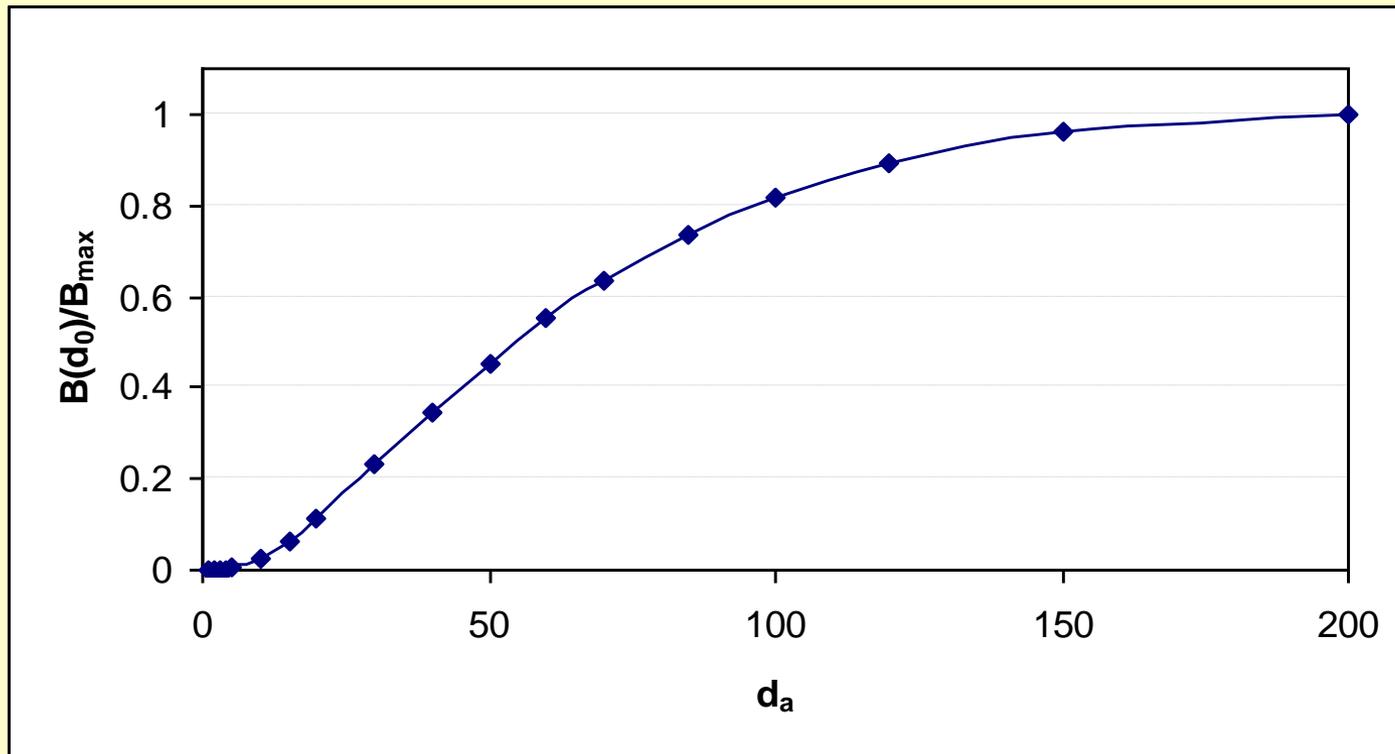
Stream Periphyton Response

(equations adopted from QUAL2K)

RB 3 Sites as a function of nutrients and light



Fraction of Potential Maximum Periphyton Biomass as a Function of Days of Accrual (Biggs, 2000)



Putting the framework work into practice

Hypothetical Scenario for Use of Tiered Criteria

Assume following tier boundaries for Total N:

Tier I/II 0.1 mg/l

Tier II/III 2.0 mg/l

For a given concentration in a water body, describe strategies to be adopted with respect to:

- Tier I, II, or III classification
- Assessment approach
- Potential for TMDL listing
- Impact on permitting of point source discharges

| Site | TN Conc (mg/l) | Tier | Assessment | TMDL | Permitting |
|------|----------------|--------------|--|----------------------------------|--|
| A | 0.08 | I | Site concentration is below the Tier I/II boundary; therefore the site is immediately assessed as not impaired by nutrients. | Not needed | Allocations up to the Tier I/II boundary of 0.1 don't require an antidegradation analysis for nutrients. |
| B | 0.75 | II -> III | Site potentially at risk, requiring further study. Use tools to calculate a site-specific concentration compatible with achieving uses of 0.6 mg/L. Concentration is greater than this site-specific criterion, therefore impaired. | Listed; site target - MOS = TMDL | No further wasteload allocations are available (impaired). |
| C | 0.25 | II | Site requires further study. Application of tools (SWAT, reference sites) suggests that the site-specific background should be 0.3 mg/l, higher than the general Tier I/II boundary. Concentrations does not exceed the site-specific background level | Not needed | Concentrations up to the site-specific background level of 0.3 mg/l are allocatable, between 0.3 and 0.6 mg/l are potentially allocatable subject to a more detailed analysis, and above 0.6 mg/l are not allocatable. |

Next Phases

- ❖ **Recommendations for 305(b) Monitoring: (CA - SWAMP)**
- ❖ **Refine / Finalize Assessment Tools**
- ❖ **Modeling Framework to Develop Background Nutrient Loading and Concentration Estimates**
- ❖ **Training Workshops**
- ❖ **Parallel Development of Regional loading, concentration, and bio condition estimates**
- ❖ **Development of Tier Boundaries for all Region 9 Ecoregions**