Nutrient Criteria Development Plan for North Dakota

Presented to the
North Dakota Nutrient Reduction Strategy
Nutrient Criteria Workgroup
April 16, 2014

EPA's National Strategy Approach

- Issued 1998
- Phase I
  - Regional criteria as a first step to developing state-specific nutrient criteria
    - Based on "aggregate" level III ecoregions
      - Nutrient Ecoregions IV, V and VI
    - Based on the statistical distribution of data (25th percentile)
      - N and P concentration
      - Chlorophyll – a concentration (endpoint)
    - Lakes and reservoirs
    - Rivers and streams

Nutrient Criteria for Rivers and Streams

Nutrient Ecoregions	Total N (mg/L)	Total P (mg/L)	Chlorophyll-a (µg/L)
Level IV	0.56	0.023	2.4
Level V	0.88	0.067	3.0
Level VI	2.18	0.076	2.7

Nutrient Criteria for Lakes and Reservoirs

Nutrient Ecoregions	Total N (mg/L)	Total P (mg/L)	Chlorophyll-a (µg/L)	Secchi Disk Transparency (m)
Level IV	0.44	0.020	2	2
Level V	0.56	0.033	2.3	1.3
Level VI	0.781	0.037	8.59	1.356

Problems with Statistical Methods

- Percentiles of data do not necessarily take into consideration environmental context of the resource (e.g., the method would apply the same criterion to all perennial streams, regardless of size)
- The “arbitrary” choice of a percentile rank may establish a numeric criterion which is lower than the least impacted or minimally impacted conditions
- Lacks linkage to the stressor-response relationship

EPA's National Strategy Approach

- Phase II
  - States given the flexibility to select and implement an approach for nutrient criteria which will be adopted as standards
    - Adopt EPA nutrient criteria based on aggregate Level III ecoregions (as a range of values or a single value with the range)
    - Combine EPA recommendations for nutrient criteria with their own databases to develop their own statistically-based criteria
    - Use EPA methodology (or some other accepted approach) for defining criteria or, alternately, construct a scientifically defensible method for developing nutrient water quality criteria

North Dakota's Nutrient Criteria Development Plan

- Described in detail in the *State of North Dakota Nutrient Criteria Development Plan* (May 2007)
- Goal
  - To develop technically defensible nutrient criteria for surface waters, which are protective of the resource, and consistent with federal guidance

The Plan

- Provides the framework for criteria development
- Includes lotic systems (small to large wadable and non-wadable rivers and streams)
- Recognizes Missouri River and Red River as unique river resources
- Includes lentic systems (lakes and reservoirs)
  - Mid- and large lakes and reservoirs
- Excludes wetlands

North Dakota Approach

- Guiding Principles
  - Protective of the state's water resources and their designated uses
  - Tailored to the unique physiographic characteristics and water resources of this region (i.e., northern plains)
  - Technically and scientifically defensible
  - Based upon conceptual ecosystem models that reflect **cause (stressor) – effect (response)** relationships founded on excess nutrient concentrations and that reflect the reasons for resource impairment (e.g., excessive algae in a lake) and the loss of beneficial uses

Nutrient Criteria Development Considerations

- Spatial scale of criteria
  - Ecoregions
  - Hydrologic basins
- Temporal scale
  - Reflect the timing (when during the year) and duration (how long) of the effect or impairment
- Stressor – Response Relationship
  - Quantifiable (i.e., must be able to measure both variables)
  - Criteria or standard may be an expression of one or the other or both

Nutrient Criteria Development Considerations

- Classification
  - Reservoirs and lakes (Lentic systems)
    - Reservoirs
      - Large river reservoirs (e.g., Lake Sakakawea, Lake Oahe, Jamestown Reservoir, Pipestem Reservoir, Lake Ashtabula, Lake Tschida, Patterson Lake, Bowman-Haley Reservoir, Lake Darling)
      - Small and medium river reservoirs (e.g., Brewer Lake, Sweet Briar Dam, McDowell Dam, Fordville Dam, Odland Dam)
    - Natural lakes
      - Shallow lakes (e.g., Lake Hoskins, Green Lake, Powers Lake)
      - Non-shallow lakes (e.g., Spiritwood Lake, Devils Lake)

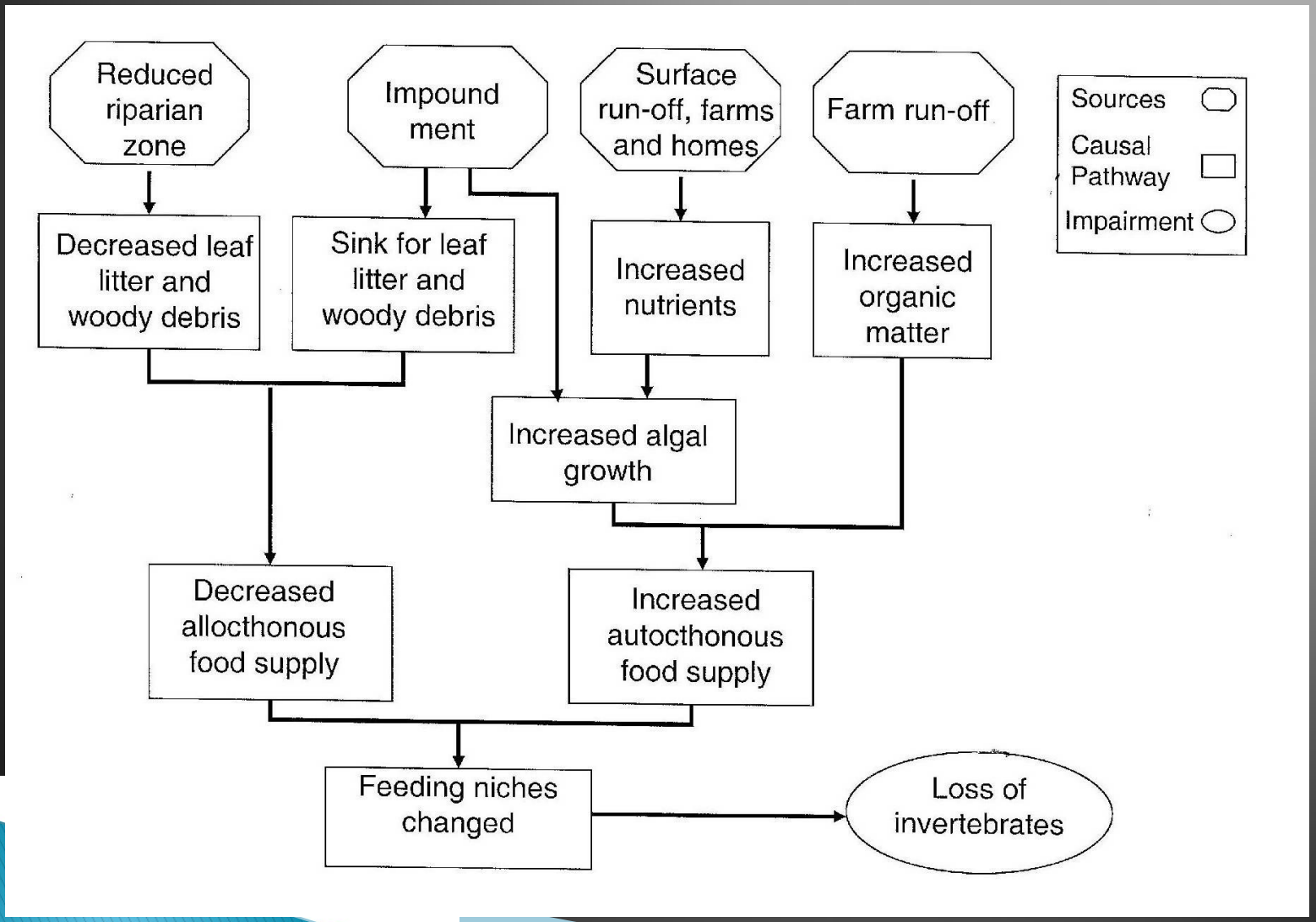
Nutrient Criteria Development Considerations

- Classification (con't)
  - Rivers and Streams (Lotic systems)
    - Perennial
      - Wadable
      - Non-wadable (large)
      - Missouri River and Red River
    - Intermittent/Ephemeral

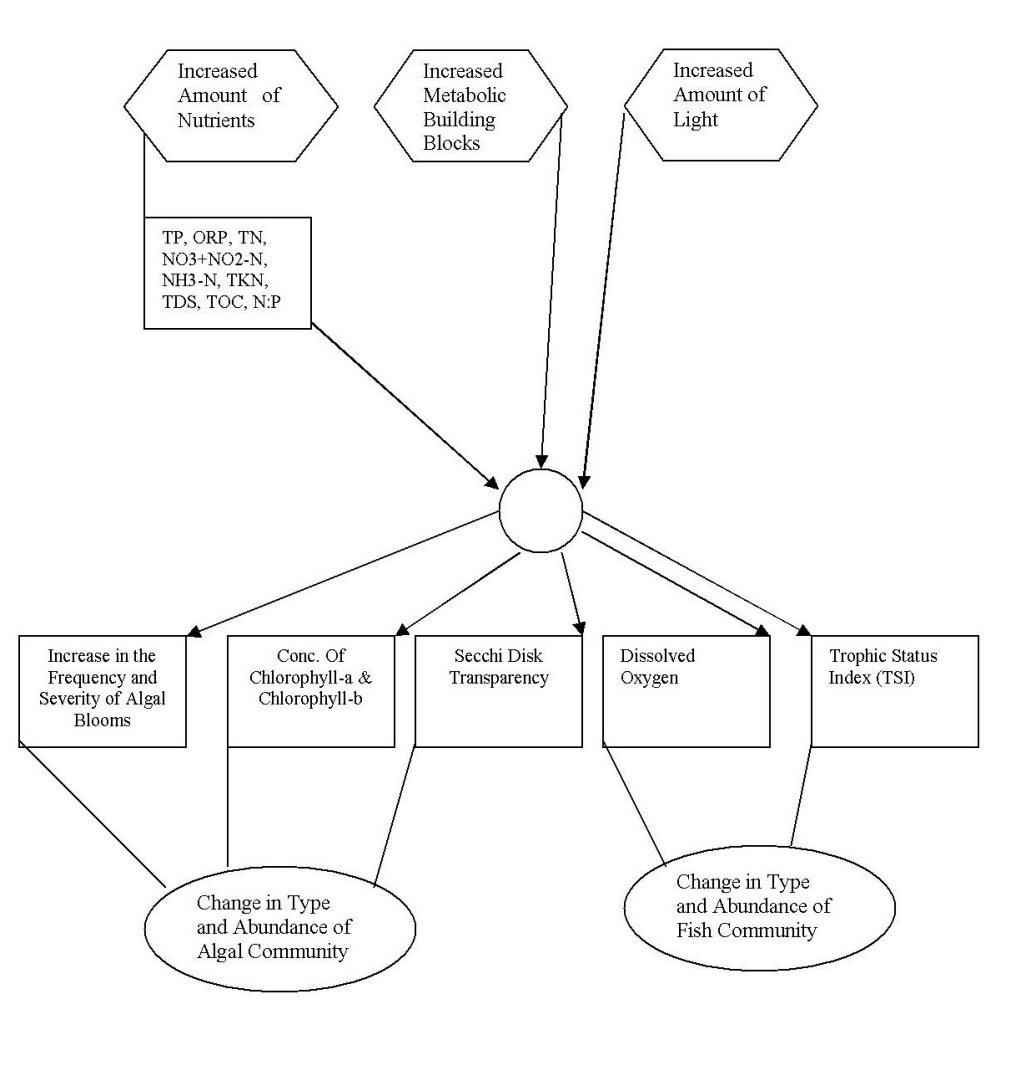
Defining the Stressor – Response Relationship

- Conceptual Models
  - Describes how a system works (conceptually)
  - Describes hypothesized relationships among sources, stressors (e.g., nutrients), and biotic responses within aquatic systems
  - Provides a framework for data collection and analysis

Conceptual Model for the Response of a River or Stream System to Excess Nutrients



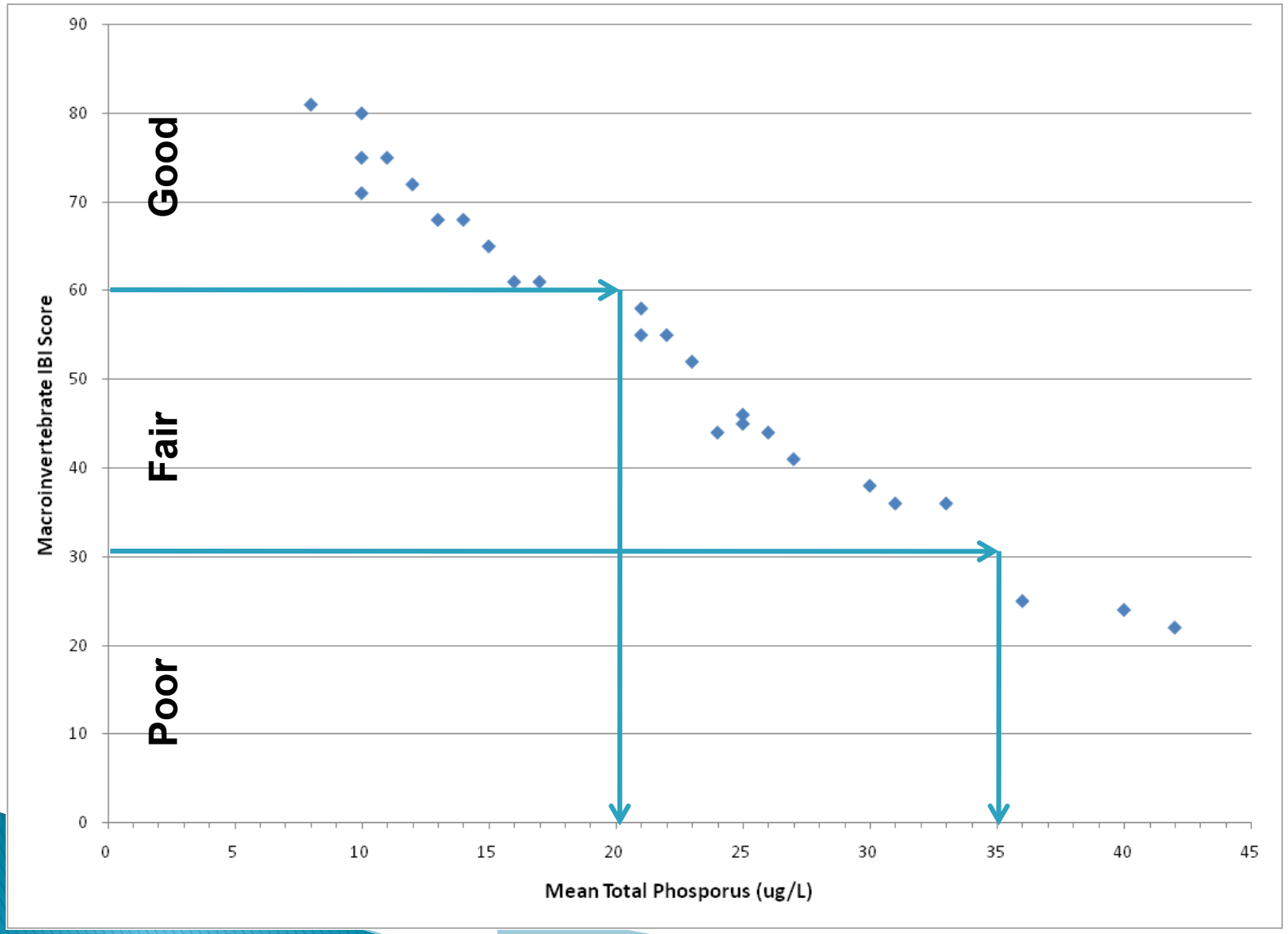
Conceptual Model for the Response of a Lake or Reservoir System to Excess Nutrients



Criteria Development Process

- Identify and analyze available data and data gaps
  - Stressor and Response Variables
- Collecting and analyzing additional data
  - Across the disturbance/stressor/nutrient gradient
- Developing a proposed criteria
  - Based on thresholds of change to the response variable
  - Based on statistical differences
  - Protective of the use

Theoretical Nutrient–Response Relationship



Criteria Development Process

- When necessary, a downstream lake, reservoir, or even river may need to be taken into consideration
  - Resulting in a more restrictive criteria

Questions???