Utah's Ecological Benefits Study

A Road to Numeric Nutrient Criteria

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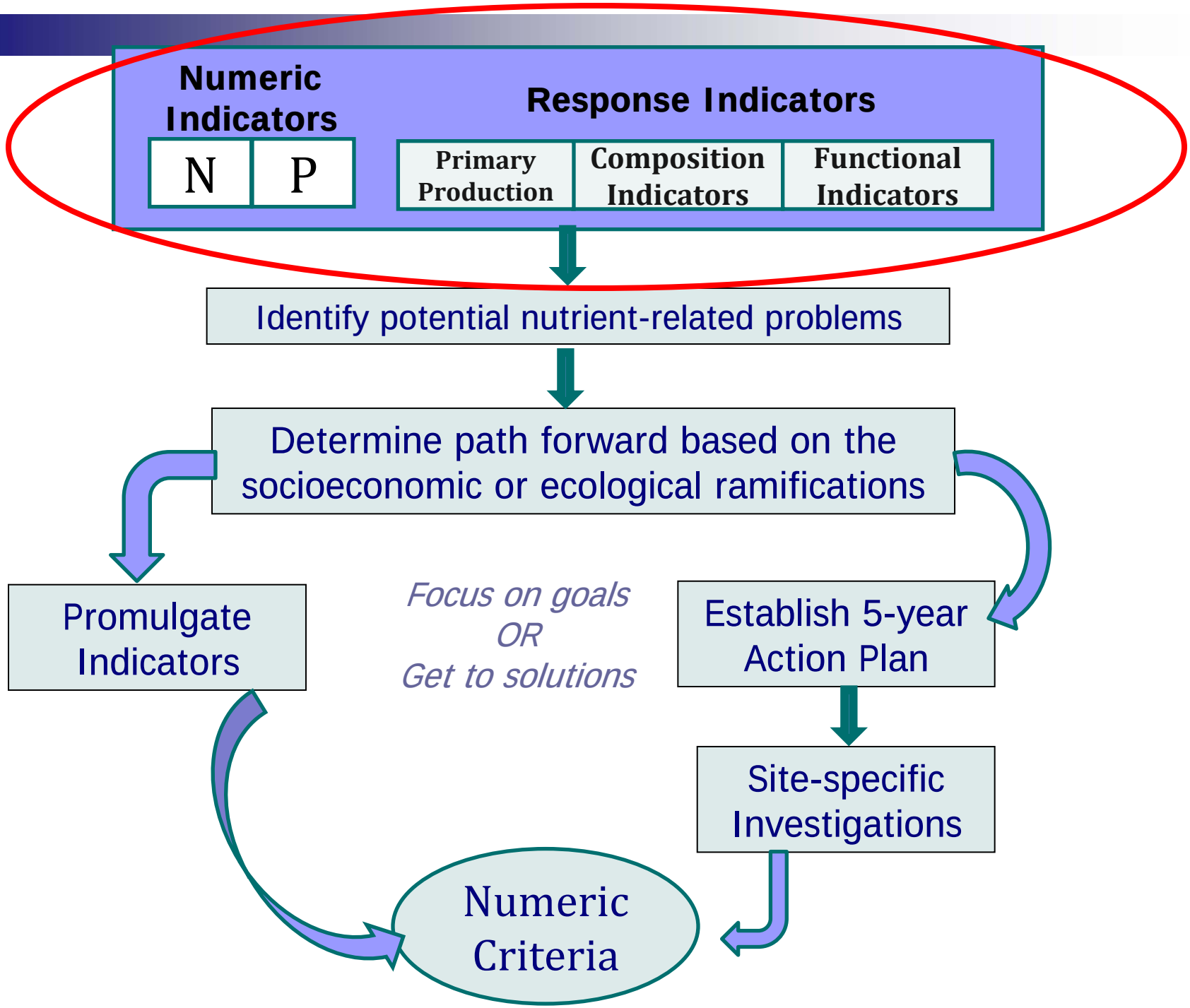
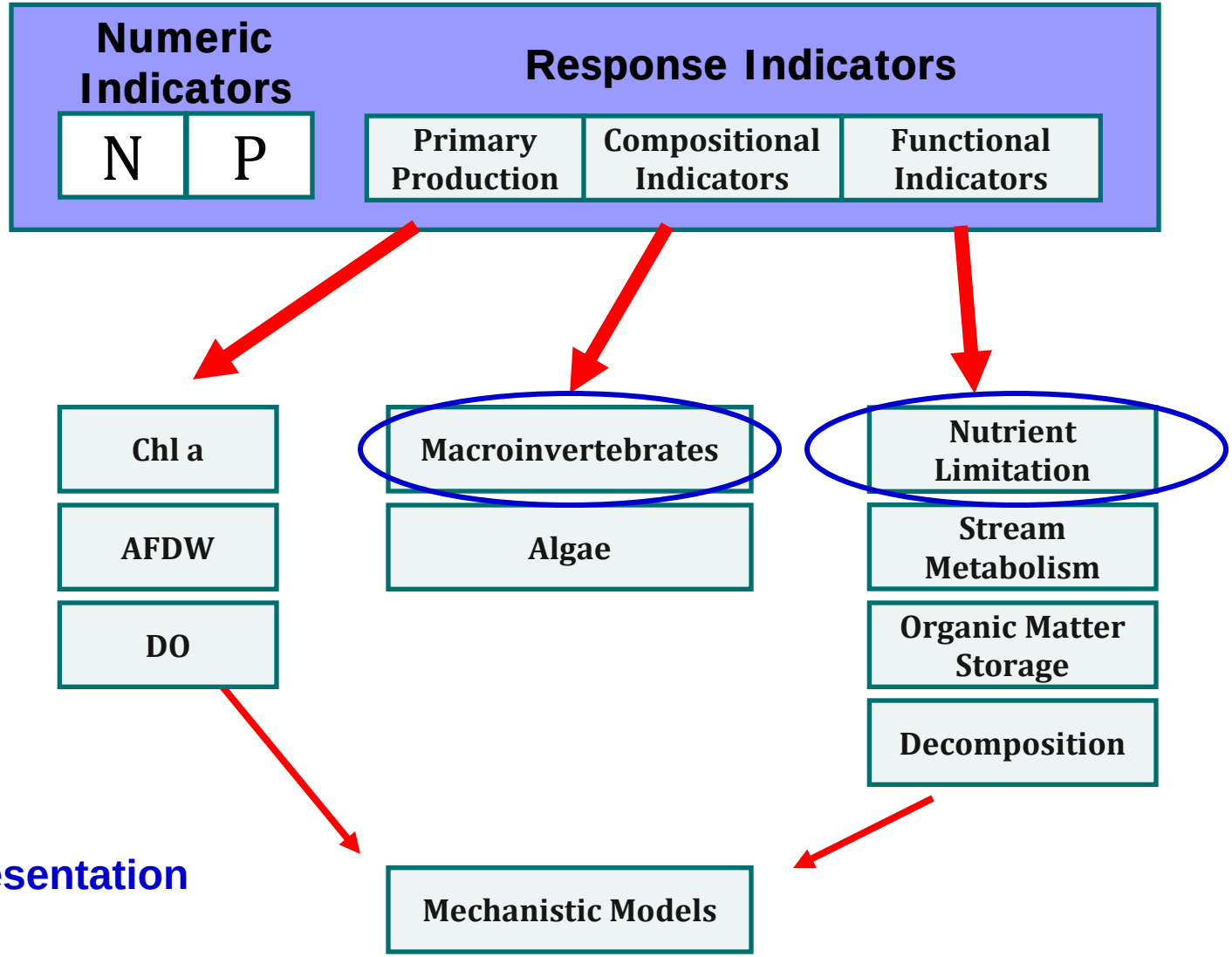
Nutrient Core Team Meeting September 21, 2011


Numeric Indicators
N
P
Response Indicators
Primary Production
Composition Indicators
Functional Indicators
Identify potential nutrient-related problems
Determine path forward based on the socioeconomic or ecological ramifications
Promulgate Indicators
Focus on goals
OR
Get to solutions
Establish 5-year Action Plan
Site-specific Investigations
Numeric Criteria



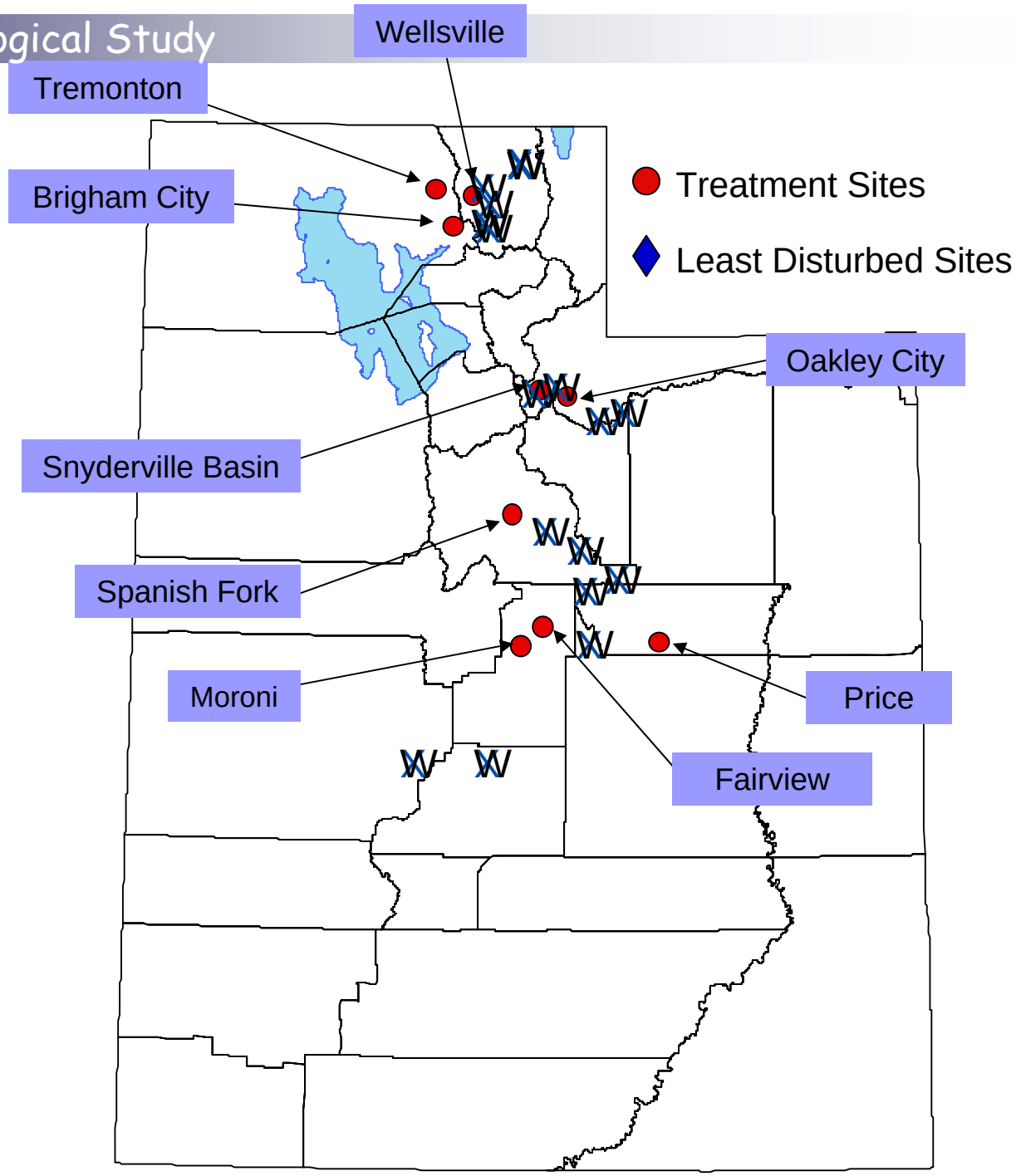
Focus of Presentation

Data Sources

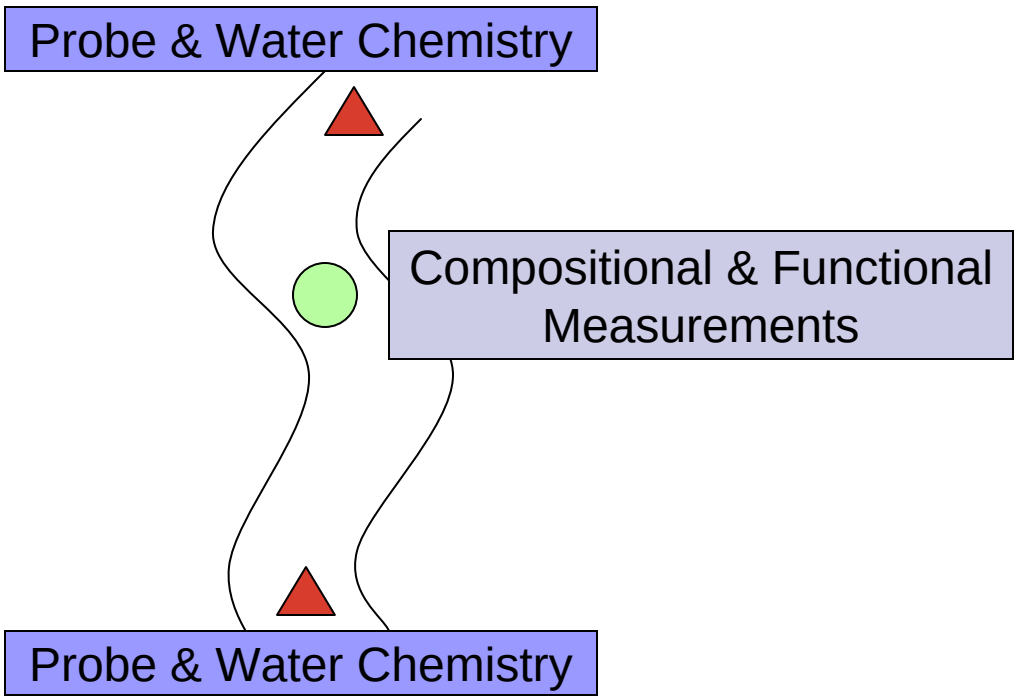
- 2003 National Wadeable Streams Assessment (WSA)
- 2009 National Rivers and Streams Assessment (NRSA, *pending)*
- Other Utah DWQ programmatic sampling
- Utah DWQ's 2010 Ecological Study

Site Locations

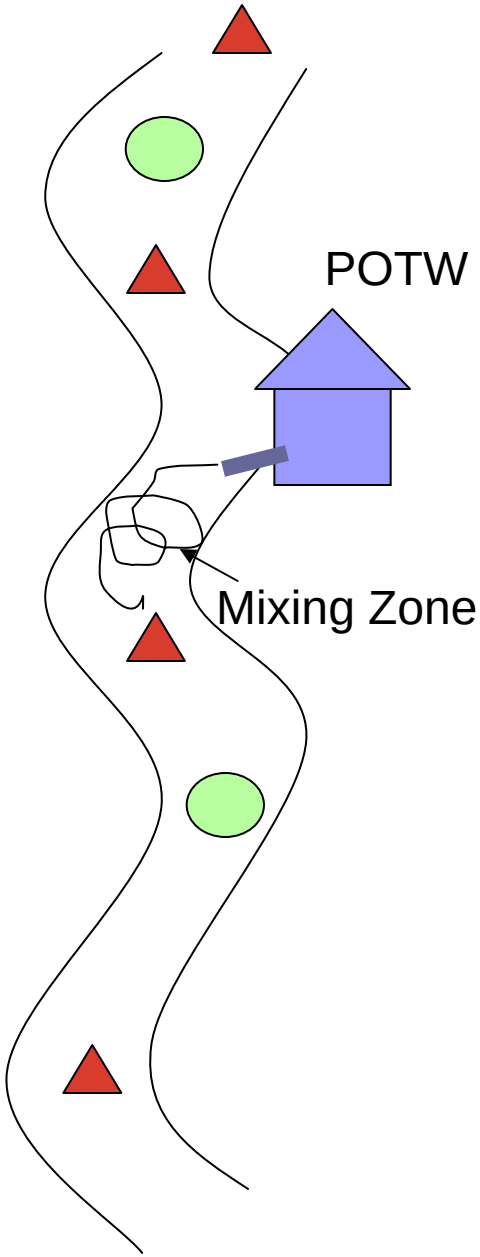
- 9 POTWs
- 17 Reference Sites



Nutrient Criteria Ecological Study



17 Reference Sites



9 POTWs

Indicators

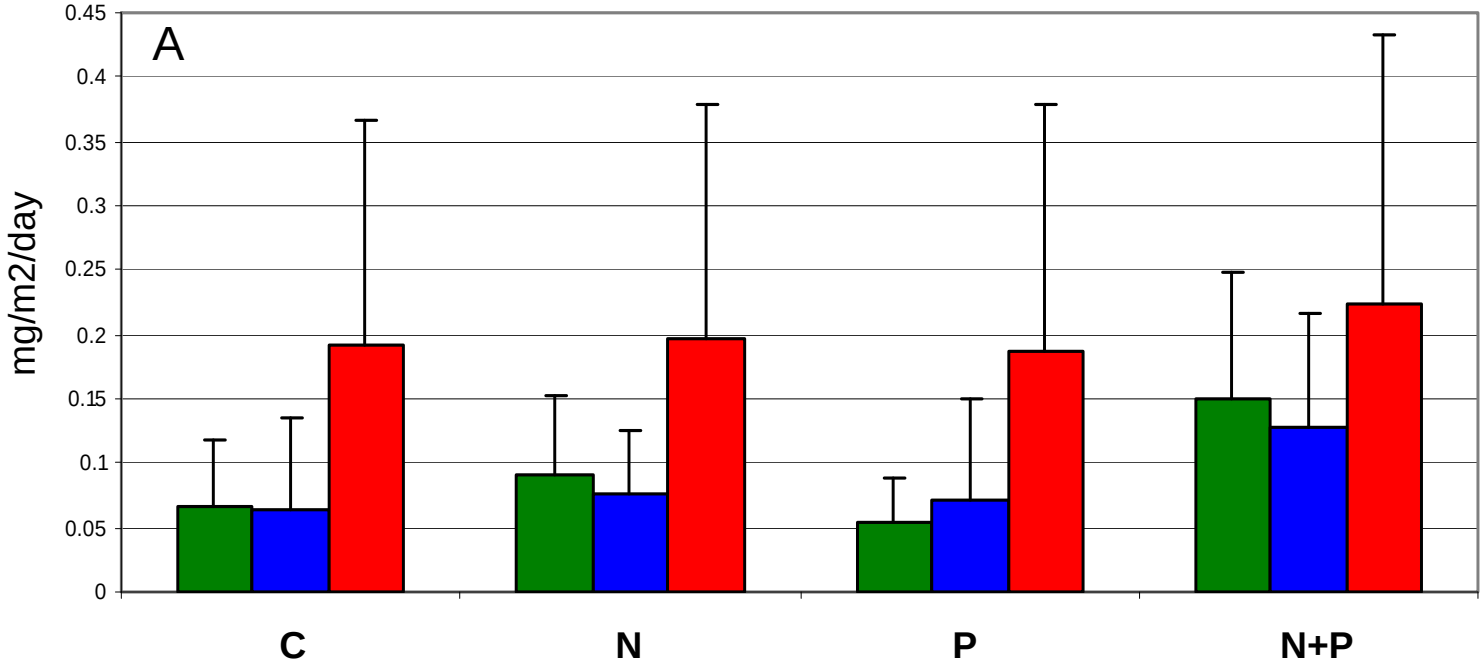
- Functional Indicators
  - **Nutrient Limitation**
- Compositional Indicators
  - Macroinvertebrates
- Statewide Snapshot

Nutrient Limitation

- Adding the limiting nutrient will have the greatest affect on algal growth
- Nutrient Diffusing Substrates (NDS)
- Control, Nitrogen, Phosphorus & Nitrogen + Phosphorus
- Analyze algal growth under different nutrient additions

NDS Results

A) Mean Chl a growth rate per treatment

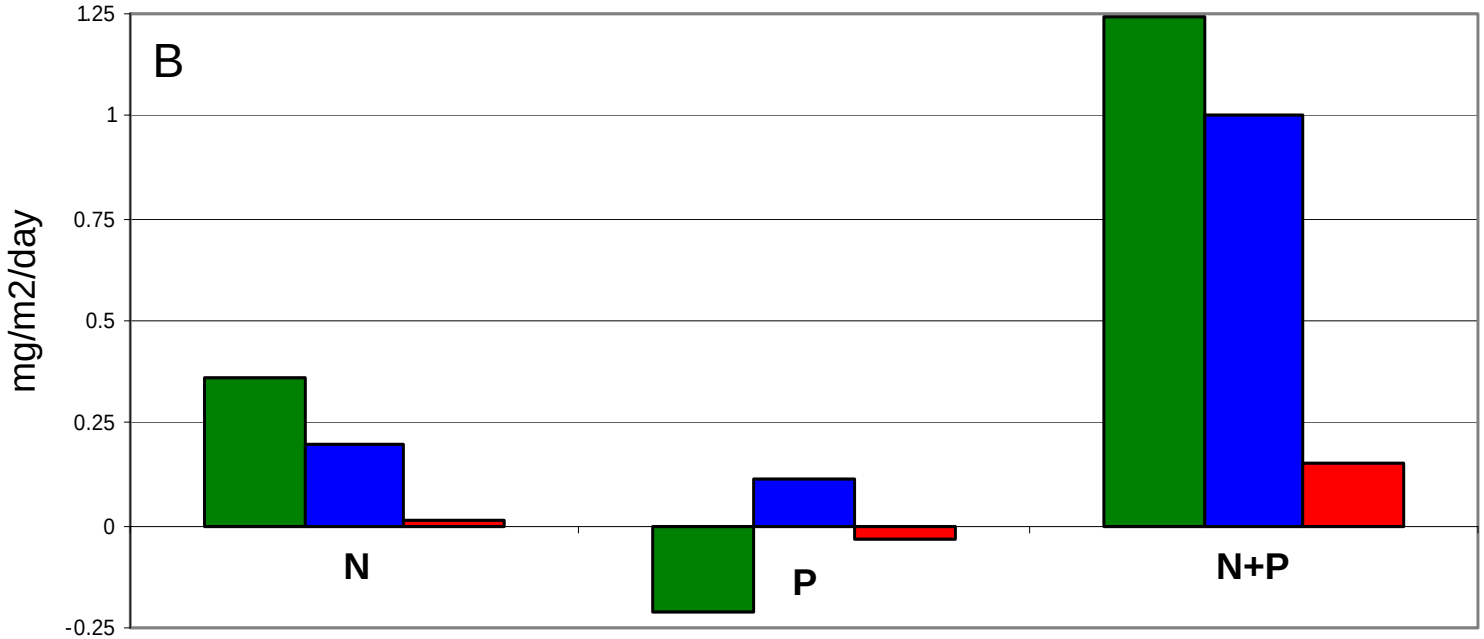


Reference

Above POTW

Below POTW

B) Mean Chl a growth rate per treatment, relative to control



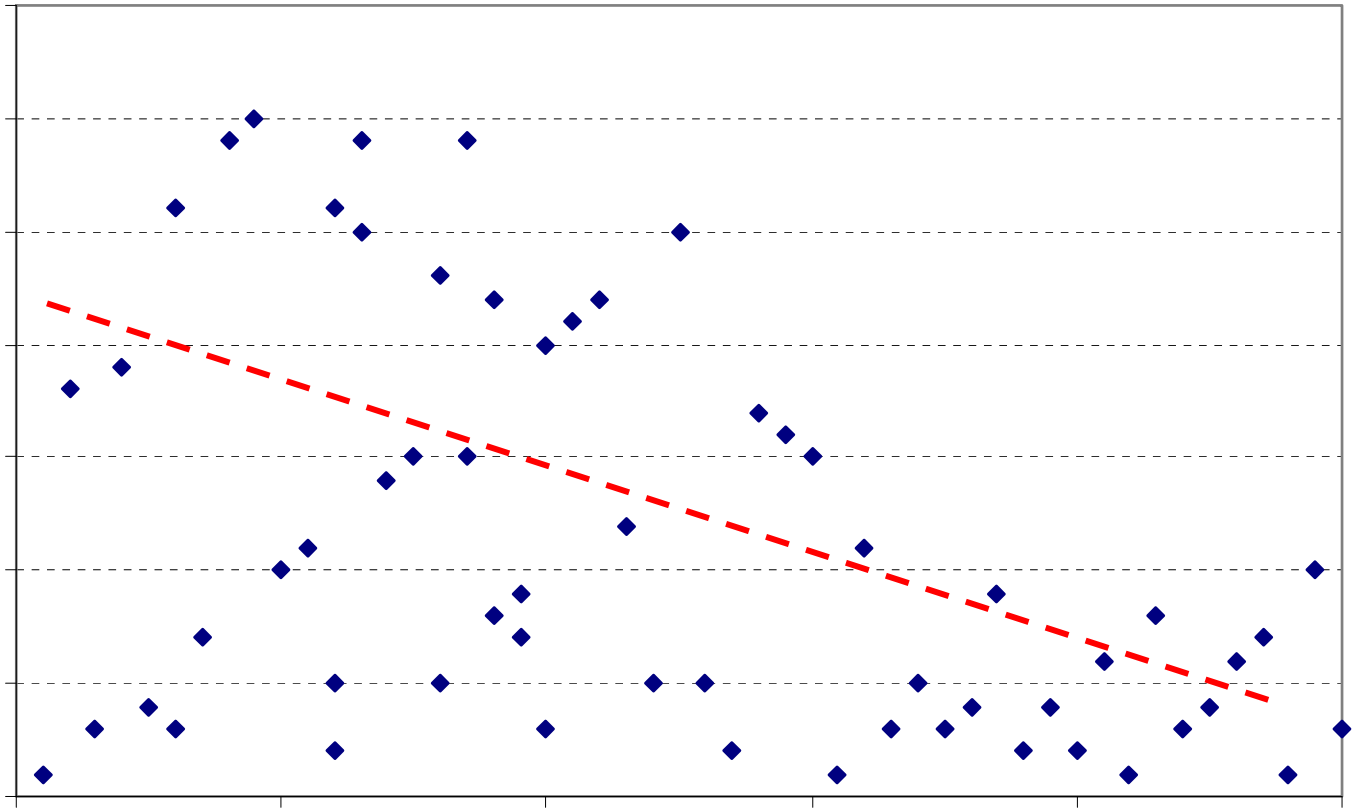
Nutrient Limitation Results

Site	Nutrient Limitation					
	None	N	P	N&P	N1 P2	P1 N2
Reference	3	5	0	5	2	0
Above POTW	2	1	2	1	1	0
Below POTW	6	0	0	0	1	0

- 80% of reference sites have some form of Nitrogen limitation
- No reference sites are solely Phosphorus limited
- 6 of 7 Below POTW sites are not limited by nutrients
- Reducing point sources alone may not get streams back to reference condition

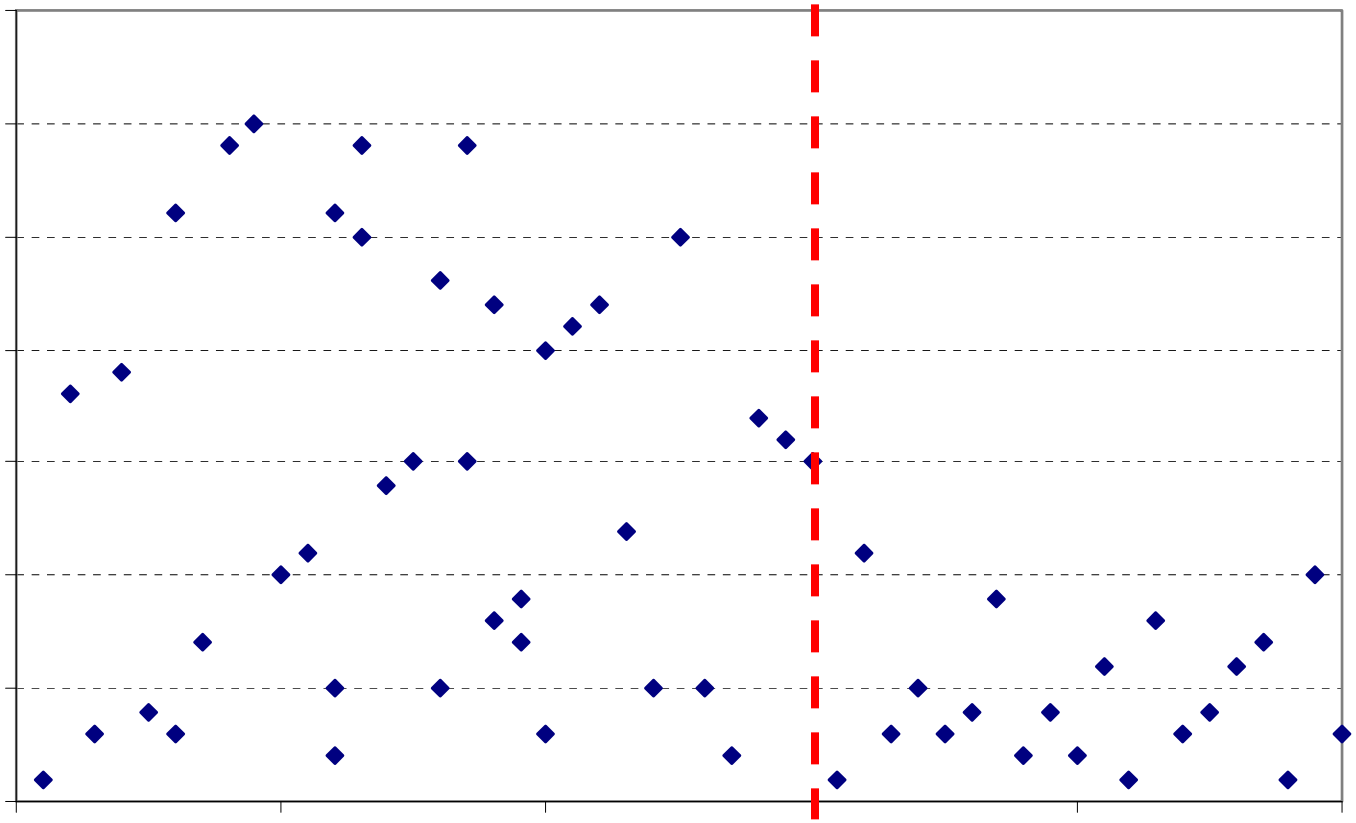
Classification And Regression Trees, Changepoint Analysis, etc.

Hypothetical Distribution



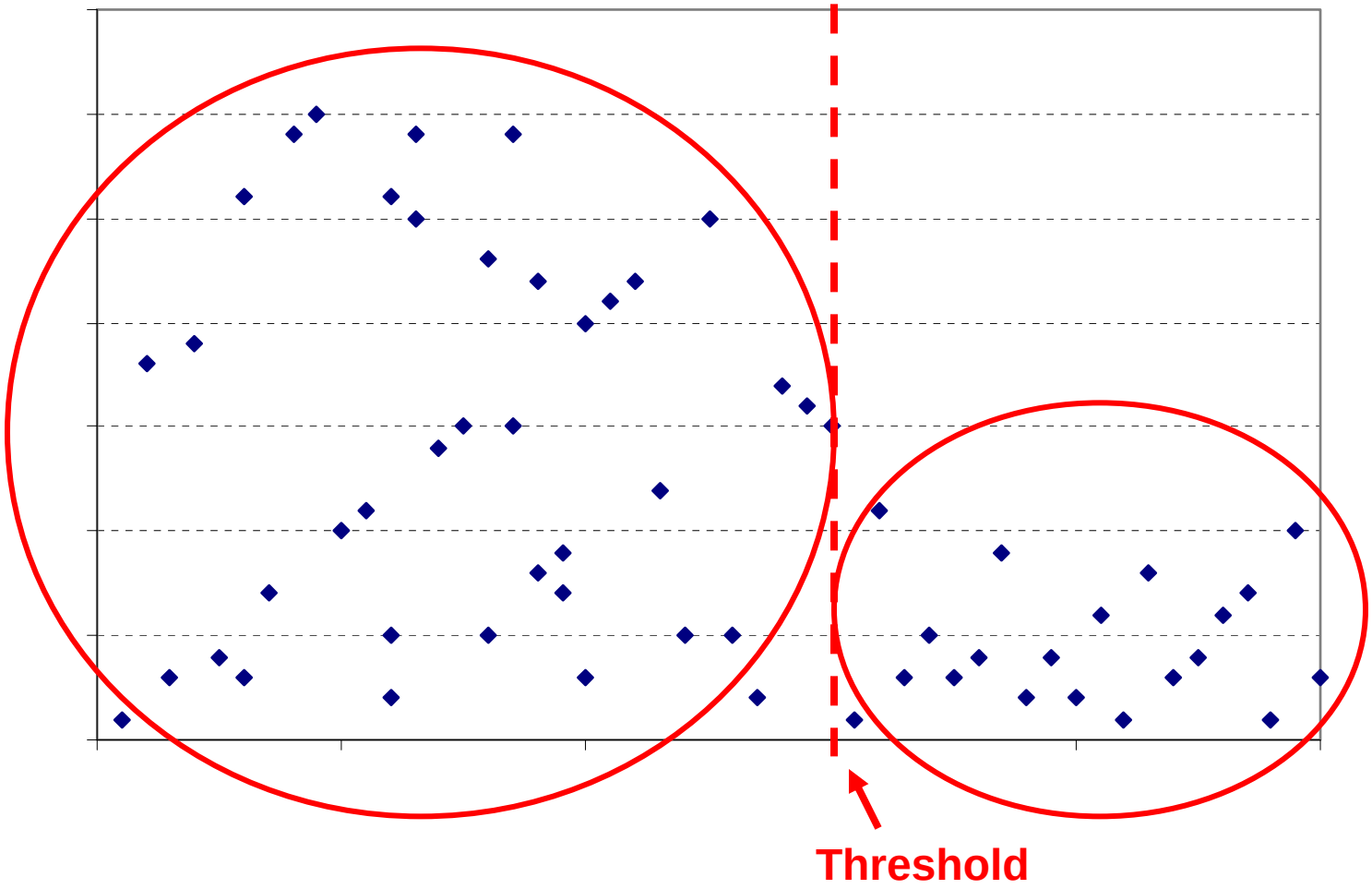
Classification And Regression Trees, Changepoint Analysis, etc.

Hypothetical Distribution

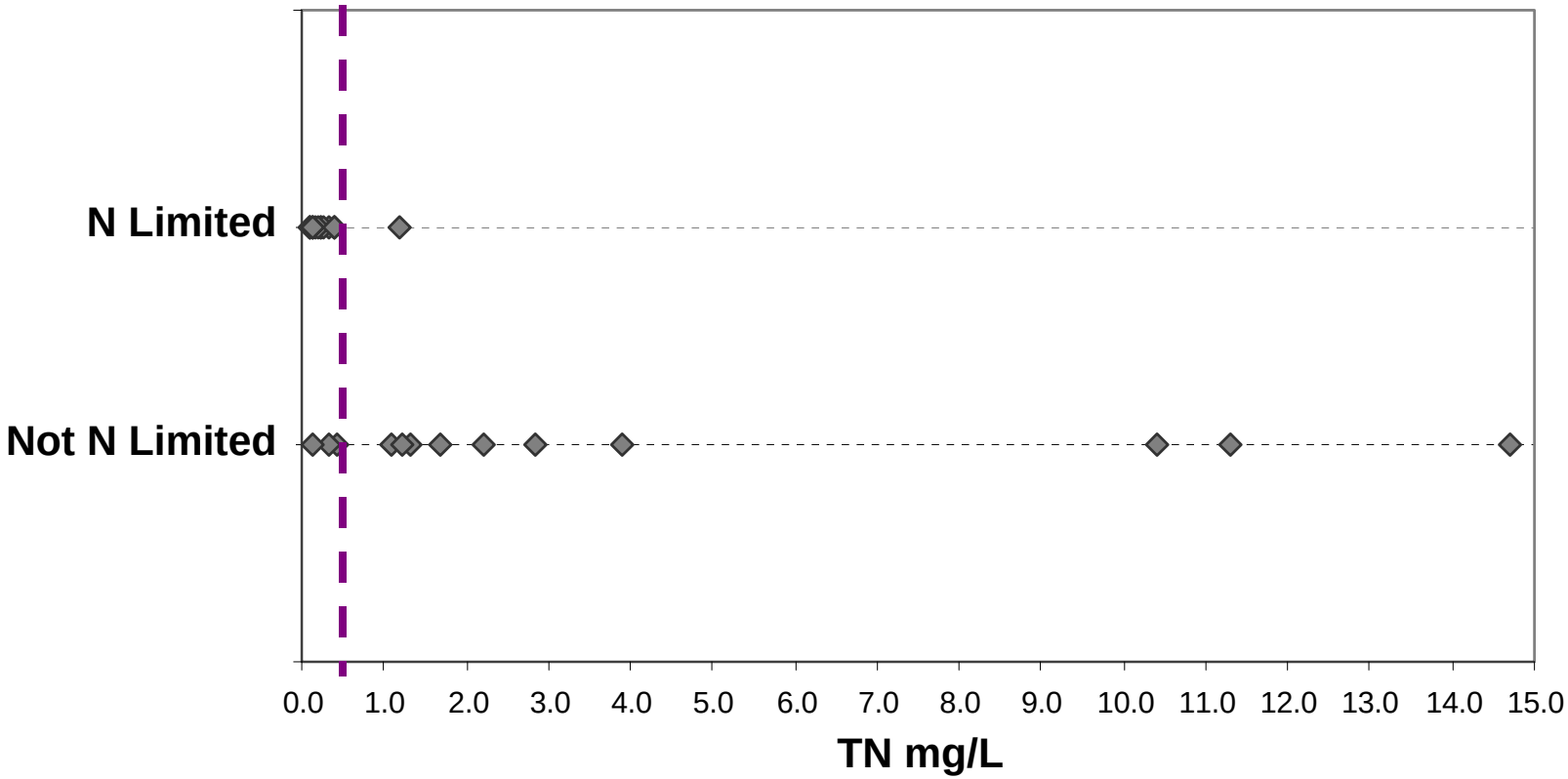


Classification And Regression Trees, Changepoint Analysis, etc.

Hypothetical Distribution



NDS Threshold Analyses (CART)



- Any form of N limitation considered reference condition (N, N+P or N1P2)
- Thresholds
  - TN : 0.42 mg/L
  - TP: 0.078 mg/L

Indicators

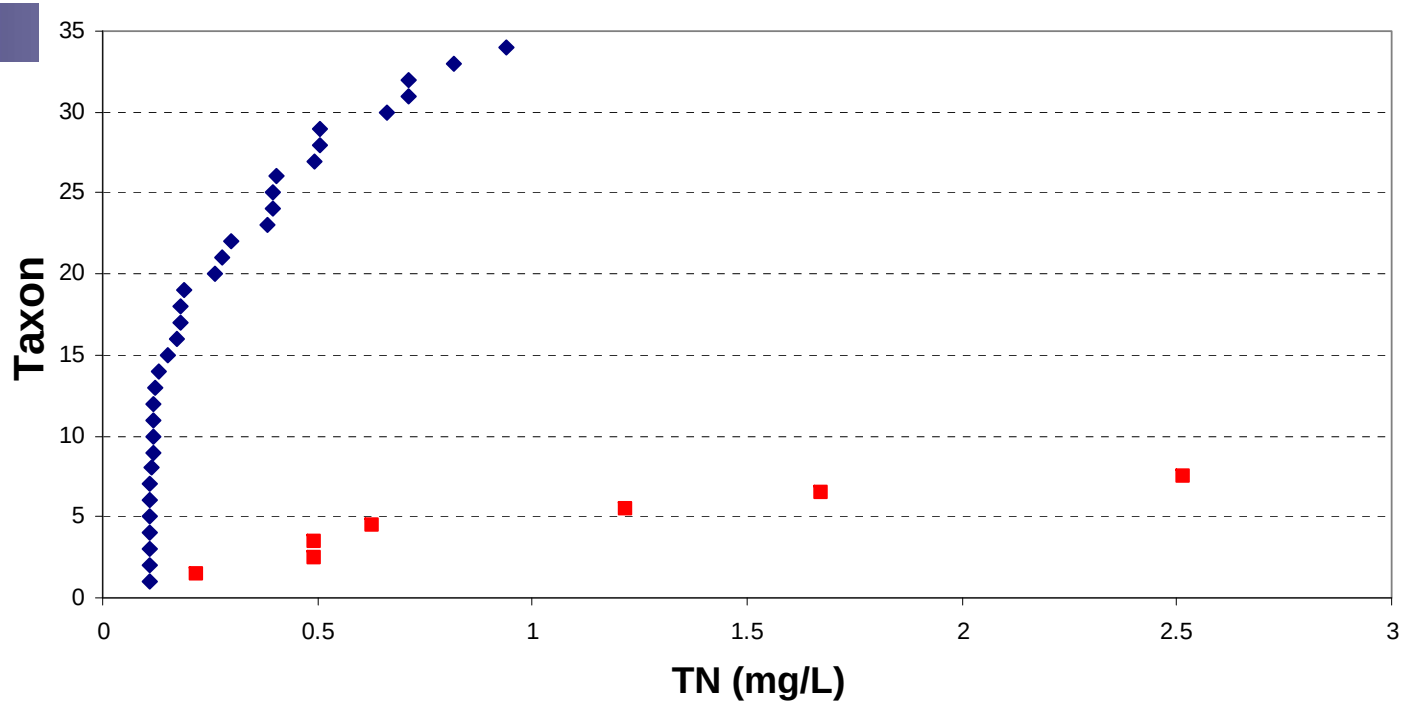
- Functional Indicators
  - Nutrient Limitation
- Compositional Indicators
  - **Macroinvertebrates**
- Statewide Snapshot

Taxonomic Indicator Threshold Analysis -TITAN

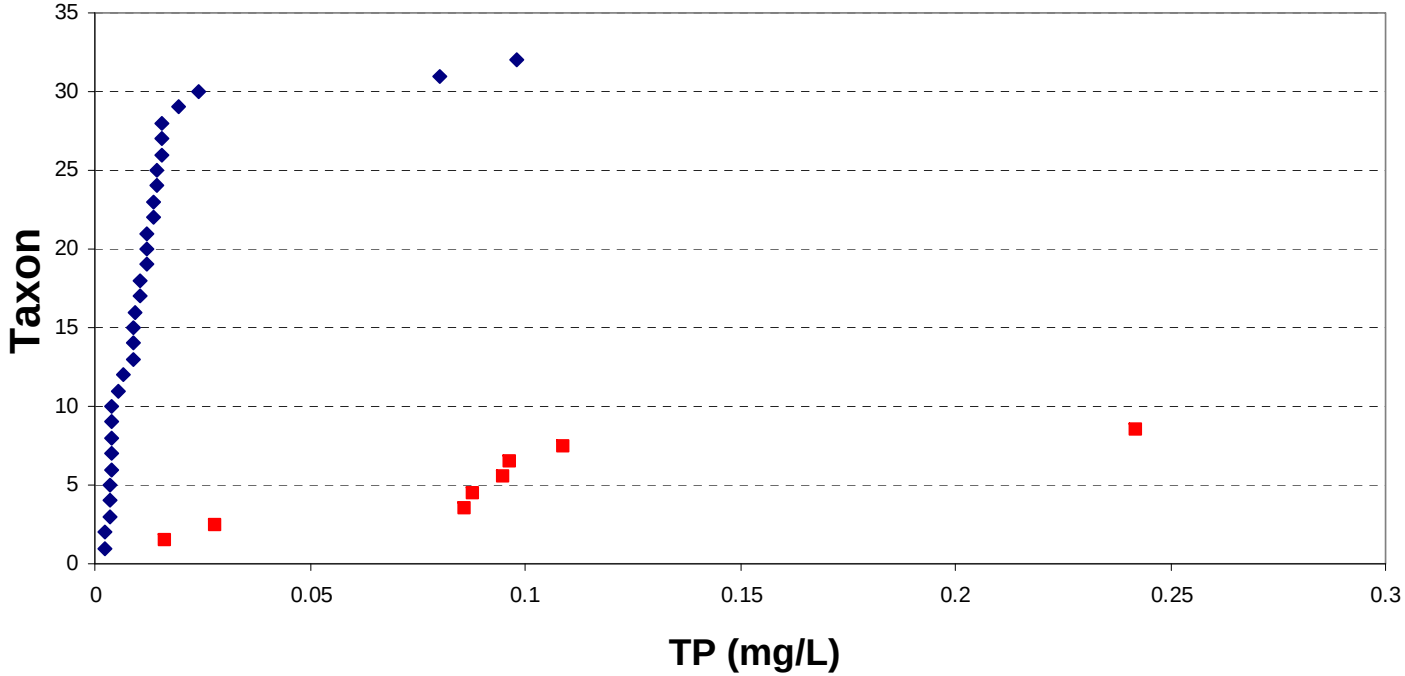
- Uses individual taxon responses instead of community metrics/composition
- Identifies and categorizes taxa into two categories
  - Negative responders (sensitive)
  - Positive responders (tolerant)
- Ideal for developing numeric criteria

TITAN Results

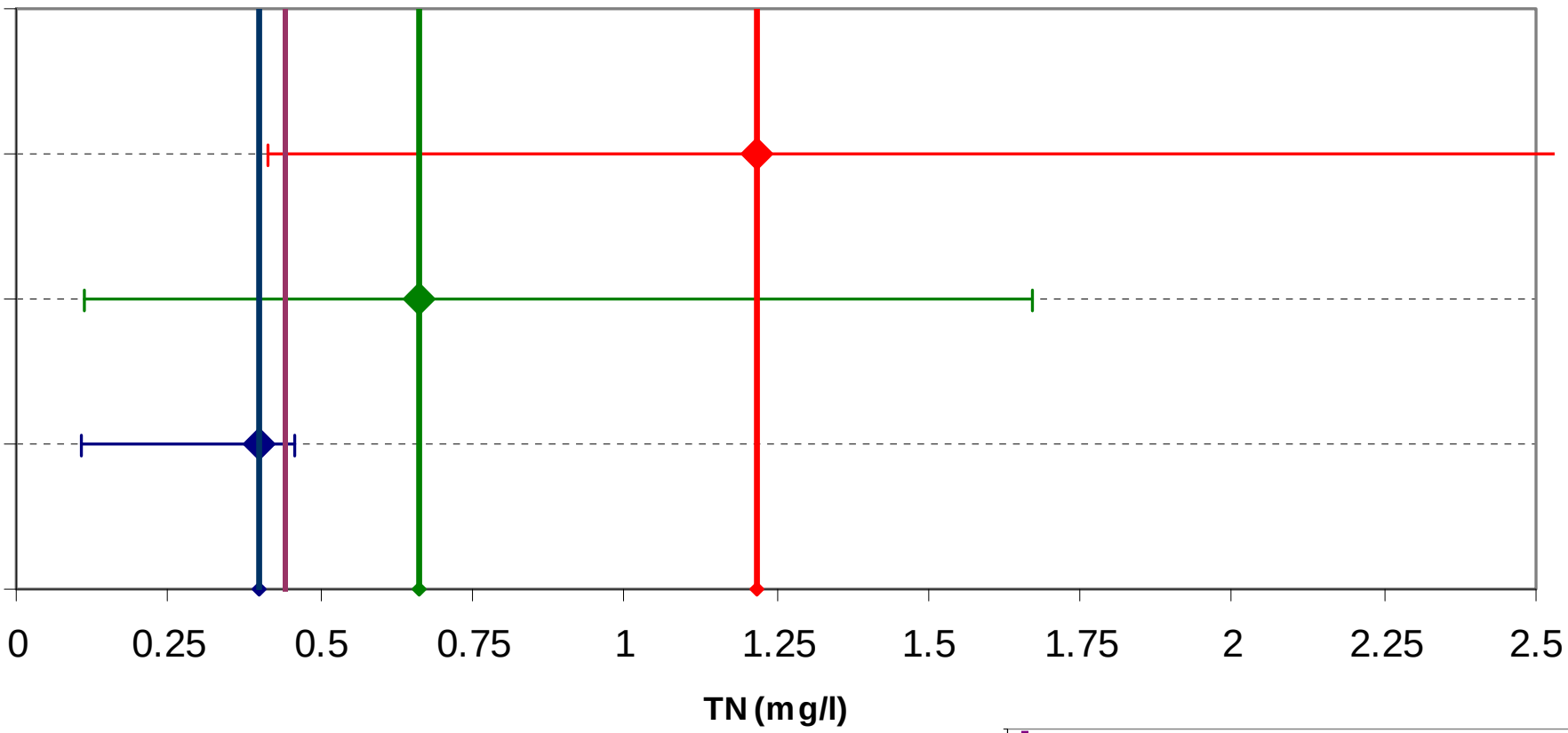
Respond negatively to increasing nutrients



Respond positively to increasing nutrients



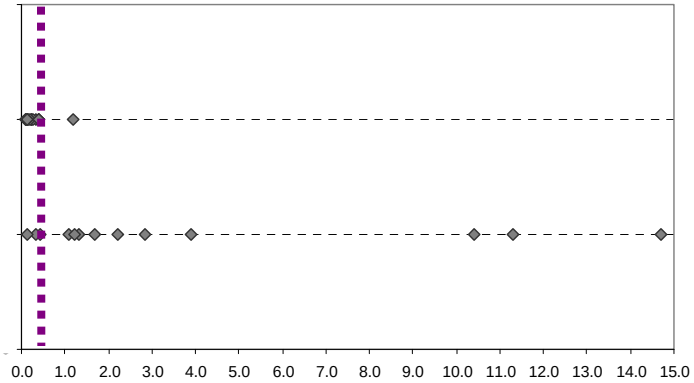
TITAN Results TN (mg/L)



Negative responding taxa - 0.39 mg/L

All significant taxa – 0.66 mg/L

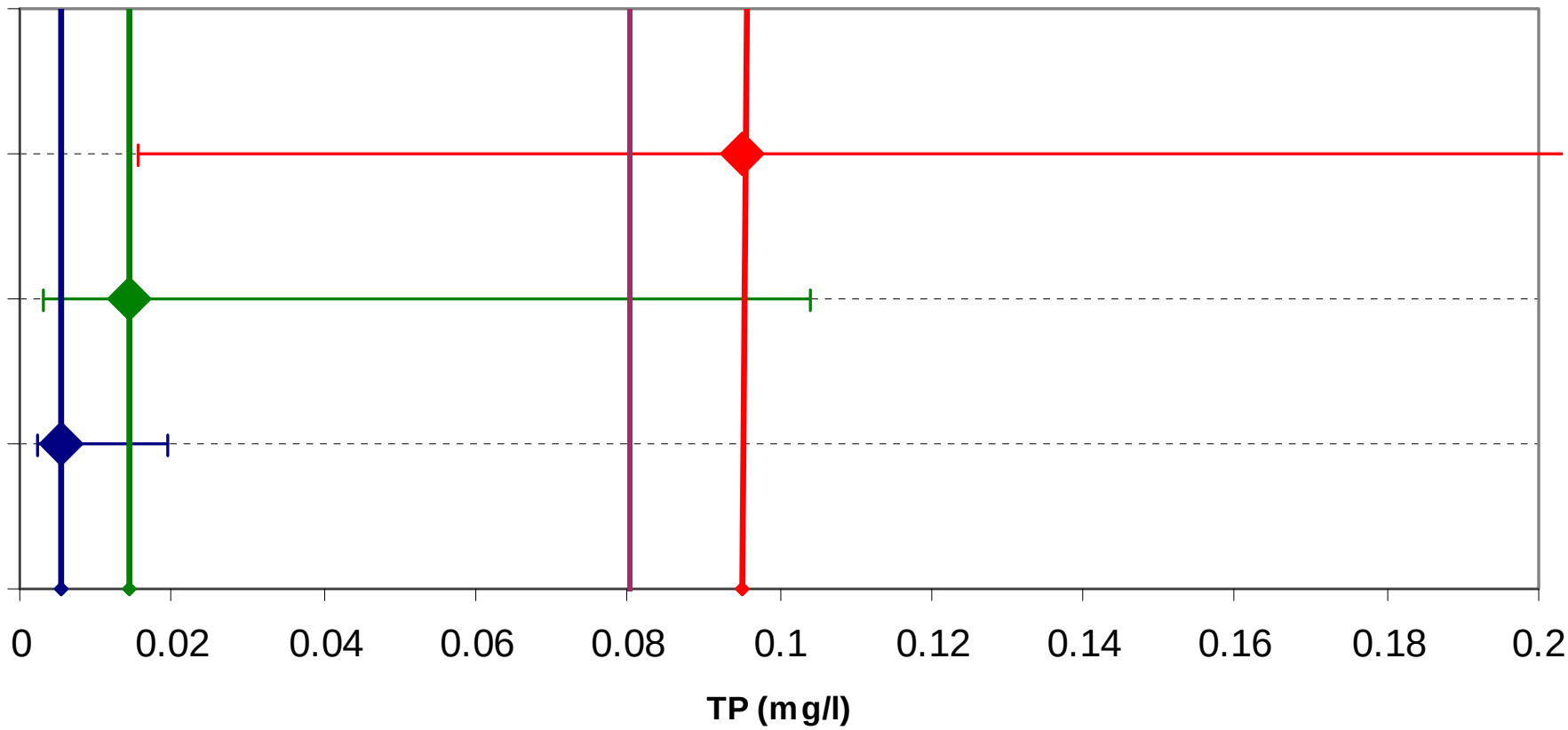
Positive responding taxa – 1.2 mg/L



Nutrient Limitation

ANY N limitation vs NOT N limited – 0.42 mg/L

TITAN Results TP (mg/L)



Negative responding taxa - 0.006 mg/L

All significant taxa – 0.015 mg/L

Positive responding taxa – 0.09 mg/L

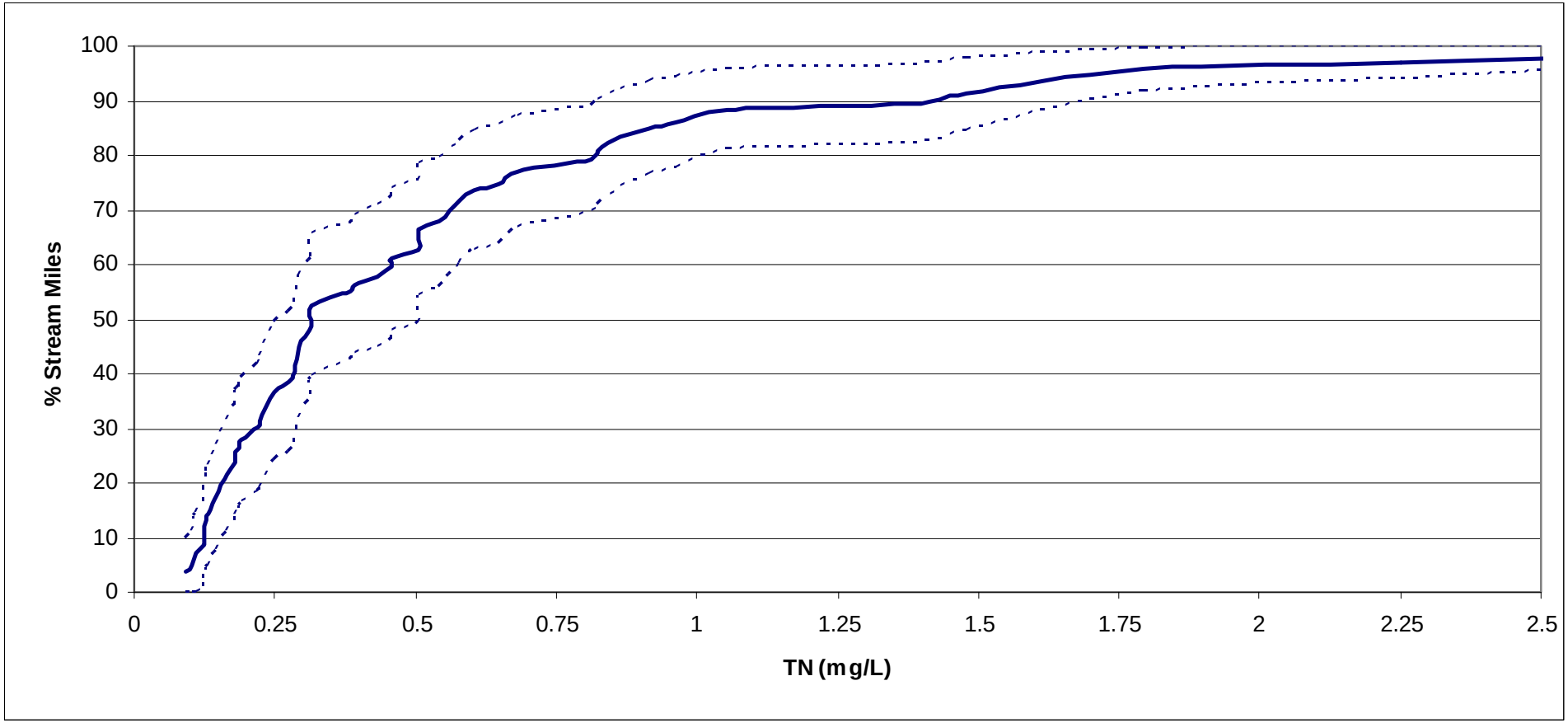
Nutrient Limitation

ANY N limitation vs NOT N limited – 0.078 mg/L

Indicators

- Functional Indicators
  - Nutrient Limitation
- Compositional Indicators
  - Macroinvertebrates
- **Statewide Snapshot**

What does this mean for Utah's streams?



Possible Criteria, TN	Percent Impaired	Stream Miles Impaired
Min 0.4	43%	~5100
Medium 0.66	33%	~3900
Max 1.2	11%	~1300

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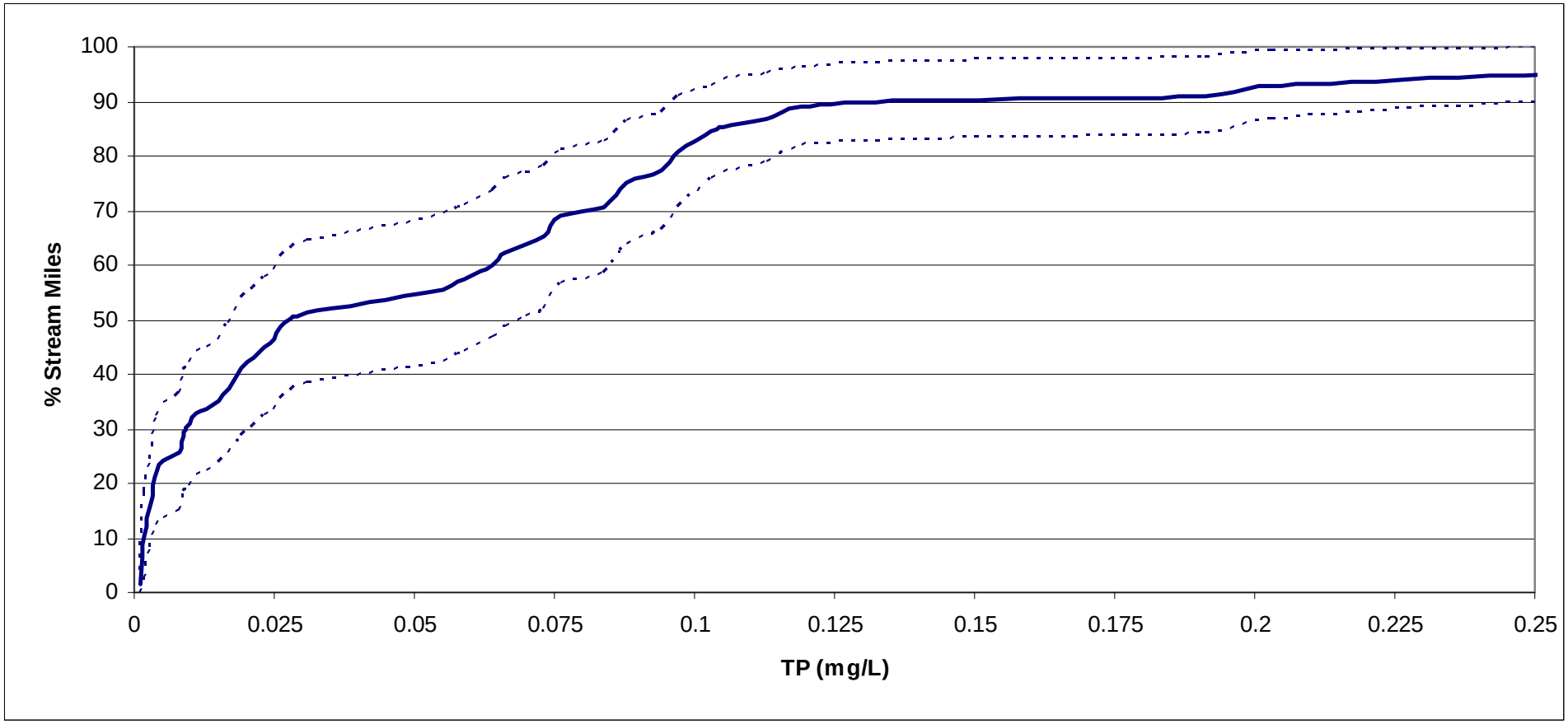

Possible Criteria, TP	Percent Impaired	Stream Miles Impaired
Min 0.006	75%	~9000
Medium 0.078	34%	~4100
Max 0.095	19%	~2280

Next Steps

- Continue analyzing remaining functional indicators
- Add 2009 NRSA data to TITAN & CDF's
- Examine regional differences
- Risk Analysis

Questions?

- Special Thanks
  - Utah DWQ
    - Emilie Flemer
    - Suzan Tahir
    - Jared Terry
    - Emily Bartusek
    - Kate Tipple
    - Alex Anderson
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    - Andrew Hobson