The Pennsylvania TMDL Program

December 2007

Legal Background

- Section 303(d) of the Federal Clean Water Act (40 CFR §130.7(a))
  - States must identify, list and prioritize all water quality limited segments and establish total maximum daily loads for those segments
  - TMDLs must be established for all pollutants identified as preventing attainment of water quality standards
  - Total Maximum Daily Loads (TMDLs) established for these waters must ensure attainment of water quality standards.

Legal Background Cont….

- April, 1997 -- EPA settles with litigants
  - MOU between DEP and EPA signed
- MOU Obligations
  - Assess all unassessed streams -- 10 years
  - Assess 100 significant lakes -- 10 years
  - Establish TMDLs for 1996 303(d) listed waters (569)
    - 10 years (non AMD), 12 years (AMD)

What is a TMDL?

A Total Maximum Daily Load (TMDL) is the amount of pollutant loading that a waterbody can assimilate and meet our water quality standards.

The TMDL process is a planning tool to develop pollution reduction goals that will improve impaired waters to meet water quality standards.

TMDL Development

- Evaluate watershed land use and all potential sources of the pollutant causing the impairment
- Apply or develop appropriate WQS goals
- Use water quality and land use models to calculate total allowable load (TMDL), allowable nonpoint source load (load allocation) and allowable point source load (WLA)
- Consider impacts of background pollution, critical, and seasonal environmental conditions

TMDL Development Cont…

- Include a Margin of Safety (MOS)
- Demonstrate reasonable assurance that the proposed TMDL can be met
- Allow for public participation

Pennsylvania's Watershed Management Cycle

- A stream/watershed assessment
- Streams that are water quality limited are put in Category 5 of Pennsylvania's Integrated Water Quality Monitoring and Assessment Report (a.k.a.the 303(d) List)
- The TMDL is completed to address the impairments
- Implementation plan developed
- Remediation activities
- The watershed will be re-surveyed

TMDL Status Report

- MOU obligations met for 1996 listed non-AMD waters
- AMD waters on 1996 must be completed by April 2009 (40%)
- Post Consent Decree requirements driven by CWA, EPA policy and funding

What's Driving TMDL Development

- Statutory requirements for TMDL development still apply
- EPA PACE
- Post CD agreement pending

Post Consent Decree Vision

- Select TMDL watersheds with an eye toward implementation
- Focus TMDL efforts on Regional Office Priority Watersheds
- Application of more detailed current and planned BMP data
- Increased level of stakeholder and interested party involvement

Pennsylvania's NPS TMDL Challenge

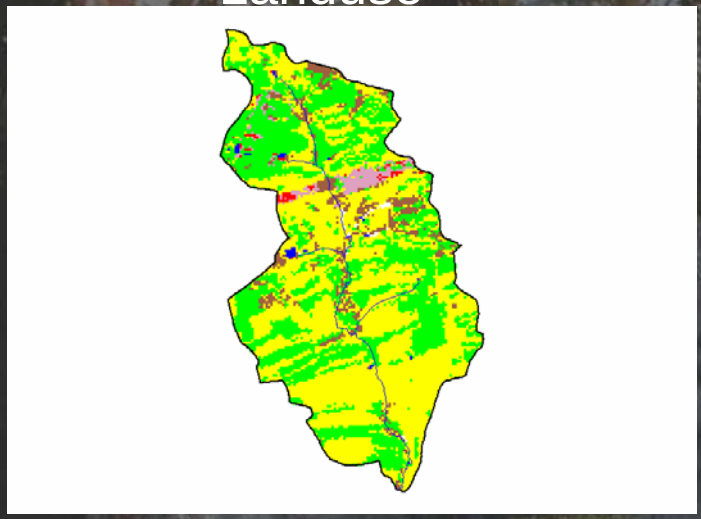
- Thousands of assessed stream miles impaired by nutrients/sediment
- Impaired segments need TMDLs
- No no numeric water quality criteria for pollutants of concern
- Sparse monitoring data in most cases

Reference Watershed Approach

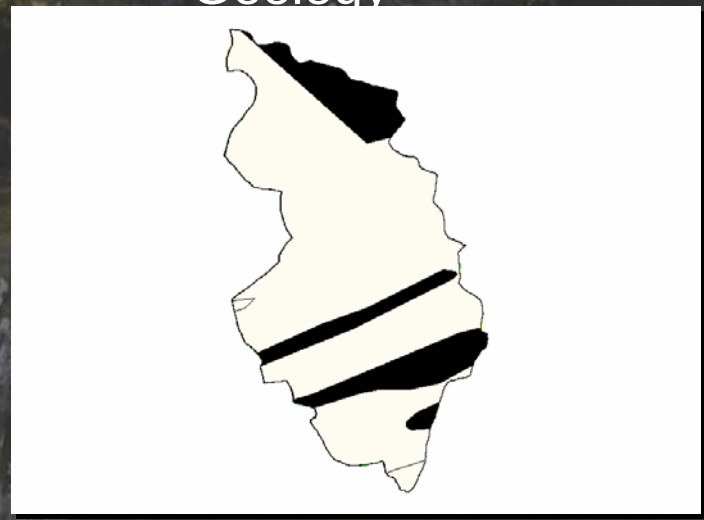
- Identify similar watershed meeting standards (Reference Watershed) with similar characteristics to impaired watershed
- Determine loading rates in reference and impaired watersheds through modeling analysis
- Calculate load reductions by land use/source required in impaired watershed to meet reference watershed loading rates
- Allocate loads to subwatersheds

Identify Reference Watershed

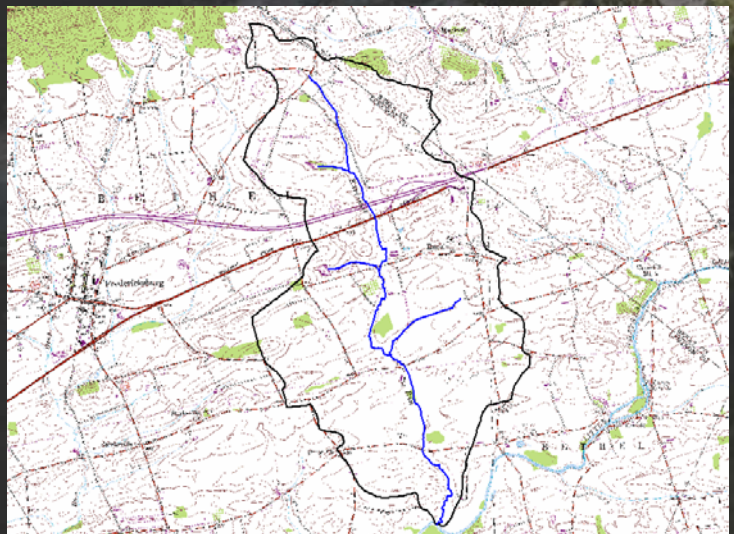
Landuse



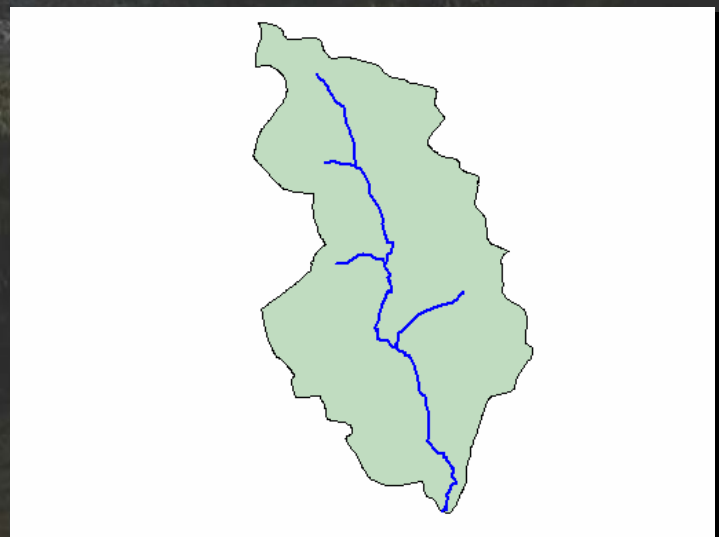
Geology



Topography



Streams Meeting Standards



Watershed Comparison

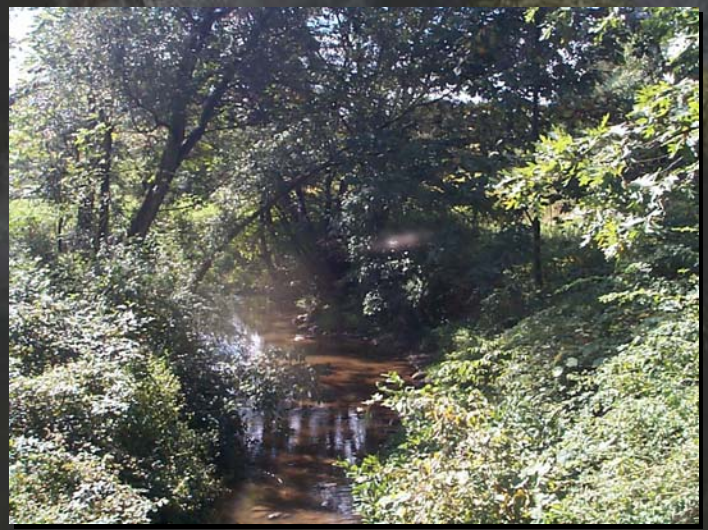
	Earlakill Run	Lick Run
Size (mi^2)	4.38	5.96
Physiographic Province	Ridge and Valley	Ridge and Valley
% Agriculture	90	63
Surface Geology	80% Interbedded Sedimentary	95% Interbedded Sedimentary
Dominant HSG	C	C
20-year Average Rainfall (in)	40.5	41.4

Impaired Watershed Field Survey

- Cows in stream
- Cut banks and sparse riparian vegetation
- Endless corn

Reference Watershed Field Survey

- Contour strips and fallow land
- Buffered riparian zone
- Fenced pastures and cattle crossings



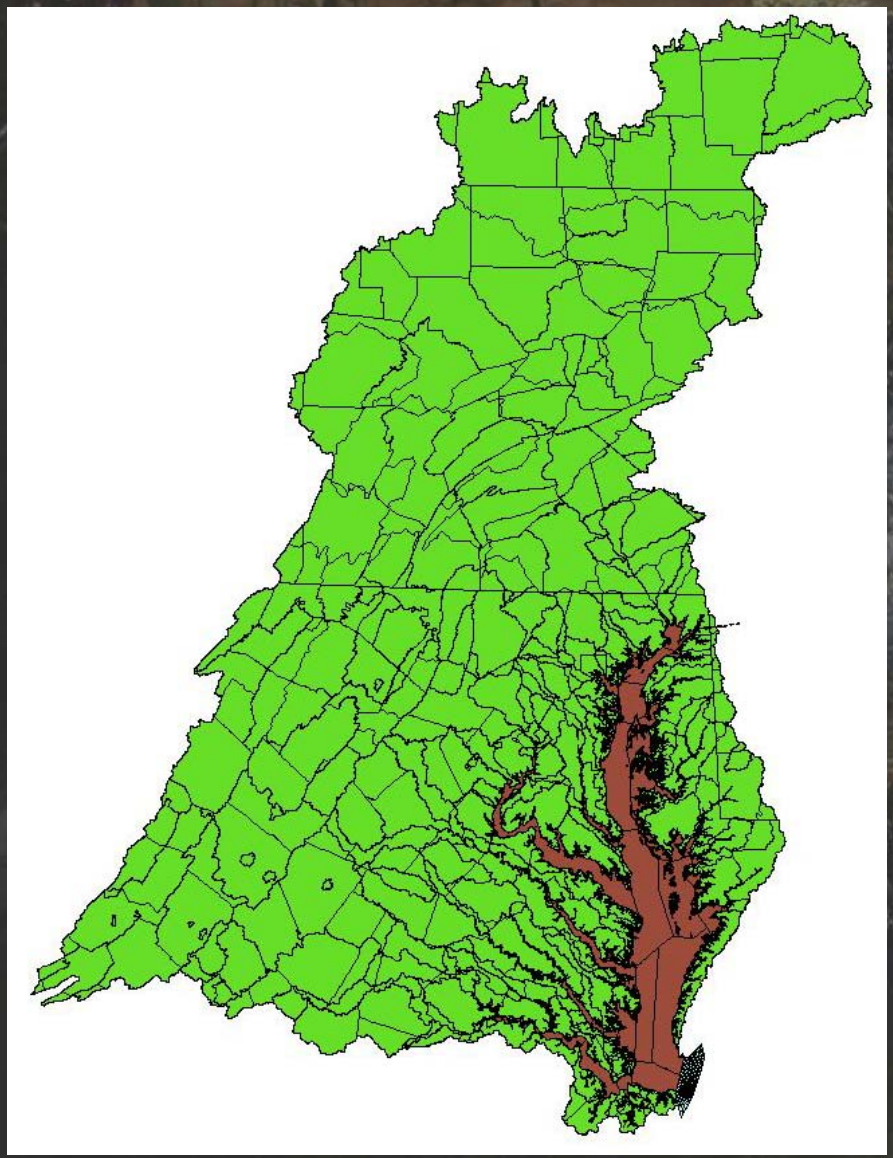
Keys to Success with PA Reference Watershed Approach

- Thorough investigation of source/cause listings
- Site visits essential in the verification/adjustment of model parameters derived from GIS data sets
- TMDL based on relative, not absolute, difference between watersheds

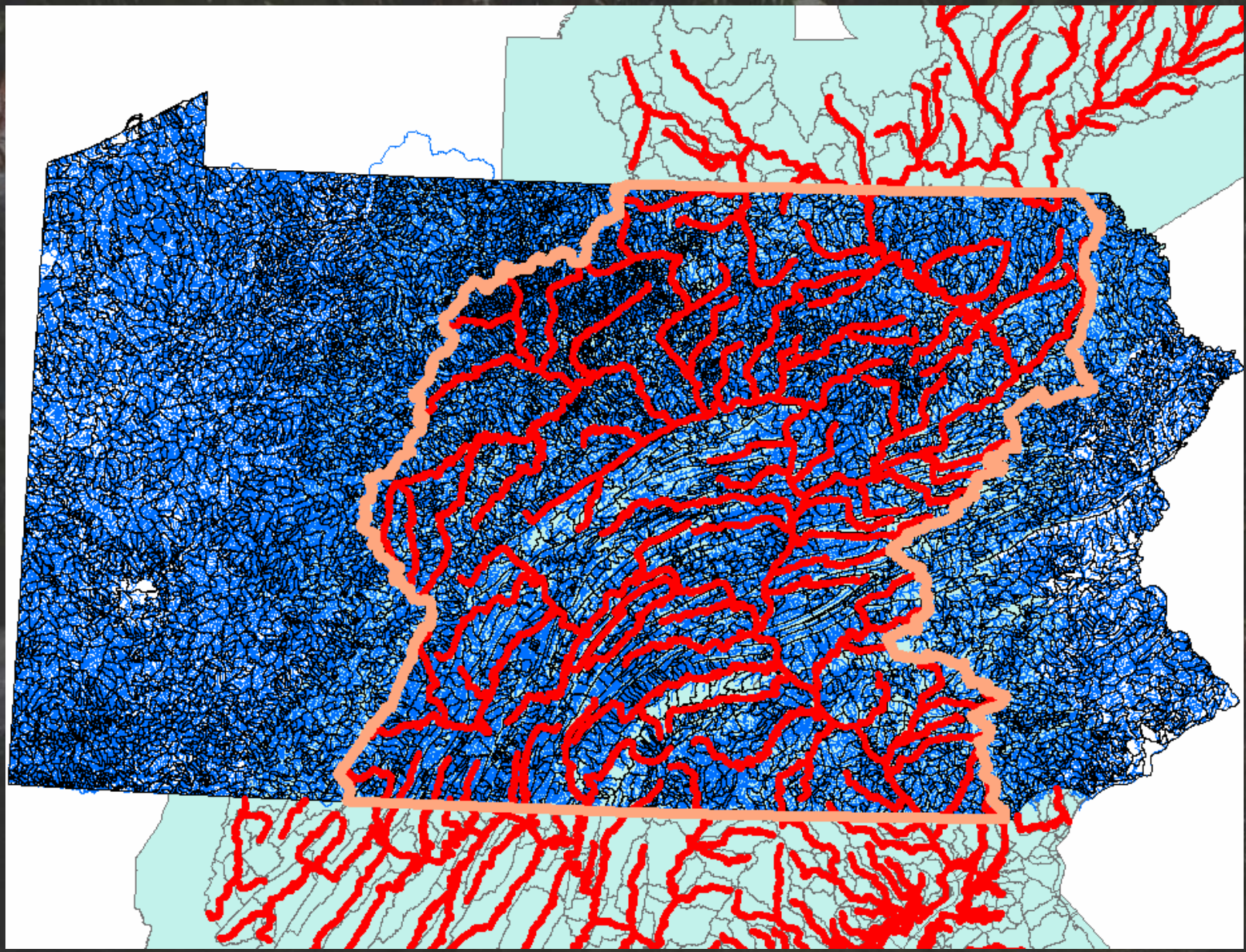
Local TMDLs vs. Chesapeake Bay Requirements

- Derived independently
- Similarities in specific TMDLs to Chesapeake Bay requirements are coincidence
- TMDLs define the load required for waterbody to meet water quality standards (i.e. support designated uses)

Local TMDLs vs. Chesapeake Bay Tributary Strategies



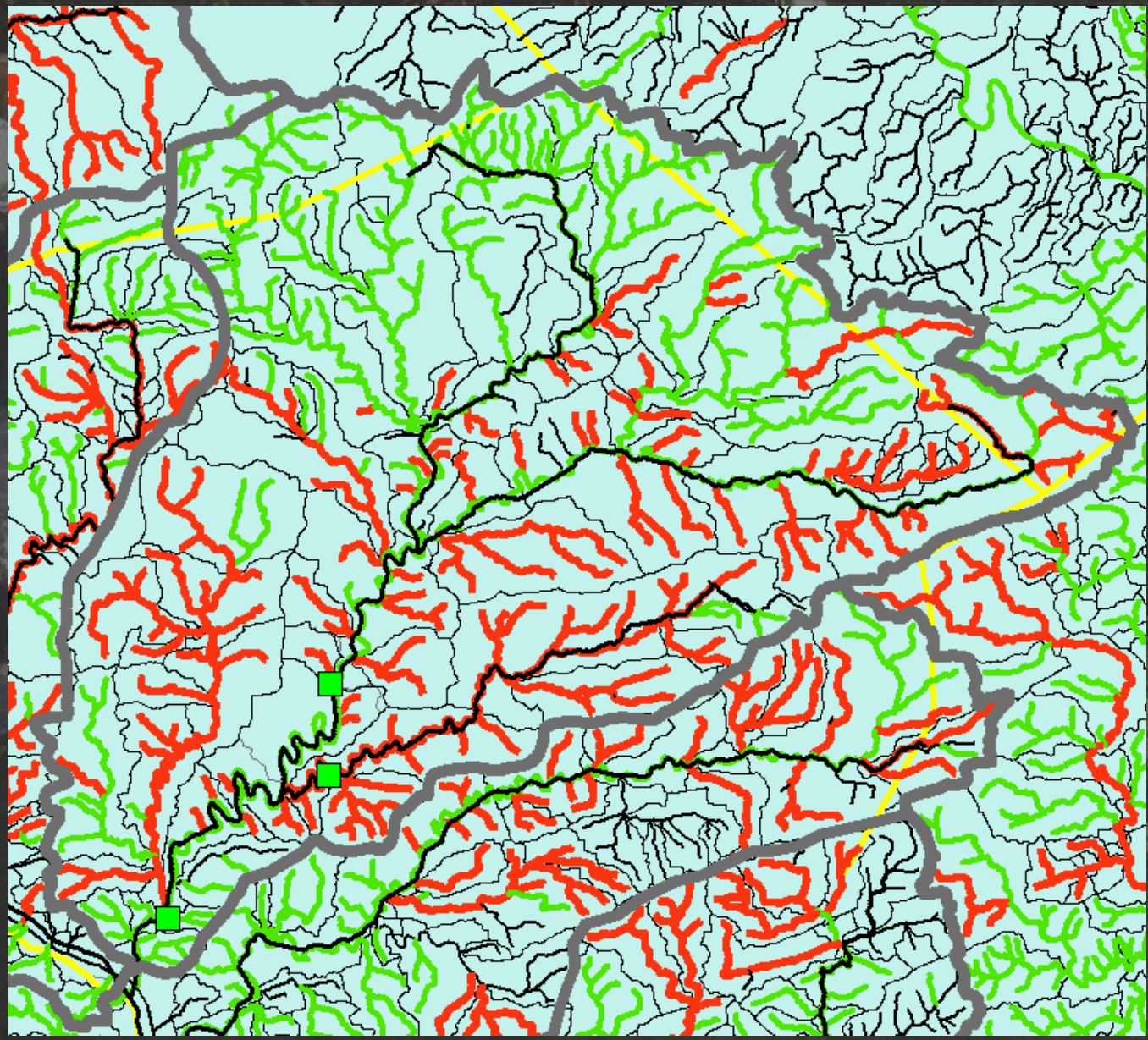
Scale Issues



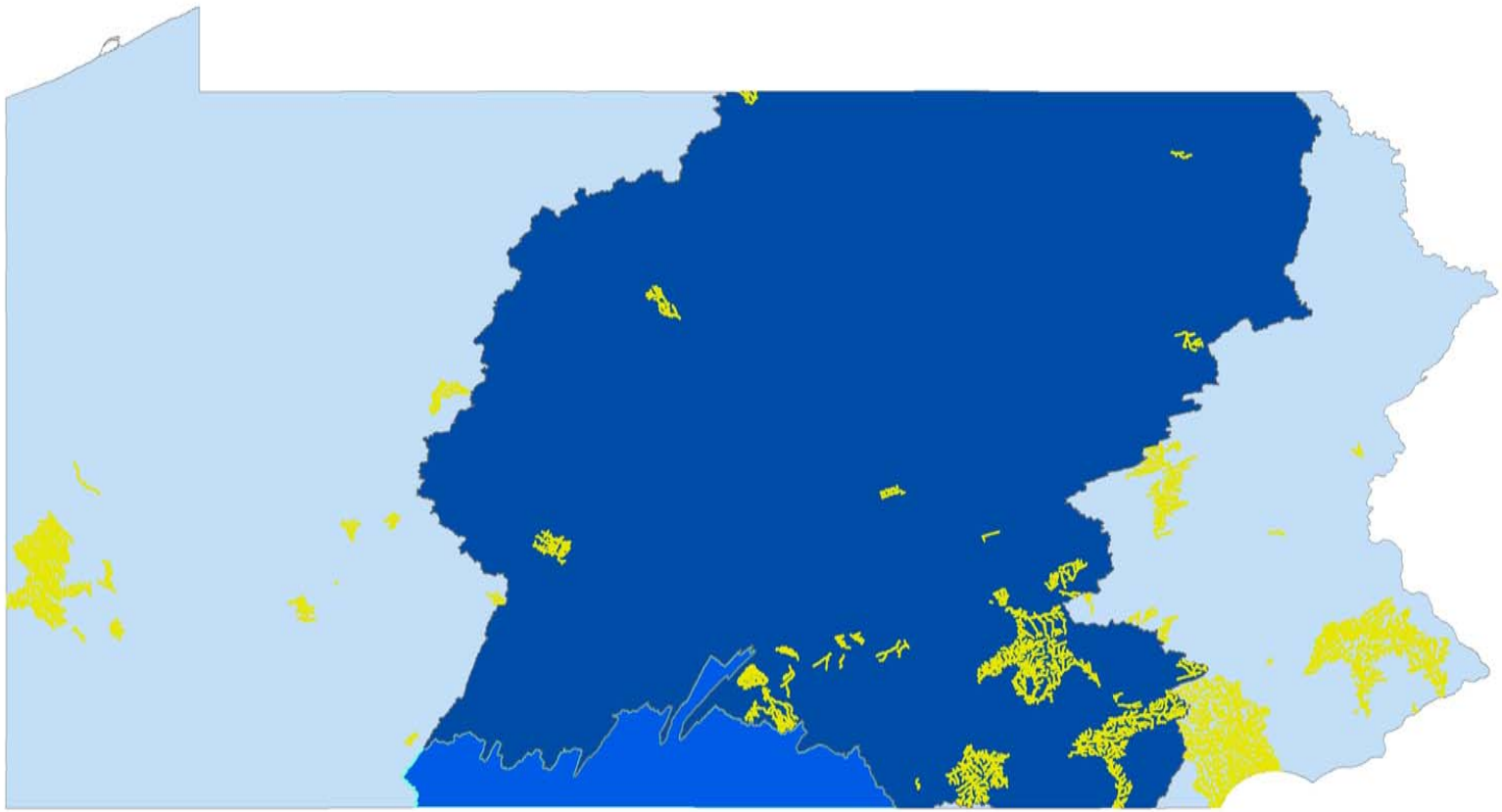
2006 Pennsylvania Integrated Water Quality Monitoring and Assessment Report - Streams, Category 5 Waterbodies, Pollutants Requiring a TMDL

Stream Name / *Use Designation (Assessment ID)* / *Source*	*Cause*	*Date Listed*	*TMDL Date*
Conestoga River (Unt 07794)			
HUC: 02050306			
Aquatic Life (10239) - 2.14 miles			
Urban Runoff/Storm Sewers	Siltation	2002	2015
Conestoga River (Unt 07795)			
HUC: 02050306			
Aquatic Life (574) - 1.99 miles			
Agriculture	Nutrients	2002	2015
Aquatic Life (690) - 1.32 miles			
Agriculture	Nutrients	2002	2015
Conestoga River (Unt 07796)			
HUC: 02050306			
Aquatic Life (576) - 2.32 miles			
Agriculture	Nutrients	2002	2015
Conestoga River (Unt 07797)			
HUC: 02050306			
Aquatic Life (575) - 1.17 miles			
Agriculture	Nutrients	2002	2015
Conestoga River (Unt 07799)			
HUC: 02050306			
Aquatic Life (10254) - 0.78 miles			
Grazing Related Agric	Organic Enrichment/Low D.O.	2002	2015
	Siltation	2002	2015
Conestoga River (Unt 07800)			
HUC: 02050306			
Aquatic Life (10254) - 5.94 miles			
Grazing Related Agric	Organic Enrichment/Low D.O.	2002	2015
	Siltation	2002	2015

Scale Issues

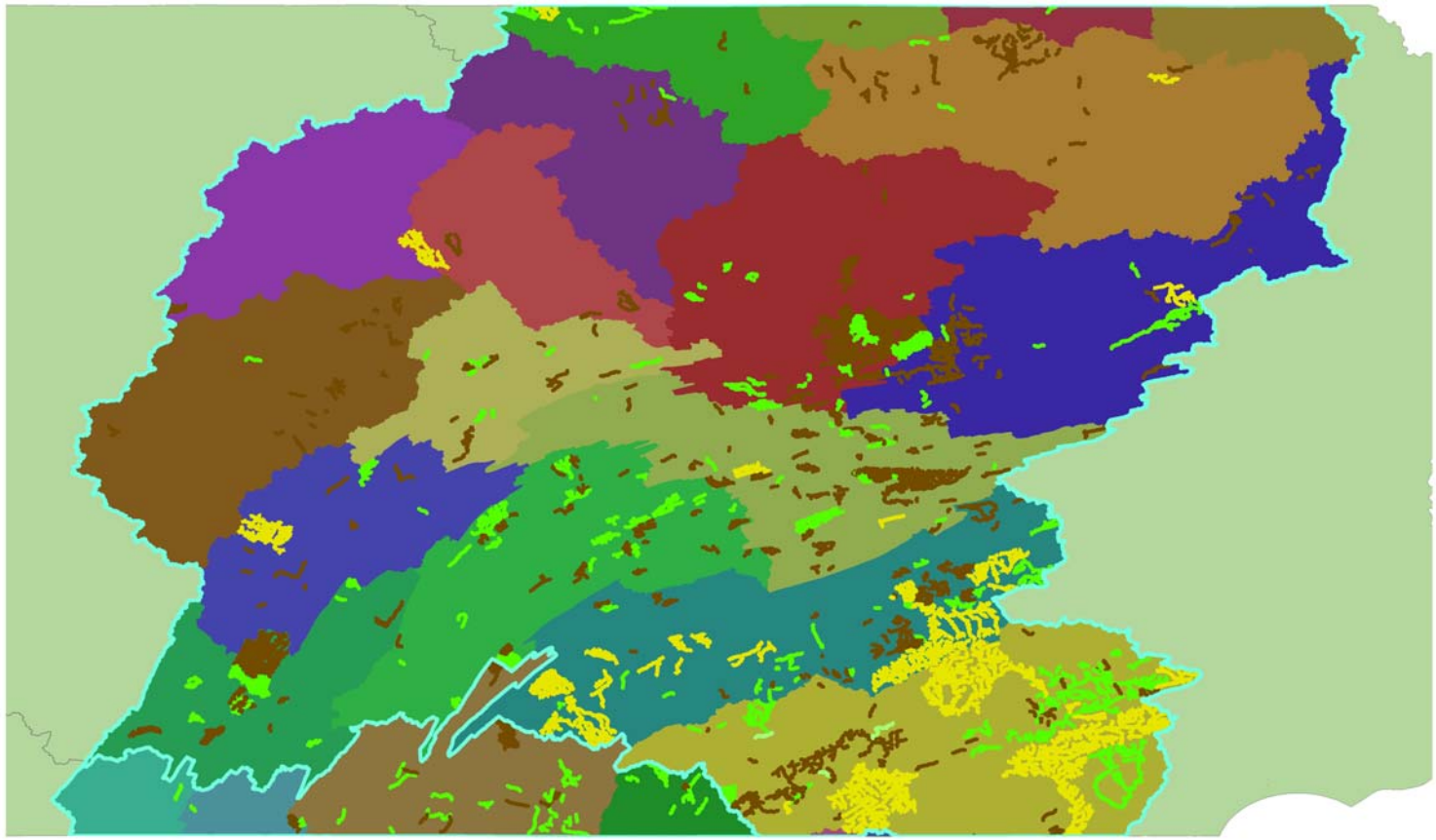


Approved Nutrient/Sediment TMDLs in Pennsylvania Through April 2007



≈ 900 stream miles

Streams Impaired by Nutrients/Sediment in Chesapeake Bay Watershed

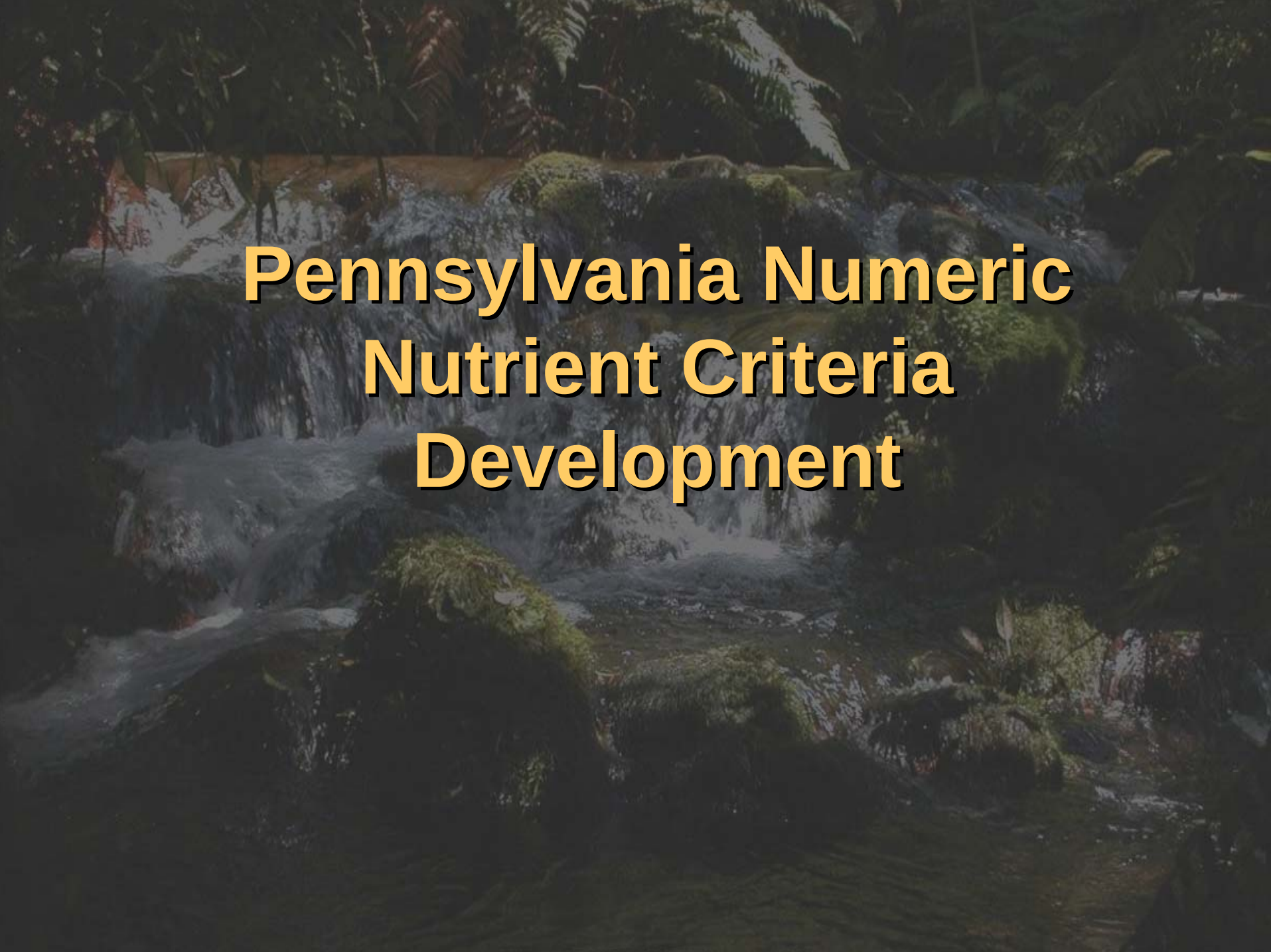


≈2,900 miles requiring TMDLs

2006 Impairment Causes in Chesapeake Bay Watershed

Impairment Cause	Stream Miles
Cause Unknown	256.15
Chlorine	5.90
Color	11.65
Excessive Algal Growth	11.53
Mercury	417.01
Metals	82.06
Nonpriority Organics	6.57
Noxious Aquatic Plants	5.05
Nutrients	836.34
Oil and Grease	4.29
Organic Enrichment/Low D.O.	256.83
Pathogens	18.05
PCB	16.11
Pesticides	20.57
pH	207.58
Priority Organics	0.95
Salinity/TDS/Chlorides	2.21
Siltation	1,563.32
Suspended Solids	14.48
Thermal Modifications	2.38
Unknown Toxicity	6.28
TOTAL	3,745.31

*** Excludes AMD**



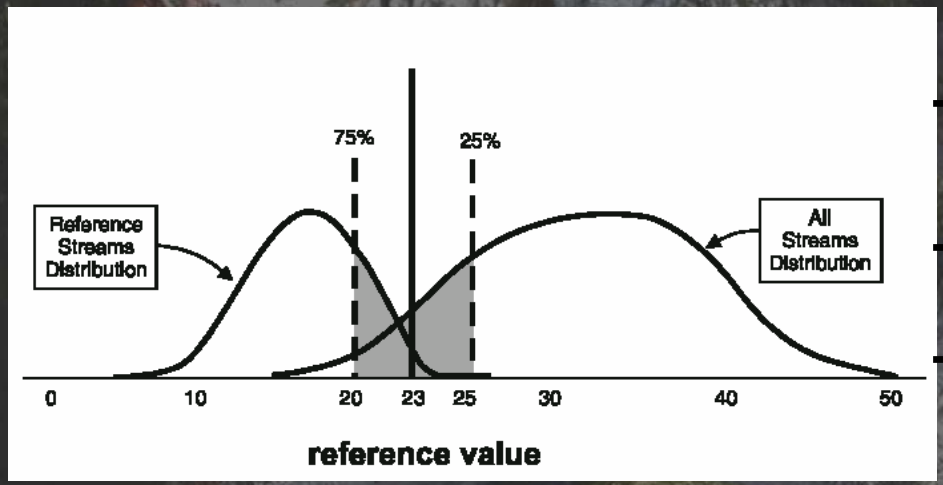
Pennsylvania Numeric Nutrient Criteria Development

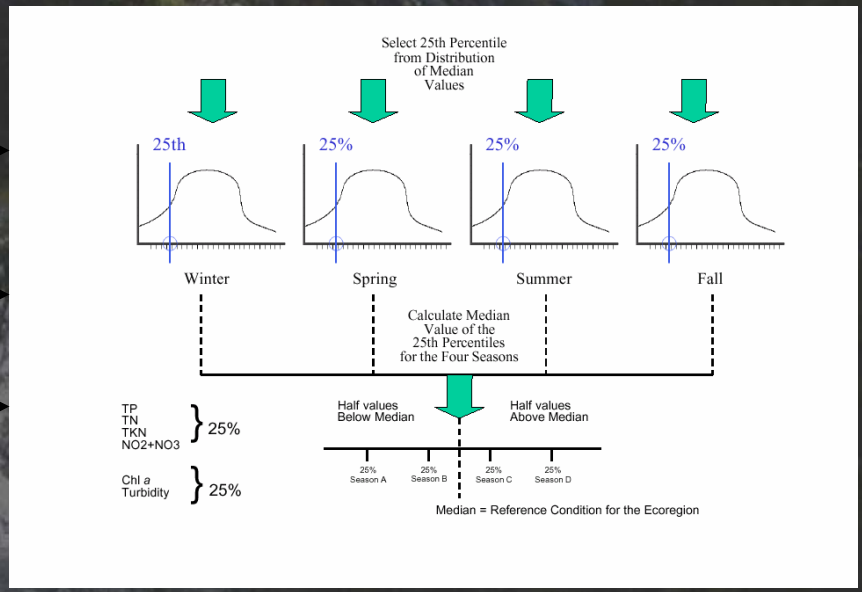
National Strategy for the Development of Regional Nutrient Criteria

- **CWAP called for EPA to establish numeric nutrient criteria by the year 2000**
- **January 9, 2001 *Federal Register* notice called for Nutrient Criteria Development Plan by end of 2001**
- **November 14, 2001 memorandum from EPA OST extended due date to October 2002**
- **Plan to include**
  - **Strategy for criteria development**
  - **Detailed schedule ending with criteria adoption**

Concerns with EPA Proposed Method

- Not response-based



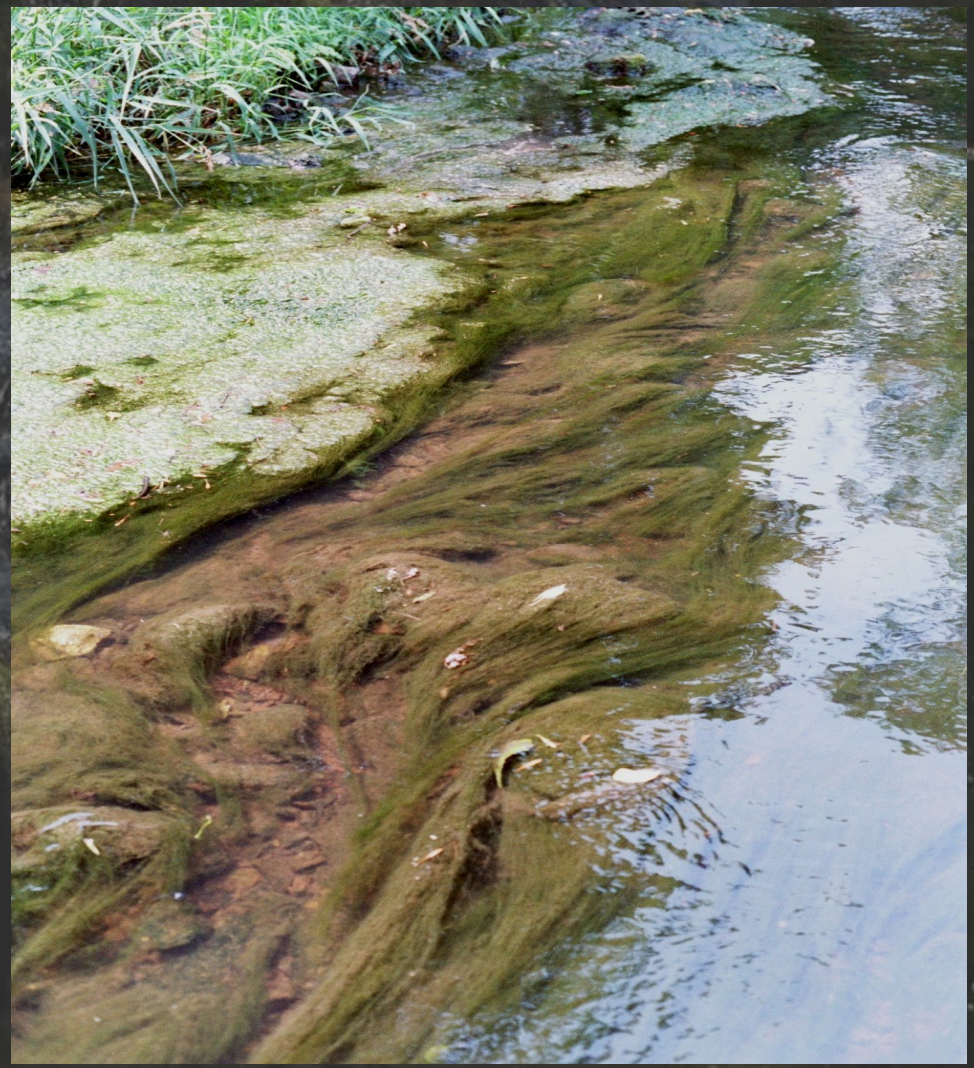


- Derived using data over all seasons and flow regimes
- EPA has strongly encouraged States to develop their own criteria

Questions

- What constitutes a nutrient impairment?
  - Dissolved oxygen violations?
  - Excessive algae?
    - What is excessive?
    - What level is excessive enough to deem the stream impaired in the absence of a DO violation?

Excessive Algae?



EPA Nutrient Criteria Technical Guidance Manual (Rivers and Streams)

- Only EPA Technical Guidance issued for states charged with adopting numeric nutrient criteria
- Focused on nutrient/algae relationship
  - Algal metrics
  - Effects on biotic integrity as a measure of aquatic life use support
  - Benthic chlorophyll-a thresholds as basis for, or part of, nutrient criteria

Region 3 Periphyton Study

- **Data collected at 50 sites across Region 3 over two years (2004-2005) including:**
  - **Full nutrient suite**
  - **Diurnal dissolved oxygen, pH, temperature and conductance over 48 hour period**
  - **Algae sampling**
    - **Chlorophyll-a**
    - **Ash-Free Dry Mass**
  - **Periphyton identification/assemblage composition**
  - **Relationship between nutrient concentrations, DO and algae (amount and type)**

Pennsylvania Nutrient Criteria Work

Correlative Approach:

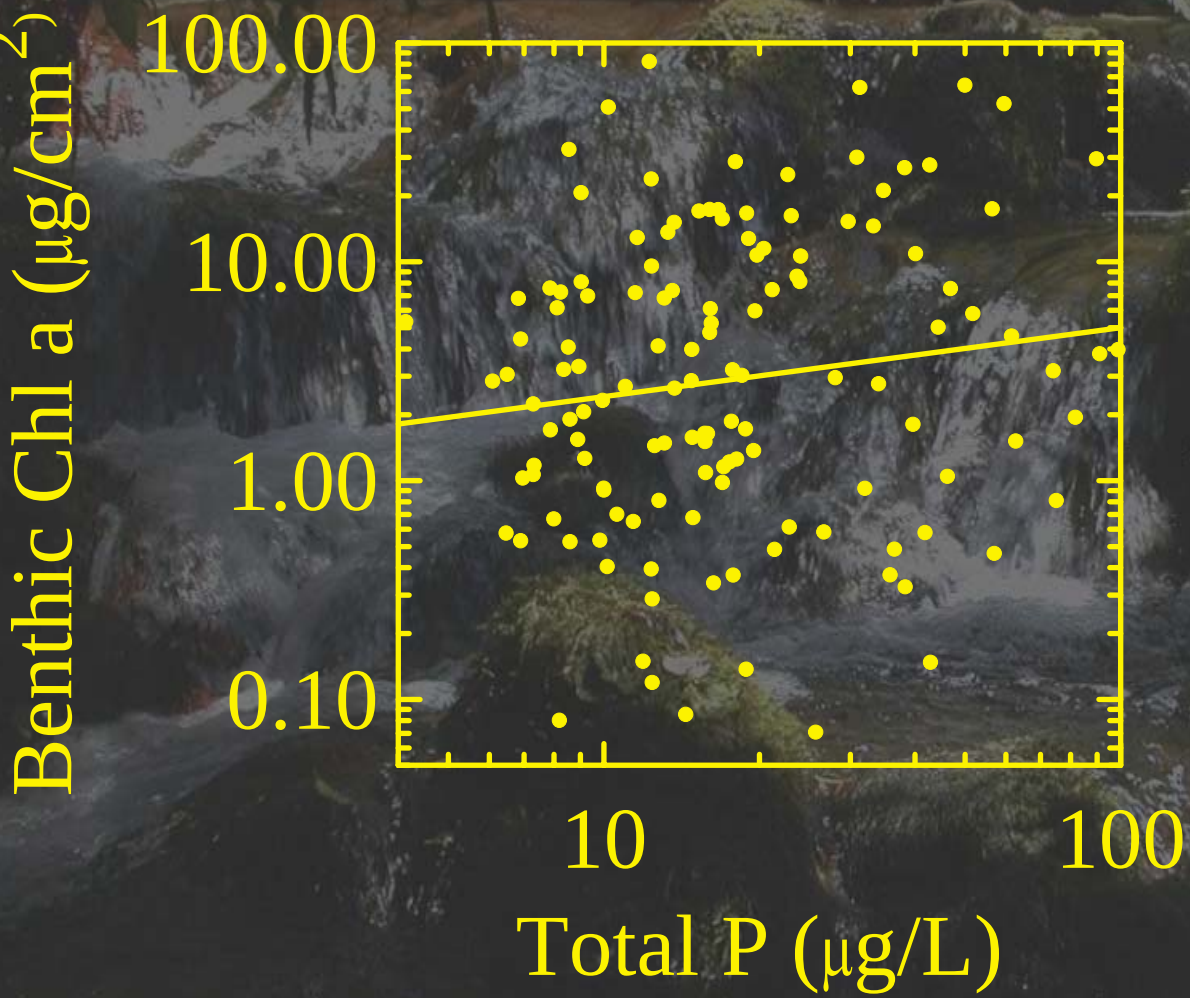
- Sampling periphyton biomass, water column chemistry, field chemistry, algal species/community structure state-wide

- Eight fixed water quality monitoring stations sampled 2-3 times in each of our six regions and ≈ 100 TMDL related sites

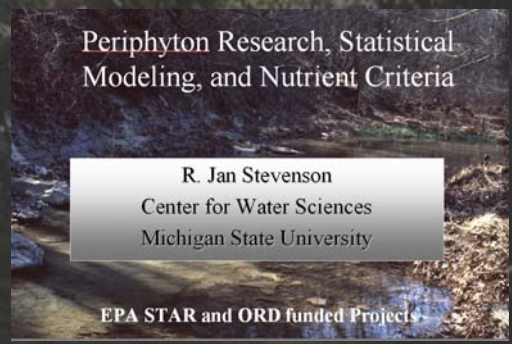
Causal Approach:

- Nutrient releasing substrata study

Algal Response to TP

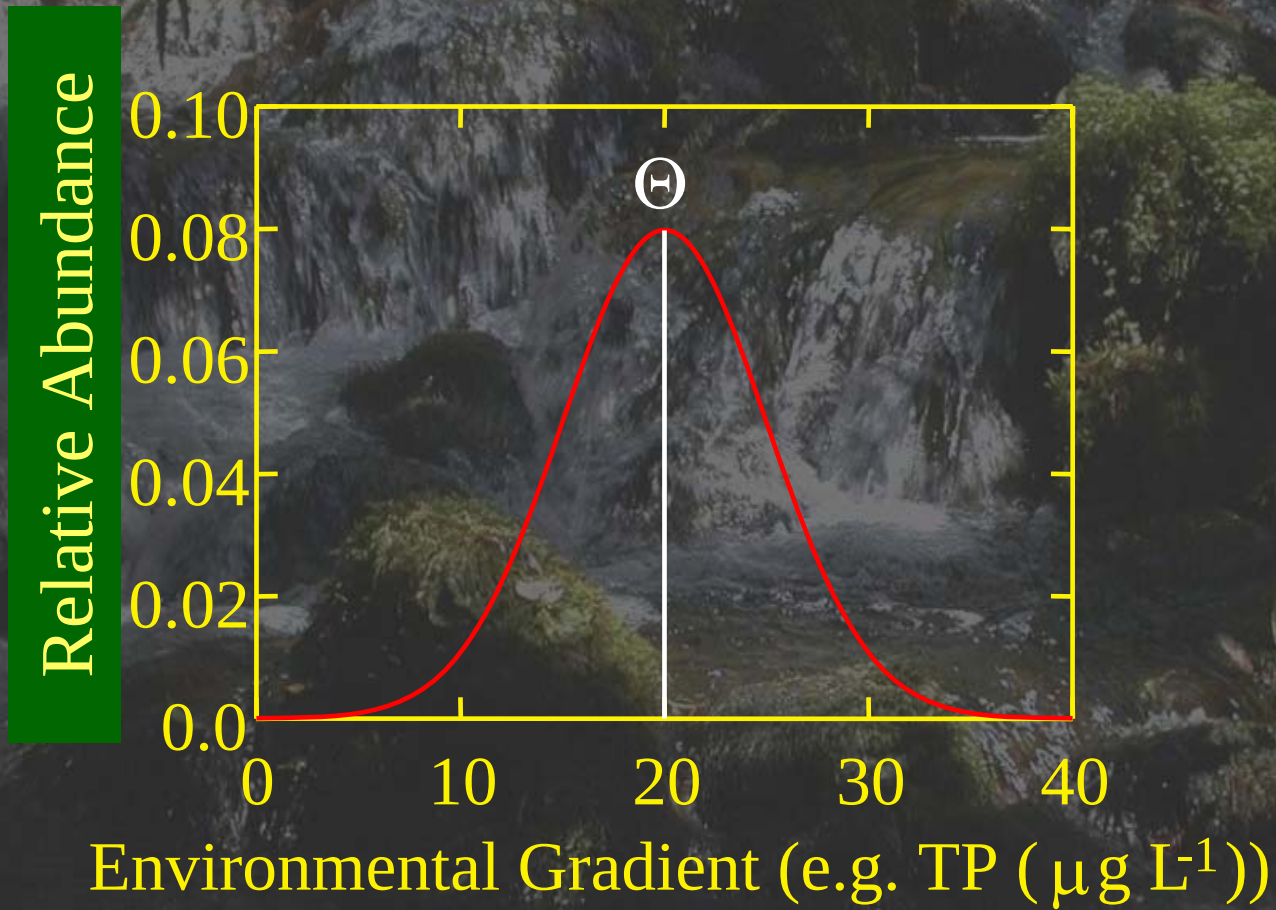


R^2=0.053, P=0.007



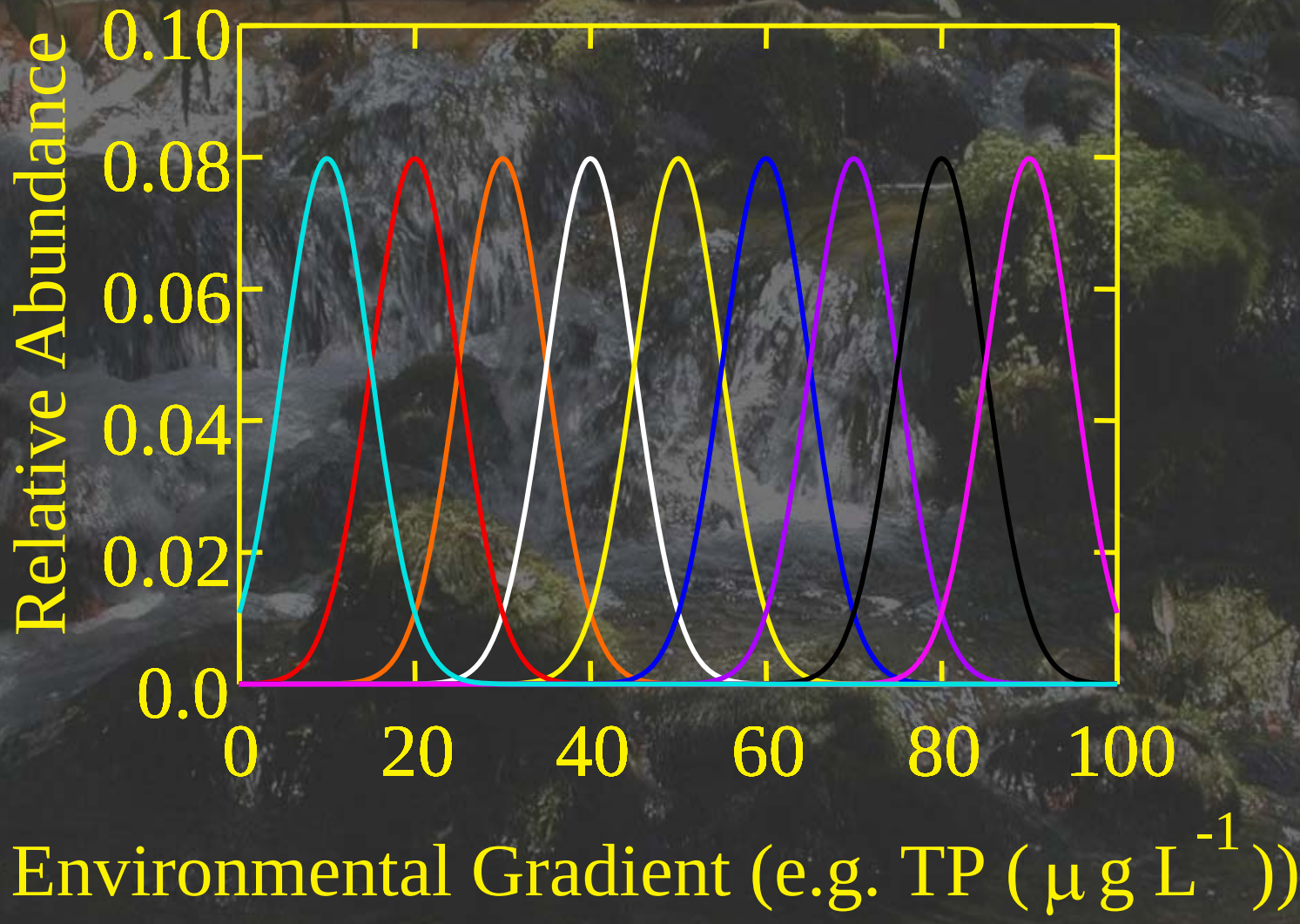
(Stevenson, 2006)

Determine Species Environmental Optimum



(Stevenson, 2006)

Species Abundances Along Environmental Gradient

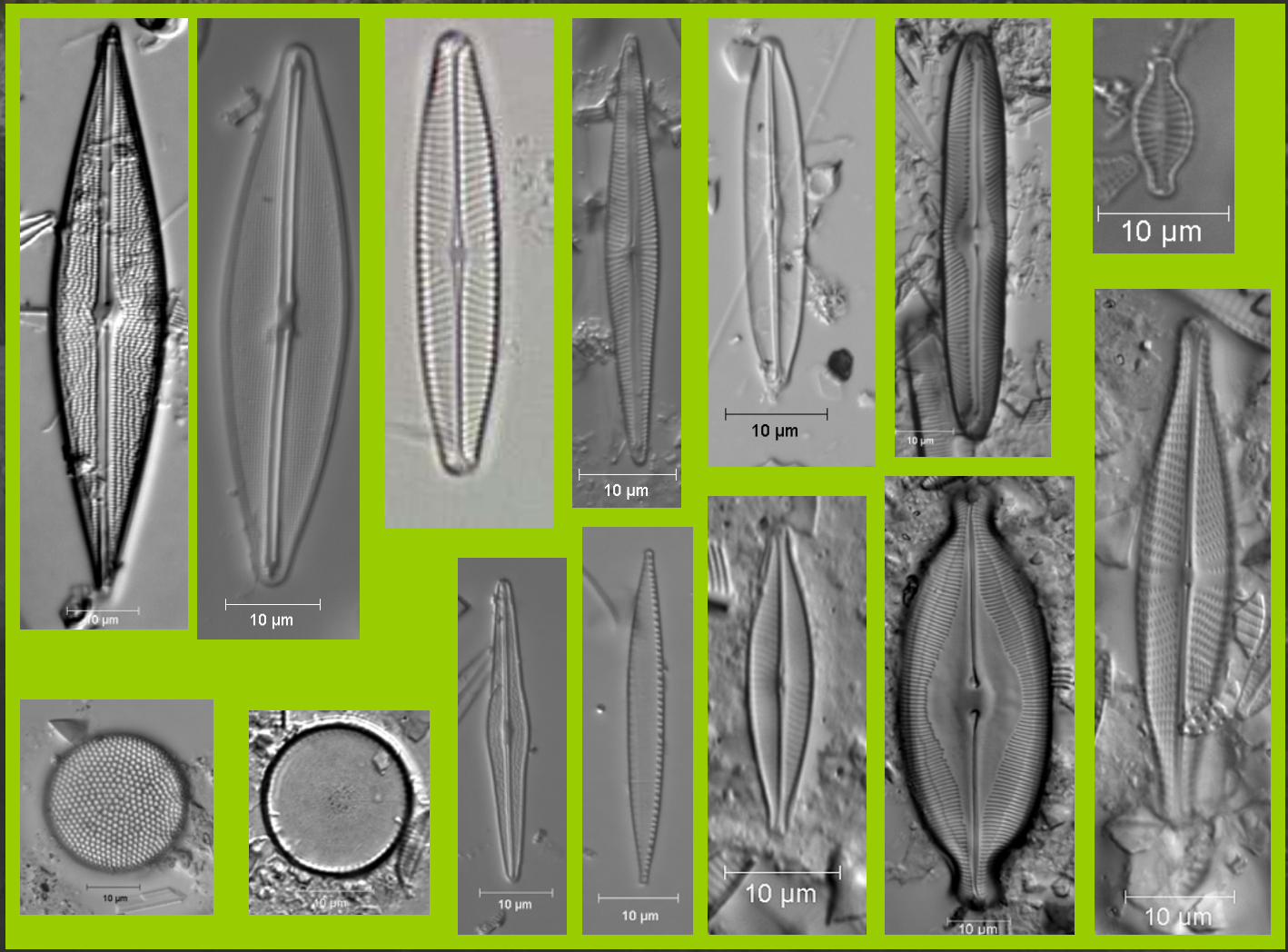


(Stevenson, 2006)

Distinguishing Differences Among Assemblages

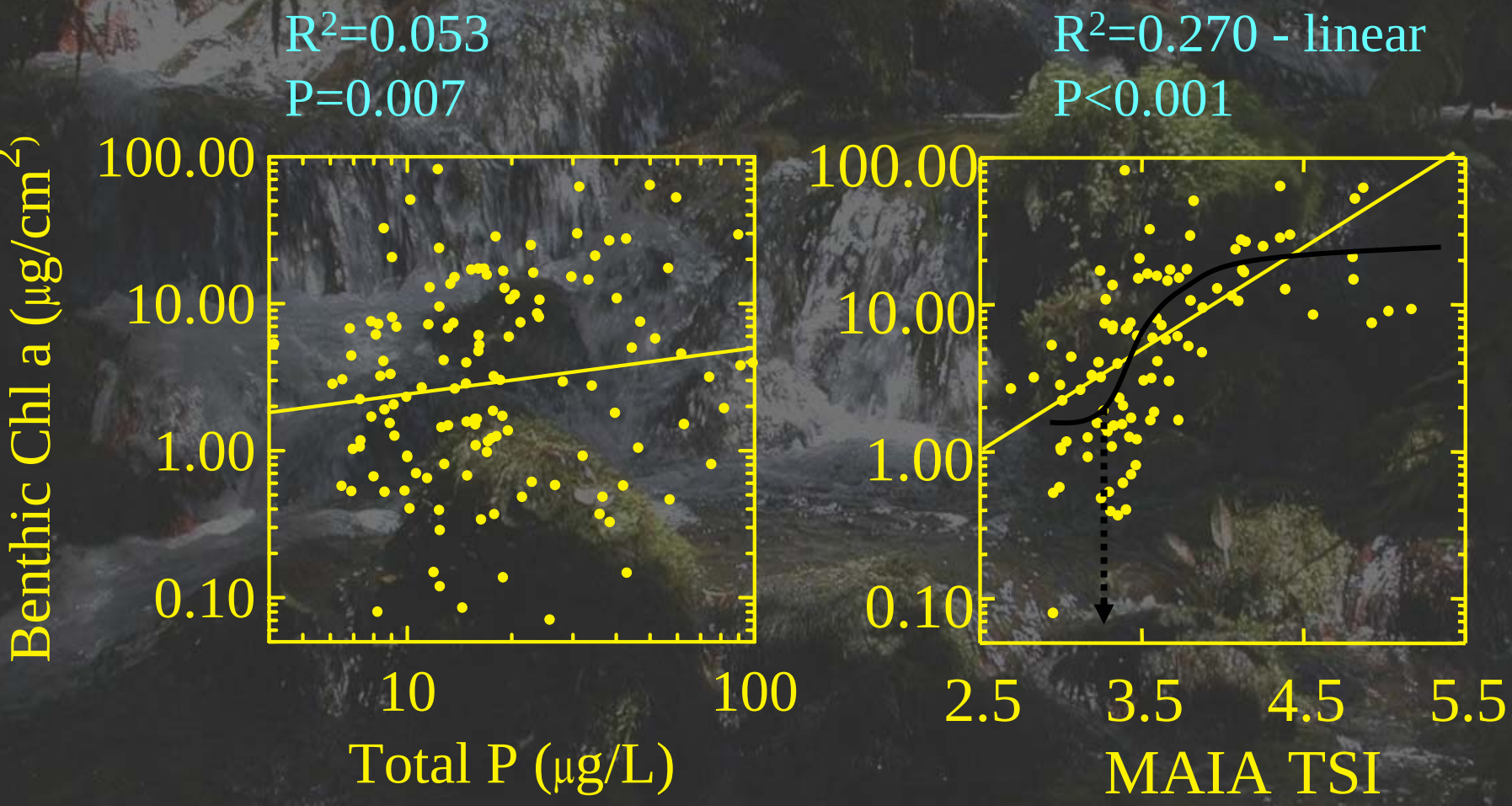
Sensitive Taxa

Tolerant Taxa



(Stevenson, 2006)

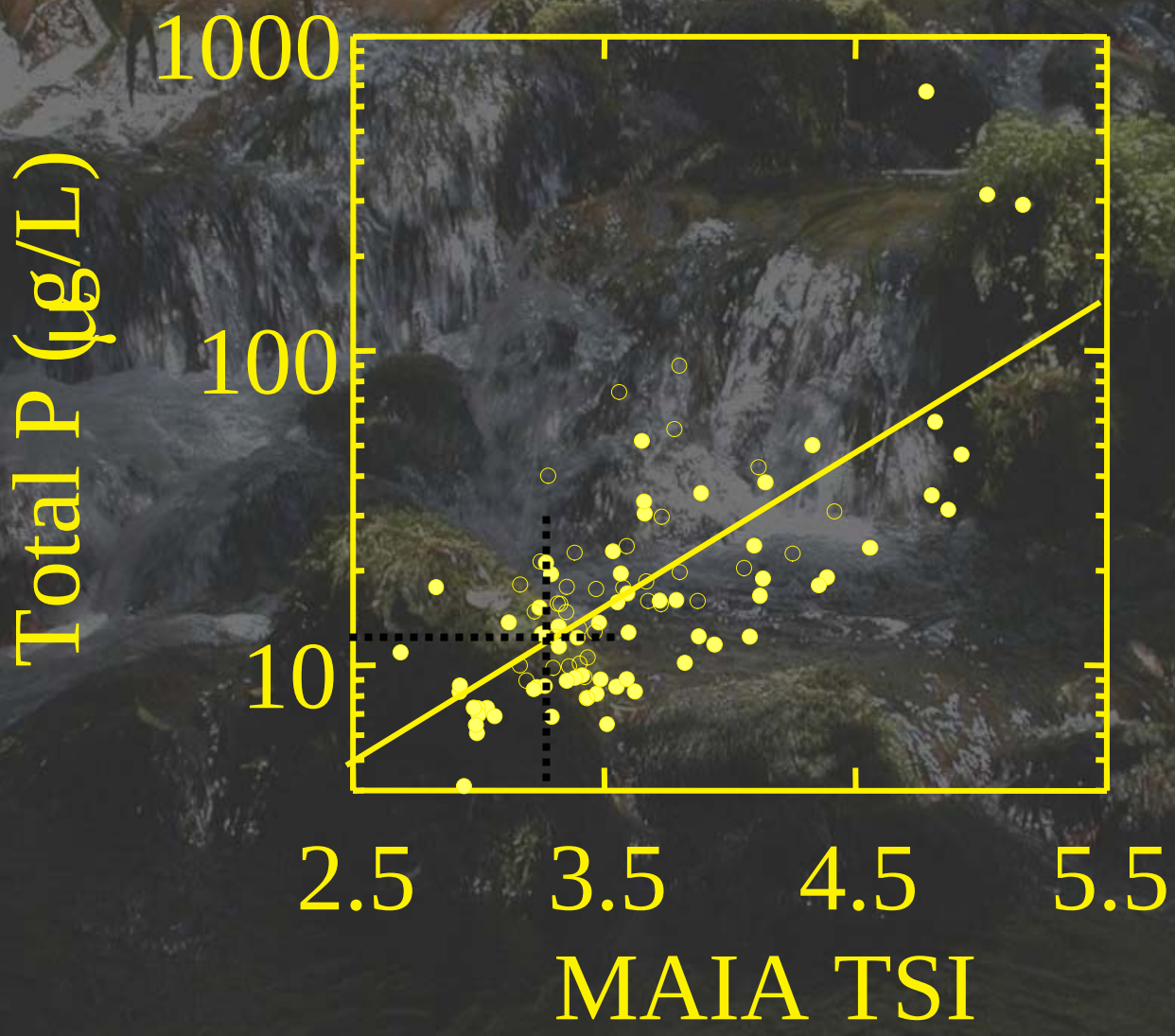
Chl a/Nutrient Model Improves with Diatom Inferred TSI



Use TSI to predict Frequency & Intensity of High Biomass

(Stevenson, 2006)

Translating TSI to Nutrient Criterion



(Stevenson, 2006)

Nutrient Releasing Substrata

- Controlled nutrient amount and release rate
- External variables minimized
- Data collection in 2007-2008

Scientific Needs

- Demonstration of aquatic life use impairment from excessive nutrients without DO violations
- Develop a better understanding of point vs. nonpoint contributions to impairments observed under critical conditions
- Determine impact of nutrient reductions not reaching cell growth limiting levels