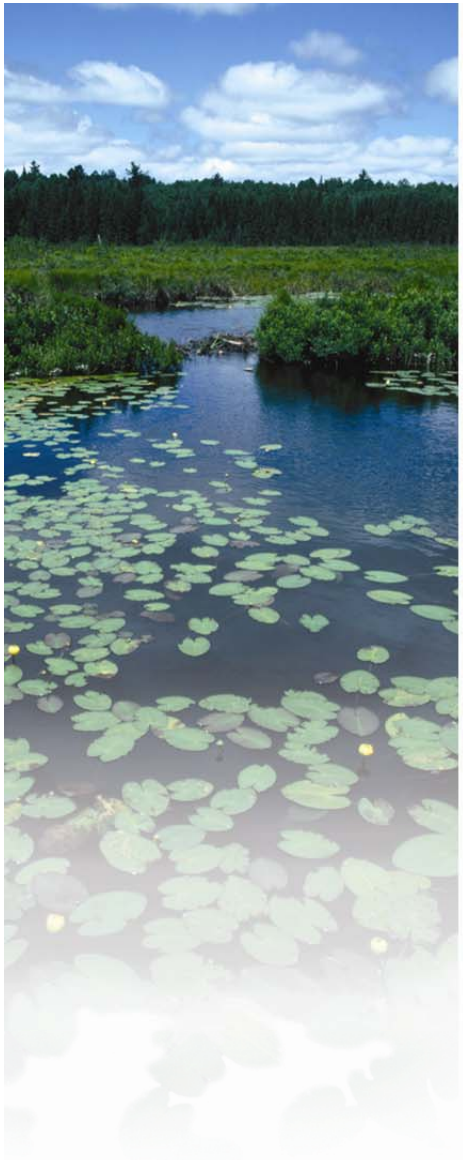

National Trends and Drivers

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History of Nutrient Control in U.S.

- Great Lakes Water Quality Agreement (1978):
  - Phosphorus Load Supplement 1983
  - All POTWs of 1 mgd or more discharging to Great Lakes and tribs to 1.0 mg/L TP
  - Widespread phosphate detergent bans
- Chesapeake Bay Agreement (1983):
  - 1987 Goal: 40% reduction in TP and TN
  - Current Goal: Typically 3.0 mg/L TN and 0.3 mg/L TP for larger POTWs
- Other more localized programs in 1980s (Neuse R, NC; Tualatin R, OR; Lake Champlain; etc.)
- Wisconsin adopts technology-based TP control state-wide in 1990s (1.0 mg/L for POTWs)

Why Are Nutrients Such a Hot Topic Now?

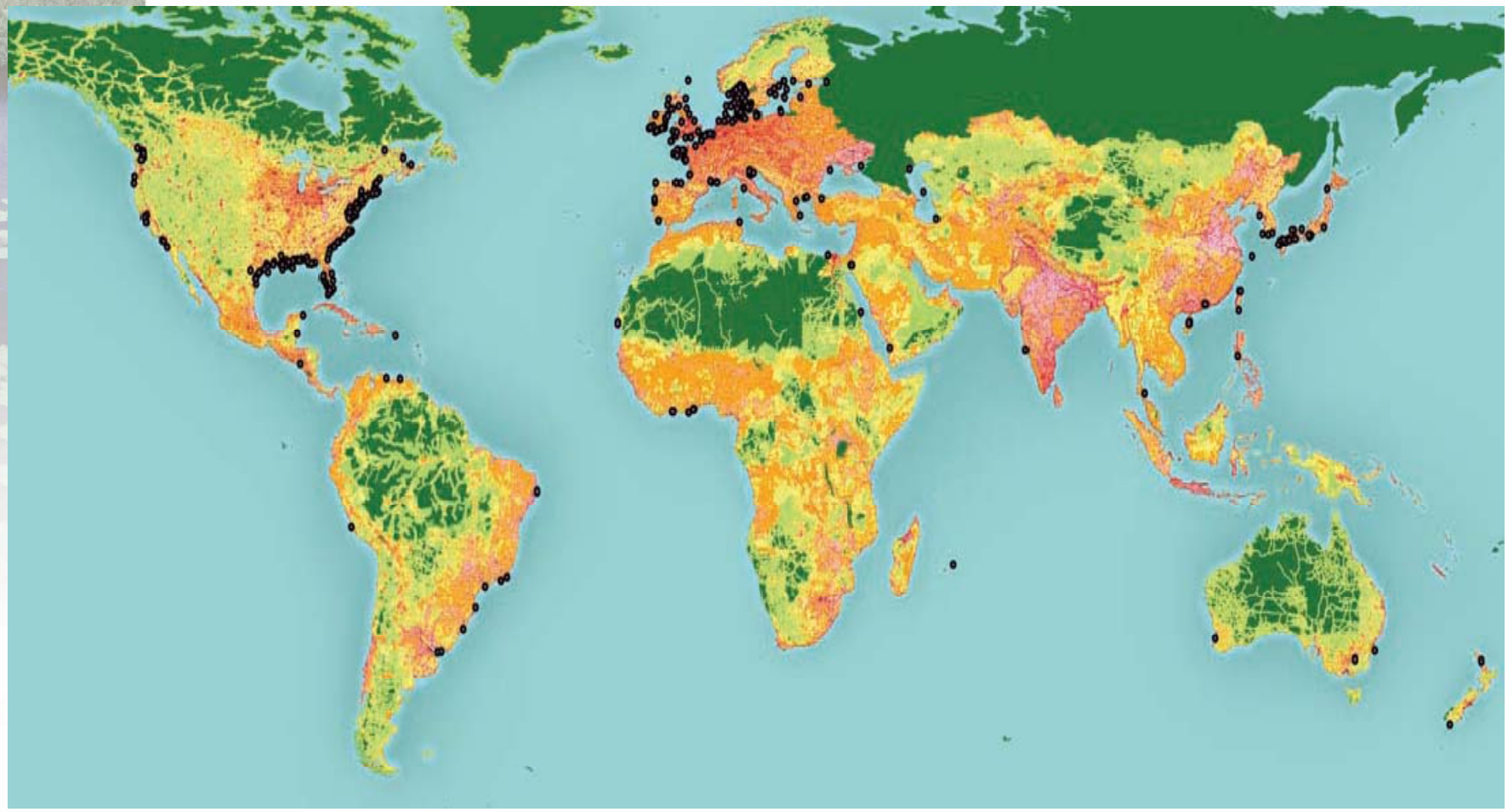
- One of the More Frequent Causes of Water Quality Impairment on State 303(d) Lists, many TMDLs

Cause of Impairment Group Name	Number of Causes of Impairment Reported
Pathogens	10,402
Mercury	9,135
Metals (other than Mercury)	6,952
Sediment	6,470
Nutrients	5,985
Organic Enrichment/Oxygen Depletion	5,687
pH/Acidity/Caustic Conditions	3,823
Cause Unknown - Impaired Biota	3,320
Polychlorinated Biphenyls (PCBs)	3,078
Temperature	3,011
Turbidity	2,448
Pesticides	1,612
Salinity/Total Dissolved Solids/Chlorides/Sulfates	1,554

Why Are Nutrients Such a Hot Topic Now?

- EPA HQ Nutrient Criteria Policy (1998 to now)
- NRDC and ASWIPCA Proposals to Add Nutrients to Definition of Secondary Treatment
- Recent EPA Region 10 Report Indicating Low Cost and Affordability of Nutrient Removal to Very Low Levels
- Accumulating Scientific Evidence of Nutrient Effects:
  - Mississippi R/Gulf of Mexico Hypoxia (EPA SAB Report, 2007; NAS Report, 2008)
  - Role of Phosphorus and Nitrogen?

Coastal Hypoxic Zone "Hot Spots" Correlate with Human Population



Diaz, R. J., *et al.*, "Spreading Dead Zones and Consequences for Marine Ecosystems," *Science*, **321**, 926-929, 2008.

EPA Nutrient Criteria Strategy (1998) and Action Plan (2001)

- Affirmed in May 2007 Memo from EPA HQ
- EPA Wanted:
  - 4 Parameters (TP, TN, chlorophyll, clarity)
  - 4 Water Body Types (lakes and reservoirs, streams and rivers, estuaries, wetlands)
- Eco-Region (Reference Condition) Approach:
    - TP Generally 0.01 to 0.05 mg/L
    - TN Generally 1 to 2 mg/L
- Effects-Based Approach:
  - Shifts in Biological Metrics
  - Aquatic Ecosystem Modeling (e.g., AQUATOX)
- Weight of Evidence Approach
  - EPA R3 Examples in PA TMDLs

Status of Nutrient Criteria Implementation

Table 1. Number of States with Adopted Numeric Nutrient Standards by Year and Waterbody Type

Numeric Nutrient Standards Status by Year	4 Parameters 4 Waterbody Types [1]	1+ Parameters 1+ Entire Waterbody Types [2]	1+ Parameters Selected Waters [3]	No Numeric Criteria [4]
1998	0	6	7	37
2008	0	7	18	25
2008 Numeric Nutrient Standards Status by Waterbody Type	**4 Parameters 4 Waterbody Types**	**1+ Parameters 1+ Entire Waterbody Types [6]**	**1+ Parameters Selected Waters [7]**	**No Numeric Criteria [4]**
Lakes/Reservoirs	0	6	13	31
Rivers/Streams	0	5	9	36
Estuaries (24 eligible States)	0	3	7	14
Wetlands	0	0	4	46

Recent Examples of Nutrient Criteria

- Wisconsin:
  - Streams: 0.075 mg/L TP
  - Rivers: 0.10 mg/L TP
  - Lakes/Reservoirs: 0.015 – 0.040 mg/L
  - Method: Shifts in biological communities
- Montana:
  - Periphtyon Chlorophyll: 150 mg/sq.m
  - Method: User Surveys (Recreation Uses)
  - Supplemented by MT-Specific EcoRegion Criteria

The Politics of Nutrient Control

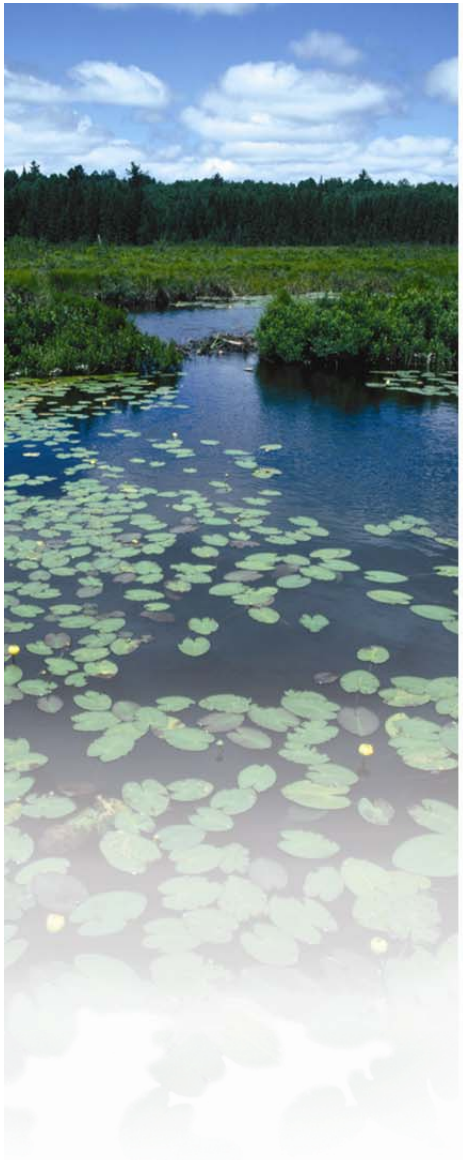
- Some Perceive Slow Progress on Nutrient Control Using the Case-by-Case Approach (TMDLs)
- Lack of Methods to Control Non-Point Sources, Rural (Agriculture) in Particular
- “Renewed” Emphasis on Point Sources

The Apparent Truth is That Point and Non-Point Source Control Will Ultimately be Required to Meet Water Quality Objectives.

The Issue is How Much of Each.

Emergence of Successful Nutrient Trading Programs

- EPA National Policy/Guidance Supports
- Can Be Most Cost-Effective Means to Achieve Low-Level Nutrient Goals:
  - PS to PS trades
  - PS to NPS trades
- Good Examples:
  - Connecticut (Long Island Sound)
  - Virginia (Chesapeake Bay)
  - North Carolina (Tar-Pamlico and Neuse)
  - Lower Boise River, broader Idaho trading program



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