Patterns of Water Quality in Relation to Stream Flow in Vermont Streams

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Hurricane (Tropical Storm) Irene

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Post Irene Research Questions

- How resilient (in terms of water quality) are Vermont streams to such high flow events?
- How do variations in flow regimes affect deposition rates into the Lake Champlain Basin?
- Which land uses influence the strength of water quality-flow relationships?

Nature of Data

- EPSCoR-
  - Very diverse in content
    - E. Coli, Total Phosphorus, total suspended solids
    - Extensive site details
  - Collected Biweekly
- USGS
  - Very throughout, reliable stream flow data

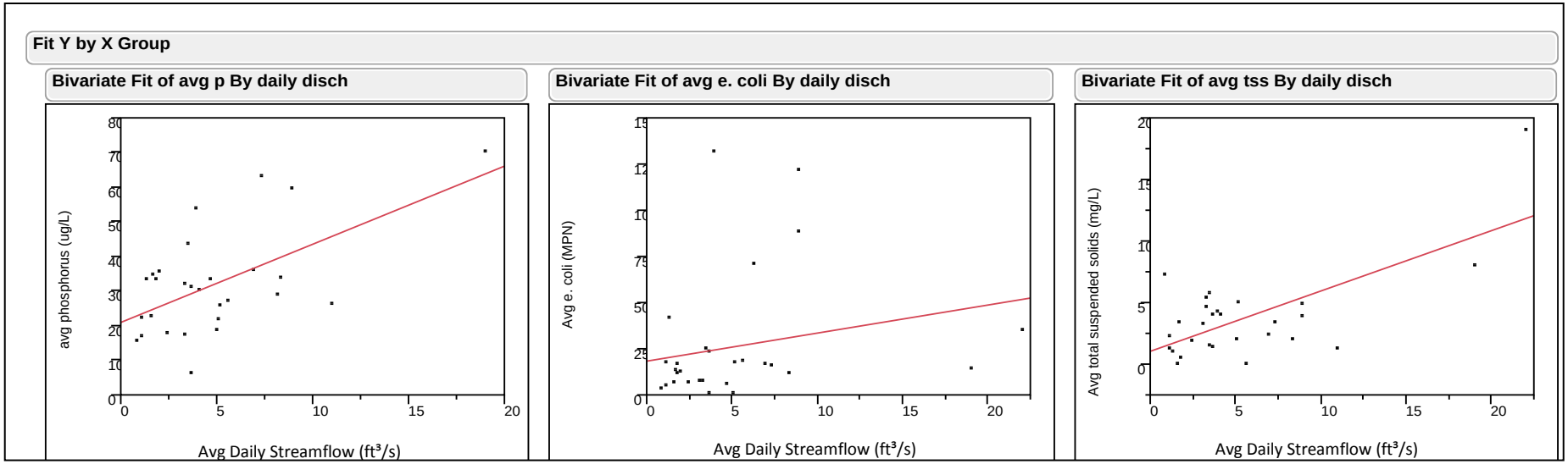
Nature of Data

- Both sources are observational
  - No manipulation of variables
  - Correlational study

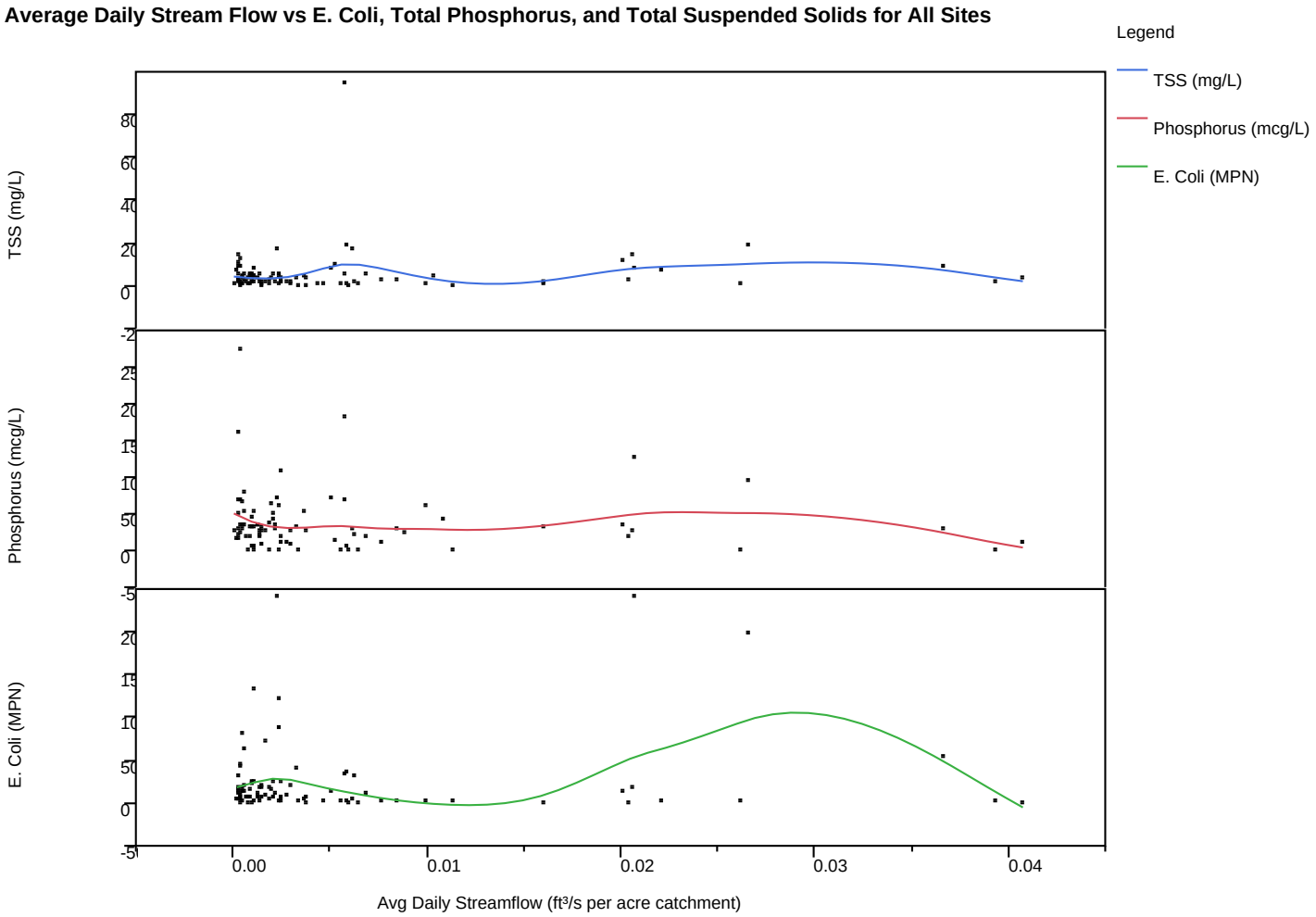
- 104 sample from 7 sites

Positive Relationships

- Expected relationship between stream flow and particulate matter
- As seen in results from Potash Brook, South Burlington, VT



Overall Relationships?



Land Use

Predominant Land Use Type	E. Coli		Total Phosphorus		Total suspended Solids	
Forested	P=.1056	R^2=.098	P=.3354	R^2= .037	P=0.29	R^2=.038
Pasture/cropland	P<.0001	R^2= .26	P=0.443	R^2=.077	P=.1037	R^2=.049
Urban	P=.3123	R^2=.031	P=.2793	R^2=.035	P=.0275	R^2= .14

- Significant positive relationships between flow and concentration of E. Coli and Total Phosphorus in watersheds dominated by agriculture
- Significant positive relationships between flow and TSS concentrations were observed in Urban Watersheds

Seasonality

Season	E. Coli		Total Phosphorus		Total suspended Solids	
Summer	P=.0067	R^2=.15	P=.7422	R^2= .0024	P=0.0154	R^2=.12
Autumn	P=.1963	R^2= .047	P=0.2491	R^2=.039	P=.4466	R^2=.015

- Stream flow rates were only significant for E. coli and TSS during the summer months
- Stream flow did not appear to affect water quality during the Autumn months

Resilience

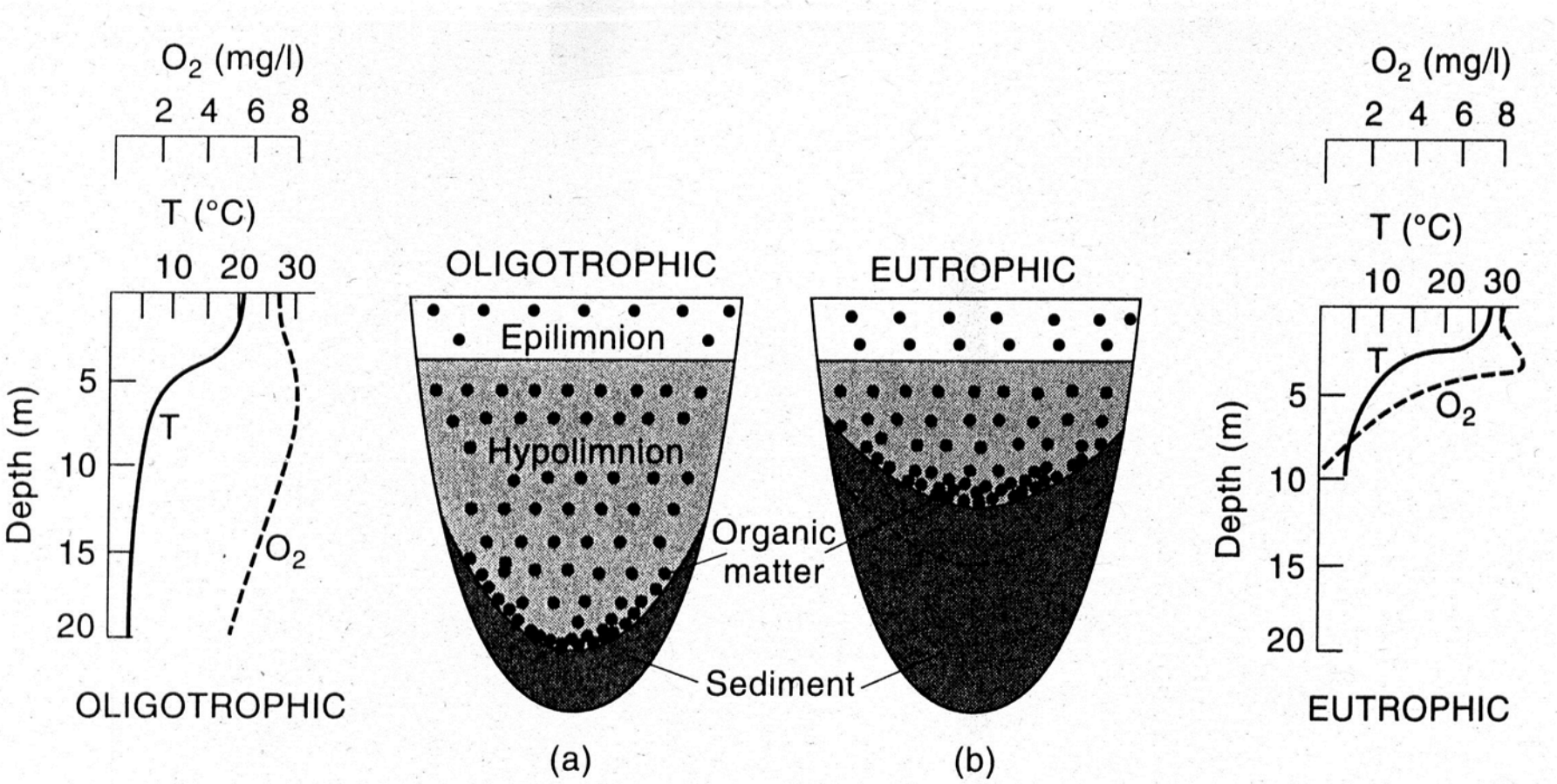
- Compared water quality of samples following flood stages (upper tenth percentile) to samples during normal flow conditions
- No significant differences observed (p= 0.76)
- Consistent with current understanding of low residence time of particulate and dissolved matter in lentic systems (Schlesinger 1997)

Schlesinger, W. 1997. Biogeochemistry: an analysis of global change. Academic Press. 2nd edition: 269-270

Implications

- >75% Forested sites showed no significant changes in water quality during or after flood stages
- The water quality of VT's streams can recover quickly following flood events
  - But can Lake Champlain?!

Eutrophication Concerns



Focusing Efforts

- This correlational study found **positive** relationships between storm events and high concentrations of:
  - E. Coli and Phosphorus from Agricultural drainages
  - Suspended Solids from Urban Drainages
  - E. Coli and TSS during summer months
- Regulations and outreach efforts can be concentrated on these conditions to limit degradation of VT's waterways!

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