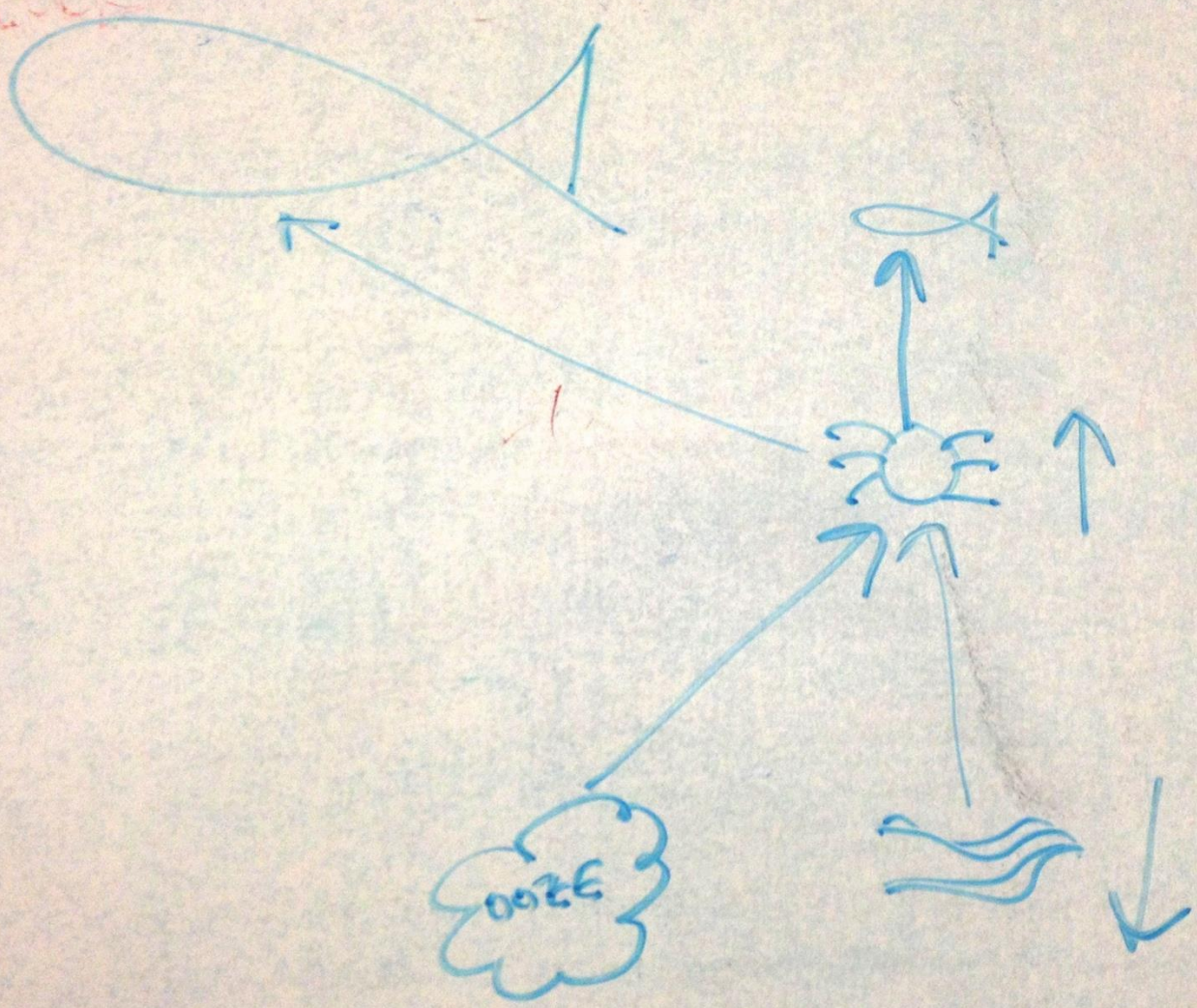
TROPHIC INTERACTIONS IN AQUATIC ECOSYSTEMS

My first thought about trophic interactions…


ooze

STREAM ECOSYSTEMS AND TROPHIC INTERACTIONS

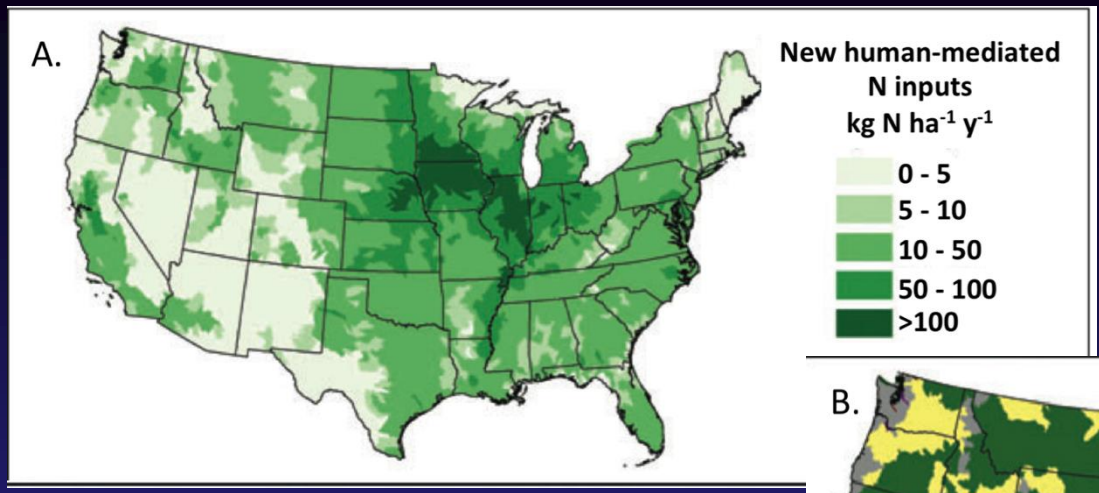
- STReam Experimental Observatory Network (STREON)
- Stream Consumers and Lotic Ecosystem Rates (SCALER)
- Stream Resiliency Research Coordination Network

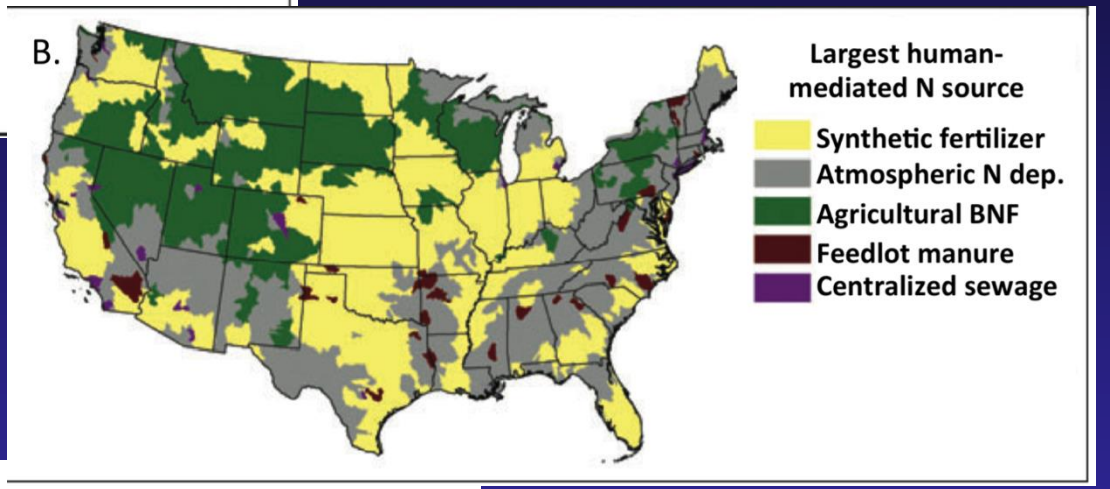
AQUATIC BIODIVERSITY

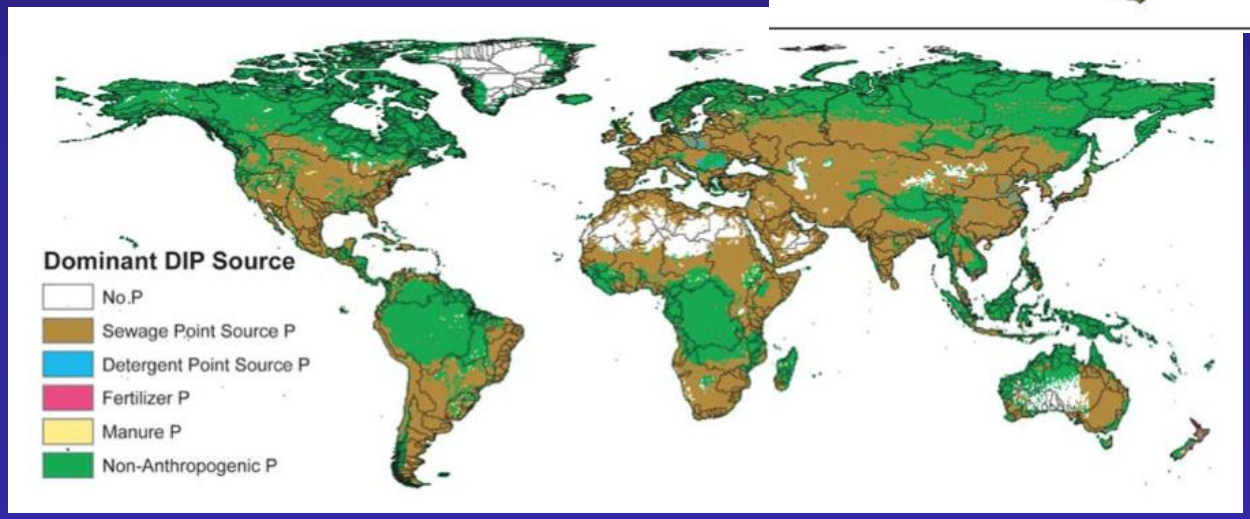
- Freshwater biodiversity In the United States:
  - 800 species of fishes
  - 300 species of mussels
  - 300 species of crayfishes
  - 150 species of salamanders
  - 100 species of frogs and toads
  - 500 species of snails

- Over the past 20 years extinction, endangered, threatened or species of concern:
  - 20 % of fishes
  - 45 % of mussels
  - 48 % of crayfishes
  - 20 % of aquatic snails

NUTRIENT INPUTS

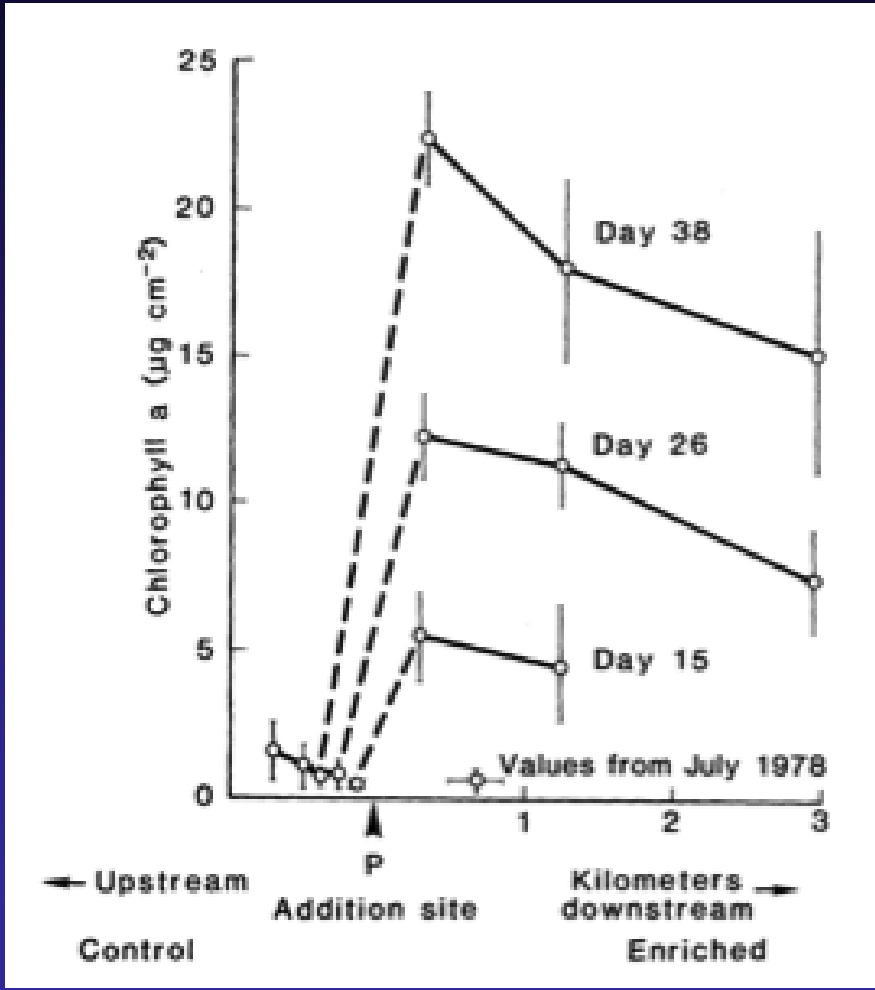


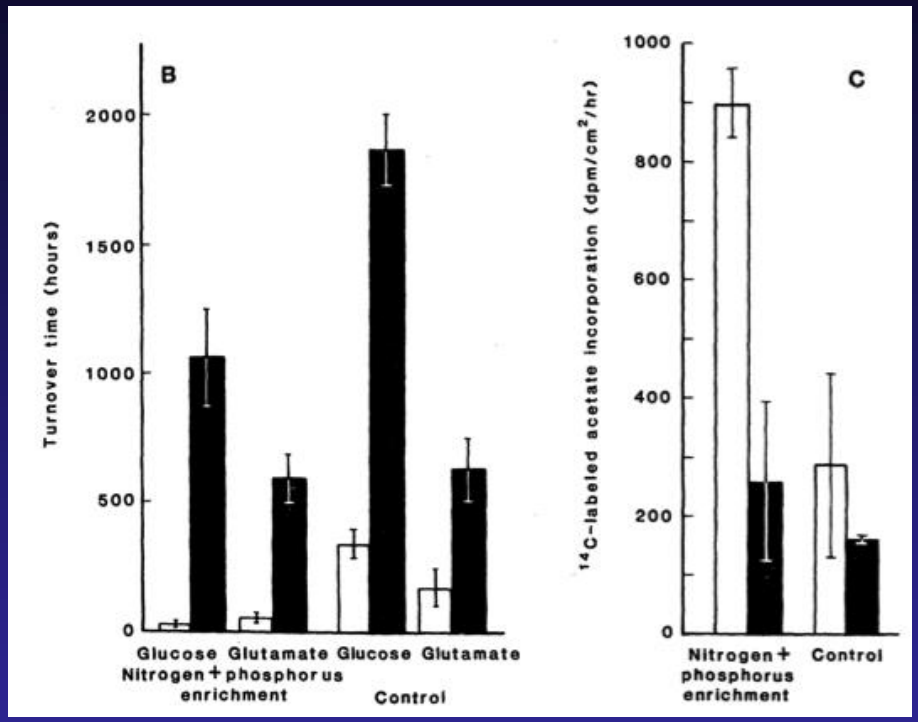




From Sobota et al. 2013
Harrison et al. 2010

NUTRIENTS INPUTS AND ECOSYSTEM FUNCTION

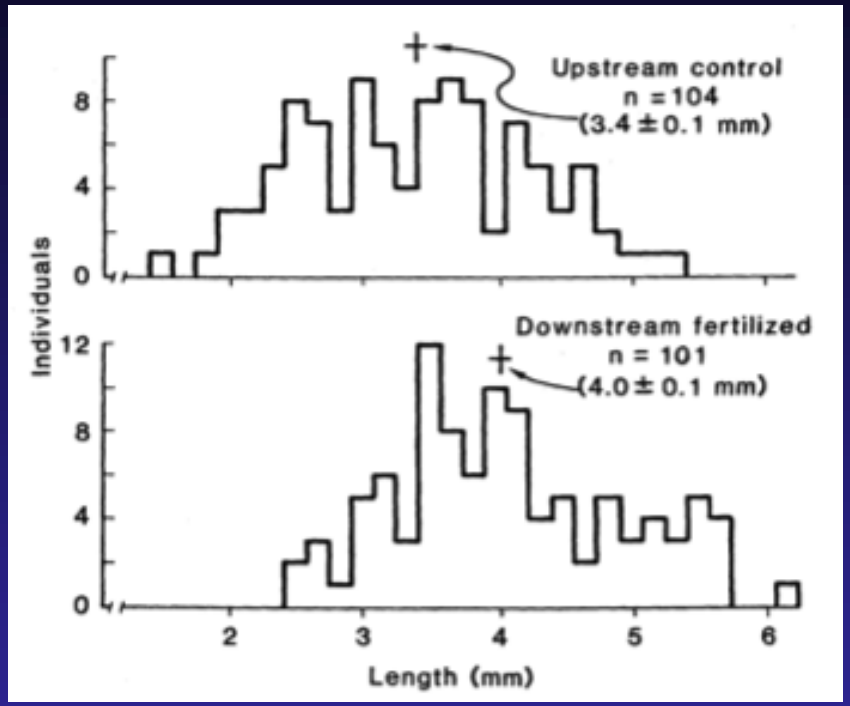


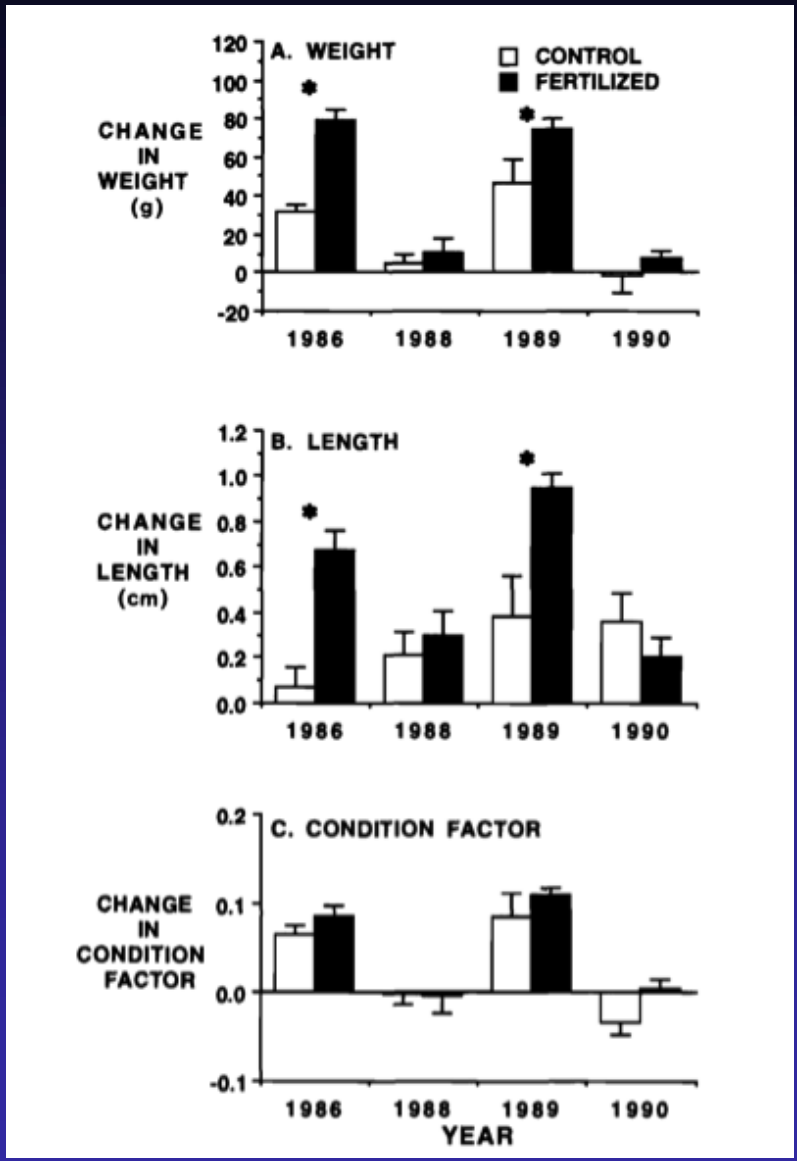


- Rapid response of algal biomass
- Increase in bacterial respiration
- Increase in respiration hypothesized to result from DOC from algae

From Peterson et al. 1985

NUTRIENTS INPUTS AND ECOSYSTEM FUNCTION





From Peterson et al. 1985
Deegan and Peterson 1992

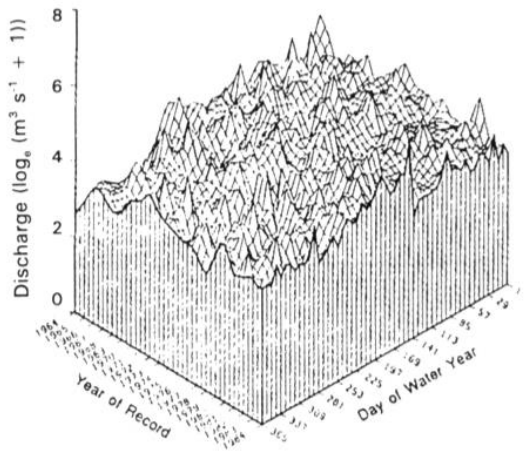
Konza-Kings Creek

Courtesy Katie Bertrand

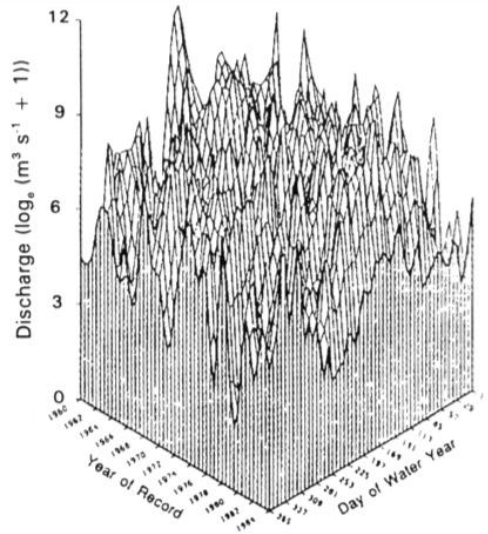
- Large consumers

+ Large consumers

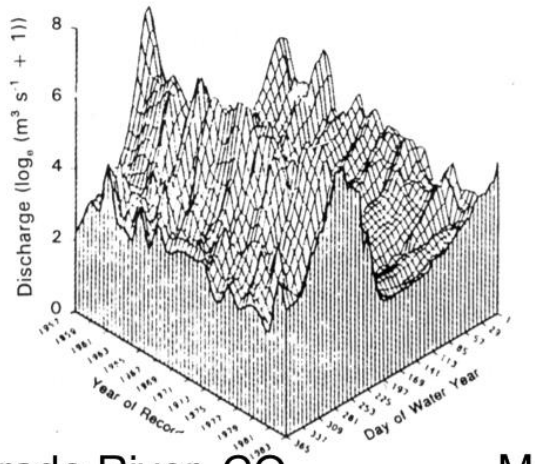
HYDROLOGY AND STREAM COMMUNITIES



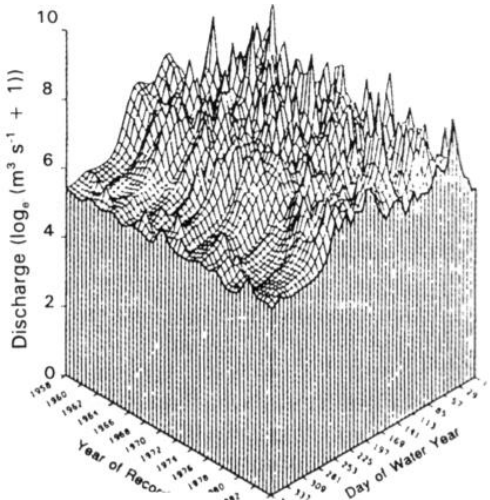
Augusta Creek, MI



Satilla River, GA



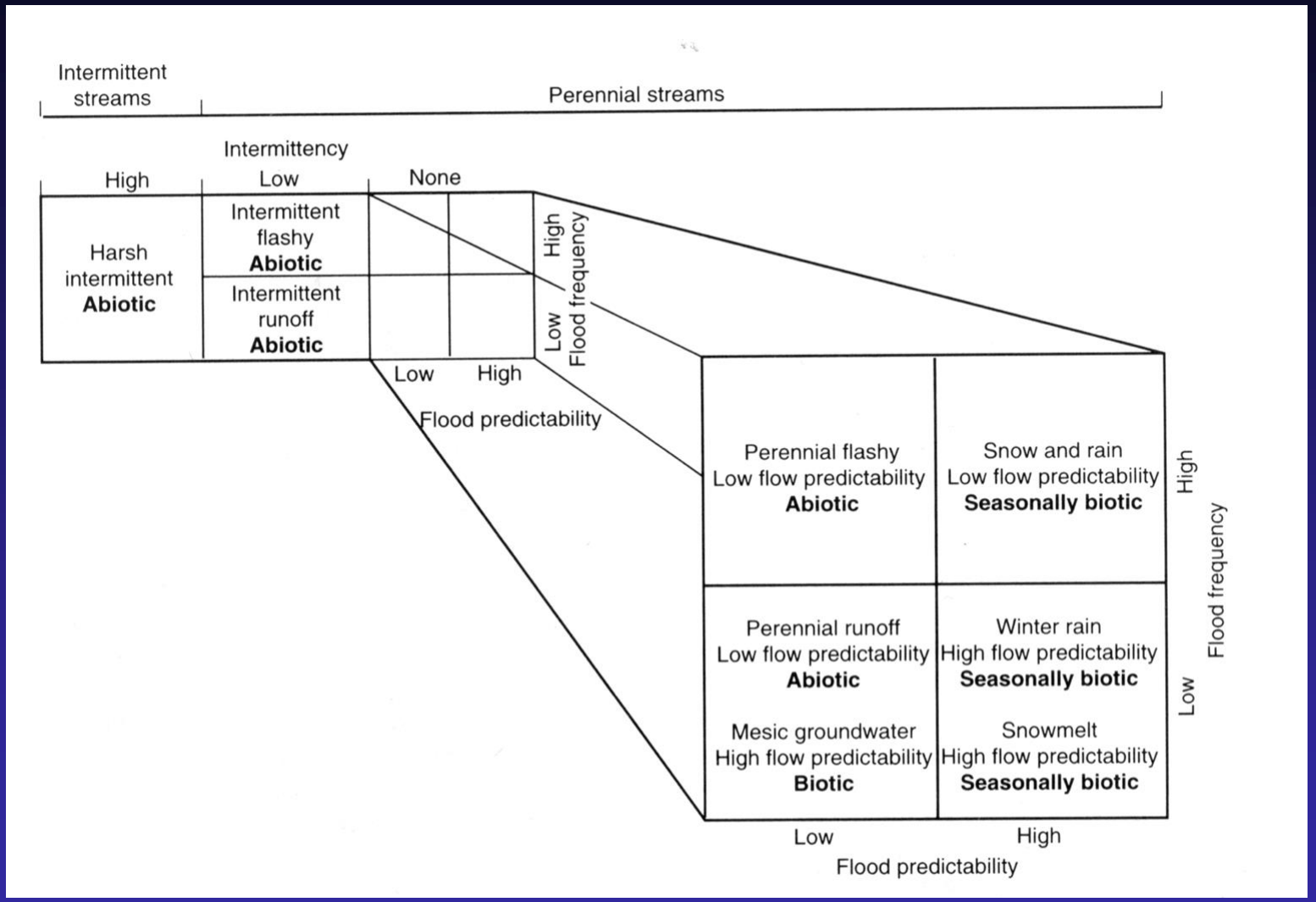
Colorado River, CO



McKenzie River, OR

From Poff and Ward 1989

HYDROLOGY AND STREAM COMMUNITIES



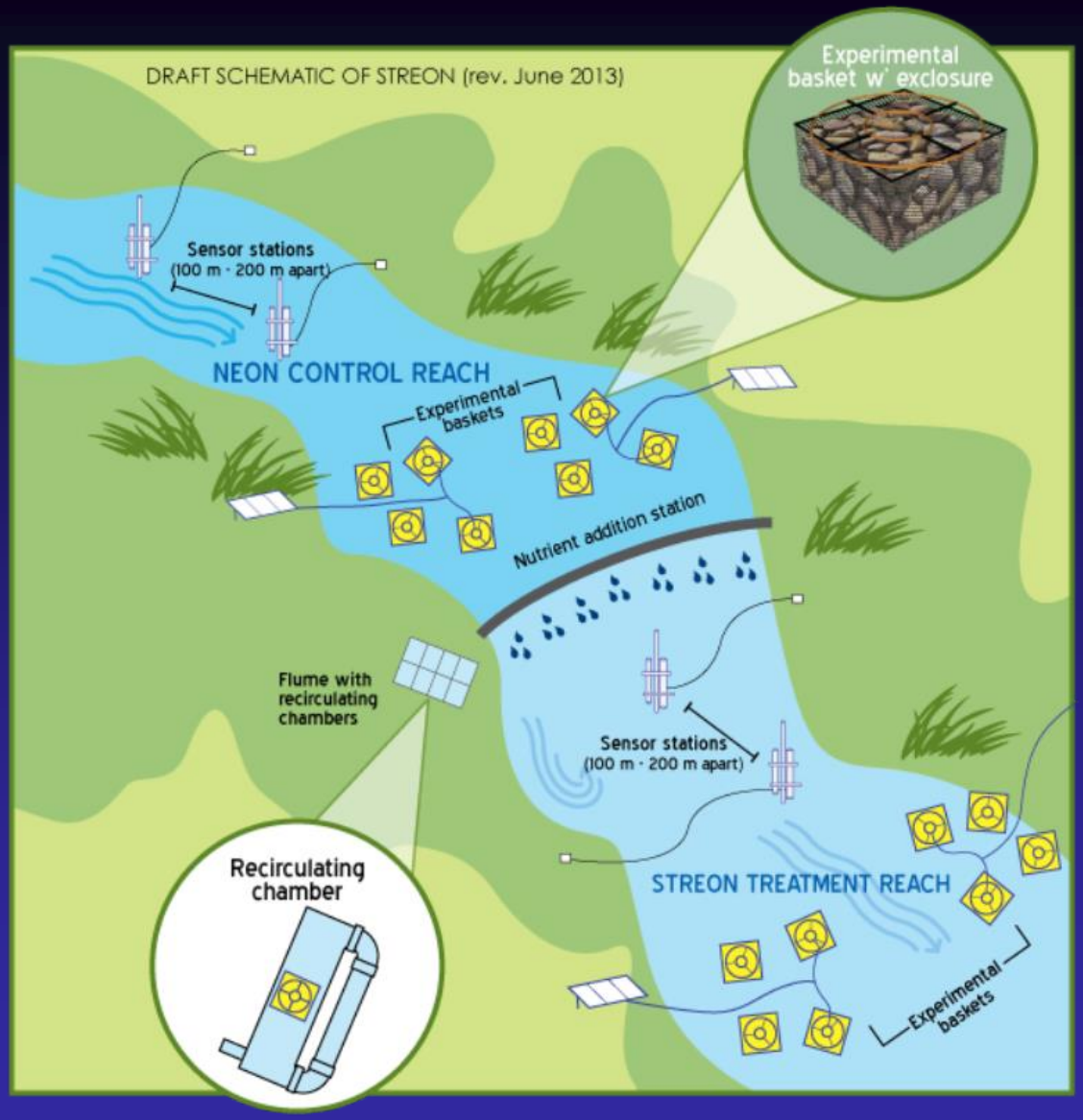
From Poff and Ward 1989

STReam Experimental Observatory Network (STREON/NEON)

Overarching question: ***How will chronic nutrient inputs, higher probabilities of droughts and floods, and loss of consumers impact the resistance and resilience of stream ecosystem function?***

STREON Experimental (tentative)

AND = Andrews Exp. Forest; ARC = Arctic; CPC = Caribou-Poker; CWT = Coweeta; GLV = Green Lakes Valley; GPR = Rio Guayanilla; KNZ = Konza Prairie; MAL = Gun Powder Falls; MMW = Middle Mississippi; ORW = Oak Ridge; RBC = Red Butte; SYC = Sycamore Creek; TAL = Talladega Forest; TKL (SNV) = TeaKettle Exp. Forest (Sierra Nevada)



The STREON experiment is designed to study how stream ecosystems respond to eutrophication and the loss of large consumers

- **Simulate chronic nutrient additions and the exclusion of large animals**
  - **3 years of pre-experiment observations**
  - **7 years of experiment**
- **Response variables:**
  - **nutrient spiraling**
  - **stream metabolism**
  - **abundance and diversity of stream organisms.**

SCALER

Scale, Consumers, and Lotic Ecosystem Rates : Centimeters to Continents

Walter Dodds, Janine Rüegg, Ford Ballantyne, Christina Baker, William Bowden, Kaitlin Farrell, Michael Flinn, Keith Gido, Tamara Harms, Ashley Helton, Jeremy Jones, Lauren Koenig, John Kominoski, Danelle Larson, William McDowell, Samuel Parker, Amy Rosemond, Ken Sheehan, Chao Song, Matt Whiles, and Wil Wollheim

Question 2: How does scaling vary among biomes?

Tundra

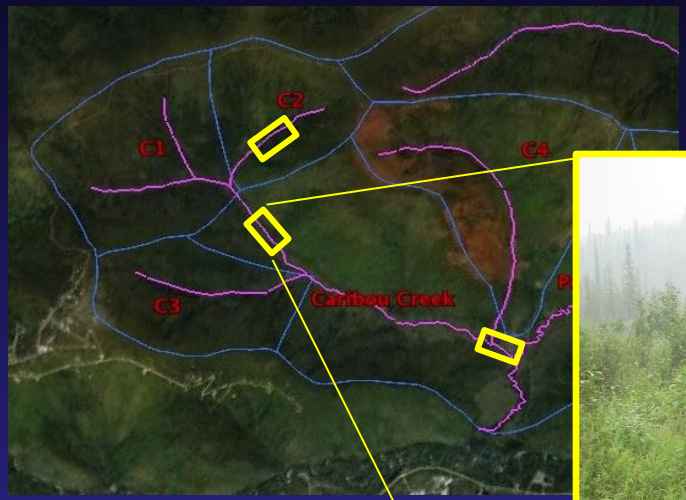
Taiga

Prairie

Appalachia

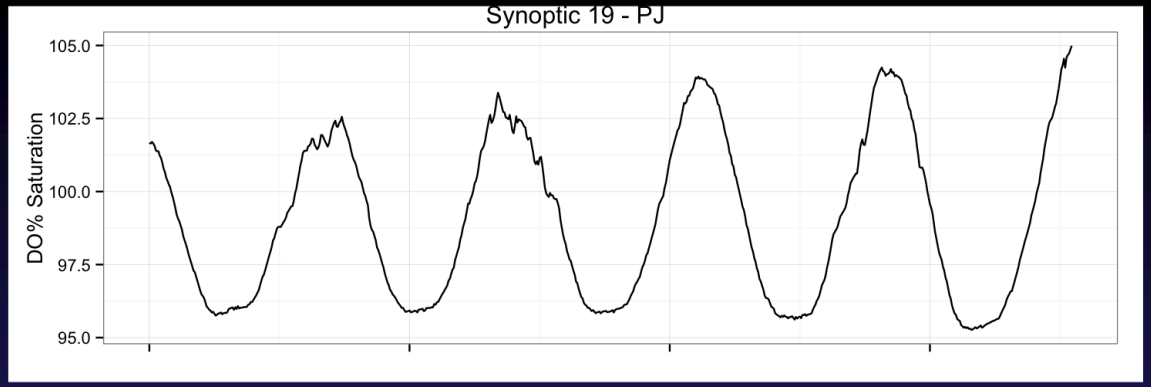
Neotropical

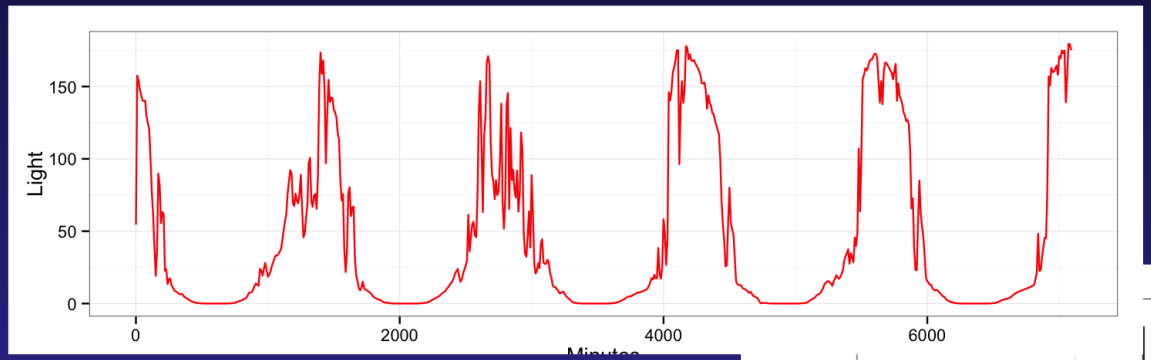
Question 1: How can small-scale experiments be used to understand network scale processes?

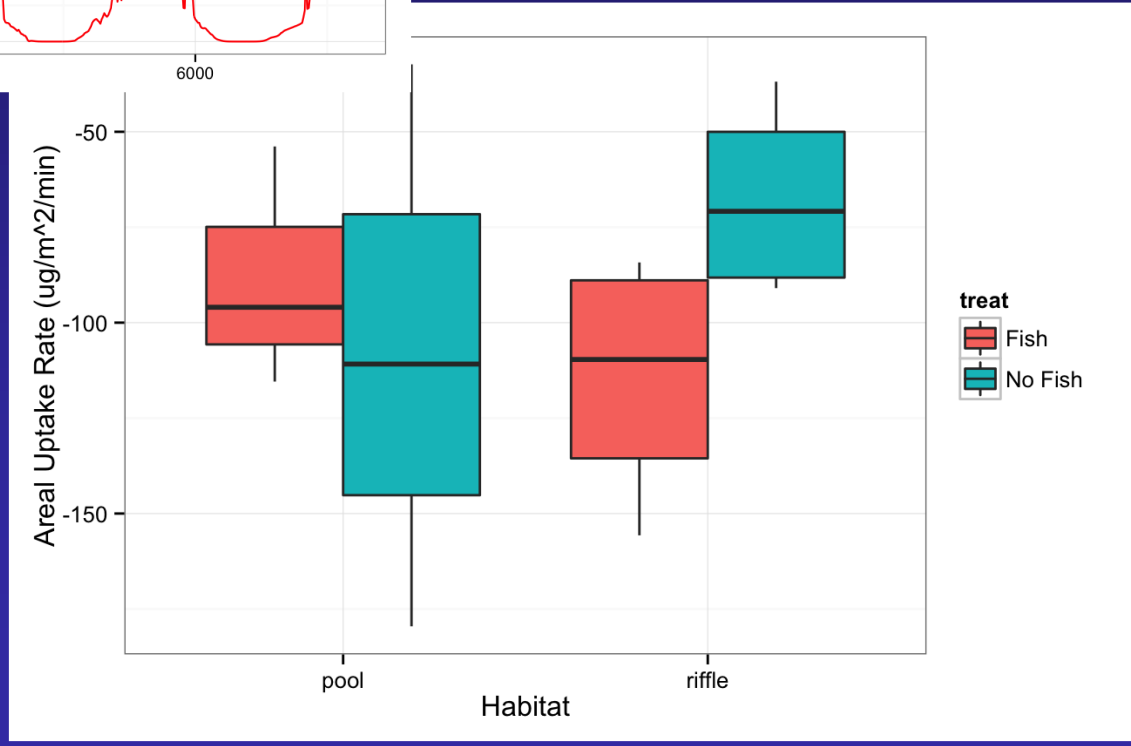


Measures of Ecosystem Function

- Metabolism
- Nutrient Uptake


Synoptic 19 - PJ
DO% Saturation
105.0
102.5
100.0
97.5
95.0


Light
150
100
50
0
0
2000
4000
6000


Areal Uptake Rate (ug/m^2/min)
-50
-100
-150
pool
riffle
Habitat
treat
Fish
No Fish

STREAM RESILIENCY RESEARCH COORDINATION NETWORK

Link stream ecologists with hydrologists, statisticians, modelers, and resource managers

Goal – develop a synthetic understanding of the resistance and resilience of lotic ecosystems to chronic nutrient inputs and changing species diversity.

Planned Activities:

- **Hosting four workshops over the next five years**
- **Developing a web portal to share information**
- **Hosting a graduate seminar**

STREAM RESILIENCY RESEARCH COORDINATION NETWORK

Tentative themes for the workshops are:

1. Structural equation modeling stream ecosystem responses to top-down and bottom-up drivers with changing climate and land uses
2. Time series analysis to understand long-term patterns and predict change in stream ecosystems
3. Connectivity and metabolism along river continuum
4. Meta-analysis of stream ecosystem response to changing nutrients and biodiversity

Hosting first planning workshop in Portland, Oregon at the Joint Aquatic Sciences Meeting

My first thought about trophic interactions…