

Effects of Nutrients on Spring Biota Workshop
UF for FDEP
Gainesville, Florida, August 21, 2007

Known Unknowns

Chuck Jacoby - [Questions about algae, plants and animals](#):

- Direct effects of nutrients on plants and algae
 - Are plants and algae in Florida's springs nutrient limited?
 - If so, is nitrogen the primary limiting nutrient?
 - What is the form and magnitude of a response to increases or decreases in a limiting nutrient?
 - Do responses to changes in nutrients differ in timing or magnitude among native, non-native and nuisance species (plants and algae)?
- Indirect effects of nutrients on plants and algae
 - Have plant and algal assemblages in Florida's springs changed?
 - Are growth and reproduction of native vascular plants compromised by increased algae (e.g., phytoplankton, periphyton or macroalgae) and resulting changes to ecological processes (e.g., increased respiration or decomposition leading to oxygen deficits for plants in low O₂ environments, altered biogeochemistry, or positive feedback on algal growth due to loss of grazers as palatable food decreases)?
 - Are non-native and nuisance plants and algae that "cope better with altered nutrient conditions" competitively displacing native vascular plants in Florida's springs?
 - Have changes in plant and algal assemblages affected the structure and function of faunal communities?
- Submersed aquatic vegetation as habitat
 - What is the form and strength of the relationships between faunal assemblages and plant and algal assemblages?
 - What is the timing and magnitude of a response by grazers to changes in plant and algal assemblages (e.g., changes in availability and quality of food)?
 - What is the timing and magnitude of a response by predators to changes in plant and algal assemblages (e.g., changes in value as a refuge for prey or from higher order predators)?
 - What is the timing and magnitude of a response by predators to changes in grazer assemblages (e.g., changes in availability and quality of food)?
- Direct effects of nutrients on fauna
 - What concentrations of nutrients, especially nitrate and ammonia, lead to effects on animals?
 - How do sublethal, physiological effects on individuals translate into effects at the population and assemblage levels?
 - How do effects at the population and assemblage levels feedback through trophic interactions and foodwebs?

Patrick Inglett
What is the.....

1. Importance of uptake vs. transformation as a determinant of nutrient fate. (N/P)
2. Potential for coupling of sediment/algal mat processes to water column chemistry.
3. Potential for the existence of alternate pathways of N cycling.
4. Potential for coupling of N, P, C, and S cycles.

Dr. Bob Knight (8/20/07)

Key Ecosystem-Level Spring Research Needs

- Comparisons of Control and Affected Springs:
 1. Define the range of normal and abnormal ecosystem metabolism in springs over a wide range of nutrient conditions, including upstream/downstream studies along nutrient gradients
 2. Define the trophic-level biomass pyramids and energy flows in these reference spring systems
- Controlled Ecosystem-Level Studies:
 1. Mesocosm studies *in situ* to determine the effects of nutrient levels on key primary producers and effects of consumers on various natural and “weedy” benthic and periphytic algal assemblages
 2. Interactive effects of multiple stressors on springs ecology – nutrients, flow reductions, aquatic plant control, recreation, etc.

Jason Evans, invasive plants:

1. Does increased nutrient (particularly nitrate) loading into Florida springs increase the spread, growth, and coverage of major invasive plant species (i.e., hydrilla, water hyacinth, and water lettuce)?
2. Would decreased nutrient loading be expected to lessen the spread, growth, and coverage of major invasive plant species?
3. What are the known habitat effects of major invasive plant species?
4. What non-target effects may be associated with aquatic plant management activities in springs ecosystems?

-Effects on non-target plants

-Deposition of organic matter and ???pulsed??? nutrient release -Potential grazer impacts, both toxicological and habitat disruption -Effects on algal community composition, particularly the potential to select for herbicide tolerant/resistant algal species (e.g., *Lyngbya wollei*)

Matt Cohen

- 1) Role of temporal variability in loading on ecological responses; links between N loading and nominal water age for particular springs.
- 2) What fraction of the nutrients are from short-term capture zones.
- 3) Role of covariates/confounders on macronutrient-ecosystem interactions (e.g., dissolved oxygen, toxicants, micronutrients).
- 4) If some bottom-up driver other than the alleviation of N limitation is causing ecological changes, what are the risk factors of importance? For example, if alleviation of P limitation is the stronger ecosystem change driver, when and how is P getting to the springs? If dissolved oxygen is the indirect driver of algal standing stock increases, what about springsheds (flows, BOD loads) are putting spring ecosystems at risk?
- 5) What are the landscape sinks (assimilatory/dissimilatory/abiotic) for nutrients upstream of and in the spring vents/runs and are they at risk of saturation?