Project Title

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Total Budget Request:

Project Description:

Abstract:

**Goal and Research Questions**

The abundance of man-made ponds and lakes is increasing globally (Downing 2007) and in regions like Virginia, that lack an abundance of natural ponds and lakes, man-made impoundments represent an important aquatic habitat. Despite the prevalence of man-made ponds in Virginia, there has been little research on how organic and inorganic nutrients cycle in these systems. Aquatic systems are an important component of the processing of terrestrially derived organic matter. Globally, natural aquatic systems process and decompose 70% of their total organic matter inputs (Tranvik et al. 2009). Terrestrially derived organic matter supplies aquatic systems with inorganic nutrients (e.g, nitrogen and phosophorus), and dissolved organic carbon, as well as supports the production of microbes and invertebrates (Gessner et al. 1999). Despite the recognized importance of terrestrial organic matter in natural aquatic systems, its role in man-made ponds is still largely unexplored. Furthermore ponds have been shown to retain nutrient run-off from the watershed (Johnston 1991, Hansson et al. 2005). Terrestrial leaf litter has been shown to sequester inorganic nutrients during decomposition (Trant et al. 2013), suggesting that the presence of leaf litter in the sediments may alter the Data collected by our lab has shown that man-made ponds near Farmville, Va, have an average of 82 mg of CPOM m-2 in the sediments, suggesting significant inputs of terrestrial organic matter into these system. Our proposed research project focuses on understanding the way in which man-made ponds contribute to the processing of watershed organic matter and nutrients. In other words, how are man-made ponds effecting the way in which nutrients and organic debris that wash into ponds altering the fluxes of inorganic and organic nutrients in the system? Specifically, we will be asking two research questions. The first is “how does the input of terrestrial detritus affect the nutrient retention or release from the sediments of man-made ponds?” Second, “how does the input of terrestrial detritus alter the sensitivity of pond metabolism to nutrient enrichment?”

**Objectives and Hypotheses**

To answer these questions, we must fulfill three main objectives. The first objective is to quantify the effect of CPOM on the flux of nutrients across the sediment water interface. We propose that the presence of CPOM will result in an increase in the N and P fluxes into the sediments, increase the DOC flux out of the sediments, and increase the SOD. The second objective is to quantify the way in which CPOM alters microbial biomass. We hypothesize that CPOM will increase water column bacterial abundance, increase sediment bacterial abundance, and increase fungal biomass. The final objective is to quantify how CPOM alters the response of sediment metabolism to nutrient enrichment. Our hypothesis is that CPOM will increase SOD when the sediments are enriched with N and P.

**Background**

Explanation of each hypothesis and supporting literature (if applicable)

**Experimental Design**

**Treatments and Response Variables**

To conduct our experiment, we have selected five response variables, which we will use to collect data from each of the four treatments. Our designated response variables include N and P flux, SOD, absorbance, bacterial abundance, and fungal biomass. The first treatment will consist of samples that contain no CPOM and have ambient nutrients present in the samples. The second treatment will be similar to the first in that it will contain ambient nutrients, but it will also contain 0.16g/m^2 of CPOM. The third and fourth treatments will vary from the first two in that they will have been enriched with N and P to the effect of 2x the ambient N and P present in treatments 1 and 2.

**Methods**

Water and sediment samples will be collected from a local, man-made pond. Once back at the lab, the sediment samples will be run through a 250 micro mesh strainer to remove any CPOM particles and macroinvertebrates that may be present. By running the sediments through the strainer, we should be left with only SOM, which will be a necessary component later in the experiment. Next, 300 ml septum topped glass jars will be filled with approximately four cm of the recently-sifted SOM. The remaining volume in the jars will be filled using the pond water samples collected at the time of sediment sample collection. To create the CPOM samples, 0.5 mg of tulip poplar leaves will be added to the sediment surface. Prior to being weighed, the leaves used will undergo senescence, before being air dried and then conditioned for 24 hours. The final two treatments will be created by adding NO3 and PO4 at 2x the concentration seen in the original water samples from the pond to some of the jars without CPOM and some of the jars with CPOM.

Once each of the treatments has been prepared, the sample jars will be incubated at room temperature in darkness. Over the period of one week, we will pull at least one jar from each of the treatments to analyze. To measure the nutrient concentration, or N and P flux, 25 ml of water will be removed from the jar and filtered through GFF. Once the water has been filtered, it will be frozen to keep the nutrients from escaping from the water. Next, absorbance will be evaluated by filtering 1 ml of the jar water through GFF and then running the sample through a nanopore mass spectrometer. Additionally, 5 mL of the jar water will be filtered onto a black membrane filter and stained with DAPI for bacterial counts with epiflorescence. Then, SOD flux will be measured. In order to quantify SOD, we will refill the jar(s) with pond water and then seal them without air. 15 ml samples will be extracted from the jar after 1, 3, and 6 hours of dark incubation. It is important to note that air will not be introduced into the jars during sample extraction. Oxygen content will be determined using the Winkler titration method. Finally, at the end of the experiment, the fungal biomass on the CPOM will be measured based upon the amount of ergosterol present.

**Budget**