A Solution to Excess Phosphorus in Streams? Looking at Biochar Filters on Shelburne Farms,Shelburne,Vermont

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Abstract

Shelburne Farms is a non-profit environmental education center near of the Lake Champlain in Shelburne, Vermont established in 1889. While a model farm, some streams on the property have low water quality due to excess levels of phosphorus and E.coli. Phosphorus (P) is a common element that is found in plants, animals, soils and throughout watersheds. While it is an essential nutrient for plant growth, in excess P acts as a pollutant. P can affect the water quality and increase algal blooms in nearby Lake Champlain. Phosphorus has different sources: fertilized lawns, cropland, manure storage areas, soils, rocks and wetlands. E. *coli* is a gram negative bacteria found in the lower intestine of animals and humans. High levels of E. *coli* are considered a health hazard. In April 2010, two biochar filters were installed on two of the five streams on site. Biochar is a charcoal type compound of a chemical decomposition called pyrolysis. The biochar filters have the potential to retain and absorb nutrients from the streams and reduce E. *coli* levels. The purpose of this research is to test the effects of the biochar filters in reducing phosphorus and E.*coli* in the streams. Samples were collected and compared from upstream and downstream of the biochar filters.

Introduction

Phosphorus is an essential nutrient for the plants and animals that make up the aquatic web (Caduto 1990). In freshwater systems, Phosphorus is a limiting nutrient for algal growth. In the Lake Champlain Basin, phosphorus is associated with an increase in algal blooms and associated problems (site). Phosphorus enters the Lake via multiple point and non-point sources. Streams which carry sediments associated phosphorus and dissolved phosphorus are major transporters of Phosphorus into the Lake. Phosphorus is derived from: soils, rocks, cropland, disturbed land areas, water treatment and other sources. Shelburne Farms is located along the shore of the Lake Champlain, a nonprofit environmental education center created in 1886 as a model agricultural estate. They have elevated phosphorus levels in their streams despite implementation of many BMP's (Best Management Practice). In April of 2010, two biochar filters were installed along two of the five streams on the state. Biochar filters may sorbs phosphorus there by reducing phosphorus output into the lake.

Objectives

- Testing phosphorus levels in streams above/ below filters
- See if the Biochar filter can reduce phosphorus levels in Vermont streams
- Take samples for compare the site where stay the Biochar

Materials and Methods

- Samples taken upstream and downstream of biochar filters
- Sampled during the storm events and during base flow
- Analyzed soluble reactive phosphorus (SRP) and total phosphorus (TP) to compare upstream values with downstream values
- Went to Shelburne Farms in different weather activities
- Samples in Shelburne Farms for E.*coli* and total phosphorus and analyzed all samples collected in UVM's Agricultural and Environmental Testing Lab

Results

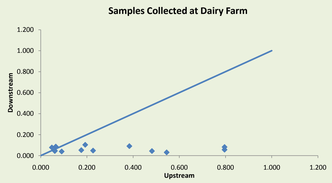

Figure 1 The samples collected Upstream vs. downstream

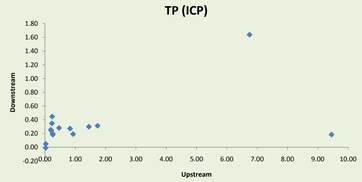

Figure2. Compare the amount of TP using the ICP between upstream /downstream

❖ Both SRP and TP values were significantly reduced in downstream samples as compared to upstream samples

Discussion

❖ We see the amount of TP that we can found in the dairy farm, but with the use of the biochars, the pollution is less in downstream. (Figure1)
❖The time that we collected samples are in intervals of 10 minutes for see the differences in the site
❖We found the ICP for see the amount of phosphorus in the streams, at the same time using different chemicals for see the nutrients that stay in the streams(Figure 2)
❖ This is a beginning of this research and for future works ,we can found the role of the biochars in Shelburne Farms

References

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