Suspended Solids and Phosphorus in the Lamoille River Basin

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Introduction

Eutrophication is the overgrowth of algae in a body of water which causes serious harm to a local ecosystem. It becomes possible when too much of certain nutrients, primarily nitrogen and phosphorus (P), are present in water, usually due to human activity. An estimated 921 metric tons (2.03 million lbs) of phosphorus is carried into Lake Champlain by its tributaries each year (Lake Champlain Basin Project, 2015). This overabundance of P fuels dangerous algal blooms.
Most Phosphorus enters rivers in the basin as runoff during storm events. P is often present in soil, which storms wash into the river and carry into Lake Champlain. This P can be present naturally in the soil or can be enriched by fertilizers and other human activities (Uusitalo, 2000). Erosion of river banks and overland runoff washes soil particles into the streams, turning the water a brown color, which scientists measure as total suspended solids (TSS). Runoff, and subsequently TSS, is known to be higher in areas with little vegetative cover. This gives urban and agricultural lands the potential to supply large amounts of TSS that is rich in P (Hively, 2005).
Hence, there is a close correlation between the suspended solids in a river and the amount of phosphorus it is carrying. When this phosphorus reaches Lake Champlain and offsets the balance of nutrients and encourages the growth of harmful algae. Preventing these nutrients from reaching the lake in such excessive amounts would help to curb these events (Lake Champlain Basin Project, 2015). This study focused on 19 sites located along 10 tributaries to the Lamoille River, comparing the amount of P and suspended solids present in the rivers during storm events. Better understanding the strength of the correlation between the two will help determine better ways to prevent phosphorus loading in the future.

Methods

Two sets of samples were taken from each river during storm events. Samples are taken from an area of the river that is at least knee deep, where the flow of the water is unobstructed.

One set of samples was digested and analyzed for concentrations of total phosphorus, and the other set was filtered to measure suspended solids on a filter paper. These filters were dried and weighed to determine the TSS present per liter of water.

Results

As shown in Figures 1, 2, and 3 most sampling sites over the past four years have shown a positive correlation between TSS and total phosphorus (TP) levels. The wet years of 2013, 2014 and 2015 showed significant increases in TP when TSS concentrations were high (Fig. 1). High elevation sites, like Browns River 859, had small increases in TSS and TP, whereas lower elevation (Browns 535 and Browns 355) showed significant increases during storm events (Fig. 2). TP and TSS levels are dramatically higher during the highest-flow conditions of storms (Fig. 3).

Figure 4
Sampling and data collection at French Hill River

Results

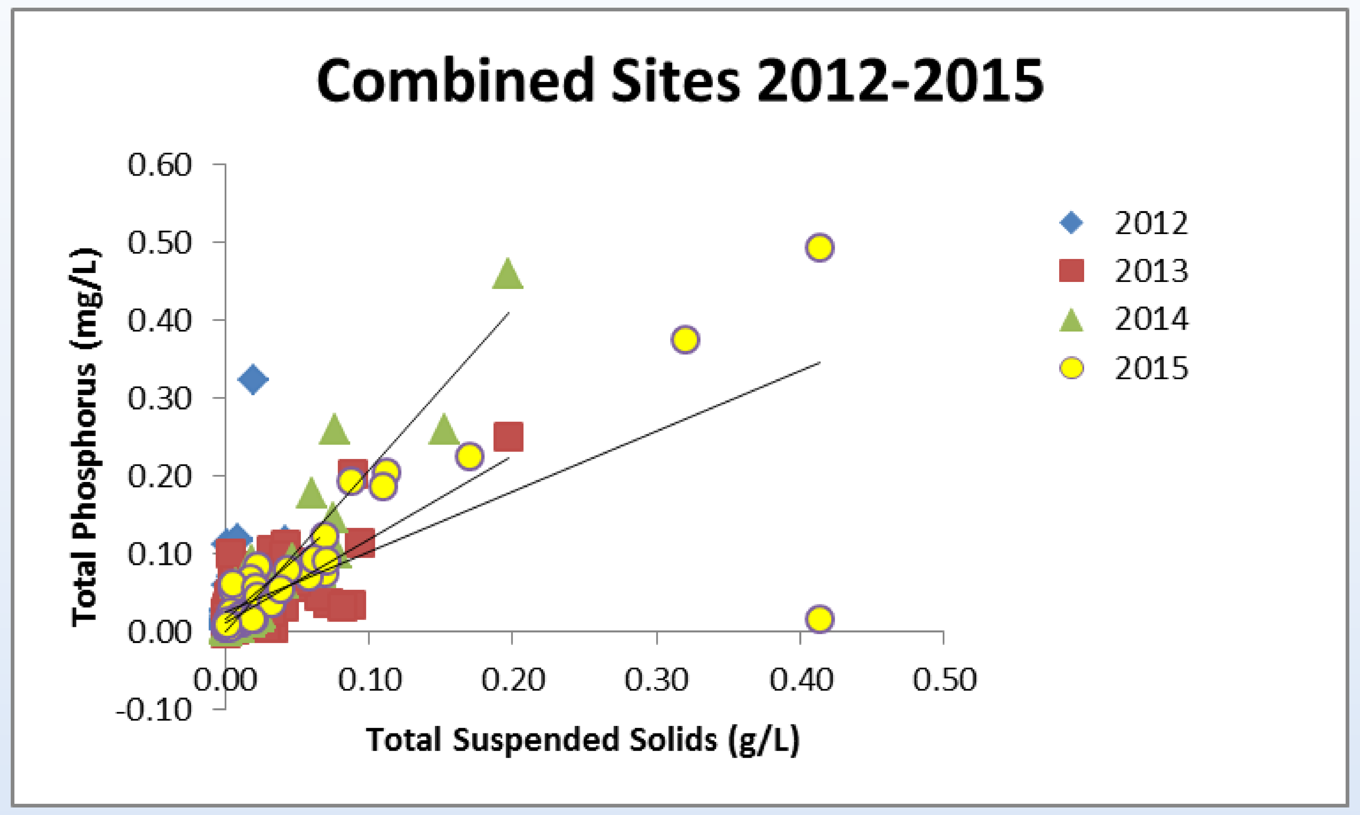

Figure 1

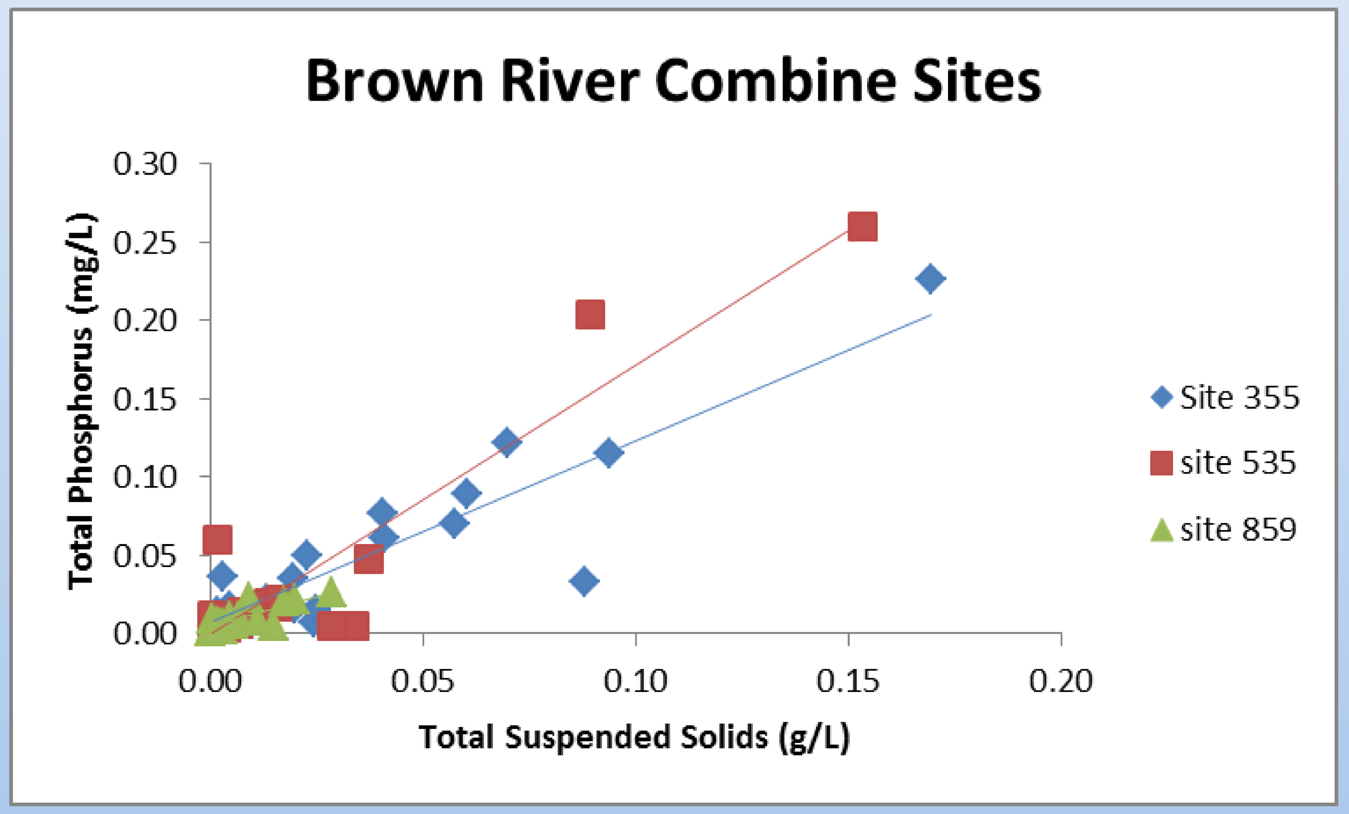

Figure 2

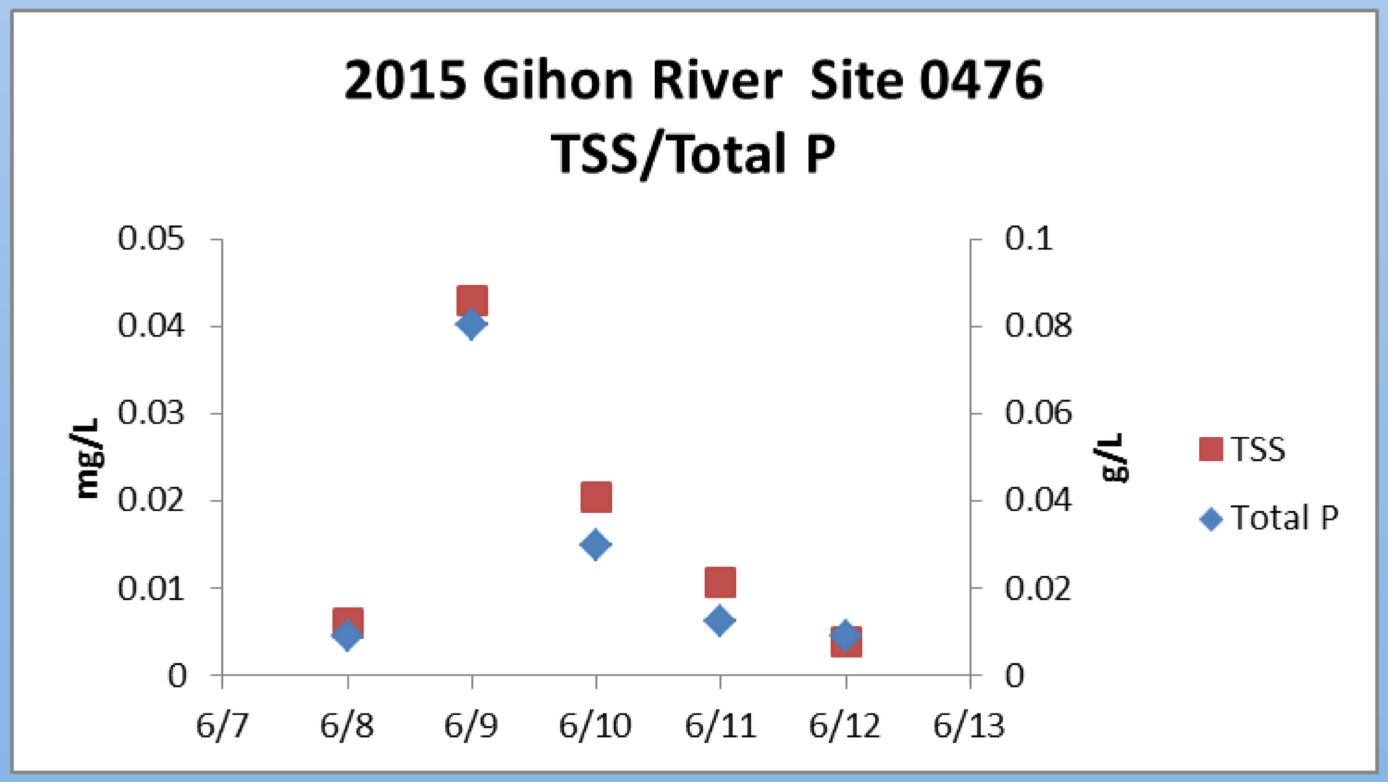

Figure 3

Conclusion

Results of this study show a correlation between increases of TSS and phosphorus in river water, supporting my original hypothesis. The majority of data taken from 2012 to 2015 shows a proportional increase in P levels when TSS increases (Figures 1, 2, and 3). Significant increases in either value are due to storm events which cause runoff from the surrounding area to enter the rivers.

A pattern also emerged in rivers that were sampled at multiple sites. Sites at higher elevations appear to have noticeably lower amounts of both TSS and P. For example Figure 2 combines data from all three Brown River sites. The green triangles clustered next to the X and Y intersect represent the site at the highest elevation. Since this higher elevation site has a higher percentage of tree cover, this suggests that forested areas have a lower amount of runoff than urban (Browns 535) and agricultural (Browns 355) areas. This would be due to vegetation holding soil in place (Hively, 2005). Planting vegetation along rivers is already an important strategy for preventing soil erosion. This study is consistent with other findings, and supports the idea that this is also a good method of preventing P loading (Troy et al. 2007).

References

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