The Effects of Land Use of Phosphorus and Sediment Concentrations in the Lake Champlain Basin

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Introduction

Water quality affects a number of aspects from safe drinking water to an influx in biodiversity. An example of poor water quality is eutrophication, or the excessive uploading of nutrients, which causes algae blooms and fish kills. Water quality can be impaired due to factors like land use, erosion and runoff, and even tree cover. The agricultural and urban land use in the Lake Champlain basin has caused a decrease in water quality and a rise in eutrophication. (Manley, 2004) The majority of pollution in the Lake Champlain basin is from a non-point source. (Manley, 2004) This means that the pollution in this basin is not from a specific or targeted point, the contamination in our waters comes from a much larger area. Researchers are able to see these effects when measuring water quality. To do so, we used several different methods for our study. For example, we tested stream current, measured temperature and pH, sampled nutrients (total nitrogen and total phosphorus) and total suspended solids (TSS). From this study, we developed our question; how does land use (forested, agricultural, and urban) affect phosphorus and TSS concentrations? Our hypothesis is that the watersheds that contain more human development will lead to higher concentrations of phosphorus and TSS.

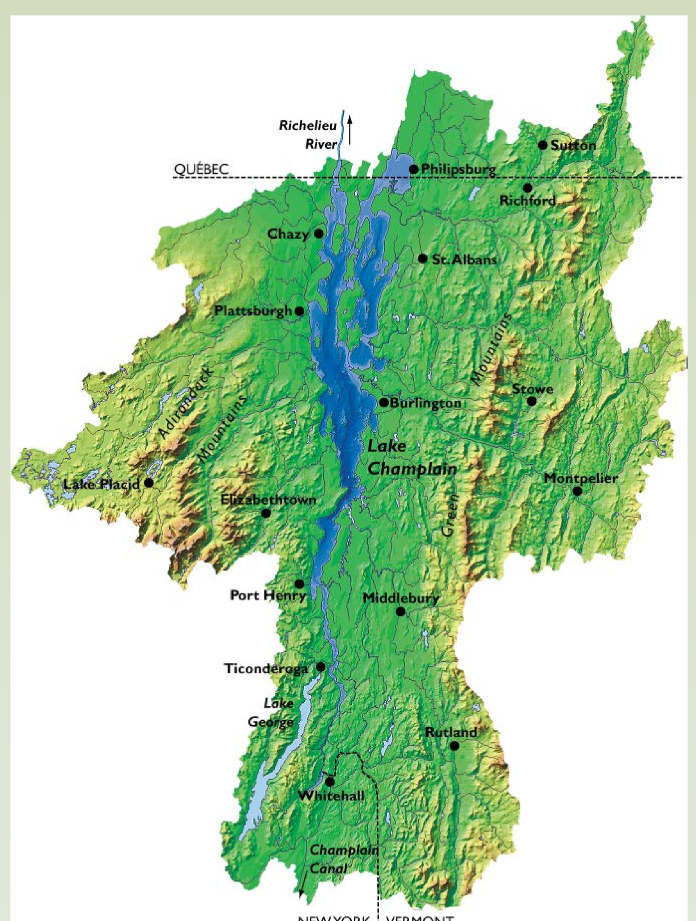

Figure 1. The Lake Champlain Basin (LCBP, 2015)

Methods

Figure 2. The SoRo EPSCoR Team Preparing to Sample

Nutrient and TSS samples are collected at stream sites in triplicate, and analyzed by the EPSCoR laboratories. Land use data is computed by a geographic information system (GIS). We made our data set by selecting all of the EPSCoR streams data from 2011-2017 that had total phosphorus and total suspended solids from Lake Champlain Direct Rivers, the Winooski River, Missisquoi River and Lamoille River. We collected data from 32 different streams from these rivers, including 465 samples. We analyzed this data using linear regression.

Results

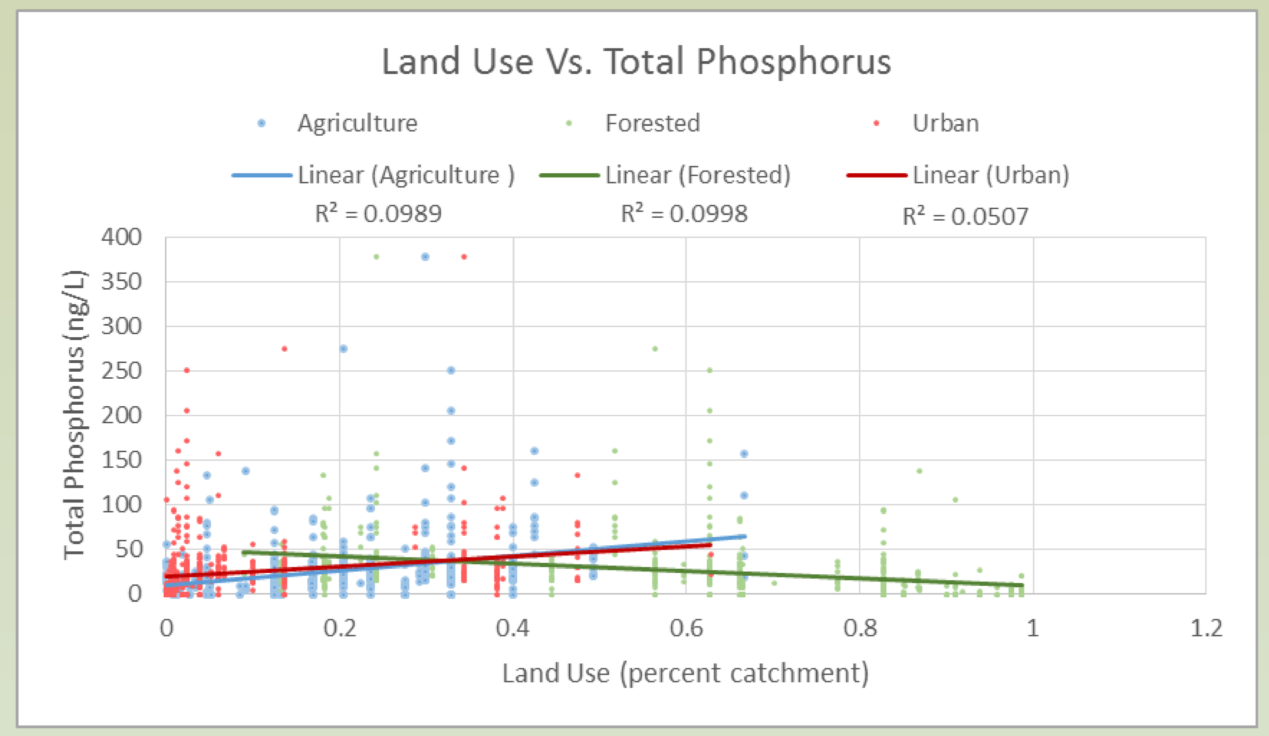

Figure 3. Land Use vs. Total Phosphorus

- In figure 3, agricultural and Forested land areas had the highest correlation
- Agricultural and Urban have positive slopes while Forested has a negative slope

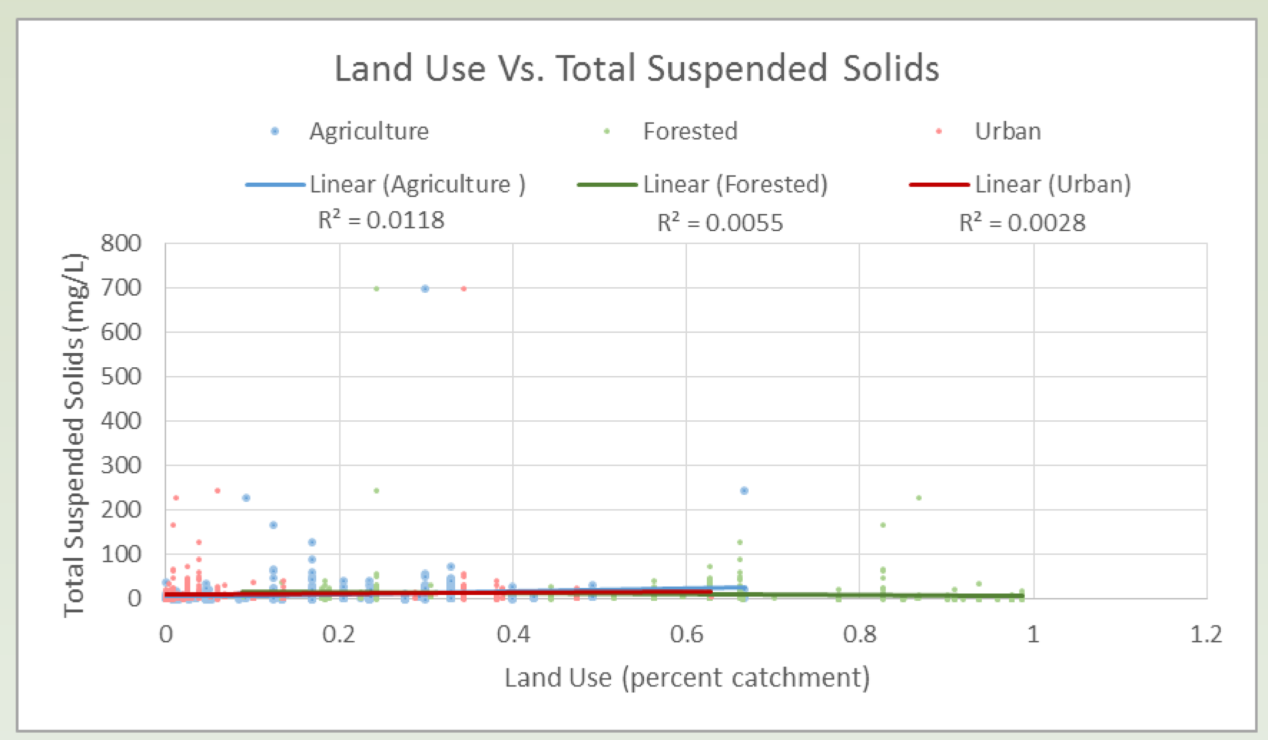

Figure 4. Land Use vs. Total Suspended Solids

- In figure 4, the correlations for all land types are very low

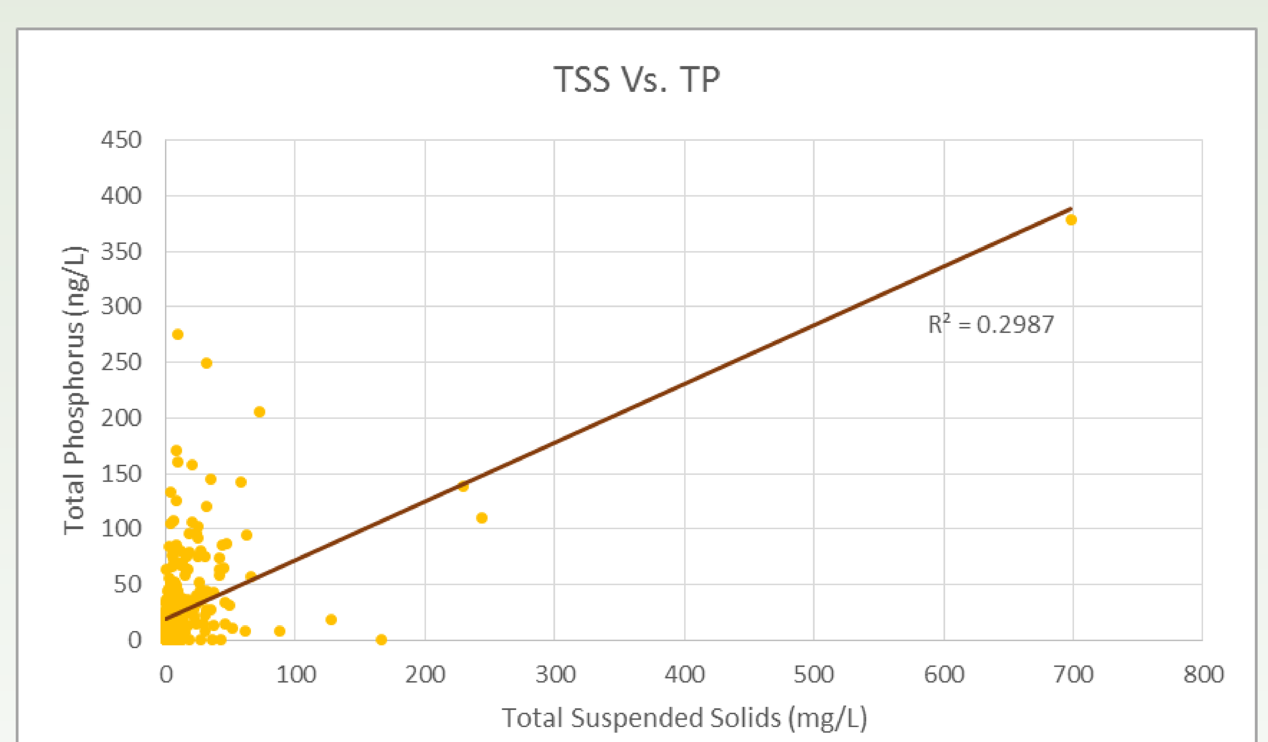

Figure 5. Total Suspended Solids vs Total Phosphorus

- In figure 5, there is a strong positive correlation between Total Suspended Solids and Total Phosphorus

Conclusion

The results from Figure 1 conclude that as you increase the amount of forested land, the total amount of phosphorus tends to decrease. And as you increase the amount of agricultural land, the amount of total phosphorus tends to increase. We cannot draw any conclusions from Figure 2, because of the randomness of the data. Figure 3 shows that total suspended solids are indicative of the concentration of total phosphorus. We could improve our study by relating our data to specific storm events, or the land immediately near the river.

This conclusion supports our hypothesis that more human influence leads to higher concentrations of total phosphorus. Furthermore, the erosion and runoff from agricultural land leads to higher concentrations of TSS, therefore leading to high concentrations of phosphorus. It is important that we continue to regulate our land use near rivers and streams. For our future generations to thrive, we need our rivers to jive.

Figure 5. An Algae Bloom in Lake Champlain (LCBP, 2015)

Acknowledgments

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