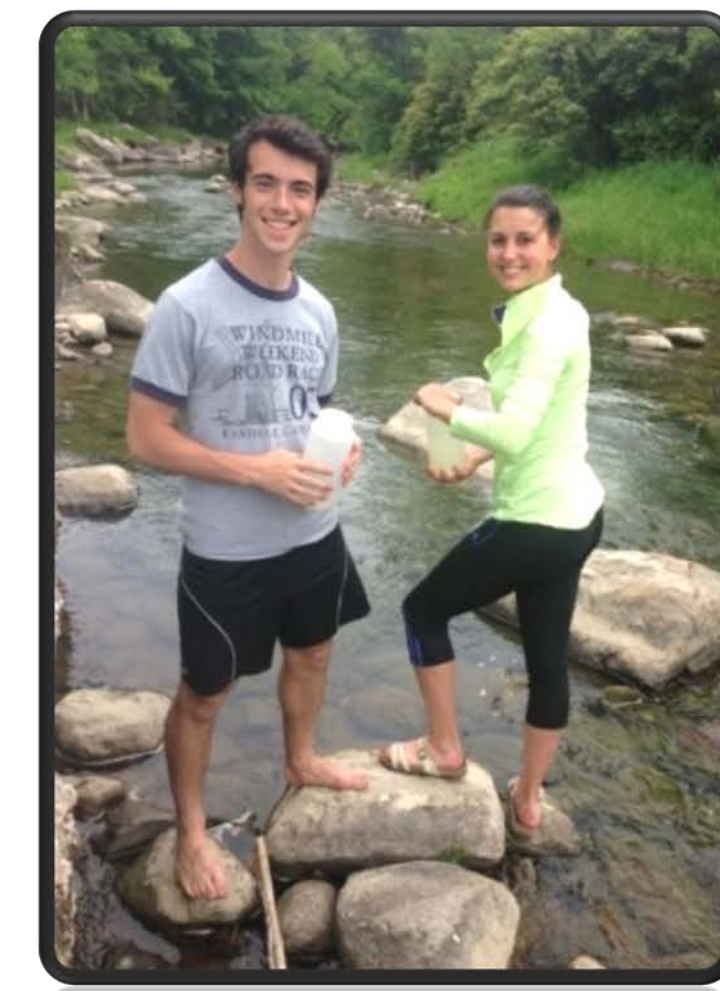


Storm Chasers: The Correlation Between Water Discharge, Suspended Solids and Nutrients During a Major Storm Event in the Winooski River, Montpelier, VT.

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Introduction

- The quality of a freshwater ecosystem is dependent upon the watersheds that surround it (Uusitalo *et. al.* 2000).
- The Winooski watershed drains into Lake Champlain and includes the Winooski River, the second largest river in VT (<http://nature.thecompass.com>), which begins in Cabot VT and flows 90 miles to Lake Champlain in Colchester, VT. Approximately 1,880 square miles of land from Central VT drains into the Winooski River (Danz *et. al.* 2013).
- According to "Issues in Ecology," major factors that regulate freshwater ecosystems include flow patterns, sediment and organic matter, light, chemicals, and nutrients (Ecology Society of America 2003).
- TSS and nutrient data are indicators of water quality. There are optimum levels of nutrients and solids necessary for proper ecosystem growth and survival; too much can result in detrimental effects such as over-eutrophication and harmful algae blooms (Ecology Society of America 2003).
- Danz *et. al.* found that 64%-97% of annual sediment phosphorus loads can be introduced to water systems during just a few major storm events.
- In Southwest Finland, Risto Uusitalo *et.al.* found a major relationship between the total phosphorus concentration and the Total Suspended Solid (TSS) content.
- A relationship between TSS data and nutrient data (such as total phosphorus or total nitrogen) can potentially indicate how much of the total nutrients are bound with the sediments as opposed to other sources such as run-off.
- This study observed how one major storm event in Vermont impacted the relationships between TSS, discharge and nutrient data.
- Specifically this study focused on the Winooski River at the Montpelier USGS site, as other simultaneous studies focused on the Mad River and Winooski River at Essex sites.
- It was expected that there would be a relationship between discharge and the suspended solids at each site. And therefore, an increase in nutrients.



Materials and Methods

Obtaining Isco Samples

- Water samples were collected from May 2013-August 2013 using Isco Samplers, which were installed at established sites along the Winooski watershed. Iscos were monitored using the USGS webpages
- Once samples were taken, interns collected the bottles and transported them to Johnson State College and Saint Michael's College laboratories for analysis.

Water Quality Testing

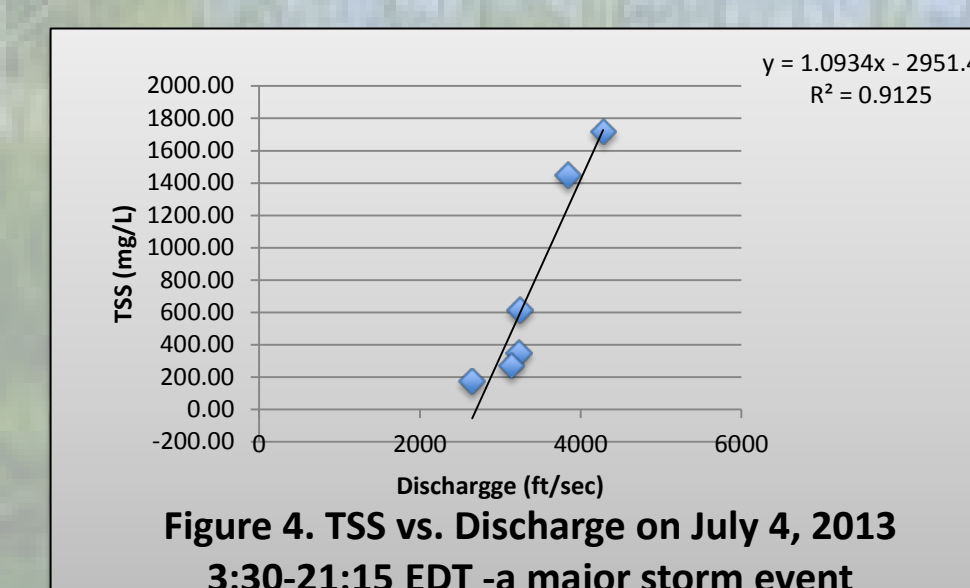
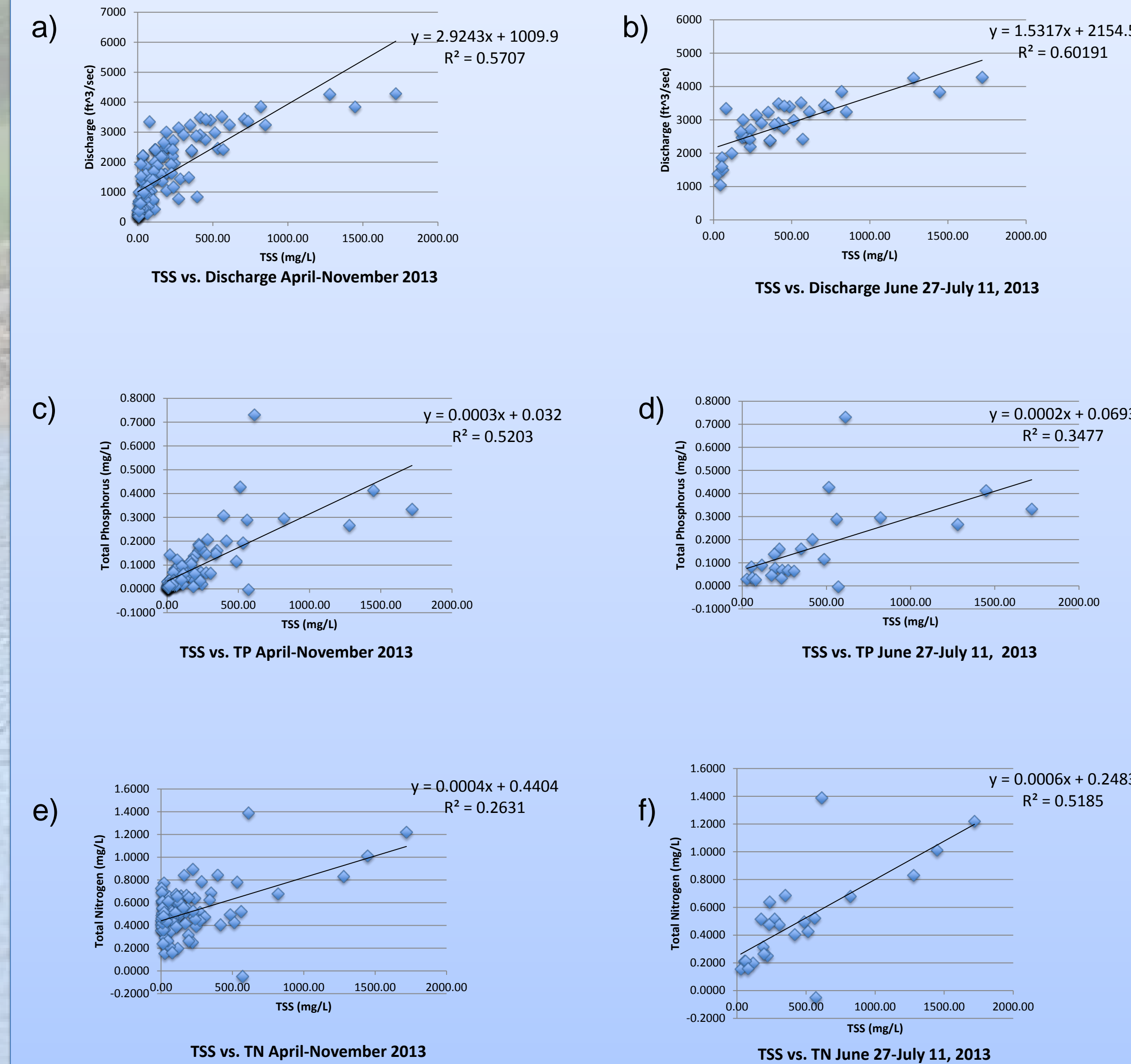
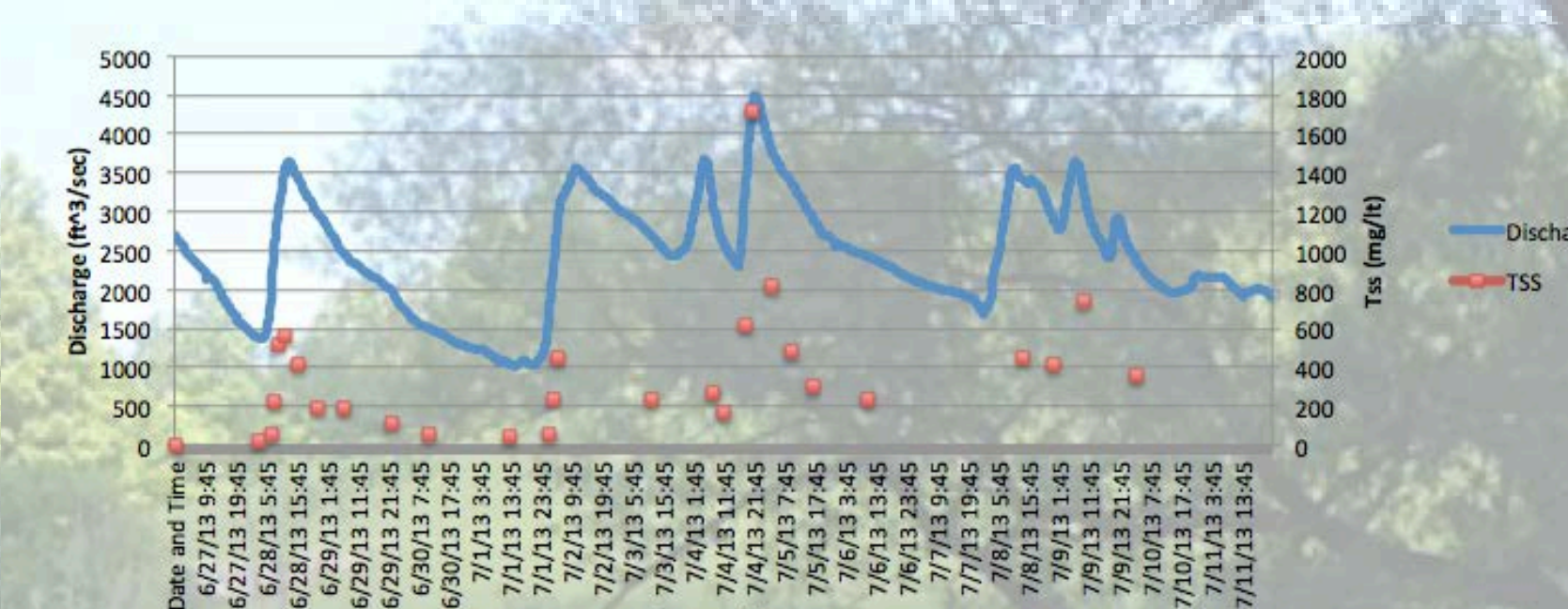
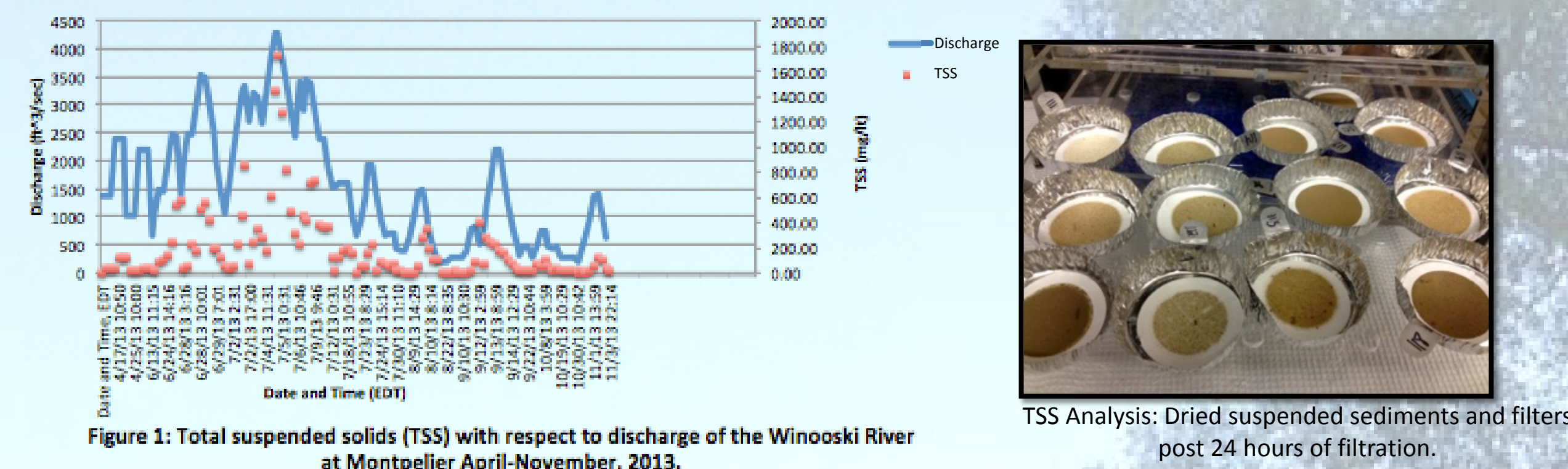
- Bottles were brought to Johnson State College for nutrient testing and to Saint Michael's College for TSS analysis.
- Nutrient data were analyzed according to the EPA methods 365.1 Rev.2 (TP) and 353.2 Rev. 2 (NO₃) at Johnson State College.
- TSS data were analyzed using a three manifold filtration apparatus according to the Standard Methods for the Examination of Water & Wastewater (APHA 2005) and Wetzel & Likens 2000.
- Post filtration, filters were dried in the oven at 103-105°C for 24 hours and weighed.

Identifying the "Major Storm Event"

- Using the USGS website and data from 2013, discharge and the amount of samples collected from each site were plotted against time using Microsoft Excel to determine the greatest period of rain fall.
- The "major storm" was identified as the sampling period that collected the most samples at each site.
- The major storm event was determined to be July 4, 2013.



Results



Discussion

- As originally expected, this study showed that there was in fact a relationship between discharge and suspended solids; specifically during a storm event (Figure 1, Figure 2).
- Therefore, because TSS and nutrient data correlate, there is also a relationship between discharge and phosphorus or nitrogen (Figure 3).
- Thus this data confirms previous studies.
- As indicated previously by Dantz *et. al.*, correlations were typically more significant and yielded higher R² values (Figure 3, Figure 4) during a major storm event; relationships strengthened.
- R² values greater than 0.50 are considered significant, which is displayed.
- The results support the idea that as storms become more frequent, not only will water levels and suspended sediments rise, but nutrients embedded within sediments will be found in higher concentrations.
- Data could have been influenced by the location of the Montpelier site; 13% of the surrounding land area is used for agriculture, 3% for urban purposes and 78% of the land is forested (determined using ArcGIS and satellite imagery).
- In future studies, a deeper investigation of the TSS and nutrient data and relationships immediately before and after a major storm event would be useful.

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