Comparison of TSS and Sources of Fecal Coliforms in Streams Surrounded by Forested and Agricultural Land Uses

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ABSTRACT

Several land uses may increase the vulnerability of surface waters towards degradation. The concentrations of Total Suspended Solids and E. Coli in a stream may be helpful to indicate whether water quality is related to certain land uses or not. This research focused in evaluating these two parameters in four streams; two in an agricultural setting and two forested. During 4 weeks, water samples were taken once or twice a week paying attention to weather events in the previous 24 hours. Samples were analyzed in the Streams Project water quality laboratory using different protocols for each parameter. For Coliform samples the IDEXX Colilert System was used. TSS samples were analyzed using preweighed filters and drying them at 105ºC to calculate the increasing weight due to Suspended Solids. A large range of E.Coli concentrations was observed for each of the sampled streams. In terms of Total Suspended Solids (TSS), variation among the data is not as drastic, but is also considerably high. It was not possible to make a reliable comparison in terms of E.Coli and TSS concentrations, between the two types of land use analyzed, due to the large variability in the data.

INTRODUCTION

•The vulnerability of surface and ground water to degradation depends on a combination of natural landscape features, such as geology, topography, and soils; climate and atmospheric contributions; and human activities related to different land uses and land-management practices.[1] Intense storm events may increase concentrations of several parameters by over an order of magnitude.[2]

•Streams running through agricultural land have been linked to decreased water quality, compared to those surrounded by forested land, due to runoff from fertilizers and cattle access to the water.[3]

•Total Suspended Solids (TSS) is a water quality measurement that may include a wide variety of materials and is an important cause of water quality deterioration leading to aesthetic issues, higher costs of water treatment, a decline in the fisheries resource, and serious ecological degradation.[1] High concentration of TSS may cause physical alterations to the water body by reducing the penetration of light; leading to reduced photosynthesis rates.

•*E. coli* is an indicator of fecal contamination. Elevated levels often indicate the presence of pathogenic bacteria and viruses. Pathogenic intestinal organisms from faeces deposited in surface waters may lead to health problems and possible death in humans as well as other animals that drink from contaminated waterways.[4]

METHODS

- Four sites were identified and classified according to land use:

Forested:	Agricultural:
Duck Brook	Munroe Brook
Snipe Ireland	Potash Brook

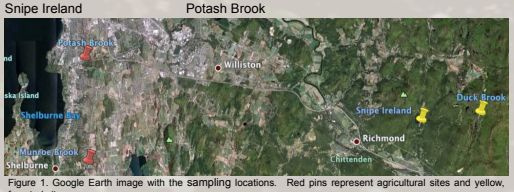


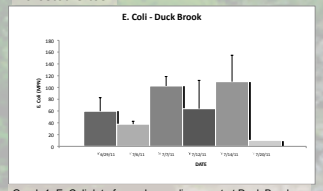
Figure 1. Google Earth image with the sampling locations. Red pins represent agricultural sites and yellow, forested sites.

- Samples were taken once or twice a week during 4 weeks, looking for before and after rain events, totaling six sampling events.
- 3 replicates for each parameter (TSS and E. Coli) and a blank for E. Coli were collected for each sampling event.
- TSS was analyzed by vacuum filtration through a preweighed filter, then dried in 105ºC, and weighed again to calculate the increasing weight of the filter.
- E. Coli samples were analyzed using the IDEXX Colilert System[5].

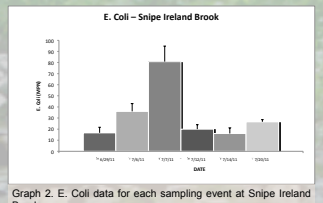
RESULTS

E. Coli:

Forested Sites:

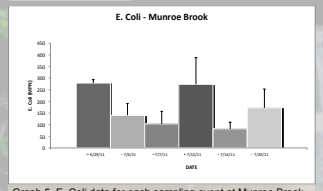


Graph 1. E. Coli data for each sampling event at Duck Brook.

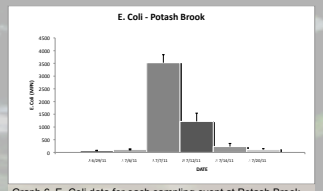


Graph 2. E. Coli data for each sampling event at Snipe Ireland Brook.

Agricultural Sites:



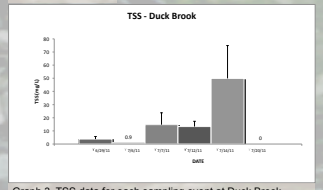
Graph 5. E. Coli data for each sampling event at Munroe Brook.



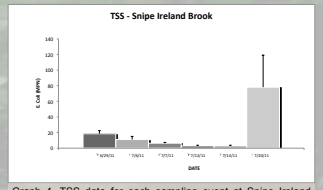
Graph 6. E. Coli data for each sampling event at Potash Brook.

Total Suspended Solids (TSS):

Forested Sites:

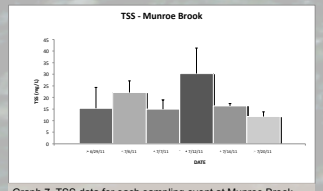


Graph 3. TSS data for each sampling event at Duck Brook.

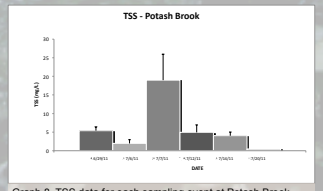


Graph 4. TSS data for each sampling event at Snipe Ireland Brook.

Agricultural Sites:



Graph 7. TSS data for each sampling event at Munroe Brook.



Graph 8. TSS data for each sampling event at Potash Brook.

DISCUSSION

A large range of E.Coli concentrations was observed for each of the sampled streams. They ranged between 10 Most Probable Number (MPN) in Duck Brook to 3525 MPN in Potash Brook. Concentrations stayed relatively constant in Duck Brook and Munroe Brook. In 7/7/11 an increase was noticed for Snipe Ireland Brook and Potash Brook. This increase can be related to heavy storm events in the previous 24 hours. Generally higher concentrations were observed in agricultural sites when compared to forested sited. Due to the variation in the data it is not possible to make a dependable comparison between these two type of land use.

In terms of Total Suspended Solids (TSS), variation among the data is not as drastic, but is also considerably high. There were days where the concentrations increased fairly; 7/14/11 for Duck Brook, 7/20/11 for Snipe Ireland Brook, and 7/7/11 for Potash Brook. This increase may be related to rain events observed in a 24-hr period preceding sampling. An inexplicable 0 mg/L TSS concentration was observed in Duck Brook. Such value is not realistic in any stream. Overall, TSS concentrations were similar in all of the four streams.

CONCLUSIONS

•Higher concentrations of E.Coli were observed in agricultural sites.

•It is not possible to make a reliable comparison of neither E. coli or TSS between forest and agricultural sites due to the large variability in the data.

•This variation may be due to sample contamination during sampling events and/or during laboratory analysis procedures.

•Storm events have considerable implications in water quality because they are likely to alter dissolution and contaminant load of both parameters.

•Munroe Brook showed the most stable data, with almost no variability. This site had very consistent conditions in terms of flow rate and appearance. No research was concurrently conducted in this site, reducing human error when handling samples

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