The effects of Urban and Forested land use on Escherichia coli and Total Suspend Solids in Potash Brook and Snipe Island Brook in Vermont

Karoline Rios-Rodriguez[1] and Christine Gingras[2]

[1]School of Science and Technology, Universidad Metropolitana, San Juan, PR 00928
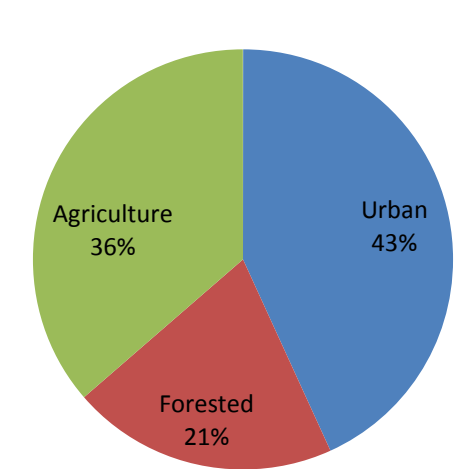
[2]School of Engineering, University of Vermont, Burlington, VT 05405
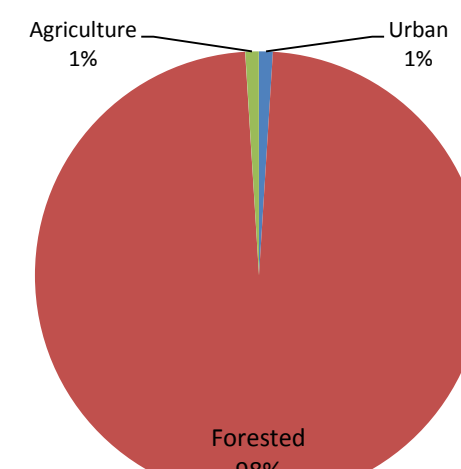
Introduction

The main goal of this research to study the impact of urban and forested land uses on Escherichia *coli* and Total Suspend Solids in Potash Brook and Snipe Island Brook using data since 2009. Potash Brook (LCD_PoBrk_133) is an urban catchment located on Farrell St, South Burlington, Vermont, areas in order to observe the impact of these variables. This study will use data from Potash and Snipe Island Brook since 2009. These land use consists of: 43% urban, 36% agriculture and 21%, forested areas. Snipe Island Brook (WR_SIBrk_714) is in a forested catchment located in Richmond, Vermont. The land use consists of 98% forested area. Escherichia *coli* (E. *coli*) is a gram negative bacteria that lives in the lower intestine of warm blooded organisms, include humans. E. *coli* are provided by different sources: human feces, recreational areas, landfill, farms, industries, etc. The USEPA has recommended the use of E. *coli* as the preferred fecal indicator bacteria from fresh water, because it is a much more effective predictor of gastrointestinal illness than other fecal indicator bacteria (USEPA 2002). Coliforms are indicators of bacteria that estimate the possible presence of organisms that cause disease in humans who use the streams (Ashbolt et al 2001). Samples are tested for coliform to detect if any bacteria are present in the water. Total suspend solids (TSS) are sediments that include a variety of materials such as silt, decaying plant, animal matter and industrial waste. High concentrations of TSS in streams affect the water quality, vegetation and others factors related to pollution. Low concentrations of TSS do not directly affect the streams. Some factors that may influence the high concentrations of Total Suspend Solids (TSS) are: soil erosion, urban runoff, decaying plants. Sedimentation in surface waters may interference with proper gill function in aquatic animals as well as embedded pebbles, which eliminate hiding and spawning places for aquatic flora (Wood et al 1997).

Figure1. This figure represent the distribution of the different land uses at Potash Brook

Figure 2. This pie chart represent the distribution of the different land uses at Snipe Island Brook

Objectives

•Collect samples at Potash Brook and Snipe Island Brook and test for E. *coli* and TSS throughout summer 2011.
•Analyze TSS and E. *coli* data since 2009 for Potash Brook and Snipe Island Brook
•Compare all the results from: Snipe Island Brook (Forested Area) to Potash Brook (Urban Area)

Methodology

•Using Geographical Instrument System (GIS), identify two sites with varying land uses (forested and urban areas).
•Collect stream samples from identified sites three days per week.
•Using the data collected since 2009 provided by Streams Project Database, analyze and observe the changes.
•Analyze all the samples for E. coli and TSS in the Streams Project Water Quality Lab, using a protocol provided by Environmental Protection Agency (EPA) and American Public Health Association (APHA)
•Use statistical methods programs for the obtained results, which is to see the factors and differences between each site tested. The statistical programs used in this research are: JMP 9, a statistical program provided by University of Vermont and Excel provided by windows.

Figure1. Potash Brook, an urban land use, located in South Burlington, VT
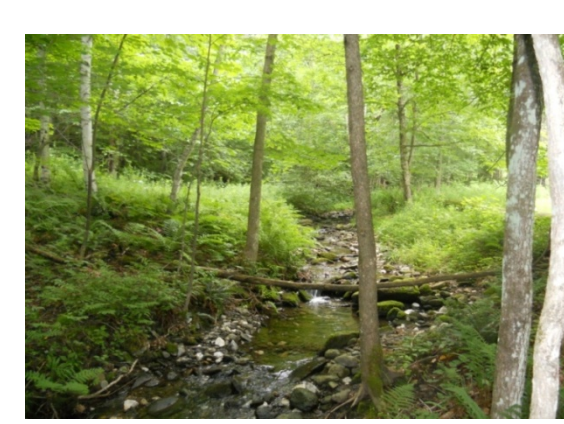
Figure 2. Snipe Island Brook, an forested land use, located in Richmond, VT
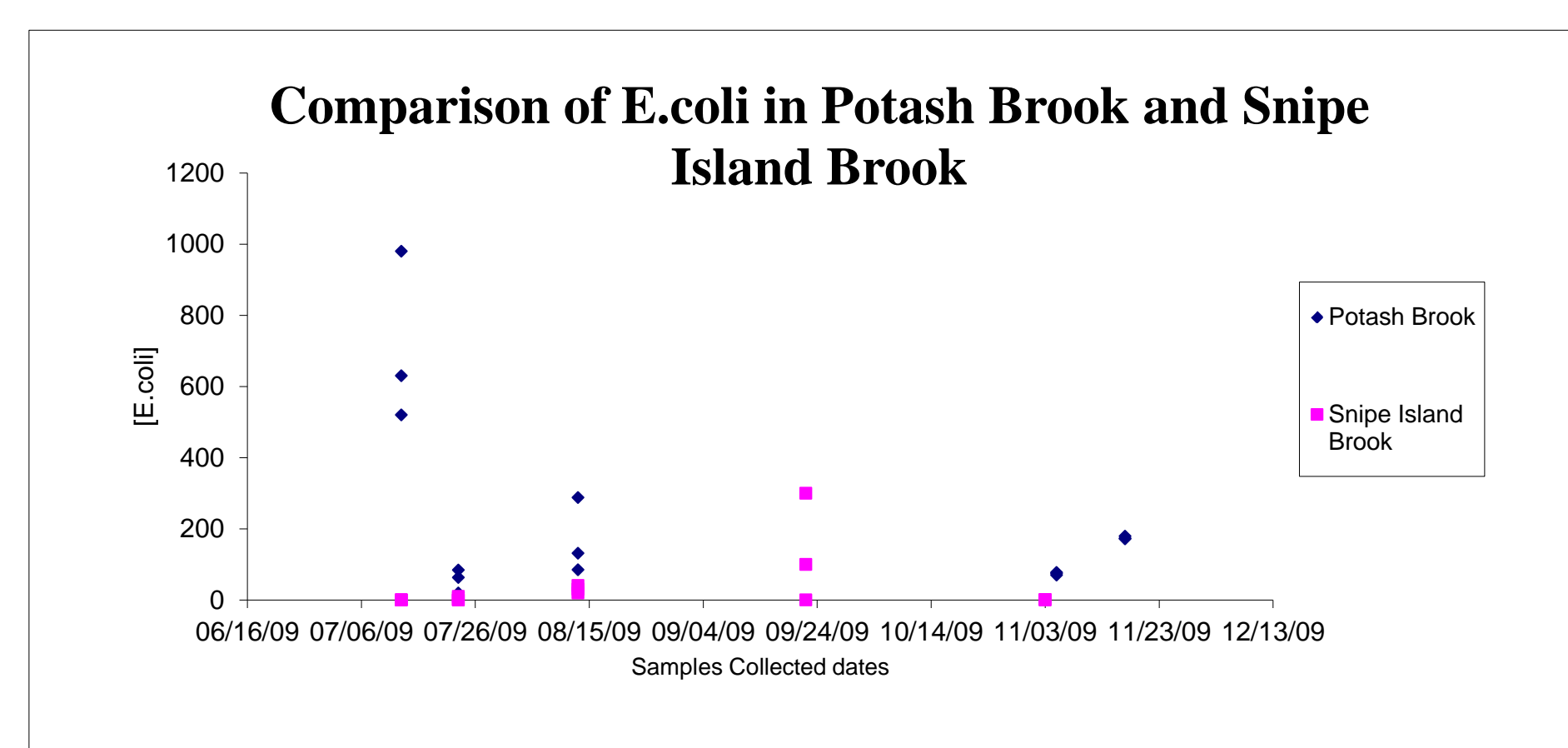
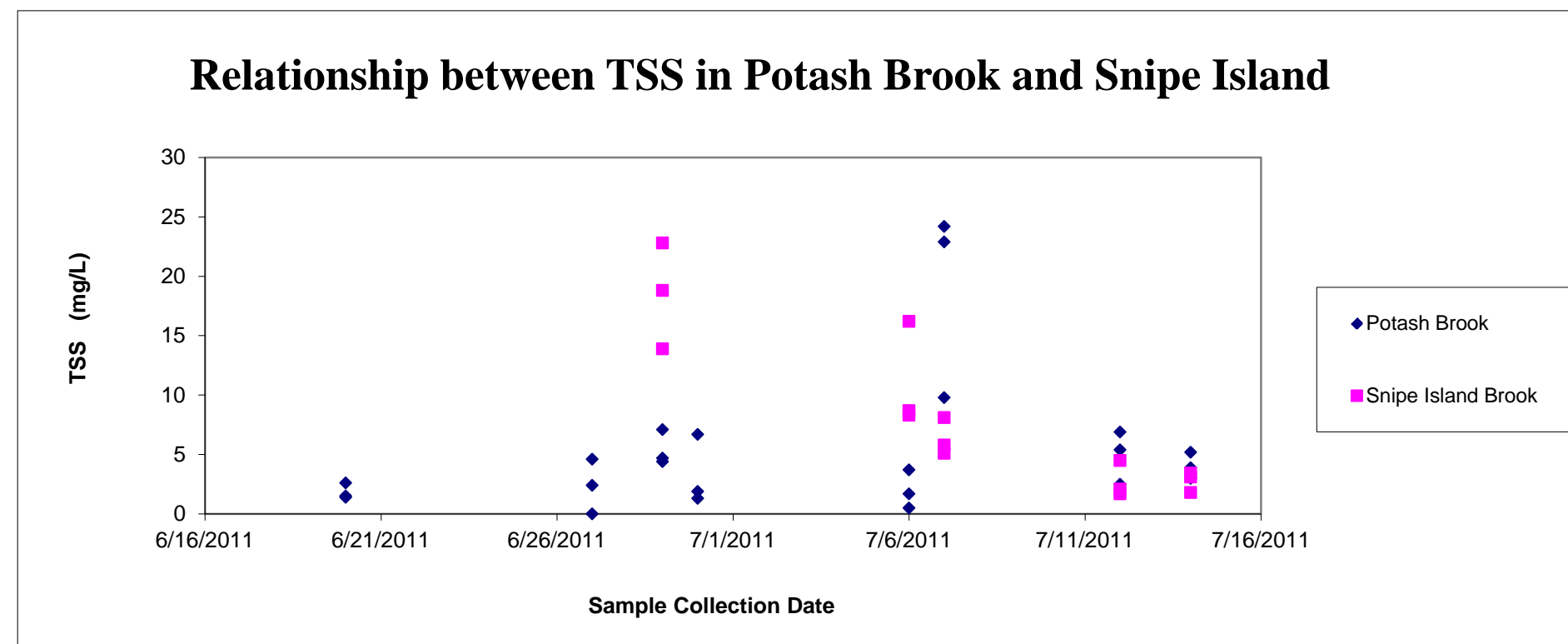**Figure 3.** Some samples obtained of Total Suspend Solids(TSS)

Figure 4. Results of E. *coli* samples using a dilution 1:10 to observe the amounts of E.coli and coliform

Results

Figure 1. This graph indicates the comparison of E.coli between two different land uses, Potash Brook and Snipe Island brook.

Figure 2. This graph represent the relationship of TSS in Potash Brook and Snipe Island Brook, observe the high concentrations of TSS in the forest area during the Summer 2011 compare with the urban area.

Conclusions

•To realize the comparison in Snipe Island Brook, provided by Streams Project database. Only compare the data collected between 2009 and 2011. Because, the data from 2010 are not available. With the results obtained during this research, the E. *coli* and TSS Concentration in the forested area are more less compare with urban area.
•Potash Brook, an urban land use, found more concentration of E.coli and TSS, because the causes of obtained this results depends of the different sources near of the land use and the weather activities.
•Snipe Island Brook, an forested land use. With all the samples collected in 2009 and 2011 have less concentration of TSS and E. *coli*
•Urban land use compare with Forested land use have more amount of E. *coli*, because in the urban area have more sources that affect directly the water quality at the same time create an impact to the streams.

References

• APHA (1992) **Standards methods for the examination of water and wastewater**. 18th ed. American Public Health Association, Washington, DC.
•Ashbolt, N.J, Grabow. W, Snozzi, M., (2001) **Indicators of microbial water quality.** World Health Organization (WHO). Water Quality: Guidelines, Standards and Health. Pages: 289-315
•Byers, H.L, Cabrera, M.L, Matthews, M.K., Franklin, D.H., Andrae J.G, Radcliffe, D.E, McCann, M.A, Kuykendall, H.A, Hoveland and Calvert II, V.H.(2005) **Phosphorus, Sediments and Escherichia coli Loads in Unfenced Streams of the Georgia Piedmont, USA.** J. Environ Qual 34: pages 2293-2300.
•USEPA. (2002) **Implementation guidance from ambient water quality criteria for bacteria.** May 2002 Available: www.epa.gov/ost/standards/bacteria/bacteria.pdf (Accessed 17 Mar 2003; verified 29 July 2005). USEPA, Office of Water, Washington, D.C).
• Wood, P.J and Armitage, P.D (1997) **Biological effects of the sediments in the lotic Environment**. Environmental Management 21:203-217

Acknowledgements