

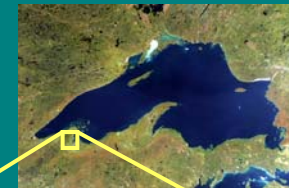
Water Quality and Community Based Research

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ABSTRACT

Northland College is a small liberal arts college with an environmental emphasis, situated in northern Wisconsin on the shore Lake Superior. All of our students are connected in some way to Bay City Creek, a small, somewhat disturbed stream that bisects the college campus before flowing through the City of Ashland to Lake Superior. Our SENCER course is an introductory biology course taken by both majors and non majors that will engage students in monitoring Bay City Creek for *E. coli*, addressing potential sources of fecal pollution, and presenting the data in a format that is useful to Ashland city managers.

INTRODUCTION

Northland College in Ashland, WI is a liberal arts college with an environmental emphasis. Our location on the shore of Lake Superior provides an extraordinary opportunity for students to learn about the culture, the arts, and the science of its watershed. Bay City Creek (BCC) is a 7-mile stream that begins in the agricultural land southwest of Ashland, flows through residential areas, four school campuses, including Northland College, before it empties directly into Chequamegon Bay of Lake Superior (Figure 1). BCC is a warm water stream that frequently has a high sediment load and input from multiple storm water drainage pipes (Figure 2). In addition, consistently high *E. coli* counts have been found with sporadic testing, indicating some fecal pollution. Pollution in storm water runoff is of civic concern to the City of Ashland and this provides a learning opportunity for Northland College students.

BIO115 Concepts in Biology is a multiple-section introductory biology course for both majors and non-majors and it is taught by up to 5 different faculty members the same semester. Historically this single-track course has been somewhat difficult to teach because some of the biology majors are not challenged and some of the non-science majors are lost or not interested. Our motive for developing this SENCER course is to use BCC as a resource for our introductory biology course. BCC literally bisects campus and most students walk across either of the two bridges that span the ravine through the tree canopy at least once a day. Many students walk along the streambed, have observed the abundant wildlife such as bear, deer, and beaver, and most have sledged down its slopes. BCC is therefore a natural resource that all students are familiar with no matter what their major or reasons for being here.

Three Biology professors and one student have teamed up to plan this SENCER course, along with a staff member from the Sigurd Olson Environmental Institute at Northland College who has extensive experience with civic issues dealing with wetlands and watersheds.

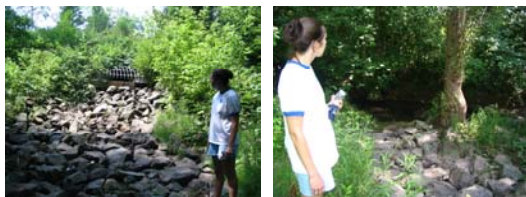


Figure 2. Kristi Walsh standing beside the storm water outflow where it drains Vaughn Avenue and flows into BCC on the Northland College campus.

OBJECTIVES

Collect scientific data, quantify and analyze the data, and report it in an effective and meaningful way

Understand the influences and indicators on the quality of freshwater resources

Understand the complex nature of science and the necessity of consideration of different viewpoints

Describe ways in which students can bring about policy change in a community to improve water quality

COURSE DESIGN

Students in the three sections of BIO115 will be assigned to teams of 4. Students will work as scientists who collect the water samples in Bay City Creek (BCC), perform the laboratory work, gather and record data, and present the results to the City of Ashland. All students will be introduced to the civic issues of storm water runoff during the first week of class, including sources of pollution. During the first lab, students will be introduced to the scientific method, including hypothesis testing and use of controls, and learn standard water sampling and *E. coli* monitoring techniques that meet state testing standards. Throughout the fall semester these teams of students will sample BCC at 4 locations two times per week and will perform the filtration method of water quality monitoring. 100-ml water samples will be collected and filtered, and filters grown on selective media (Figure 3). Students will count coliforms and *E. coli* colonies and record their results in a database. An experienced student will serve as a Teaching Assistant to supervise the sample collection, processing, and data entry. Lecture material will frequently refer to this research and students will prepare a final report to be

BCC: THE FOCUS OF LABS

Scientific method and *E. coli* monitoring technique

Cellular diversity and use of the microscope

Pollution and biological oxygen demand (BOD)

Bacterial enumeration, quantification, and data analysis

Scientific report preparation and presentation

EXAMPLE OF RESULTS

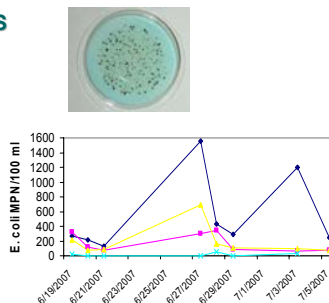



Figure 3. Data sheet for each water sample, filter showing *E. coli* (blue) and coliforms (red) growing on m-ColiBlue24 media, and an example graph of changes in *E. coli* numbers found in nearby Fish Creek.



Figure 1. Satellite image of Bay City Creek flowing through agricultural land and the city of Ashland before draining into Chequamegon Bay of Lake Superior. The yellow square represents the location of Northland College.

EXPECTED OUTCOMES

Greater sense of belonging to place and greater student retention

Greater understanding of pollution in watersheds

Greater understanding and appreciation for STEM disciplines

Contribution of valuable information for city

Continuance of a long term research project

ASSESSMENT

SALG pretest and posttest will be administered to our BIO115 students in the Fall of 2007. We administered the SALG pre- and post-test to BIO115 students in Fall 2006 so that we can compare pre- and post-SENCER modification of the course. We will also evaluate 1) the continued interest of the faculty to teach this course, 2) the appropriateness of a single level biology course for majors and non-majors, and 3) the logistics of conducting long-term environmental monitoring using first-year students. Necessary changes will be made for Fall 2008 when BIO115 is offered again.

OTHER STUDENT PROJECTS IN BCC

Northland College students are involved with a number of activities that link students, landowners, local schools, and Ashland city managers to the study and preservation of Bay City Creek.

Water chemistry. Students in our General Chemistry class are involved with using water samples from BCC as a focus of learning water chemistry parameters.

Bay City Creek Estuary. Student interns working at the Sigurd Olson Environmental Institute conduct water quality monitoring, vegetation and animal surveys, and erosion and sedimentation assessments of the area where BCC enters Lake Superior.

Northland Pathway. Students developed a walking trail adjacent to BCC linking the Northland College campus to Wisconsin Indianhead Technical College, Ashland School District (elementary, middle and high schools) and Memorial Medical Center.