

SOAR Project Proposal

Summer 2017

How Does Land Protection Preserve Good Water Quality?

Faculty Adviser: Frank T. Kuserk, Louise E. Juley Professor of Biological Sciences and Director, Environmental Studies & Sciences Program

Students:

Catalina Perez	Adel Sharif
Junior	Junior
Biology	Biology
perezc@moravian.edu	stams22@moravian.edu

Project Title: *How Does Land Protection Protect Good Water Quality?*

Project Start & End Dates: Tuesday, May 30, 2017 to Friday, August 4, 2017 (10 weeks)

Project Description: Since 2014 my students and I have partnered with the Wildlands Conservancy (Emmaus, PA), and the Academy of Natural Sciences (ANS) of Drexel University as part of the Delaware River Watershed Initiative (DRWI) to assess the condition of the streams within the Upper Lehigh River Watershed. We have been asked to participate in Phase II monitoring efforts that focus on assessing specific land use practices and how they affect water quality in the region. More than 50 nonprofits and academic institutions have joined together, aligning priorities for land protection and restoration projects and assessing water quality impacts using standardized methods. We will focus our efforts on the following questions:

- 1) How does land protection preserve good water quality?
- 2) What are the impacts to water quality that are being avoided through protection of forested land?
- 3) What are the impacts to aquatic health from different forest management practices?
- 4) How can our monitoring efforts inform land protection and stewardship decisions?

In 2017 we will focus our efforts on the following areas:

- 1) Maple Tract Preserve, Tunkhannock Creek. Land is permanently protected and up- and downstream areas are in natural cover. However, a dam creates a disturbed environment in and along this section of the stream.
- 2) Klondike Property, Upper Lehigh River. The river runs through forested, natural cover upstream from the dam. When it reaches the large impoundment created by the dam there is no shade or cover provided for a long stretch.
- 3) Thomas Darling Preserve, Red Run. This property is permanently protected and consists of valuable forested land and wetlands. The Wildlands Conservancy has commenced a number of stewardship projects with plans for further improvements (e.g. maintaining early successional habitats for warbler restoration, Northern flying squirrel habitat, proposed burn areas).
- 4) Newswanger Property, Aquashicola Creek. This property was recently protected as part of our Phase I DRWI effort. Continual monitoring during Phase II will provide us with information on how land use protection in this area is impacting water quality.

Proposed 2017 monitoring activities:

The specific activities this summer will consist of 1) collecting, identifying and analyzing aquatic macroinvertebrate samples taken from the stream bed at various sites; 2) conducting electrofishing surveys at designated sites in order to identify and quantify resident populations; 3) conducting physical habitat assessments (cover, substrate embeddedness, velocity/depth regime, sediment deposition, channel flow status, channel alteration, frequency of riffles, bank stability, temperature, vegetation protection and riparian zone width); 4) performing chemical assays (pH, alkalinity, specific conductance, dissolved oxygen, biochemical oxygen demand, nitrates, nitrites, phosphates); and 5) performing *Escherichia coli* bacterial assessments at selected sites suspected of being contaminated with feces.

My students and I have worked with the Wildlands Conservancy on numerous stream and riparian buffer restoration projects to reduce erosion, alleviate sediment buildup, enhance water flow, and improve water quality within the Lehigh River watershed since 2001. Under my direction 19 Moravian College students have successfully participated in these projects as SOAR students. In addition, they have all presented their results at scientific meetings including the Landmark Conference Undergraduate Research Meeting, the Middle Atlantic Section of the Ecological Society of America Annual Meeting, and the National Conference on Undergraduate Research.

Two of the individuals with the Wildlands Conservancy that we work with are Moravian College alumni. Kristie Fach, Director of Ecological Restoration, is a 1999 biology alumna, and the Wildlands Conservancy recently hired Kerry Reider, a 2016 environmental science major and former SOAR participant as an Aquatic Ecologist.

Qualifications and Certifications: I have attended workshops on benthic macroinvertebrate sampling and identification (SUNY College of Environmental Science and Forestry) and electrofishing techniques (Smith-Root, Inc., Vancouver, WA). I currently hold a Scientific Collector's Permit (#349) from the Pennsylvania Fish and Boat Commission to conduct benthic macroinvertebrate and electrofishing surveys.

Roles and Responsibilities of Faculty and Students:

Faculty Role: I have been working with the Wildlands Conservancy since 2001 on stream monitoring and restoration projects in the Lehigh River Watershed. As a result, I have engaged many Moravian College students in assessment projects because of these collaborations. My previous work at the Stroud Water Research Center (Academy of Natural Sciences of Philadelphia) provides both theoretical and applied knowledge of the dynamics of stream ecosystems. I have published papers in the *Canadian Journal of Fisheries and Aquatic Sciences* and *Microbial Ecology* on the carbon dynamics of streams. I have also authored several technical reports for the Wildlands Conservancy based on collaborative projects and have published an article in *The American Biology Teacher* in which I describe how techniques developed as part of my research can be used in an undergraduate ecology class. For this project I will assist my research students, Catalina Perez and Adel Sharif, to develop a background literature search, provide expertise in how to conduct the required assessments, assist in collection and analyses, and guide them in the preparation of results for presentation and publication.

Student Role: Catalina and Adel will participate in pre-project planning with Kristie Fach, Kerry Reider and me, collect, and analyze samples using established protocols. They will assist in the analysis of the data that we collect and in writing the final report that will be given to the Wildlands Conservancy. Finally, they will prepare and deliver presentations at scientific meetings including the Landmark Conference Summer Undergraduate Research Conference and the National Conference on Undergraduate Research and will participate in next year's Moravian College Annual Student Scholarship and Creative Arts Day. Over the past seven years I have had 23 of my SOAR and Honors research students present their findings at the annual National Conference on Undergraduate Research.

Timetable: Field sampling and laboratory work will consume the entire 10-week summer period. A report to the Wildlands Conservancy that provides an analysis of the data will be completed by October 1, 2017.

Justification for Involving Two Students in the Project: Ecological field research is a time and labor-intensive endeavor that involves teams of scientists. Electrofishing surveys require a minimum of three persons to safely operate the equipment, net the temporarily shocked specimens, and identify/count them. Macroinvertebrate surveys require a minimum of two individuals to handle the collecting net, collect, sort, identify and enumerate the resulting specimen collection. Even then we occasionally require additional assistance. For example, in order to perform fish surveys last summer, our team consisted of four persons (two students, Kate Ebel and myself). This summer Kerry Reider will replace Kate Ebel.

Benefits to the Student, Faculty Member and Moravian College:

Student Benefits: The students will benefit by being part of a long-term ecological study that has great environmental importance. They will become part of a team of researchers and conservation scientists dedicated to improving stream habitat quality. In this way they will experience how modern ecological research is a collaborative effort involving many people, each contributing in a specific way according to their expertise. More importantly, their work will assist in determining whether currently accepted stream restoration and land preservation efforts have a positive impact on streambed biological communities and overall water quality. They will need to operate both as team players and as individuals charged with the responsibility of learning accepted sampling protocols, identifying fish species and aquatic macroinvertebrates, and performing statistical analyses on the results. Additionally, they will gain experience in the writing of scientific reports and papers. Depending on the outcome of the project they will also prepare their work for publication either as a technical report to the Wildlands Conservancy and the Academy of Natural Sciences. They will additionally present their work at Moravian College's Annual Student Scholarship and Creative Arts Day and at a scientific meeting such as the National Conference on Undergraduate Research next spring.

Faculty & College Benefits: I am eager to continue a research program that actively involves undergraduates and collaborates with local and state environmental organizations and individuals. Continued cooperation with the Wildlands Conservancy the Academy of Natural Sciences will assist us in providing our students with meaningful field experiences. This organization has provided meaningful opportunities for students engaging in scientific research, environmental policy, environmental management, and environmental education. Our Biology and Environmental Studies & Sciences Programs rely on our ability to develop strong relationships with environmental organizations.

SOAR Project Proposal
Summer 2017
Student Statement of Purpose

Project Title: *How Does Land Protection Protect Good Water Quality?*

Student Name: Catalina Perez

Major: Biology

Date of Graduation: May 2018

Faculty Mentor: Dr. Frank T. Kuserk

Campus Housing: No

Participation Rationale and Expected Outcomes:

I believe participating in a SOAR project with Dr. Kuserk over the summer will be a perfect opportunity for me during my college experience. Since I was a child, I've been amazed by all forms of life; this is one of the main reasons why I chose to study Biology at Moravian College. Throughout my short experience here, Dr. Kuserk has managed to spark my interest in two areas so far: ecology and evolutionary biology. Now, I often consider furthering my studies in these two areas of biology in graduate school. By participating in this summer research project, I hope to gain my insight for the environment and continue to learn from Dr. Kuserk who has already made an impact in my life.

This summer research project would add to my scientific knowledge and expand my understanding of the ecosystem I currently live in. I am most interested in being able to identify aquatic macroinvertebrates and fish species in my area. Collecting the specimens and analyzing them in the lab would allow me to work outside the classroom and receive a hands-on experience in ecological field research. I would learn techniques for capturing different organisms, the scientific names of these specimens, and key structures that aid in identification. These skills can make me a better-qualified candidate as a prospective graduate student or interviewee as well. I also see myself working in an indoor and outdoor setting instead of solely indoor which is why I am so drawn to ecology as a career field.

Since this research project has been collecting data for several years, I believe this is a great opportunity to improve my abilities in analyzing a massive collection of data. This could be extremely beneficial for me in a future career setting since I would most likely need to interpret large quantities of data to write and present my work at scientific conferences. Participating in this well-developed project that has multiple testing sites would also allow me to understand how water travels in the Lehigh Valley via streams and rivers and how watershed affects the water quality in my area. A big problem in this area for many species is that there are many old dams that block fish and other wildlife from migrating up and down streams freely. Hopefully this summer, I would be able to collect data that provides sufficient evidence to support the removal of a dam like in previous years. Such a small change could have a huge impact on aquatic species in my environment.

SOAR Project Proposal
Summer 2017
Student Statement of Purpose

Project Title: *How Does Land Protection Protect Good Water Quality?*

Student Name: Adel Sharif

Major: Biology

Date of Graduation: May 2018

Faculty Mentor: Dr. Frank T. Kuserk

Campus Housing: No

Participation Rationale and Expected Outcomes:

I believe that participating in a SOAR project with Dr. Kuserk will be an excellent opportunity to further my scientific knowledge and potential. I hope to one day become a certified wildlife biologist and so, participating in a project over the summer researching will adequately show if I truly enjoy this field and would like to continue it as a career. Learning to take hands-on data in the field and being able to identify different biological characteristics and attributes would be an incredible learning experience very valuable to my future.

Another significant reason that I wish to participate in this SOAR project is to strengthen my skills in both the laboratory and the field. I will be able to both advance in techniques in acquiring data and, analyzing the same data, promoting myself and developing a broader set of skills. This is an opportunity to gain experiences not contained within a classroom, experiences that transcend lectures and can be used in a career later in life.

From this project, I will be able to improve my ability to work as both cooperatively and as an individual. I will have specific individual responsibilities assigned to me that I will need to perform to further the project along. I'll also be working with other students from Moravian and other universities, as well as professional scientists as a team in this large-scale project.

Outcomes that are expected from this project include the ability to bolster my research ability. Also expected will be the ability to analyze as well as write about and present work at scientific conferences and organizational meetings. I will also learn how to properly collect large datasets by while in the field, as well as incorporate the collected data with my own research, seeing if it will support the hypotheses. Being able to organize data to correctly analyze and make factual conclusions is another aspect I hope to be capable of by the conclusion of the program. These will all be skills I hope to develop on during the project, as these skills can be used throughout life no matter what career I will end up in. I also truly believe that this program will be both an amazing educational experience as well as enjoyable way to figure out what I want to do with my future.

Expense Proposal

Project Title: *How Does Land Protection Protect Good Water Quality?*
Faculty Mentor: Frank T. Kuserk
Students: Catalina Perez
 Adel Sharif
Budget: \$1000

Expenses as described below:

\$100	Since this project involves extensive travel in the Upper Lehigh River Watershed to conduct sampling at field sites we request funds for gasoline. We will use the Environmental Studies & Sciences van for travel.
\$150	Licenses. Each team member requires a valid 2017 Pennsylvania Fishing License plus Trout Stamp.
\$ 50	2017 Pennsylvania Scientific Collector's Permit. This is required by the Pennsylvania Fish & Boat Commission in order to conduct electrofishing surveys.
\$700	Expendable laboratory supplies. This includes specimen collection vials and containers, reagents to conduct chemical assays, bacteriological media, petri dishes and membrane filters. Equipment to conduct macroinvertebrate and electrofishing surveys currently exists in the department.
<hr style="width: 10%; margin-left: 0;"/> \$1000	Total