

SOAR Research Proposal -- Summer 2015

Project Title: **Succession Monitoring in Prescribed-burn and Control Plots at a Portion of the Restoration Area of the Palmerton Superfund Site**

Faculty Mentor: **Dr. Diane Husic**, Professor and Chair
Department of Biological Sciences

Student: **Ms. Brittany Spinosa-Weber**
Class Year: 2016 Major: Biology

Start Date: June 1st, 2015

Project Duration: 10 weeks

Project Description:

Background: The Palmerton Superfund site is the largest contaminated site on the National Priorities List east of the Mississippi River. Since the 1990s, a series of revegetation efforts have been tried. The most successful approach to date has been to use warm-season grasses – a process that was first tested in 2003 in the Lehigh Gap Wildlife Refuge (LGWR) is a 750-acre reserve on the Kittatinny Ridge (Blue Mountain), in northern Lehigh and southern Carbon Counties, Pennsylvania. Once a barren landscape essentially devoid of vegetation, this site is now largely covered with vegetation and is being managed as grassland habitat and monitored for ongoing risks associated with the toxic heavy metals that remain in the soil as a result of the zinc smelting operations that occurred in the area.

Each year, the annual vegetative growth of the warm-season grasses dies back and gradually rebuilds topsoil in the area. This, along with some modest soil amendments done at the time of grass seeding, have provided conditions that enable other plant species to come into the area – a process known as succession. In addition, a number of forbs (herbaceous flowering plants other than a grass) have been planted intentionally to increase diversity at the site.

Studies conducted previously by Moravian College SOAR students demonstrated that the most prominent successional species (gray and sweet birch and aspen tree species¹) were taking up significant levels of metals. Such uptake interferes with the remediation plan to immobilize heavy metals in the soil and to minimize the flow of metals through the food chain or into the Lehigh River at the bottom of the mountainside. To determine whether prescribed burns could be used to eliminate the trees that were taking up heavy metals and essentially taking over the grassland, a test burn was permitted by the EPA in 2013 on a 10 acre plot. This was done in conjunction with burn experts, and scientists from Cornell University and the U.S. Forest Service to sample the air quality and soil pre- and post-burn and the smoke to determine the metal levels and risk associated with conducting such a burn at the contaminated site. It has now been determined that the risk is low and that further burns on the site could be conducted. What remains to be learned is the impact of plant diversity in the area that was burned compared to an adjacent grassland plot.

Proposed studies for summer 2015: The goals of this project build on previous SOAR projects and include:

1. Establish monitoring plots in the 10-acre test burn site and in adjacent plots within the grassland area that have not yet undergone a prescribed burn (control plots).
2. Inventory the trees, shrubs, and forbs that are growing in these plot areas (species inventory and determine numbers and size of each species) to determine which plant species are present in each area and what differences are noted.

¹ *Betula* and *Populus* species.

3. Determine whether burning:
 - a. Reduced the number of early successional trees known to take up heavy metals;
 - b. Served to eliminate the invasive species that were noted in previous monitoring; and
 - c. Inadvertently killed off desirable plants for a functioning grassland habitat.
4. Compare results to succession monitoring studies that were done previously to see which plant species are thriving and which are not surviving. If some plant species are not surviving, attempt to determine whether this is due to
 - a. toxicity from the metal contaminants;
 - b. predation by deer, rodents, and insects; or
 - c. competition from early successional trees or non-native shrubs such as butterfly bush which has invaded the area.
5. Use results from this student and from that of another SOAR student investigating metal uptake in forbs at the site to make management recommendations to the EPA.

Roles and Responsibilities: In order to identify all plant species present throughout the growing season, some monitoring will likely begin in April and May and continue through August. After orientation to the site (layout, safety, etc.), Brittany will work under the supervision of Diane Husic, along with Dan Kunkle, Executive Director of the LGWR, and Jenn Lansing, of Cardinal Directions (an environmental consulting firm representing the responsible party and the EPA) to set up and map test plots and to learn the succession monitoring protocols. It is estimated that about half of the time will be in the field conducting the monitoring and the other half doing literature reviews, data analysis, and learning and running statistical analyses. In anticipation of there being a team of 3 students working on different aspects of monitoring at the site in summer 2015, we will hold weekly team meetings to review protocols and data and discuss the implications of what we are learning. Some of these meetings will also be with Dan Kunkle, Jenn Lansing, and representatives from state and federal agencies charged with the oversight of the Superfund project. Results will lead to a better understanding of the biochemical, ecological, and management consequences of the contamination, revegetation efforts, and the value of a prescribed burn as a management tool and will be shared with the regulatory agencies to help determine the implications for adaptive management of the site and scientists working on a native bee study at the Refuge. The data could lead to presentations for the Ecological Society of American, NCUR, and, of course, Student Scholarship Day at Moravian College.

Summary of Benefits: Due to this being a Superfund site, Brittany will have the chance to be part of a unique conservation and restoration project that has received state and national attention and awards. She will, over the course of the summer, interact with representatives from the PA Department of Conservation and Natural Resources and Department of Environmental Protection, Fort Indiantown Gap biologists (who manage a unique grassland habitat along the Kittatinny Ridge southwest of the Lehigh Gap using prescribed burns), the U.S. EPA, a professional environmental consulting firm, and the responsible party (CBS Operations). Being a part of the ongoing collaborative restoration efforts at the Lehigh Gap has already led to publications (with several student contributors)² and national conference presentations, and it has been rewarding for the College since we are partners in this innovative remediation project at the only Superfund site in the country that has been converted to a public resource for recreation, education, conservation, and research.

² For example, see the extensive published ecological assessment available at <http://lgnc.org/resources/reports/lgwr-assessment-ii>.

Budget Items:

Student summer stipend: \$300/week for ten weeks:	\$3000
Faculty stipend for mentoring: \$100/week for ten weeks:	\$1000 ³
Supplies:	
Field supplies (flags, tape, etc. to set up plots; hand lens)	
Plant identification book	\$ 175
Mileage for several trips to the Lehigh Gap for field work and sample collection	\$ 350
TOTAL:	\$4500

³Since Dr. Husic is submitting proposals with more than 2 students, it is understood that the faculty stipend decreases with student #2 and a single faculty member will not be paid for students beyond the second one.