



## **Mercyhurst University Erie, Pennsylvania Habitat**

### **SCHOOL**

Mercyhurst University, Private Institution, 4-year, 4,400 students, Erie, Pennsylvania.

### **ABSTRACT**

The purpose of this project consisted of the anticipated completion of two main goals. The first goal was to accurately determine and document differences in levels of carbon sequestered in the soil due to various land uses. If carbon sequestration had increased due to changing from traditional agricultural methods to organic agricultural methods, the university would be able to measure carbon amounts to offset campus GHG emissions. The second goal was the creation of a small scale biochar pyrolyzer, or oven, which would use differing organic materials from the surrounding Girard area and convert them into charcoal. The charcoal would later be crushed into a powder and used for research and agricultural purposes. Eventually the team would be able to evaluate the effectiveness of using the biochar product as a soil additive for carbon sequestration and restoration of fertility to support vegetable production in degraded soils. Both primary goals have been accomplished and the project is moving into the latter stages which extend beyond the fellowship. Such research will involve future Biology and Sustainability students of Mercyhurst University and may eventually engage members of the Girard and Erie community. The construction of additional and more sustainable pyrolyzers is currently being considered and will attempt to rely solely on donated materials from the generosity of local community members and driven student researchers.

### **GOALS AND OUTCOMES**

#### **Goals**

The fellow hoped at the start of the fellowship to determine and document differences in levels of carbon sequestered in the soil due to various land uses (such as traditional till, fallowed or rested land, wetland, etc.). The fellow also planned to construct a small scale biochar pyrolyzer and eventually evaluate the effectiveness of using the biochar product as a soil additive for carbon sequestration and restoration of fertility to support vegetable production in degraded soils. In the next two years, the goal of this project is to advance educational and business development activities that will promote beneficial reuse of organic waste materials that might otherwise contribute to contamination of land, water, and air resources. The Mercyhurst team hopes to demonstrate the environmental and economic benefits of local scale biochar production from organic wastes as a cornerstone of sustainable community development. Also, the team expects to develop a novel community-scale GIS-based organic waste inventory and planning model that will facilitate calculations of the magnitude of organic waste resources available, and support community education and decision-making about how these materials can be managed more productively. This project will be supported by the information obtained from a team members' visit to Burt's Greenhouses in Kingston, ON, which utilizes the process of pyrolysis in heating greenhouses. The team's goal of a local training program located at the Mercyhurst Sustainable

Farm will offer hands-on demonstrations of practices and technologies that advance soil restoration, carbon sequestration, organic matter recycling, and utilization of biomass for renewable energy.

### **Accomplishments and Outcomes**

The two major goals outlined above were achieved. After collecting the necessary soil samples, the results for basic soil analysis, percent organic material and percent carbon were received from Penn State Soil Analytical Lab and analyzed. The highest percent organic material was determined to be in the woods sample (average of ~4.15%) followed by the wetland, cover crop, fallow (which is where the expected biochar plot will be located), and finally conventional farming (~1.0%). This pattern was repeated for the percent carbon data with the highest value for the woods sample (~3.085%) and the lowest value appearing in the conventional till soil (~0.80%). These patterns were exactly what the fellow and her advisors expected. At home tests for percent organic material were done, finding that the percent difference between at home tests and the Penn State Soil Analytical Lab tests were significantly different in the first attempt (the highest value of 6.03% for the woods sample, and the lowest value being the conventional till sample at 2.00%). Still, the results did follow the same pattern as was established by the Penn State Analytical Lab, meaning that there was some success in this procedure. This is perhaps due to human error in experimental technique or a mechanical inefficiency with the laboratory oven.

The second major goal of the experiment was completed with the creation of a small scale biochar pyrolyzer. The fellow placed a 20 gallon steel barrel upside down inside of a 55 gallon steel barrel that had air inlets cut into the base of the drum. In order to make biochar, the inside barrel is filled with organic material such as tree branches and then placed back into the larger barrel. The outer fringe is then filled with additional organic material and burned. The resulting product is a combination of ash from the outer fringe and charcoal from the interior 20 gallon drum. Future research will use this biochar for determining its effectiveness as a soil additive and how it acts as a form of carbon sequestration.

This project aims to help offset the total carbon emissions of Mercyhurst University and in turn benefit the greater environment. This project indirectly benefits the natural environment and the wildlife it encompasses through the design of small scale carbon sequestration. The creation of a larger biochar pyrolysis kiln may increase the amount of carbon sequestered and may be added to larger agricultural lands for the purposes of soil restoration and increased fertility.

### **Challenges and Responses**

The major challenge encountered during this project was finding the necessary materials, namely steel barrels of the appropriate size, needed to construct the biochar pyrolyzer. The 55 gallon steel barrel was eventually donated by a branch of the Erie Park Services. The fellow made the necessary phone calls to all of the surrounding junk metal yards in the hunt for needed materials and met with little success, but with perseverance a 20 gallon steel barrel was found. For future projects of similar nature, some beneficial resources could be advertising online in local forums for desired materials.

### **Campus Climate Action: Your School's Carbon Footprint**

The project both indirectly and directly addressed global climate change. The first component of the project assessed if carbon sequestration has increased due to changing from traditional agricultural methods to organic agricultural methods. Evidence collected by the Mercyhurst team suggests that

compared to conventional tilling techniques, the various sustainable agricultural practices such as fallowing and cover cropping increase the total amount of carbon and percent organic material that exists within the soil. The second component of the project directly addressed global climate change through the creation of a biochar pyrolyzer. This small oven converts organic material into charcoal through the process of pyrolysis. The resulting useable charcoal, or biochar, is a stable form of carbon and can act as both a beneficial soil additive by encouraging beneficial microorganisms, increasing soil pH, and retaining soil moisture, and also creating a carbon sink where the element may sit for hundreds of years.

### **Commentary and Reflection**

This project has taught me the important lesson of being able to effectively communicate with peers, colleagues, and advisors. By truly listening to opinions and innovative ideas brought forth by a multitude of people that I worked with, I was able to mold and shape the project as I was presented with difficulties. This turned out to be a team effort and I hope that this research will continue to succeed in the future as new members are brought in to take over responsibilities. In order to really drive a project along, future fellows should not be afraid to ask their advisors, team leaders, and team members for help. Asking for help shows that you place trust in the people you are working with, and additional unforeseen benefits such as a fresh perspective and driving motivation may come from it.

The Campus Ecology Fellowship experience allowed me to develop valuable communication skills and a more professional business sense. This project hopefully will encourage and inspire more students from Mercyhurst University to tackle sustainability problems within the university's structure. I hope that future students will seek out programs such as the NWF Campus Ecology program for financial and social support in order to accomplish similar small scale community projects.

### **ENGAGEMENT AND SUPPORT**

#### **Leaders and Supporters**

Many people from diverse departments at Mercyhurst University were instrumental in the success of this project. Two professors of Biology, Dr. J. Michael Campbell and Dr. Marlene Cross acted as key advisors in helping the fellow with the creation of the pyrolyzer, experimentation and analyzing the results. Brittany Prischak, the Sustainability Officer, helped the fellow with editing documents and tracking the project's progress throughout the year. She was also heavily involved in the application process and with presenting the fellow with the original idea. In addition, Sheila Coon tirelessly helped the fellow with grant processing and sending updates with reminders. Tim Boucher, the Mercyhurst Sustainable Farm Manager, allowed the fellow to set up the biochar pyrolyzer in the Farm vicinity and contributed additional supplies, such as sand and wood stock. Also, Debbie Morton, the assistant director/media relations manager, set up two interviews with the fellow and subsequently wrote two online articles on the biochar project. She also set up an interview with the local newspaper about this venture for the research team.

#### **Funding and Resources**

This project had a total cost of \$995.34, with \$4.66 unspent. The fellow did not need to seek money or financial support outside of the Fellowship grant, but rather relied on small donations given by local businesses and extra materials that were given freely by the university. The project was supported internally by the Mercyhurst University Biology Department for giving the fellow laboratory space, time and also allowing use of equipment. The Mercyhurst Sustainable Farm provided the needed space for

the two barrel pyrolyzer on its property in order to conduct the experiment and has promised space for a biochar research plot for future use. It also allowed the fellow to take soil samples in order to establish a carbon data baseline for the surrounding land.

### **Education and Community Outreach**

The fellow presented a PowerPoint presentation in February of 2012 on biochar's agricultural and climate change mitigation potential and discussed the soil data collected from the Penn State Soil Analytical Laboratory to Dr. John Campbell's Biology Seminar Class. The class seemed genuinely interested in the conservation initiatives presented and one university student mentioned that they might be willing to help further the plan along after the current fellow graduates.

The fellow also conducted two EarthAction after school class sessions in January and March of 2012 on climate change and carbon sequestration (which was entirely new to the students). The students ranged from 9-12 years of age and the program was held at the Art House of the Benedictine Sisters of Erie in Pennsylvania. The sessions were conducted with visual and verbal depictions of carbon sequestration; games with prizes were used for encouragement and incentive. The students responded positively to the information presented and were capable of recapping information learned a few weeks following the lessons.

Future plans for education and community outreach include plans to create a one day workshop on the benefits of biochar and the pyrolysis for small farms and home gardens for interested members of the Girard and Erie community. This workshop will be conducted on the Mercyhurst Sustainable Farm if weather permits. Surveys may be sent out with these workshop participants to judge general interest in utilizing at home additions of biochar.

### **National Wildlife Federation's Campus Ecology Program**

The Campus Ecology program was the primary financial supporter of this project and added a driving force behind the completion of this project. Also, the support of the Campus Ecology leaders, such as Crystal Grant and Courtney Cochran, and current fellows provided indispensable enthusiasm, support, and motivation to the Mercyhurst University fellow, Ellen Teygart. In addition to social support, attending the NWF Annual Meeting gave the fellow useful groundwork for developing and completing this project.

*"As a campus ecology fellow, I have found the bi-monthly conferences calls to be useful due to the valuable business networking skills they provide. The conference calls have given me a way of keeping up to date with my project and also a way to reflect on how much I have personally accomplished. The NWF name recognition has also been useful in the academic scene, prompting scholarly conversation among peers and professors about this specific project and also about similar research currently being done in the Mercyhurst University Biology Department and out at the Mercyhurst Sustainable Farm."--Ellen Teygart, Campus Ecology Fellow*

### **CONTACT INFORMATION**

#### **Contacts**

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## **MORE ABOUT YOUR SCHOOL**

### **Campus Sustainability History**

Environmental and social responsibility is an integral part of Mercyhurst College's mission. The college is committed to educating their students and community about living green lifestyles to ensure a sustainable future for everyone. They encourage ongoing participation in recycling and the idea of energy conservation both on and off campus. As part of an undergraduate degree, the college offers a Sustainability Studies major and minor, or a Sustainability Studies concentration in either the Biology or Chemistry departments, as well as a Sustainability Studies Post-Baccalaureate certificate for students interested in enhancing their overall educational experience with an environmental focus. Also, the biology department provides the Mercyhurst College community with several ways to get involved in sustainability projects, activities, and volunteering efforts.

Website Link to Mercyhurst University's Sustainability Program: <http://sustainability.mercyhurst.edu>

## **ADDITIONAL MATERIALS**

Additional materials such as the final budget, figure, links to press releases, and pictures are attached to the email as separate documents.