

**Green Fund Project  
Final Report**

This report may be published on the SIU sustainability website.

Name of person(s) completing report: Dr. Marjorie L. Brooks

Department: Zoology

Contact Phone and email address: O: 618-453-4121, C: 307-399-0576, mlbrooks@siu.edu

Faculty Advisor (if applicable):

Project Title: Sustainable Eco-Recreation

Project ID #: 17SP128

Award Date: 1 May 2017

Completion Award: \$29,777

Total Funds Used: \$29,777

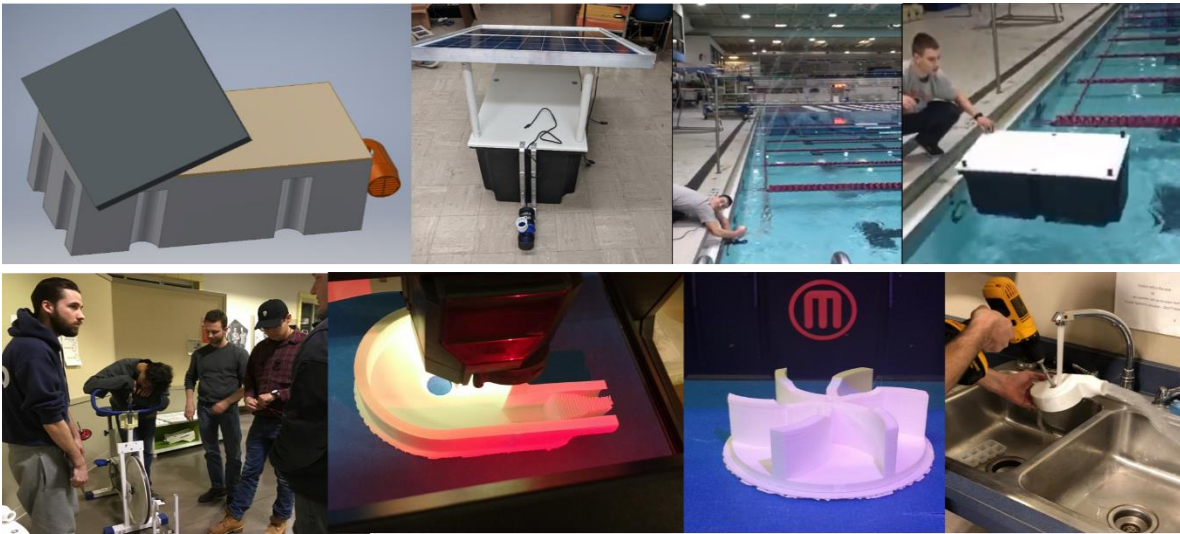
1. Please provide a write up of your project/project experience.

During the 2017/2018 academic year, we established the Sustainable Eco-Recreation Project at Southern Illinois University in Carbondale. This project is an innovative form of lake management aimed at promoting good water quality while providing novel forms of outdoor recreation. Specifically, student teams are inventing forms of recreation that aerate, cool, or manage nutrients to make lake waters healthier and more resistant to cyanobacterial harmful algal blooms (CyanoHABs). The program officially began in late August 2017 at which time Dr. Brooks hired a graduate student charged with documenting the biological impact of recreation on CyanoHABs as well as two human dimensions of the research, namely perceptions of natural resources among lake users and professional career skills among student teams engaged in this unique form of experiential education.

The Design Phase of the Sustainable Eco-Recreation Project began with a Kick-Off event in September 2017 for all students interested as well as for engineering students in the Senior Engineering Design Course (ECE 495). Three student teams formed to invent in-lake solar fountains (engineering students), pedal-powered fountains on stationary bicycles, and wetlands designed to receive water from the stationary bicycles. The “solar-fountain team” as well as the “bicycle team” completed their design phase during the Fall 2017 semester. The wetland group developed a landscape design for their wetland and tested ammonia loss in a laboratory wetland.

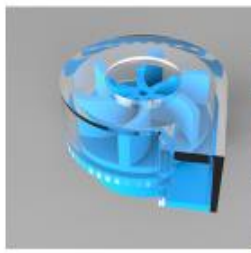
During the Prototype Phase across the Spring 2018 semester, the solar-fountain team progressed from fabrication of the prototype to indoor testing at the Student Recreation Center pool. As well as testing the fountains, they learned the distinction between observed versus estimated buoyancy during the pool tests. The results informed their design of deployment anchors. The bicycle group designed and tested a 3-D-printed water pump using recycled plastic. They concluded that it lacked adequate force. While they learned a great deal about 3-D printed designs of water pumps, for their initial prototype, they connected a commercial pump to a recycled exercise bicycle from the Department of Recreational Sports and Services. Their inflow hose is specially designed sinking hose recycled from an old project in the Brooks Laboratory. The wetland group conducted laboratory tests during the spring 2017. In a 40-liter aquarium, they created a laboratory wetland filled with

water plants from Campus Lake and observed a 50% decrease in ammonia concentration when flow increased to a lazy 1 liter per hour (D. Mandell, undergraduate, personal comm.).



**Figure 1.** Ongoing learning during design, fabrication, and testing phases for the Fountain Team (top) and Bicycle Team (bottom) during the 2017-2018 academic year.

The Testing Phase began during the final weeks of Spring 2018 semester and continued throughout the Summer (Figs. 2 and 3). This phase consisted of ex situ testing of the effects of aeration and cooling on the environmental health of Campus Lake. Physical Plant granted permission to place prototypes in a “treatment” cove next to Bucky’s Dome for the summer. A control site with similar depth and number of storm drains was established in the northern arm of the Lake. The treatment site consisted of an array of 4 prototype solar fountains and a pedal-powered exercise bicycle.



**Drawing and final 3D-printed pump**



**Exploring the function of a re-purposed exercise bicycle**

**Team Members:**  
Ashley Booth, Anthony Bux, Bobby Caswelch, Nick Faust, Melissa Halstead, Ian Herndan, Adam Spencer, Gary Tippin, Zach Weddle

## 2017-18 Bicycle-Powered Water Pump: Students in Industrial Design



**2017-2018 First bike prototype installed**

**Figure 2.** Testing phase of 2017-2018 pedal-powered fountain.

## 2017-2018 Floating Solar Fountain: F17-94-LAKE



2017-2018 First Prototype

**Team Members:**

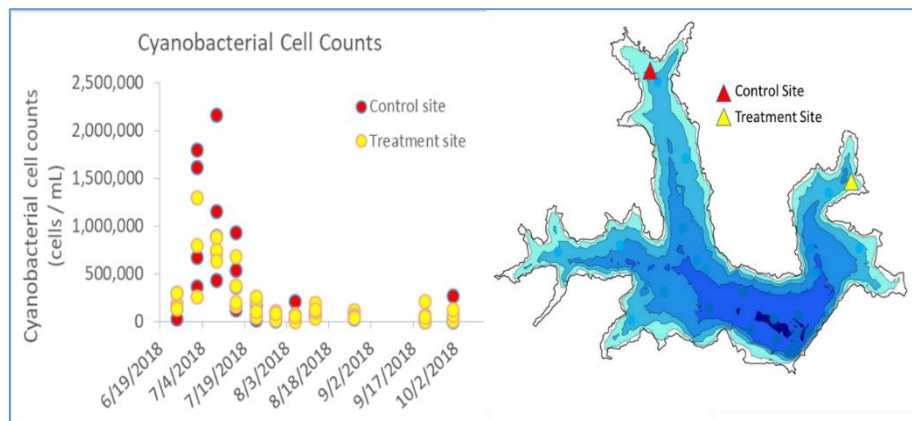
Jacob Lidy, Michael Wolfe, Cory Daenzer, Andrew Will, Jacob Soriano, James Cooper



**Figure 3.** Testing phase of 2017-2018 solar-powered fountain.

Objectives for the summer included testing cooling and aeration compared to cyanobacterial abundance and production of cyanotoxins. We predicted that the combination of solar fountains and the pedal-powered fountain (depended on the cyclist) would cool the surrounding lake water by 5 °C (9.8 °F). Compared to stagnant, control site, we predicted that higher turbulence and cooling would significantly lower nutrient levels, cyanobacterial abundance, and cyanotoxin production. Data analyses are still underway. Preliminary analyses consistently indicate that the treatment site

with greater aeration was consistently “healthier” during the peak of summer heat in terms of lower cyanobacterial abundance (Fig. 4). When conditions were cooler, the two sites had no obvious differences. The take home message is that aeration and cooling minimize the impact



**Figure 4.** Preliminary results of ex situ experiments in Campus Lake. Left panel: Raw data for cyanobacterial cell counts at control and treatment

of CyanoHABs. The laboratory phase of the study is currently focused on culture techniques that trigger robust growth. Cyanobacterial cultures will be compared to tests on natural blooms of cyanobacteria transported into the lab next summer.

A second objective of the project was to conduct two surveys: 1) Learning by students involved in Sustainable Eco-Recreation, and 2) public perception. To develop the survey instruments, Ms. Rachel Steiger was provided with objectives and specific learning competencies for the survey instruments, which she drafted. Following edits, it became a scientific activity. The public survey focused on aquatic recreation and perceptions of natural resources but did not explicitly mention Sustainable Eco-Recreation (which I now view as a data gap). During the Spring 2018 semester, eighteen students participated in the survey of their educational experience. Beginning in April and ending in October 2018, approximately 300 people completed the survey of their impression of Campus Lake.

During the summer, two undergraduate students, Mr. Colin Clark-Dinovo and Mr. Gage Mofield participated actively in experiential learning through Eco-Recreation by conducting approximately 50% of the surveys, 90% of the laboratory analyses, and 75% of the lake fieldwork. Each earned 3 credit hours for independent research (ZOOL 497).

Several design advancements occurred in Summer 2018. Mr. Jason Thomas and Mrs. Debbie Thomas, private citizens of Carbondale took an active interest in helping improve conditions in Campus Lake. Mr. Thomas designed an effective solar fountain that is elegantly simple, which we replicated and used for our ex situ experiments (See example in Fig. 5). As an electrical engineer, Dr. Michael Cubley worked diligently to trouble-shoot problems with the initial solar fountain. He identified a malfunctioning solar panel controller, inefficient battery, and fitted the fountain with wireless technology. By mid-summer, the fountain, now controlled wirelessly was deployed as a demonstration project by the Becker Pavilion. We continue modifications that will increase its efficacy for Summer 2019.

## 2018-2019 Students building and using Solar-Powered Fountains



**Figure 5.** Left panel shows students building a solar fountain to kick off the fall semester. Right panel show students at the ex situ treatment site (See Fig. 4), collecting data.

In Fall 2018, three teams of students enrolled in Senior Engineering Design (ECE 495) and embarked on Sustainable Eco-Recreation projects to help Campus Lake. Two groups are refining the 2017-2018 solar fountain and pedal-powered fountains into arrays that will serve as an obstacle course (Figs. 6 and 7). The third group is developing temperature probes to wirelessly transmit information in real time (Fig. 8). Faculty mentoring the teams include Dr. Brooks, Dr. Harackiewicz, and Dr. Mathias (Co-PIs of the Sustainable Eco-Recreation project), Dr. Michael Cubley, Dr. Peter Filip, and Dr. Kane Chen (other faculty in Engineering). Mr. Thomas is a technical advisor for the teams. Mr. Tim Attig, Supervisor of the Research Laboratory Shop in Engineering also provides technical advice.

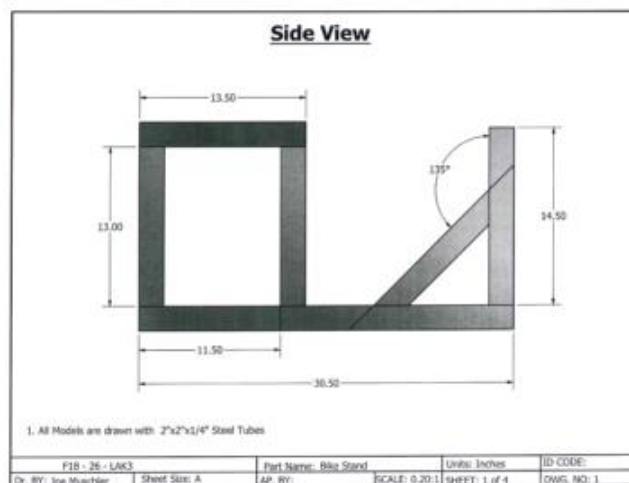


Figure 6. Design phase of the 2018-2019 solar-panel fountain.

## 2018 Bicycle Powered Pump Array: F18-26-LAK3



**2018-2019 Prototype  
Team Members:**  
Jared Sims, Joseph Muschler, Dalton Cobb,  
Matthew Lunde, Trey Hentis



Draft design for bicycle

Figure 7. Design phase of the 2018-2019 pedal-powered water fountain.

## Ad Hoc Mesh Network: F18-22-IIoT



Raspberry Pi  
Wireless communication



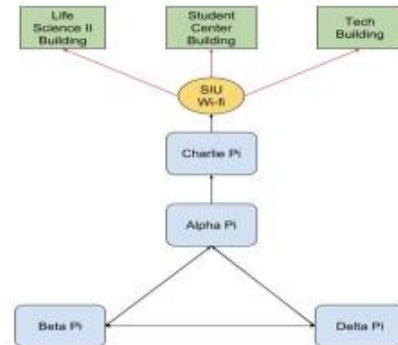
Virtual screen interface



Building the solar power supply

### 2018-2019 Team Members:

Carlos Teran, Ryan Burns, Abdullah Abdulrahman, Majid Aldhafeeri, Alwalid Aljasham and Mahdi Alkhadrawi



Proposed temperature sensor network with link to Student Center

**Figure 8.** Design phase of the 2018-2019 wireless temperature probe.

A team of students in Dr. Brooks' Limnology course (ZOOL 415) furthered the wetland initiative during the Fall 2018 semester (Fig. 9). Students restored an arm of the wetland on the south side of Campus Lake (former beach area) with mainly flowering water plants. The main goal of the restoration was to increase biodiversity, which accelerates the removal of nitrogen and decaying matter (i.e. wetland function). Students transplanted aquatic plants from around Campus Lake and planted seeds of endemics. They also planted aquatic plants from a local nursery that deals only in endemics from our region. Future plans for the wetland include studies of nitrogen cycling in that

## 2018-2019 Students restoring wetlands



**Team Members:**  
Louis Helsing, Marj Brooks, Caitlyn Kleber, Carmen Burkett, Sarah Zeman, Jared Gorrell, and Roza Svaner (not shown)

**Figure 9.** Students in Limnology course restoring biodiversity to a wetland.

arm compared to other areas. In addition, Mr. David Tippy, Head of Campus Landscaping will re-contour other arms of the wetland during summer 2019, decreasing depths to approximately 2 feet to promote wetland function. Mr. Brad Dillard, Head of Physical plant provided wise advice and will install an interpretive sign once wetlands establish.

On a sad note, in September 2018, the graduate student working on this project, Ms. Rachel Steiger was given the choice to transition to another laboratory due to lack of general interest and minimal participation in cyanobacterial research. She no longer represents the Sustainable Eco-Recreation project. Dr. Brooks has a written memorandum signed by Dr. Brooks, Ms. Steiger and Dr. Kamal Ibrahim (Zoology Chair) that allows Ms. Steiger to use surveys for writing a thesis. Dr. Brooks retains oversight of all data. Publications are contingent on Dr. Brooks' evaluation that the data are analyzed and evaluated correctly. Currently, two undergraduate student workers are employed to aid Dr. Brooks in the research.

2. Please provide a summary of your results (environmental, social, and/or economic) including quantifiable data as appropriate (ex. # of individuals reached, lbs. diverted from landfill, energy saved, etc.).

The Sustainable Eco-Recreation project has touched the lives of many students and members of the community. Approximately 50 people attended the Design Open House held in December 2017. Depending on the semester, during the 2017-2018 academic year, Dr. Brooks facilitated 15 to 19 students directly involved in the bicycle or wetlands teams. In addition, Dr. Brooks, Dr. Fran Harackiewicz, and Dr. James Mathias co-advised a research team of 6 students in Senior Engineering Design (ECE 495). As of Fall Semester 2018, 17 engineering students are actively designing projects. Six Limnology course students worked to restore a wetland.

Relative to the interdisciplinary aspect of this program, it involves students, staff, and faculty from the departments of Architecture, Biology, Center for Environmental Health and Safety, Engineering, Geography and Environmental Resources, Industrial Design, Physical Plant, Recreational Sports and Services, and Zoology.

Collaboration and internal team building are important aspects of student learning. Students' current activities include:

- Campus Lake Eco-Rec Interest Group on Office 365
- Bicycle Design Students' closed Facebook page

3. Summarize how your project promoted the Green Fee/Sustainability on campus including, but not limited to, flyers created, screenshots of website, signage, etc. Please include website links, if applicable.

To date we promoted student education, community involvement, and outreach through public presentations, news coverage, and Design Open Houses including the following participants and events:

### **Experiential Learning at SIU**

Table 1 shows that many people benefit from SIU's involvement in Sustainable Eco-Recreation. Students who participated as volunteers made important strides in designing both wetlands and a bicycle fitted with a pedal-powered water pump. Their time commitments outside of class were truly impressive.

Students contributing within the structure of the Senior Engineering Design (ECE 495), Research Credits (Zool 497), or Limnology (ZOOL 415) classes also contribute creatively and extend their work beyond class expectations. Faculty have forged strong bonds between the Departments of Zoology and Engineering as well as with private citizens. Beginning in the Fall 2018 semester, and with the support of Engineering faculty, Dr. Brooks provided students with a timeline for design and testing accomplishments (Appendix A), and met with each engineering team repeatedly (one team is struggling).

**Table 1. Students, Faculty, Staff and Citizenry Involved in Experiential Learning**

2017-2018 Students	2018-2019 Students	Faculty, Support Staff, Support Citizenry
David Mandell	Ryan Burns *	Tim Lyle Attig
Molly Barnes	Abdullah Abdulrahman *	Kang Chen
Cain Hassim	Alwalid Aljasham *	Michael Cubley
Courtney Nichols	Majid Aldhafeeri *	Peter Filip
Izak Hill	Carlos Teran Rivero *	Tammy Kay Hopkins
Ashley Booth	Dalton Cobb *	Aaron Scott
Anthony Bux	Trey Hentis *	Debbie Thomas
Bobby Caswelch	Matthew Lunde *	Jason Thomas
Nick Faust	Joseph Muschler *	
Melissa Milstead	Jared Sims *	<b>Advisory Board</b>
Ian Herndan	Kurt Borgsmiller *	Jane Cogie
Adam Spencer	Nicholas Duitsman *	Brad Dillard
Gary Tippin	Mychal Gibbens *	Leslie Duram
Zach Weddle	Ethan Harris *	Kyle Harfst
James Cooper *	Mohammad Irsheid *	Geory Kurtzhals
Cory R Daenzer *	Joshua Sykes *	Debra Ann Sarvela
Jacob Lidy *	Colin Clark-Dinovo *	
Jacob Soriano *	Gage Mofield *	<b>Principle Investigators</b>
Andrew Will *	Carmen Burkett *	Craig Anz
Michael Wolfe *	Louis Helsing *	Marj Brooks
	Caitlyn Kleber *	Jeff Goelz
250+ people	Jared Gorrell *	Rolando Gonzalez-Torres
participated in the	Roza Svancr *	Frances J Harackiewicz
public survey	Sarah Zeman *	James A. Mathias

\* Earned experiential college credit

### Community involvement and open house events

- The community representative on our Advisory Board is Dr. Jane Cogie, the Chair of the Shawnee Group of Sierra Club.
- Mr. Jason Thomas became a member of the Technical Advisory Faculty for engineering students (see more below).
- In December 2017, our Design Open House, which was open to the public, gathered the participation of approximately 50 people.



- Our Design Open House in 18 April 2018 was largely a thank you to the participating students with about 25 attendees, including mainly students, but also faculty and community representatives.
- 3 May 2018. The Solar Fountain Installation Event (Appendix B) was attended by approximately 20 people, including *The Southern Illinoian* (see below).

#### News coverage

- On 27 September 2017, the *Southern Illinoian* newspaper reported on our Kick-Off Event ([http://thesouthern.com/news/local/siu/eco-recreation-project-seeks-to-improve-water-quality-at-campus/article\\_34bb0ba3-ad81-5e46-92f3-ad81244a04bc.html](http://thesouthern.com/news/local/siu/eco-recreation-project-seeks-to-improve-water-quality-at-campus/article_34bb0ba3-ad81-5e46-92f3-ad81244a04bc.html)). This coverage ignited the interest of the Illinois Environmental Protection Agency in Springfield.
- 28 February 2018. The Daily Egyptian reported on the importance of the **Green Fund** to keep Campus Lake healthy via this program (<https://dailyegyptian.com/80098/news/green-fund-project-to-promote-recreation-at-campus-lake-while-helping-ecosystem-thrive/>).
- The Director of Sustainability was kind enough to let us know that the DE article was linked **worldwide** in the newsletter for The Association for the Advancement of Sustainability in Higher Education (Geory Kurtzhals, pers. Comm.).
- 3 May 2018. The Solar Fountain Installation Event was covered by *The Southern Illinoian*. [https://thesouthern.com/news/local/siu/solar-powered-fountain-is-part-of-siuc-s-plan-to/article\\_63c9c9c3-4c69-5307-b2e3-1df86efbf52a.html](https://thesouthern.com/news/local/siu/solar-powered-fountain-is-part-of-siuc-s-plan-to/article_63c9c9c3-4c69-5307-b2e3-1df86efbf52a.html)
- 11 May 2018. Again, The Director of Sustainability kindly let us know that twenty-four associated press® news outlets picked up *The Southern Illinoian* about Sustainable Eco-Recreation at SIU. Outlets ranged across the United States from the *San Francisco Chronicle* in California to *The Washington Times* in Washington, DC to the *Times Union* in New York, reaching **22,360,000 people** (Geory Kurtzhals, pers. Comm.). Please see an enthusiastic response from Dr. James Lewis, at Western Michigan University (Appendix C.)
- 28 November 2018. *The Southern Illinoian* newspaper featured hands-on learning as SIU, including coverage of the Sustainable Eco-Recreation project [https://thesouthern.com/news/local/siu/at-siu-carbondale-students-hands-on-learning-equals-gains-for/article\\_958e95b4-123b-5f34-914c-bd282f2c90d8.html](https://thesouthern.com/news/local/siu/at-siu-carbondale-students-hands-on-learning-equals-gains-for/article_958e95b4-123b-5f34-914c-bd282f2c90d8.html)

#### Outreach presentations

##### On campus:

- Fall 2017 to Spring 2018: Six presentations by Dr. Brooks to individual classes in the Recreation Department and Department of Engineering.
- 16 August 2018. Dr. Brooks presented a Sustainable Eco-Recreation table at the Becker Pavilion as part of SIU's Weeks of Welcome events (Thanks to an invitation from **Sustainability Office!**).
- 9 September 2018. Dr. Brooks presented research needs to all Senior Engineering Design students.
- 19 September 2018. Presented Sustainable Eco-Recreation at SIU Day to prospective students.

#### Community presentations to the Shawnee Chapter of the Sierra Club:

- 12 April 2018. Title: *Human Recreation Improves Water Quality: Bike-powered fountains and wetlands*. Approximately 50 people attended, including visitors from Utah.
- 10 May 2018. *Engineering Human Recreation Improves Water Quality*. Presented by engineering students: James Cooper, Cory R Daenzer, Jacob Lidy, Jacob Soriano, Andrew Will, and Michael Wolfe.

**Presentations at the state or regional level:**

- 22 March 2018. Two presentations at the Illinois Lake Management Association Conference, Bloomington, IL. Title: *A Living Laboratory at Southern Illinois University: Remediation and Sustainable Science for Harmful Algal Blooms Following the 2016 Dredging of Campus Lake*. Presented by Dr. Brooks.
- Title: *Sustainable-Eco Recreation Lake Management: Environmental Engagement at Southern Illinois University*. Poster presented by Ms. Steiger and Dr. Brooks.
- 10 July 2018. The Field Museum, Climate Change Forum, Chicago, IL. Title: *Climate, Conservation, and People: Adaptation for the Anthropocene*. Invited presentation by Dr. Brooks (Appendix D). Enthusiastic response to Sustainable Eco-Recreation as an adaptive measure.
- November 8, 2018. Annual Meeting of the Association of College and University Building Service Supervisors, Carbondale, IL. Title: *SIU Collaborative Model: Physical Plant & Building Supervisors, Community, Students, Recreation, and Faculty*. Presented by Dr. Brooks.

**Other promotional activities**

- 8 February 2018. Participation in the “Tabling Event” preceding the screening of the film *Before the Flood*. Event sponsored by the Sierra Club.
- 11 April 2018. Passed out our informative brochure to participants at the Saluki Water Workshop (Appendix E).
- Throughout the Fall 2018 semester. Mrs. Thomas and Dr. Brooks participated in *Operation Mousetrap*, which is a course taught through the SIU Research Park. We explored the possibility of developing a collaborative business opportunity between SIU and private citizens—Mr. and Mrs. Thomas. Each week, we presented the concepts of Sustainable Eco-Recreation to colleagues across campus, including faculty from the Colleges of Business, Engineering, Science, and Agriculture.
- Although the installation of the Eco-Recreation prototypes in summer 2018 was not near running paths, we received terrific anecdotal feedback. Each project had a **Green Fund** sign as visible examples of hands-on learning.

**Upcoming outreach**

- As stated above, the wetland restoration will eventually have a permanent interpretive sign (Appendix F).
- Projects deployed around the Becker Pavilion in summer 2019, will have educational signs along the shoreline emphasizing experiential learning and ways that humans can sustain environmental health through Eco-Recreation. By locating projects next to the running path, we expect to reach many of the 70,000 to 80,000 people who pass along the shores of Campus Lake each year (J. Goelz, personal comm.).

4. Is there anything you would do differently if you were to do a similar project in the future? If so, please describe.

As the students learn, so do we. Several aspects of the project changed for the 2018/2019 academic year.

**Current changes include:**

- **Guidance in Business and Marketing.** We included Dr. Kyle Harfst, Executive Director, SIU Research Park & Executive Director of Economic Development on our Advisory Board. Staff at

the Office of Technology Transfer guide inventors through the steps of obtaining patents and bringing ideas to fruition (<http://siusystem.edu/tech-transfer/>).

- **Guidance in Landscape Architecture.** Dr. Rolando Gonzalez-Torres is now a Co-PI. As a landscape architect, he is a valuable resource for developing wetlands.
- **Structure of Student Participation.** We now encourage student participation within the framework of existing courses. During the 2017-2018 school year, we witnessed the struggle of highly motivated students to find the extra-curricular time to devote to this program. As of the Fall 2018 semester, the design and fabrication are incorporated into formal coursework to remove the time conflict.
- **Personnel changes.** Doctoral candidate Azam Baharlouei “Bahar” who has a strong background and high interest in microbiology is taking the lead on cyanobacterial research during summer 2019. Her expertise in high resolution analyses, specifically quantitative polymerase chain reaction (Q-PCR) and enzyme-linked immunosorbent assay (ELISA) protocols to quantify both genetic production of cyanotoxins and very sensitive assessment of cyanotoxin concentrations.

**Future changes:**

- Edit any surveys of public to include their perception of the Sustainable Eco-Recreation program when fountain arrays are deployed in summer.
5. Please attach a minimum of 5 digital images –these will be images used to promote interest in sustainability projects on campus. These can be photos of the progress of the project or the completed project.  
Please see attached photos in addition to other figures.
  6. Optional: Do you have any suggestions for the SIU Sustainability Council to improve the Green Fund Award Process?  
In addition to releasing half of the funds at the onset of the project, I suggest providing another quarter of the funds at the end of Fall semester, depending on progress, of course.

Appendix A. Guidelines for 2018-2019 students in Senior Engineering Design (ECE 496). Guidelines were approved by engineering faculty

### Sustainable Eco-Recreation Projects

**Fabrication Goals: Durable, waterproof, removable minimalist designs (stored inside in winter)**

- **Structural:**
  - Array of pedal-powered sprayers: water cannons, in-lake fountains, dog washes, etc.
  - Array of solar-powered fountains for in-lake obstacle course
- **Functional:**
  - Calculated and measured calories of heat loss from evaporative cooling
  - Calculated calories of human energy burned
- **Assessment Criteria:**
  - **Stationary bikes: Volume of water and evaporation achieved by pedal-powered pump**
  - **Solar fountains: Volume of water and evaporation achieved by solar-powered submersed pumps**

#### Timeline:

- 11 September: Complete building a Thomas Solar Fountain.
- 18 September: Initial design of solar or bicycle array.
- 1 October: Two page report: design update, equipment list with suppliers, detailed budget.
- 15 November: Complete initial builds with functional components of one model.  
Can submit requests for additional parts from this point forward.
- 17 January: Begin laboratory testing of electrical circuitry and mechanical function.
- 31 January: Eco-Rec Open House. Guyon Rotunda, Morris Library  
 11:00AM: Set-up. 12:00-1:30PM: Present designs and initial builds.
- 10 February: Replicate and test fully functional models. Request parts.
- 1 March: Deploy and field test arrays. Assess needs. Submit design updates. Request parts.
- 25 March: Complete design updates. Deploy field arrays. Monitor and refine designs.
- 15 April: Complete refinements in design and function.

#### Faculty Contacts:

Name	Email	Phone Number
Dr. Marj Brooks, Zoology	mlbrooks@siu.edu	307-399-0576
Dr. Mike Cubley, Engineering	mcubley@siu.edu	618-841-5867
Dr. Frances J Harackiewicz, Engineering	Fran1@siu.edu	618-453-7031
Dr. James A. Mathias, Engineering	mathias@siu.edu	618-453-7016
Mr. Justin Thomas, Technical Faculty, Engineering	thomaspub@me.com	618-303-4766

Appendix B. Announcement for solar-fountain installation.

# SUSTAINABLE ECO-RECREATION FOUNTAIN INSTALLATION EVENT

## PROTOTYPE TESTING BEGINS

### WHEN

May 3, 11 am – 12 pm

### WHERE

Campus Lake at Bucky's  
Dome



FUNDED BY THE  
**STUDENT  
GREEN FEE**  
SIU SUSTAINABILITY

### HELP IMPROVE CAMPUS LAKE

WITNESS  
STUDENT  
INVOLVEMENT  
for better water quality

TESTING  
BEGINS  
for solar-powered  
recreation  
opportunities

EXPERIENCE  
The cooling effects of  
solar powered  
fountain techniques

NETWORK  
and build your resume  
for more opportunities  
in sustainable design  
and environmental  
career fields

### FOR MORE INFORMATION:

Dr. Marj Brooks  
[mjbrooks@siu.edu](mailto:mjbrooks@siu.edu)



Appendix C. Response to nationally circulated news article, originally presented in the Southern Illinoisan on 3 May 2018.

**To:** [Marjorie L. Brooks](#)  
**Date:** Friday, May 11, 2018 4:49:09 PM

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Hi Marjorie..

I am forwarding comments from a former student that was a Undergrad ,and GA with us in rec sports decades ago regarding SI article and your terrific collaboration at the lake.

Bill

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**From:** James B Lewis <james.lewis@wmich.edu>  
**Sent:** Friday, May 11, 2018 8:08 AM  
**To:** William P McMinn; Lynda Langford  
**Subject:** Re: This week's highlights

That is a FRIGGIN GENIUS idea! I love how the students are allowed to make mistakes and fix them on the fly. The idea of a kayak or boat course among the fountains is even a better idea. Wow, a bike with an output of water. Geez, this is the type of thinking that really makes SIU a great school. I love it.

James Lewis, Ph.D.  
Associate Professor  
Department of Human Performance  
and Health Education  
Western Michigan University  
Kalamazoo, MI 49008-5426  
(269) 387-2697

"If you want to make God laugh, tell him what you have planned for tomorrow"

"All that is necessary for the triumph of evil is that good men do nothing" Edmund Burke

"Most people are on the world, not in it. " John Muir

Appendix D. Flier circulated by the staff of the Field Museum in Chicago, IL announcing an upcoming presentation for their Climate Change Forum.



CLIMATE CHANGE FORUM brown bag for  
Field Museum scientists and staff

Climate, Conservation, and People: Adaptation for the  
Anthropocene

Dr. Marjorie Brooks  
Associate Professor, Department of Zoology  
Southern Illinois University

Tuesday, 10 July 2018  
12:00 PM-1:00 PM  
Montgomery Ward Hall

As humans continue to affect our planet, we are seeing declines in wildlife and fish populations worldwide. Identifying specific causes is tremendously challenging because animals are experiencing death by a thousand cuts from the compounding of multiple sublethal stressors. I discuss how stressors redirect energy reserves from growth and reproduction and research designs that can track the impacts of multiple stressors. Next, we take the view from 35,000 feet of the biogeographic impacts of global warming compounded by chronically poor water quality. Finally, I will present some strategies by which we can help animals adapt, and how humans can be part of the solution for improving ecosystems.

Appendix E. 2018 brochure for the Sustainable Eco-Recreation project (Current brochure includes Dr. Rolando Gonzales-Torres as a co-investigator (page 1 at top, page 2 at bottom)).



**Solar-powered Fountain**

**Engineering Senior Design Group**

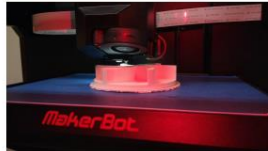
Mechanical and Electrical Engineers have designed and are now fabricating a solar-powered fountain that can spray up to 10ft in the air!

With enough fountains, Campus Lake could be home to a paddle board/kayak obstacle course!

The solar- and bike-powered fountains will be featured near Bucky's Dome – May 2018

**"When ecosystems thrive, people thrive"**  
– Dr. Marj Brooks

**Bike-powered Fountain**



**SIU IDSA Design Group**

- Repurposed stationary bicycle from the SIU Rec Center
- 3D printed pump prototype

Campus Lake has the perfect trifecta that triggers cyanobacterial harmful algal blooms (CyanoHABs): high nutrient inputs, high temperatures, and low oxygen levels. Student teams design Eco-Recreation activities that aerate and cool the water, which will also lower nutrients and act as a combined force to inhibit algae growth. Sustainable Eco-Recreation is a way to use solar and human powered fountains that improve water quality when lake users interact with the environment.

**Faculty advisors:**

**Dr. Marj Brooks**  
Associate Professor,  
Zoology

**Mr. Jeff Goelz**  
Assistant Director,  
Recreational Sports and Services

**Dr. Craig Anz**  
Associate Professor,  
ASA School of Architecture

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**COLLABORATE**  
WITH STUDENT GROUPS  
TO IMPROVE CAMPUS  
LAKE WATER QUALITY

**DESIGN & BUILD**  
A SUSTAINABLY-  
POWERED WATER  
FOUNTAIN OBSTACLE  
COURSE

**GAIN  
EXPERIENCE**  
WITH WATER QUALITY  
TESTING AND SURVEYING  
TECHNIQUES

**NETWORK**  
AND BUILD YOUR  
RESUME FOR MORE  
OPPORTUNITIES IN  
SUSTAINABLE DESIGN  
AND ENVIRONMENTAL  
CAREER FIELDS

**New ideas? Questions?  
Interested in getting involved?**



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For information on the **Green Fund** visit the  
Innovation and Sustainability Hub in the  
Student Center  
<http://sustainability.siu.edu/>



**Sustainable  
Eco-Recreation**  
Help improve Campus Lake










**Sustainable Eco-Rec  
promotes active solutions  
that use experiential  
learning and novel  
inventions led by student  
research teams to  
develop outdoor activities  
that improve water  
quality and promote  
healthy lifestyles**

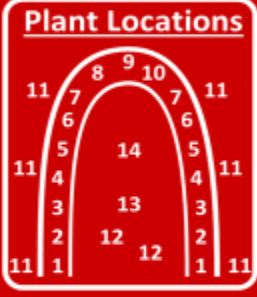


Appendix F. Draft of sign that will be placed at restored wetland.

## Campus Lake Beautification Wetland Experiment #1: Increasing Biodiversity

1. *Chelone obliqua*  
(Rose Turtlehead) 
2. *Asclepias incarnata*  
(Swamp Milkweed) 
3. *Iris fulva*  
(Copper Iris) 
4. *Lobelia cardinalis*  
(Cardinal Flower) 
5. *Lobelia siphilitica*  
(Great blue lobelia) 
6. *Iris versicolor*  
(Blue Flag) 
7. *Sagittaria latifolia*  
(Common Arrowhead) 

### Plant Locations



### Functional Goals:


- Speed Nutrient Removal
- Improve Leaf Litter Breakdown







### Esthetic Goal:

- Beautify Campus Lake

### Acknowledgements:

- SIU Physical Plant
- Students in Limnology Zool 415, Fall 2018



8. *Elyocharis sp.*  
(Spike Rush) 
9. *Caltha palustris*  
(Marsh Marigold) 
10. *Scirpus sp.*  
(Bulrush) 
11. *Carex sp.*  
(Sedges) 
12. *Pontederia cordata*  
(Pickerel weed) 
13. *Ceratophyllum demersum*  
(Coontail) 
14. *Nymphaea odorata*  
(White Water Lily) 