**Funding Criteria**

**A. General Rules**

1. Students, faculty, and staff are encouraged to submit requests for funding. Student-led projects require a faculty or staff sponsor in order to have funds awarded.
2. Funding can only go to university-affiliated projects from students, faculty, staff, and departments.
3. All SSC projects must make a substantial impact on students. This may be a direct impact or an impact through education and engagement. All SSC funding is 100% from student green fees, so the projects funded by the students must benefit them.
4. SSC encourages innovation and new technologies – creative projects are encouraged to apply.
5. Unless a type of expense is specifically listed below as having restrictions, SSC can generally fund it. The items referenced below should not be taken as comprehensive list.

**B. Things SSC Can Fund, On A Case-By-Case Basis**

1. SSC can fund feasibility studies and design work; however, it must work toward ultimately addressing a sustainability need on campus.
2. SSC can fund staff positions that are related to improving campus sustainability. Strong preference will be given to proposals receiving matching funding from departments and/or plans for maintaining continuity of the position after the end of the initial grant.
3. SSC can fund outreach events with a central theme of sustainability, provided their primary audience is the general campus community.
4. SSC discourages funding requests for food and prizes but will consider proposals on a case by case basis that prove significant reasoning.
5. SSC can fund repairs and improvements to existing building systems as long as it works toward the goal of improving campus sustainability; however, a preference is shown to projects utilizing new or innovative ideas.
6. SSC can provide departments with loans for projects with a distinct payback on a case by case base. Loans will require a separate memorandum of understanding between SSC and departmental leadership pledging to repay the award in full and detailing the payback plan.

**C. Things SSC Will Not Fund:**

1. SSC will not fund projects with a primary end goal of generating revenue for non-University entities.
2. SSC will not fund personal lodging, food, beverage, and other travel expenses.
3. SSC will not fund any travel expenses.
4. SSC will not fund tuition or other forms of personal financial assistance for students beyond standard student employee wages.

**Your Step 2 funding application should include this application, the supplemental budget form, and any letters of support.**

*Please submit this completed application and any relevant supporting documentation to* *Sustainability-Committee@Illinois.edu**. The Working Group Chairs will be in contact with you regarding any questions about the application. If you have any questions about the application process, please contact the Student Sustainability Committee at* *sustainability-committee@illinois.edu.*

**General & Contact Information**

**Project Name:** Valorizing Archived Soils: Changes in the Land, Carbon, and Nutrients in the 20th century

**Total Amount Requested from SSC:** $79,958

[In an effort to make this project more student-oriented, the budget was re-focused to shift workload from faculty and graduate students to undergraduate students. This change resulted in a significant reduction in the original request ($91,090), but the PIs believe this is more in-keeping with the spirit of the funding source.]

**Project Topic Areas:** [x]  Land & Water [ ]  Education [ ]  Energy

[ ]  Transportation [ ]  Food & Waste

**Applicant Name:** Andrew Margenot, Reid Christianson

**Campus Affiliation (Unit/Department or RSO/Organization):** Crop Sciences

**Email Address:** margenot@illinois.edu, reiddc@illinois.edu

**Check one:**

 [x]  This project is solely my own ***OR***

 [ ]  This project is proposed on behalf of (name of student org., campus dept., etc.):

**Project Team Members**

|  |  |  |
| --- | --- | --- |
| **Name** | **Department** | **Email** |
| Andrew Margenot | Crop Sciences | margenot@illinois.edu |
| Reid Christianson  | Crop Sciences | reiddc @illinois.edu |
| Name | Department/Organization | Email Address |
| Name | Department/Organization | Email Address |

**Student-Led Projects (Mandatory):**

Name of Faculty or Staff Project Advisor:
Advisor’s Email Address:

**Financial Contact *(Must be a full-time University of Illinois staff member)***

Contact Name: Anna Tammen

Unit/Department: Crop Sciences

Email Address: amtammen@illinois.edu

**Project Information**

*Please review the proposal materials and online content carefully. It is highly recommended you visit a working group meeting sometime during the proposal submission process.*

**Please provide a brief background of the project, its goals, and the desired outcomes:**

*You may copy and paste your Step 1 application answer if nothing has changed.*

The University of Illinois has a rich agricultural history, and is poised to continue this legacy into the future. Our university is one of the original land-grant institutions established by the Morrill Act in 1862 and the Morrow Plots is the oldest field cropping experiment in the United States. An overlooked education and research asset of the university is its involvement in the state soil survey, in which soils were mapped across Illinois beginning in the early 1900s. Soils collected collected throughout the 20th century as part of the United States Department of Agriculture’s National Soil Survey effort are stored, albeit in poor conditions and in neglect, at the university campus farms.

The 20th century was also a time in which our state and nation saw cataclysmic changes in agricultural practices, such as tillage (e.g., Dust Bowl) and industrialization (e.g., mechanization, increased adoption of chemical fertilizers, herbicides, and GM crops). While these changes profoundly altered the agricultural and environmental landscapes, as well as human health, of Illinois, it is obviously not possible to travel back in time to directly evaluate how agricultural sustainability has changed over the past century.

The statewide archive of soils stored on our campus offer the next closest option to time travel: by virtue of being sampled across the 20th century, including prior to the industrialization of agriculture, the archive offers a window back in time. These historical samples enable answers to otherwise unanswerable questions such as: "How has agricultural impacted sustainable use of soils over the past century?"; "How has industrialization of agriculture impacted soil nutrients, including micronutrients?"; "How did herbicide usage led to herbicide-resistant weed evolution?"; "How has soil carbon sequestration been altered, and how might this contribute to climate change?" Answering these questions by capitalizing on these rare historical archive of soils also lets us better understand and predict the past and future sustainability of modern agricultural practices in Illinois.

We propose to restore, digitize, and make open-access this historical resource for educational and research purposes, reinforcing the University of Illinois' position as a leader in agricultural and environmental sciences. Importantly, we believe that this resource and its lessons should be made accessible to the public. To achieve this goal, a graduate student-led undergraduate team mentored by the PIs will conduct a restoration and archiving effort to rescue and digitize the samples and data of this centennial soil archive.

The specific outcomes of this work include:

1) Provide undergraduate students hands-on and practical experience through including them from the start of the project. This will include assistance with standard operating procedure development for inventorying samples and collecting new samples.

2) Enable testing of fundamental questions on the sustainability of agriculture in Illinois and the greater US Midwest by having a window back in time to how soil fertility has changed over the past century. Though a plurality of questions can be answered, for this work we will start by measuring carbon in these archived soils in order to establish a historical sequence of soil carbon changes and thus sequestration deficits and potential in Illinois.

3) Offer a platform for University undergraduate and graduate students to pursue student-focused research funding such as the Sustainable Agriculture Research and Education (SARE) proposal as well as NSF Graduate Research Fellowship (GRF). Additionally, faculty will benefit by being able to leverage this resource for future studen-focused projects.

4) Restore and steward a valuable resource of our land grant university that is unique in the United States, which can be used in future student and faculty learning opportunities via classroom and student-focused projects.

5) Build a database for 'big picture' questions in environmental sciences, geospatial statistics, and agricultural sciences for use in the classroom.

6) Establish an open-access, online database that will capitalize on this unique historical archive to enable additional students and researchers from other land grant universities.

7) Publicize and disseminate findings and open-access database, both on-campus through a seminar and panel discussion, and off-campus by public outreach events in Chicago at the Chicago Field Museum and the Good Food Expo.

**Where will the project be located? Are special permissions required for this project site?**

*If special permission is required for this location, please explain and submit any relevant letters of support with the application.*

**The project will be initiated at the University of Illinois Crop Sciences Research and Education Center (Urbana, IL), where the soil sample archive is currently situated, and the Department of Crop Sciences storage facilities in Turner Hall, to which the samples will be transferred, restored, and archived. The Department of Crop Sciences as well as Department of Natural Resources and Environmental Sciences have expressed interest in supporting this work by devoting a physical space for housing this historical archive. All permission has been granted for accessing these spaces by the department head(s).**

**Other than the project team, who will have a stake in the project? Please list other individuals, groups, or departments affiliated directly or indirectly by the project. This includes any entity providing funding (immediate, future, ongoing, matching, in-kind, etc.) and any entities that benefit from this project.**

*Please attach letters of commitment or support at the end of the application.*

University of Illinois Crop Sciences Research and Education Center

Dept. Crop Sciences (CPSC) students and faculty

Dept. Natural Resources and Environmental Sciences (NRES) students and faculty

Illinois Climate Action Plan (iCAP)

Illinois Nutrient Loss Reduction Strategy (NLRS)

**How will this project involve and/or benefit students?**

*This includes both direct and indirect impact.*

**Direct impacts on students include hands-on training in natural resource archiving, digitizing datasets, and stewardship of public databases and exhibit. It will benefit a graduate student by providing partial stipend support and by providing an opportunity for mentorship and leadership of the undergraduate student team. Multiple undergrad students will be involved with completing the archiving process, collecting additional soil samples, and analyzing samples.**

**Indirect impacts on students include informing how agricultural changes in the 20th century have altered carbon footprints of food.**

**How will you bring awareness and publicize the project on campus? In addition to SSC, where will information about this project be reported?**

Awareness and publicity will be achieved through multiple on-campus complementary approaches that directly target students and stakeholders relevant to the University of Illinois and her land grant mission of serving the greater public.

On-campus, we propose the following:

1. An 'exposition' seminar and panel discussion that provides long-form discussion on how agriculture impacts environment and climate change with a specific focus on historical context that draws upon the restored archive.

2. Establishing a website that describes the history of the state soil survey. Margenot will draw on contacts at the Illinois Geological Survey and federal USDA NRCS to promote dissemination through a webinar of the finalized restoration effort and plans for digitization of open-access data.

3. Establishing a webpage in the CPSC 'resources' page to indicate to current and prospective students that this is a resource available for classes (e.g., honors thesis) and student research projects.

4. Integrated into CPSC and NRES Department courses on food security and horticulture (list courses- at least 3-4 of these).

In addition to on-campus outreach, information about this project will be further publicized online and off-campus in the following ways:

5. Online database established and stewarded by undergraduate student team.

6. Webinar promoting effort and highlighting findings and inviting collaborators for future student projects.

7. Chicago Field Museum exhibit January 2021 highlighting the insights revealed by the state soil survey.

8. Good Food Expo in March 2021, both via a panel on local food systems and climate change. This will be organized by undergraduate team mentored by graduate student co-advised by Margenot and Christianson.

9. Presentation of work by the grad-lead undergraduate student team at the IL Nutrient Loss Reduction Strategy (NLRS) symposium ium in Nov 2020 and 2021, and at the national Soil Science Society of American (SSSA) conference in 2021.

# Financial Information

*In addition to the below questions, please submit the supplemental budget spreadsheet available on the Student Sustainability Committee* [*website*](http://ssc.sustainability.illinois.edu/?page_id=2087)*. Submission of both documents by the submission deadline is required for consideration of your project.*

**Have you applied for funding from SSC before? If so, for what project?**

No

**If this project is implemented, will you require any ongoing funding required? What is the strategy for supporting the project in order to cover replacement, operation, or renewal costs?***Please note that SSC provides funding on a case by case basis annually and should not be considered as an ongoing source of funding.*

To ensure continuity of access and upkeep of this resource beyond the project timeline, a stipend will be requested from the Department of Crop Sciences for an undergrad student to oversee and steward the physical and digital archive. This will provide an ongoing stipend and opportunity for undergrad students to develop skills in managing and curating large sample collections and databases. Given the support of the department head in identifying this resource and granting permission for its restoration, we are very optimistic that this stipend can be secured.

**Please include any other obtained sources of funding. Have you applied for funding elsewhere?**

*Please attach any relevant letters of support as needed in a separate document.*

No other funding has been obtained to-date, but an accepted proposal would be leveraged by the PIs to pursue two extramural funding sources: the Illinois Nutrient Loss and Education Council (NREC), to study how historical changes in agriculture have impacted off-farm nutrient loss and sustainability, and the USDA AFRI Foundational Program to evalute how nutrient use efficiencies have been altered by industrialization of agriculture. Additional research projects that may be funded by leveraging this resource, which can include support for the maintenance costs of the archive, include but are not limited to herbicide resistance in weeds, soil depletion, and historical changes in beneficial microorganisms with industrialization of agriculture.

# Environmental, Economic, and Awareness Impacts

**How will the project improve environmental sustainability at the Urbana-Champaign campus? If applicable, how does this project fit within any of the** [**Illinois Climate Action Plan**](https://icap.sustainability.illinois.edu/) **(iCAP) goals?**

By providing a historical assessment of soil carbon changes over the past century in Illinois, this work will provide quantitative foundation for evaluating historical trends in carbon sequestration in Illinois landscapes. Aligning these changes with known historical changes in agricultural practices, such as fertilizer usage and mechanization, we will be able to provide an empirical basis for potential carbon sequestration. This so-called "carbon debt" is critical to identifying priority regions for carbon sequestration, as soils with historically higher but currently lower carbon stocks represent a 'deficit' that can be more readily increased (Sanderman et al, 2017).

This project is directly aligned with the 2015 iCAP chapter 7 objective 1, "Perform a comprehensive assessment of GHG emissions from agricultural opertions…" where our agricultural system can be evaluated over a very long time period to inform future quantification efforts. Further, considering the iCAP will be updated in 2020, thought has been put into likely focus areas for the new Land and Water Sustainability Working Advisory Team (SWATeam), for which Dr. Christianson serves as the co-chair. One new area of emphasis is develooping a benchmark soil characterization for our agricultural areas on the "South Farm" to quantify potential for additional carbon sequestration. The proposed project would align with that emphasis, too, by informing how historic land management has resulted in benchmarked soil carbon levels.

Citation:

Sanderman, J., Hengl, T., & Fiske, G. J. (2017). Soil carbon debt of 12,000 years of human land use. Proceedings of the National Academy of Sciences, 114(36), 9575-9580.

**How will you monitor and evaluate the project’s progress and environmental outcomes? What short-term and long-term environmental impacts do you expect?**

*Some examples include carbon emissions, water conservation, green behavior, and reduced landfill waste.*

**Project progress and success will be monitored by a combination of technical and outreach milestones that will provide feedback on social and environmental impact. Transferring, restoring, and exhibiting the soil archive will be achieved by mentorship of the grad-undergrad team by PIs Margenot and Christianson, who each advise multiple grad and undergrad students on similar scale and effort projects. Biweekly meetings of grad-undergrad team with PIs will be used to work through challenges and provide regulator monitoring of project progress. The grad student, who will be trained by PIs in soil carbon measurement, will collect a relatively small but critical piece of data that will leverage the accessory information of these archived samples to establish a historical record of soil carbon changes over the past century of Illinois. Outreach deadlines (e.g., booth proposal for Good Food Expo, abstract submission for symposia) will help maintain project progress. Working with professionals on web design and graphic art will ensure complex aspects of project outreach will be achievable.**

**By providing knowledge and enabling research and education on how agricultural land use has impacted soils and carbon stocks in Illinois, this project is anticipated to enabled education, research, and policy on how agricultural land use impacts soil fertility and soil carbon sequestration. Additionally, the open-source nature of the data and sample collection will enable students and faculty at our tier 1 research institution institution to develop answers to related environmental questions, such as "How much phosphorus and nitrogen has built up in soils over the past century, and how can this help explain nutrient losses off-farm into surface waters?" By addressing knowledge gaps on historical trends in soils, nutrients, and carbon, this resource will facilitate others having immediate impact on current policy and research questions on sustainability of agriculture from nutrient losses (e.g., eutrophication) to climate change (e.g., the soil carbon deficit and sequestration potential of Illinois).**

**What are your specific outreach goals? How will this project inspire change at UIUC?**

**We envision this as a catalyst for the greater discussion on agricultural sustainability in Illinois and the greater Midwest, including soil health, food quality, and climate change. Given our university's agricultural origins and land grant mission, we aim to constructively stimulate a dialogue on how agriculture has transformed our state's landscapes and role in climate change, and how we may move forward given this historical context. For example, a recent global study concluded that agriculture has initiated a "global carbon debt" due to soil carbon losses.** **In Illinois, the relatively recent conversion of prairie to agricultural fields following European colonization in the early 1800s has radically transformed -- and likely compromised -- ecosystem services, including climate regulation.** **This archive will enable educational and evidence-based assessment of the degree to which industrialization of agriculture in the 19th century has come at a cost to these ecosystem services, and how new movements such as regenerative agriculture may adapt lessons learn from this historical record.**

**More broadly, we seek to inspire UIUC students, from undergrad to grad level, by (1) unearthing lessons from the past and (2) showing how these can be used to contextualize discussions of how we as a society move forward to proactively address challenges of the 21st century, notably climate change, soil degradation, and food security. We believe that providing a detailed story of our university's context -- how Illinois' lands changed in the 20th century -- can provide such inspiration. By reclaiming and sharing a unique resource through a student-led project, we anticipate empowering students through a hands-on experience of their potential to contribute to local and national discussions and efforts on global challenges.**

**Our specific outreach goals are:**

**(1) On-campus, stimulate discussion on agriculture's past and future role in climate change and its environmental footprint. This will be achieved through a seminar and panel discussion centered on the exposition of the completed archive as a campus-open talk.**

**(2) On-campus, incorporate the soil archive into CPSC and NRES courses on environment and agriculture.**

**(3) On/off-campus, develop website for future accompanying physical archived exhibited: "Changes in the Land: Illinois and her soils, past and future".**

**(4) Off-campus, to reach the greater public with current interest in food systems, we will present a panel at the annual Good Food Exposition, held every March in Chicago. This is a diverse exposition and conference on food system sustainability with a focus on local foodsheds in the upper Midwest. In addition to a panel, the grad-undergrad team will hold a booth that has example archived soils and maps of soil locations and data (e.g., where was the most carbon sequestered in Illinois soils, and how has that changed?). PI Margenot has experience in setting up these panels and has organized citizen science booths on agricultural outreach in past years.**

**(5) Off-campus, plan and conduct a Chicago Field Museum exhibit-discussion in January 2021 highlighting the insights revealed by the state soil survey and generating a discussion on the history of environment and agriculture in Illinois. Margenot has been in discussion on such public outreach efforts with the director of the CFM.**

**(6) Off-campus, the grad-undergrad team to prepare a summary of this effort and presentation of scientific findings at the annual Illinois Nutrient Loss and Reduction Strategy symposium in Springfield, IL and at the national level at the annual Soil Science Society of America meeting. This will communicate findings to policy makers and scientists, respectively.**

**If applicable, how does this project impact environmental injustice or social injustice?**

**This project does not directly impact environmental or social injustice. However, by restoring and digitizing this resource for open-access to the public (which funded the original state soil survey),**