



## STUDENT SUSTAINABILITY COMMITTEE

### Funding Application – Step II

#### 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](mailto: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](mailto:sustainability-committee@illinois.edu).

## General & Contact Information

**Project Name:** Census of Trelease Woods – phase 2

**Total Amount Requested from SSC:** 64,496

**Project Topic Areas:**  Land & Water  Education  Energy  
 Transportation  Food & Waste

**Applicant Name:** James Dalling

**Campus Affiliation (Unit/Department or RSO/Organization):** Department of Plant Biology, LAS

**Email Address:** dalling@illinois.edu

### Check one:

- 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
James Dalling	Department of Plant Biology	dalling@illinois.edu
Jennifer Fraterrigo	NRES - ACES	jmf@illinois.edu
James Ellis	University Natural Areas	jellis@illinois.edu
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: Penny Broga

Unit/Department: School of Integrative Biology

Email Address: broga@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.*

We request funding to complete the first full inventory mapping and measuring every tree >1 cm diameter in the 24 ha Trelease Woods. During phase 1 (Fall-Spring-Summer-Fall 18-19 with SSC support) 69 students, primarily from LAS, ACES and AHS, were trained in forest inventory methods, laser mapping and species identification and collectively tagged and measured 17,675 trees. However, we have been unable to complete the census (10.5 ha in the north of Trelease Woods remain to be mapped). This shortfall reflects the complexity of the challenge (organizing 8-10 teams of students working 7 days a week), weather restrictions (extremely wet Spring and early summer 2019) and under-estimation of total stem number. Completing the census in a timely manner (i.e., under 2 years) is crucial to ensuring utility of the data and to incorporating our dataset into the forest global monitoring network (Forest Geo) we plan to join. In this second phase we will be able to:

- Train an additional 50+ undergraduates in forest mensuration and carbon budgeting/monitoring
- Submit the census data to ForestGeo – providing access to Illinois students to forest data and internship opportunities across the global network (>70 forest sites worldwide)
- Continue our efforts this year to develop lab activities for undergrad classes that use the data to teach methods for analysis of forest carbon storage
- Educate students on the critical importance of forests in mitigating and reducing carbon emissions
- Add a new soil carbon inventory and map of Trelease Woods
- Develop a student-led environmental monitoring program at Trelease Woods aimed at correlating forest productivity and soil respiration responses to short-term climate fluctuations

### **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 located at Trelease Woods, 5 miles east of Urbana and approximately 10 minutes drive from campus. Trelease Woods are part of the University's network of natural areas. Research and teaching activities within the natural areas is regulated by the Committee on Natural Areas (CNA) within the Office of the Vice-Chancellor for Research. Activities proposed here have been approved by the CNA (see attached letter).**

**Although the site is close to campus there is no public transport that can be used to access Trelease. For 2018-19 we rented a university vehicle for undergraduate student use (paid for by the School of Integrative Biology). This will continue over the next academic year. For safety, the vehicle will remain at the site at all times while students are in the forest.**

**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.*

Primary beneficiaries of this project will be undergraduate students in ACES – Department of Natural Resources and Environmental Sciences, and LAS – School of Integrative Biology. Students participating in the forest census are drawn primarily from these units, although we have advertised widely on campus, and have attracted students from other majors (e.g., School of Earth, Sustainability and Environment concentration in Earth's Biosphere and Ecology, Landscape Architecture and the School of Business). We aim to establish a

diverse mix of students (major, family background, race and ethnicity) among the census crews. This is particularly important because it is widely reported that under-represented minority (URM) students have a low rate of engagement in environmental sciences, and are therefore under-represented in environmental organizations (e.g. Taylor (2014) The state of diversity in environmental organizations [https://orgs.law.harvard.edu/els/files/2014/02/FullReport\\_Green2.0\\_FINALReducedSize.pdf](https://orgs.law.harvard.edu/els/files/2014/02/FullReport_Green2.0_FINALReducedSize.pdf))

As noted above, one primary goal of the census is to add Trelease Woods to the Forest Geo plot network, which currently includes forests associated with Washington University St Louis, Indiana University and the University of Michigan. Under the Forest Geo model, funding for the first forest census is raised locally (in this case from the SSC) as an indication of the local PIs investment in the project. However, plot PIs entering the Forest Geo network make a commitment to repeat surveys every five years, generating valuable data on forest growth and turnover (mortality and recruitment). Typically, the longer plots remain in the network, the more valuable their data become. After the first census is completed (and Trelease has joined the network) we will therefore be able to request Smithsonian funding (for example, the Tyson plot in Missouri recently received \$15K towards its recensus). As this project also has a substantial benefit to undergraduates through experiential learning, and as repeat censuses of Trelease will allow us to measure changes in forest carbon sequestration, we may also return to the SSC for support of a second census in 2023. Note: major costs are associated with the first census, which involves a one-time purchase of tree tags, and laser mapping of trees. The second census typically takes half as long as the initial census, and has minimal requirements for additional materials.

Once we have completed the plot census and quality control checks in Spring 2021 we will have an exciting new data resource that undergraduate students will be able to use to either carry out their own analyses (for example, as undergraduate research credit in the Dalling or Fraterrigo labs or those of other interested faculty and postdocs), or as part of a formal class activity or field lab. To date, we have already supported 9 out of the 69 undergraduate students participating in the census by creating opportunities for independent research using data from the on-going census.

Data from the on-going (partial) census have already been provided to the instructor of IB372 Ecology (Prof. James O'Dwyer) for course-based undergraduate research. We funding from this stage 2 proposal we will be able to make these data available to other classes that hold field/lab activities in Trelease.

Because the census is still incomplete, this year we held off on plans to access two additional funding sources on campus to develop teaching materials from the Trelease plot census. Next year we will request support from the Office of Undergraduate Research (OUR) and from the Provost's Initiative for Teaching Advancement (PITA) – application dates for both these funding sources are anticipated for March 2020. We will use these funds to:

1. Support the development of lesson and lab exercise plans around the census data. These lesson plans will be field tested using our undergraduate census workers, and then integrated into the curriculum of our classes that already do group field projects in Trelease woods. Adding census based field activities to the IB ecology classes IB203 and IB372 alone would engage ~200 sophomore and junior students with the Trelease census data each year. One example of a potential class project that could combine field work and use of the census data would be to measure tree heights in the field, use tree diameter data from the census and collate wood density data from published resources to generate an estimate of individual tree carbon storage. Students could then explore how the current ash tree dieback is impacting forest carbon storage at Trelease and potentially other sites.

2. Use the extensive field dataset that we will assemble as a vehicle to introduce undergraduate students to statistical analysis and data visualization using the R programming language. While the R language has been broadly adopted by biologists, and is a core skill that graduate students are expected to master, few opportunities have been developed for undergraduate students in SIB and ACES to gain experience using the program. The size of the dataset we will develop, containing information on >30,000 trees, necessitates that we develop powerful, yet accessible data management protocols that our students can use. Accordingly, we will develop a manual for exploring the Trelease census dataset using R, with examples of how to manipulate and extract data, applying statistical tests, and use plotting functions. In our application to the OUR we will also propose developing a shiny app – which is an interactive web-based app that students can use to access the plot data without the requisite R skills (for examples see <https://shiny.rstudio.com/gallery/>).

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

*This includes both direct and indirect impact.*

**Undergraduate students will be engaged in this project in four ways:**

- **As participants in the forest census students are trained in tree identification and tree measurement protocols and in the use of laser mapping equipment. We have also provided training in data analysis using the program R. We will strengthen this analysis component as the census is completed. Students earn credit (e.g., IB 390) for independent research. Practical research and fieldwork experience in ecology is especially valuable for students interested in applying for MS or PhD programs or for careers in natural resource management. The demand from undergraduates for this opportunity has been overwhelming, with 69 students participating over the first year.**
- **As participants in a new forest carbon monitoring program established this year students will install dendrometer bands to measure individual tree growth, and will measure soil respiration (both on a monthly basis). These measurements will be especially important for understanding how forest carbon balance changes in response to ash tree dieback. Soil temperature and moisture will be measured weekly, and dendrometer bands will be measured monthly to the nearest 0.01 mm. Soil respiration measurements will be made with equipment (gas analyzers) already available in the Fraterrigo lab. Dendrometers are inexpensive to make and are included in the budget.**
- **As participants doing independent research using the census data. In Spring 2019 we supported 9 student-led research projects on deer usage of Trelease, standing dead woody biomass surveys, and coarse wood debris (two additional important pools of carbon in the forest). Students registered for IB490 Independent Research or NRES equivalent.**
- **As hourly workers (summer 2020) engaged in the census**
- **As participants in organized lab activities that are incorporated into the curriculum of NRES and IB classes. We will also request funding for an 50% RA who will (i) coordinate the completion of the census, data quality control checks, data dissemination, new soil carbon/soil respiration and tree growth measurements, and (ii) will develop new lab activities/lesson plans in collaboration with instructors of the four courses that currently use Trelease Woods.**

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

Over the last year we publicized the project through presentations to classes in Integrative Biology promoting research opportunities in Trelease Woods (IB150 Organismal and Evolutionary Biology; IB203 Ecology) and at the Integrative Biology Fall welcome for new students. We also publicized the project in the NRES newsletter and solicited interest through NRES student advisors. We placed announcements around campus and on video screens in the Natural History Building and through the Integrative Biology undergraduate newsletter (spotlight). We will continue to promote opportunities widely across campus for all undergraduates.

This year we will also be able to highlight research opportunities at Trelease to a new NRES course (NRES 105 - Climate Change and Ecosystems). The first offering of this course reached 300 students and included College of Business, Engineering, LAS, Fine & Applied Arts, DGS, Media, and ACES.

Additionally, we will use a news story in the LAS alumni newsletter and a video produced by the LAS communications team to promote the project. The video story is available on the SIB website: [sib.illinois.edu/news/130](http://sib.illinois.edu/news/130)

During the week of Earth Day (April 22, 2020) we will hold a field day at Trelease Woods, inviting the campus community to visit the woods and meet students working on the census and soil carbon/respiration measurements. We will coordinate this event with Eric Green/iSEE to ensure it is well publicized through existing iSEE media channels.

We will also meet with the RSO group Students for Environmental Concerns to highlight opportunities for students to participate in the census in 2020 and become involved in independent research.

Undergraduate research resulting from the census will be presented at the undergraduate research symposium, with some projects potentially publishable in peer-reviewed journals.

In the next year we will also promote the completed census through the ForestGeo network website and news blog ([www.forestgeo.si.edu/what-forestgeo/news-blog](http://www.forestgeo.si.edu/what-forestgeo/news-blog))

We have also been in contact with Mr Brent Lewis, University Landscape Architect, and coordinator of the campus tree inventory. Mr. Lewis is supportive of incorporating the Trelease census data into this inventory <https://illinois.edu.treekeepersoftware.com/>  
See attached letter of support.

## **Financial Information**

*In addition to the below questions, please submit the supplemental budget spreadsheet available on the Student Sustainability Committee [website](#). 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?**

Yes - this is continuing funding request to complete the census of Trelease which was started in the Fall semester 2018.

### **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.*

Once we have the complete census we will not require additional funding for the project until 2023 when we will be able to provide research opportunities for an additional group of ~60 students. However, the costs of the next (and future) censuses will be much lower as we will have already mapped and tagged the majority of the trees. We will also be eligible for a funding from the ForestGeo network.

### **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.*

We have received funding support from the School of Integrative Biology for car rental and gasoline costs associated with transporting students to Trelease Woods. In addition both SIB and NRES each provided the summer hourly worker wages for one student working for 10 weeks.

## **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 \(iCAP\)](#) goals?**

This project addresses iCAP Objective #5 in the area of Agriculture, Land Use, Food, and Sequestration: Determining the carbon sequestration value of existing university plantings. While the focus of iCAP is to inventory trees and other plantings on the main campus, the university also manages a network of natural areas that sustain carbon-rich old-growth forest. These provide a benchmark of soil and biomass carbon storage of natural vegetation in the C-U area for comparison with new plantings, and will provide information on the carbon storage potential of native species introduced into campus planting initiatives. We have also been in contact with Mr. Brent Lewis, coordinator of the campus tree inventory, to ensure that data collected at Trelease and on campus are comparable. A full set of the Trelease census data will be provided to the campus tree inventory project.

**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.*

**The proposed census provides the core dataset that is needed to determine biomass carbon storage in Trelease woods. Results from this census can also be applied to the university's other natural areas - including Brownfield, Hart, Rutan, Richter and Funk Woods and the Vermillion River Observatory. In total the university manages 224 ha (553 acres) of mature or late secondary forests. Future student projects can sub-sample from these woodlands in conjunction with Trelease Woods data to generate carbon storage estimates for all university wooded areas.**

**The first project milestone will be completion of mapping, measuring and identifying all woody trees in the Trelease plot. We anticipate finishing this in Summer 2020.**

**The second milestone will be the completion of data quality checks on the full Trelease dataset, including review of species identifications for hard to identify species (elm, ash and hickory species). During the data quality check we will also visit all ash trees recorded in the census (estimated 700 individuals) to determine tree health (ash trees are currently undergoing a dieback associated with emerald ash borer infestation). We anticipate finishing this in Fall 2020.**

**The third project milestone will be soils data collection for the Trelease Woods carbon map. This map will require four components: the tree census (on-going), the standing dead wood survey (initiated by undergrads in Spring 2019), the coarse woody debris survey (estimation of the amount of dead wood on the ground to be started in spring 2020), and the soil carbon survey (to be started in summer 2020). We anticipate completing the soil carbon map and inventory in summer 2021.**

**The fourth project milestone will be integration of the four components of the Trelease Woods carbon map to generate the Trelease ecosystem carbon budget. This will provide the baseline for carbon sequestration in mature forest for comparison with carbon sequestration achieved with campus plantings. Once this budget is complete we will be able to compare the current status of Trelease with data from past partial censuses of Trelease carried out from 1922 – 2004 to determine how carbon sequestration at Trelease has changed over the last century, and is likely to change in the future. During wet days over the summer 2019 our hourly undergraduate student workers collated and entered these data in a new Trelease Woods**



database ready for the completion of the census. We anticipate completing the ecosystem carbon budget in early Fall 2021.

Beyond these milestones there are several potential impacts of the census that can be measured over the long-term:

(1) Contribution of Trelease to our understanding of regional and global carbon budgets. Once the census is completed the plot data will become available for Forest Geo network wide analysis and collaboration. A measurable environmental impact will be the extent that the Trelease data are used in, and contribute to, science and policy papers that address climate change effects and mitigation measures associated with managing or enhancing forest cover.

(2) Contribution of census activities to the training of the next generation of environmental scientists. Work on the Trelease census will provide a diverse pool of students with experience and transferable skills which are likely to impact their career choices and career success. We will consult with CITL and Illini Success on developing surveys of students engaged in the census before and after working on the plot to determine how the experience has influenced attitudes towards, and preparedness for careers in ecology and environmental science. Similar to the Santa Cruz plot, we will also maintain a database of census participants to permit long-term engagement with these "Trelease alumni."

(3) Adoption of management for iCAP objectives from Trelease data. Data from the census, and future re-censuses of the Trelease Woods will provide data on native species with traits that can maximize carbon sequestration. An additional impact will be the extent to which Trelease Woods census data informs planting designs and species choice for restoration and carbon sequestration on campus. We will therefore make Trelease data available to campus leaders and faculty involved in iCAP activities, in particular the iSEE Agriculture, Land Use, Food and Sequestration SWATeam.

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

Our recent video and LAS newsletter highlighted the importance of university natural areas as research and education resources, and as rare remaining areas of high-quality natural habitat in a predominantly agricultural landscape. Many students (and other members of the campus community) are unaware of the existence of these sites, and of the opportunities to integrate them into research and education activities. The Trelease census has also garnered attention outside the university. For example, the LAS newsletter story put us in contact with a landowner in central Illinois interested in using census data for the management of another similar forest in Livingston county.

Our specific outreach goals are:

1. To highlight the student-led census, SSC support and broader research goals of the project through print and other media
2. Educate all SIB and NRES undergraduate students on the importance of carbon sequestration from forest biomass through classroom activities designed around the Trelease woods census.
3. Provide an opportunity to all interested undergraduate students to participate in research in forest ecology through (i) participating in the census during Fall and Spring semesters, (ii) participate in the census as hourly undergraduate workers over the summer, (iii) develop and conduct independent research using the census data.

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

Carbon sequestration through reforestation has been highlighted as the most cost-effective approach to mitigating the climate warming effects of increasing atmospheric CO<sub>2</sub> (Bastin et al. 2019). Furthermore, mature temperate forests dominated by oak forests have among the highest above ground-biomass and soil carbon storage of any forest ecosystem. Long-term studies in the Trelease forest can provide insights into

**how to manage and restore these forests and therefore help combat a fundamental basis of environmental injustice.**

**Bastin J-F et al. (2019) The global tree restoration potential. Science 365:76-79**