*Please submit this completed application and any relevant supporting documentation by the deadline listed on the SSC website 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 SSC at* *Sustainability-Committee@Illinois.edu**.*

# General Information

**Project Name:** Student-led census of the Trelease Woods Forest Dynamics Plot

**Total Amount Requested from SSC:** $95,000

**Project Topic Area(s):** [ ] Energy [x] Education [ ] Food & Waste

 [x] Land [ ] Water [ ] Transportation

# Contact Information

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**Project Team**

|  |  |  |
| --- | --- | --- |
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# Project Information

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

Understanding how climate change, atmospheric nitrogen deposition, and invasive plant species will impact the future tree species composition and carbon sequestration potential of Midwestern forests will require the establishment of long-term forest dynamics plots. These plots are large enough to capture ecologically-relevant sample sizes of populations of dominant tree species, and by means of periodic censuses, track rates of growth, mortality and recruitment of plant populations. In addition, by estimating both soil and vegetation carbon stocks, they provide predictions for long-term carbon sequestration trends essential to calibrate earth-system models.

Over the past 30 years a global network of forest monitoring sites has been established by strategic partnerships between the Smithsonian Institution and universities and forestry departments. This ‘Forest-Geo’ network currently monitors 6 million trees, and 10,000 tree species in 63 plots and 23 countries (<http://www.forestgeo.si.edu)>. Plots in the network are censused every five years using a detailed shared protocol generating data on forest productivity and dynamics. Across the Midwest, plots have now been established in Missouri, Indiana, Wisconsin and Michigan in collaboration with our peer institutions (Washington University, and Big Ten institutions: Wisconsin, Indiana and Michigan).

The goal of this project is to establish Trelease Woods, a 24 ha old growth deciduous forest, and a university-managed natural area, as the next site in the Forest-Geo network.

Unlike other forest plots currently in the Forest-Geo network, Trelease wood has an extraordinary history of study, allowing us to reconstruct the past as well as present composition, structure and carbon storage. The woods, which once were part of a much large prairie forest grove, were purchased in two sections in 1917 and 1918. The first census of the tree community was carried out in 1922, with subsequent surveys in 1928, 1931-44, 1964, 1976, 1986, 1995, and 2004. This is the longest survey period for any Midwestern forest, and one of the most thoroughly surveyed forests in the world. During this period, Trelease has gone through dramatic transitions in its composition – including a long-term decline in oak abundance, a complete die-off of 1200 elm trees associated with Dutch Elm disease in 1955, and a replacement by sugar maple. A survey by undergraduates in the IB372 class in Fall 2017 showed that Trelease is now going through another major transition, with nearly all of the 700 ash trees infected by emerald ash borers.

We propose to complete a first census of Trelease woods in 2018-19 following the standard Forest-Geo protocol, allowing Trelease to enter the plot network. In the census, all trees with a diameter >1 cm are mapped, tagged and identified, with the commitment that the plot will be re-censused every five years. Trelease data will contribute to analyses of global forest productivity and carbon storage data. More importantly however, we propose to make Trelease the second student-led forest dynamics plot, following a model established in 2007 at UC Santa Cruz. At the Santa Cruz plot, over 100 undergraduate students have been involved in plot-base studies through undergraduate courses, senior theses, and internships. We anticipate that similar numbers of students will be involved either in the Trelease census itself, or in the use of the forest plot dataset, by participating in field projects designed using the data for the core Integrative Biology major course, IB203, Integrative Biology Honors Ecology class, IB372, the core NRES major course, NRES 219 - Principles of Ecosystem Management, and NRES 419 - Environment and Plant Ecosystems.

Please provide a brief summary of how students will be involved in the project:

The plot census will supervised by Profs. Dalling and Fraterrigo. We will hire a graduate student from the Dalling lab, with experience in establishing Forest-Geo style plots in Panama, to train groups of students to carry out the census. Dalling will consult with Prof. Greg Gilbert at UC Santa Cruz, who has developed protocols for student training, in-field data entry, and data quality verification in their own student-led Forest Geo plot. We anticipate that a group of ~30 undergrad students from ACES and IB will be involved in the census. In addition to collecting field data, students will be trained in using the programming language R, and existing R packages already developed for analysis of Forest-Geo data, to provide the first-cut analysis of the Trelease plot data.

Although other old growth forests are in the university’s natural areas network, we have selected Trelease for this project because it is a key site for undergraduate education in ecology. Currently ~25 students per year from IB372 and ~120 students per year from IB203 spend three weeks collecting and analyzing data in Trelease woods each Fall. The plot dataset will provide an exciting new resource for these courses. Students will be able to explore and analyze plot datasets in the lab, while students and course instructors will be able to use plot data to develop hypotheses for class projects in the field. For example, the plot census will generate high resolution maps of the distribution of individual tree species. This will allow students to explore how local population density, or local neighborhood composition of tree species influences processes like seed predation, herbivory or the incidence of disease.

Please provide a brief summary of the project timeline:

Based on our experience at other Forest Geo plots (Dalling has worked in plots in Utah, Panama, Malaysia, Colombia, Ecuador, and Thailand) we anticipate that it will take about 7000 person hours to complete the census. We anticipate training several groups of students that will each work 1-2 days per week on the census, optimally with a group of 8 students in the field at one time. Funds permitting, we will hire the first group of students to work in the plot starting in August 2018, and will work until the end of November (4 months). The second group of students will restart the census after Spring break and work from April unti July, completing the census in one calendar year.

Data will be collected using tablets in the field. Dalling and Fraterrigo will review the data as it is entered and with the student RA, randomly checking 10% of trees to ensure data accuracy. We then anticipate spending one month (July-August 2019) preparing the data to make it available to NRES and IB ecology classes starting in the Fall semester 2019.

Additional comments

Trelease woods is currently undergoing a major compositional shift, reflecting the die-off of a major canopy species caused by an invasive insect pest (emerald ash-borer). Given historical data on Trelease we will be very well placed to analyze how this replacement (most likely by sugar maple) will impact forest carbon storage at Trelease, and likely other Midwestern forest fragments.

An additional rationale for incorporating Trelease into Forest Geo is that other forests in the network are unusually highly managed (for example the Tyson plot in Missouri is fenced to remove deer). Trelease woods, while managed to exclude invasive species, is more representative of prevailing conditions in wood-lot forests across the Midwest, where fire suppression, and high levels of deer browsing strongly impact forest regeneration.

Finally, incorporation of Trelease into the Smithsonian Forest Geo network will bring prominence to the Trelease site and to the SSC, and allow us to access funding sources and additional resources (e.g., soil analyses and remote sensing data) that are provided by the Forest Geo network. Furthermore, although Forest Geo does not fund plot censuses directly, students working in the plot will also be well-placed to take advantage of internship and studentship opportunities offered by the network (e.g. here: http://www.forestgeo.si.edu/article/255/).