5. Overview and purpose of the project:

Addressing agriculture challenges is a main focus of sustainability science. Global food demand is expected to double by 2050. At the same time, environmental impacts from agriculture are already at unsustainable levels (Tilman et al. (2011) *PNAS* 108: 20260–20264). Urban agriculture can help meet food demand without compromising natural lands. It can also improve nutritional conditions and alleviate food insecurity for vulnerable urban residents.

Research on urban agriculture provides excellent opportunities for combining scientific inquiry, education, and community service. The Corner Store Procurement Project combines greenhouse research on crop production with service to a nutritional program run by the Minneapolis Health Department. Here I request Campus Sustainability Funds for infrastructure, consumables, and student stipends to support this project. These investments will allow our students to conduct distinctive and impactful research projects, to contribute to the community, and to increase awareness of food insecurity and other agricultural challenges.

*Background:*

Food insecurity—when people lack the resources for or access to affordable, nutritious food—is a growing problem in the United States. The US Department of Agriculture estimates that 15% of American households faced food insecurity at some point over the last year (http://www.ers.usda.gov/publications/err-economic-research-report/). Food insecurity increases the likelihood of obesity and all of its associated health consequences including type-2 diabetes. Obesity is a major health concern in the United States; the Center for Disease Control reported that almost 36% of adults and 17% of children in the US were obese in 2010 (http://www.cdc.gov/obesity/). Food insecurity and obesity can be particularly high in low-income urban areas where car ownership is low and supermarkets are rare. Residents of such neighborhoods often get food primarily from corner stores that carry mostly highly processed convenience foods.

The City of Minneapolis has launched an initiative aimed at reducing food insecurity in low-income neighborhoods. This program, called the Healthy Corner Store Initiative, encourages corner stores owners to stock more fruits and vegetables. It has had mixed results since its inception in 2010 (http://minnesota.publicradio.org/display/web/2012/10/18/health/corner-stores-experience-with-selling-fresh-produce-a-mixed-bag). One main problem has been that store owners have had difficulty finding the small
quantities of produce they need at affordable prices. In response, owners have had to buy produce from grocery stores to stock their shelves. The time and money that this requires has made participation in the program difficult.

This situation inspired us to develop the Corner Store Procurement Project (CSPP). The CSPP combines undergraduate-led research and community service. As a research project, we conduct studies in the JRC greenhouse on the UST campus to test the effectiveness of urban agriculture methods. In our inaugural run in spring 2013, UST first-year student Taylor Schuweiler and I are testing how earthworm-generated compost from spent coffee grounds affects plant growth and nutrient content; we are comparing compost effects to those of synthetic fertilizer or uncomposted coffee grounds. Our main question is how fertilizer effects differ among common vegetables: lettuce, mustard greens, collard greens, tomatoes, cucumbers, and potatoes. While it is known that composting coffee grounds with earthworms can increase concentrations of nitrogen and other minerals (Liu and Price 2011), it is not yet known how effectively vermicomposted coffee increases crop growth or crop nutrition, nor how effects differ among crops. The results of our study will thus be publishable and useful to scientific and greenhouse grower communities.

For the service component, we are coordinating with partners from the Minneapolis Health Department to deliver the “results” from our greenhouse study to stores participating in the Healthy Corner Store Initiative. We will be selling the produce from the experiment at market price to the stores, and we will be tracking store owner and customer interest in our vegetables. Once we establish our delivery system, we will be able to measure whether these deliveries of locally produced vegetables impact sales in participating stores. Our hope is that increased access to high-quality vegetables will lead to increased participation in the Healthy Corner Store program.

In sum, the CSPP combines urban agriculture research with community service, and provides opportunities for undergraduate students to develop and manage a research project from start to finish.

My goal is to continue the CSPP indefinitely. There are dozens of additional hypotheses related to urban agriculture that can be tested in our system. Almost all agriculture research is focused on large-scale farming methods, so studies seeking to identify best practices for urban agriculture would be valuable contributions. Moreover, we can continue to design these projects such that the produce generated can contribute to the Healthy Corner Store program.

**Current funding request:**

Here I request funds for greenhouse infrastructure and disposables to support the CSPP during the 2013-2014 academic year.
One part of the request is funds for grow lights and supports. We are conducting our current experiment on the single level of shelving that exists in our JRC greenhouse bay. We will be building temporary shelving in the bay this spring. Although this will give us additional space, it likely will not increase production capacity unless we purchase grow lights for the lower shelves.

I am also requesting funds for supplies (soil, pots, and seeds) and student salary for the 2013-2014 academic year. I hope that this funding serves as a bridge until I can secure external funding to support the project over the long term.

6. How the project will be implemented:

Implementation of the project will be straightforward. We will work with Brad Moore (head of carpentry) to construct additional shelving in August 2013. We will also purchase grow lights and install them in August 2013. We will purchase additional pots, soil, and other supplies in August 2013 for use throughout the 2013-2014 academic year. We will then conduct experiments as part of the CSPP in fall 2013 and spring 2014.

7. Budget:

a. 8 Evergreen fluorescent 4-ft. grow lights with 4 lamp fixtures. These are premium, durable grow lights suitable for industrial use. ($150/light = $1200). Price estimate from http://www.greenhousemegastore.com/


d. Lumber and labor for additional shelving construction (estimated to be $1000 based on quote from Brad Moore, UST carpenter). Price estimate from personal communication.

e. Pots for planting (80 1-gallon pots (~$1/pot), 40 2-gallon pots (~$1.50/pot), and 80 5-gallon pots (~$2/pot) = $300). Price estimate from http://www.homedepot.com/

f. Potting soil and rice husks (soil structural materials). $300. Price estimate based on previous orders from BFG suppliers.

g. Seeds. $300. Price estimate based on previous orders from seedsofchange.com

h. Student support. I would like to use CSF funding to pay 1 student to work 10 hours per week in both the fall and spring semester and 20 hours a week in January term (to run the project and to work on data analysis and manuscript preparation). Estimated costs are (Fall: 15 weeks at 10 hours/week, $10/hr =
$1500, January: 4 weeks at 20 hours/week, $10/hr = $800, Spring: 15 weeks at 10 hours/week, $10/hr = $1500, Total = $3800

Total request is: $1200 + $300 + $40 + $1000 + $300 + $300 + $300 + $3800 = $7240.

8. Include defined metrics for a clearly measurable outcome and a schedule of appropriate progress reports to the CSF through the duration of the project:

We will inform CSF when the work has been completed. We will provide CSF with blog posts written about the project (which will be posted on the campus sustainability blog utsustainblog.com), conference proceedings, and any publications and press that come out of the project.

9. If your project will offset greenhouse gases and reduce the campus carbon footprint, describe thoroughly how this will happen:

The project is not specifically designed to offset greenhouse gas emissions. Instead, it aims to increase awareness of sustainability issues and to provide training for students interested in sustainability science careers. The project is closely aligned with the UST Stewardship Garden project, which has already extended awareness of nutrition, food security, and other sustainability issues across campus and in the surrounding community. The CSPP extends those efforts by focusing on integrating agriculture research into an established social service program. I hope that this research-service combination can serve as a model for other urban agriculture research programs. In addition, the CSPP is well-suited as a research experience for undergraduates. The scale of the projects makes it feasible for students to play leading roles; this program will thus give students valuable scientific training. In addition, I think the novelty of this approach will mean that the results will be useful for the scientific community and the general public. Publishing this work will help students professionally by making them more attractive candidates for sustainability-science graduate programs.

As an aside, my plan for the future is to have our greenhouse equipment (e.g., grow lights) be powered by renewable power sources. If I can work on the logistics, I will submit a CSF proposal in 2014 for solar panels to support the JRC greenhouse.

10. Describe if and how students will be involved and/or the educational value to our community:

Students have been and will continue to be central components of this project. Current student Taylor Schuweiler is leading the current study. Other Kay lab students (Elizabeth Chambers, Ashela Richardson, Tyler Abrahamson) will help with the distribution to corner stores. Students will also be co-leaders of all future research projects associated with the CSPP.

I hope that the novelty of this project will bring attention to food insecurity,
nutrition, and other important sustainability issues. We are currently working with student videographers on a video to highlight the project, and we will certainly complete related advertisements in the future.

11. **Highlight innovations and the potential for the project to be scalable across our campuses:**

   This project is an innovative integration of research, education, and service. Very few projects provide students the opportunity to engage in discovery science while also making a tangible contribution to their community. The greenhouse purchases will allow us expand the research component of the project, and will greatly enhance the experience of students participating in the project.

   This project has a lot of potential to be scaled up. My community partners at the Minneapolis Health Department are very excited about the project and would love to see it expand. It should be possible to create a network of similar projects in collaboration with other regional liberal arts colleges. We are also discussing how we could integrate outdoor urban agriculture projects with Health Department programs. In addition, my colleague Dalma Martinovic-Weigelt and I are submitting a grant to the National Science Foundation to extend this and our other related projects on urban agriculture. Finally, I plan to write a concept article about research-service integration for an ecology journal. My hope is that these efforts will catalyze related activities at UST and at other institutions.

12. **If applicable, include lifecycle costs, possible investment payback schedules and potential long-term savings:**

   Not applicable.

13. **If necessary, include additional supplemental materials as an appendix to the main application. Please limit the application plus appendix to no more than 10 total pages.**

   Not applicable.