

Memo

To: Alan Townsend
CC: Dean Urban
From: Jesko von Windheim
Date: 4/9/15
Re: 2015 Summer Grant Program – Submissions

NSOE Summer Grant Program Summary

The Nicholas School of the Environment (NSOE) has announced its 2015 Summer Grant from the school's Environmental Innovation and Entrepreneurship Program. An amount of up to \$5,000 per team member (but not more than \$20,000 per team) was awarded to one or more student teams selected to work on developing and/or launching a business enterprise (for-profit or not-for-profit) that is focused on creatively solving a pressing environmental problem.

Final project approvals are summarized in Table 1. Details of the three funded programs are provided in the appendix.

Table 1

Project	Participants	Description
Canopy Scientific	Aaron Berdanier Ramsey Meigs Antje Lang	Measure forests with small, unmanned aerial vehicles (UAV) equipped with LIDAR to help forest landowners sustainably and affordably manage their natural resources.
Anaerobic Digestion Pasteurization System (ADPS)	Aaron Forbis-Stokes Zhu Mei Daniel Rittschof, Ph.D. Danny Suits	Develop a business addressing sanitation in Spermonde Islands, South Sulawesi, Indonesia using a proven method for anaerobic digestion of human waste to generate biogas. Initial funding investigates implementation on Barrang Lompo
FullCycle	Elizabeth Albright, Ph.D.	Investigate a bicycle-based, restaurant take-out delivery and compost pick-up company serving residents and restaurants in the urban core of Durham, North Carolina

Appendix: Project Descriptions

1. Canopy Scientific

Accurate and affordable forest carbon measurements for small forest landowners.

Project Goal

Canopy Scientific's goal is to measure forests with small, unmanned aerial vehicles (UAV) to help forest landowners sustainably and affordably manage their natural resources. This summer, we will complete a proof-of-concept project, begin promoting our services, and build our customer base as we work towards incorporation in late 2015.

Project Description

Environmental problem and opportunity

Forests provide multiple environmental benefits to society, such as natural resource jobs and forest products, wildlife habitat, recreational opportunities, and a range of ecosystem services. Landowners throughout the Eastern United States rely on forest measurements to assess sustainable harvest limits, identify conservation areas, and market carbon storage services.

However, these measurements are currently expensive, time-consuming, and uncertain. Forest carbon projects are particularly expensive to develop, which prevents many small forest landowners from accessing lucrative carbon offset markets. This issue is greatest for the over 550,000 forest landowners in the Eastern U.S. with relatively small properties (<5,000 acres).

Canopy Scientific proposes to reduce the cost of measuring and monitoring forest carbon using recent technological advances in forest biometric data collection and analysis. An investment in our technology and team will allow us to (1) offer small forest landowners a unique conservation finance tool to protect their land through carbon offsets and (2) develop proprietary forest measurement tools and models applicable in a wide range of forest management settings beyond carbon, including traditional timber cruising, wildlife surveys, and forest health modeling. These proprietary tools will allow Canopy Scientific to diversify its services and establish itself as the preeminent emerging company in remote sensing forestry.

Summer 2015 goal and feasibility

This summer, we will complete a proof-of-concept project that will help us begin marketing and selling our services. We will demonstrate our ability to accurately and affordably measure forest attributes with test flights and spend time designing and producing company promotional materials. Our project has already gained interest and momentum: this spring, we won first runner-up prize and a starting grant from the North Carolina Institute for Emerging Issues that will cover some of our initial capital needs. We have also established partnerships and are planning test flights for forest carbon inventories this summer with three organizations: *The Duke Forest*, *The Forest Company* (Chapel Hill), and *Urban Offsets* (Durham). These groups have agreed to provide property access and materials for us to develop our proprietary forest measurement models. Further support from the Nicholas School Grant in Environmental Innovation and Entrepreneurship will be essential for us to complete these analyses, prove our capabilities, and launch Canopy Scientific.

2. FullCycle

Take-out delivery and compost pick-up company

Project Goal:

To conduct a feasibility study of an innovative, for-profit start-up, named FullCycle, a bicycle-based restaurant take-out delivery and compost pick-up company serving residents and restaurants in the urban core of Durham, North Carolina. Through the integration of bicycle food delivery with a composting service, the company will seek to maximize diversion of food waste from landfills, minimize the use of non-biodegradable, single-use packaging and encourage the use of bicycle transportation in Durham.

Project Description

Environmental problem and opportunity

Approximately a third of food that is produced globally goes wasted, much of which is discarded—not only clogging our landfills but also depriving our soils of the return of vital nutrients. As food waste decomposes in landfills, nutrients are locked away from productive soil, increasing emissions of greenhouse gasses through decomposition and increasing soil nutrient loss. Minimizing food waste could provide economic, nutritional and environmental benefits. Capturing this stream of food waste in innovative ways not only reduces waste loads of landfills, but could provide a value stream to individuals and companies in need of nutrient-rich soil.

The use of non-biodegradable food packaging, used by many restaurants across the US, further exacerbates the issue of food waste. In a January 2015 study of 47 restaurant chains and grocery stores in the United States, the Natural Resources Defense Council found that the prevalence of disposable single-use packaging wastes approximately \$11.4 billion per annum in lost materials to landfills or that otherwise pollute our earth's oceans and lands. Reduction of food waste and single-use packaging are critical for the protection of our nation's natural resources, as well for the mitigation of greenhouse gas emissions. Food waste, if seen as a nutrient-rich valued commodity, may provide innovative market opportunities. By promoting a company that focuses on the complete lifecycle of food production and consumption, FullCycle hopes to change how Durham thinks about food consumption and waste production.

An Innovative Solution

Durham, North Carolina, a mid-size city with a burgeoning nationally-recognized restaurant and locally-based food culture, provides a laboratory to investigate creative means to capture this nutrient-rich stream of food waste and encourage its beneficial use. While several cities have very profitable bicycle delivery companies and many support composting services, integrating these two services into one provides a novel approach to tackling the food waste problem. Dr. Elizabeth Albright proposes the development of an innovative start-up company, FullCycle, a bicycle-based food delivery company that encourages and incentivizes composting and the reduction in use of non-biodegradable packaging material. Through a smart-phone app- driven ordering system, residents in neighborhoods in and adjacent to downtown Durham may select and order restaurant meals to be delivered to their home via an ELF, a locally-produced solar-powered bicycle. Individuals who would like to compost their own food scraps but who are limited in time or space, may join the composting service for a monthly fee. Those customers who order food delivery AND participate in the composting program will receive a discount on the food delivery fee.

For the monthly fee, FullCycle will offer customers composting containers along with a monthly pick-up of compost material from their residences. This service will reduce the barriers to composting, particularly for those clients with inadequate space to compost at their home or apartment. To incentivize participation in the composting program, customers participating in the program will receive discounts on the food delivery fee. The collected food scraps will be composted at a centrally located facility in downtown Durham. Twice yearly, FullCycle will deliver composted soil to those participating in the program. For those individuals not able to use compost, their allotment of composted soil can be sold to local businesses or residents or donated to local community gardens. To help reduce the use of non-biodegradable single-use containers, restaurants will be required to use biodegradable packaging for deliveries. Locally-produced solar-paneled bicycles (ELFs produced by Organic Transit), will be used for food delivery, encouraging bike transit across increasingly-congested Durham.

Durham provides a nearly ideal laboratory to test this business concept due to: (1) significant increases in residential density in downtown areas due to new construction of a number of urban residential loft and apartment complexes; (2) a robust and vibrant assemblage of locally focused restaurants that are increasingly garnering national attention; (3) the presence of innovative independent, entrepreneurial companies and organizations that emphasize sustainability and entrepreneurialism, such as Organic Transit, Tilthy Rich, SEEDS and Keep Durham Beautiful; and (4) community members who are concerned about sustainability issues.

The proposed feasibility study will: (1) assess current and projected demand for take-out delivery in the urban core of Durham; (2) evaluate type of take-away packaging currently used in Durham restaurants and assess costs to and willingness of restaurants to switch to biodegradable containers; (3) examine current residential composting practices and identify barriers and incentives to increase composting practices; (4) assess bicycle travel times from restaurants to neighborhoods adjacent to the urban core; (5) examine potential composting sites in downtown Durham; (6) evaluate the demand and willingness to pay for composted soil of households, businesses, including local farms and urban gardens, and non-profits located in Durham, NC and (7) assess costs of implementing the bike food delivery and compost pick-up service (e.g., website and app development, onsite composting costs, ELFs, labor, etc.).

3. Anaerobic Digestion Pasteurization System

A novel sanitation technology developed for low-resource environments.

Project Goal

Our goal is to develop a business addressing sanitation in Spermonde Islands, South Sulawesi, Indonesia. The business would begin with a demonstration project that relies on anaerobic digestion of human waste to generate biogas on Barrang Lompo.

Since 2010, Rittschof and professional masters from Duke University have collaborated with Hasanuddin University and Mars Symbioscience on conservation programs in the region. Coral reef ecosystems have become severely damaged, compromising environmental, social, and economic sustainability. In addition to improper fishing practices, land-based pollution from plastics and organic wastes have contributed to this decline. Sanitary conditions are rudimentary on the islands. Households use pit toilets and the waste has no way to be disposed safely. Furthermore, electricity is only available for several hours a day and from small scale diesel generators. We learned that environmental changes in the islands are so slow that local people do not perceive environmental deterioration as a pressing issue. Thus, we deduced that local people require economic incentives to participate in conservation efforts, which has informed our approach to meeting their needs in order to improve the environment.

Our proposed sanitation business seeks to meet the needs for improved waste treatment and sustainable energy supply in order to holistically improve the environment and livelihoods on the island.

Project Description

We propose to build a sanitation service industry that provides waste collection, treatment, and reuse. Waste treatment and reuse will be provided by the Anaerobic Digestion Pasteurization System (ADPS) – a novel sanitation technology developed by the Marc Deshusses Lab, Duke University. The ADPS would be a demonstration project on Barrang Lompo, an island of approximately 89 hectares, with a population of about 5000. The high density of population is ideal for the project.

Using the inputs of collected sewage (and potentially other organic waste as determined by proposed workshop) the ADPS generates biogas while treating wastes. A portion of the biogas powers a simple heater to sterilize the digested waste while the remaining biogas can be used for other energy purposes.

The development of renewable energy is highly encouraged and prioritized by Indonesian government policies, including a program specifically targeting biodigester construction. Additionally our current collaborator Mars Symbioscience has corporate interests in organic waste treatment. These frameworks as well as a recently renewed MOU between Hasanuddin University and Duke University that enables business create an enabling, strategic environment.

The project would be finally commercialized and operated by the local community. We would set up a business to collect waste and maintain the facility. Our business model would connect biogas with “Trash Bank”, a waste recycling collection system on the island, for example, trade biogas for plastic in order to set up an integrated waste management system. The small profit stream by selling plastic is hopefully to keep the biogas business solvent.

If this demonstration project were successful, it would be a model for additional facilities on Barrang Lompo, similar facilities on other islands in the archipelago and might be considered for other waste stream needs in Indonesia.