Proposal Title: Rooftop Gardens

Total number of pages (not counting cover pages): 9

Student Name: Rachel Alm
e-mail address: alm@eden.rutgers.edu
Major(s): EPIB and History
Minor(s): None
Planned graduation: 2014
Month and Year: October 2014
Mailing address: 4 Matthew Ct, Bordentown, NJ, 08505
Contact phone number: (As necessary, please reproduce and fill in the contact information fields for all the students collaborating on this proposal below, adding more pages if necessary.): 609-575-105
Faculty advisor name: Dr. Rachael Shwom
Title: Professor
e-mail address: shwomrac@rci.rutgers.edu
Department: Human Ecology
Campus phone number: 848-932-9235

200-word (maximum) summary of the proposal or video:

The proposal focuses on the idea of green roofing on campus buildings that are viable as rooftop gardens as well. The main premise of the proposal is to implement a rooftop garden atop Brower Commons that will extend to other University buildings upon the completion of the trial run. The focus will be on the promotion of energy efficiency through the use of green roof and the promotion of localized farming to decrease the number of miles students and community members travel in order to purchase localized food.

The project will further promote green activities and includes calculations of various green roofing systems and studies of rooftop gardens in order to get a better understanding of the viability of the project.

Rachel Alm

March 10th, 2014

Environmental Solutions

Energy Initiative Project

Rooftop Gardens

The University is an energy waster but it is also taking steps to alleviate that burden on the environment. There are many ways to innovate waste reduction, but Rutgers University still has a long way to go in decreasing the amount of waste produced by its buildings, offices, and facilities. The idea I am proposing through this presentation is to install green gardening center on various Rutgers-affiliated buildings (notably, Brower Commons) in order to decrease energy usage, save money, and encourage a community gardening center that would thrive with student involvement and help promote localized and seasonal eating. This would take into account both aspects of dining services, and Rutgers Green Initiatives, and would heavily involve and be dependent on student help. The proposed project would promote beautification, nutritional awareness, the importance of sustenance farming, local sourcing, and would reduce energy consumed by the buildings that house the gardens. To accomplish all of this, University infrastructure specialists will have to work with both local community members and dining services to make this project as robust and far-reaching as possible.

The dining services program at Rutgers already implements food recovery program that is fairly environmentally aware in it waste reduction. They have an agreement with Pinter farms to sell their scraps for animal feed. According to an article by the EPA, Rutgers saved $100,000 in 2007 by using the food for animal feed instead of traditional disposal. While this is a great way to rid the dining halls not only of excess food waste (put to good use in farming) but also the

financial burden of disposing of it elsewhere, there are other areas that can work with the recovery program to better manage awareness not only for the dining halls, but for the University as a whole.

Urban areas face a difficult climate when it comes to locally grown sourcing--there just simply aren't enough farms in New Jersey compared to the number of people who live within the borders. Rutgers University is an urban campus but there are many ways to keep it "green". The actual construction of the garden would prove to be the largest part of the project to tackle and would require student input and planning in regards to the upkeep. It can be collaborative between students, city leaders, and University leaders. Rooftop gardening itself is a healthy alternative to clearing land for farming, as it utilizes already existing areas. A GIS study conducted by the Bloustein School produced viable rooftops for green gardening that included University and community rooftops (Newman, Kathe *et al.*). Infrastructure specialists would need to survey the most suitable housing positions for a rooftop garden, based on the necessity of repairs to older buildings, which plays a big role in cost efficiency if the roofs in question needed replacing.

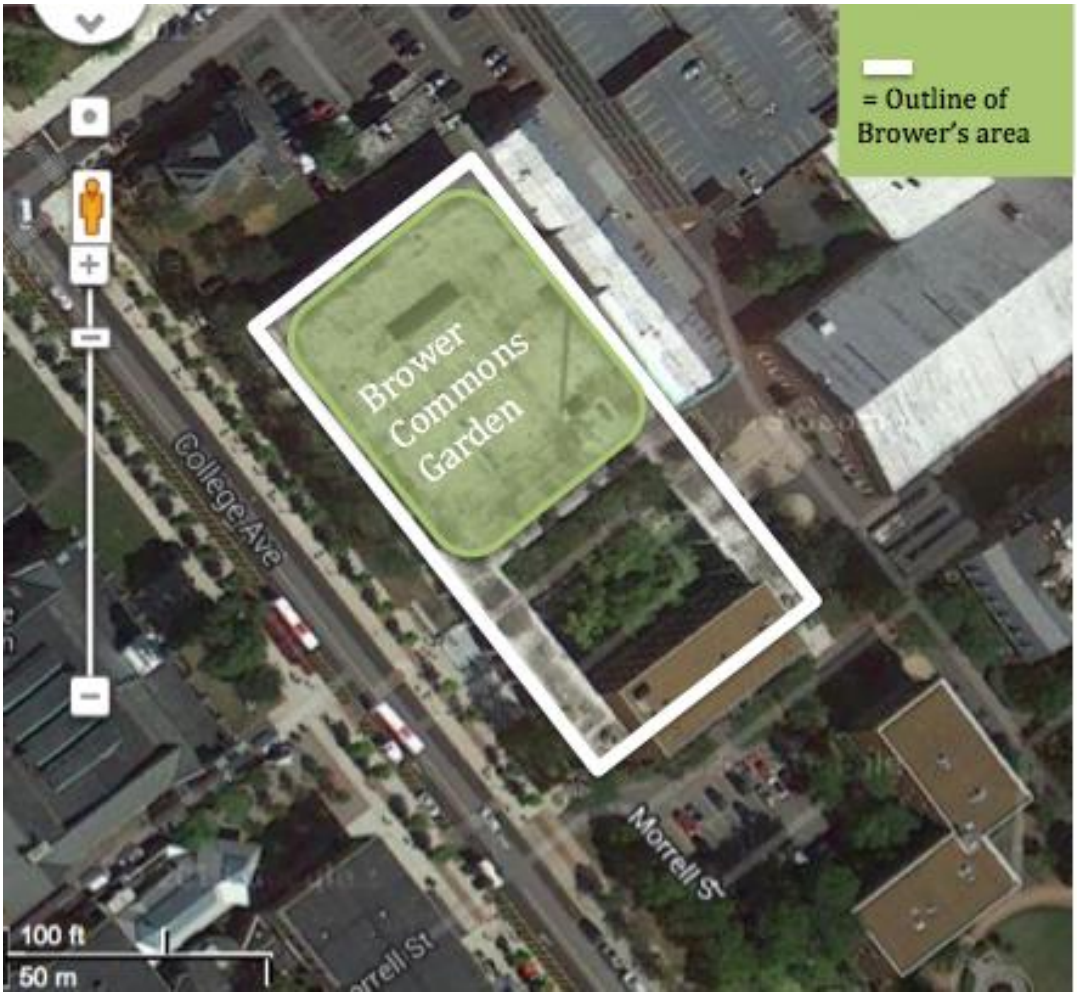
A rooftop garden would help to alleviate costs associated with heating and cooling of the buildings that they were built upon. The Chicago City Hall is an example of a successful green roofing project, as it saw decreases in temperatures of the town hall, and the installation helped to absorb 75% of the rainfall of an inch before there was stormwater discharge. Since the inception of the project, the City of Chicago has seen and increases to around 5,469,463 square feet of green roofing. Since stormwater is a large issue in urban centers, having a green roof that functions as both a garden and as a water collection unit will serve the community on both levels. The City of Chicago website utilizes GIS to help locate the green roofs in the community, and

the Rutgers Bloustein School's study did the same. Using GIS as well, the School charted over 122 potential rooftop sights for green building, most of which were either associated with the University itself, or were government buildings. Of the 944,895 square feet that Rutgers owns, 33% of that (or 315,445.35 square meters) is suitable for sustainable growth. This information is available through the Bloustein School's Report on Sustainability. If all the University buildings were turned "green" using the roof project, there would be monetary savings double the cost of the installation.

According to the University of Michigan, a space of 21,000 square feet could cost $464,000 to install if it were a green roof versus $335,000 for conventional. This is a price difference of 12,900 dollars but the savings of the roof, due to energy efficiency in the building itself, numbered around 200,000 dollars annually—much higher than the initial price difference. If this same idea and cost efficiency were applied to Rutgers green roofing initiatives, around 3,004241.42 dollars could be saved off a green roof that cost 6,969,840.09. Meaning that in two years the installation of the roof will have virtually paid for itself. Maintenance of the roofs would be paid for and enacted by the student groups and that sign up to help run the gardens atop the structures.

In order to better represent this on an available University scale, I used Brower Commons as an example of the measurements applied to a real life area. It is listed as being a suitable area for rooftop gardens by the aforementioned graph, and beginning at Brower Dining Hall and renovating the roofing on such an old building would prove exponentially more useful since it is a dining hall and could therefor help promote healthy and sustainable food. The measurements of Brower I deduced by measuring the distance using Google Earth. Brower's measurements were approximately 24,000 square feet—which is near in size to the experiment green roof University

of Michigan observed in savings. If Brower was utilized as "site I" for the initial project, it would function on multiple levels to improve University sustainability by decreasing energy use within the building, reducing stormwater drainage to the New Brunswick system, and reducing energy used in food mile transportation as many vegetables could be grown seasonally atop this area for the easy access by the Dining Hall community workers and chefs. Below is an image I rendered that would show the area of Brower and its accompanying garden:



The EPA lists that green roofing can cost anywhere from 10-25 dollars per square foot, which is higher than most conventional roofing. That price increases with the inception of intensive roofs, such as those used in rooftop gardening. The savings of a green roof versus a

traditional roofing system could number in the 200,000 dollars range and it would decrease the usage of stormwater drainage and costs associated with temperature regulation as well, thus, bringing energy costs and uses down. A similar study in Canada of a 32,000 square foot structure showed a savings of 21,000 kWh total, as well as decreases by 10% of heat energy use. Toronto's sea level at its urban centers ranges, but its highest point in 208 meters (or approximately 682 feet) above sea level. New Brunswick's average height above sea level is around 80 feet (or around 24 meters). The study, when compared with another in California, showed that the lower the elevation the more energy savings—thus, New Brunswick's savings would be higher than what the study in Toronto found. This means that 1.5 kWh total are saved per square foot. The estimated cost if going off the Michigan model would be lower than the cost estimated by an EPA report on green roofs—which shows that intensive roofs such as those used in gardening can cost upwards of $30 per square foot. If these calculations are applied to the idea of Brower Commons garden, the following would be true:

Cost of Roofing per ft^2	**Brower roofing ft^2 available**	**Total cost**	**Savings annually (1.5 kWh per ft^2): energy usage**	**Savings annually ($9.52 per ft^2): Monetary**
Conventional: ~7.05	24,000	169,200	---	---
Green: ~30	24,000	720,000	36,000	222,000
U. Mich study: 22	24,000	528,000	36,000	222,000

I found the average savings per square foot by dividing the overall area used in the University of Michigan study by the savings incurred annually. I calculated the energy saved by dividing the total kWh used on the roof study in Canada by the total area of land studied to get kWh per square foot. The above calculations ultimately showcase that within 3 years or so the

green roof will have paid for itself and the energy saved in Kilowatt-hours during that time will number in the 10k range. This is simply for the building of the green roof atop Brower with the benefits of simply *being* a green roof. The inclusion of gardening and agricultural factors would increase the viability and diversity of the flora in the area and would provide a teaching tool that would be unprecedented in recent University memory.

The first step in the implementation process would be getting out word about the potential impacts of the program and feeling out the University community with what it would like to see. Asking students what problems they think are the biggest and gauging interest in something like a community and student-run rooftop garden project can do this. Surveys, outreach to potentially interested faculty or student groups will give them a heads-up of what to expect out of the project upon its completion.

The plan itself will begin with the construction of agricultural green roofs on Rutgers-designated buildings suitable for such growth (flat roofed buildings). The project itself will be divided into five phases:

Phase I: The implementation of an experimental green roof via its construction on a Rutgers-designated building (in this case, Brower Commons). The building will be designated "site I" and the project will occur during either the school year (to pique student interest) or during the summer. Cooperation with the dining halls in regards to the produce that will be available atop the garden.
Phase II: Media outreach over the programs potentiality. Student and Faculty run initiatives and class programs designed to work with the idea of urban agriculture and green design--using the rooftop garden at site I as a both a classroom and a design example.
Phase III: After careful, first regulation and attention, the use of the gardens will slowly

be adapted into the usage by dining services. Offering a "fresh from the garden" type of marketing campaign, which will gauge student engagement in the project and test the viability and acceptance of it, will accomplish this.
Phase IV: Outreach to the community after a period of University-only experimentation. If the University community reacts well to the idea of rooftop gardens. Expansion of a program designed specifically for community school students in order to engage them in the use of renewable energy through the use of green roofs, while simultaneously educating them on agricultural use. The introduction of a summer farmer's market for the beginning of the fall year and for the summer will help engage harvesting and care over the summer and will also create a profit margin.
Phase V: Through the experimentation, attrition rates for garden volunteers, student run help, etc. will help to see if the rooftop gardening is a good idea. Popularity of the "fresh from the garden" dishes will also help measure as well as surveys given. If the experimentation of the Brower Commons model is proven successful, then further projects can be initiated University and community-wide.

Students working on the project would gain valuable skills in urban management, sustainable agriculture, and outreach to various organizations. A partnership with the dining halls will help to bring sustainable food harvested from the rooftop gardens to the plates of students, giving them a local, food-mile reduced, and carbon-foot print friendly alternative. Recycled food, aside from being put through the pulper to be used as food for the Pinter farm, could be reused for fertilizer across the rooftop gardens. The next step of the process would be to research the suitable foods to be grown in the region. According to the USDA, New Brunswick is located in

zone 7a, with temperatures at an average of 0-5 degrees Celsius. According to the New Jersey Department of Agriculture, summer vegetables and herbs that are available through the fall months include eggplant, collard greens, leeks, lettuces, nectarines, peaches, peppers, radishes, spinach, squash, sweet corn, sweet potatoes, and tomatoes (a Jersey favorite). Dishes utilizing these vegetables can be made in the dining hall, and the control of pesticide use will help students make healthier choices. By using the rooftop garden system as an alternative to heavily trafficked food transportation, Rutgers dining services can help increase local food use and seasonal offerings by taking from the garden the produce planted and maintained by the University faculty and students.

The increase in locally sourced, available food from a 20,425 square foot structure such as the top of Brower could yield high depending on the area used and which crops are used in the area. The accessibility of the area would require students to travel less in order to find fresh food and produce and could reduce the food miles of University members (and therefore, the energy used) in travelling to shop for local, fresh produce. The implementation of this program will, overall, introduce a new wave of sustainable growth at Rutgers. It will engage students, attract attention, beautify the community, sustain the dining hall, and pique interest in potential gardening and volunteer opportunities to garden. The energy saved in kWh and the potentiality of expansion and reduction of food miles are just two parts of the project: it is the education factor and the idea behind the roofs that will ultimately sustain future interest and savings practices.

Works Cited

University of Maryland Dining. Retrieved from http://www.sustainability.umd.edu/content/campus/dining.php#South

Achebe, Chike. Brotman, Marc. Capece, Andrew, *et al.* (Fall 2011). *Urban Agriculture in New Brunswick*. Retrieved from http://policy.rutgers.edu/academics/projects/studios/food11report.pdf

EPA (November 22nd, 2013). *EPA Green Roofs* Retrieved from http://www.epa.gov/heatisland/mitigation/greenroofs.htm

USDA Plant Hardiness Zone Map. Retrieved from http://planthardiness.ars.usda.gov/PHZMWeb/Default.aspx

Topix 2014. *New Brunswick Information*. Retrieved from*:* http://www.topix.com/information/new-brunswick-nj

Homewyse. *Cost the Install a Shingle Roof.* Retrieved from: http://www.homewyse.com/services/cost_to_install_shingle_roof.html

Land Information Toronto, Parks & Recreation, Natural Resources Canada. *Toronto's Geography*. Retrieved from: http://www.toronto.ca/toronto_facts/geography.htm

Bell, Ryan. Berghage, Robert, *et al. EPA: Reducing Urban Heat Islands: A compendium of Strategies. Retrieved from:* http://www.epa.gov/hiri/resources/pdf/GreenRoofsCompendium.pdf

Rutgers Cooperative Extension. *New Jersey Department of Agriculture's Jersey Fresh Availability Report* Retrieved from: http://www.njfarmfresh.rutgers.edu/pdfs/Whats-in-Season-9-25.pdf