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# Green Roofs Provide Heating And Cooling Sustainability Benefits In The

# Great Plains Environmental Climates Melina Alferoff, Trisha Moore, PhD

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#### Developing Scholars Program

#### STUDY GOALS/OBJECTIVES

- Working on improving the design and functionality of a vegetated green roof in the Great Plains area of the U.S.
- Ability to use different growing media to have a thriving green roof.
- The temperature sensors that we are using will record the temperature changing of the green roof pods when they are watered and when they are exposed to the temperature of the roof.
- A significant article that was utilized was,
  "Evaluation of the energy performance and irrigation requirements of extensive green roofs in a water- scare
  Mediterranean climate.", that discussed several affects of the functionality of green roofs.

### INTRODUCTION

This research project is designed to help society understand the cooling and heating properties of a green roof and the way it can help reduce energy consumption of buildings in the Great Plains climates. By developing this research we are hoping to make green roods and a more frequent tool of energy and resource minimization.

#### **METHODS AND MATERIALS**

- First, we are utilizing a tool called Thermodata, which collects and graphs the data of thermostat sensors, in order to record the temperature of each of the green roof pods.
- We have set each of the sensors to record temperature changes, as well as provided the sensor with a range of temperature from 20 degrees Celsius to 100 degrees Celsius.
- The temperature sensors are helping us to monitor the cooling and heating properties of each of the green roof pods.
- We are utilizing a variety of vegetations that will be planted in a specific type of soil encased in a 4-6 inch tall cube. Each of the cubes (pods) will be placed on the roof of Seaton Hall, and watered twice-three times a week with about 500 mL of water.
- The sensors will help us to understand how the water and the vegetation type changes the heating and cooling properties of the green roof.

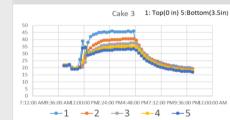
## PRELIMINARY RESULTS

- As we prepped the green roof pods, we utilized several temperature tests in order to determine how the water in the soil impacted the changes recorded by the temperature sensors.
- Each pods (green roof container), had 3 ½ inches of soil, with one sensor placed between each of the 5 layers of soil.
- For the first test trial, we added 200 mL of water to each of the green roof pods and recorded the temperature changes.
- For our second test trial, we decided to observe whether the amount of water had an effect on the recording of the temperature sensors for each green roof pod. We conducted this second test by changing the amount of water in each pod, starting with 0 ml for the first pod, and increasing 50 ml for the second, 100 ml (third) and 200 (fourth). Placing them in the oven and completely drying out the soil.

Figures: Green roof on Seaton Hall (photo credit: L. Skabelund and picture of green roof at K-State stadium

#### DATA ANALYSIS

- Figure one, showed that the temperature sensors, all recorded 30-40 degrees Celsius, but the sensor that was placed at the bottom of the pod was closer to the heat source therefore recorded a higher temperature, and the temperature of the sensors decreased as they reached the top.
- Figure two, involved different water amounts with the pod 1 having no water, pod 2; 50mL, pod 3; 100mL, and pod 4; 200mL. The sensor that recorded the highest temperature was located at the bottom of the pod.
- We are hoping that the green roof will help to reduce the temperature of the building while utilizing the water to grow vegetation and removing heat from the air by transpiration.



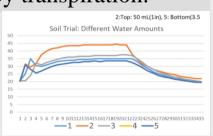


Figure 2:Trial 2

## **FUTURE STEPS**

• Our future plans include continuing to work on the effects of temperature, vegetation and water on a green roof. Understanding those variables and how having a functional green roof will aid in the energy conservation strategies of buildings.

# REFERENCES

Schweitzer, Orna, and Evyatar Erell. "Evaluation of the Energy Performance and Irrigation Requirements of Extensive Green Roofs in a Water-Scarce Mediterranean Climate." Energy and Buildings, vol. 68, 2014, pp. 25–32., doi:10.1016/j.enbuild.2013.09.012.