

# Ecological Function of Urban Rooftop Garden as a Green Roof in New York City

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## Introduction

- Urban green roofs **combat the effects of climate change and improve urban ecosystem function**<sup>1</sup>.
- They provide **cooling through shading and evapotranspiration, reducing the urban heat-island effect, and provide a habitat for insects, birds, and other organisms**<sup>2</sup>.
- The urban-heat island effect occurs when an urban environment experiences higher temperatures than its surrounding rural areas; in order to mitigate the UHI effects, amount of vegetation and reflective surfaces should be increased<sup>3</sup>.
- The aim of this study was to determine the current status of the Lowerre Family Terrace at Marymount Manhattan College as a small intensive green roof in New York City.

## Methods

- To determine amount of biodiversity, the terrace was divided into 3 sections and each section was surveyed for species richness and plant abundance.
- In September, 10 HOBO Data loggers were buried across the three sections of the terrace in order to measure soil temperature.
- In October, these 10 HOBO Data loggers were launched again but on shears placed above ground to measure air temperatures.
- Summary data analysis was run to determine the average high and low temperatures for the different sections of the terrace.
- Terrace data was compared to publicly available soil<sup>4</sup> and air<sup>5</sup> temperatures in Central Park during the same time period using paired t-tests.

## Results

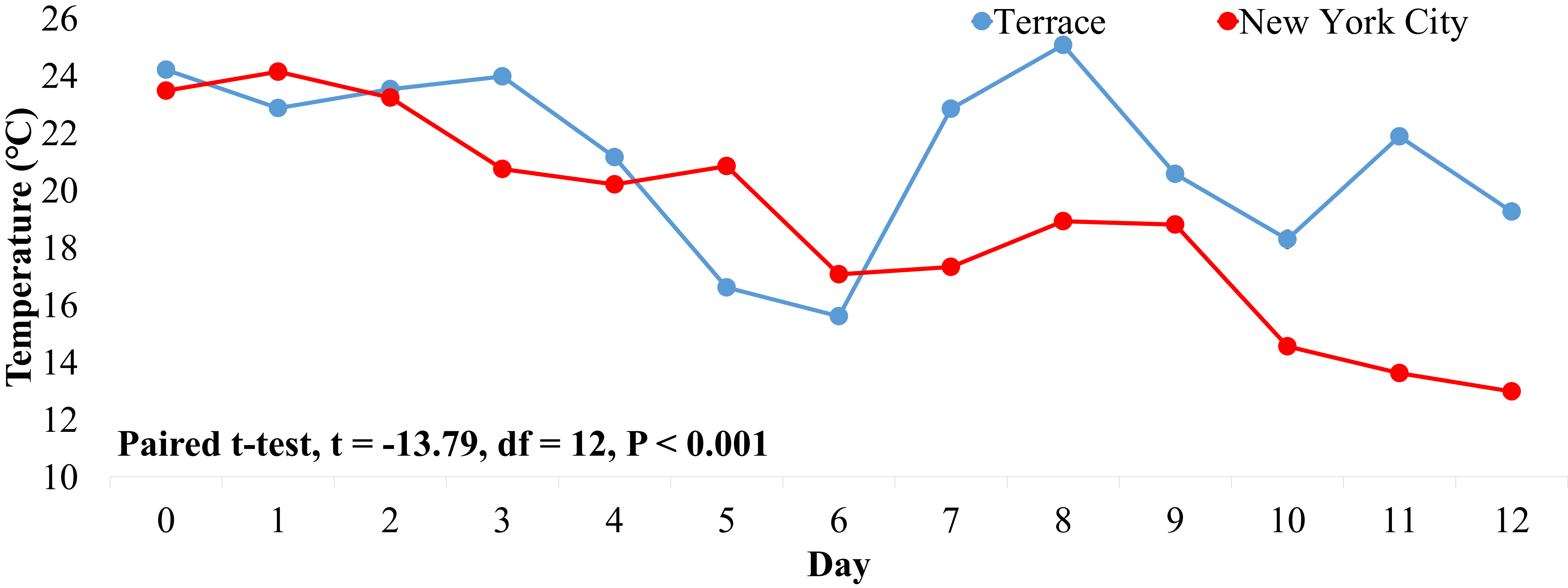


Figure 1. Soil temperatures in September for the Lowerre Family Terrace versus New York City in September 2020. New York City data points are single observations of average temperature day<sup>-1</sup>, and terrace data points are daily mean temperature ± standard error collected from each logger day<sup>-1</sup> (n = 10).

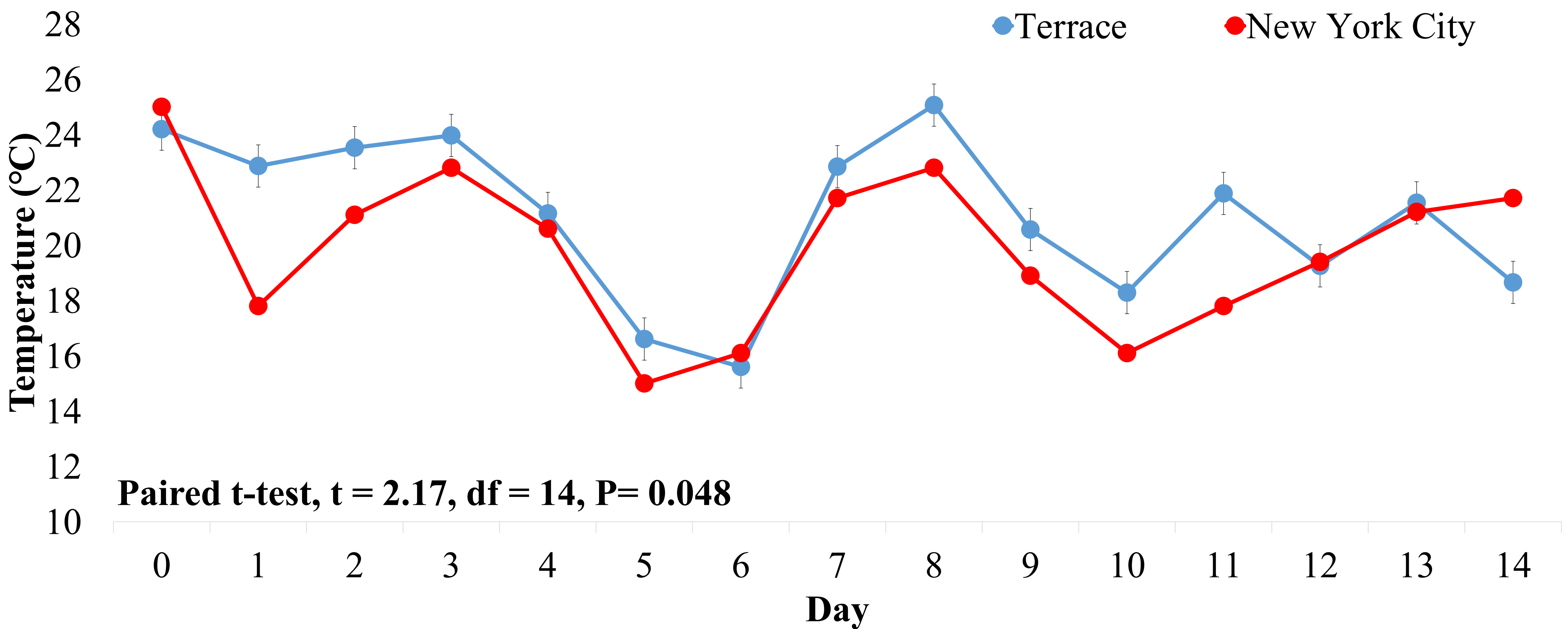


Figure 2. High air temperatures in October for the Lowerre Family Terrace versus New York City in October 2020. New York City data points are single observations of high temperature day<sup>-1</sup> and terrace data points are mean high temperature ± standard error collected from each logger day<sup>-1</sup> (n = 10).

### Works Cited

- Muhammad et al. (2018) Green roof benefits, opportunities and challenges – a review. **Renewable and Sustainable Energy Reviews**. 757-773
- Abolata, A. (2021) Assessment of green roof benefits on buildings’ energy-saving by cooling outdoor spaces in different urban densities in arid cities. **Energy**. 119514
- Takebyashi and Moriyama (2020) Adaptation Measures for Urban Heat Islands, *Academic Press*, 2020.
- <https://www.greencastonline.com/tools/soil-temperature>
- <https://www.accuweather.com/en/us/new-york/10007/weather-forecast/349727>
- Bollman et al. (2021) Effects of shading and composition on green roof media temperature and moisture. **Journal of Environmental Management**. 111882

Species	Abundance		
	Section 1	Section 2	Section 3
<i>Hydrangea arborescens</i>	1	0	3
<i>Phalaris arundinacea</i>	0	0	1
<i>Ipomoea batatas</i>	1	0	3
<i>Caladiumbicolor bicolor</i>	22	0	0
<i>Taxus canadensis</i>	0	8	0
<i>Ulmus crassifolia</i>	2	0	1
<i>Begonia cucullata</i>	11	0	13
<i>Euonymus fortunei</i>	3	6	8
<i>Chelone glabra</i>	0	0	1
<i>Lagerstroemia india</i>	0	0	1
<i>Spiraea japonica</i>	0	0	7
<i>Ophiopogon japonicus</i>	4	0	0
<i>Corpynocarpus laerigatus</i>	1	0	0
<i>Prunus laurocerasus</i>	15	0	9
<i>Hydrangea macrophylla</i>	6	10	0
<i>Rhododendron maximus</i>	0	1	0
<i>Acer palmatum</i>	0	3	0
<i>Hosta plantaginea</i>	5	1	0
<i>Picea pungens</i>	0	1	1
<i>Dracaenta reflexa</i>	0	0	15
<i>Sequoia sempervirens</i>	0	3	0
<i>Prunus serofina</i>	0	1	0
<i>Zelkova serrata</i>	0	0	1
<i>Liriope spicata</i>	0	21	5
<i>Parthenocissus tricuspidata</i>	1	0	0

Table 1. This data table displays each individual unique plant species identified on the terrace. The abundance of each of these plant species in their respective sections on the terrace.. There were a total of 196 plants from 25 species.

## Conclusion

- A total of 25 species of plants were found on the terrace, but their distribution was not consistent among sections (Table 1) and many of the plants do not provide significant overhead shading.
- Terrace soil temperatures were significantly higher than city-wide averages, particularly later in September (Fig. 1).
- Terrace high air temperature was marginally significantly higher than city-wide highs (Fig. 2).
- The biodiversity of plants on the Lowerre Family Terrace may provide habitat space for urban organisms, and it has potential for cooling.
- There is potential to improve cooling on the terrace by including plants that can provide more overhead shading<sup>2,6</sup>.