Skunk Cabbage on an Urbanizing Planet

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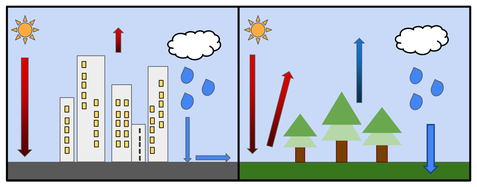
Introduction

Background

Ecological responses to anthropogenic climate change are beginning to be widely observed. **Urbanization (**the development of land for human use) and the Urban Heat Island (UHI) effect have caused unique and pronounced changes to local climates.



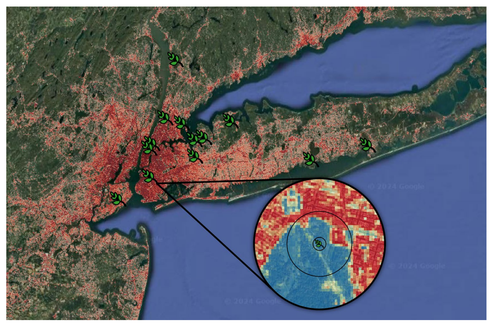
- Increased absorption
- Less evapotranspiration from plants
- Less groundwater storage
- Increased reflection
- Evapotranspiration from plants
- Groundwater storage

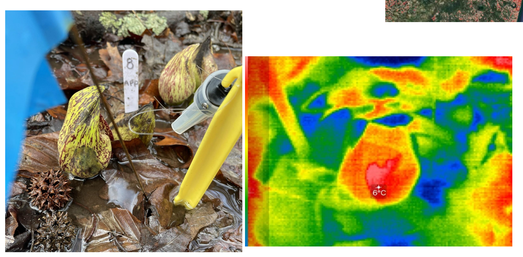
We are interested in how urbanization and UHI have impacted the adaptation and evolution of plant taxa that display **thermogenesis.** Our study species, *Symplocarpus foetidus,* is a plant that is able to increase its body heat up to 35℃ above the ambient temperature.

Pilot Study

Methods

- We used iNaturalist to identify 13 different sites.
- At each site, we placed data loggers to monitor ambient temperature near ground level and inside of the spathe of a selection of plants in the female phenophase to measure internal temperatures.





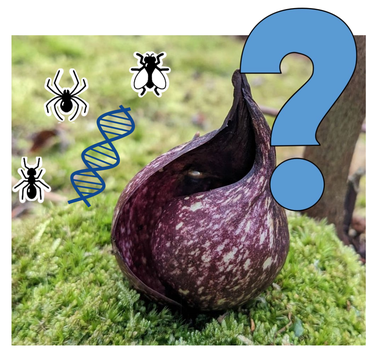
Sample plant and thermal image.

- We used data for land surface temperature and impervious cover of 100 m, 500 m, and 1 km buffer zones around the sites to determine urbanization.
- Differences between ambient and internal temperatures were used to infer thermogenesis.
- Statistical analysis done in R Studio.

Ongoing and Future Studies

This winter…

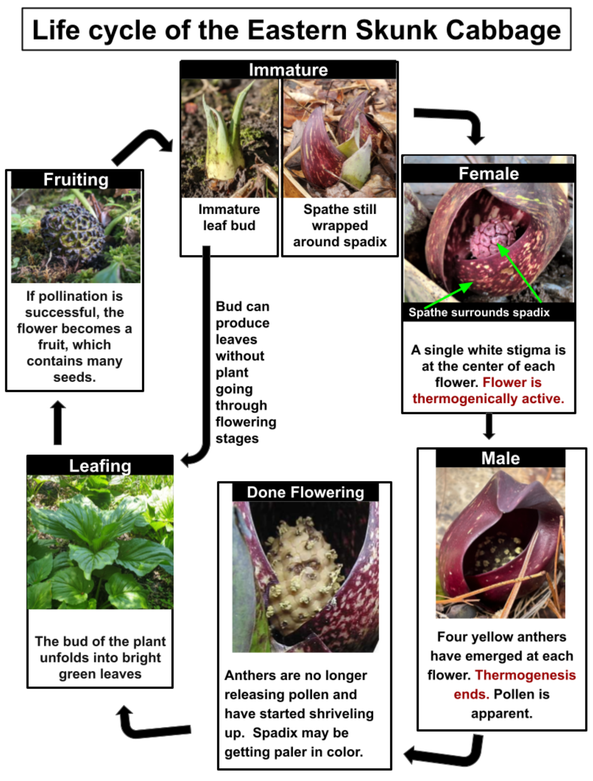
- We are using digital PCR to measure expression of the main gene (alternative oxidase; *AOX*) involved in thermogenic behavior within female inflorescences.
- We are engaging community scientists to help collect data on phenology at each site to observe how UHI may change the timing of flowering and fruiting.



- We are sequencing environmental DNA (eDNA) from female and male inflorescence samples to determine the species composition of the pollinator assemblage, and how it varies with urbanization.

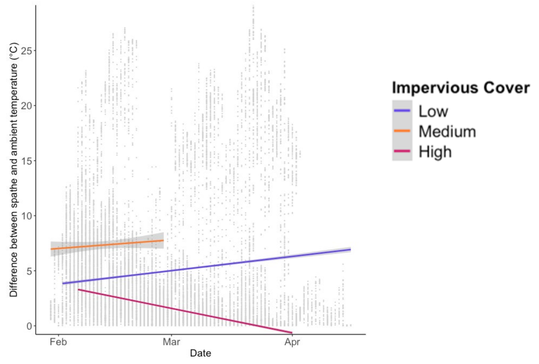
Study Species

The **Eastern Skunk Cabbage (*Symplocarpus foetidus*)** is a unique endothermic plant native to the eastern US. While there are a handful of plant species that are capable of thermogenesis, the Eastern Skunk Cabbage is exceptional. It is able to raise its internal body heat above ambient more than most mammals.



Findings and Implications

Thermogenic behavior is affected by a significant date-by-impervious cover interaction.

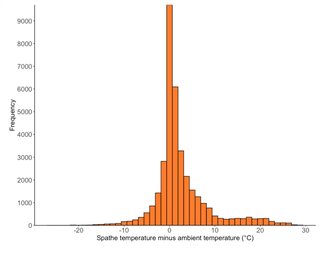


Thermogenic behavior decreases over time in the most urbanized sites and increases over time in the least urbanized sites. At moderate urbanization, thermogenesis does not significantly change over time.

We hypothesize that this may be because:

- **The growing season for plants started and ended earlier in the year in highly urbanized areas (in line with observations of earlier phenophases in several urban plants).**
- **Intermediate disturbance hypothesis: species diversity is maximised at moderate levels of urbanization leading to more competition for pollinators, and increased thermogenic behaviour generally**

For our model, we defined thermogenesis as values where the temperature of the inflorescence is higher than ambient temperature. However, many readings were negative. It is unclear what exactly negative values represent and if it means that there is no thermogenesis.



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