Ecology in Florida's Expanding Residential Landscapes: Quantifying Approaches and Attitudes

Brooke Moffis[1], Robin Pitilon[2], Alessandra Pandolfi[2], Marie Burdett[2], Patrick Bohlen[2], Basil Iannone[3]

[1]UF/IFAS Extension Lake County, UF School of Natural Resources and Environment
[2]University of Central Florida Urban Ecology Lab
[3]UF/IFAS School of Forest, Fisheries, and Geomatics Sciences

Introduction

- Solving complex landscape problems needs partnerships between academics, NGOs, & private industry
- Sunbridge Stewardship District requested strategies from UF/IFAS to reduce water use and stormwater runoff for a planned development
- Well selected native plants could offer solutions to limit water and fertilizer use and support ecosystem services and functions in suburban landscapes
- Compacted and nutrient depleted, urban soils challenge native plant establishment
- Soil organic amendments could optimize native plant health while decreasing irrigation and fertilizer inputs

Objective

1) To determine optimal irrigation & soil amendment strategies for establishing native plants in development soil conditions
2) To quantify the ecological benefits of these strategies

Methods

- Designed an experiment at the entry way of at Sunbridge Stewardship District's Weslyn Park Development (Figure 1)
- Experiment doubles as an attractive, educational landscape feature (Figure 2)
- Established 16, 20'X 30' plots
- Assigned 1 of 2 compost and irrigation treatments to each plot
  - Compost or No Compost amendments (Figure 3A)
  - Regular Irrigation (once a week) vs. As Needed (Figure 3C)
- Planted 26 native plant species
  - Informing plant suitability for future landscapes
- Measured soil & plant health over time (Figure 4)
  - Bulk density, organic matter, plant available water, plant survival, pest/disease presence, herbivory, growth rate and percent coverage
- UCF collected data on pollinator diversity



Figure 1. (A) Aerial view of entry to Weslyn Park with (B) closeup of experimental plots.

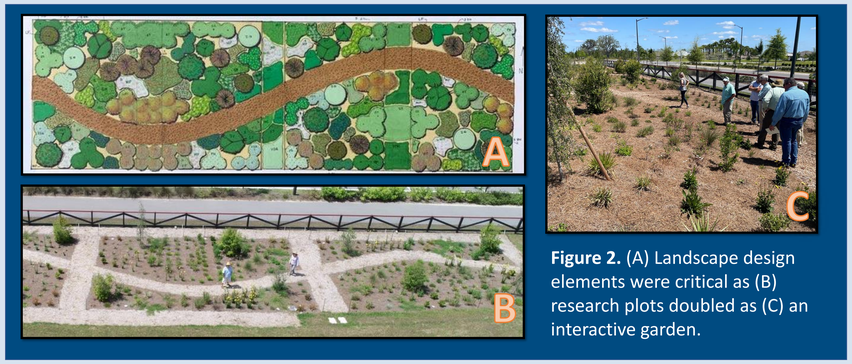


Figure 2. (A) Landscape design elements were critical as (B) research plots doubled as (C) an interactive garden.



Figure 3. Preparation of plots included (A) applying compost, (B) tilling, and (C) installing irrigation.

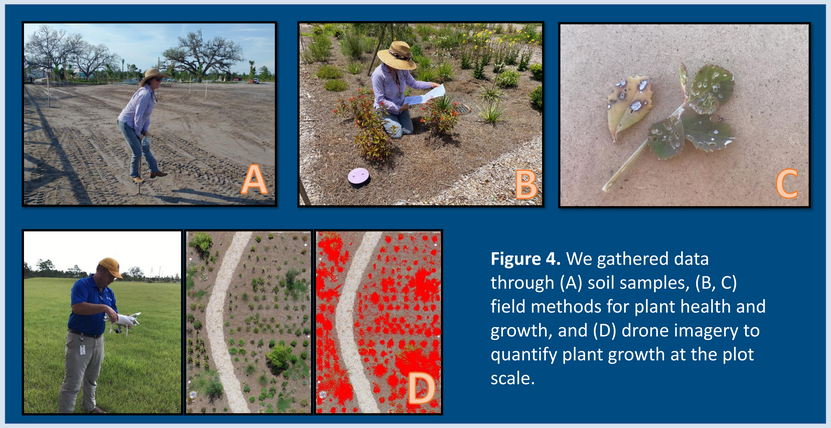


Figure 4. We gathered data through (A) soil samples, (B, C) field methods for plant health and growth, and (D) drone imagery to quantify plant growth at the plot scale.

Results

- Prior to the addition of compost amendments, soil bulk density was at levels that could prevent/slow root growth, i.e., 1.6 g/cm^3 (Table 1)
- Variability in soil pH, as measured by standard deviation (SD), decreased after the second regrading of the site (Table 1)

Table 1. Baseline soil properties showing high soil bulk density and decreases in soil pH variability

Soil Properties	Mean	Min.	Max.
Bulk Density g/cm$_3$			
December 2021	1.58 ± 0.01	1.39	1.69
pH			
After 1st Grading	6.5 ± 0.5	5.1	8.1
After 2nd Grading	5.8 ± 0.2	5.2	6.3

Results

- Visual quality at the plot level was 14% to 17% higher and less variable in plots with compost amendments six and nine months after planting (Figure 5)
- Visual quality declined slightly as expected due to fall senescence, but decline was more pronounced in non compost plots (Figure 5)
- No effects of irrigation were detected yet

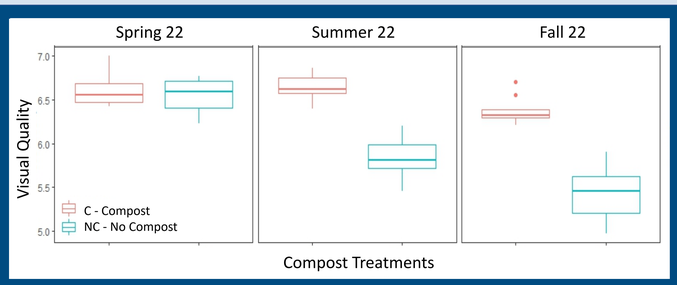


Figure 5. Visual quality response to compost amendments over time

- Plots containing compost produced nearly twice as many total flowers and attracted twice as many pollinators as plots without compost (Figure 6)

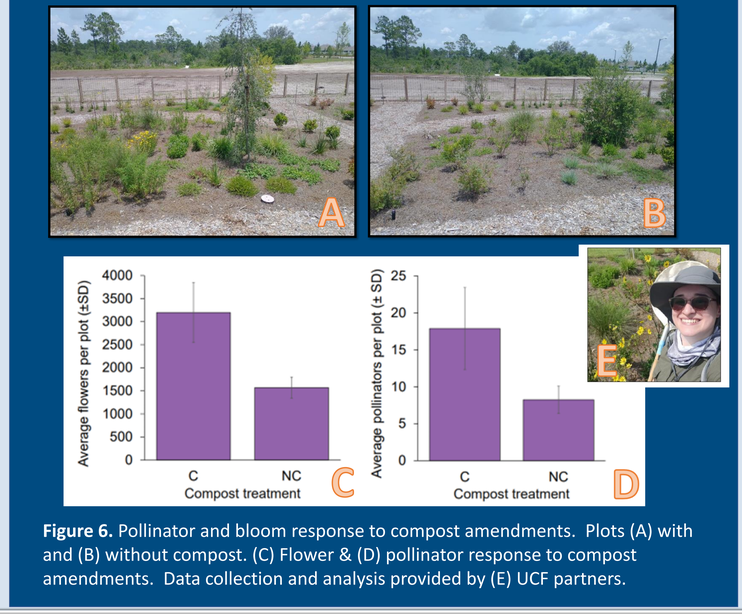


Figure 6. Pollinator and bloom response to compost amendments. Plots (A) with and (B) without compost. (C) Flower & (D) pollinator response to compost amendments. Data collection and analysis provided by (E) UCF partners.

Discussion

- Compost amendments resulted in greater visual quality, and an increase in flowers & pollinators showing the importance of soil health in establishing residential plant communities.
- No plot level differences in pest, disease, and herbivory was detected, but we our refining our procedures for future data collections. We have yet to analyze the 3rd sample period for these data.
- We will analyze species specific responses to compost amendments & irrigation regimes.
- We are processing bulk density, organic matter, and plant available water samples to see how they relate to plant health and ecosystem functions.
- The results from our research will inform the landscape design and plant installation in 29,000 single-family homes of a multi-decade development project.

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