# Alternative Urban Landscapes: A Look into public perspective and ecosystems trade-offs

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## INTRODUCTION

➢Ecosystems provide different benefits that contribute to the human's well-being (Monteiro 2017)

➢Mixing plants belonging to different functional groups has the potential to increase ecosystem services (ES) in urban landscapes (e.g., lawns, golf course roughs, medians), assuming they are aesthetically pleasing and accepted by the end-user (Thompson and Kao-Kniffin 2017)

➢For example, in a legume + grass + flower mixture, the legume would provide nitrogen for plant growth, the grass would filter water and provide control erosion and the flower mixture would attract pollinators (Monteiro 2017; Moffis et al., 2020)

➢**Goals:** generate science-based information about the overall benefits, performance, and management requirements of four model landscape alternatives adapted to subtropical climates and develop management recommendations (e.g., establishment periods, weed control) for landscape alternatives

➢As a result, different landscapes can be selected based on ecosystem service tradeoffs, community goals, and consumer preference, rather than relying on opinions or anecdotal observations.

➢**Objectives: Evaluate the feasibility, ecosystem service tradeoffs, and public perception of different landscape alternatives**

➢**Hypothesis: More diverse landscapes will provide greater ecosystem services but increase maintenance requirements and be less likely to be adopted by the end user due to higher seasonal variability in aesthetic quality**

## METHODS

➢In 2021, turfgrass plots located at the West Florida Research and Education Center, Jay, FL, U.S. were stripped using a sod harvester. After one week, the plots were planted/covered with three alternative landscapes, which included: **Peanut + Turfgrass mix; Forb mixture; Cypress woodchips; Turfgrass Lawn.** Details about the treatments are presented in Figure 1

➢The turfgrass plots consisted of a mixture of common centipedegrass and 'Floratam' St. Augustinegrass. The experiment was arranged as a randomized complete block design with eight replications

➢All landscapes were irrigated with 2.5 cm of water per week for one month during establishment. Irrigation was not applied thereafter. The turfgrass plots were fertilized once with polymer-coated urea at 24 Kg N $ha^{-2}$

## MEASUREMENTS

➢Public perception survey: Gulf Coast Turfgrass Field Day attendees and Master Gardeners

➢Ecosystem Services Tradeoffs: Aesthetics (Visual quality); percent ground cover; temperature abatement (Surface temperature, FLIR E8 thermal imaging device); weed pressure (grid counts); pollinators (visual assessment of insects visiting flowers); crawling insects

## DATA ANALYSIS

➢Data were analyzed using R (R_Core_Team 2022). Ecosystem service rankings are represented as weighted average scores. Visual quality was analyzed using a general additive mixed model and fitted to the ocat family distribution for multinomial data (Wood and Scheipl 2020). Temperature abatement was analyzed with ANOVA. Block was modeled as a random effect. Weed and pollinator counts were presented as medians

✓Preliminary results suggest that the peanut + turfgrass mixture provides a middle ground between traditional turfgrass lawns and forb mixtures providing more ES than turfgrass monocultures and lowering maintenance requirements than a forb mixture

✓While only ~25% of the survey respondents would consider using the forb mixture in their yards, ~40% indicated they would use the peanut + turfgrass mix

✓Therefore, the peanut + turfgrass mixture retains the recreational benefits and cultural values from a traditional turfgrass lawn being more likely to be adopted by end users

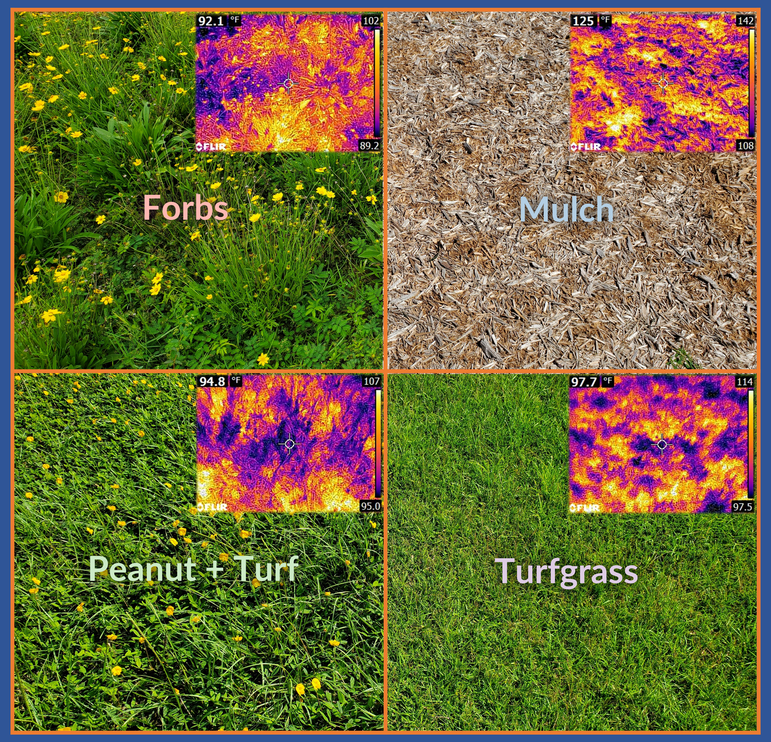


Figure 1. Aerial image showing an example of the four landscape types evaluated at the UF/IFAS West Florida Research and Education Center, Jay, FL, U.S.

**Treatments: Peanut + turfgrass mix**: 'Pensacola' bahiagrass + 'Ecoturf' perennial peanut. Mowed biweekly at 7.6 cm; **Forb mixture:** sunshine mimosa (*Mimosa strigillosa* Torrey & A. Gray), coreopsis (*Coreopsis lanceolata*), frogfruit (*Phyla nodiflora*), and centipedegrass (*Eremochloa ophiuroides* Munro); **Nonliving ground cover** (Mulch): Cypress woodchips; **Turfgrass Lawn**: centipedegrass and 'Floratam' St. Augustinegrass [*Stenotaphrum secundatum* (Walt.)] mowed biweekly at 5 cm

## RESULTS AND DISCUSSION

➢**Public Perception and Aesthetics:** Reducing the amount of fertilizer, erosion control and conserving water were identified as the most important ES by the survey respondents (Figure 2). The traditional turfgrass lawn had the least variability in visual quality and percent ground cover over time (Figure 3). The forbs had greater green cover than the turfgrass and peanut + turfgrass mix during the winter (Jan-Feb 2021). However, the forbs also had lower percent ground cover values from December 2021 to March 2022

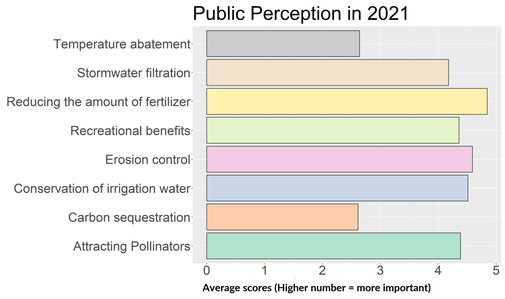


Figure 2. Ecosystem service ranking from survey respondents. Rankings are represented as weighted average scores (Higher number = more important)

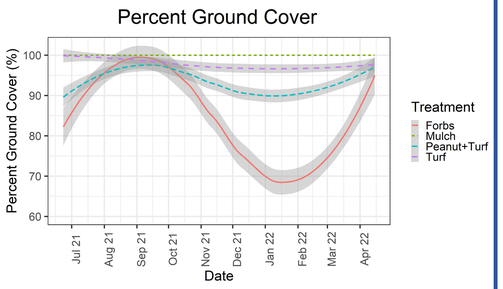


Figure 3. Percent ground cover (%) measured as the percentage of plant material (living, dead or dormant). Grey areas represent the 95% CI. Four landscape types: Forbs; Mulch; Peanut + Turfgrass; Turf

➢**Weed Pressure:** The forb mixture had the greatest weed pressure in the Summer during establishment. Whereas the peanut + turfgrass mix had the greatest pressure during Winter and Spring (Figure 4)

➢**Mix stability:** In Summer and Fall, coreopsis dominated the forb mix occupying more than 50% of the plot. Centipedegrass receded from the mixture. Conversely, the percentage of peanut + turfgrass and turfgrass did not vary after one year.

➢**Temperature abatement:** The vegetated groundcovers reduced surface temperatures compared to the wood chip mulch. Temperature abatement increased with canopy height

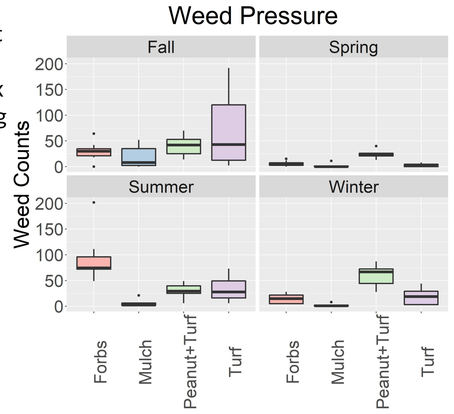


Figure 4. Seasonal weed pressure quantified as weed counts from July 2021 to April 2022. Boxplot showing medians, Q1, Q3, min, max, and outliers. Four landscape types: Forbs; Mulch; Peanut + Turf; Turf

Syrphid Fly Adult

Syrphid Fly maggots in a bahiagrass seedhead

➢**Pollinators:** the forb mixture had the greatest pollinator visits and biodiversity (Figure 5). However, we observed various pollinators and beneficial insects in the turfgrass and peanut + turfgrass plots including syrphid flies, bumble bees, and damselflies. The presence of these insects was highly influenced by the seasonal flower producing in both forbs and turfgrass

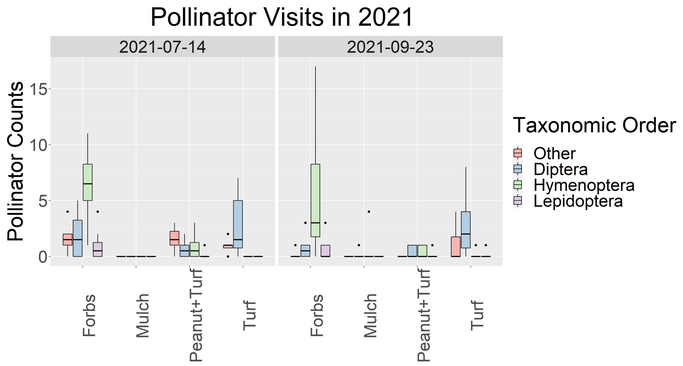


Figure 5. Pollinator counts in July and September 2021. Boxplot showing medians, Q1, Q3, min, max, and outliers. Four landscape types: Forbs; Mulch; Peanut + Turf; Turf. Pollinators were groped into four taxonomic groups; Diptera (Syrphidae, Dolichopodidae, etc.), Hymenoptera (Apidae, Vespidae, etc.), Lepidoptera (Pieridae, Nymphalidae, etc.) and Other (Odonata, Hemiptera, etc.).

➢**Crawling arthropods:** Interestingly, the total abundance of invertebrates in pitfall traps was greater in peanut + turfgrass mix and turfgrass plots compared to the forbs. Moreover, the diversity of the order-level community did not differ between vegetated treatments

**References:** Moffis B, Iannone B, Wilber W, Dale AG, Unruh JB, Rcynya J, Wilson SB. 2020. Multispecies lawns: An alternative strategy for water conservation and ecological enhancement. ASHS; Monteiro JA. 2017. Ecosystem services from turfgrass landscapes. Urban Forestry & Urban Greening, 26:151-158; R_Core_Team. 2020. R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austri.; Simon Wood and Fabian Scheipl (2020). gamm4: Generalized Additive Mixed Models using 'mgcv' and 'lme4'. R package version 0.2-6. https://CRAN.R-project.org/package=gamm4; Thompson GL, Kao-Kniffin J. 2017. Applying biodiversity and ecosystem function theory to turfgrass management. Crop Sci. 57:1–11