

Introduction

- Native seeding helps to increase native diversity, increases ecosystem stability, and prevents re-invasion by invasive species (Bucharova and Krahulec 2019).
- Seed mixes are typically designed to optimize species recruitment and restoration success under certain environmental conditions.
- Functional traits influence how species establish and persists in different soil types and light availabilities and should be incorporated into seed mix design (Funk et al 2021).
- This research considers how the seed mixes used in the restoration of oak woodlands differ in their plant functional traits.
- Oak woodlands are threatened by logging, altered fire patterns, and invasive species, leading to biodiversity loss (Meisel 2002).
- Understanding trait patterns across seed mixes for different woodland environments can inform future seed mixes and restoration projects.



Figure 1: Bags containing oak woodlands seed mixes. Photo by Stephen Packard

Question

Do species within seed mixes designed for specific ecosystem types have different functional trait patterns?

Methods:

- Collected information on the seed mixes designed by experts and volunteers at the Forest Preserves of Cook County (FPCC).
- Examined ten different seed mixes designed for oak woodlands of varying soil properties and light availability (Figure 2).
- Used the Functional Trait Data for Vascular Plant Species from Northeastern North America Database to collect trait data for each species in the seed mixes
- Focused on three specific traits: plant vegetative height, specific leaf area (SLA), and seed mass.
- Used Rstudio to combine, clean, visualize and run 2-way ANOVA tests and Tukey's HSD ad-hoc tests.

Soil Type	Shade Type	
Mesic	Open	
Wet Mesic	Intermediate	
Wet	Woods	
Pond		

Figure 2: Visual depictions of the soil and shade types analyzed in this study

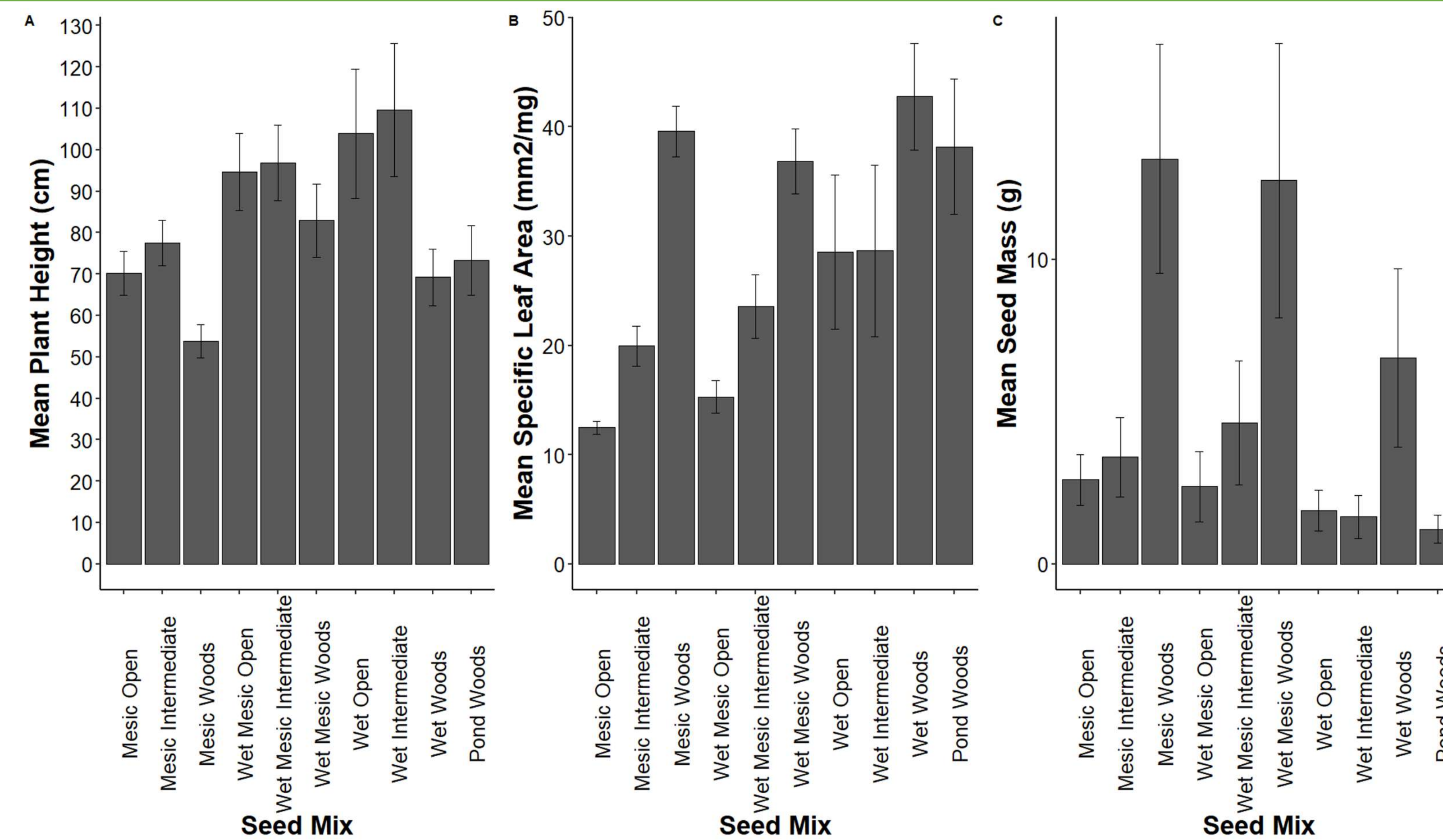


Figure 3: All three of the traits measured had a relationship between functional trait values and the type of ecosystem the seed mixes are used in. Both shade type and soil type influences mean plant height and SLA ($P < 0.001$). Seed mass differed across woodland seed mixes of different shade types ($P < 0.001$)

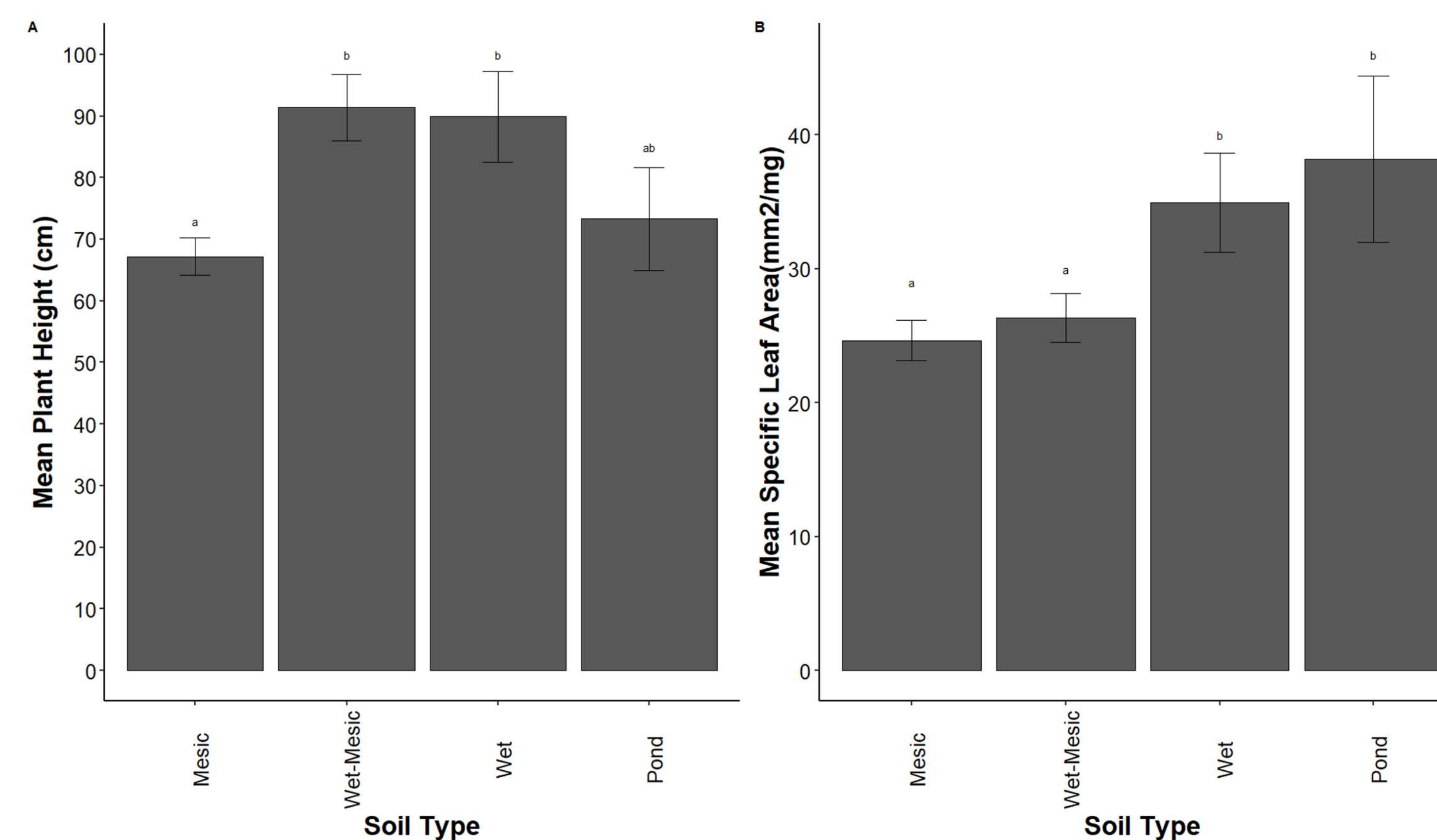


Figure 4. Species seeded into wet-mesic and wet woodlands had significantly higher vegetative plant height than those from mesic or pond mixes, but did not differ significantly from each other. Species seeded into wet and pond mixes had significantly higher SLA than those from the wet-mesic and mesic mixes.

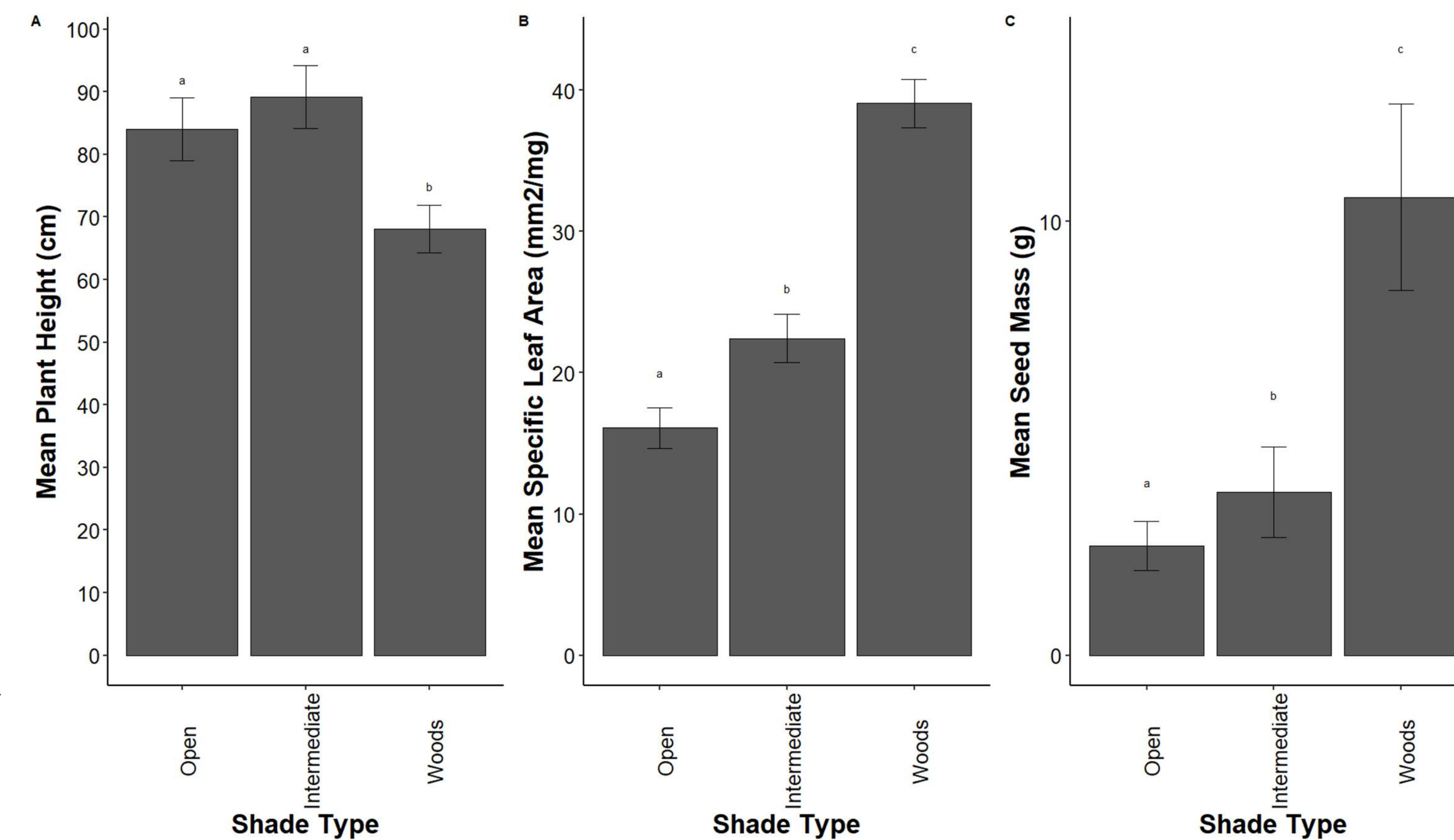


Figure 5. Species seeded into open and intermediate shade types had significantly higher vegetative plant height than those from woods mixes. As canopy coverage increased, species had significantly higher SLA and seed mass than those in the previous seed mix.

Results

Trait	Function	Number of species analyzed within each seed mix	P-value
Vegetative Plant height (cm)	lifespan, competitive vigor	124	4.07e-5
Specific leaf area (mm ² /mg)	nutrient acquisition, photosynthetic ability	122	<2e-16
Seed mass (g)	dispersal abilities, establishment, seedling survival	110	0.00783

Table 1: Traits analyzed within each seed mix, with their function, N, and p values represented.

Discussion

- The results of this study underscore the importance of considering plant functional traits in the restoration of oak woodlands through native seeding. Each trait analyzed demonstrated a significant relationship with the type of community present in the seed mixes, highlighting the necessity of site-specific management in restoration efforts.
- This data is based on the Functional Trait Data for Vascular Plant Species from Northeastern North America Database, but unfortunately we could only use about a third of the data available, which creates some doubt for our predictions. However we still have enough data to suggest that the success of native seeding in oak woodland restoration depends heavily on the careful selection of seed mixes tailored to specific environmental conditions.
- By understanding the variation in plant functional traits across different woodland environments, restoration practitioners can optimize species recruitment and enhance restoration outcomes.

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