



Small Mammal Species Diversity in Response to Disturbance from Silvicultural Treatments in the Southern Appalachians



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Abstract

Diversity of small mammals in the southern Appalachians is high. We experimentally tested whether silvicultural practices recommended to promote oak regeneration affected small mammal diversity on the Cold Mountain Game Lands in western North Carolina. The treatments were: midstory herbicide; prescribed burn; shelterwood harvest (prescribed burns planned for winter 2013-2014); and control, implemented 3-4 years prior. Treatment units were 5-ha, replicated four times per treatment. Small mammals were trapped from May 2013 to August 2013 using eight drift fences with a pitfall trap at both ends of each fence. Three diversity indices were calculated and compared by one-way ANOVA with treatments (and control) as the main effect. Mean (\pm SD) Shannon-Wiener index values were 0.55 ± 0.09 in controls, 0.45 ± 0.03 in shelterwood, 0.59 ± 0.05 in midstory herbicide, and 0.46 ± 0.07 in prescribed burn treatments ($P = 0.03$). Mean Simpson index values were 4.62 ± 3.66 in controls, 2.78 ± 0.52 in shelterwood, 3.02 ± 0.35 in midstory herbicide, and 2.89 ± 0.94 in prescribed burn treatments ($P = 0.51$). Mean PIE index yielded 0.69 ± 0.16 in controls, 0.63 ± 0.06 in shelterwood, 0.68 ± 0.03 in midstory herbicide, and 0.58 ± 0.12 in prescribed burn treatments ($P = 0.48$). The only significant difference was the Shannon-Wiener index in the shelterwood treatment. Similar diversity results may suggest that there was not enough time to see a treatment effect on small mammal diversity. Conversely, despite the habitat disturbance, the needs of these species are potentially being met.

Introduction

The diversity of small mammals in the southern Appalachians is one of the highest in the world, due to high levels of coarse woody debris on the forest floor, which is necessary for cover, nesting, foraging, and thermoregulation (Loeb 1999). However, during the last century, ineffective forest management practices have caused an oak regeneration gap in the southern Appalachians (Lorimer 1993), and the effect of these practices on small mammal population are not well understood. In an attempt to counteract this regeneration gap, silvicultural practices have been implemented which may also affect small mammal populations.

In a study conducted 3-4 years prior, the effect of disturbance of silvicultural treatments on forest wildlife was tested (Raybuck 2011). Using midstory herbicide removal, shelterwood harvest, and prescribed burn treatments, the results of the study indicated no changes on small rodent abundances (Raybuck 2011). A similar study was conducted in Ouachita Mountains of Arkansas and Oklahoma, in efforts to promote pine regeneration (Perry, Ronald 2005). Silvicultural treatments used were single-tree selection, group selection, shelterwood harvest, and clear-cutting (Perry, Ronald 2005). All terrestrial small-mammal populations monitored in the seven and a half year study responded either favorably or appeared to be unaffected (Perry, Ronald 2005). However, in a different study conducted in the New Jersey Pinelands, areas that had been treated (burned, mowed, soil disruption, and logging) had a negative effect on short-tail shrew population (Shenko et al. 2012).

Methods

- Study was conducted in Cold Mountain State Gamelands in western North Carolina (see Figure 2).
- Silvicultural treatments that had been previously implemented consisted of controls, midstory herbicide application, shelterwood harvest removal, and prescribed burn (burns to be conducted winter 2013-2014)
- Treatment units were 5-ha, replicated 4 times per treatment
- Traps consisted of 7.6 m drift fences with 19 L pitfall traps at each end
- Traps were checked daily (except on Sundays) throughout the 3 month study, and small mammal by-catch was monitored
- Small mammals were identified and recorded using morphological characteristics found in Peterson's Field Guide to Mammals of North America to differentiate between species
- Three diversity indices (Shannon-Weiner Index, Simpson Index, PIE Index) were calculated and compared using a one-way ANOVA test for each treatment and control, followed by a Tukey Least Significant Test.

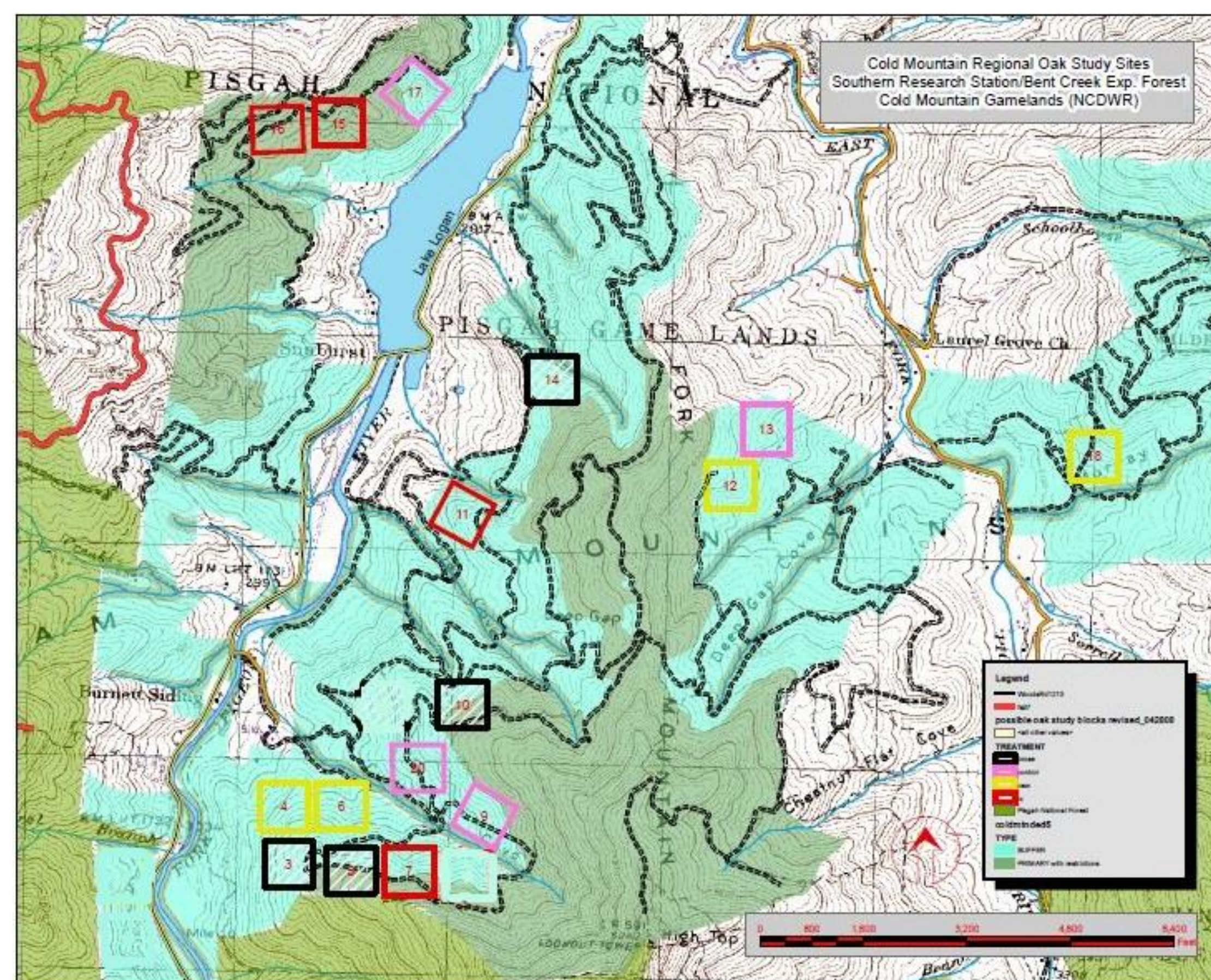


Figure 2: Regional oak study area at Cold Mountain State Gamelands showing 3 treatments and control with 4 replicates each. Each treatment unit is 5 ha.

Results



Figure 2. **A-** *Condylura cristata*, **B-** *Sorex cinereus*, **C-** *Myodes gapperi*, **D-** *Sorex fumeus*. The most abundant small mammals during this study.

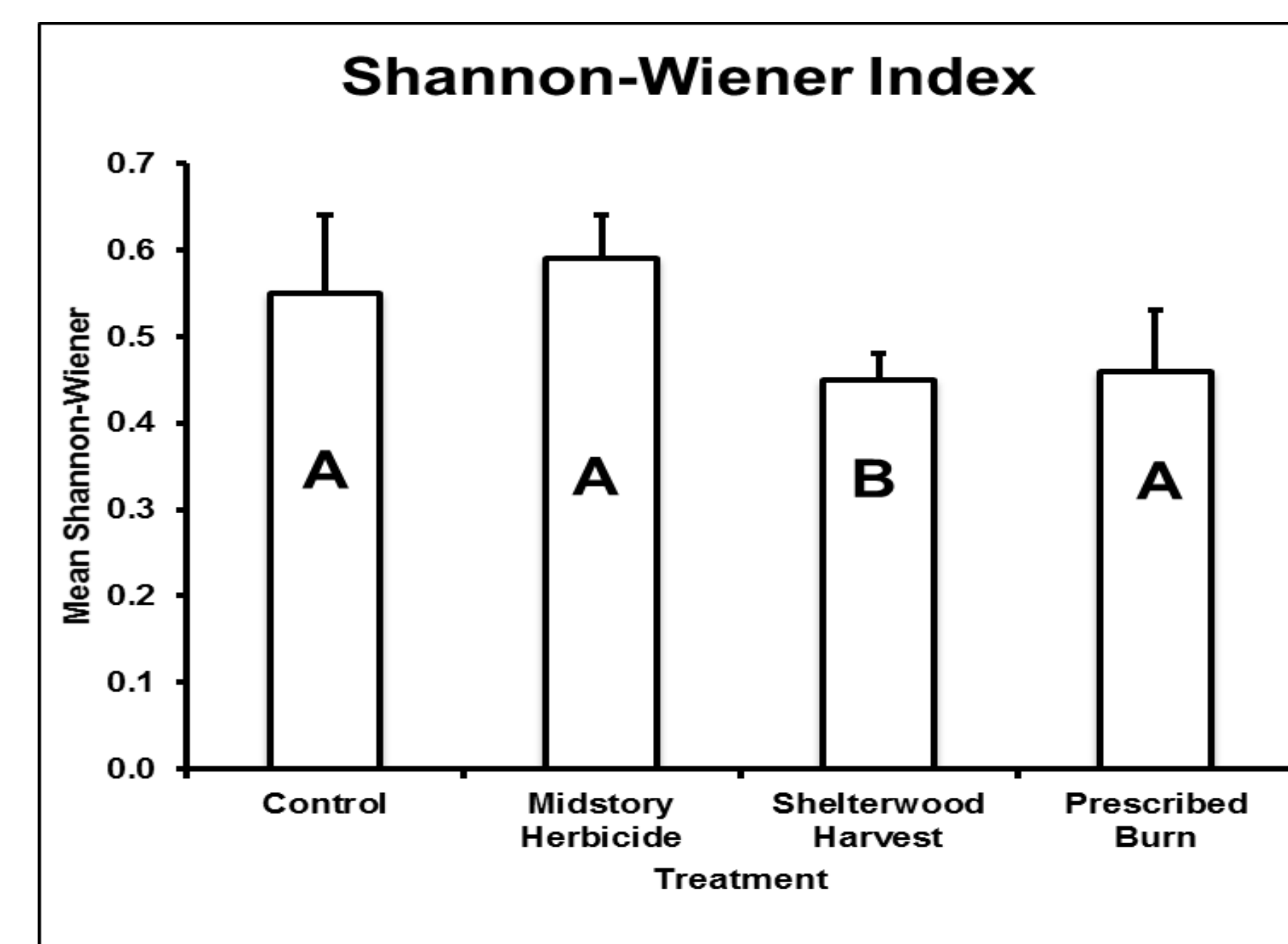


Figure 3. Mean Shannon Wiener values for each treatment, 0.55 ± 0.09 in controls, 0.59 ± 0.05 in midstory herbicide, 0.45 ± 0.03 in shelterwood, and 0.46 ± 0.07 in prescribed burn treatments (ANOVA, Tukey, $P = 0.03$). A significant difference was seen in shelterwood harvest.

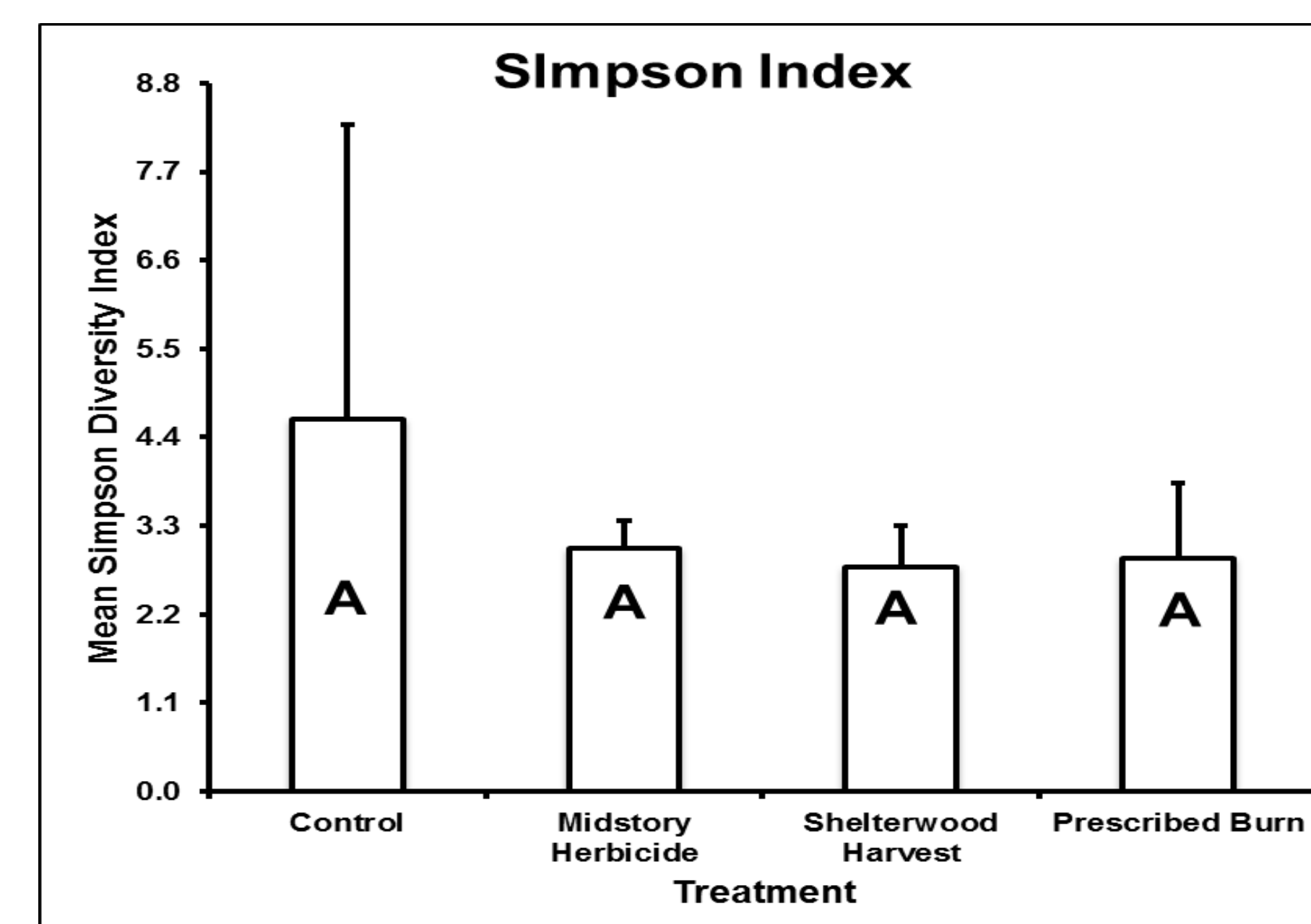


Figure 4. Mean Simpson Index values, 4.62 ± 3.66 in controls, 3.02 ± 0.35 in midstory herbicide, 2.78 ± 0.52 in shelterwood, and 2.89 ± 0.94 in prescribed burn treatments (ANOVA, Tukey, $P = 0.51$).

Results cont'd

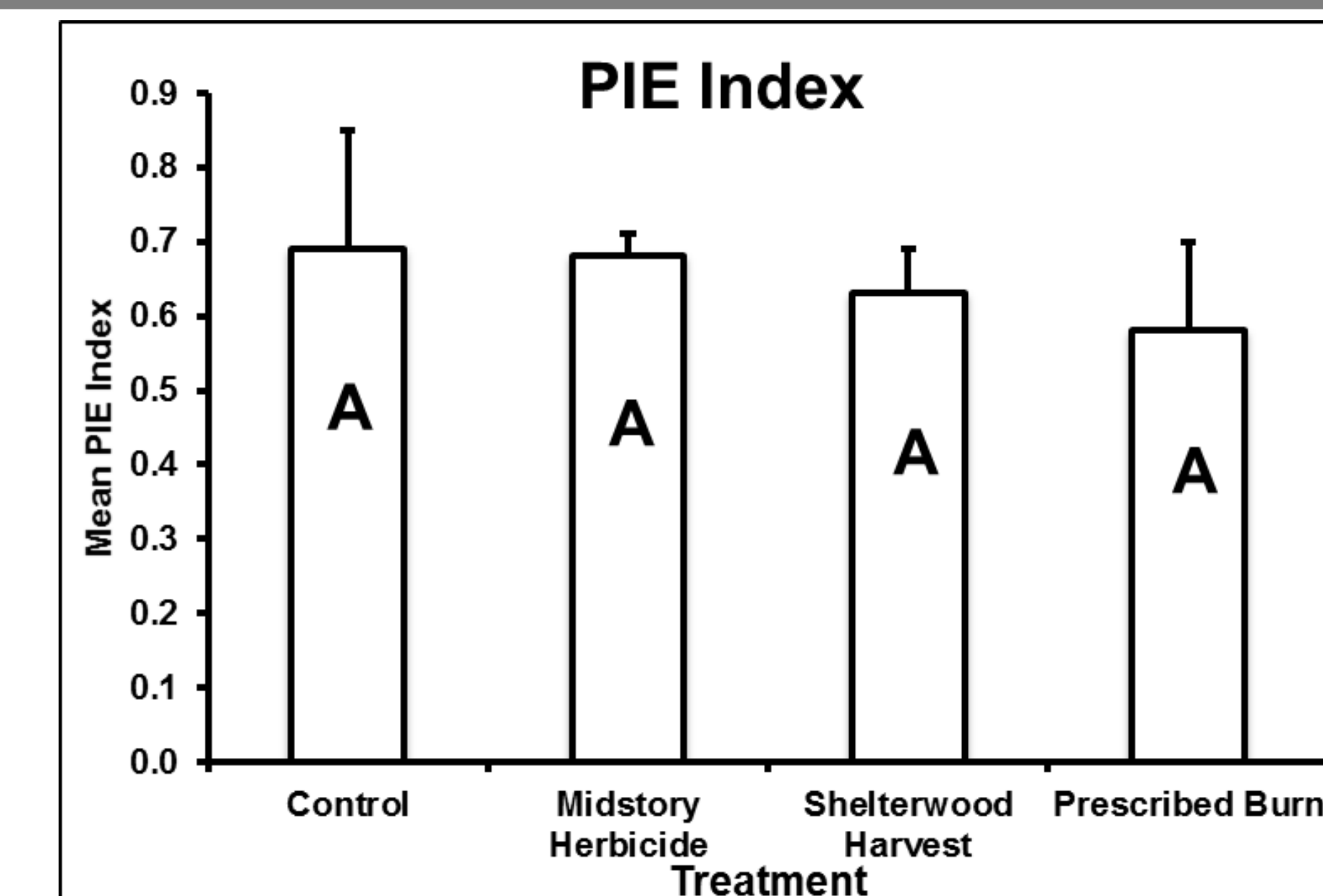


Figure 5. Mean PIE index values, 0.69 ± 0.16 in controls, 0.68 ± 0.03 in midstory herbicide, 0.63 ± 0.06 in shelterwood, and 0.58 ± 0.12 in prescribed burn treatments (ANOVA, Tukey, $P = 0.48$).

Conclusions

- The only significant difference shown in the study was the Shannon-Wiener index for the shelterwood treatment, which was significantly lower than all other treatments
- The lack of significance within the study indicates the small mammal's needs are potentially being met despite the disturbance to the forest.
- This may suggest that more time may be required to see abundance differences in the species population throughout the areas treated.

References

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