The Impacts of Prescribed Fire on Snake Habitat Use at Nahant Marsh

Kaelyn Kamholtz | Augustana College

Summary

This study compares snake detections from cover boards and baited traps with burn history, habitat type, vegetation cover, litter depth, invasive species presence, and habitat structure. The goal is to identify which fine-scale habitat features are associated with snake presence and how prescribed fire may influence habitat use at Nahant Marsh.

Introduction

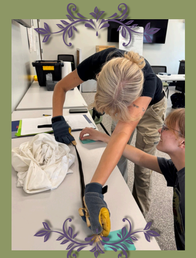
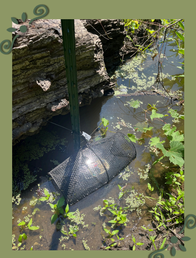
Snakes are important components of prairie, wetland, and forest-edge ecosystems because they function as both predators and prey while helping regulate populations of small mammals, amphibians, and invertebrates. Snake habitat use is influenced by many fine-scale properties like vegetation structure, ground cover, litter depth, soil moisture, and sun exposure. At Nahant Marsh Education Center, prescribed fire is used to restore and maintain prairie, oak savanna, and other habitats by reducing woody encroachment and invasive vegetation while promoting native plant communities. However, fire also alters the ground-level structures snakes rely on for shelter, thermoregulation, and foraging. These changes may increase or reduce habitat patchiness depending on the site and its successional stage of post-fire recovery. This study evaluated snake detections across multiple habitat types and compared them with habitat structure, plant community characteristics, and burn history. I hypothesized that sites with greater ground-cover patchiness, measured using the Shannon diversity index, would contain more snakes, and that prescribed fire could influence snake occurrence indirectly by altering this structural diversity. Understanding these relationships can help Nahant Marsh balance habitat restoration with the conservation of suitable snake habitat.

Methodology

From May through August 2026, twenty-six wooden and corrugated metal cover boards were distributed across various habitat types and were checked one to six times per week for snake presence. Four boards were saturated with scented snake lure to increase the likelihood of snake use. Five baited minnow traps were also deployed in suitable wetland and prairie habitats and were replaced or relocated as needed over a three-week period due to changing field conditions. Minnow traps were baited with chicken eggs and snake lure and checked approximately every 24 hours. For each captured snake, species, sex (when determinable), length, and body mass were recorded. Snakes meeting the minimum size requirement were implanted with a Passive Integrated Transponder (PIT) tag for future identification. All snakes were released at their original capture locations after processing.

Habitat surveys were completed at ten sampling locations representing multiple habitat types. At each site, a 1-m² quadrat was placed directly north of a selected cover board, with four additional quadrats placed 3 m from the board in each cardinal direction, resulting in five quadrats per site. Within each quadrat, percent grass, forb, woody vegetation, bare ground, and litter cover were estimated. Litter depth, maximum vegetation height, soil moisture, invasive species cover, sun exposure, plant species composition, habitat type, soil type, and prescribed burn history were also recorded.



Results

A total of 17 snake observations, among five different species, were recorded across six habitat types. Species included: nine Common garter snakes (*Thamnophis sirtalis),* three Plains garter snakes (*Thamnophis radix*), one Western fox snake (*Pantherophis ramspotti*), three DeKay's brownsnakes (*Storeria dekayi*), and one Northern banded water snake (*Nerodia sipedon*).

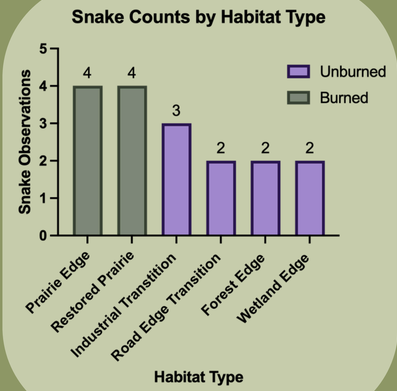


Figure 1. Snake observations across habitat types.
Columns represent the total number of snakes observed in each habitat type, with colors indicating whether the habitat was burned or unburned. Prairie Edge and Restored Prairie had the most observations, with four snakes each, followed by Industrial Transition with three snakes. Road Edge Transition, Forest Edge, and Wetland Edge each had two observations. These values represent raw observations and were not adjusted for differences in sampling effort.

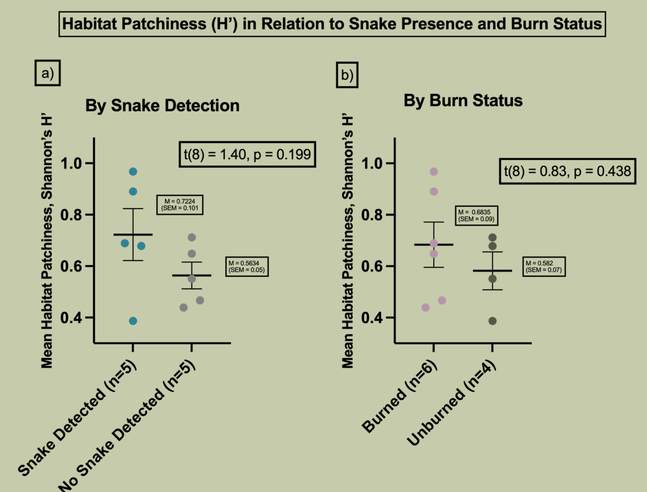


Figure 2. Habitat diversity in relation to snake detection and prescribed-fire status.
Each point represents the mean Shannon diversity index (*H'*) calculated for an individual board or trap location. a) Locations where snakes were detected ($n = 5$) had higher mean habitat diversity than locations without snake detections ($n = 5$), although the difference was not statistically significant [$t(8) = 1.40$, $p = 0.199$]. b) Burned locations (n=6) also had higher mean habitat diversity than unburned locations (n= 4), but this difference was also not statistically significant [$t(8) = 0.82$, $p = 0.438$]. Snakes were detected at 3 of 6 burned locations and 2 of 4 unburned locations, resulting in a 50% detection rate for both groups. A chi-squared test found no significant association between prescribed-burn status and snake presence, χ^2 (1, N = 10)= 0.00, p = 1.000. Overall, snake detections tended to occur in more structurally diverse habitats, but neither habitat patchiness nor burn status was significantly associated with snake presence.

Snake Board and Trap Locations at Nahant Marsh

Discussion

Snake observations were highest in Prairie Edge and Restored Prairie habitats, suggesting that open areas near habitat edges may provide basking opportunities, shelter, and access to prey. However, these raw observations do not demonstrate habitat preference because sampling effort and detectability may have varied among locations. The hypothesis that greater ground-cover patchiness would be associated with snake occurrence was partially supported. Sites with snake detections had greater mean patchiness than sites without detections, but the difference was not statistically significant. The short sampling period and small number of detections likely reduced statistical power, making it difficult to separate a true habitat relationship from natural variation. Because snakes are elusive and may be present but hidden, non-detection also does not necessarily indicate absence. Burned sites had slightly greater patchiness than unburned sites, yet snakes were detected at 50% of both burned and unburned locations, indicating that burn status alone did not explain snake presence. Similarly, previous research found that open-habitat snake specialists selected frequently burned sites, whereas generalist species used a broader range of burn frequencies, suggesting that snake responses depend on species-specific habitat needs and the conditions created by fire rather than burn status alone (Howze and Smith, 2021). Overall, prescribed fire does not appear to be simply beneficial or harmful to snakes. Its effects likely depend on the specific species impacted, burn frequency, time since fire, and the fine-scale habitat conditions remaining afterward. Additional sampling across more sites and stages of post-fire recovery is needed to determine whether patchiness or other vegetation characteristics predict snake occurrence at Nahant Marsh.

Works cited

Howze, J. M., & Smith, L. L. (2021). The Influence of Prescribed Fire on Site Selection in Snakes in the Longleaf Pine Ecosystem. Forest Ecology and Management, 481, 118703. https://doi.org/10.1016/j.foreco.2020.118703

Acknowledgements

I would like to express my gratitude for Tori Adamson, whose support and encouragement made this project possible. I am also incredibly thankful for Jimmy Wiebler, Maddie Kull, Brain Ritter, and the entire Nahant Marsh staff for sharing their knowledge and making this entire experience so meaningful. Finally, I dedicate this project to my Stevie, whose life inspired my love for reptiles and continues to motivate my passion for reptile care and conservation.