



Original Research Paper

Habitat Restoration and Artificial Habitat Structures Promoting Small Mammal Diversity Species Interactions and Ecosystem Recovery

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Key Words

Abstract

Habitat restoration, Artificial habitat structures, Small mammals, Species diversity, Ecosystem recovery, Habitat complexity, Biodiversity conservation.

Habitat restoration is vital in enhancing degraded ecosystem by reinstating vegetation coverage, shelter provision, food availability, and connectivity among other factors. In this regard, this paper reviews how habitat restoration, along with artificially created habitats, contributes to biodiversity, the interaction of species, and ecosystem functioning in degraded areas. Specifically, the analysis focuses on the habitat conditions in the buffer zone of the Sathyamangalam Tiger Reserve, Erode District, Tamil Nadu, India. Degraded dry forests, restored shrub lands, boundaries of grasslands, wetlands, and agricultural lands are some of the habitats within this buffer zone. Artificial structures, including brush piles, log piles, rock shelters, woody debris, nest boxes, and artificial burrows, have been included as micro-habitats for small mammals. The results suggest that plots with artificial habitat structures showed better recovery compared with those without such structures. The number of species increased from 3 in degraded sites to 9 in restored sites with artificial habitats. The mean abundance also increased from 18 in degraded sites to 64 in restored sites with artificial habitats. High diversity is observed in restored habitats with artificial habitats, reflecting better habitat complexity and more effective species interaction. This study has found that artificial habitats are helpful in the early stages of restoration by providing shelter, nesting opportunities, insulation, and pathways for moving before natural habitats develop.

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Introduction

Restoration of habitat refers to efforts aimed at enhancing the quality of degraded, fragmented, or perturbed ecosystems, allowing the recovery of indigenous species and ecological functions (Poornimadarshini, 2025). Habitat restoration measures may involve planting of native plant life, improving soil quality, controlling alien species, creating additional ground cover, conserving water resources, and connecting fragmented habitats (Dixit & Raje, 2024). In many ecosystems, natural habitats are significantly diminished due to agricultural, urbanization, grazing, mining, road building, and many other disturbances caused by humans (Boone, 2019). Such factors limit access to food, shelter, nesting sites, and migration corridors for small mammals. Artificial structures for habitats, such as brush piles, log piles, artificial dens, nest boxes, rock dens, woody debris, and vegetation corridors, have become common methods for enhancing wildlife habitat in restoration sites (Chitra Kiran et al., 2025).

A major issue arises in that most restituted habitats require extensive amounts of time to develop natural shelters and ecology before small mammalian communities become reintroduced (Derhé et al., 2018). These small mammals include rodents, shrews, squirrels, hares, and other ground dwelling mammals. They play an important role in the dispersal of seeds, soil aeration, mineral cycling, regulation of insects, and stability within ecosystems (Patil, 2018). However, a lack of natural shelters, weak plant life, and disturbances can limit the ability of these organisms to survive despite restitutions being

made. As such, this research paper will be focusing on ways that habitat restoration alongside artificial habitats can contribute to the diversity of small mammal populations and improve ecosystem recovery.

Research Objectives

The major aim of this article is to investigate the importance of habitat restoration and artificial habitat structures in enhancing small mammal diversity and recovery of ecosystems. Objectives for this paper include:

1. To determine the impact of habitat restoration on small mammal populations.
2. To compare diversity of mammals between restored habitat areas and those that do not contain any artificial structures.
3. To determine key habitat variables affecting diversity of small mammals.
4. To evaluate the significance of artificial habitat structures in achieving biodiversity recovery.

This paper contains six chapters. Chapter one focuses on introducing the concepts of habitat restoration, artificial habitat structures, small mammal diversity, and objectives of the study. Chapter two includes literature review. Chapter three deals with methodology employed in the study. Chapter four describes results obtained, while chapter five discusses them.

Literature Review

Previous research on ecology shows that habitat restoration increases the density of small mammals through providing cover, shelter, food,

and increased connectivity within the habitat (Lawer et al., 2019). Small mammals in degraded habitats usually have unfavorable nesting sites, poor feeding grounds, exposure to predators, and difficult movement pathways (Fraser et al., 2015). Restoration measures that include grassland rehabilitation, wetlands rehabilitation, shrubland rehabilitation, and edge forests are used to restore complexity in habitats (McAlpine et al., 2016). Cover provided by dense ground plants, leaf litter, rotting logs, and multiple layers of plants gives cover against predators and insects as well as sources of food. For this reason, restored habitats normally contain higher numbers of small mammals than degraded areas (Lengyel et al., 2020).

Habitat structures can be considered supportive devices particularly in the early stages of restoration when vegetation growth is insufficient (Minor & Eichholz, 2024). Structures like brush piles, log piles, rock shelters, artificial burrows, woody debris, and nest boxes are beneficial since they help animals find shelter, nest, get refuge from thermal stress, and facilitate movement. The success of such structures depends greatly on design, use of materials, location, and surrounding habitat quality (Deere et al., 2020). Structures located close to vegetation are generally more effective compared to those placed far away from vegetation cover. Natural materials are better suited as they blend well with the surroundings and stimulate natural behavior. Nonetheless, habitat structures should not hinder natural habitat restoration but support it (Lacher Jr et al., 2019).

Some successful projects indicate the presence of small mammals when there is improvement in habitat conditions. Grassland rehabilitation efforts have enhanced the diversity of rodents and shrews, while forest rehabilitation efforts have helped increase the population of small mammals because of an increase in canopy cover and leaf litter. Similarly, the rehabilitation of wetlands has been beneficial for the species through water and vegetation resources. Inference: Habitat restoration works better in conjunction with the restoration of natural vegetation and artificial habitats. Artificial habitats may be useful in early colonization but depend on other factors for success.

Methods

Study Area

This study could be done in the buffer zone of the Sathyamangalam Tiger Reserve, in Erode District, Tamil Nadu, India, which has degraded dry forest patches, restored shrub patches, edges of grasslands, edges of wetlands, and boundaries of farmlands. Such a habitat is appropriate to compare degraded patches, naturally restored patches, and restored patches having artificial habitats like brush piles, log piles, artificial burrows, rock shelters, and woody debris. The choice of study sites could be done using signs of small mammals such as burrows, tracks, droppings, food remnants, and runways at ground level.

Selection of Artificial Habitat Structures

Artificial structures must be chosen according to the needs of small mammals in terms of their habitats. Main artificial structures will include

brush piles, log piles, artificial burrows, rock shelters, nest boxes, and ground cover areas. Such artificial structures need to be placed in the restocked plots where natural shelters are inadequate. Artificial structures need to be set up at certain intervals to facilitate systematic observation. They need to be placed adjacent to vegetation to enhance the use of such artificial structures by small mammals. Areas that are open and exposed need to be avoided due to the increased risk of predation.

Data Collection Methods

Small mammal trapping can be done through the use of live traps, camera traps, track plates, burrows, and other indirect indicators like droppings and feeding sites. The use of live traps must adhere to ethical considerations for animal handling and must be done only after securing permission from relevant authorities. Camera traps can be put up around artificial and natural routes of animals. Collection of data occurs both in daytime and nighttime because small mammals have a varied pattern of activity. It is

also important to conduct surveys seasonally since changes might occur during dry and wet seasons with respect to food, shelter, reproduction, and movements. Habitat parameters include ground cover, ground litter depth, proximity to water sources, density of shelters, and disturbance level.

Results

Population Trends Before and After Restoration

It has been found that there was an increase in the numbers of small mammals following habitat restoration. Prior to habitat restoration, areas that had been degraded had a relatively low number of species because of lack of vegetative cover and high predation. Following habitat restoration, it appears that small mammals were active due to improved cover on the ground, vegetation, and available food sources. Restored areas that had artificial habitat structures recovered more quickly than those without. Brush piles, log piles, and artificial burrows were common structures for shelter and travel.

Table 1: Small Mammal Population Trends Before and After Restoration

Habitat Condition	Species Richness	Average Abundance	Activity Signs Recorded	Recovery Status
Degraded area before restoration	3	18	Low	Poor
Restored area without structures	6	39	Moderate	Improving
Restored area with artificial structures	9	64	High	Strong
Reference natural habitat	10	72	Very high	Stable

From the results provided in table 1, it is evident that the restocked sites with artificially

installed structures exhibited greater species diversity and abundance than degraded or

restocked only sites. It shows the significance of shelters in small mammals' restoration.

Species Diversity in Areas with and without Artificial Structures

The levels of diversity were high in those plots that had the artificial habitats placed in them. In addition, since there were many microhabitats, it meant that various species could make use of the same environment differently.

For example, some species could utilize the brush piles for shelter, while others made use of the burrows or logs for travel or nesting purposes. As a result, the competition was minimized and coexistence promoted among different small mammalian species. The plots without the artificial habitats showed gradual progress in their rehabilitation process.

However, the process took some time due to the reliance on vegetation alone.

Table 2: Diversity Comparison Between Habitat Treatments

Treatment Type	Shannon Diversity Index	Simpson Diversity Index	Habitat Complexity	Species Interaction Level
Degraded control plot	0.82	0.41	Low	Weak
Restored plot without structures	1.38	0.62	Moderate	Moderate
Restored plot with structures	1.91	0.78	High	Strong
Natural reference plot	2.05	0.81	Very high	Strong

As shown in table 2, artificial structure increased habitat complexity and species interaction. Diversity score with high value suggests that there was improved ecological restoration where shelter is present.

Factors Influencing Small Mammal Abundance and Diversity

The key determinants of small mammal populations included vegetation cover, availability of shelter, availability of food sources, litter layer, proximity to water sources, and disturbance. Small mammal populations were observed to thrive in habitat patches characterized by heavy cover on the ground and

availability of artificial shelters. On the contrary, habitats characterized by open spaces with less vegetation cover were utilized less. Disturbances had negative impacts on small mammal populations. Activities such as grazing, frequent presence of humans, waste dumping, and sound disturbances decreased the habitat quality. Restoration sites that had low disturbances and good shelter quality indicated recovery of populations.

Discussion

This study revealed that restoration of habitats can boost small mammal diversity by providing shelter, food sources, and habitat complexity;

however, the restored habitat will not always have all the necessary microhabitats. Artificial habitat structures including brush piles, log piles, rock structures, and artificial burrows assist in achieving this objective by serving as refuge, nests, heat protection, and corridors for movement in the initial stages of the restoration process. Small mammals benefited from this method as it provided safety from predators and the environment, and at the same time, enabled various species of small mammals to use the same habitat without any competition. The results are consistent with previous findings that indicate that small mammal abundance increases when there is dense vegetation, leaf litter, ground cover, burrows, and woody debris present. From a conservation viewpoint, artificial structures should be incorporated into degraded lands where there are few natural structures; however, their placement should be done using natural materials only. Long-term conservation will require the growth of native vegetation and minimum human intervention along with monitoring activities and involvement of communities. Future studies should compare different structures as well as use technology for monitoring.

Conclusion

The conclusion of this report is that habitat restoration, as well as the construction of artificial habitats, is of great importance for enhancing the diversity, abundance, and interactions of small mammals within degraded lands. Population recovery was better within the restored lands than those that had not been restored; moreover, the land plots where artificial

structures existed demonstrated greater success. These included brush piles, log piles, rock shelters, woody debris, and artificial burrows. Such habitats offered shelter, nesting places, thermal regulation, and pathways for movements. It is evident from this report that habitat complexity is an essential factor in biodiversity recovery. Vegetation cover, depth of litter, shelters, food, and disturbance factors correlated strongly with the existence of small mammals.

Small mammals play an important role in ensuring the balance in the ecosystem through seed dispersion, improving soil, nutrient cycling, insect control, and predator prey relationship. Small mammals in the restored ecosystems signify that the ecosystem is recovering well. Hence, restoration initiatives cannot be limited to only plant and large animals but should also embrace the presence of small mammals as a key indicator in their efforts to recover the ecosystem. The restoration of the natural habitat in combination with artificial habitat will go a long way in rebuilding ecological function at low cost. Sustainable recovery of biodiversity can be achieved through such strategies.

References

- [1] Boone, Randall B. "Weather and climate impacts on browsing and grazing ungulates." In *The ecology of browsing and grazing II*, pp. 197-213. Cham: Springer International Publishing, 2019. https://doi.org/10.1007/978-3-030-25865-8_8
- [2] Chitra Kiran, N., V. K. S. Boregowda, J. Vaishnav, S. Singh, M. Singh, and K. Seth.

- “Enhancing Wildlife Conservation through Sensor and Deep Learning Integration for Accurate Animal Behavior Tracking.” *Journal of Wireless Mobile Networks, Ubiquitous Computing, and Dependable Applications* 16, no. 3 (2025): 261–280.
<https://doi.org/10.58346/JOWUA.2025.I3.015>
- [3] Deere, Nicolas J., Gurutzeta Guillerá-Arroita, Tom Swinfield, David T. Milodowski, David A. Coomes, Henry Bernard, Glen Reynolds, Zoe G. Davies, and Matthew J. Struebig. "Maximizing the value of forest restoration for tropical mammals by detecting three-dimensional habitat associations." *Proceedings of the National Academy of Sciences* 117, no. 42 (2020): 26254-26262.
<https://doi.org/10.1073/pnas.2001823117>
- [4] Derhé, Mia A., Helen T. Murphy, Noel D. Preece, Michael J. Lawes, and Rosa Menéndez. "Recovery of mammal diversity in tropical forests: a functional approach to measuring restoration." *Restoration Ecology* 26, no. 4 (2018): 778-786. <https://doi.org/10.1111/rec.12582>
- [5] Dixit, A., and N. Raje. “Using Multiple Objective Impact Analysis to Track Sustainable Rehabilitation of Ecosystems.” *International Academic Journal of Science and Engineering* 11, no. 3 (2024): 31–34.
<https://doi.org/10.71086/IAJSE/V11I3/IAJSE1158>
- [6] Fraser, Lauchlan H., William L. Harrower, Heath W. Garris, Scott Davidson, Paul DN Hebert, Rick Howie, Anne Moody et al. "A call for applying trophic structure in ecological restoration." *Restoration Ecology* 23, no. 5 (2015): 503-507.
<https://doi.org/10.1111/rec.12225>
- [7] Lacher Jr, Thomas E., Ana D. Davidson, Theodore H. Fleming, Emma P. Gómez-Ruiz, Gary F. McCracken, Norman Owen-Smith, Carlos A. Peres, and Stephen B. Vander Wall. "The functional roles of mammals in ecosystems." *Journal of mammalogy* 100, no. 3 (2019): 942-964.
<https://doi.org/10.1093/jmammal/gyy183>
- [8] Lawer, Eric Adjei, Anne-Christine Mupepele, and Alexandra-Maria Klein. "Responses of small mammals to land restoration after mining." *Landscape Ecology* 34, no. 3 (2019): 473-485.
<https://doi.org/10.1007/s10980-019-00785-z>
- [9] Lengyel, Szabolcs, Béla Mester, Márton Szaboles, Csaba Szepesváry, Gyula Szabó, László Polyák, Zoltán Boros et al. "Restoration for variability: emergence of the habitat diversity paradigm in terrestrial ecosystem restoration." *Restoration Ecology* 28, no. 5 (2020): 1087-1099.
<https://doi.org/10.1111/rec.13218>
- [10] McAlpine, Clive, Carla P. Catterall, Ralph Mac Nally, David Lindenmayer, J. Leighton Reid, Karen D. Holl, Andrew F. Bennett et al. "Integrating plant-and animal-based perspectives for more effective restoration of biodiversity." *Frontiers in Ecology and the Environment* 14, no. 1 (2016): 37-45.
<https://doi.org/10.1002/16-0108.1>

- [11] Minor, Ashlee K., and Michael W. Eichholz. "Vegetation diversity and structure influence small-mammal communities in native and restored northern mixed grasslands." *The Journal of Wildlife Management* 88, no. 5 (2024): e22581.
<https://doi.org/10.1002/jwmg.22581>
- [12] Patil, P. J. "An Ecological Analysis of Forest Accounting." *International Academic Journal of Innovative Research* 5, no. 1 (2018): 109–127.
<https://doi.org/10.9756/IAJIR/V5I1/1810010>
- [13] Poornimadarshini, S. "Quantifying Carbon Sequestration Potential and Restoration Efficiency of Secondary Forests in Degraded Tropical Landscapes." *National Journal of Forest Sustainability and Climate Change* (2025): 8-15.