

Landscape Alterations and Butterfly Diversity in the Moist Shiwalik Sal Forest of the Lower Garhwal Himalayas: A Comparative Study between Natural Forests and Urban Areas

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INTRODUCTION & AIM

Forest ecosystems in the lower Garhwal Himalayas are severely threatened by urbanization, commercial activities, and resource overuse, leading to fragmented and degraded habitats. Given these threats, modern biodiversity assessments are crucial for conserving the remaining forest patches in the Himalayan ecosystem. Urbanizing natural and semi-natural habitats is a primary driver of habitat loss and fragmentation, reducing both the quantity and quality of habitats, which negatively impacts biodiversity. Butterflies, due to their sensitivity to environmental changes, serve as effective indicators of the ecological impacts of urbanization and landscape development. This study monitored butterfly diversity across different land use types in the lower Garhwal Himalayan region, focusing on natural forests and urban landscapes.

METHODOLOGY

Sampling: A total of 288 sampling surveys of 1 hour each were conducted over 6 seasons across two consecutive years (March 2022–March 2024) in 6 sites under the major land uses (Urban Blocks, and natural Sal forests) in the Dehradun Valley of Uttarakhand, which lies in the lower Garhwal Himalayas (Fig. 1). Butterflies were sampled using the “Pollard Walk” method, and the data were collected on species richness and the abundance of butterflies across the land uses.

Seasons Covered: Spring, Pre-Monsoon, Monsoon, Post-Monsoon, Autumn, and Winter.

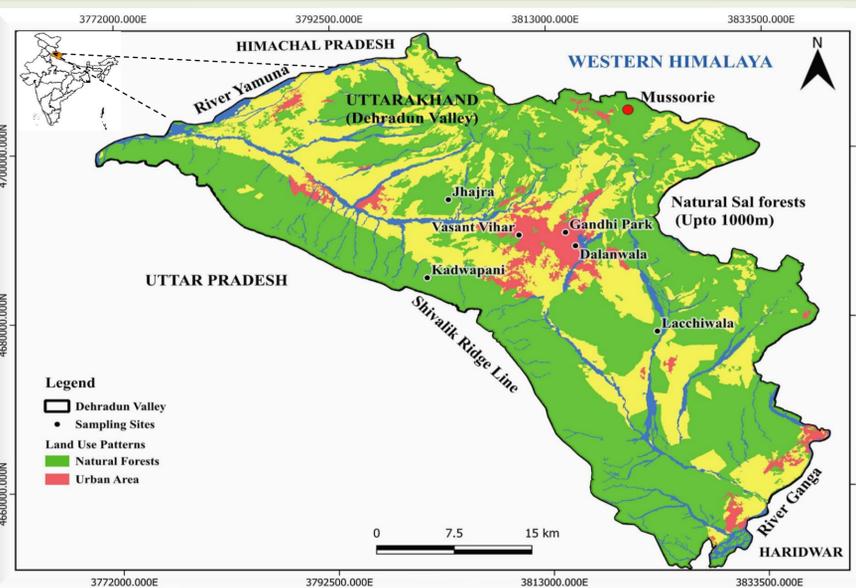


Fig.1. Study sites across land use in Dehradun Valley, Uttarakhand.

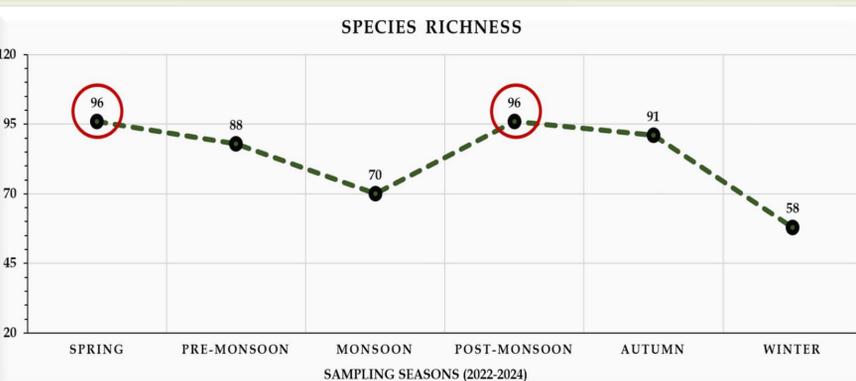


Fig.2. The variations in butterfly species richness across six seasons over two consecutive years in Dehradun Valley, Uttarakhand.

RESULTS & DISCUSSION

- A total of **129 species** of Butterflies belonging to 6 families were sampled and identified.
- The species richness exhibited two main annual peaks: the first peak occurred in **spring** and the second in the **post-monsoon** season (Fig.2).
- Natural sal forests recorded 113 species, while urban blocks had 83 species.
- Natural forest sites** exhibited **distinct compositions** of butterfly species than urban block sites in their species composition (Fig.3).
- Natural forests host a total of **113** butterfly species. As the land use changes to urban areas, it leads to the loss of **45–46** additional species.
- 61 species** were identified as **urban avoiders**, including **35 natural forest specialists**. That can be used as indicator species to monitor disturbance and urbanization in the valley.
- 14 species** are classified as **urban exploiters** and indicated an urban environment.
- While **34 species** were considered **ubiquitous**.

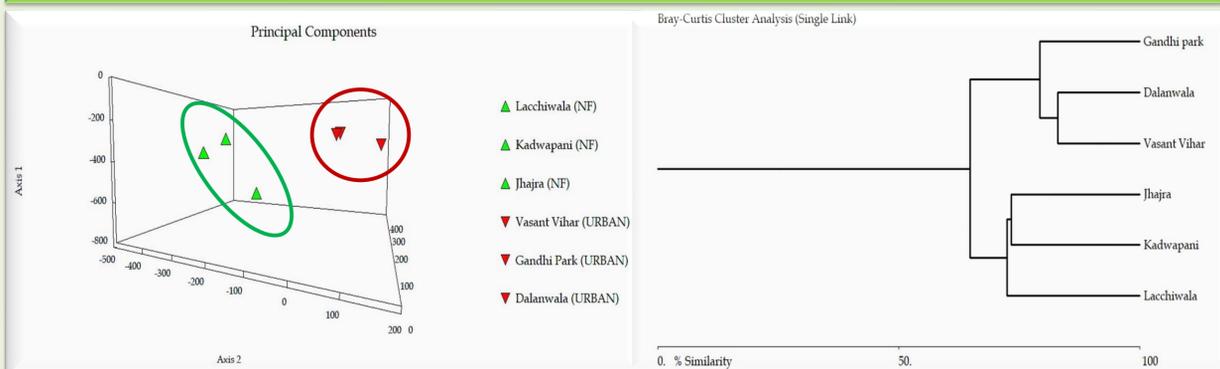


Fig.3. PCA plot and Bray-Curtis dendrogram revealing similarities of butterflies among land uses in Dehradun Valley.



CONCLUSION

- The study suggests that natural sal forests have a unique butterfly species composition. Land use changes in the lower Garhwal Himalayas (e.g., urbanization, agroforestry extension) reduce species richness and increase community homogenization, highlighting the ecological cost of habitat modification.
- Strategic conservation planning- Preserving forests, restoring native vegetation, and enhancing habitat complexity are vital for maintaining butterfly diversity and ecosystem resilience.

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