Environment and Ecology 44 (3) : 673—680, July—September 2026
Article DOI: https://doi.org/10.60151/envec/SMAH8285
ISSN: 0970-0420 (Print), ISSN: 3049-3625 (Online)

Documentation of the Forest Edge Species and Their Role in Forest Conservation with Special Reference to Joypur Forest, Bankura District, West Bengal, India

Sentu Kumar Dey, Ahinsuk Barua, Soma Chanda

Received 18 March 2026, Accepted 23 July 2026, Published on 19 August 2026

ABSTRACT

Forest edges represent ecotones—transitional zones between dense forest interiors and open landscapes—that harbor unique plant assemblages adapted to variable microclimatic and edaphic conditions. The present study documents the floristic composition of edge vegetation in Joypur Forest, located in the Bankura District of West Bengal, India. A total of 34 plant species belonging to 23 families were recorded along the forest edges. The vegetation comprises herbs, shrubs, climbers, grasses, and trees that play crucial ecological roles such as soil stabilization, microclimate regulation, providing habitat and food sources for fauna, and acting as buffer zones that protect the forest core from anthropogenic pressures. The predominance of phanerophytes (59.52%) and scarcity of hemicryptophytes and chmaephytes (both 2.38%) in the present study area is a typical indication of active ecological succession coupled with structural buffering and microclimate mitigation leading to a stable undisturbed forest edge ecosystem with a dense and intact canopy cover. The study highlights the significance of conserving edge flora as an integral part of forest management and biodiversity conservation strategies.

Keywords Forest edge flora, Joypur forest, Conservation, Biodiversity, Bankura, West Bengal, Ecotone vegetation.

INTRODUCTION

Forest edges are boundary zones where forests meet open habitats, forming ecologically distinct areas that differ from both adjoining systems in terms of soil pH, nutrient availability, and moisture regimes. These conditions influence the composition of species that are able to thrive in such regions (Vallet *et al.* 2010, De Pauw *et al.* 2021, Asanok *et al.* 2022). Vegetation at forest edges typically comprises a mixture of species from forest interiors and adjacent open habitats, along with edge-specialist taxa. This assemblage often results in higher species richness at edges compared to forest interiors, thereby enhancing overall

Sentu Kumar Dey[1], Ahinsuk Barua[2,] Soma Chanda[3]*

[1]State Aided College Teacher, [2,3]Assistant Professor
[1,2,3] Department of Botany, South Calcutta Girls' College, 72, Sarat Bose Road, Kolkata 700025, West Bengal, India

Email: somac10@gmail.com
*Corresponding author

landscape complexity (Erdős *et al.* 2019, Vanneste *et al.* 2024, Michalková *et al.* 2025).

The characteristic vegetation structure at forest edges contributes to variations in canopy height, stem density, and understorey density. The gradients of these structural attributes are shaped by factors such as patch size, edge length, surrounding landscape matrix, macroclimatic conditions, and management practices associated with adjacent land use (Meeussen *et al.* 2020, Kadawatha *et al.* 2025, Blanchard *et al.* 2023, Harper *et al.* 2023). Gradual transitions or "edge feathering" enhance light heterogeneity and promote greater understorey diversity, whereas abrupt edges may generate stressful microclimatic conditions (Kadawatha *et al.* 2025, Meeussen *et al.* 2020).

In certain contexts, particularly within urbanized or highly fragmented landscapes, forest edges tend to support a greater abundance of disturbance-tolerant, nutrient-demanding, and thermophilous species (De Pauw *et al.* 2024, De Pauw *et al.* 2021). While forest edges can buffer interior habitats from external pressures, they may also facilitate the invasion of non-forest or exotic species, especially under conditions of fragmentation or urban influence (Vallet *et al.* 2010, Vanneste *et al.* 2024, Harper *et al.* 2023). Despite their ecological significance, forest edges often receive limited attention, even though they play a critical role in maintaining ecological balance between natural forest interiors and human-dominated landscapes.

The Joypur Forest, located in Bankura District of West Bengal, constitutes part of the dry deciduous forest ecosystem along the fringe of the Chotanagpur Plateau. The forest is predominantly composed of *Shorea robusta* (Sal), accompanied by a variety of associated species. However, the forest margins have experienced substantial alteration due to grazing pressure, encroachment, and colonization by invasive species. In this context, systematic documentation of edge flora is essential for understanding ecosystem processes, assessing ecological degradation, and informing strategies for restoration and conservation.

This study aims to:

1. Document the plant species occurring along the forest edge of Joypur Forest.
2. Classify these species according to their habit and life forms.
3. Discuss their ecological and conservation significance.

Study site

The study was conducted in the Joypur Forest, located in Bankura District, West Bengal (India), situated approximately between 23°10′–23°25′ N latitude and 86°30′–86°45′ E longitude (Plate:1). The area experiences a tropical monsoon climate with an average annual rainfall of about 1,200 mm, and temperature varying between 10°C in winter and 40°C in summer.

The forest is primarily composed of dry deciduous vegetation dominated by *Shorea robusta*, *Terminalia tomentosa, Diospyros melanoxylon*, and *Pterocarpus marsupium.* The forest edge zones are characterized by open canopy, presence of grasslands, shrubs, and climbers, and are often impacted by livestock grazing, firewood collection, and agricultural encroachment.

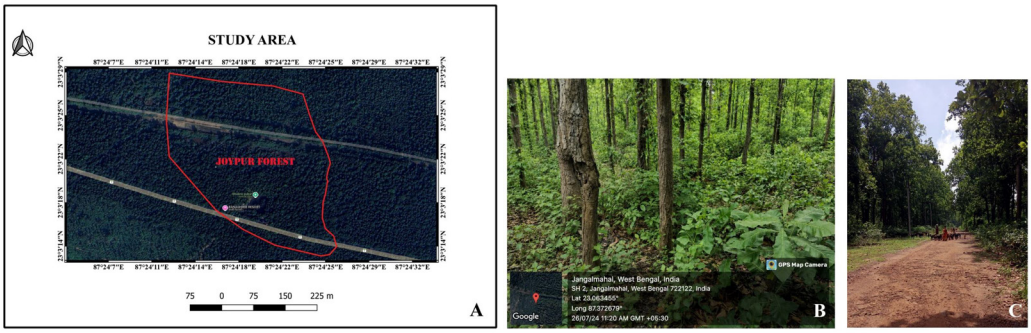

Plate 1. A- Study area map, B- Field study and data collection, C- Habitat fragmentation showing forest edge.

Survey and documentation

Field surveys during different seasons (pre-monsoon, monsoon, and post-monsoon) were conducted in a stretch of forest edge along the peripheral belt of Joypur Forest to record the plant species diversity. Random sampling method was followed in different patches of the study area. Photographs and plant samples were collected during the study for identification, future references and documentation. All encountered species were identified using regional floras and reference materials such as *Flora of British India* (Hooker 1872–1897), *Flora of Murshidabad District* (Guha Bakshi 1984), and *Bengal Plants* (Prain 1903).

Habit analysis and life form (following Raunkiaer 1934) of the documented species were noted during the course of study. Ecological functions and

Table 1. Edge Flora of Joypur Forest, Bankura District, West Bengal.

Sl. No.	Scientific Name	Family	Habit	Life Form
1	*Abrus precatorius* L.	Fabaceae	Climber	Liana (Phanerophyte)
2	*Acacia catechu* (L.f.) Willd.	Fabaceae (Mimosoideae)	Tree	Phanerophyte
3	*Ageratum conyzoides* L.	Asteraceae	Herb/Shrub	Therophyte
4	*Ageratum houstonianum* Mill.	Asteraceae	Herb	Therophyte
5	*Alstonia scholaris* (L.) R.Br.	Apocynaceae	Tree	Phanerophyte
6	*Andrographis paniculata* (Burm.f.) Nees	Acanthaceae	Herb	Therophyte
7	*Annona squamosa* L.	Annonaceae	Shrub/Small Tree	Phanerophyte
8	*Anisomeles indica* (L.) Kuntze	Lamiaceae	Herb	Therophyte
9	*Asparagus racemosus* Willd.	Asparagaceae	Climber	Liana
10	*Azadirachta indica* A.Juss.	Meliaceae	Tree	Phanerophyte
11	*Blumea lacera* (Burm.f.) DC.	Asteraceae	Herb	Therophyte
12	*Borassus flabellifer* L.	Arecaceae	Palm	Phanerophyte
13	*Butea monosperma* (Lam.) Taub.	Fabaceae	Tree	Phanerophyte
14	*Butea superba* Roxb.	Fabaceae	Climber	Liana
15	Calotropis procera (Aiton) Dryand.	Apocynaceae	Shrub	Phanerophyte
16	*Carissa spinarum* L.	Apocynaceae	Shrub	Phanerophyte
17	*Chromolaena odorata* (L.) R.M.King & H.Rob.	Asteraceae	Shrub	Phanerophyte
18	*Clerodendrum viscosum* Vent.	Verbenaceae	Shrub	Phanerophyte
19	*Curculigo orchioides* Gaertn.	Orchidaceae	Herb	Geophyte
20	*Desmodium gangeticum* (L.) DC.	Fabaceae	Shrub	Phanerophyte
21	*Elaeocarpus collinus* Roxb.	Elaeocarpaceae	Shrub	Phanerophyte
22	*Elephantopus scaber* L.	Asteraceae	Herb	Therophyte
23	*Flacourtia indica* (Burm.f.) Merr.	Salicaceae	Shrub	Phanerophyte
24	*Gloriosa superba* L.	Liliaceae	Climber	Geophyte
25	*Holarrhena pubescens* Wall. ex G.Don	Apocynaceae	Shrub/Treelet	Phanerophyte
26	*Jatropha gossypiifolia* L.	Euphorbiaceae	Shrub	Phanerophyte
27	*Lantana camara* L.	Verbenaceae	Shrub	Phanerophyte
28	*Leonurus sibiricus* L.	Lamiaceae	Herb	Therophyte
29	*Mesosphaerum suaveolens* (L.) Kuntze	Lamiaceae	Herb	Therophyte
30	*Mikania micrantha* Kunth	Asteraceae	Climber	Liana
31	*Mucuna pruriens* (L.) DC.	Fabaceae	Climber	Liana
32	*Phoenix acaulis* Roxb.	Arecaceae	Shrub/Palm	Chamaephyte
33	*Saccharum munja* Roxb.	Poaceae	Grass	Hemicryptophyte
34	*Semecarpus anacardium* L.f.	Anacardiaceae	Tree	Phanerophyte
35	*Senna alata* (L.) Roxb.	Fabaceae	Shrub	Phanerophyte
36	*Smilax rotundifolia* L.	Smilacaceae	Climber	Lianas
37	*Smilax zeylanica* L.	Smilacaceae	Climber	Lianas
38	*Spermacoce hispida* L.	Rubiaceae	Herb	Therophyte
39	Tridax procumbens L.	Asteraceae	Herb	Therophyte
40	*Tragia involucrata* L.	Euphorbiaceae	Shrub	Chamaephyte
41	*Vernonia cinerea* (L.) Less.	Asteraceae	Herb	Therophyte
42	*Ziziphus mauritiana* Lam.	Rhamnaceae	Shrub	Phanerophyte

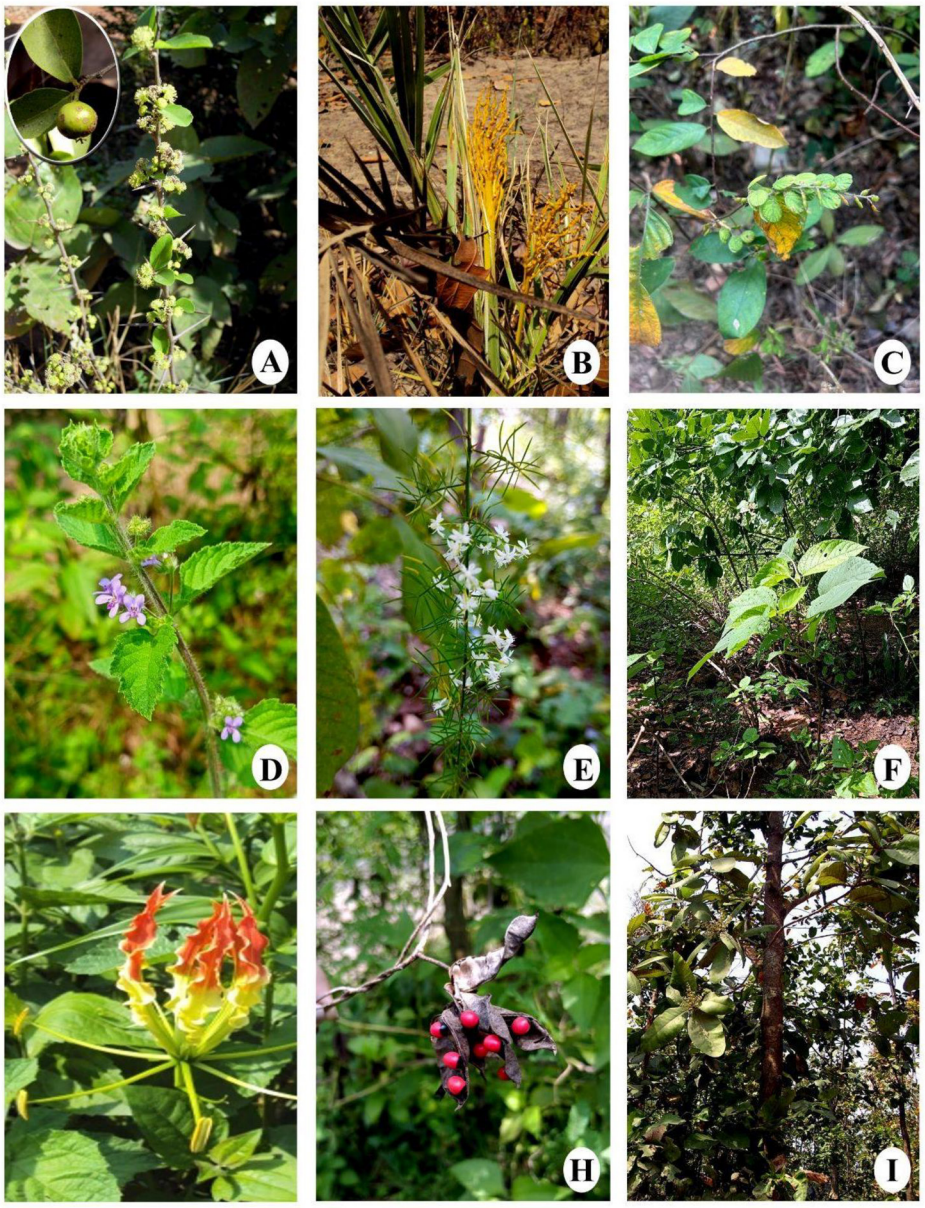

Plate 2. **(A)** *Flacourtia indica (inset: Fruit)*, **(B)** *Phoenix acaulis,* **(C)** *Desmodium gangeticum,* **(D)** *Anisomeles indica,* **(E)** *Asparagus racemosus,* **(f)** *Clerodendrum viscosum,* **(G)** *Gloriosa superba,* **(H)** *Abrus precatorius,* **(I)** *Semecarpus anacardium.*

roles were interpreted based on literature review and field observations.

The present study documented a total of 42 plant species (Table:1) occurring along the forest edge of Joypur Forest, Bankura District, West Bengal. These species belonged to 36 genera and 18 families, reflecting a moderate level of floristic diversity characteristic of tropical dry deciduous forest margins. The vegetation comprised a heterogeneous assemblage of trees, shrubs, herbs, climbers, grasses, and palms, indicating structural complexity at the forest

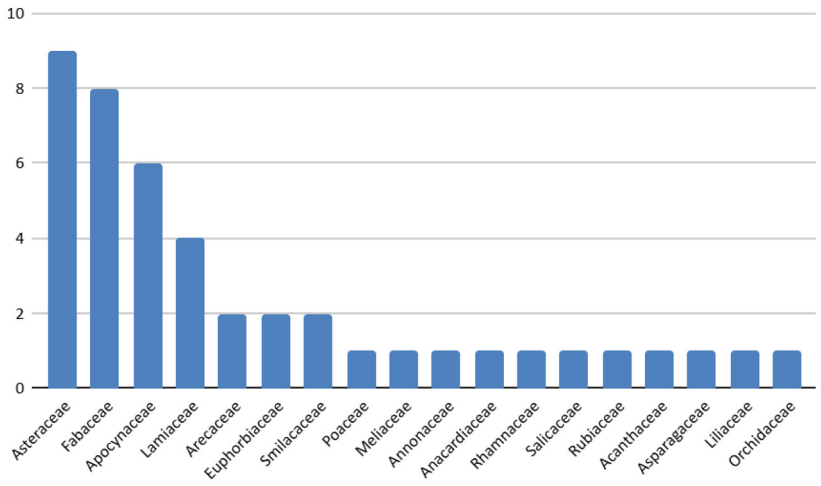

Fig. 1. Family-Wise Species Count.

boundary (Plate:2).

Among the recorded families, Asteraceae was the most dominant, contributing the maximum number of species, followed by Fabaceae, Apocynaceae, and Lamiaceae (Fig. 1). The predominance of these families is typical of forest-edge and disturbed habitats, as members of Asteraceae and Fabaceae are known for their adaptive strategies, rapid growth, and colonization ability.

Habit-wise analysis revealed that herbs and shrubs formed the major components of the forest-edge flora, followed by trees and climbers (Fig. 2). Grasses and palms were represented by fewer species. The dominance of herbaceous and shrubby elements indicates greater light availability and frequent disturbance at the forest margin, which favors fast-growing and pioneer species.

The presence of several tree species such as *Shorea-associated species* (e.g., *Butea monosperma, Azadirachta indica, Alstonia scholaris,* and *Semecarpus anacardium*) suggests that the forest edge also serves

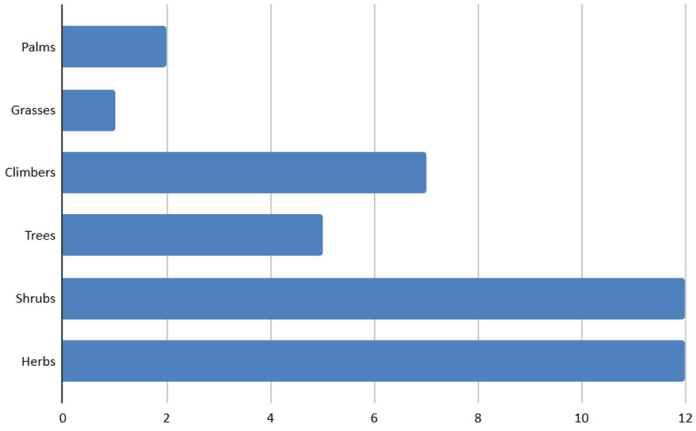

Fig. 2. Habit-Wise Analyses.

Biological Spectrum Analysis based on Raunkiaer's Life Forms:

Life Form	Normal Spectrum (%)	No. of Species	Percentage (%)
Phanerophytes	46	25	59.52
Therophytes	13	13	30.95
Cryptophytes	6	2	4.76
Hemicryptophytes	26	1	2.38
Chamaephytes	9	1	2.38

as a transition zone supporting woody perennials that contribute to canopy continuity.

The life-form analysis based on Raunkiaer's classification showed the dominance of Phanerophytes, followed by Therophytes, Cryptophytes, Hemicryptophytes, and Chamaephytes (Fig. 3). The high proportion of phanerophytes indicates the presence of perennial woody vegetation and reflects relatively stable climatic conditions in the region.

Therophytes constituted a significant proportion of the flora, mainly represented by annual herbs such as *Ageratum, Blumea, Tridax,* and *Vernonia.* Their abundance is indicative of anthropogenic disturbances, grazing pressure, and seasonal dryness typical of forest-edge ecosystems.

The dominance of phanerophytes (59.52%) and the very low representation of hemicryptophytes and chamaephytes (2.38% each) indicate a well-developed and stable forest-edge ecosystem which is characterized by advanced ecological succession. The prevalence of woody perennial species reflects the presence of a dense, continuous canopy that maintains higher humidity, moderates temperature fluctuations and reduces environmental stress, thereby creating buffered microclimatic conditions. Such structural complexity enhances ecosystem stability, promotes species persistence, and supports long-term vegetation development. This life-form spectrum is consistent with observations from recent forest-edge studies, where canopy integrity and microclimate regulation are closely associated with mature, relatively undisturbed vegetation (Park *et al.* 2026, Reek *et al.* 2025, Rinas *et al.* 2024).

Observation

Forest edges represent ecotonal zones where forest and non-forest ecosystems interact. The species documented in Joypur Forest edge exhibit diverse ecological roles that contribute significantly to forest conservation and ecosystem stability.

Shrubs and herbs act as buffer vegetation, reducing soil erosion, moderating microclimatic conditions, and preventing the invasion of exotic species into the forest interior. Species such as *Lantana camara* and *Chromolaena odorata,* although invasive, play a temporary role in soil stabilization, highlighting the dual nature of edge species.

The dominance of phanerophytes contributes to long-term ecosystem stability by providing structural support, carbon sequestration, and habitat continuity.

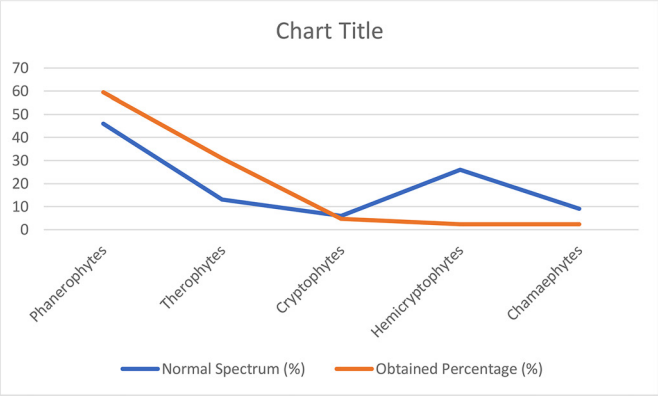

Fig. 3- Life-Form Analysis.

Trees and shrubs at the forest edge protect the interior forest from wind damage and desiccation, thereby maintaining forest integrity.

Lianas and climbers, including *Mucuna pruriens, Smilax zeylanica,* and *Gloriosa superba,* enhance vertical stratification and provide food and shelter for wildlife, particularly birds and insects. These species also facilitate seed dispersal and nutrient cycling.

Therophytes, though short-lived, play a crucial role in rapid ground cover formation, nutrient turnover, and early successional stages. Their dominance suggests frequent disturbances but also reflects the resilience and regenerative capacity of the forest-edge vegetation.

The floristic composition and life-form spectrum indicate that the forest edge of Joypur Forest is a dynamic and disturbance-influenced ecosystem. While the presence of native phanerophytes points to ecological stability, the high abundance of therophytes and invasive shrubs underscores the need for active management strategies.

Conservation efforts should focus on:

Promoting native tree and shrub species at the forest boundary.

Controlling invasive species to prevent encroachment into forest interiors.

Maintaining forest-edge vegetation as a protective buffer zone.

Proper documentation and management of forest-edge species are essential for conserving biodiversity and ensuring the long-term sustainability of the Joypur Forest ecosystem.

CONCLUSION

The study highlights that forest-edge species play a vital role in maintaining ecological balance, supporting biodiversity, and enhancing forest resilience. The forest edge of Joypur Forest, Bankura District, functions as an important transitional zone where species diversity and life-form composition reflect both natural and anthropogenic influences. Effective conservation of these edge habitats is therefore crucial for the overall conservation of the forest ecosystem.

ACKNOWLEDGMENTS

We are thankful to the Principal, South Calcutta Girls' College for continuous support during this work.

REFERENCES

Asanok, L., Taweesuk, R., & Kamyo, T. (2022). Edge tree functional traits and their association with edaphic factors in sea sonally dry forests in northern Thailand. *iForest - Biogeosciences and Forestry.* https://doi.org/10.3832/ifor3870-015

Bakshi, D. N. G. (1984). *Flora of Murshidabad District, West Bengal, India*. Scientific Publishers.

Blanchard, G., Barbier, N., Vieilledent, G., Ibanez, T., Hequet, V., Mccoy, S., & Birnbaum, P. (2023). UAV-Lidar reveals that canopy structure mediates the influence of edge effects on forest diversity, function and microclimate. *Journal of Ecology,* 111, 1411 - 1427. https://doi.org/10.1111/1365-2745.14105

De Pauw, K., Depauw, L., Calders, K., Cousins, S., Decocq, G., De Lombaerde, E., Diekmann, M., Frey, D., Lenoir, J., Meeussen, C., Orczewska, A., Plue, J., Spicher, F., Zellweger, F., Vangansbeke, P., Verheyen, K., & De Frenne, P. (2024). Nutrient-demanding and thermophilous plants dominate urban forest-edge vegetation across temperate Europe. *Journal of Vegetation Science*. https://doi.org/10.1111/jvs.13236

De Pauw, K., Meeussen, C., Govaert, S., Sanczuk, P., Vanneste, T., Bernhardt-Römermann, M., Bollmann, K., Brunet, J., Calders, K., Cousins, S., Diekmann, M., Hedwall, P., Iacopetti, G., Lenoir, J., Lindmo, S., Orczewska, A., Ponette, Q., Plue, J., Selvi, F., Spicher, F., Verbeeck, H., Vermeir, P., Zellweger, F., Verheyen, K., Vangansbeke, P., & De Frenne, P. (2021). Taxonomic, phylogenetic and functiona l diversity of understorey plants respond differently to environmental conditions in European forest edges. *Journal of Ecology,* 109, 2629 - 2648. https://doi.org/10.1111/1365-2745.13671

Erdős, L., Krstonošić, D., Kiss, P., Bátori, Z., Tölgyesi, C., & Škvorc, Ž. (2019). Plant composition and diversity at edges in a semi-natural forest–grassland mosaic. *Plant Ecology,* 220, 279-292. https://doi.org/10.1007/s11258-019-00913-4

Harper, K., Gray, L., Macdonald, S., Lesieur, D., Defields, D., Dodonov, P., Franklin, C., Haughian, S., López, L., Heath cote, A., Jager, K., Yang, R., Angelidis, C., Braga, A., Butler, W., Coley, S., Kornelsen, J., Murphy, L., Pelton, J., Recco, E., De Oliveira Xavier, R., Wilson, I., Ribeiro, M., Da Silva Matos, D., & Bergeron, Y. (2023). Data on vegetation across forest edges from the FERN (Forest Edge Research Network). *Ecology,* e4098. https://doi.org/10.1002/ecy.4098

Hooker, J. D. (1872–1897). *Flora of British India.* Vols. 1–7. L.

Reeve & Co., London

Kadawatha, A., Mecaskey, J., Swab, R., & Burns, J. (2025). Edge Feathering Across Forest-Meadow Ecotones Increases Light Heterogeneity and Understory Plant Diversity. *Forests.* https://doi.org/10.3390/f16030441

Meeussen, C., Govaert, S., Vanneste, T., Calders, K., Bollmann, K., Brunet, J., Cousins, S., Diekmann, M., Graae, B., Hedwall, P., Moorthy, S., Iacopetti, G., Lenoir, J., Lindmo, S., Orczewska, A., Ponette, Q., Plue, J., Selvi, F., Spicher, F., Tolosano, M., Verbeeck, H., Verheyen, K., Vangansbeke, P., & Frenne, P. (2020). Structural variation of forest edges across Europe. *Forest Ecology and Management.* https://doi.org/10.1016/j.foreco.2020.117929

Michalková, M., Bacigál, T., Čahojová, L., Dyderski, M., Jarolímek, I., Nemček, V., Slabejová, D., & Šibíková, M. (2025). Dissimilarity, nestedness, and turnover patterns in vegetation at the edge and in the core of lowland forest hab itats. *Plant Ecology.* https://doi.org/10.1007/s11258-025-01520-2

Park, M. H., Guzmán Q., J. A., Dyalsingh, H., Scott, A., & Cavender-Bares, J. (2026). Forest composition and diversity buffer microclimates and enhance productivity. *Journal of Ecology.* Advance online publication. https://doi.org/10.1111/1365-2745.70347

Prain, D. (1903). *Bengal Plants.* Botanical Survey of India, Calcutta.

Raunkiaer, C. (1934). *The Life Forms of Plants and Statistical Plant Geography.* Clarendon Press, Oxford.

Reek, J. E., Crowther, T. W., & Lauber, T. *et al*. (2025). Forest edges are globally warmer than interiors and exceed optimal temperatures for vegetation productivity. *Commun Earth Environ* 6, 635 (2025). https://doi.org/10.1038/s43247-025-02626-1

Rinas, C. L., Harper, K. A., & Rad, J. E. (2024). Recent advances in studying vegetation at forest edges. *Plant Ecol* 225, 301–303. https://doi.org/10.1007/s11258-024-01417-6

Vallet, J., Beaujouan, V., Pithon, J., Rozé, F., & Daniel, H. (2010). The effects of urban or rural landscape context and distance from the edge on native woodland plant communities. *Biodiversity and Conservation,* 19, 3375-3392. https://doi.org/10.1007/s10531-010-9901-2

Vanneste, T., Depauw, L., De Lombaerde, E., Meeussen, C., Govaert, S., De Pauw, K., Sanczuk, P., Bollmann, K., Brunet, J., Calders, K., Cousins, S., Diekmann, M., Gasperini, C., Graae, B., Hedwall, P., Iacopetti, G., Lenoir, J., Lindmo, S., Orczewska, A., Ponette, Q., Plue, J., Selvi, F., Spicher, F., Verbeeck, H., Zellweger, F., Verheyen, K., Vangansbeke, P., & De Frenne, P. (2024). Trade-offs in biodiversity and ecosystem services between edges and interiors in Europe an forests. *Nature ecology & evolution.* https://doi.org/10.1038/s41559-024-02335-6