

Research Practices - CCE1 Literature Survey

Team Code: TY3-19A

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Tentative Title: Biodiversity and Urbanization

Domain: Environmental Science & Sustainability

Sub Domain:

1. Urban Ecology
2. Environmental Policy & Planning
3. Nature-Based Solutions & Urban Design

Objective Description:

The objective of this research is to examine the relationship between urbanization and biodiversity, focusing on the ecological, social, and policy dimensions. It aims to analyze the negative impacts of urban expansion on ecosystems, review global and Indian case studies where biodiversity has been integrated into urban development, evaluate existing conservation policies, and propose sustainable strategies to enable biodiversity to coexist alongside rapid urban growth.

Team Member1:

PICO 1:

Paper Title: Urban Green Infrastructure Planning in Jaipur, India: A GIS-Based Suitability Model for Semi-Arid Cities

Authors of Paper: Nathawat R, Gupta SK, Kanga S, Singh SK, et al. (2025)

Paper Description:

Problem: Lack of data-driven methods to guide green infrastructure development in semi-arid urban environments.

Intervention: A GIS-based model to map suitable zones for green infrastructure in Jaipur.

Comparison: Suitable vs. less suitable areas based on environmental parameters.

Outcome: Identification of priority zones for green infrastructure implementation, offering structured guidance for urban planners.

PICO 2:

Paper Title: Mainstreaming urban nature-based solutions in India

Authors of Paper: ICF Insights (2025)

Paper Description:

Problem: Conventional grey infrastructure fails to address urban challenges like heat, flooding, and biodiversity loss.

Intervention: Adoption of Nature-Based Solutions (NbS) like green roofs, urban forests, permeable surfaces.

Comparison: NbS versus grey infrastructure approaches.

Outcome: NbS provides climate regulation, biodiversity enhancement, and reduced flood risk—positioned as holistic, low-cost alternatives.

PICO 3:

Paper Title: Promoting Conservation and Sustainable Management of Urban Biodiversity in Noida

Authors of Paper: ICLEI South Asia (2023–2024)

Paper Description:

Problem: Urban planning often neglects biodiversity, leading to degraded ecosystems in growing cities.

Intervention: Development of a Local Biodiversity Strategy & Action Plan, City Biodiversity Index, natural asset mapping in Noida.

Comparison: Standard urban planning versus biodiversity-integrated planning.

Outcome: Framework for mainstreaming biodiversity into urban management, raising stakeholder awareness and embedding conservation into city planning.

PICO 4:

Paper Title: Co-benefits of Urban Biodiversity

Authors of Paper: Dhote M., Mukherjee D. (2018)

Paper Description:

Problem: Urban green spaces are often seen only as recreational assets, undervaluing their ecological roles.

Intervention: Multi-scale biodiversity conservation strategy emphasizing legal and governance tools.

Comparison: Planning with versus without consideration of ecosystem services.

Outcome: Highlighted co-benefits like pollution control, climate regulation, flood management; identified policy mechanisms to integrate biodiversity into cities.

PICO 5:

Paper Title: Role of Biodiversity – Opportunities, Threats, and Strategic Interventions for a Resilient Indian City

Authors of Paper: Souporni Paul, Suchandra Bardhan, Sankeerthana Ananthula (2023)

Paper Description:

Problem: High-density Indian cities face escalating biodiversity loss without clear urban resilience strategies.

Intervention: Assessment of biodiversity in Kolkata; formulation of strategic interventions and resilience planning.

Comparison: Business-as-usual development vs. biodiversity-informed urban resilience.

Outcome: Recommendations for habitat restoration, biodiversity profiling, and strategy planning to improve urban resilience in megacities.

Team Member2:

PICO 1:

Paper Title: Biodiversity impacts and conservation implications of urban land expansion

Authors of Paper: Güneralp B., Seto K.C., et al. (2020, PNAS)

Paper Description:

Problem: Global urban land expansion threatens one-third of assessed species.

Intervention: Spatial modeling of biodiversity impacts across projected urban growth zones.

Comparison: Current habitat distribution vs. projected urban expansion zones.

Outcome: Identified hotspots of biodiversity loss; stressed urgent need for integrated land-use policies.

PICO 2:

Paper Title: Urbanization driving changes in plant species and communities

Authors of Paper: Aronson M.F.J. et al. (2022, ScienceDirect)

Paper Description:

Problem: Rapid urbanization alters plant communities globally.

Intervention: Analysis of plant biodiversity patterns across urban gradients.

Comparison: Urban vs. peri-urban/rural plant communities.

Outcome: Clear decline in native species; invasive species dominate urban landscapes.

PICO 3:

Paper Title: Direct and Indirect Impacts of Urbanization on Biodiversity Across the World's Cities

Authors of Paper: Liu J. et al. (2025, MDPI Remote Sensing)

Paper Description:

Problem: Lack of comprehensive metrics to quantify biodiversity intactness in cities.

Intervention: Use of Biodiversity Intactness Index across 1,523 global cities.

Comparison: Cities with high vs. low levels of intact biodiversity.

Outcome: Found both direct habitat loss and indirect anthropogenic stressors as major biodiversity threats.

PICO 4:

Paper Title: Urban Ecosystems and Biodiversity: Climate Change Perspectives

Authors of Paper: Rosenzweig C. et al. (2016, Columbia University ARC3.2 Report)

Paper Description:

Problem: Cities face biodiversity loss while also being climate change hotspots.

Intervention: Review of adaptation/mitigation strategies integrating biodiversity into climate planning.

Comparison: Urban areas with vs. without biodiversity-sensitive climate planning.

Outcome: Biodiversity integration enhances climate resilience, ecosystem services, and human well-being.

PICO 5:

Paper Title: Importance of Urban Biodiversity: A Case Study of Udaipur, India

Authors: Satya Prakash Mehra (2017)

Problem Statement: Lack of understanding about how anthropogenic activities affect urban biodiversity in semi-arid Indian cities.

Intervention: Survey of urban biodiversity indicators—focus on avifauna and habitat variety in Udaipur.

Comparison: Differing levels of biodiversity across green spaces, artificial lakes, and built environments.

Outcome: Highlighted how artificial habitats—parks, lakes—support significant flora and fauna, including birds, and underscored the importance of ecological elements in urban planning for ecosystem resilience.

Team Member3:

PICO 1:

Paper Title: Bio-Inclusive Urban Ecosystems and Their Conservation – A Review

Authors: A. E3S Web of Conferences (2024)

Problem Statement: Urban development often overlooks wildlife conservation, especially in rapidly expanding Indian cities.

Intervention: Review of bio-inclusive urban ecosystem design—joint focus on wildlife protection, wetland management, and habitat regulation.

Comparison: Biocentric urban planning vs. traditional urban models.

Outcome: Advocated for habitat-sensitive zoning, wildlife-friendly planning, and policy support for wetlands in the urban context.

PICO 2:

Paper Title: Habitat heterogeneity influences avian feeding guild composition in urban landscapes: evidence from Bhubaneswar, India

Authors: Sahu H.K., Sahu B., et al. (2021)

Problem Statement: Urbanization alters ecological networks and feeding guild composition, threatening species richness and ecosystem functions.

Intervention: Field surveys of avian feeding guilds across varied urban habitats in Bhubaneswar.

Comparison: Homogeneous built-up areas versus heterogeneous green-rich urban habitats.

Outcome: More heterogeneous urban habitats supported higher avian species diversity and functional richness; findings highlight importance of habitat diversity in mitigating urban biodiversity loss.

PICO 3:

Paper Title: A Critical Study on Status of East Kolkata Wetlands with Special Emphasis on Water Birds as Bio-Indicator

Authors: Bhattacharyya A., Sen S., Roy P.K., Mazumdar A. (2008)

Problem Statement: Urbanization is disrupting East Kolkata Wetlands, threatening waterbird diversity used as ecological indicators.

Intervention: Wetland status evaluation using GIS, remote sensing, water quality, and bird surveys.

Comparison: Historical biodiversity data vs. contemporary wetland condition.

Outcome: Demonstrated decline in bird species and wetland health, reinforcing the need for policy-driven conservation and wetland protection.

PICO 4:

Paper Title: Ecosystem Service Assessment of Selected Wetlands of Kolkata and the Indian Gangetic Delta

Authors: Everard M., Kangabam R., Tiwari M.K., et al. (2019)

Problem Statement: Urban wetlands are under pressure from development, compromising their ecosystem functions.

Intervention: Quantitative assessment of ecosystem services (flood regulation, water purification, biodiversity support) across Kolkata wetlands.

Comparison: Performance of wetlands under different management stresses.

Outcome: Highlighted significant loss of services in unmanaged areas; recommends structured wetland policy frameworks for sustainable urban planning.

PICO 5:

Paper Title: Nature-based solutions in Bhubaneswar: Urban agriculture as biodiversity strategy

Authors of Paper: Dash A., et al. (2022, Discover Sustainability – Springer)

Paper Description:

Problem: Urbanization threatens peri-urban biodiversity in Odisha.

Intervention: Integrating urban agriculture as a nature-based solution.

Comparison: Conventional urban land-use vs. urban-agriculture-integrated planning.

Outcome: Urban agriculture enhances food security, green cover, and pollinator diversity.

Github link:

https://github.com/manali-dhamale/CCE1_Biodiversity_Urbanization_TY03-19A.git