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DOES URBANIZATION EFFECT BIODIVERSITY …?

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ABSTRACT
Urbanization is a main thing that transforming natural ecosystems into highly developed city environments This transformation occurs in biodiversity-rich areas, leading to significant biodiversity loss as natural landscapes are replaced by surfaces like roads and buildings. This conversion creates harsh, human-made environments are characterized by habitat degradation and fragmentation, The environmental urbanization is further increased by rapid industrial growth and increasing carbon combustion, which resulted in climate change.

Keywords: *Urbanization,Biodiversity,climate,environment,pollution,habitat*

INTRODUCTION
Urbanization is one of the most important way that transform the natural ecosystems into highly urbanized city environments that function very differently from the land that are less developed areas (Shochat et al., 2006). Many cities are built in the regions which has rich in biodiversity, that means urban expansion leads to loss of biodiversity (Myers et al., 2000). As natural landscapes are replaced by urban ones that is construction of roads and buildings, (Stewart & Oke, 2012), reduced soil absorption that increases the chances of having floods (Scalenghe & Marsan, 2018), Urbanization also causes greater disturbance to habitats (Knapp et al., 2008)

Many species cannot live in the harsh environments that are created by humans (Blair & Launer, 1997; Tait, Daniels, & Hill, 2005; McKinney, 2006; McKinney, 2008; Urban et al., 2006), and this leads to significant decline in their population. These human-modified environments are often characterised by habitat degradation (McKinney, 2006; McKinney, 2008; Grimm et al., 2008).

Urban areas are growing faster, with more rates than 8% each year (World Population Review, 2021). Rapid industrial growth, expanding cities, and uncontrollable population increases are degrading environment. The pollution comes from human activities, increase in carbon combustion are increasing climate change (Tollin, 2015). including the use of poor-quality fuels, heavy traffic, older vehicles, poor road infrastructure, and weak inspection and maintenance systems (Roy et al., 2020).

Current research still struggles to track how urbanization, pollution, and ecosystems change over time due to limited long-term monitoring and inconsistent methods. There's also a shortage of studies from fast-growing regions like Asia, Africa, and Latin America, where urban change is most intense. We still don't fully understand pollution, land-use shifts, and climate impacts—work together. Moreover, the links between green infrastructure, human health, and traditional local knowledge remain underexplored.

This review aims to understand how urbanization affects biodiversity, identify existing research gaps, and explore sustainable urban planning strategies that can balance development with ecological preservation.

METHODOLOGY
This review is based on a careful understanding of research articles that explore various themes, including urban planning, sustainable practices, ecological patterns, and climate-related challenges. The insights from these studies were grouped into broader themes to make it easier to compare findings across different species, regions, and environmental factors. The main research gaps identified were then summarized and used to outline future directions for more focused and impactful research.

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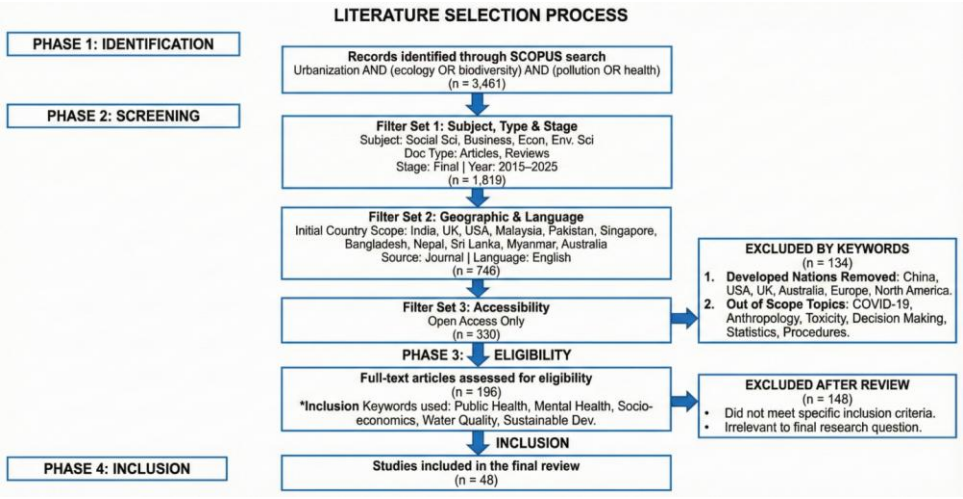
Description



Source: Gemini

Inclusion Criteria

To ensure the review should be relevant and high-quality, several filters were applied:

- Subject Areas

Studies were included if they fell under the following subject categories:

- Social Sciences
- Business, Management
- Economics, Econometrics, and Finance
- Environmental Sciences
- Document Type

Only articles and review papers were included, reducing the dataset to 1840 documents.

- Publication Stage

Only fully published documents were considered, resulting in 1819 records.

- Publication Year

Articles published between 2015 and 2025 were included (total: 4728, before applying other filters).

- Country/Region Filter

Studies were restricted to selected countries to maintain regional relevance. Included countries:

India, UK, USA, Malaysia, Pakistan, Singapore, Bangladesh, Nepal, Sri Lanka, Myanmar, Australia

After applying this filter, 767 documents remained.

- Open Access Availability

Leaving 330 open-access English-language documents.

- Source and Language
- Only journal publications were included.
- Only English-language papers were selected (746 documents before OA filter).
- Keywords

Articles containing the following keywords were considered relevant for detailed screening:

- Public health
- Controlled study
- Non-human / animal studies

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- Adolescent (health context)
- Mental health
- Health care / risk
- Environmental exposure
- Risk factors
- Water quality
- Economics
- Sustainable development
- Metabolism
- Pollution exposure

These keywords ensured coverage of ecological, health, socio-economic, and environmental dimensions linked to urbanizatio

Exclusion Criteria

Several criteria were applied to remove irrelevant or non-target literature:

- **Country Exclusion**

Studies based primarily in or focusing on the following regions were excluded:

China, USA, Australia, UK, Queensland, North America, Europe (Used to avoid oversaturation and maintain regional focus.)

- **Subject and Document Exclusions**

The following were excluded to avoid non-relevant or specialized content:

- Anthropology
- Priority journals (non-mainstream or not aligned with scope)
- Statistics-focused papers
- Review papers (in some cases, depending on stage—your data shows review was excluded again)
- Decision-making or policy-only papers
- Procedural papers
- COVID-19-related research (196 records removed)
- Toxicity-focused studies
- Health surveys with no link to urbanization
- General ecology papers not linked to urbanization
- Studies focusing only on demographic groups like male/female/adult with no environmental context

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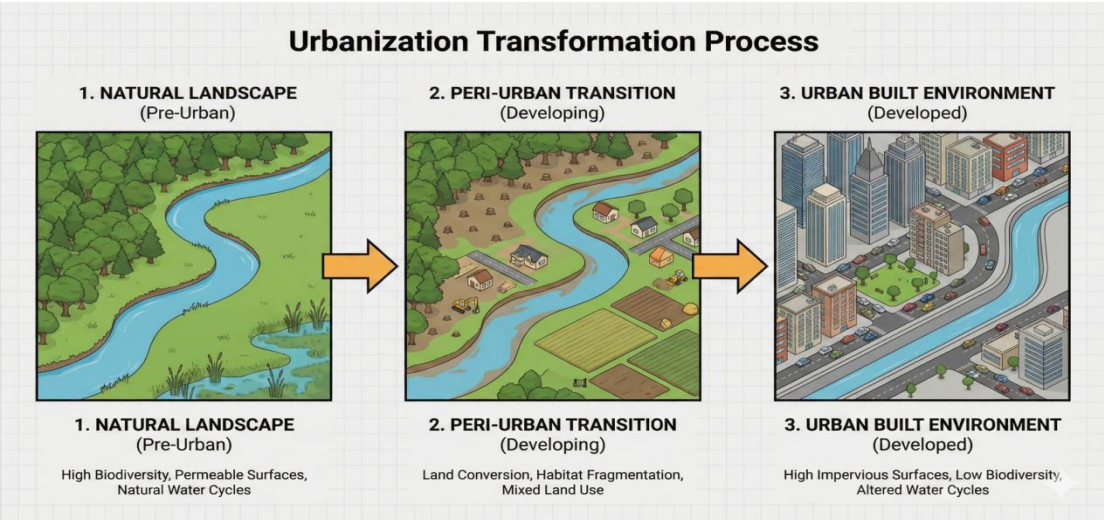


Source: Gemini

The image explains the "Urbanization Transformation Process" in three different stages:

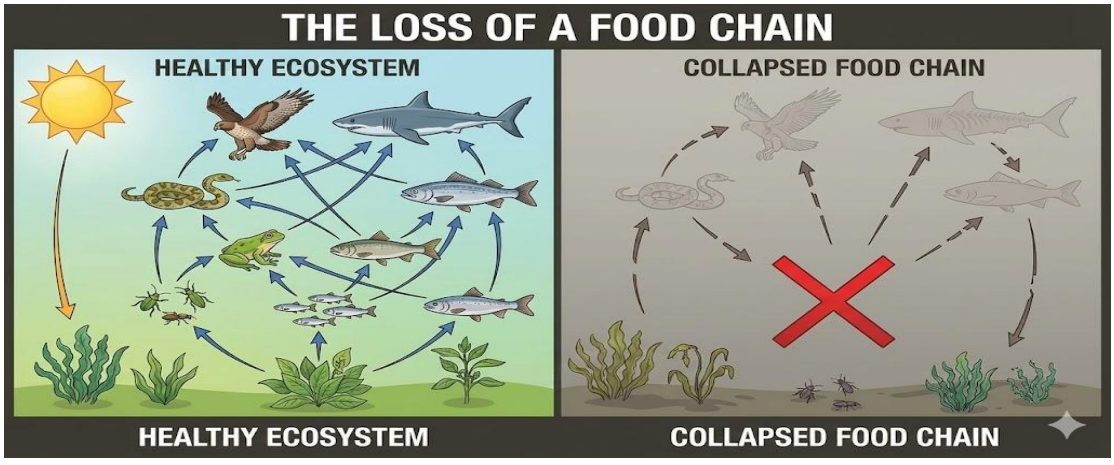
Pre-Urban: This initial stage has high biodiversity and has surfaces that allow water absorption characterized by forests.

Developing: The second stage tells us the start of transforming natural land areas to human made areas, characterized by mixed land use agriculture and early construction.

Developed: The final stage shows a developed city with concrete and buildings, and had less biodiversity, and altered water cycles,

source: Gemini

This image shows us how rainwater absorbed when there is natural surface and urban grounds which are filled with concrete This results in "reduced absorption," causing rainwater to stay on the surface and flow into drains rather than soaking into the ground. By this the soil does not get water which reduce soil fertility and reduce in underground water level



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source: Gemini

This image tells us the impact of urbanization on ecological balance, showing the transformation from a "Healthy Ecosystem" to a "Collapsed Food Chain." Urban development destroys natural habitats, eliminating the plants and insects that form the base of the food web. The loss of primary producers by urban pollution, causes starvation to higher-level consumers, leading to the decrease of predators and a severe loss of biodiversity.

DISCUSSION

A clear pattern emerges from urbanization that it transformed ecosystems, species communities, and human–environment relationships. One of the strongest impact is the loss of native biodiversity. Birds, plants, amphibians, butterflies, and fish all show similar responses as land use changes, fragmentation, and responsiveness to diseases declined which resulting in decline of species Even species numbers appear stable, functional and phylogenetic diversity has been decreased. This transition shows us how disturbance and intolerant this environment becomes

Pollution adds another layer to this ecological pressure. Microplastics damage mangroves and coral reefs, groundwater contamination, urban water supplies in India, and nutrient overload degrades aquatic systems. Industrial pollution in low-income regions produces both environmental harm and social injustice. Wetlands, lakes, and streams are especially vulnerable, often receiving multiple pollutants simultaneously.

Green and blue infrastructure are the best solutions to address this situation. Access to parks, forests, and water bodies improves health, reduces heat, and supports biodiversity. Nature-based solutions—such as green roofs and stormwater systems helps to cool buildings and manage floods. However, their success depends on design, and strong governance. Uneven distribution or over distribution of green spaces also raises concerns

Urban water management has additional challenges. Wastewater reforms have to be improved. Integrated Water Resources Management reveals that where solving one water issue creates another.

Meanwhile, aquaculture is expanding but faces governance weaknesses, poor resource quality, and environmental concerns.

Another important threat is the role of local and indigenous communities. Traditional knowledge about plants and ecosystems passed down through generations remains incredibly valuable for conservation. However, this knowledge is at risk of disappearing as younger generations move away from these traditions. The studies make a strong case for listening to and involving local people in decision-making.

Overall, the impacts of urbanization are complex and interlinked. Progress requires shifting from isolated studies to integrated, multi-disciplinary research that connects ecology, social sciences, planning, engineering, and governance.

Only holistic approaches can help cities balance development with biodiversity conservation, human well-being, and long-term resilience.

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CONSCLUSION

Urbanization is rapidly changing ecosystems and the way people connect with nature. Land-use changes, pollution, and weak governance continue to drive biodiversity loss and environmental decline. Yet, if cities invest in well-planned and fairly distributed green spaces, they can build resilience, support public health, and reduce the risks of climate change. Creating sustainable and inclusive cities will require collaboration—combining ecological knowledge, social understanding, and innovative urban design, along with stronger governance, continuous monitoring, and genuine community involvement. Looking ahead, researchers and policymakers should focus on studying microplastics and groundwater in underexplored regions, integrating Social–Ecological Systems (SES) into urban planning, encouraging community participation in green infrastructure design, improving wastewater and climate-resilient systems, and ensuring everyone has access to clean, healthy green and blue spaces.

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