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GROWING CITIES, SHRINKING NATURE *EXPLORING THE ENVIRONMENTAL EFFECTS OF URBANIZATION* A LITERATURE-BASED REVIEW OF GLOBAL EVIDENCE, WITH REFERENCE TO PAKISTAN

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Abstract

Background. *Urbanization is a gradual process that is taking place on a global scale. Urban areas currently accommodate over half of the population, with the urban share projected to rise steadily in the coming decades (UN-DESA, 2018). Urban centers have been engines of economic growth and innovation, but they have also experienced fast growth in their built environment, which is putting increasing strain on the natural environment.* ***Objective.*** *This article explores the environmental impacts of urbanization, in relation to land-use change and biodiversity, air quality, water resources, and climate, and applies the Pakistani context of one of the leading urbanizing countries in Southern Asia.* ***Methodology.*** *The study is a narrative, literature-based review. It integrates peer-reviewed studies and information and information and data from authoritative sources such as the United Nations, the World Health Organization, UN-Habitat, and the World Bank. Primary Data were not collected.* ***Major findings.*** *These facts suggest that urbanization is the chief contributor to habitat and biodiversity loss (Seto et al., 2012), urban centers are responsible for a substantial share of global energy use and contribute significantly to greenhouse-gas emissions (UN-Habitat, n.d.; UNEP, n.d.), and that nearly the entire world's population is at risk of being affected by air pollution above air-quality guidelines (WHO, 2024). According to official data, Pakistan is experiencing continued urban growth, accompanied by increasing pressure on land resources, air, and water in the urban centers.* ***Conclusion.*** *While urbanization can cause environmental harm, it does not have to be, as environmental impacts per capita can be lowered by well-designed compact and green cities. The common problem is to control urban development to ensure that the growth of cities is not at the expense of the loss of nature.*

1. Introduction

1.1 Background of Urbanization

Urbanization is a process of a gradual movement of people from countryside areas into cities, together with the outward growth of urban settlements. It is a major characteristic of modern times. The global urban population rose substantially, increasing from approximately 751 million people in 1950 to 4.2 billion by 2018, and is projected to rise to nearly 90 per cent of the global population in 2050, of which nearly 90 per cent will be living in Asia and Africa (UN DESA, 2018). This

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change can have many positive impacts, such as better access to services and economic opportunity, but can also have an unprecedented impact on landscapes and ecosystems.

1.2 Urbanization and the Environment

Cities expand into forests, farmland and wetlands, change local climate and focus energy and water use. Cities represent just three per cent of the Earth's surface, but roughly 70 per cent of global GHGs are emitted and around three-quarters of global energy use is accounted for in cities (N.Habitat, n.d.; IEA, 2021). The consequences of city development extend beyond the city limits and impact biodiversity, the atmosphere and the climate system in general.

1.3 Why the Issue Matters

The environmental impact of urbanization is important because of interactions with human health, food security, and climate stability. Urban air pollution has emerged as a significant global public health concern (WHO, 2024), while the destruction of natural habitats reduces essential ecosystem services, including air purification, water regulation, and pollination, on which human populations depend. These pressures can be particularly strong in developing countries that are undergoing rapid urbanization, with outpaced planning and infrastructure.

1.4 Research Gap

While the environmental impacts of urban growth are well-documented in a large international literature, many of these studies have a broad global or high-income city flavor. Syntheses linking global evidence to the unique situations of fast urbanizing South Asian nations like Pakistan are still relatively small, and national urban environmental quality data are not uniform. This article fills this gap by incorporating global scientific evidence into the Pakistan context.

1.5 Objectives of the Article

The article aims at the following:

- To explain the scale and patterns of the urbanization process around the world;
- To examine the main environmental impacts of urban development including changes in land use, declining biodiversity, deteriorating air quality, and the effects of climate change;
- To draw inferences from this worldwide evidence regarding the experience of urbanization in Pakistan; and
- To seek out solutions – planning, green infrastructure and policy – to mitigate the environmental impacts of urban expansion; and
- To provide actionable and fact-based suggestions for more sustainable cities.

2. Literature Review

2.1 Trends and Scale of Urbanization

Today's level of urbanization is unprecedented. In addition to the overall trend of urbanization, growth is very concentrated, as a few nations located in Asia and Africa are projected to make up the majority of the urban population's growth by 2050 (UN DESA, 2018). More importantly, in many areas, the spread of urban land is faster than the growth of urban population, with urban expansion happening at low densities, which is frequently referred to as urban sprawl, with increasing environmental pressures per capita (Seto et al., 2012).

2.2 Land-Use Change and Biodiversity Loss

The most evident environmental consequence of urban growth is the conversion of natural habitats and agricultural areas into built-up land. Seto et al. (2012) projected that the worldwide extent of urban land could nearly triple by 2030 compared with 2000, reaching approximately 1.2 million square kilometers, with a considerable proportion of this expansion occurring in and around regions recognized as biodiversity hotspots. Urban development is recognised as a major cause of

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biodiversity loss and for wider changes in landscape ecology (Grimm et al., 2008), as it breaks and eliminates habitat.

2.3 Air Quality and the Urban Atmosphere

Urban air pollution has received extensive research attention because emissions generated by transportation, industrial activities, and energy consumption contribute substantially to deteriorating air quality, but it is also transmitted by the wind to other suburbs. Cities focus on emissions from transport, industrial activity, and energy consumption, which are major contributors to urban air pollution, making it one of the most extensively examined environmental challenges in cities. Moreover, airborne pollutants can be transported by prevailing winds, affecting surrounding suburban areas. Nearly all of the earth's population (99 per cent) is open to air pollution levels in ambient air (outdoor air) that are higher than the WHO guideline limits for fine particulate matter (WHO, 2024) and ambient air pollution (outdoor air) was estimated to contribute approximately 4.2 million premature deaths were attributed to air contamination worldwide in 2019 (WHO, 2024). Although air pollution is not confined to cities, urban areas are typically where exposure and emissions are highest.

2.4 Water Resources and Pollution

Water is impacted in a variety of ways by urbanization. Impervious surfaces, like roads and rooftops, limit the way that rainwater naturally flows into the ground, causing surface runoff that can lead to urban flooding, and concentrated demands for freshwater put stress on supplies. In many areas, municipal and industrial wastewater has not kept pace with growth, and can cause rivers and groundwater to be polluted. These pressures are well documented in the urban-environment literature as contributing to the transformation of natural systems by cities (Grimm et al., 2008).

2.5 Climate and the Urban Heat Environment

Cities are a source of, and vulnerable to, climate change. Given that they have a small land area, urban areas account for most of the greenhouse gas emissions (UNEP, n.d.). Additionally, urban areas, due to their built surfaces and low vegetation, experience higher temperatures than the surrounding rural or less-developed areas, which increases the demand for cooling and the health risk due to heat. Creating green space has often been cited as one of the solutions to regulate urban temperature and support livability (UN-Habitat, n.d.).

3. Methodology

The article is not a systematic review nor a primary empirical research but a narrative literature-based review. A survey, field measurement, and the creation of original modelling were not carried out. The analysis is based on 2 types of sources. The first is scientific peer-reviewed literature related to the environmental impacts of urbanization that includes basic and widely cited studies. The second consists of authoritative institutional and governmental documents such as reports and data from the United Nations, UN-Habitat, UNEP, and the World Health Organization, the International Energy Agency, the World Bank, and the Government of Pakistan.

Sources were chosen based on their relevance, trusting in the publisher's credibility, and their timeliness, with special attention to seminal older studies that are conceptually relevant. Primary institutional statistics were preferred over other statistics for factual claims on urbanization and environmental indicators. The study is based on the information previously published, and therefore is not meant to establish causation, but is subject to the limitations discussed in Section 9.

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4. Findings from Existing Literature

4.1 The Scale of Urban Growth

The evidence reviewed confirms that there is a rapid and ongoing global shift towards residing in urban areas. The world's urban inhabitants have grown since the mid-1950s, and are expected to continue this trend through 2050 (UN DESA, 2018) (Figure 1). Each of these environmental effects is related to this expansion.

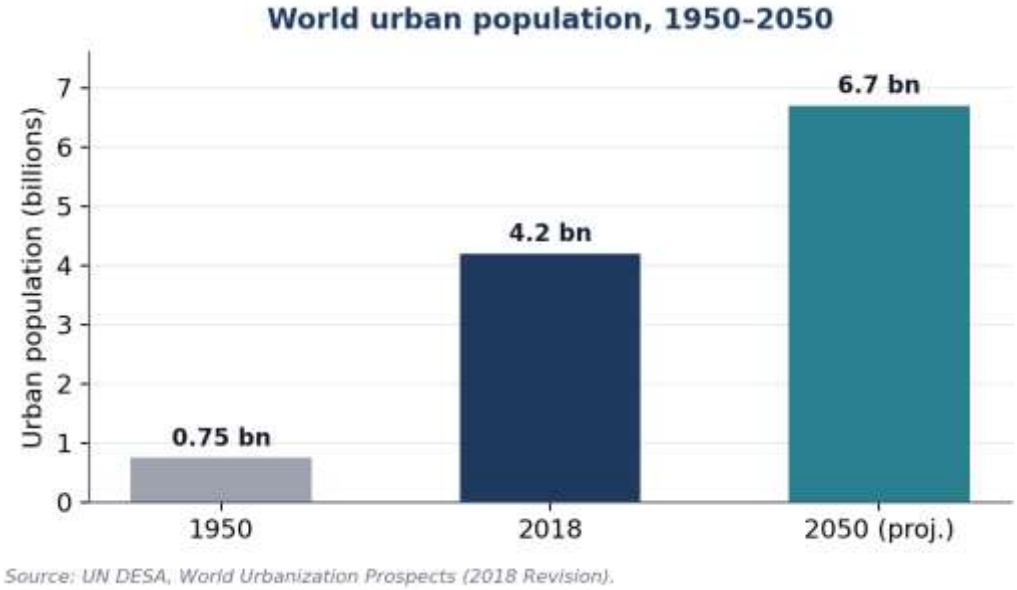


Figure 1. World urban population, 1950–2050 (UN DESA, 2018).

4.2 Land, Biodiversity, and Carbon

Land use and loss of habitat are caused by urban growth. Seto et al. (2012) calculate that urban land use could increase the global urban area by almost 3 times in the next 30 years, and the loss of biomass from urbanization in the pan-tropics would be equivalent to the carbon emission resulting from tropical forest loss and changes in land use. This biodiversity-richness is concentrated in areas where biodiversity conservation and appreciation are a pressing need in the face of urbanization.

4.3 The Urban Environmental Footprint

An over-observed phenomenon is that cities, although physically small, contribute a significant portion to the environmental impact. As illustrated in Figure 2, urban centres account for a substantial share of global energy consumption and are responsible for a significant proportion of worldwide greenhouse-gas emissions, even though they cover just a few per cent of the Earth's land. This concentration is also an opportunity: With efficiency gains in cities, these gains can have disproportionately large environmental impacts.

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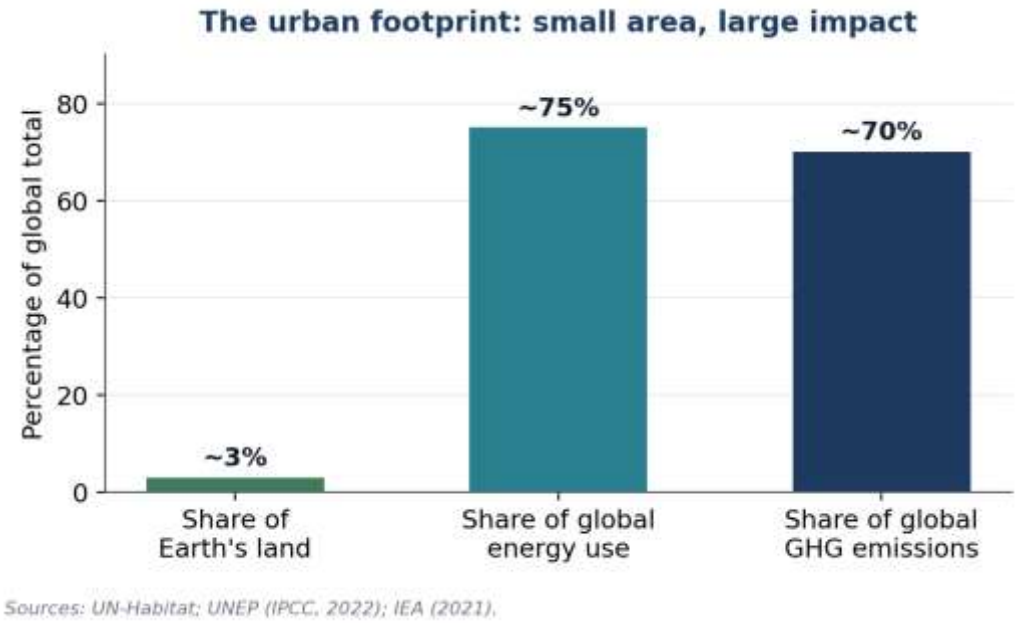


Figure 2. Small area, big impact of the urban footprint (UN-Habitat; UNEP; IEA).

4.4 Air Pollution and Health

Exposure to polluted air in urban environments can have serious consequences for human health. The following Table 1 outlines the key indicators of urbanization and environmental impacts from urbanization found in the literature reviewed.

Table 1. Indicators selected of urbanization and its environmental impacts on a global scale

Indicator	Value	Source
World's population living in urban areas, 2018	55% (projected 68% by 2050)	UN DESA (2018)
The proportion of GHG emissions made up of cities' emissions.	≈ 70% (on ≈ 3% of land)	UN-Habitat (n.d.)
The global urban land is expected to grow by 50% by 2030. By 2030, the worldwide area occupied by urban development is projected to increase by approximately half.	≈ 1.2 million km² (nearly triple 2000)	Seto et al. (2012)
The number of individuals who are breathing unsafe air.	≈ 99% of the world population	WHO (2024)
Mortality from outdoor air pollution (2019)	≈ 4.2 million per year	WHO (2024)

Note. GHG = greenhouse gas. Figures represent estimates worldwide based on the information provided.

4.5 The Pakistan Context

These trends are highlighted in Pakistan in the context of rapid urbanization. It is the most urbanized country in South Asia, and the official census data indicates that the urban population has increased over the years (UNDP, 2019). These are shown in Table 2. High population and

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industry density in major cities like Karachi and Lahore have been paralleled with a well-documented decline in air quality, water quality, and green space. A recent study by the World Bank, based on satellite data, shows that much of Pakistan's growth is now taking place in the urban setting if the population density is factored in, thus making the effective level of urbanization much higher than official statistics, indicating that there is a mismatch (World Bank, 2025).

Table 2. The percentage of Pakistan's population residing in urban areas was assessed across a range of selected years.

Year	Urban population (share)	Source
1998 Census	32.5%	UNDP (2019)
2017 Census	36.4%	UNDP (2019)
2023 Census	38.82% (≈ 93.8 million)	PBS (2023)

Note. The official census figures are presented as shares, but alternatives based on densities are higher (World Bank, 2025).

5. Discussion

Collectively, the evidence highlights the close interlinkages between urbanization and environmental change; yet they are not necessarily synonymous with harm. The cities moving people, energy consumption, and emissions together, and the outward expansion of cities is a major contributor to habitat and biodiversity loss (Seto et al., 2012). Meanwhile, the efficiency of a city in terms of energy per capita can be in contrast to its absolute energy consumption: the compact, well-served cities consume less energy per capita than do dispersed settlement patterns. City growth hence has a significant impact on the environmental outcome

It's important to differentiate between evidence and interpretation. This is known: cities contribute the majority of global emissions, and most of the global population is living in exposure to unsafe air (UNEP, n.d.; WHO, 2024). Predictions of the exact extent of urban land growth, on the other hand, rely on assumptions of population and economic growth and are therefore projections (Seto et al., 2012). The major danger in rapidly urbanizing countries like Pakistan is the rapid development without proper planning, whereas pollution increases and the natural spaces are being lost before the proper infrastructural development and green spaces are established.

6. The Role of Planning and Green Infrastructure

Deliberate planning is essential to reduce environmental costs of urban growth. Mixed-use development can reduce sprawl and reduce travel distance, reducing emissions and conserving nearby land. Public and low-carbon transport investment decreases air pollution, and the more parks, street trees, and other green infrastructure are added, the more moderate the urban heat, the better the management of stormwater, and the more biodiversity in the city. (UN-Habitat, n.d.) Ecological footprints of cities can be further lowered by the protection of ecologically sensitive areas from the process of conversion, wastewater treatment, and enhancement of building energy efficiency. These are complementary measures, and a city that is dense, green, and well planned is likely to be healthier and more liveable - and to produce fewer emissions.

7. Policy Context

At the international level, sustainable urban development has gained prominence within major policy frameworks, including the Sustainable Development Goals (SDGs), particularly SDG 11, which focuses on inclusive and sustainable cities and communities, as well as UN-Habitat's New Urban Agenda. The responsibility of urban development in Pakistan is largely shared by the provincial and municipal governments, and strengthening urban planning and environmental

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management has been promoted through national and provincial initiatives (UNDP, 2019). The reader is reminded that there are many variations across jurisdictions, and that laws, standards and institutional arrangements are subject to change over time; that this description is designed to provide only a general context and should not be relied on as definitive legal advice and should be checked against the official copy of the law.

8. Recommendations

To the best of our knowledge, from the evidence reviewed, the following directions are recommended:

- Encourage well-designed, well-managed urban development to reduce sprawl and preserve natural and agricultural resources.
- Enhance green infrastructure – parks, urban forest and green roofs – for thermal, stormwater and biodiversity regulations.
- Make investments in clean and public transport to mitigate urban air pollution and transport emissions.
- Improve water and wastewater management for growth not to impact rivers and groundwater.
- Increase the energy efficiency of buildings and city-wide use of renewable energy to reduce emissions.
- Use land-use planning and regulation to safeguard ecologically important areas from urban development.
- Enhance urban environmental monitoring and data to allow policy to be responsive to conditions.
- Plan for and coordinate urban development in accordance with established environmental objectives across government, planners and communities.

9. Limitations

There are a few points to be considered. The analysis is based on a literature review, which relies on the quality and coverage of previous studies and upon the official statistics which may have different definitions and extent of coverage, as seen in the urbanization estimates of Pakistan which differ from administrative estimates to density-based estimates (World Bank, 2025). The literature from around the world has been drawn from high-income cities, and may not be readily applicable to the developing country context. Urban projections are always subject to uncertainty, and observation studies can only draw associations but not causalities. Lastly, there are yet areas in the world that are quickly urbanizing, but for which city-level environmental data is not available.

10. Conclusion

Urbanization is one of the greatest forces that is transforming the world. The evidence presented here demonstrates that urban sprawl puts a heavy burden on the natural world: it's destroying habitat and diminishing biodiversity, it's condensing climate-changing emissions, and it's exposing large populations to poor air quality. These impacts are observed all over the world, and, more often than not, in countries which are rapidly urbanizing like Pakistan. However, city-nature relations are dynamic. The environmental costs of urban growth can be significantly lowered with a compact design, green infrastructure, cleaner energy and transport, and better planning. The message in the middle is that of balance – if cities are aware and take coordinated action, they can keep growing without nature shrinking at the same pace.

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