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Short Review Paper

A Review of Urban Light Pollution and its Impacts on Human Health and the Environment

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Abstract

Light pollution is often neglected compared to other forms of pollution. This review examines the multifaceted impacts of urban light pollution on human health, ecological systems, and societal well-being. These studies show worsening trends in light pollution and the need for continuous monitoring to inform mitigation strategies. They establish a clear link between ALAN and sleep disturbances, particularly in urban areas where excessive nighttime illumination is prevalent. They also show the effect of light pollution on species behavior and food webs.

Keywords: Light pollution, artificial light, human health.

Introduction

Rapid urbanization has given rise to light pollution. Light pollution is defined as the presence of excessive or misdirected artificial light in the environment that interferes with natural darkness[1]. The key sources of light pollution include streetlights, headlights of vehicles, and indoor lighting. Each of these sources contributes to various forms of light pollution like sky glow, glare, and light trespass[2]. Longcore and Rich were among the first researchers to conceptualize ecological light pollution as a significant environmental issue affecting natural ecosystems and biodiversity[3].

In today's time, Artificial light at night (ALAN) has become an environmental issue on global scale. Recent evidence further recognizes artificial light at night as an emerging environmental stressor affecting biodiversity, ecosystem functioning, and multiple aspects of human health, emphasizing the need for integrated management strategies[4]. Falchi et al. estimated that more than 80% of the global population lives under light-polluted skies[1]. Arroyo et al. reported increasing trends in nighttime brightness due to expanding urban infrastructure and LED adoption[2].

Methodology

This review is based on the peer-reviewed open-access research papers published between year 2015 to 2025. Key words like light pollution, human health, ecological impact of light pollution, urban light pollution are used to search research papers. Relevant literature was identified using Google Scholar and academic databases. Preference was given to recent and high-impact open-access publications. Although the review includes selected high-impact studies, broader systematic analysis involving larger datasets and additional regional studies would provide a more comprehensive understanding of global light pollution trends.

Global Trends and Monitoring of Light Pollution

Light pollution has increased significantly over recent decades due to rapid urban expansion and increased dependence on artificial lighting. Falchi et al. developed the New World Atlas of Artificial Night Sky Brightness, providing one of the first comprehensive global assessments of nighttime illumination[1]. Arroyo et al. further emphasized worsening trends in nighttime brightness and limitations in current monitoring technologies[2]. Recent studies also suggest that ecosystem metabolism and carbon exchange may be influenced by ALAN[5].

Kyba et al.[6] further reported that the artificially lit surface of Earth continues to increase annually in both radiance and spatial extent, highlighting the accelerating growth of global light pollution[6].

Gaston and Sánchez de Miguel further reviewed the global expansion of artificial light at night and highlighted the ecological consequences of increasing LED adoption and the importance of sustainable lighting practices[7].

Ecological and Environmental Impacts

Holzhauer et al. demonstrated that artificial light at night alters predator–prey relationships, species interactions, and food web dynamics[8]. Insects, birds, bats, amphibians, and aquatic organisms are particularly vulnerable to nighttime illumination[8]. Urban wildlife may exhibit behavioural adaptations to artificial lighting but these responses are often insufficient to compensate

for the long-term ecological consequences of increasing nighttime illumination[9]. Recent literature suggests that LED-based nighttime illumination may intensify ecological disruption because of increased blue-rich emissions and over-illumination[5].

Human Health Impacts

Patel showed significant associations between ALAN exposure and insufficient sleep among urban populations[10]. Cho et al. reviewed experimental and observational studies demonstrating that nighttime light exposure suppresses melatonin secretion, disrupts circadian rhythms, and delays sleep onset[11]. A recent review also reported associations between outdoor artificial light at night and obesity, cardiovascular disease, several cancers, and adverse pregnancy outcomes, although further studies are needed to establish causality[12].

Conclusion

Recent assessments continue to emphasize the increasing ecological and public health concerns associated with artificial light at night and the urgent need for sustainable lighting policies[13]. The reviewed literature shows that urban light pollution is a growing environmental issue with very significant ecological and human health consequences. The solution of this problem requires interdisciplinary collaboration, improved monitoring technologies, sustainable lighting practices, and increased public awareness. Future research should focus on long-term ecological and epidemiological studies to understand the cumulative impacts of artificial light at night. Standardized monitoring methods and interdisciplinary research are also needed to improve understanding of dose–response relationships and to develop effective mitigation strategies[14].

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