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Light Pollution and Its Impact on Humans and Animal Health

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Abstract

The need for urban housing construction has grown due to the expanding world population, not just in cities but also in suburbs and rural regions. Due to the slow but rapid urbanisation and globalisation, individuals now lead new “night lifestyles,” participating in numerous entertainment activities from late at night to early in the morning. Our cities increasingly employ more different types of lighting systems as a result of the growth in urban construction and changes in lifestyles, to the point that some cities, like Mumbai and New York City, are referred to as “the city that never sleep.” Even while they may have a large economic impact, they have little to no knowledge of the broader harm they are doing. Therefore, this paper highlights the numerous forms and causes of light pollution, as well as its effects on everything from astronomy to plants, animals, and people.

Introduction

Artificial illumination that is undesirable, improper, or overly abundant is known as light pollution. Light pollution, as used in a descriptive sense, refers to the results of any shoddy lighting, whether it is used during the day or at night. Urbanization and industrialisation are to blame for the excess artificial light, often known as light pollution or photo pollution. Along with sewage, greenhouse gases, and plastic trash, pollution on Earth takes many different forms.

For our environment and even our health, light pollution can have major consequences. According to the International Dark-Sky Association, a dome-shaped shield of light pollution known as sky glow is produced by a combination of street lighting, household and business illumination, cars, and security lights. Glare, light trespass, and clutter are examples of light pollution in addition to sky glow. Light trespass, on the other hand, refers to light that escapes from sources like bedroom windows and can directly cause pain to the eyes. The overabundance of grouping is clutter (Bennie *et al.*, 2015).

Categories of Light Pollution

Light Trespass

Light trespass or overflow occurs when the light extends beyond the designated area. For instance, when unwelcome light permeates a person’s home or structure. When light comes *via* a window, this can be a significant daily bother that leads to persistent concerns of insufficient sleep and insomnia. To protect rights from light overflow, several American communities have adopted street lighting laws.

Over Illumination

The excessive use of light well beyond that required for a specific activity is referred to as over-illumination. Many places, both indoors and outdoors, have lights on when

no people are present. In many cases, this goes beyond the need for security lighting. Examples include office buildings that have lights on all night even though the buildings are virtually empty or even landmarks, historic buildings, and attention-seeking skyscrapers (Azman *et al.*, 2019).

Sky Glow

Sky glow or sky shine is the term for the orange-pink glow that blankets the night-time skies of many cities and metropolises. Along with the natural causes of sky glow, inefficient artificial lighting also contributes to the phenomenon by emitting superfluous glow into the sky, which is then dispersed by airborne dust, gas, and water droplets. Sky glow becomes more noticeable in bad weather, when these little particles are much more prevalent in the sky, making it more difficult for astronomers to see objects in the night sky.

Glare

Glare is a phenomenon that occurs when eyes are exposed to bright light. This occurs when bright lights are flashed straight into one's face, which can be dangerous for pedestrians because it almost blinds one and may result in eyesight issues as well. There are four types of glare: the first is distracting glare, which occurs when light reflects off or within the lens; the second is discomforting glare, which occurs when direct glare from natural sources like sunlight causes eye discomfort because the luminance is greater than what the eye can adapt to; and the third is disabling glare, which is much more intense than discomforting glare and seriously obstructs vision (Kaushik *et al.*, 2022).

Impact of Light Pollution

The circadian clock is slowly harmed by repeated exposure to excessive light from a variety of indoor and outdoor sources, which has been demonstrated to have negative effects on not just humans but also other animal, insect, and plant species. Due to artificial lighting used at night, several night sky observatories throughout the world have also seen changes in the visibility of various celestial bodies in the sky, making it challenging to monitor the night sky in many cities and sub-urban areas. The following section discusses a few of the known effects of light pollution.

Impact on Humans

Artificial night-time lighting is a need due to urbanisation and population growth. The use of artificial light at night; however, has been found to have a detrimental impact on humans' physiological processes by interfering with their circadian rhythm, which refers to the biological clock in the brain that controls sleep-wake cycles in all animals, including humans. One of the main reasons that might alter circadian rhythms and other physiological abnormalities, such as metabolic changes that result in cardiovascular, renal, and type II diabetes, is unfavourable exposure to light. Cortisol levels can rise and melatonin levels can fall as a result of night-

time exposure to artificial illumination, which can affect both sleep quality and the occurrence of depressive symptoms.

LED bulbs have the potential to impair visual perception in the human eye. Constant exposure to artificial lighting can result in retinal illnesses such as Retinitis Pigmentosa (RP) and Age-Related Macular Degeneration (AMD), which affect the wavelengths and intensities of light (Figure 1).



Figure 1: Diseases caused by light pollution

Impact on Animals

Artificial light pollution has a significant impact on all animal species, including fish, amphibians, coral reefs, reptiles, birds, and mammals (Bennie *et al.*, 2015). Migration of migratory bird species is hampered by light pollution, particularly at night when nocturnal birds are more likely to become caught by lighted sources in urban areas, which disrupts their sleep patterns. As a result of the buildings' surfaces that reflect light, birds also run into them. Petrels, one of several vulnerable bird species, are at a significant mortality risk as a result of environmental pollution.

The behaviour and distribution of amphipods were found to be altered by LED lights, which had a greater influence on the ecology as a whole. As mature female turtles go for considerably darker zones to deposit their eggs, artificial light sources near beaches have gradually decreased the number of turtle hatchlings. The way different fish react to different light sources varies depending on the species, but for the most part, fish tend to steer clear of the white light utilised in commercial fishing. The eyes of fish species, which are often accustomed to the darker environment, can be severely damaged by bright light sources, which can have a negative effect on their behaviour. Because natural light has a significant impact on coral reef activity, they are particularly sensitive to cycles of light and dark in shallow water.

Conclusion

Over brightening of the sky, sometimes known as light pollution, has a detrimental impact on both human and animal health. The goal of emphasising this study is to raise awareness of the comparatively less well-known "pollutants" released due to light pollution that are

inflicting comparable harm to the other pollutants. We hope that the results of our work would inspire academics from many disciplines in India to do more structural light pollution research here at home. Furthermore, we think that by using more environmentally friendly night-time illumination, our study will encourage policymakers to create regulations to address the issue of lack of knowledge and lessen the effects of pollution.

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