

Urban Light Plan-Light Pollution in Urban Areas & Light Pollution Control

N. Supriya¹, Dr. Shashikant Kumar²

¹Student, Masters in Planning, Faculty of Architecture and Planning
Parul Institute of Architecture and Research, Parul University, P. O. Limda, Vadodara, Gujarat - 391760
Email ID: [supriyanune06\[at\]gmail.com](mailto:supriyanune06[at]gmail.com)

²Professor, Masters in Planning, Faculty of Architecture and Planning
Parul Institute of Architecture and Research, Parul University, P. O. Limda, Vadodara, Gujarat - 391760
Email ID: [shashikant.kumar45137\[at\]paruluniversity.ac.in](mailto:shashikant.kumar45137[at]paruluniversity.ac.in)

Abstract: *The use of artificial light has grown exponentially since the invention of the first light bulb, leading to light pollution. This is caused by economic development, population growth, and urban sprawl, which can lead to an increased risk of health issues. This study aims to identify the negative effects of light pollution, acknowledge the value of dark skies as a resource and comprehend the advantages of protecting them. First, I will discuss about the types and cause of the light pollution and it impacts animals and human health. Next, basic standards and how to measure the light pollution (tools and methods). Finally, how to plan for dark skies, local authority's role with best practices and existing situation of my study area.*

Keywords: Light pollution, Trespass, over illumination, glare, clutter, skyglow, Light emitting diode (LED), International Dark Sky Community (IDA), Bureau of Indian Standards (BIS), etc

1. Introduction

This study attempts to recognize dark skies as a valuable resource and comprehend the various benefits of light pollution. It also outlines the negative impacts of light pollution and the responsibility of planners in tackling the problem. Artificial outdoor lighting used excessively or improperly results in light pollution, negatively affecting wildlife behavior, human health, and our ability to see the stars and other celestial objects. In order to recognize dark skies as a valuable resource and comprehend the numerous benefits of light pollution, this study aims to: identify how light pollution impacts dark skies; describe the adverse effects of light pollution, and the role of planners in tackling the problem. Energy savings and a reduction in greenhouse gas emissions, tourism, improving human health, safety, and well-being, protecting ecosystems, and preserving culture and heritage are provided by darkness.

2. Need for the study

It is now understood that the development and extensive use of artificial light has negative effects on human health, animal and plant populations, and ecosystems, among other things. Many counties, regions, and towns are creating new lighting programs and concepts with an emphasis on energy efficiency and greenhouse gas emissions in response to climate change and energy shortages. In order to solve this, light pollution laws must consider socioeconomic effects, ecological structure and function, and human health. This calls for a comprehensive understanding of what night is, what it means to people, and what it means to natural systems.

Emergence of Light Pollution as an issue

“The global spread of artificial light is eroding the natural night-time environment,” said first author Dr Alejandro

Sánchez de Miguel, of the Environment and Sustainability Institute on Exeter's Penryn Campus in Cornwall. “This study provides clear evidence not only of how bad light pollution has become as a global problem, but also that it is continuing to get worse, and probably at a faster and faster rate.”

Global light pollution has increased by at least 49% over the 25 years to 2017, and may be even higher. An estimate for light-emitting diode (LED) technology, which is not detectable to existing satellite sensors, estimates that the rise in visible spectrum radiation may be as much as 270% worldwide and 400% in some areas. There is not much proof that technological advancements have reduced light emissions. Other studies show similar results, with an analysis of satellite data from 2012 to 2016 revealing that the total area lit by artificial light at night increased by 2.2% per year.

Types of Light Pollution



Types of light pollution

Over Illumination: Excess light that is provided over what is necessary for a specific task. Light is wasted when an empty space is illuminated, wasting energy. excessive or

Volume 12 Issue 7, July 2023

www.ijsr.net

Licensed Under Creative Commons Attribution CC BY

irritating lighting that has a negative impact on your health and causes glare.

Glare: When light reflects off surrounding objects and scatters, it creates glare, which impairs eyesight. Although it does not affect night vision, it makes it challenging to locate and recognize objects.

Clutter: Poor location design is the root cause of mild confusion, a unique human-made issue. Contrasting lighting that obstructs visibility and illumination at night can be produced by business lighting or street lamp clusters. It is also capable of being potent enough to shut down an animal's inborn nocturnal system.

Light trespass: In many places, it is a criminal as well as a kind of pollution. Unwanted light intrusion occurs when it enters a person's property. It might be, for example, the light of a sign entering a neighborhood.

Sources of Light pollution

- 1) Light Pollution from Residential Lights.
- 2) Light Pollution from Vehicles and Street Lights.
- 3) Light Pollution through improper planning.
- 4) The dense population is also responsible.
- 5) Light pollution through Night Sport Stadiums.
- 6) Light pollution through Commercial Ads and Electronic Hoardings.
- 7) Reckless use of lights.
- 8) Light Pollution from shopping malls, Gaming Zones, and Restaurants.
- 9) Light Pollution from Public Places.

Effects of Light Pollution

The effects of this issue are undiscovered and the study of light pollution is still in its infancy. The brighter night sky is one of light pollution's most evident effects, but many additional worrying implications have not yet been thoroughly investigated. One-fourth of all energy consumed worldwide goes towards lighting, and 19% of all power utilized goes towards nighttime lighting. The release of greenhouse gases as a byproduct of producing electric lighting from burning fossil fuels contributes to global warming and the loss of non-renewable resources. Other negative effects of light pollution on the environment include harm to people, vegetation, and animals. Not only does it impact nocturnal, migratory, and flying creatures, but it also harms plants.

Impacts on Plants

Plants need to use darkness in many ways, such as measuring and responding to the length of the night. Short-day plants need

long nights, while single plants usually bloom in the fall when the day length is shorter. Light pollution near lakes can prevent zooplankton from feeding on surface algae, causing algal blooms that can destroy lakes. Additionally, nocturnal insects and nocturnal flowers that depend on moths for pollination may be impacted, as well as other ecosystems. Numerous animal species depend on trees for their ecosystems, and light pollution has a negative impact on trees. Artificial lighting inhibits trees from adjusting to seasonal variations. Because of ambient light pollution, birds

are unable to nest in trees.

Impacts on Animals

Light pollution alters the normal cycle of light and dark, which has an impact on physiology, competitive behaviour, predator-prey relationships, and animal behaviour.

Threats to Birds:

Light has been used to attract migratory and non-migratory birds since the 19th century, but it is unclear why birds become disoriented under artificial night lights. Experts suggest that birds use the horizon as a reference point for orientation.

- 1) Lighthouses and bird boats were first recorded in the mid-19th century, with static white lighting attracting more people.
- 2) Light beams –Rays have been noticed since the 1940s, and in 1999 Bruderer et al. investigated how birds responded to exposure to both light and X-band radar. Longer wavelengths have been filtered out, and fixed beam units have been replaced, which has decreased the number of fatalities.
- 3) Oceans have fewer artificial light sources, making them more attractive to seabirds, who can be injured or killed by heat impact, or oil. Fishing with light also affects birds, as hooks can hurt them.
- 4) The light trapping effect, which makes birds hover close to light sources, depletes their reserves of energy, making it difficult for them to reach the next beach or hindering their capacity to reproduce or survive the winter.
- 5) Due to low visibility and the luminous matrix surrounding the tower, an increase in the number and height of telecommunication and broadcasting towers causes an increase in deadly confrontations with migratory birds. There is still work to be done, however newer studies demonstrate that employing rotating or blinking red lights and white strobe lights can lessen the effect of capturing birds at lit towers.

Effects on Human Health and Psychology:

Light pollution or excessive exposure to light can have several negative effects on one's health, according to scientific research on the effects of excessive light on the human body. These include a worsening headache, worker weariness, stress that has been medically determined, impaired sexual function, and heightened anxiety. Blood pressure can be raised by around 8 points in a workplace with normal fluorescent lighting levels. There is proof that regular, long-term exposure to fairly strong light diminishes sexual function. Due to the reduction of natural nocturnal melatonin production, some published research also points to a link between nighttime light exposure and a higher risk of developing breast cancer.

According to the International Agency for Research on Cancer of the World Health Organization, working nights shifts may cause cancer. Numerous studies have shown a link between working nights and a higher prevalence of breast cancer.

Effects on Astronomy

Skyglow reduces the contrast between stars and galaxies in

the sky and the sky itself, making it more difficult to view fainter objects. As a result, new telescopes are being built in farther-flung locations. To lessen the impacts of light pollution, astronomers utilize broadband "light pollution filters" or narrow-band "nebula filters." However, because these filters alter how people perceive color, they cannot be used to evaluate the brightness of variable stars visually. When scattered light enters a telescope tube off-axis and reflects off surfaces other than the telescope mirrors, it finally reaches the eyepiece and causes a flare across the entire field of vision. This is known as light trespass, and it can impact observations.

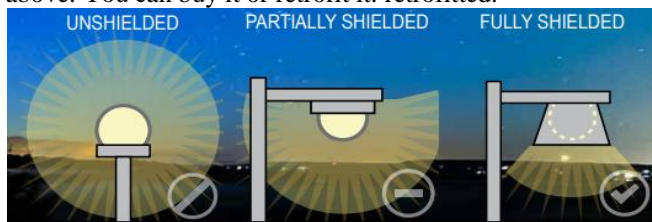
Flocking the telescope tube and any accessories to lessen glare is a common solution, as is mounting a bright shield on the telescope to cut down on incoming light coming from angles away from the target. Because there is a direct link between the light source and the "optical channel," this diffused light effect is referred to as "optical pollution" in one of the regional lighting rules in Italy.

3. Dark Skylighting Basics



Raising awareness of light pollution issues can lead to universal acceptance of lighting policies and regulations, which are based on appropriate lighting design standards. These criteria form the basis for dark sky-friendly lighting and political solutions is called "three-legged chair".

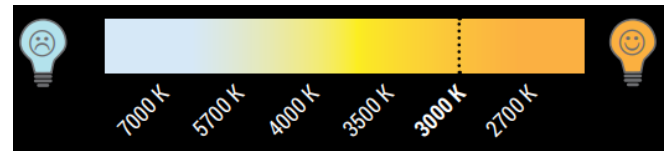
Shielding of Fixtures: Fully shielded downward lighting illuminates desirable regions while reducing glare by keeping undesired light from leaking into the surroundings and the sky above. You can buy it or retrofit it. retrofitted.



Comparison between shielded and unshielded lighting

Lighting Color: The colour of the light contributes to light pollution, which can harm wildlife and have a negative impact on human health. The IDA advises utilising long-wavelength illumination that has a colour temperature of no

more than 3000 Kelvin less.



Kelvin scale

Amount of Light: Limiting outdoor lights has the potential to lessen light pollution. The best lighting levels are created by employing the lowest bulb intensity, lighting only the desired areas, and shining downward. You can darken the skies and save money on energy by using timers, motion sensors, dimmers, and off switches.

4. Light Pollution –Measurement

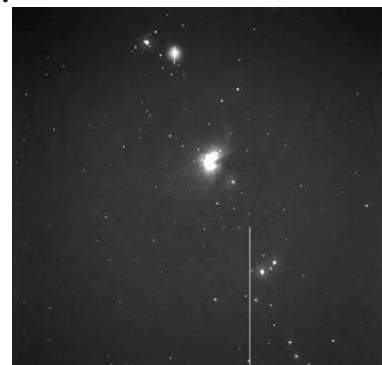
Light pollution creates a skylight, which is the result of artificial light scattering from airborne pollutants. Night Sky Brightness (NSB) is an indicator of light pollution, measuring the brightness of the skylight. It is a combination of stray light from an artificial light source and natural emission. Common NSB units include arc per square second ($\text{mag}/\text{arcsec}^2$) and candela per square meter (cd/m^2).



Sky quality meter

Handheld Devices: Low-cost automatic zenith skylight meters such as the Digi Lum Luminance Meter, Mark Light Meter, and Sky Quality Meter (SQM) offer wide geographic and full temporal coverage and high accuracy of light pollution monitoring. The SQM is the most common and has various hardware interface options. Operational requirements are small compared to CCD photometry, and the device can be easily installed and read almost instantaneously at a high frequency. With regular maintenance and calibration, the accuracy is sufficient for most applications.

Photometry:



Astronomers are the most affected by light pollution, so photometry is used to estimate the NSB level in different

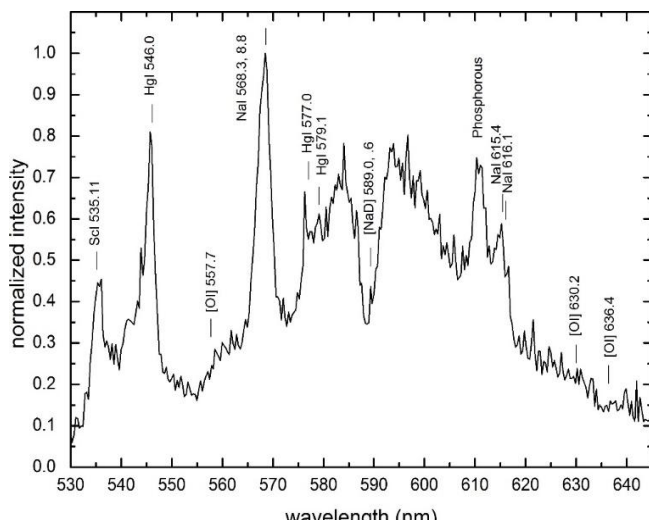
wavelength bands. In open spaces where the night sky is illuminated by natural light sources, astronomers can accurately indicate potential danger from light pollution and assist in finding a potential new observing site.

Satellite Imagery:



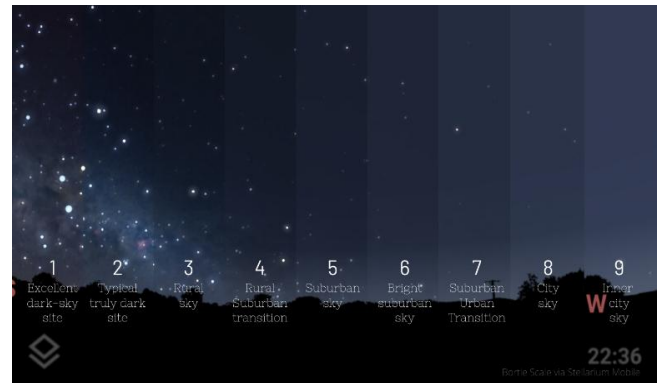
Nighttime images of the Earth from space provide a clear insight into the spatial distribution of light pollution. Images taken by DMSP and VIIRS satellites and astronauts aboard the International Space Station provide high-resolution data of Earth at night. Bright spots show commercial and residential areas, while dark spots show undeveloped deserts and forests.

Spectroscopy: Astronomical spectroscopy is used to study the spectra of the night sky, breaking down the light frequency and recording the signal with a camera. Artificial features such as emission lines and continuations can be identified when they are present in the spectrum.



Sky spectrum of a light-polluted location

Bortle scale: The Bortle scale is the most used and easy tool for measuring the quality (brightness) of the night sky for a specific location. The Bortle scale has nine levels, with Class 9 representing the most extreme amount of light pollution.



Bortle scale explanation through an example

5. Planning for Dark Skies

Planning and community effort are required to reduce light pollution in a sustainable manner while maintaining the night sky. Planning for the night sky requires administrative codes (processes) and zoning (locations), just like other types of land use planning.

Outdoor lighting code

The major goals of most lighting laws are to reduce light pollution, encourage energy efficiency, control outdoor lighting installations, and develop a comprehensive public outdoor lighting strategy. The more effectively you can eliminate light pollution, the more effective your lighting regulation must be. Several levels of government, including states (the most common), counties, or municipalities, as well as development projects or districts (the most specific), can implement lighting rules.

Lighting Zones

A lighting zone defines an area where the lighting code requires some difference in lighting standards because the general conditions associated with the use of lighting are sufficiently different. The lighting area can be accessed in four ways.

Landuse Zoning Approach: Single-use zoning is the foundation of land use zoning methods, sometimes referred to as Euclidean zoning. This method links lighting regulations to various types of land use zones, such as big businesses or single-family residences.

Relationship and Proximity Approach: Lighting zones can be determined by their proximity to or link to a certain resource (such as a gazebo or park). Near airports, these overlapped regions are also typical, mostly for airport security concerns.

Combined Approach: A third choice combines a relationship/proximity strategy with land use zoning. In contrast to an urban situation, where the same business area would count as another illuminated area, a commercial area close to an observatory would count as one illuminated area.

Overlay Zoning: An overlap zone is frequently used to describe a bright zone. In order to designate unique conditions in addition to those of the default basic zoning, nested zoning is a regulatory mechanism that adds a special zoning zone on top of an existing basic zoning. As a result, the illumination zones "overlap" the land use zones while

remaining distinct from them. This makes it simple to cross-reference lighting regulations with other relevant laws and ordinances, such as electrical codes, symbol codes, or planning regulations, and to incorporate lighting regulations into already-existing ordinances or codes. IDA suggests using five outdoor lighting zones for laws and ordinances after choosing a strategy.

LZ0: No ambient lighting - places where the natural environment is severe or adversely affected.

LZ1: Low Ambient Light – An area where lighting can negatively impact the natural environment.

LZ2: Moderate Ambient Lighting - An area where lighting is typically used for safety, security, and comfort, but is not necessarily uniform or continuous.

LZ3: Moderately bright ambient lighting - An area where lighting is generally desirable for safety, security, and comfort and is usually uniform and continuous.

LZ4: Strong ambient light - Lighting is generally considered essential for safety, security, and convenience.

See the IDA-IESNA Model Lighting Ordinance (MLO) Instruction Manual for details on the five recommended lighting zones.

Lighting Code Enforcement

All rules, particularly those governing lighting, must be followed. To successfully reduce light pollution and protect the night sky, lighting restrictions must be followed. Communities should devise procedures and tactics for enforcing the law that specify how it is intended to be put into effect. Depending on the size, resources, culture, and demands of the community, different enforcement strategies are used. The most effective implementation method will be one that fits the community's talents and culture.

General lighting compliance may require:

- Fixture redirection
- Light source shielding
- Reconstruction or relocation of luminaires
- Replacing luminaires with suitable luminaires
- Remove the lamp
- Penalties such as fines

6. Purpose of Preservation of Darkskies

We are animals of light, but in recent decades, technology has allowed us to prolong our work and leisure time into the hours of twilight and darkness, pushing back the boundaries of darkness. But we frequently overlook the fact that ecosystems and wildlife are active around-the-clock. They have developed coping mechanisms, reliances, and uses for their innate darkness. Therefore, a night sky devoid of artificial light is crucial for the health of natural ecosystems. To just a few examples of the effects of light pollution, predator-prey relationships, circadian rhythms, and species migration patterns are all impacted by artificial illumination. In order to properly comprehend our surroundings, satiate our curiosity, appreciate our environment from all angles, and preserve the integrity of our rich cultural heritage, natural darkness is also necessary. However, when attempting to maintain biodiversity and cherish the natural world and cultural legacy, the need for natural darkness and the consequences of artificial light are frequently

disregarded in comparison to climate change, acid rain, invasive species, habitat destruction, and other pressures.

There are numerous reasons to lessen light pollution and safeguard the night sky. Beyond protecting the environment, they also promote sustainable development principles in urban planning.

- Wildlife viewing is assured, and the ecological integrity of the natural environment is preserved.
- Value the honesty, uniqueness, and beauty of rural vistas.
- Preserving and showcasing the genuineness of cultural artefacts (material heritage).
- Contribute to the preservation of customs and rituals associated to the night sky.
- Contributing to the preservation of mythological cultural heritage, conventional navigational heritage, and astronomical cultural heritage.
- Protection of the physical and mental health of people.
- Encourages energy conservation.
- Supports amateur and scientific astronomy (star tourism) and everyone is right to take in a clear, unpolluted night sky.
- Improve personal security in urban settings with glare-free illumination.

The International Union for Conservation of Nature (IUCN) acknowledges the significance of nighttime for ecological protection, sustainable living, and livable cities. To enhance this recognition, the IUCN World Commission on Protected Areas has formed a Dark Sky Advisory Group. The organization, with assistance from the International Dark Sky Parks Association Initiative, offers this website to encourage communities and protected areas to embrace the idea and importance of dark skies. Searching the internet for terms like "dark sky," "starry sky," "dark sky reserve," "night ecology,"

"Starlight reserve," and "artificial light at night" will rapidly turn up a wealth of informative lighting guidance websites. effects of light pollution on both people and the environment. The Dark Sky Advisory Group does not and will not attempt to reproduce them. Rather, our goal is to support the IUCN Night Sky Initiative and provide guidance for more information.

7. Steps to Conserve Darkskies

We can all act today and every day to make lighting consumption more efficient. Here are six quick and low-cost strategies to lessen light pollution.

- Guards against glare and light penetration into the surrounding area; protects all outdoor lighting
- Point the lights downward. Use all available lighting to illuminate the desired region. Make sure that no light is emitted onto a flat surface.
- Use a motion sensor if you want to light up your home at night for security. The light is activated, when necessary, by a sensor. Save money and more successfully ward off troublemakers.

Examples of Acceptable / Unacceptable Lighting Fixtures



Differences between unacceptable and acceptable lighting fixtures

- Purchase lighting in lumens rather than watts - Many manufacturers now include lumens (light output) in addition to watts (power consumption) on the packaging of their products. You can have good illumination, save money, and conserve energy by checking labels for lumen ratings. A 13-watt CFL bulb uses eighty percent less energy and lasts four years while producing the same amount of light as a 60-watt incandescent bulb.
- To begin, enquire "Do you want it on?" Consider using spotlights rather than lights to indicate the driveway entrance.
- You may practice lighting the night sky, conserve energy, cut costs, improve neighborhood relations, and take advantage of starry skies by following a few easy steps.

8. Local Authorities' Role in Reducing Light Pollution

Your property might be checked by the County Council to make sure the lights are turned on appropriately. Some offices could have strong lights pointing upward that are lit from below. Ideally, you should take it out or at the very least switch it out with a dimmer light and turn it off as necessary.

Every light fixture that local governments maintain, including street lights, must be able to be turned off or muted after a certain amount of time. Street lighting is another responsibility of city councils. With a typical street light wasting 30% of its light, this is one of the worst types of light pollution. Better illumination, however, can be used

to address this issue.

Replace outdated "orange" streetlights with "Full cut off" (FCO) lights. No light can reach the horizon in this light, therefore all of it is focused on the roads and pavements, where it is most required.

City of Calgary

Calgary, Alberta, Canada, provided the best illustration of this in action. The city set out to replace more than 40,000 streetlights in 2007 with 100- and 150-watt flat lens lights instead of 200- and 250-watt plate lights.

While the earlier lanterns cast some of their light horizontally and some towards the sky, the new completely switchable lanterns cast all their light downward, enabling the city to maintain an adequate level of light despite the reduced lamp power.

The project cost CAD 7.8 million, although it was implemented to cut expenditures. The city expects to save more than \$2 million a year on energy bills by utilising the new lighting. Most likely a lot more given the escalating cost of oil. As the project reduces CO2 emissions by 18,000 tonnes, it is also excellent for the environment.

The endeavour was successful. The new flat lens street lights have been installed for the first time in Calgary, North America. More than 37,000 streetlights were updated by the city, resulting in yearly energy savings of more than \$1.7 million. This project will save enough electricity to annually power 3,000 families.

Between 2002 and 2010, the City of Calgary achieved the following savings and reductions after upgrading:

- Energy savings of 107,000 MWh.
- Reduction of 124,000 tons of CO2.
- Saved US\$11 million by reducing energy consumption.

Going one step further, in 2011, 310W lighting fixtures were introduced instead of the existing 400W lighting fixtures, and a pilot project was conducted to reduce streetlight energy consumption in non-residential areas.

Ireland's local authorities may not be able to take such action. But they, like Calgary, need to replace all faulty streetlights with FCO designs. We recommend installing FCO lighting in all new buildings.

On the planning front, local governments should make it clear in their development plans and planning regulations that environmentally friendly facilities must be used. The plan application must include specifics of exterior lighting plans proposed as part of a new development, indicating that these plans meet the minimal standards.

9. Best Practice– Flagstaff

Due to their inventive and outstanding leadership, the City of Flagstaff and the region of Northern Arizona have gained distinction on a global scale for the conservation of the night sky. An astronomical industry that now includes the Lowell Observatory, the United States Naval Observatory, the Naval Prototype Optical Interferometer, the National

Undergraduate Research Observatory, the US Geological Survey Astrogeology Centre, and the new Discovery Channel Telescope was fostered over the course of more than 50 years of policy and implementation, which started with Regulation 400 of 1958, which dealt with reflectors. Support from the general public for preserving the night sky for amateur and professional space exploration has evolved into a foundational component of local and regional identity.

Both cities and counties enacted local codes limiting the amount of light per acre in outdoor lighting installations in 1989, and the regulations have been frequently modified and tightened since then.

On October 24, 2001, Flagstaff received recognition as the first international night sky city in the world for its groundbreaking work fusing preservation of the night sky's natural treasures with concerns for public and financial safety. We recognize the region's hard-earned reputation and achievements as a vital asset that must be further reinforced rather than damaging its significant economic and cultural heritage.

"Flagstaff Star Party," a dark-sky experience for locals and guests from all over the Southwest and the world, is held in the city every year. The Star Party aims to introduce those who are unable to see the starry sky owing to light pollution to the magic of Flagstaff's dark skies. Amateur and professional astronomers in the Flagstaff region have set up up to 30 telescopes so that people can view the wonders of the night sky.



2015 Flagstaff Dark Skies Coalition

The region is an evolving standard that is actively addressing must be put into place if it is to continue to be one of the world's foremost astronomical sites, recognize the preservation of the naturally dark night sky as a permanent expression of social value, and better utilize significant economic and tourist attractions. Issues include more artificial light, air pollution, lit signs, and buildings, both nearby and within the vicinity of huge scientific equipment.

Ordinance No. 440

An ordinance that defines floodlights for the City of Flagstaff prohibits the use of certain commercial floodlights within the boundaries of the City of Flagstaff, Arizona, and issues fines, judgments, and a declaration of emergency.

"The Mayor of the City of Flagstaff and the General Assembly decide as follows.

- It is declared that any person or persons employed in the city of Flagstaff shall prohibit any light or arc lamp, beacon, or lighting device accordingly planned within the

city of Flagstaff that may set or adjust to more than half of the light (1/2) mile from the sky.

- The provisions of this Law do not apply to emergency lamps or street lamps or public street lamps.
- Nothing in this code shall be construed to prohibit the use of short-open wide-angle anchors that cannot serve a beam longer than half (1/2) mile.
- Any person violating any provision of these regulations will be committing a misdemeanor and may be fined not more than \$300 or imprisoned for not more than (90) days, or both.
- This Law, which came into force immediately in order to protect and protect the health, safety, and welfare of the public, has been declared an emergency so that it will enter into force when it is published and published in accordance with the law.

Flagstaff's Mayor and City Council approved and passed the ordinance on April 15, 1958.

Street Lighting for Enhancing Dark Skies (SLEDS)

Project purpose statement:

By analyzing the effect of different lighting systems on night use, the control or improvement of the dark night (visual brightness and spectral width) is evaluated, while technologies and strategies for improving the aging street lighting of the city are evaluated. This project aims to develop a new street lighting system that balances the Flagstaff community's commitment to the dark skies, sustainability, and safety.

Project Background:

The primary goal of the Street Lighting for enhancing dark skies (SLEDS) project is to address Flagstaff's current street lighting problems while evaluating dark skies, safety, and maintenance/good results.

Low Pressure Sodium:

The SLEDS project is the culmination of years of collaboration between the city and local observatories (US Naval Observatory - Flagstaff Station and Lowell Observatory) that began in May 2012. - High Sodium (LPS), the best lighting system since 1989, has become more expensive, quality changes difficult and the city is faced with light pole/post arm combinations and the size of the sample is useless. The weight of LPS fixtures, especially in air.

Funding:

In June 2015, to provide funds for SLEDS project, an Interim Agreement (IGA) was approved with the Arizona Department of Transportation (ADOT). This is in the form of \$100,000 (FY16) to hire a team of consultants (finally Monrad Engineering), \$200,000 for testing (FY16) to support the work of the consultant team, and \$370,000 (FY18) for the initial project. Lighting Change phase. All proceeds from the Flagstaff Metropolitan Planning Organization (FMPO), Surface Transportation Program (STP) grant.

Light Emitting Diode Technology (LED):

The SLEDS project gave Flagstaff the opportunity to

demonstrate to other cities new lighting solutions that use LED technology to combat dark skies, meet the city's safety and security requirements, set astronomical targets for effective and dark skies, in addition to innovation or the best applications. This pushes the industry to support technological change to prevent dark skies.

Light Pollution in HiTech City, Hyderabad

Research paper by *Professor SibaPrasad Mishra* of the Department of Civil Engineering at Centurion University of Technology and Management, Bhubaneswar, states that "Hyderabad has the highest light intensity in India with a light intensity of 7,790 $\mu\text{cd}/\text{m}^2$ (unit of the luminous intensity per square meter)".

According to Bortle scale, two places in Hyderabad shows 8-9 on the scale i.e., Charminar and HITECH city & its surrounding area recorded highest light pollution around 2012 to 2019 (survey conducted by pollution board).

HITECH city has the highest intensity of illumination due to IT Hub, various commercial spaces and activities happening in and around the locality.

Commercial spaces like IKEA, Sharath City mall, Inorbit, shopping malls, pubs, clubs, drive-ins, clothing stores, studios, etc. There is particularly a whole street with food stalls at DLF that is open 24/7 for morning and mainly for night shift workers. Recreational spaces like Shilparamam, Biodiversity Park, Durgam Cheruvu, Birds view park, etc. IT Hub of Hyderabad is the home of many multinational companies like Google, Deloitte, Amazon, Microsoft, TCS, Qualcomm, Dell, Oracle, and many more. These spaces are the main cause of the light pollution in the city. These spaces in order to showcase their places, they over illuminate their buildings. These are also the strengths of the area. It has the highest land value compared to in and around Hyderabad. Street lights in the area provide glare to the passengers. The fixtures are also not according to the standards of The Bureau of Indian Standards (BIS).



High illuminating lighting from street food shops and restaurants in case area

10. Conclusion

The significance of space-time night has grown in recent decades as a result of social and cultural changes. We can call attention to the following among the evolving drivers: In addition to reducing the distinction between day and night, a variety of life rhythms are emerging as a result of social practice liberalization, demographic shifts, and the emergence of new urban living patterns. These changes are due to advancements in lighting technology that enable individuals to engage in social, cultural, or political activities well into the night or simply have some alone time.

A new focus on night and darkness is being put on light planning. This idea is becoming more prevalent in urban planning as a means of developing a fresh image that artistically distinguishes the cities. When making plans for the nights - simple acts - cultural, economic, and environmental policies should be taken into consideration. The effects of light pollution will worsen over time, even though many nations are currently unaware of it.

The major goal of this essay is to raise awareness of the detrimental effects of light pollution, to appreciate black skies as a precious resource and as a part of our heritage, and to comprehend the countless advantages that result from protecting dark skies. We have a duty to safeguard the environment and our cultural heritage for future generations. This effort aimed to raise awareness about one such natural treasure, dark skies, which are dwindling as a result of carelessness. This thesis project concludes with a recommendation that the black sky must be pursued, not only for tourism and leisure possibilities, but also for the preservation of the environment. This is a constructive move

that local authorities, planners, etc. should take.

References

- [1] International Dark Sky Association – Portal, <https://www.darksky.org/>
- [2] Light pollution is latest menace to haunt Hyderabad – The New Indian Express (News Article)
- [3] Komal Kaushik, Soumya Nair, Arif Ahamad, “Studying light pollution as an emerging environmental concern in India” - Journal of Urban Management, Volume 11, Issue 3, September 2022 (article)
- [4] Siba Prasad Mishra, “Photoperiodic Biodiversities under Lightpollution in India During Anthropocene Epoch” – Research Gate, 2018 (article)

Author Profile

N. Supriya, Master’s student at Parul University, Vadodara, Gujarat.
Email id: supriyanune06@gmail.com

Dr. Shashikant Kumar, Professor at Parul University, Vadodara, Gujarat.
Email id: shashikant.kumar45137@paruluniversity.ac.in