2023 ICM
Problem E: Light Pollution

Photo Credit: K. Blyman

Background
Light pollution is used to describe any excessive or poor use of **artificial light**. Some of the phenomena that we refer to as light pollution include **light trespass**, **over-illumination**, and **light clutter**. These phenomena are most easily observed as a glow in the sky after the sun has set in large cities; however, they may also occur in more remote regions.

Light pollution alters our view of the night sky, has environmental impacts and affects our health and safety. For example, plant maturation may be delayed or accelerated, and migration patterns of wildlife affected. Excessive artificial light may confuse our **circadian rhythms,** leading to poor sleep quality and perhaps physical and mental health issues. **Glare** caused by artificial lights may contribute to some motor vehicle accidents.

Community officials or local groups may implement **intervention strategies** to mitigate the negative effects of light pollution. Artificial light, however, has both positive and negative effects that impact different locations in different ways. For example, to avoid the negative impacts of light pollution listed above, some communities opt for low-light neighborhoods which in turn might lead to increased crime. The impacts of light pollution may depend on factors such as the location's level of development, population, biodiversity, geography, and climate. Therefore, assessing the extent of the effects and the potential impacts of any intervention strategies must be tailored to a specific location.

Requirement
COMAP's Illumination Control Mission (ICM) is working to promote awareness of the impacts of light pollution and develop intervention strategies to mitigate those impacts. In support of this ICM work, your task is to address measuring and mitigating the effects of light pollution in various locations, incorporating both human and non-human concerns. Specifically, you should:

- Develop a broadly applicable metric to identify the light pollution risk level of a location.

- Apply your metric and interpret its results on the following four diverse types of locations:
    - a **protected land** location,
    - a **rural community**,
    - a **suburban community**, and
    - an **urban community.**

- Describe three possible intervention strategies to address light pollution. Discuss specific actions to implement each strategy and the potential impacts of these actions on the effects of light pollution in general.

- Choose two of your locations and use your metric to determine which of your intervention strategies is most effective for each of them. Discuss how the chosen intervention strategy impacts the risk level for the location.

- Finally, for one of your identified locations and its most-effective intervention strategy, produce a 1-page flyer to promote the strategy for that location.

Your PDF solution of no more than 25 total pages should include:
- One-page Summary Sheet.
- Table of Contents.
- Your complete solution.
- One-page promotion flyer.
- Reference List.

Note: The ICM Contest has a 25-page limit. All aspects of your submission count toward the 25-page limit (Summary Sheet, Table of Contents, Report, One-page promotion flyer, Reference List, and any Appendices). You must cite the sources for your ideas, images, and any other materials used in your report.

Glossary

Artificial Light: Any non-naturally occurring source of light.
Circadian Rhythms: The natural 24-hour sleep-wake cycle on which humans and other organisms operate.
Glare: Excessive brightness that decreases one's ability to see.
Intervention Strategies: Policies and/or actions that could be taken to disrupt the negative impacts of light pollution.
Light Clutter: Excessive grouping of lights.
Light Trespass: When light enters unintended areas.
Over-Illumination: Lighting at an intensity higher than what is needed for an activity or location.
Protected Land: Areas that governments or private entities protect from development due to their ecological, cultural, and/or natural importance.
Rural Community: A community located in one of the least densely populated parts of a country or region, and not easily accessible from an urban community.
Suburban Community: A community located in a moderately densely populated part of a country or region, or easily accessible from an urban community.
Urban Community: A community located in one of the most densely populated parts of a country or region.