Starry Campus: Reducing Light Pollution at Smith College

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INTRODUCTION

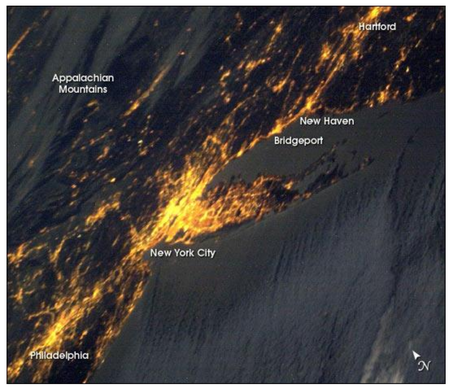
I am a senior at Smith College in Northampton, MA centering my thesis on teaching Smith students about the dangers posed by light pollution and inspiring them to help make Smith a better dark sky area. My work will focus both on general astronomy education to catch their interest and specific light pollution information as well. My advisor, Professor James Lowenthal, is creating an initiative for dark skies education and preservation on college campuses, and this project would be the pilot program. College students can help both on campus and off and will be able to take what they learn to inform their decisions about lighting when they move out on their own. The ultimate goal will be to convince Smith College to make the changes it needs to reduce its light pollution as well as to motivate its students to learn more about astronomy and light pollution.

LIGHT POLLUTION

Light Pollution: Light that is meant to illuminate our cities and streets that instead escapes into the sky

- Like air and water pollution, it is unintended and a serious problem
- It is not too late to reduce it and help prevent future harmful effects

- This creates **glare**, which is light that shines directly in your eyes, making it much harder to see
- There are serious health risks involved with excessive light at night, especially blue-rich white light like that from many LEDs
- Human sleep cycles are disrupted when there is too much light during the night
- Excessive light at night has also been linked to higher probabilities of breast and prostate cancers, diabetes, and obesity.
- Wildlife also is negatively impacted by artificial light at night, which has appeared only relatively recently on an evolutionary time scale



Earth Sciences and Image Analysis Laboratory at Johnson Space Center, ISS image of East Coast at night, 2003

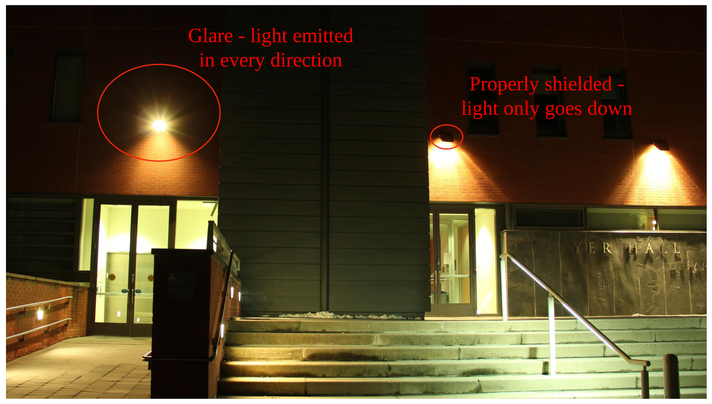
CHALLENGES AND SOLUTIONS

- Challenge: Initial cost and commitment required to decrease light pollution in an area
  - Add shielding to existing lights or replace the lights with better alternatives
  - Change to higher efficiency bulbs like LEDs
- Solution: Although there may be an initial cost involved with changing to better lighting, focusing all the light on the ground greatly reduces the amount of energy that needs to be put into lighting

- Challenge: Humans’ innate fear of the dark
  - Many people are worried that having less lighting in an area will make them less safe
  - The concept of a “dark sky” may seem threatening
- Solution: The goal is not to eradicate light on the ground but to focus all of the light from fixtures on the ground instead of letting it escape up into the sky
  - This helps illuminate the ground and remove some of the dark shadows that can occur when lights go in all directions
  - When there is glare from a light in one’s eyes, it makes it even harder to see potential threats that may be in the dark area

PROJECT PROCESS

- Research the current sky quality in different areas on campus
- Research the amount of light that is coming from different light fixtures around campus
- Developing an education and outreach program
  - House teas and lectures
  - Meetings to teach other students, the staff, and faculty about the issue
- Work with existing clubs and organizations on campus
- Work with Smith faculty and staff to develop campus lighting standards
- Propose lighting standards to the college, as there are no current standards in place for lighting around campus
- Create surveys and a website to track people's reactions to the programs and determine their effectiveness
- Work with Professor Lowenthal and the International Dark Sky Association to develop a more general college campus program

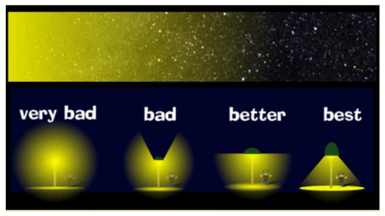


Rear entrance to Hillyer Hall, showing two properly directed lights and one unshielded one – the light cones underneath are similar but the unshielded one adds glare

LIGHT POLLUTION GUIDELINES

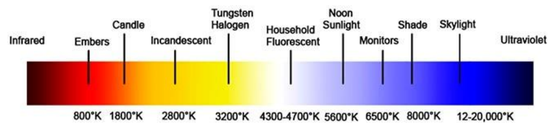
An easy way to help combat light pollution is to choose outdoor lighting for your home or business that will direct light only towards the ground, not sideways or off your property. There are four main rules to follow when choosing outdoor lights:

1. The light should be fully shielded against glare, with no light escaping above the horizontal, and ideally no light above 80 degrees from vertical.



2. The light should be only as bright as needed for safety, and no brighter.

3. The light should not be too blue - at most 3000K, and ideally a "warmer" color such as 2700K or even 1800K. The “Kelvin” system of color is used to compare the color of light to the color of metal that is heated to that temperature. (The lighting fixtures are not actually reaching this temperature.) For comparison, the older high pressure sodium lighting fixtures have a color of 1900-2100K.



4. The light should be turned off when it's not needed. For streetlights, this could be in the early morning hours when few people are outside. For parking lots, it could be an hour after the close of business. One of the benefits of new LED lighting fixtures is that they can be easily dimmed or extinguished during low-use hours.

SMITH COLLEGE AND NORTHAMPTON, MA

- Smith College has improved its outdoor lighting over time
- New standard for lights is 2700K, with shielding so the light does not escape above 90° but there is still some glare
- Working to create a codified standard on campus
- Currently in planning stage of new college library construction

Archival photos of campus by Gabriel A. Cooney and Paul Anderson, courtesy of Smith College Archives

- Northampton recently changed to LED lights with no shielding and 3000K temperature, which is more energy efficient but has much worse glare

Before: old high-pressure sodium lamp in well-shielded fixture.

After: New LED street light. Poorly shielded, with terrible glare. Note white light flooding nearby houses, and strong shadows even far from the lamp post. At 3000K, this lamp also produces well over 50% more blue light than the old lamp. (Same camera settings for both photos.)

REFERENCES

Globe at Night. Web. <http://www.globeatnight.org/>.

International Dark-Sky Association. Web. <http://www.darksky.org/>.

International Dark-Sky Association. "Introduction to Light Pollution - What's the Problem?" June 2009. Web. <http://www.globeatnight.org/dsr/dsee/IDA%20Resources/IDA%20Practical%20Guides /IDA%20PG1%20-%20Introduction%20to%20Light%20Pollution.pdf>.

Kraus, Louis J., MD. *Human and Environmental Effects of Light Emitting Diode (LED) Community Lighting*. Rep. *Report of the Council on Science and Public Health*. American Medical Association, 2016. Web. <http://darksky.org/wp-content/uploads/bsk-pdf-manager/AMA_Report_2016_60.pdf>.

The Prairie Astronomy Club. "Light Pollution." *The Prairie Astronomy Club*. 3 Jun. 2012. Web. <http://www.prairieastronomyclub.org/resources/light-pollution/>

Walker, Connie. "A Silent Cry for Dark Skies." *The Universe in the Classroom* 74 (Winter 2008). Astronomical Society of the Pacific. Web. <http://www.globeatnight.org/dsr/dsee/Dark%20Skies%20Articles/A%20Silent%20Cry %20for%20Dark%20Skies.pdf>.

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