

Light Pollution Matters

6% Annual increase in artificial light at night

50% Increase of developing breast cancer in heavily light polluted areas

97% Americans unable to see the Milky Way at night

35,000 years Length of documented stargazing

98 million Number of bird deaths annually from collisions with lighted buildings

\$7 billion Cost of energy waste in the US each year due to poorly designed lighting

180 billion Approximate number of outdoor light fixtures in the US

Resources

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in collaboration with

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Light Pollution
in our National Parks

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About Light Pollution

Light pollution is defined as any excessive or unwanted artificial light that obscures the view of the stars. There are many different types of light pollution (all of which are seen in Figure 4):

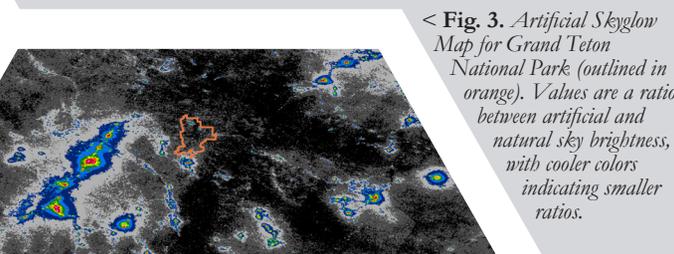
- ▶ **Glare:** an extreme contrast of light and dark areas in one's line of sight; often causes visual discomfort
- ▶ **Light trespass:** unwanted artificial light introduced into an area where it is unneeded or unwanted
- ▶ **Overlighting:** the excessive use of artificial lighting
- ▶ **Skyglow:** the faint glow seen in the night sky, usually over densely populated urban areas

The main factor that causes light pollution is poorly shielded outdoor lighting. In fact, in a typical unshielded light fixture, 50% of the light produced is wasted. This portion illuminates the surrounding air instead of its intended target on the ground.

Since many national parks are known for their pristine environments, light pollution from skyglow is a pertinent concern for NPS officials. This problem has become especially relevant with rapid urbanization in areas nearby the parks. With an obstructed view of the stars and galaxies, artificial skyglow threatens the visitor experience and tourism in the parks.



< **Fig. 1.** An unshielded light fixture (top) as compared to a shielded one (bottom). Half of the light from unshielded fixtures is unproductive, wasting billions of dollars each year.



< **Fig. 3.** Artificial Skyglow Map for Grand Teton National Park (outlined in orange). Values are a ratio between artificial and natural sky brightness, with cooler colors indicating smaller ratios.

Fig. 2. The Skyglow Estimation Toolbox creates maps that will help park officials better understand nighttime sky quality in the parks. >

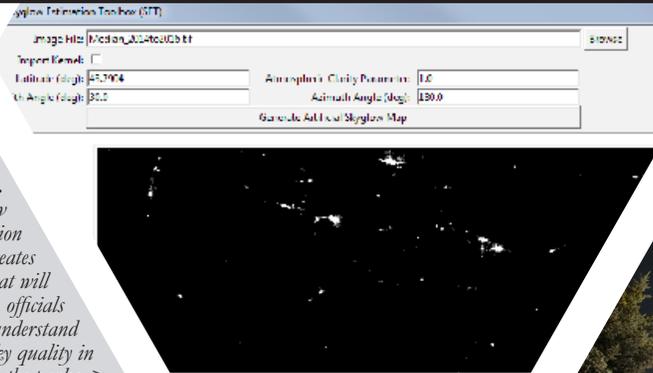


Fig. 4. Use minimum amount of lighting needed to illuminate target. In this case, excess light escapes into the sky, degrading nighttime visibility. >
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A Way Forward

In 2017, the National Park Service worked with Wyoming Stargazing and a team from the NASA DEVELOP National Program to better understand the impacts of skyglow in Grand Teton National Park in Teton County, WY. The NASA DEVELOP team created the Skyglow Estimation Toolbox (SET) that utilizes data collected by the NASA/NOAA Suomi National Polar-orbiting Partnership satellite Visible Infrared Imaging Radiometer Suite sensor Day/Night Band to calculate the effect of light scattering. The software creates Artificial Skyglow Maps that measure skyglow at various viewing angles and lines of sight in the park. This will help park officials determine the current sky quality and identify sources of light pollution that are diminishing its quality. Moreover, the data produced by SET will help government officials make informed decisions regarding lighting ordinances in Teton County.

Raise Awareness

Although light pollution does have serious ramifications, it is a problem that can easily be reversed. As a park ranger, you have the opportunity to highlight the impacts of light pollution with park visitors:

- ▶ Discuss the impacts of light pollution, especially on the night sky and on human health, as well as the wasted energy costs
- ▶ Offer suggestions on how each park visitor can reduce light pollution
 - ▶ Install outdoor lighting only if absolutely necessary
 - ▶ Use minimum amount of lighting needed to illuminate the target
 - ▶ Ensure fixtures are properly shielded
 - ▶ Turn on lights only for the time it is needed
 - ▶ Encourage local governments to establish lighting ordinances that limit light pollution

