

Shining a Light on Light Pollution in CIDSr

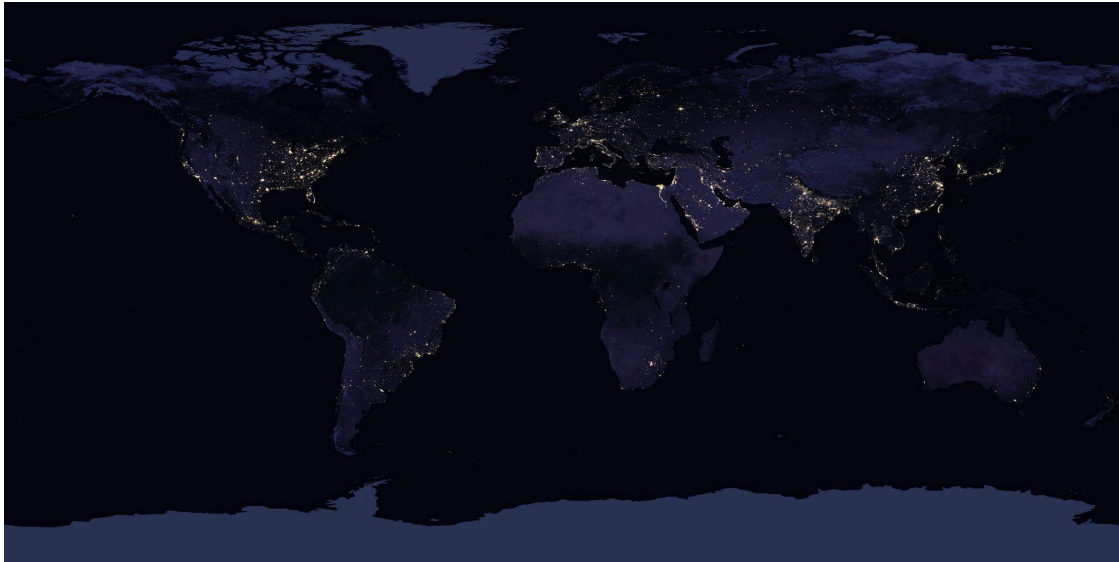
The night sky has long been a source of awe for humanity, serving as inspiration for science, religion, and countless pieces of art and literature. For past civilizations, the constellations told stories of ancestors and great heroes, and were regular tools that aided in navigation. In more modern times, it is a source of curiosity that drove us to walk on the moon and to conceive of galaxies that are far far away. Yet, these star-studded skies we dream of are not a reality for the majority of people in the United States today. The rise of industrial civilization has created a world full of artificial light at night, including regions where poorly-shielded lighting creates conditions that are several times brighter than the natural night sky during a full moon. This excess artificial light is known as light pollution. [More than 80% of our nation's population live in urban areas and cities where light pollution obscures the view of the night sky.](#)

Beyond aesthetic and cultural value, this constantly increasing light pollution has well-documented negative effects on [wildlife](#) and [human health](#). Furthermore, past research has shown that excessive or improperly implemented lighting [has minimal effects on reducing crime or improving road safety](#), running contrary to popularly held beliefs about the necessity of outdoor night lighting in the first place. To encourage more effective lighting practices and promote the benefits of the night sky, the International Sky Association has instituted international [Dark Sky Reserves](#), “a dark “core” zone surrounded by a populated periphery where policy controls are enacted to protect the darkness of the core.” In 2017, the Central Idaho Dark Sky Reserve (CIDSr) became the first gold-tier (highest quality) Dark Sky Reserve in the United States, spurring local communities and scientists to band together to preserve the natural night sky through light pollution monitoring, local policy, lighting ordinances, and public education.

The Central Dark Idaho Sky Reserve STEM Network is a NASA-funded program at Boise State University that has partnered with CIDSr. Goals of the program include promotion of community education efforts and STEM engagement, an astronomer-in-residence program, and light pollution monitoring. Dr. Travis Longcore at UCLA's Institute of Environment and Sustainability has partnered with Boise State to contribute to light pollution monitoring efforts in CIDSr, which will help inform educational and policy efforts to mitigate the effects of light pollution. This includes training of two UCLA students as light pollution ambassadors, who are well-versed in communicating light pollution impacts and monitoring techniques. This year's light pollution ambassadors are Jules de la Cruz and Mahliya Purificacion.

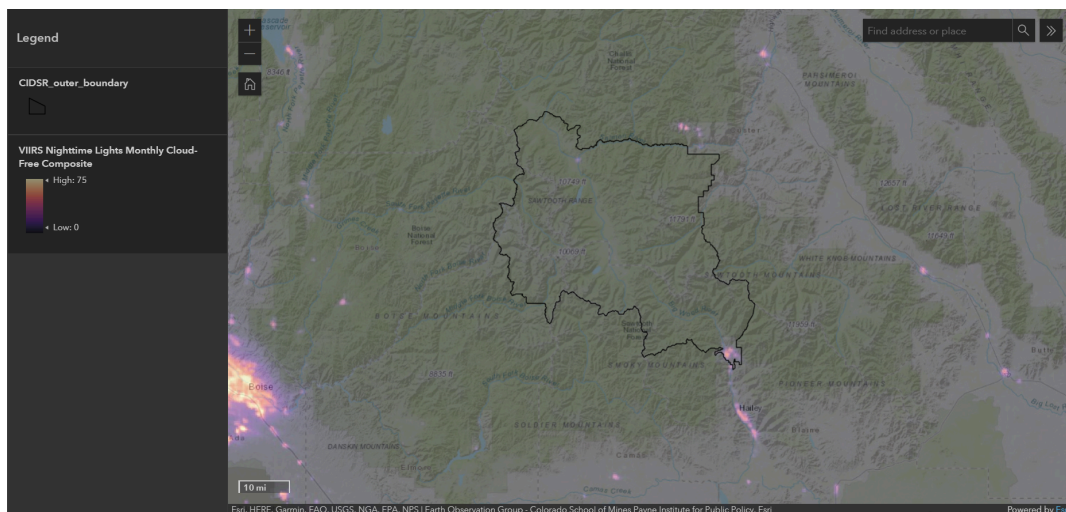
There are a multitude of ways to measure light pollution. You can even contribute to some of them, through using the Loss of the Night App ([ios](#), [Android](#)) or reporting your observations of the night sky to the [Globe at Night](#) website. These are global citizen-science

databases that allow us to understand how artificial lighting in different areas leads to changes in the night sky. One tool that scientists often use for measuring light pollution is the [Visible Infrared Imaging Radiometer Suite \(VIIRS\)](#), a sensor aboard the joint NASA/NOAA Suomi National Polar-orbiting partnership and NOAA-20 satellite. The VIIRS instrument captures a wide variety of imagery and radiometric data, including data on nighttime artificial lighting.



The NASA Black Marble, a composite image of Earth at night using 2016 VIIRS data
Photo by NASA

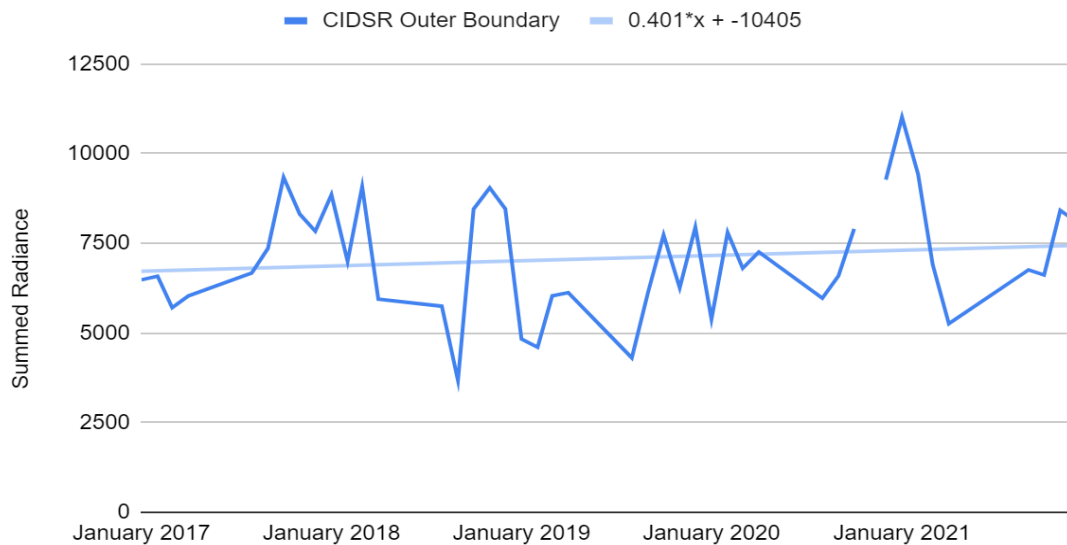
More specifically, the VIIRS instrument measures radiance, or the amount of light energy that a given surface emits or reflects. This data can be used to visualize the sky at night, such as in the NASA Black Marble Picture above, or to visualize light pollution severity and sources on maps like [this one](#), which focuses on the CIDSr region.



Screenshot of CIDSr Light Pollution Map, viewable [here](#)

VIIRS monthly night-time data, which spans multiple years, can also be used to graph light pollution and radiance trends within the CIDSR boundary, as well as in neighboring communities.

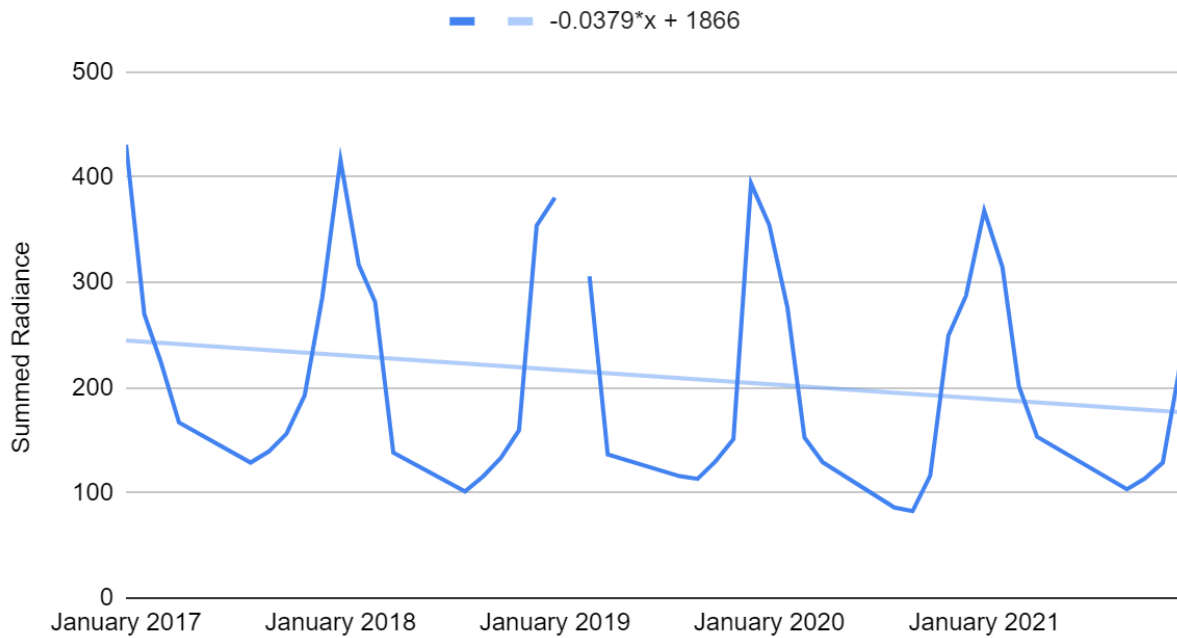
CIDSR Outer Boundary



Graph of Light Pollution within the Reserve, 2017 -2021, by Jules de la Cruz

This graph shows a slow but steady increase in radiance within the boundaries of the Central Idaho Dark Sky reserve from January 2017 to December 2021. Stanley, a town that lies within the boundaries of the Reserve, shows similar increases. However, some communities like Ketchum, which lies within the southern boundary of the Reserve, show an overall decrease in light pollution.

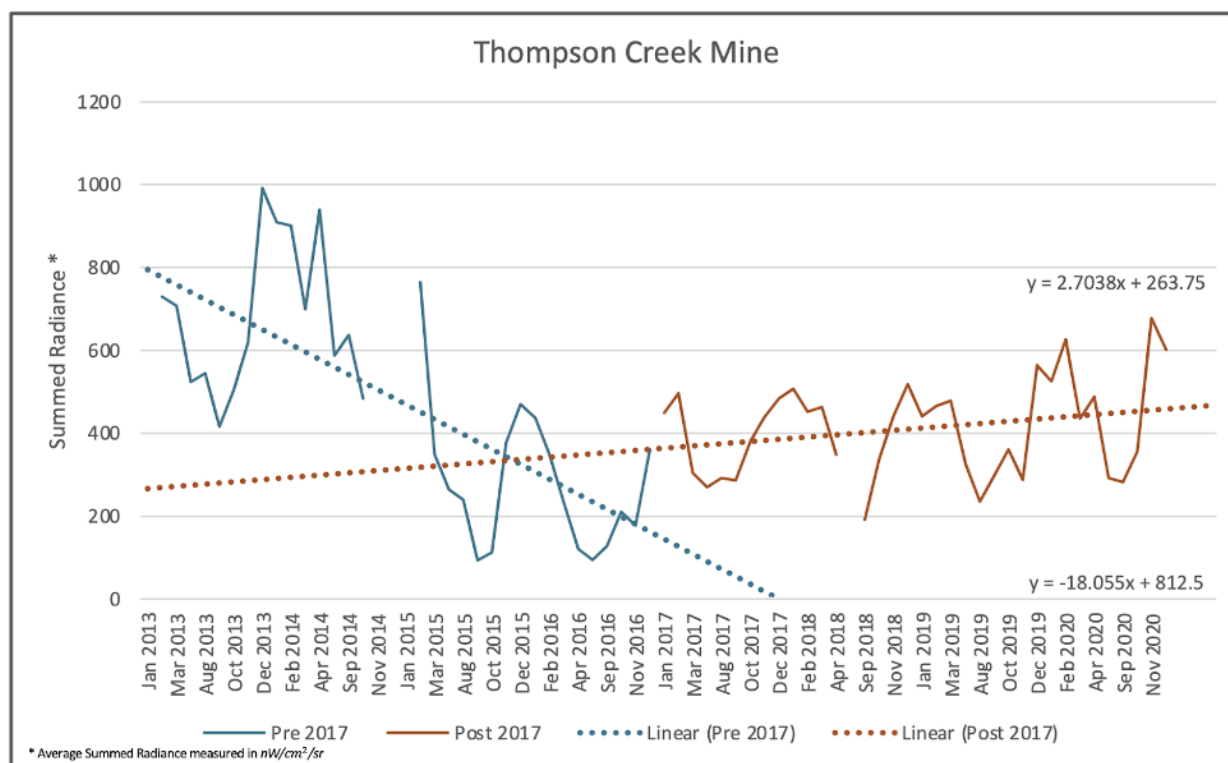
Ketchum



Graph of Light Pollution in Ketchum, Idaho, 2017 -2021, by Jules de la Cruz

This may mean light pollution reduction efforts, such as street light shielding, are effectively reducing the upward-directed light that the VIIRS satellite is able to detect. An example of this is the Thompson Creek Mine, a mine just outside CIDS SR borders that is known to contribute to light pollution within the reserve. Following public involvement, the Thompson Creek Mine reduced light pollution pre-2017. Unfortunately, we begin to see light pollution

increase from 2017 onward, indicating a further need for light pollution mitigation.



Graph of Light Pollution in the Thompson Creek Mine, Idaho, 2017 -2021, by 2021 UCLA IoES Practicum

VIIRS data is an incredibly useful tool for light pollution measurement because it provides monthly assessments of upwards-directed radiance, but it has its limitations. Considering that [the VIIRS sensor can not see blue light created by LED lighting](#), and LED light comprises the majority of new artificial lighting implements, the true changes in light pollution may be more severe than our graphs indicate.

Another way to observe light sky pollution is with a Sky Quality Camera, which uses a DSLR camera to take hemispherical pictures of the night sky. These measurements must be taken on site, and unlike the VIIRS instrument, they can measure light pollution caused by LED lights. These images are analyzed in a special program which can measure light pollution in terms of sky brightness, luminance (radiance relative to human light perception) and Correlated Color Temperature (CCT). Read more about how a Sky Quality Camera works and about the data we can collect from these images here. [[link to SQC post.](#)]

In late June 2022, the UCLA Light Pollution Ambassadors will collect Sky Quality Camera images at sites around CIDSr, as well as in the neighboring towns. In the future, other volunteers will collect data at these sites, so that scientists can develop a greater understanding

about how light pollution is changing in and around the Central Idaho Dark Sky Reserve. They will also participate in public outreach events within CIDSr, to communicate these trends and advocate for a dark sky and continued efforts to preserve it.