

Light pollution is out of control, say astronomers

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The Earth at night. What will it look like 100 years from now? Credit: NASA-NOAA

Concern over global light pollution is growing. Astronomers are noticing its growing effect on astronomical observations, just as predicted in prior decades. Our artificial light, much of which is not strictly

necessary, is interfering with our science.

But there's more than just scientific progress at stake. Can humanity afford to block out the opportunities for wonder, awe, and contemplation that the night sky provides?

We've all seen satellite images of Earth at night, with glittering interconnected cities lit up like strings of holiday lights. These images show us how our global civilization has grown, how we've made progress, and how advanced we've become. But in reality, what we're seeing is also light pollution. And we're beginning to pay a price for that pollution.

In January 2023, the Globe at Night organization released a paper based on 10 years of data on the night sky. The data wasn't from satellites—an important point that we'll get to later—it was from citizen scientists spread around the world.

Globe at Night published a [research article](#) showing that the night sky is getting 10% brighter each year. Each year, more of the sky's dimmest stars are being drowned out by sky glow from streetlights, traffic lights, and other sources. For more and more people around the globe, the sky shows fewer and fewer stars, never mind the grand arch of the Milky Way.

Globe at Night gathered over 50,000 individual naked-eye observations of the [night sky](#), where they asked citizen scientists to find the dimmest stars. The decrease in dim stars visible in these observations over the ten-year effort indicated a steadily brightening sky.

If the Globe at Night paper was a rallying cry, other researchers are responding. A pair of researchers have released their own brief paper that acts as a kind of addendum to the Globe at Night paper. They are

Fabio Falchi from the Applied Physics Department at the Universidade de Santiago de Compostela in Spain, and Salvador Bara, an independent researcher in Spain. Falchi is also affiliated with the Light Pollution Science and Technology Institute in Italy.

Satellite data paints a less worrying picture, but satellites have a different perspective. They can only measure the light that reaches them and only in wavelengths their instruments are tuned to. But the light that reaches them is not necessarily the light that drowns out the sky from the perspective of people on the Earth's surface. That's why the Globe at Night effort eschewed [satellite data](#) in favor of citizen scientists spread around the globe.

Forecasts based on satellite data predicted that light pollution will increase by 2% each year, but the Globe at Night effort showed that the actual number is 10%. That's a huge discrepancy, and it means that light pollution will double in fewer than eight years. That number should seize everyone's attention, but why the discrepancy? Why can't high-tech satellites get it right?

"Part of this discrepancy could be explained by the impossibility of these satellites to detect the blue light, emitted in great quantity by the LED light that started to be used outdoors about 10 years ago," the pair of researchers write. "These satellites are also not able to see well the light emitted mainly horizontally, such as that from the increasing number of ultra-bright LED billboards and lighted buildings' façades."

Falchi and Bara urge the building of next-generation satellites that can overcome this weakness. Multi-band sensitivity is necessary, as are "... multi-angle monitoring capabilities," according to the pair.

They're not the only ones. In 2020 a group of researchers tackled the issue in a paper titled "[Remote sensing of night lights: A review and an](#)

[outlook for the future.](#)" One of the authors was Christopher Kyba, who also co-authored the paper from *Globe at Night*.

In that paper, the authors agree with Falchi and Bara that we need satellites that can sense the rapidly spreading LED lights. They also point out that we need a better understanding of angular patterns of light emission. They don't stop there. "Perhaps most importantly," they write, "we make the case that higher spatial resolution and multispectral sensors covering the range from blue to NIR are needed to more effectively identify lighting technologies, map urban functions, and monitor energy use."

That's great. Detailed, robust data is part of any genuine effort. But we already know that light pollution is increasing. "People, media and politicians are used to associating artificial light thaumaturgical properties on road safety and personal security that it seems not to merit," the pair of researchers point out. "So, year after year, more and more light is installed to light up the night."

What can we do about it?

Something in the human psyche wants to eliminate darkness. We want comfort, safety, convenience, and an overall sense of well-being and prosperity. There's nothing wrong with creating safety if well-lit areas can combat crime, but is more and more light the answer? Is there a point of diminishing returns? Not only for us but for the natural world?

"Life on Earth evolved with sunlight during the day and starlight and the Moon, when present, during the night," Falchi and Bara write. "If we introduce in ecosystems artificial light to levels that surpass, even by thousands of times and more, the level experienced in natural conditions, animal behavior will change consequently." Increased night-time lighting could disrupt predator-prey relationships, change mating behavior, and

even help drive some populations or species to extinction.

It's not just star-gazing and the natural world that's paying a price for light pollution. Science is taking a hit, too, as observatories near urban centers have faced the light pollution problem head-on. Take the case of the 100-inch Hooker Telescope at the Mt. Wilson Observatory near Los Angeles.

From its completion in 1917 up to 1949, it was the largest aperture telescope in the world. But as light pollution increased, it became more and more difficult to perform useful astronomical observations. The light was extinguishing faint stellar images, and it kept getting worse. Finally, in 1985, in direct response to the growing artificial light problem, the Hooker Telescope was mothballed.

This was no small matter. The telescope was in good working order and had played an important role in establishing extra-galactic distances, figuring out the nature of spiral galaxies, and establishing the expansion of the Universe, among other scientific endeavors. Other instruments at the Mt. Wilson Observatory are still operating, but the Hooker Telescope's potential was eliminated by excessive sky-glow.

Nobody thoughtful would say they want species driven towards extinction and powerful telescopes shuttered while they're still effective. Nobody thoughtful wants sky-gazing curtailed, either. But one of the main problems in this issue is our prosperity. As lighting becomes cheaper—and LEDs are cheaper—we're putting up more and more lights and illuminating roads and streets that never needed it before. What can be done?

We're not likely to go on a mass campaign of streetlight removal, for example, but people have tried other things. "Attempts to control [light pollution](#) have been carried out in the last decades in several places, at

local up to national level," Falchi and Bara write. These attempts haven't been successful, even when lights are pointed so that they only shine below the plane of the horizon. "This approach is not sufficient, as any new light, even if shielded, will add pollution to the night environment after being reflected off the surfaces intended to be lit," they explain.

Instead, we need to put caps on lighting just like we do on other forms of pollution. The authors point to the Clean Air Act in the U.S. as an example, which limits the use of air contaminants like cancer-causing solvents and toxic fuel additives.

It's axiomatic that human activities will affect nature. But that doesn't mean we can put the blinders on and just accept it. Light pollution might not seem like a big deal in a world enduring the growing catastrophe of the global climate crisis. Can't we just go on the internet and see the sky in far more detail, and even from different parts of the globe? Sure, but computer monitors are not the same as sitting out under the sky, gazing and letting your mind take it all in. Those activities form memories we reflect on, and that stir something inside of us.

Astronomy divorced from humanity's natural spirit is an impoverished venture. Without simple star gazing, and the way it can engage our imaginations, and our sense of wonder and awe, most of us might not even care about the science of astronomy.

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