How Light Pollution Works

by Jessika Toothman

Introduction to How Light Pollution Works

Humans have been able to harness electricity for only a relatively brief span of time. Prior to that, while people did have some small measures of warding off the darkness, it was still a very important facet of their lives. They were guided by the stars and directed by the moonlight. They timed their lives according to their natural circadian rhythms and were in tune with all the vast bodily and behavioral impacts that entailed. Nowadays, we can stay up all night and defy the dark -- but at what cost?

There's no real definitive, overarching definition for the phenomenon known as light pollution, but here's a general way to break it down into types:

- **Sky Glow**: Occurs when diffuse light escapes from developed landscapes, leaving a bright, hazy dome cast over cities and towns. Nighttime photos of major metropolitan areas often show this in amazing intensity, with the most brilliant blankets of sky glow emitting dusky, smoldering blazes dotted with shining hotspots. This type of light pollution typically results from the multitude of stray light particles that are shot straight up into the air and scatter in the atmosphere.

- **Light Trespass**: Your neighbors might know better than to hop over your fence in the middle of the night, but do they know enough not to leave all their lights on -- inside and out -- in anticipation of a late night out? That sort of scenario is what light trespass is all about, and there can be many more potential sources, such as street lamps or nearby businesses.

- **Glare**: This usually happens when lights aim directly into people's eyes; in other words, you see straight into the source of the light. Driving around at night, you've probably run across many lights emitting eye-scorching examples of glare (headlights are an excellent case in point). This can be a dangerous phenomenon when being able to see at night is paramount to everybody's safety.

- **Clutter**: This concept basically involves an overabundance of lighting. Whether stringing streetlights too close together along a highway or brightening a building with midday cheer in the dead of night, practices like these can be both distracting and wasteful.

While there are other names sometimes used to describe the above and similar lighting issues, the basic idea to keep in mind is that light pollution involves too much artificial light (often because of poorly chosen light bulbs, arrangements and fixtures) shining at the wrong time of "day" and typically resulting in grave consequences.

The Dark Side of Light Pollution: Animal Effects

Astronomers just aren't fans of light pollution; it outshines distant incoming celestial light and interferes with their telescopes. But a wide array of animals suffers even more, their lives thrown horribly out of whack by the bright glow of light pollution.

Sleeping cycles, breeding cycles, migration cycles, feeding cycles -- animals follow all the proper patterns of life by taking cues from the sun, the moon, the seasons and other earthly phenomenon. An abundance of light confuses them and makes them act out of accordance with nature. It might not seem like a big deal if a flock of birds migrates a month early, but what if it's too cold when they get to their destination or the nesting conditions aren't right? Birds can also become confused when they fly over a bright city -- without the stars to guide them, they end up hopelessly lost and often fly until they're exhausted.

It's similar with baby sea turtles. When they hatch on a beach they're supposed to head down to the water. The moon serves to guide them and draw them on, but bright beach lights can easily distract them and the little turtles often head off in the wrong direction, frequently ending up the victims of passing cars.

Frogs and toads, bats and moths, fireflies and fish, plus many other animals can all suffer sometimes detrimental physiological and behavioral changes if they're fooled by artificial light. Activity levels, for example, often change. Some owls take advantage of the situation and hunt more, which increasingly drives their prey into hiding. Insects can be fatally drawn to certain wavelengths of light in droves, and it doesn't help that bats often follow to forage. Some animals are prone to breed more, others to breed less. Bioluminescent species are suddenly faced with tireless
The Dark Side of Light Pollution: Animal Effects

The larger impacts of ecological disruptions such as these aren’t always clear to researchers, but considering how delicate the planet’s ecosystem is, long-term impacts are completely possible. Unfortunately for us, we’re as much a part of the animal kingdom as any sparrow or sea turtle. So although we might not realize it, light pollution affects us just as surely as it does them.

The Dark Side of Light Pollution: Human Effects

We might not wander the wrong way on the beach or crash headfirst into the upper stories of skyscrapers, but that doesn’t mean that light pollution -- and an overexposure to light in general -- isn’t just as damaging to our bodily functions and overall health.

Regular people also suffer when there’s too much light floating around. There are many complex components, but one factor that pops up repeatedly is melatonin: Too much nighttime light equals too little melatonin production. One little hormone might not seem like too big of a loss, but research has consistently proven that low melatonin levels are incredibly detrimental, with sweeping health effects across the body. Light during the nighttime, even at low levels, can seriously impede melatonin production. Less than 40 minutes basking under an incandescent light bulb can reduce melatonin levels up to 50 percent [source: Navara].

Melatonin affects a whole host of bodily processes including metabolism, immune function, and, through the endocrine system, helps balance reproductive, thyroid and adrenal hormones. When you throw Into the mix closely related factors such as disrupted circadian rhythms and sleep deprivation, there’s a laundry list of the health concerns that have been linked in some degree to an artificially lit world. Among them are obesity, type II diabetes, coronary heart disease, hypertension, insulin resistance, poor metabolism and heart attacks.

Breast cancer and other cancers are another major concern. Melatonin acts as an antioxidant, so combined with all its other key roles, increased cancer risk should come as no surprise -- although the actual figures might. In the developed nations, women are five times more likely to get breast cancer than women in underdeveloped nations [source: Navara]. Shift workers who spend their nights under artificial lights are another group that’s highly susceptible to these effects.

It’s even been suggested that we’ve basically been running a massive global experiment, seeing how much we can handle before our addiction to light leads us to a very dark place. Luckily, light pollution is a pretty easy fix with benefits even larger in scope than the improved health of pretty much everything on the planet. Find out what you can do about it on the next page.

The Solution to Light Pollution

Even apart from the major health and environmental improvements that would come with fixing the light pollution problem, there are many other benefits. Plus, among all the pollution issues we have on Earth, light pollution ranks right up there as one of the easiest and most cost effective to solve.

Since light pollution wastes vast amounts of money, one of the biggest perks of proper lighting would be felt in the world’s collective wallet. Similarly, cutting down on inefficient and unnecessary lighting decreases the amount of carbon emissions that we shoot up into our unhappy atmosphere -- always a bonus.

So what are some of the quick fixes?

- Use lower wattage light bulbs. Flood lamps over the garage might make you feel more secure, but while you’re gazing blindly across a midnight sea of noon, anyone trying to prowl around has likely slipped stealthily into the shadows.
- Replace unloved lights with motion sensor lights that only flip on when they’re triggered. Don’t use any lights when you don’t specifically need them.
- Proper aiming and shielding is fundamental to decreasing light pollution. Buy fixtures that fully encase bulbs so all the light is shining down where it’s actually needed, not shooting off in every direction.

Once you’ve addressed your own abode, consider encouraging others to take steps as well. Billboard owners and municipality leaders are good starts, since light pollution is a major contributor to high-cost, low-efficiency operations.

Now you can turn your attention indoors, too. There are several things you can do to address the issue of bad lights in your life. For example, when it comes to personal habits, do everything you can to cut back on light use, especially as night starts to fall. A dimmer switch can be a great way to transition through artificial dusk. For late-night trips to the fridge or bathroom, consider installing a red nightlight that won’t be as likely to throw your melatonin production out of whack. Make sure your bedroom is dark enough, too.
For more advice, there are many groups out there pushing for improvements in light pollution. One example is the International Dark-Sky Association (IDA). Established in 1988, it works to educate the public on the need for smarter lighting and advises those seeking it. Members in more than 70 countries act as advocates for dark skies and help develop new technologies to help the organization with its mission.

To learn more about the IDA and other initiatives, flip over to the next page.

How Light Pollution Works: Author’s Note

Living in a large, sprawling city, I was no stranger to light pollution before I wrote this article. But I was very interested (and a little alarmed) to learn about all the ways light pollution negatively impacts both the animals and people exposed to it. Several life cycles, among them sleeping, breeding, migration and feeding cycles, can be affected by an overabundance of improperly timed light. And to a large extent, humans aren’t spared from this. Light during hours of darkness decreases the production of melatonin, which can disrupt a whole host of bodily functions.

I think the most provocative thing that I read, however, was this: By frequently and fundamentally altering our collective circadian rhythms, we are in fact running a massive global experiment. Humans -- and the plants and animals that exist around us -- evolved to follow set natural patterns, such as appropriate times for sleeping and waking, from the tiniest beetles and bats right up to the biggest CEOs and most-relied-upon RNs. We now routinely defy that millions-of-years-in-the-making dictate. I hesitate to imagine the results of this experiment if it fails.

Sources


Light Pollution: Cheat Sheet

Stuff you need to know:
- Light pollution takes many forms, like the sky glow visible in metropolitan areas and the cluttering effect common around brightly lit baseball stadiums and highways. Trespass is another, when unwanted light spills into unlit areas.
- Light pollution can affect animals in many ways. It has the potential to disrupt sleeping cycles, breeding cycles, migration cycles and feeding cycles, to name a few.
- Light pollution can affect people, too. Artificial light during evening hours decreases melatonin levels, which is linked to wide-ranging impacts on many bodily processes, including metabolic activities, immunological responses and other hormonal functions.
- Light pollution also wastes money and generates large amounts of carbon pollution. Luckily, though, it's one of the easiest and cheapest pollution problems to solve.
- Light pollution can be minimized in many ways. Lower-watt bulbs, motion-sensor lighting, directionally optimized light fixtures and dimmer switches can all help
within a household. Commercial and municipal leaders can also be petitioned to make more broad-sweeping simple fixes.

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