The Dark Side Of Light

Light Pollution is proving fatal to birds and other wildlife.

Leaving the lights on is more expensive than you'd think. It not only costs a chunk of change, but it also takes a surprising toll on the environment. The proliferation of artificial lighting threatens wildlife, ruins habitat, fouls the air, squanders resources, and blocks our view of the heavens. No wonder the pervasive problem has come to be called light pollution.

Astronomers were the first to notice this problem. About 30 years ago they began to be frustrated as sky glow, the eerie radiance that emanates from settled areas and has spread with urban sprawl, began impairing their ability to see the stars. Today as few as one in 10 Americans live in areas where they can see the 2,500 or more stars that should be visible under normal nighttime conditions. In most big cities, you're lucky to glimpse a few dozen - on a good night.

But light pollution isn't just an urban problem. In Springfield, Vermont, a controversy has erupted over the economically depressed town's decision to permit the construction of a prison; the lights from the site, it is feared, would mar the view from Breezy Hill, of of New England's best places for stargazing. Each year since 1926, thousands have flocked to Breezy Hill for a celebration of the stars called "Stellafane." David Levy, an astronomer, has led the protest against the proposed prison. "Stellafane is a magical place, a sanctuary to the stars," he wrote in "Sky & Telescope" magazine.

Although light pollution's impact on stargazing is as clear as day, its effects on other environmental elements are just coming into focus. The evidence shows that artificial lighting has direct consequences for animal behavior, particularly on the ability to navigate at night. The hundreds of species of migrating birds that fly after the sun sets, including most songbirds and many shorebirds, are prime examples.

Normally they rely on constellations to guide them during their twice-yearly migrations. But scientists speculate that when they fly near urban areas, the bright lights short-circuit their steering sense. Numerous reports have documented birds flying off course toward lights on buildings, towers, lighthouses, even boats. "Both birds and insects demonstrate positive phototaxis," says Sidney Gauthreaux, a Clemson University biologist. "To put it simply, birds are attracted to light much like moths are to a flame. But the reasons are unclear. They may use it as a reference and home in on it." When birds suddenly reach the light's source, they often seem to become confused or blinded by the glare, which can be disastrous.

Birds may slam into windows, walls, floodlights, or even the ground. On the night of October 7, 1954, for instance, 50,000 birds were killed when they followed the beam of a guide light at Warner Robins Air Force Base in Georgia - straight into the ground. The problem is particularly acute when the weather is bad. On a rainy, foggy Labor Day weekend in 1981, more than 10,000 birds collided with the floodlit smokestacks at Ontario's Hydro Lennox Generating Station, near Kingston. And on January 22, 1998, between 5,000 and 10,000 Lapland longspurs crashed into radio transmission towers near Syracuse, Kansas.

Birds that are distracted by tower lights also may end up crashing into one another. "Around communication towers with constant lights, birds curve, circle, pause, and hover around the lights," Gauthreaux explains. They are apparently trying to orient their flight to the light, which they mistake for the moon or a star. "Over time there's buildup of migrants [all trying to adjust their course], raising the possibility of hitting guylines or other birds." Nobody is certain of the total number killed across North America, but Michael Mesure of the Fatal Light Awareness Program (FLAP), a Toronto organization working to publicize the problem, estimates that at least 100 million birds are killed annually by manmade structures. "More birds die each year through collision than dies in the Exxon Valdrex spill," he says. A tall building in the path of a migration can claim hundred of lives. One example: From 1982 to 1996, 1,500 migrating birds have smacked into Chicago's McCormick Place Exposition Center.

Although few nocturnal migrants seem immume to light's dark side - for example, dead or injured members of 141 different bird species have been found at McCormick Place - songbirds may be most at risk, Mesure says, because they fly at low altitudes dominated by artificial light. Passerines are not the only order of birds waylaid by lights. The Newell's shearwater, an endangered Hawaiian seabird, is particularly vulnerable.

After their parents abandon their cliffside nests in October and November, fledglings make their first flights by relying on their innate attraction to light to guide them. Normally, because of the light's reflection on water, they fly out to sea, toward the horizon. But when the moon is neither full nor visible, many of the shearwaters instead glide toward lights in seaside resorts and towns. Disoriented, hundreds crash into structures or drop from the sky. In 1998 volunteers gathered 819 shearwaters on the island of Kauai. Most were exhausted or injured, though fortunately, only 77 died.

Other animals are threated by light pollution, too. Hatchlings of at least five sea-turtle species found in Florida rely on an instinctive attraction to light to guide them to water. But lights on or near the beach can confuse the turtles and cause them to head in the wrong direction. Scientists have seen hatchlings cross parking lots, streets, and yards - transfixed by shining streetlights or porch lights. "Their reliance on light is so strong that they'll continue heading to a light source, even if it's an abandoned fire that burns them alive," says Blair Witherington, a Florida Marine Research Institute scientist who studies sea turtles. Disoriented hatchlings usually die from exhaustion, dehydration, or predation. Many others are squashed by cars.

Insects cannot seem to resist this fatal attration either. Most people know that moths find lights irrestible. But what they may not realize is that the energy moths expend in this way can cost females the chance to attract a mate. What's more, it can interfere with locating prime spots to lay their eggs, thus giving larvae inadequate conditions to develop, according to Michael Collins, a lepidopterist at the Carnegie Museum. Some entromologists speculate that the proliferation of outdoor lights has contributed to the decline of numerous saturniid moth species in the northeastern United States.

Visual orientation is just one sense disrupted by artificial light, though it probably isn't the only one, says Meredith West, an Indiana University professor specializing in avian development. Studies of animals raised in controlled settings, like laboratories and poultry farms, indicate that lighting can affect certain "photo-periodic" behavior, including foraging and reproduction.

"Animals are very sensitive to light," West says. "Lighting is a powerful stimulus on behavior. If there's enough of it, it can make them act in ways they wouldn't normally." If enough light is present - say, in a well-lit neighborhood - it's possible that animals living there would be stimulated to act as they do during longer days. Overexposure to light may explain reports from English researchers about robins singing at night if there are streetlights in their territories, or why some birds build nests during the fall, instead of spring: Their internal clocks have gone haywire. Adult female sea turtles will not emerge from the water to next and lay eggs on beaches that are bathed in artificial light. Many behaviors influenced by changing light - from night to day and the seasonal increases of longer days - involve hormones. "Anything that alters the hormonal system will bring enormous changes," West says. "Hormones regulate growth and immune functions. But they're not produced all the time. If they don't shut down, you overload the body. It can't get rid of them. Hormones are toxic in the wrong amounts."

Even if wildlife were able to ignore direct sources of light, lighting's impact on the environment would still be unavoidable. Burning coal and oil, according to the Environmental Protection Agency, generates most of the electricity for lights. The process is a dirty one that each eyar spews out billions of tons of carbon dioxide, a greenhouse gas; sulfur dioxide, an ingredient of acid rain; and nitrogen oxides, which cause smog. Sadnly, much of this atmospheric pollution is produced for nothing. "One-third of our lighting is wasted because it shines upward or sideways, illuminating nothing but the bottoms of birds and airplanes," says David L. Crawford of the International Darksky Assocation (IDA), a 10-year old anti-light-pollution group based in Tucson. Every year this waste squanders the equivalent of 8.2 million tons of coal or 30 million barrels of oil.

Of course, using less energy would reduce emissions. In addition, research in toronto and Washington D.C. shows that when building lights are dimmed or turned off, thenumber of fatally attracted birds drop dramatically. "If you have a tower without lights, you'll cause bird collisions, but at least you won't be attracting more birds to it," Gauthreaux says. The challenge for the government and environmental groups it to, no pun intended, enlighten people. The Environmental Protection Agency has created an energy-saving program, Energy Star, to help companies and residents reduce lighting use. Several manufacturers have begun producing energy-efficient lights and appliances.

FLAP launched a 12-step bird-friendly program that encourages buildings to turn down lights during migrations; it has been adopted at 100 buildings in downtown Toronto since 1997. FLAP organizers are leading similar efforts to raise awareness in Chicago and New York. Any educational drives to publicize the impact of light on turtle hatchlings and seabird fledglings are now being sponsored by the National Park Service in Hawaii and by county governments in Florida.

Some cities, including Tuscon and Miami, are replacin innefficient streetlights with ones designed to focus the beam more sharply. In addition, last August two workshops at the Americal Ornithologists Union conference explored light pollution's impact on birds.

Meanwhile, lawmakers in hundreds of communities have passed ordinances that restrict lighting types, power, and use. Last spring Texas and New Mexico became the fourth and fifth states (along with Arizona, Connecticut, and Maine) to implement a statewide light-restriction program. The ordinances vary in scope, from banning certain types of streetlights or limiting their wattage to shielding security lights. Similar actions are being considered in other states.

Any dark-sky proponest will admist that the national impact of these programs is minimal. But Crawford of the International Dark-Sky Assocation believes that they're a good start. "All the evidence shows it's bad, but we have to educate people about the consequences. Smoking bans are coming quickly now, but the education that brought them about took a long time."

By Joe Bower, Audubon