

## How Artificial Light is Turning “A Bug’s Life” into a Horror Movie

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Suppose you take the 7:00 a.m. train to work routinely every day. Now imagine trying to stick to your routine if you didn’t have a watch to tell time, didn’t know where the train station was, and couldn’t tell a train from a bus. Makes life a little harder, right? While this is a slight exaggeration, artificial light can disrupt almost every facet of an insect’s life, turning it into a horror movie. Light pollution is so prevalent in today’s world that in some countries like Singapore and Kuwait, 99.5% of stars are completely invisible to people without any visual aids according to National Geographic. While we may feel a greater sense of security at nighttime, the excessive amount of artificial light has created a ripple effect within insects’ ecosystems that has unequivocally disrupted every aspect of their life. Avalon Owens and Sara Lewis from Tufts University set out to understand how exactly insect’s lives are altered with increased artificial light at night (ALAN) to enable researchers to develop ways humans can coexist with these species without negatively impacting them. By looking through existing research studies done in this field, they split their findings into five discrete impacts: shifting of various cycles, inhibited ability to navigate, attraction to light, decreased visual sensitivity, and reduced ability to recognize objects in their environment.

As described in another study done on features of insect clocks by Numata, Miyazaki, and Ikeno, biological clocks control everything from feeding, mating, various physiological or bodily functions, and even events in the life cycle of an insect such as hatching and pupation. ALAN, however, causes temporal disorientation which is the “desynchronization of organisms from their typical biorhythms.” A lot of insects typically make use of external light signals to keep their internal clock in check. For nocturnal insects, especially, many use the lack of light as

a signal to start feeding or mating. For example, for moths, constant light can reduce male attraction, reduce female oviposition (the process of females laying eggs), and even induce male sterility which inhibits sexual reproduction. ALAN essentially alters the length of the day causing these nocturnal insects to shift many of their natural biorhythms.

ALAN has also affected insect's spatial orientation, the ability to navigate across three-dimensional space. Nocturnal insects usually rely on the moon and stars, which are constants in the night sky, to help them position themselves. For example, dung beetles usually use the Milky Way to help guide themselves away from dung piles. Because of ecological light pollution, which is the infiltration of light into natural habitats, there are alternative sources of light in the night sky that could be confused for the moon or stars. Because of atmospheric light pollution when light pollution reduces the visibility of the night sky, it is harder for these nocturnal insects to see the moon and stars and orient themselves accordingly.

As we all can observe by taking a stroll at night near a streetlamp, insects are attracted to artificial light. As insects approach these streetlamps, 30-40% usually die from collision, overheating, dehydration, or predation. These insects that are attracted to ALAN usually lack their typical evasive instincts and are easier prey for predators that hang around these light sources. A part of the reason why light sources put these insects almost in a trance is because many nocturnal insects' eyes are not built to function in extremely bright environments. For the hawkmoth, exposure to bright light can reduce visual sensitivity by two to three orders of magnitude. Because of a combination of these factors, insects are not able to recognize objects accurately in their environment with some even losing the ability to discriminate colors.

Unfortunately, we never pause to consider the impact artificial light has on other creatures. Nocturnal insects are profoundly impacted by our desire for greater security that

comes at the expense of them altering cycles they have practiced for eons and factors they always held to be constant. Owens and Lewis intend their research to guide new lighting technology in the right direction, a balance of both public safety and non-disruptive to our local ecosystems.

#### References

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