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ENGL 21003

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Light Pollution and Nocturnal Organisms: An Annotated Bibliography

Bennie J, Cruse D, Davies TW, Gaston KJ., Inger R 2018. Artificial light at night causes top-down and bottom-up trophic effects on invertebrate populations. *J Appl Ecol.* [accessed 2022 April 23] 55(6): 2698-2706.

The organisms studied in this experiment were mainly grassland plants and invertebrate herbivores, as well as predators. White LED lights decreased the overall number of herbivores by 55% when a predator was added. Similarly, monochromatic amber light decreased the overall number of herbivores by 17% and the main reason was that it diminished the total amount of vegetation cover and flowers of their main food plant inside the mesocosms. The main conclusion of this experiment was that light pollution alters ecosystems and directly affects trophic levels. Most of these effects depend on the wavelength of artificial light.

The purpose of this experiment was to determine the different effects that artificial light has on biotic interactions. Precisely, to determine how artificial illumination affects the vegetation cover, food source, and predator-prey relationships of organisms living in the grassland communities. The authors of this research article (Jonathan Bennie, Thomas W. Davies, David Cruse, Richard Inger, and Kevin J. Gaston) are all part of the Environment and

Sustainability Institute at the University of Exeter, Cornwall, UK. Bennie et al. (2018) conducted this experiment and gathered the results by using 54 mesocosms (outdoor systems ideal for environmental and biological experiments) and recorded their observations at night for three years. Each mesocosm consisted of 72 grassland plants. 18 of them included plants only, 18 more were bitrophic treatments which included plants and herbivores, and the last 18 were tritrophic treatments which held plants, herbivores, and predators. The different systems were divided equally and exposed to both, white and amber light, as well as natural lighting at night. These are common forms of street lights and in this instance, they were used to simulate the roadside vegetation of many artificially lit fields at night and to identify the extent to which the varying light wavelengths alter grassland ecosystems. Although this experiment used the same approach as Firebaugh and Haynes (2019), which was to simulate the different types of street lighting, it was the experiment that had the most experimental systems and that only used herbivores. This article will contribute to my literary review by explaining how light pollution affects the food sources of nocturnal insects.

Boyes DH, Evans DM, Fox R, Parsons MS, Pocock MJ. 2021. Street lighting has detrimental impacts on local insect populations. *Sci. Adv.* [accessed 2022 April 23] 7(35):eabi8322.

The nocturnal organisms studied in this experiment were moth caterpillars, also known as Lepidoptera. Moth caterpillars are crucial for terrestrial ecosystems. Not only because they are prey for both vertebrates and invertebrates, but also because they carry out parasitic and symbiotic relationships. When exposed to streetlighting, nocturnal caterpillars in hedgerows decreased by 47 percent and those in grass margins decreased by 33 percent. And although

nocturnal caterpillars under white LED streetlights were affected more than those under yellow streetlamps (high-pressure sodium lamps), both types of artificial lighting affected the procurement of nutrients.

The main objective of this investigation was to determine how light pollution affects the local abundance, expansion, and food attainment of nocturnal insects like moth caterpillars. The authors of this research article (Douglas H. Boyes, Darren M. Evans, Michael J.O. Pocock, Mark S. Parsons, and Richard Fox) are all affiliated with the school of Natural and Environmental Sciences, Newcastle University, and the UK Centre for Ecology and Hydrology. Boyes et al. (2021) used two different territories to gather results: lit and unlit hedgerows and grass margins. And in total, they had 26 pairs of sites. This research study is different from the other two because instead of using manipulative fields or mesocosms, Boyes et al. (2021) utilized habitats that were directly located under regular streetlights and compared them with other unlit habitats. In other words, they did not simulate the light emitted from streetlamps but used real streetlights instead. This article will contribute to my literary review by providing evidence that light pollution directly affects wild insect abundance.

Firebaugh A, Haynes KJ. 2019. Light pollution may create demographic traps for nocturnal insects. *Basic Appl Soc Psych.* [accessed 2022 April 23] 34:118- 125.

The nocturnal organisms studied were two types of fireflies, the *Photuris Versicolor* firefly as the predator species and the *P. Pyralis* firefly as the prey species. The two species of fireflies were more attracted to artificial LED lights at night and mating interactions diminished in light-polluted spaces. Under the presence of artificial light, the *Photuris Versicolor* fireflies

did not light up or showed any mating patterns, whereas, in spaces with natural lighting, they lit up at least once and presented lighting patterns that resembled mating activities. Light pollution dwindled flashes of the *P. Pyralis* fireflies by 25 percent and female *P. Pyralis* mated twice as much in natural lighting. Moreover, light pollution did not correlate with predator-prey alterations.

The main objective of this investigation was to find out how light pollution affects the attraction and repulsion of nocturnal insects and to identify how it alters daily interactions like courtship (mating behavior) and predator-prey relationships. Firebaugh and Haynes have PhDs in environmental science, and most of their research is in community ecology and the conservation of native species. To determine if artificial lights attracted fireflies, they counted the number of fireflies captured inside 15 pairs of lit and unlit traps throughout 14 nights. To quantify the number of recurrent flashes and analyze the mating behavior of the *Photuris Versicolor* firefly (the predator species), they separated them into two containers with and without artificial illumination. They scrutinized the mating behavior of the *P. Pyralis* fireflies and the predator-prey interactions between both species by using a manipulative outdoor experimental system with and without artificial illumination. This study is different from the other two because it mainly focuses on the attraction of nocturnal insects. It will contribute to my literary review by providing evidence that light pollution attracts nocturnal insects and interferes with mating activities.