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Artificial Lighting Biodiversity Impacts

Light is used by organisms in many ways. It is a source of energy and it is a source of information for all living beings. Organisms have evolved mechanisms and adaptations to make the best of natural light as a source of information and energy for millions, sometimes billions of years. The presence of artificial lights can disrupt these naturally evolved mechanisms.

Impacts and Effects

The organisms that have been found to be most affected by light pollution are:

- insects (particularly flying insects like moths, which are important pollinators),
- birds
- bats

Through research scientists have started to show that effects on a particular group of animals might cascade on other groups:

- If insects are declining because of light pollution, then probably animals that normally eat insects (birds, bats) will also suffer from this, on top of the direct effects that light pollution might have on them.
- Light pollution can push organisms away from an area to somewhere else, if they can. When that happens, it creates complex effect in the ecosystems, because suddenly there is restructuring of ecological communities that happens beyond the lit area.

Light pollution can affect wildlife broadly in three ways:

- By masking the natural light source that organisms use as a source of information. This is the case of species that use moon and starlight to navigate (for instance birds and bats) or to time specific behaviours (for instance mass spawning in corals is tuned to the moon cycle). It can also result in animals being active at the wrong time, for instance birds that sing at night-time.
- By misleading animals to the wrong light source. This is the case for animals that move at night, which might mistake lit structures for the moon and stars, and then move towards them with the risk of colliding or getting stuck. Effects are seen not only by very prominent, massive light installations, but also at lighthouses and lit building in towns and cities. See here: https://www.designingbuildings.co.uk/wiki/Light_Pollution_-_Threat_to_Migrating_Birds. And here: <https://abcbirds.org/wp-content/uploads/2022/05/ABC-lighting-collisions-position-statement-2022.pdf>.
- By distracting animals while they are performing a task. A famous example of this is wildlife crossing at roads (eg deers). Light beams from the cars can temporarily blind crossing animals.

University of Glasgow School of Biodiversity have published a review paper about the effects <https://www.nature.com/articles/s41559-020-1135-4>

What can we do about all this?

Light pollution can be one of the easiest forms of pollution to solve. There are three major ways:

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- Use light only **where** it is strictly needed. Point illumination towards the ground (there is no reason to point it to the sky and it will affect flying animals), and limit the area of the ground that is lit to what is strictly needed. The design of the lamp post used and the intensity of the light bulb used are crucial aspects to consider.
- Use light only **when** it is strictly needed. Do not illuminate places or activity areas at times when nobody is using them or at anti-social times. Using LEDs can give a lot of flexibility, as they can be easily turned on and off or dimmed when light is not needed.
- Use light of the **right colour temperature**. Blue light is widely known to be bad for human and animals' circadian rhythms, as the photoreceptors in the brain that regulate sleep and metabolic rhythms are more sensitive to blue light than to other wavelengths. Lots of the new LED installations use LED bulbs that are rich in blue wavelengths. Use lights that have a colour temperature with less blue wavelengths and more orange-red ones. In terms of colour temperature values (measured in Kelvin), choose bulbs with temperatures of 3000 K or lower.

Further Information

The website of the International Dark Sky Association is highly recommended for further information. It has information about known effects of light pollution, examples of what we can do about it and case studies of good lighting practices:

<https://www.darksky.org/our-work/lighting/public-policy/policy-makers/>

The following links are useful for a general overview of the reported effects:

<https://www.darksky.org/light-pollution/wildlife/>

<https://www.nature.com/articles/d41586-018-00665-7>

<https://www.burohappold.com/thought-leadership/the-importance-of-conserving-dark-skies-for-people-and-nature/#>

Links about mitigation:

<https://www.unep.org/news-and-stories/story/global-light-pollution-affecting-ecosystems-what-can-we-do>

<https://www.wyomingstargazing.org/how-color-temperature-affects-light-pollution/>

<https://phys.org/news/2022-09-pollution.html>

<https://www.theagilityeffect.com/en/opinions/smarter-lighting-is-good-for-biodiversity/>

This information has been kindly provided by Davide Dominoni. Davide attended the working group workshop for Kelvingrove Park.

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