

Light Pollution in the City of Armagh

ARMAGH
OBSERVATORY

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Abstract

The Armagh Observatory is being adversely affected by the problems of light pollution in the City of Armagh. This superfluous light makes it increasingly difficult to see the stars, almost impossible near the horizon. There are also many other reasons for reducing light pollution: it causes animals such as birds to become disoriented and not know when to sleep or roost, it causes excess fossil fuels to be burnt in generating this extra light and it costs more money to run.



Figure 1. The only sign of humanity's existence from space: the lights that we spill upwards (NASA GSFC image).

A report was needed to explain and discuss these problems, as well as to suggest solutions to them. This would hopefully encourage the Government to introduce legislation which could control light pollution.

Introduction

Light pollution is unwanted or unnecessary light. It falls into four basic categories:

Light Trespass — Illumination of an unwanted area, such as a streetlight shining through a bedroom window.

Sky Glow — Illumination of the atmosphere by unshielded lights, which causes the sky to glow and the stars to be obliterated from view.

Glare — The dazzling effect very bright lights have on eyes is called glare. It happens when lights which are far brighter than the surrounding area shine into the eyes and the eye has trouble adapting. It causes peripheral vision to be lost, and if severe can cause complete blindness for a space of time.

Light Waste — Lights too bright for the purpose or left on when no-one is present to benefit from the light.

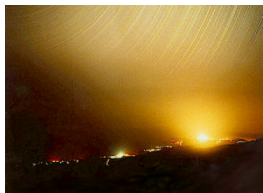


Figure 2. The effects of sky glow and glare, seen from a dark site. Notice how the stars (shown as trails on this image) cannot be seen near the horizon. Image courtesy of the IAC (see www.iac.es/proyect/otpc/what.htm).

Effects of Light Pollution

Light pollution affects everyone, not just astronomers. Poor lighting can stop us seeing the stars, seeing the road we're driving on, and sleeping. There are also environmental and economic reasons not to over-light, but still over-lighting abounds.

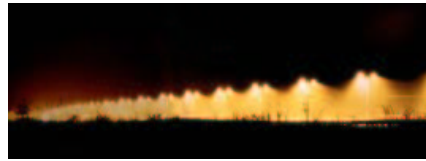


Figure 3. This picture shows a section of full cut-off streetlights installed on the M1 motorway in England, illustrating their effectiveness at reducing light pollution. Image, originally from Urbis Lighting Ltd, taken from the Campaign for Protection of Rural England web-site: www.cpre.org.uk.

In 1988–1989 the International Dark Sky Association (IDA) and Campaign for Dark Skies (CfDS) were set up to try and stop the spread of light pollution, and eliminate that which already exists. Their aim is not to turn off all external lights, as some incorrectly think, but to have 'the right amount of light, and only where needed'.

All Primary School teachers say that there are two things in science which always fascinate children: dinosaurs and space. Yet, according to the CfDS, 87.1% of people are now severely affected by light pollution, 4.6% to such an extent that they can no longer see any stars at all.

There are environmental considerations as well. In the UK every year the amount of excess coal needed to generate electricity for poorly shielded streetlights alone is some 300,000 tonnes, equivalent to the weight of 48,000 African Male Elephants. The amount of carbon dioxide produced by this coal would fill 200,000 hot air balloons per year. The cost to taxpayers is more than £60 million per annum.

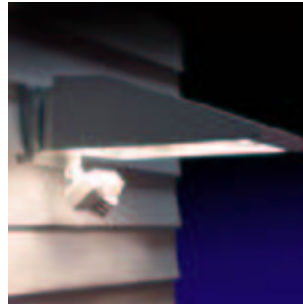


Figure 4. An example of a good security light that directs the light downwards, eliminating glare. This light is also activated only by a motion detector (see www.darksky.org).

Stopping Light Pollution

In order to reduce light pollution we need to use less light, better shielded and more energy-efficient bulbs.

The first thing to consider is whether or not we really need a light. Take security lights as an example. People put these up because they believe that more light means more safety. However there is no conclusive evidence that this is true. An experiment in the USA where all the security lighting in schools was turned off showed a reduction in crime; once people became used to having dark schools they immediately reported any lights they saw there. Excess security lighting, in fact, probably helps criminals. It provides long dark shadows in which to hide, making them very hard to see since everyone's eyes will be adjusted to seeing in bright light.

If, however, lighting is necessary we must consider what type of bulb we should use. Most people make two mistakes: they choose incandescent bulbs because they think they're cheap, and they use a far higher wattage than is advisable.

Incandescent lighting is the most expensive kind you can use. Though a single incandescent bulb is cheaper than a single metal halide, high pressure sodium or low pressure sodium bulb, you will have to replace it much more often. An average incandescent bulb burns for 1,000 hours compared to 20,000 hours for a metal halide. They are also the least efficient at producing light, only about 5–10% of the watts being converted to visual light (lumens). The most efficient bulbs are, respectively, low pressure sodium, high pressure sodium and metal halide. The only disadvantage of sodium lighting is that it has very bad colour rendition, making it unsuitable for decorative lighting. However it is still excellent for street lighting.



Figure 5. An example of a typical streetlight in Armagh. This is a low-pressure sodium light, which directs much of the light nearly horizontally and upwards. (Image taken by Jonathan McAuliffe, Armagh.)

The last thing to consider is the lamp, or luminaire which will be used. Good lighting directs light only where it is needed. Therefore up-lighting should never be used: 70% of the light will go directly up into the sky. Cut-off, or preferably full cut-off fixtures should be used, which direct the light onto the ground or building being lit and nowhere else.

Survey of Armagh

It was decided that a survey should be done of Armagh to determine how much light is being wasted, allowing us to calculate both the economic and environmental cost of the lighting in Armagh.

A route through Armagh was planned and codes for lights used to facilitate the survey. It was discovered that there are no full cut-off lights along the survey route, and only 14% of the luminaires are semi cut-off. 37% of the streetlights were of a poor, relatively old-fashioned design, which spill 30% or more of their light into the sky. Adopting these figures, the cost of wasted light in Armagh, due to streetlights alone, is approximately £80,000 per year.



Figure 6. This floodlight could be used effectively to light the ground and avoid sky glow if the glass were horizontal (see www.darksky.org).

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