



Light Pollution and the City of Armagh

"It is indeed a feeble light that reaches us from the starry sky. But what would human thought have achieved if we could not see the stars?"

Jean Perrin¹

What is Light Pollution?

Many of us have been dazzled at one time or another by an intense light source, such as a stadium's floodlights or a neighbour's security light, or struggled to see the wonders of the night sky through the now-familiar yellow glow that accompanies any profusely illuminated area such as a car park or shopping centre.

These are but some of the adverse effects of 'light pollution': the inadvertent illumination of an area other than that which the given light source is intended to cover. It comes in many forms: *light trespass*, for example when a neighbour's so-called security light is shining into your garden or through your bedroom window; *sky glow*, the illumination of the atmosphere by unshielded lights which limit our view of the cosmos to a handful of the brightest stars; and *glare*, the dazzling effect of floodlights or spotlights which prevents one from making out objects such as people or vehicles near the source.

Effects of Light Pollution

Night lighting is a necessary part of our lives. It enables people to extend their activities after sunset and provides security for public spaces and private dwellings alike. *Poor* lighting, however, gives rise to light pollution. This costs money by wasting energy; it creates potential safety and security problems through glare, and it deprives us of our view of the night sky.

Consider light waste. Lights are usually intended to illuminate specific premises (a square, a building etc.). Improperly installed or shielded lights emit a large portion of their energy away from the premises (usually sideways or upwards) and thus waste money: hundreds of pounds per unnecessary kilowatt, per year. Installing a reflective 'skirt' around the fixture will redirect most of this wasted light back towards its intended target, increasing the lamp's efficiency and providing better illumination at no extra

cost. Alternatively, a properly shielded lamp of lower power can provide the same illumination but with lower running costs.

Public safety and security at night require a certain amount of illumination, and there is clear evidence that improved lighting leads to cost-effective reductions in crime. However, rather than increased surveillance and other deterrent effects, the benefits of improved lighting are usually attributable to increased community pride and confidence, both day-time and night-time crime decreasing together. Bright lights help to allay the *fear* of crime, but do little to prevent crime itself; too much light is as much a problem as too little. High-powered (300–1000 W) so-called 'security' lights not only dazzle the eye but are extremely expensive to run, operating at much greater powers than the *maximum* (150 W) recommended for such installations by the influential Institution of Lighting Engineers.

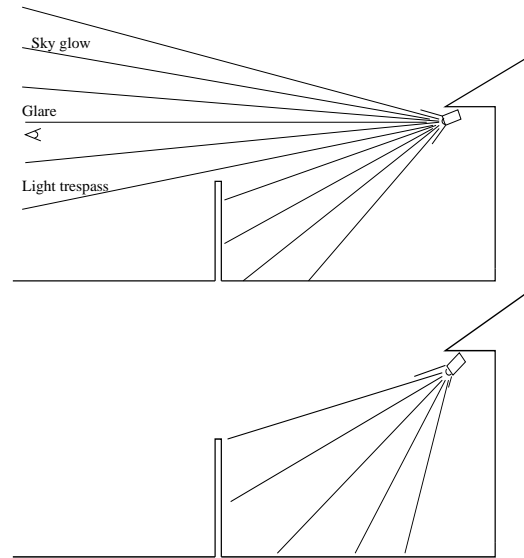


Illustration of the sources and types of light pollution. A well-shielded, well-directed light source (lower panel) goes a long way towards eliminating sky glow, light trespass and glare.

Consider someone moving through your garden, or a moving flashlight beam seen through an upper-floor window. The 'security' light impairs an observer in several ways: (a) the glare reduces the chance that suspicious movements will be detected, in part by turning shadows inky black; (b) it gives the illusion of occupancy, so that neighbours or passers-by will not be alarmed; and (c) it provides the perpetrator with a light source to assist his activities. Glare from improperly directed lighting detracts from security in the same way that a driver's ability to see the road

ahead is impaired by an oncoming car's headlights. The naked eye is an amazing imaging and motion detection system. It should not be impaired by shining excessive amounts of light at it.

Lost Views

Until now, every human being that has ever lived has enjoyed guaranteed access to the observable Universe after dark, when stars, planets, and galaxies are visible to challenge the mind and induce the rational thinking that gave rise to civilization. Countless scientists and engineers can trace the impetus of their careers in science and technology to a fascination with the night sky during childhood. The sky is part of humanity's cultural inheritance: a door to the Universe, part of the rural environment, and a social amenity. The *sky glow* of light pollution reduces this vast celestial spectacle to a pale imitation — a few pin-pricks of light — and robs us of a source of inspiration that has operated for thousands of years and which until recently could be taken for granted.

Dark-Sky Cities

Light pollution has been with us for most of the last century. In the last decade or so, however, awareness of the problem has begun to take off, as too have systematic attempts to mitigate it. Nowadays, organizations are combating light pollution in virtually every developed country around the world.

In the United States, for example, the International Dark-Sky Association (IDA) has been coordinating efforts since 1988 to lobby and inform private citizens and local and federal government departments on the benefits of good lighting practices, with great success. A noteworthy example is the city of Flagstaff, Arizona (population 50,000), host to the historic Lowell Observatory. As a result of intensive efforts by the city council and private citizens to pursue night-sky friendly lighting policies, Flagstaff was recently awarded the title of the world's first Dark-Sky City.

Flagstaff is not alone. The City of Bisei, Japan, home of a major national observatory and planetarium, recently passed a light pollution ordinance to ensure compliance with the official policy to preserve dark, star-lit skies. In order to reduce light pollution, Bisei also provides subsidies for up to two-thirds of the costs of installing, modifying or replacing offending light fittings.

Similarly, Spanish authorities have recently passed a law protecting the night sky over the island of La Palma, famous for its astronomical observatory. In February 2002 the Czech Republic followed, and became the first country to enact *national* legislation to eliminate light pollution. The "Protection of the Atmosphere" Act took effect on 1st June 2002.

¹1870–1942. French physicist; Nobel prize for physics 1926.

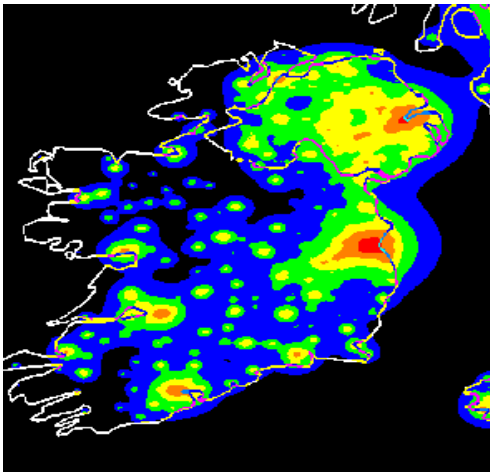
Closer to home, the Campaign for Dark Skies, initiated in 1993 by the British Astronomical Association (BAA), has raised UK awareness of the problem, leading the Institution of Lighting Engineers to issue its *Guidance Notes for the Reduction of Light Pollution*.

City of Armagh

The City of Armagh can perhaps be described as 'on the verge of urbanization'. Light pollution is present, particularly in the vicinity of recent developments, but it is still fairly localized. The position is quite different in large cities, such as Belfast or Dublin, where the problem has already acquired enormous proportions and is difficult (and expensive) to mitigate. At the moment, Armagh and indeed many parts of Ireland are exceptionally well placed compared to other parts of Europe.



The City of Armagh's southern skyline as viewed from the Observatory in October 2002. Note the comfortable background of well-dispersed medium-power sources. However, glare (and associated sky glow) comes from a few poorly shielded light sources.



Artificial night sky brightness over Ireland. Bright colours show areas of greatest light pollution. Courtesy of P. Cinzano, F. Falchi (University of Padova), & C.D. Elvidge (NOAA National Geophysical Data Center, Boulder, Colorado), *MNRAS*, **328**, 689–707, 2001. Reproduced by permission of the Royal Astronomical Society.

Armagh — along with many similar-sized towns in Northern Ireland — is thus in the happy position of being able to deal promptly and inexpensively with isolated cases of poor lighting. Indeed, such a city can maintain this situation by promoting good lighting practices, securing the view of the night sky for future generations and maximising the advantage of having low light pollution levels.

Armagh is also famous as the home of the Armagh Observatory, the oldest continuously functioning astronomical research institute in the UK and Ireland, and the Armagh Planetarium. In the eyes of its peers, it would be natural for the City to secure continued access for its citizens to the celestial spectacle that has played such an important role in its history for more than 200 years.

Benefits

How can people living in towns and cities expect to benefit from improved lighting practices aimed at eliminating light pollution? 'Right Light' policies will result in:

- Improved views of the starry sky, including the slow march of the bright planets against the 'fixed' stars, the regular daily cycle and seasonal advance of the constellations, and the monthly phases of the Moon and its changing aspect through the year.
- More efficient — and hence lower cost — lighting of public areas and private premises. This will save money and energy, and enhance public safety and security.
- Avoidance of any unnatural biological, environmental or behavioural effects on living plants and animals in brightly lit areas.
- Favourable publicity for the City and District, and a positive image of Northern Ireland on the world stage. The City's involvement will highlight its role in energy conservation and the reduction of waste, and put the region firmly on the map so far as the environment is concerned.
- Increased visitor numbers and tourism. Citizens of many countries, particularly those in continental Europe, think very highly of such schemes and would like to make a 'Dark-Sky City' part of their itinerary.

Summary

The development of a light pollution mitigation strategy will require a census of lighting installations in the area and a systematic application of proven guidelines. The overriding principle should be: "not too much; not too little; but just 'Right Light'".

Questions that should be asked of both existing and future installations are the quality and amount of light, the need for it,

and where it goes. In short, what is its purpose, and how will it improve the environment? Examining options to reduce stray light, one considers first the lamp's shielding and directionality; secondly, its duty cycle; and thirdly, opportunities to change the type of lamp or even the fixture.

Consider, for example, the case of a spherical or bowl-shaped lamp. Reduced light pollution can be achieved by (i) painting the upper part of the sphere black or installing a 'skirt' around the lamp, which if reflective will increase the lighting efficiency for no extra cost; (ii) turning the light off when it is not needed; and (iii) recessing the lamp into its holder so as to reduce glare in the horizontal direction, or replacing the entire fixture with a more directional lamp of lower power.

These options come at a variety of costs, but there is one to suit every budget. Moreover, such work will only have to be done *once*; future installations will be planned to comply with 'Right Light' guidelines from the start. This is much more effective than having to make later modifications.

In summary, good lighting practice benefits everybody. It conserves energy, reduces cost, and increases public safety and security. The development of 'Right Light' policies is an environmental issue which, especially in areas such as Armagh, can be addressed simply and at minimal cost. Elimination of light pollution will enhance the environment and preserve our view of the wonders of the night sky — fully half our field of vision — both for ourselves and future generations.

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Further Information

- International Dark-Sky Assoc. (<http://www.darksky.org/>).
- BAA Campaign for Dark Skies (<http://www.dark-skies.org/>).
- *Sky and Telescope*, **104**, 32–43, 2002 (December).
- *Light Pollution: Responses and Remedies*, by Bob Mizon. Patrick Moore's 'Practical Astronomy' Series, Springer, 2001.
- *Dark Skies for All*, M.E. Bailey; in *Astronomy and Geophysics*, **47**, 6.35–6.36, 2006 (<http://star.arm.ac.uk/preprints/491.pdf>).
- The Institution of Lighting Engineers (ILE): *Guidance Notes for the Reduction of Light Pollution* (<http://www.darkskies.org/ile-gd-e.htm>).
- UK Government Web-Site: Home Security Lighting (<http://www.crimereduction.gov.uk/burglary45.htm>).