

A New Perspective on Mapping with Night Lights



The sprawling glow of urban lights are often seen as a sign of progress. But concerns are being raised over the impact of light pollution plus street lighting at night has become a topic for public discussion. Faith Clark, geospatial technology consultant, explains how Bluesky's integrated Night Mapper system can provide focused intelligence for this debate.

The world at night is becoming a brighter place as artificial lights spread like a web across sprawling cities. The onslaught of bright lights has usually proceeded unchallenged and has been seen as a sign of progress and prosperity. However, concerns are now being voiced about the environmental impact and, with rising energy costs, the issue of energy wastage.

France seems to be one of the first countries to take the issue seriously by recognising that light pollution can be harmful when it has an impact on bio-diversity and public health. The French government surprised the world last year by ordering all non-residential buildings across France to turn off lights after 1am.

The aim was to reduce energy wastage and cut carbon dioxide emissions. The government reckoned that the move would save the equivalent electricity used by 750,000 homes a year and cut carbon dioxide emissions by 250,000 tonnes. Although the legislation covers the illumination of public buildings and monuments, major tourist sites such as the Eiffel Tower are spared, as are hotels and street lighting. It has been recognised, however, as the first serious step to tackling the issue of light pollution.

Mapping the Night Lights

With no real interest in light pollution in the past, little research has been done into the extent and impact of artificial light. Aware of the lack of data and the growing debate about lighting, aerial mapping specialist Bluesky has formed a partnership with the University of Leicester to develop remote sensing technology and trials have now been completed of the world's first integrated night mapping system.

The University worked closely with Bluesky on the specification and development of the night mapping instrument. Researchers within the University's Space Research Centre have contributed expertise in instrument design and image analysis and will continue to develop new information from captured images through expertise in the Earth Observation Science Group (www.leos.le.ac.uk/aq).

The Bluesky Night Mapper system combines a variety of remote sensing technologies to provide a highly accurate digital map that can be used as an overlay in a GIS. Using advanced spatial queries and mapping techniques, the data can be used together with existing street light overlays and digital maps as well as land, street and property details held by municipal authorities.

Bluesky has employed a specially adapted camera to cope with the low light levels and temperatures associated with night time aerial surveys. Captured from a height of 3,000 feet, the aerial photography is combined with LiDAR and thermal imaging datasets.

Co-capturing detailed LiDAR 3D measurements and thermal images provides additional intelligence relating to night time light levels, heat loss and height. The 3D data provides for an assessment of the height of the light source above ground and gives more intelligence on how lighting affects the 3D environment. In addition, the thermal sensor gives an indication of the heat signatures of different lights, which in turn provides information on energy usage and effect on the environment.

The Light Pollution debate

The whole issue of street lighting has become a topic for public discussion, mainly because of the concerns about energy wastage and the debate about plans for switching off or dimming street lights. However, light pollution has been a longstanding concern and, while the loss of the night sky for star gazers may not really be important, the impact on bird or animal habitats may be considered more so.

Researchers are showing that 'ecological light pollution' and the disruption of the natural patterns of light and dark is seriously affecting ecosystems. Some 30% of vertebrates and more than 60% of invertebrates are nocturnal with many other creatures most active at dawn and dusk.

As well as the obvious effects on breeding and feeding patterns, millions of migrating birds are killed in collisions with man-made structures after being drawn to artificial light. It is thought that a significant decline in the moth population in the UK is a result of nocturnal light and this is important as they play an essential role in pollination and as a food source for bats and birds. Bats will avoid lit areas and this impacts ecology and also agriculture where bats play a role in natural pest control.

Humans are affected by night time light as well. Light disrupts sleep and confuses the 24-hour biological processes that regulate a body's

functions. One concern is the increase in the LEDs with a blue wavelength that has a greater impact on human brains.

Focused Intelligence

The Night Mapper system produces, for the first time, a complete picture of an entire town or city. It encompasses all types of lighting, whether municipal, domestic or commercial. The debate on light pollution has focussed around street lighting but, as can been seen from the Leicester map on the opposite page, some of the most striking light pollution is from commercial buildings, such as the very bright white and blue fringed lighting from the top of a retailer's multi-storey car park. Other very bright light sources are petrol station forecourts, train and bus stations.

Elsewhere, studies have revealed that about a third of brightly lit areas relate to retail, distribution and industrial sites. Security lighting at industrial sites, although occupying quite small areas with relatively few lamps, was actually responsible for a large proportion of bright urban lighting.

Although the night mapping has obvious uses in analysing light pollution, those responsible for street lighting and city planning are expected to gain major benefits. For example, there are 7.4 million street lights in the UK and identifying those requiring replacement could lead to substantial savings.

The data can also be used to measure illumination for energy consumption evaluations and provide additional intelligence to assess the impact of light pollution from different types of lamps and shielding. It will also be useful for supporting projects involving dimming or the switching off of selected street lights in an effort to save money and reduce carbon emissions.

Tackling energy efficiency is, of course, a key factor as energy costs rise and urban areas are also expanding with new roads and developments resulting in installation of more street lighting. Night Mapper will provide key intelligence that will help to reduce unnecessary illumination and focus lighting infrastructure where it is needed most.

By providing a seamless single view of an entire town or city the light maps could be used as an aid for municipal authorities planning environmental zones for exterior lighting control within strategic plans, providing the information necessary to place any proposals in a wider context. Conservationists and ecologists can also use the maps to assess the impact of lighting on habitats. By providing evidence on the impact of light pollution on protected species, organisations will be able to work together in a joined up approach to protect all users and residents of the night time environment.

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