

Submitted Contributions

for the

**8th European Symposium for the
Protection of the Night Sky**

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Kuffner Observatory, Vienna, Austria



Presentations

Željko Andreic, Doroteja Andreic, Ana Bonaca, Korado Korlevic, Petra Korlevic and Mirna Kramar, Višnji Education Center:

"Modelling of light pollution on the territory of Republic of Croatia"

A model for analysis of light pollution effects on the brightness of the night sky is presented. The model is based on Walker's law of LP propagation and statistical data about population of the area of interest, including all surrounding areas closer than 200 km. The situation in Croatia is modelled for the first time. The model shows that the whole area of it is at least moderately light-polluted, with exception of a few islands in southern Adriatic, and some places in Lika and Gorski kotar. The model can be very useful in assessing the effect of light-pollution in cases where ecological impact studies are required for new or existing structures. Field measurements support the model predictions rather well and will be described for a few darkest places in Croatia.

Christoph Aubrecht, Austrian Research Centers GmbH – ARC and C. D. Elvidge, National Oceanic & Atmospheric Administration:

„Satellite observed nighttime lights as an indicator of human induced stress on coral reefs“

Satellite based observation of nocturnal lighting opens up a variety of research and application fields dealing with direct and indirect impacts of light on the environment, related both to anthropogenic and ecological systems.

The National Oceanic and Atmospheric Administration, National Geophysical Data Center (NOAA-NGDC) processes and archives nighttime lights data acquired by the U.S. Air Force Defense Meteorological Satellite Program (DMSP) Operational Linescan System (OLS). Initially designed to detect moonlit clouds this sensor is equipped with a photomultiplier tube (PMT) intensifying the visible band signal at night and enabling the detection of lights present at the surface of the earth. It thus provides up-to-date information on the location and impact zone of oil and gas producing and processing facilities, heavily lit fishing boats, plus the artificial night sky brightness that can extend many kilometers out from major urban centers. In addition, the nighttime lights data have been used to model the spatial distribution and density of constructed impervious surfaces (Elvidge et al. 2004), a major factor contributing to the pollution of near-shore waters.

In this paper artificial night lighting is used as an indicator to gather information about the potential human induced threat to coral reefs worldwide (Aubrecht et al. 2008). Remote sensing offers the unique possibility to observe spatial features in a consistent and cost-effective way in remote locations and on a global scale.

Three anthropogenic activities known to have adverse effects on coral reefs – development, gas flaring, and heavily lit fishing boat activity – are analyzed using DMSP nighttime lights data. Artificial nocturnal lighting represents a direct threat to coral reef ecosystems and is an excellent proxy measure for indirect impacts like human associated chronic water pollution. A growing body of evidence indicates that artificial sky brightness is a stressor for many reef organisms and can have direct ecological consequences (Rich and Longcore 2006) like disrupted spawning and forage cycles.

An index is calculated (Lights Proximity Index, LPI) measuring the distance of coral reef sites to each of the stressors and incorporating the stressor's intensity. Based on the archived nighttime lights data a time series is created enabling monitoring of temporal trends and detecting areas of improvement and degradation regarding the state of coral reefs on a regional and local scale. The results indicate that reefs in Puerto Rico, the Red Sea and the Persian Gulf are at highest risk from direct and indirect impacts of human settlements. The last two regions are also greatly affected by gas flaring while fishing activities pose the greatest threat in the Gulf of Thailand. Since 1992 the global situation considering development as reef stressor is deteriorating with regions like the Red Sea, Malaysia and Singapore especially standing out. Nonetheless there are also areas which show a positive trend. The island of Oahu in the Hawaiian archipelago serves as an example for an improving situation, presumably because of law-enforced management activities against light pollution. With the overall situation regarding nightly fishing boat activity remaining approximately stable we see a slight improvement in the Gulf of Thailand in contrast to a slight degradation in the Philippines. Looking at the temporal trend of the gas flaring LPI in the Persian Gulf – the region most affected by this particular stressor – the potential threat to coral reefs has been increasing steadily since 1992 and is likely to increase even more in the future.

The presented approach should be of high interest for reef managers to identify sites requiring restoration and precautionary actions. A major intention of the project is to raise "ecological" awareness and lead to further investigations in that field.

REFERENCES

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- Elvidge, C.D., C. Milesi, J.B. Dietz, B.T. Tuttle, P.C. Sutton, R. Nemani, and J.E. Vogelmann (2004) *U.S. constructed area approaches the size of Ohio*. EOS Transactions, American Geophysical Union, 85, 233.
- Rich, C., and T. Longcore (2006) *Ecological Consequences of Artificial Night Lighting*. Island Press, Washington DC, USA.

István Gyarmathy, Hortobágy National Park:

"Hortobágy National Park - a proposed dark sky preserve"

The park is one of the darkest areas in Hungary. This status is endangered by different development activities. We have started a monitoring program, and try to convince the stakeholders and the decision makers about the value of the dark sky as an important factor of protecting biodiversity and the natural landscape. We also going to start an education program and plan to build a public observatory in the park.

Andreas Hänel, Fachgruppe Dark Sky:

"10 years of European Symposiums for the Protection of the Night Sky"

What were the themes during the different symposiums, what has changed in Europe during these 10 years?

Andreas Hänel, Fachgruppe Dark Sky:

"News from Germany"

- Competition "Energy efficient city lighting"
- the light pollution petition in the Bundestag
- first LEDs in street lighting
- comparison measurements with the new SQM

Jan Hollan, IDA Czechia:

"Automated selection of most promising luminaire photometries for any streetlighting case"

a lecture, on a software which sorts the products offering best uniformities of illuminance of a lane by a continuous row of luminaires with predefined geometry. The background text is available at http://amper.ped.muni.cz/light/ies2/EasyLight-SaveTheSky/ch_best.htm and the examples are within the same directory. The core of the software, ies2tab, is also good for visualising the photometric properties of any luminaire.

Itai Kloog (University of Haifa), Abraham Haim (University of Haifa-Oranim), Richard G. Stevens (University of Connecticut Health Center), Micah Barchana and Boris A. Portnov (University of Haifa)

"Light at Night Co-distributes with Incident Breast Cancer but not Lung Cancer in the Female Population of Israel"

Objectives: Recent studies carried out among shift working women, have reported that excessive exposure to light at night (LAN) may be a risk factor for breast cancer. However, no studies have yet attempted to examine the co-distribution of LAN and breast cancer incidence on a population level with the goal to assess the coherence of these earlier findings with population trends. The present study attempts to investigate the links between local LAN levels and the incidence of breast cancer, using cancer rates and LAN intensity data available for 147 individual urban localities in Israel. In particular, the present analysis attempts to answer the following question: Is there a link between local LAN levels and the incidence of breast cancer in urban localities after controlling for known potential confounders?

Methods: Nighttime satellite images were used to estimate LAN levels in 147 communities in Israel. Weighted Least Squares (WLS) regression was performed, to investigate the association between LAN and incidence rates of breast cancer (for which its major causes remain a mystery) and, as a test of the specificity of our method, lung cancer (the dominant cause of which is known) across localities under the predictions that there would be a link with breast cancer but not with lung cancer.

Results: After adjustment for several variables available on a population level such as ethnic makeup, birth rate, population density, and local income levels, a strong positive association between LAN intensity and breast cancer rates was revealed ($P < 0.05$), and this association strengthened ($P < 0.01$), when only statistically significant factors were filtered out by the stepwise regression procedure. Concurrently, no association was found between LAN intensity and lung cancer.

Conclusions: These results provide coherence of the previously reported case-control and cohort studies with the co-distribution of LAN and breast cancer in an entire population. The analysis resulted in

an estimated 37% higher breast cancer incidence in the average LAN intensity communities compared to the lowest, and a further 27% higher incidence in the highest LAN intensity communities compared to the average. In addition, new results from current research regarding the association between nightlight exposure and the incidence of breast cancer in Haifa, Israel will be discussed.

**Thierry Midavaine, Association Francaise d'Astronomie:
*"From the needs to the acceptance test"***

The "Association Francaise d'Astronomie" is on the way to edit a specification on urban illumination, thanks to a two years study. A town will be able to use it in a request for proposal process, to up date its illumination infrastructure. The manufacturer will have to pass the acceptance test in agreement with the specification to get the payment from the customer.

**Bob Mizon and Martin Morgan-Taylor, British Astronomical Association Campaign for Dark Skies:
*"Progress in the UK on dark-sky legislation"***

We will give details of the Clean Neighbourhoods Act, which makes nuisance light intrusion a criminal offence, and on other recent advances such as the control of skybeams.

**Andrej Mohar, Dark Sky Slovenia:
*"LEX - Light pollution Law Efficiency Index"***

The most important condition to reduce light pollution is to have a good light pollution law. We know several types of light pollution laws and most of them are hard to compare. LEX, (light pollution) Law Efficiency Index is based on only one evaluation form for all types of light pollution laws. Every light pollution source and their regulation will get a specific weight depending on their contribution to a total light pollution. LEX index has a range from 0 % which means that such law is not efficient at all and it can reach 100 %, a maximum level. LEX will be of great importance to present and especially to all future light pollution regulations to be compared and evaluated in the same way. LEX will remind all writers of light pollution laws about missing points and regulations which must be included in every efficient light pollution law.

André Müller, Max-Planck Institut for Astronomy, Heidelberg and Günther Wuchterl, Thüringer Landessternwarte Tautenburg:

"The First Continous Measurements of Nightsky Brightness with a New Low Cost Luxmeter"

To monitor the night sky brightness to document the new environmental factor of light pollution we monitored the horizontal illuminance in downtown Jena from Nov. 2005 to Jan. 2006 and since Feb. 2006 at the "Thüringer Landessternwarte" in the Tautenburg forest. Measurements were taken continuously every ten seconds with a newly developed, low-cost luxmeter that is capable of recording all natural levels of illuminance at night. The device routinely measures from klx to to the micro-Lux domain with the same method of measurement. The median of night-illuminance in Jena, a city with 100 000 inhabitants is 0.16 lx, i.e. near the full moon value, at Tautenburg we find a bimodal distribution of illuminance, with dark moonless nights at 2 mlx, presently indistinguishable from values expected for a natural night sky.

**Thomas Posch, Institute for Astronomy, University of Vienna:
*"The Dark Side of Light"***

Recent attempts to present a large number of light pollution-related problems to the public by means of prime-time TV documentations will be presented.

**Henk Spoelstra, Platform Lichthinder:
*"Light pollution : understanding the light propagation in the atmosphere, the influence of the degree ofurbanisation and weather conditions"***

The amount of light pollution is not only influenced by the amount of fixtures, the exact upward light function and the degree of urbanisation, but also by visibility conditions and cloud cover. By means of light pollution modelling insight is given in these influences. The ultimate aim of the modelling is to develop answers where and how to take appropriate light pollution prevention measures.

Connie Walker, NOAO/IAU:

"Dark Skies Awareness and the International Year of Astronomy"

In an effort to help more people appreciate the ongoing loss of a dark night sky for much of the world's population and to raise public knowledge about adverse impacts of excess artificial lighting on local environments, the global cornerstone project, "Dark Skies Awareness" (DSA), was created for the International Year of Astronomy (IYA). Programs planned and proposed for IYA DSA will be presented. Planned programs include 3 star hunting programs offered throughout 2009: How Many Stars?, GLOBE at Night and the Great World Wide Star Count. Programs in development (traveling exhibits, a photography contest, public service announcements and a planetarium show) will be discussed. Come share your country's plans for DSA programs and choose in which DSA cornerstone programs to participate. For more information on programs, visit www.darks skies awareness.org.

Albert White, IDA Ireland:

"A new educational 3D environment based game relating to light pollution"

The NISO (Northern Ireland Space Office) and CCEA (Council for Curriculum Examinations and Assessment) have launched Astronomy and Space science units with 18 pilot Schools in Northern Ireland. Part of this implementation includes a new educational 3D environment based game relating to light pollution with themes such as, what is light pollution?, types, causes and remedies. The user assumes the role of a lighting engineer and interacts with characters during the game play to learn about light pollution and the lighting problems involved in lighting a street. Once the user has learned about the issues they are present their findings and recommendations to the virtual Town Council. The presentation at Darksky 2008 will give a brief demonstration of the game to show how schoolchildren are being educated to think about better lighting.

Günther Wuchterl, Thüringer Landessternwarte Tautenburg and Verein Kuffner-Sternwarte:

"A global survey of night sky brightness in the International Year of Astronomy 2009"

...asks people to look at their sky near home to assess the state of the world's night skies by simple naked eye observations of Umi and Ori taking a few minutes. The campaign relies on regional (multi-languages and -cultures) public communication and support centres aided by a self-propagating centralized web-infrastructure. Eye-estimates are anchored in a network of low cost luxmeters, capable of automatically and continuously recording all natural night-illumination levels. The goal is to make 1000 million people look at their home skies, collect a million observations of visual limiting magnitude and create the first global assessment of the state of the night sky by anchoring the estimates in the thousand luxmeter network distributed to (public) observatories, planetariums, astronomy clubs and schools. In short: 1 Bio people, 1 Mio observations, 1000 luxmeters for a year.

Georg Zotti, WAA & Österreichischer Astronomischer Verein:

"Sky brightness measurements with a digital camera: the effect of a small nearby village (Grossmugl) on night sky brightness."

On 2008-05-10, Astronomy Day, street lights were switched off in Grossmugl, north of Vienna. The adverse effects on sky quality by just two illuminated roads were striking! The measurement system presented at last year's workshop was used again to create impressive fisheye photographs and false-colour comparison charts.

Workshops

Jan Hollan, IDA Czechia:

"A course of digital photometry by ordinary cameras"

We'd discuss the needed procedures and calibrate the cameras of all participants, so that they could start to use them as scientific instruments. No good background text available yet in English, but it should change before the conference. Example see <http://amper.ped.muni.cz/light/luminance/candle/>
Imaging radiometry/photometry method: <http://amper.ped.muni.cz/light/luminance/english/rgbr.pdf>

Jan Hollan, IDA Czechia:

"Light pollution definition"

The Pierantonio's real, scientific definition versus a list of adverse effects. Background text, a draft for the workshop, see http://amper.ped.muni.cz/light/lp_what_is.pdf

Connie Walker, NOAO/IAU, Günther Wuchterl TLS/VKS:

"The IAU international year of astronomy dark-sky-awareness cornerstone: Globe at Night, How Many Stars, ..."

Discover one of the most effective ways of advocating dark skies awareness to the public. Participate in this workshop to promote dark skies awareness in the form of 2 citizen-science programs: How Many Stars and GLOBE at Night. Show citizen-scientists how they can make a difference in solving a global problem through local solutions by contributing measurements to these programs, especially during the International Year of Astronomy. For more information on these programs, visit <http://sternhell.at/> and <http://www.globe.gov/GaN/>.

Posters

Jan Hollan, IDA Czechia: CANCELLED

"Two years of continuous light measurement in Brno"

With some selected examples of light curves, demonstrating e.g. the varying night sky luminance due to varying transparency of the air. As available on <http://amper.ped.muni.cz/weather>

Zoltán Kolláth, Konkoly Observatory:

"The effects of artificial lights at the Zselic Landscape Protection Area"

We have finished extensive night sky quality tests in the Zselic Landscape Protection Area and in and its vicinity. The sky luminance measurements were performed with an image resolution device and also by Sky Quality Meters. The main light pollution source in the park is the city of Kaposvár. The local settlements have only a very limited effect on night sky quality. We have started performing Monte-Carlo radiation transfer calculations of light pollution in the area which fit the recent measurements and also predict any degradation or improvement in sky quality related to changes in the artificial light sources in the neighbourhood. The results of such calculations can help to draw attention to the energy emitted useless to the space and redistributed into the nature in a wide range. We also plan to use predictive models to negotiate with municipalities, stakeholders in the region in order to avoid any increase of light pollution at the planned Dark Sky Preserve. Our goal is to preserve our cultural heritage the starry sky to the next generation.

Connie Walker, NOAO/IAU:

"Dark Skies are a Universal Resource" Programs Planned for the U.S. International Year of Astronomy

The United States International Year of Astronomy's Dark Skies Working Group has established 6 "Dark Skies" programs and 6 "Dark Skies" resources. The Dark Skies programs include GLOBE at Night (with Earth Hour), Astronomy Nights in the (National) Parks, Dark Skies Discovery Sites, Quiet Skies, Good Neighbor Lighting, and a digital photography contest. Resources include a light education toolkit, the "Let There Be Night" DVD and planetarium program, the 6-minute video, on-line interactions like Second Life, podcasts, and traveling exhibits. The programs and resources are summarized here. For more information on these programs and resources, visit <http://astronomy2009.us/darkskies/>.