

Light Pollution law in Croatia International Letter of Support

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We, experts for artificial light at night (ALAN), night environment, outdoor lighting, biology, human health, astronomy and satellite monitoring, from the following nations:

	Name of expert	Field of expertise
Austria	Dr. Thomas Posch	Astronomy, LP measurements
Australia	Dr Kellie Pendoley PhD	Biologist, LP measurement
Canada	Prof. Martin Aube, Ph.D.	Light pollution modeling and detection
Germany	Dr. Maja Grubisic Dr. Annette Krop-Benesch	Biologist, ecological impacts of ALAN Chronobiologist, science-communicator
Hungary	Prof Dr Zoltán Kolláth	Astrophysicist, LP measurement, theory
Italy	Paolo Corelli	Astronomer
Malta	Alexei Pace, ing.	Civil Engineer
Romania	Dr. Dorin BEU	Public Lighting
Slovakia	Prof. RNDr. Michal Zeman, DrSc.	Chronobiologist
Slovenia	Andrej Mohar Herman Mikuž Tomi Trilar, Ph.D.	Lighting, LP measurements Astronomer, LP measurements Biologist, Entomologist
United States of America	Travis Longcore, Ph.D. Constance E. Walker, Ph.D.	Ecological light pollution Astronomer, LP education

We undersigned experts support a new Light Pollution Law which has already passed 1st reading in Parliament of the Republic of Croatia.

The new Croatian Law (Law) is a big step forward compared to present situation in Croatia because the new Croatian Law:

- 1. requires no light about horizon (ULOR 0%)**
- 2. limits correlated color temperature (CCT) to 2700K**
- 3. limits correlated color temperature (CCT) to 2200K in protected areas (parks etc.)**

Outdoor lighting is mostly used around houses where people live. Using 1750K (amber LED) and 2200K (PC amber) and also 2700K warm light has many benefits on adequate human sleep because of reduced harmful blue content of light. This is why we fully support the Croatian Light Pollution Law.

Croatia should be proud of their Island of Lastovo where, already in 2001, they replaced all public lighting with ULOR 0 % and strictly using luminaires with Correlated Color Temperature of 2200K. Energy consumption has been reduced by more than 50%. Lastovo at that time used the common technology: mostly 70-watt High Pressure Sodium lamps. Today, with development very efficient amber (yellow-orange) LED with better optics and 1800K or 2200K it would be possible to use mostly 20-watt amber LED. This means that with today's technology it would be possible to reduce energy consumption by factor of 7 compared to the situation at Lastovo before 2001.

The Lastovo project is an excellent example of good cooperation between Lastovo Municipality, Lastovo Nature Park, and environmentalists from Croatia (Korado Korlević) and Slovenia (Andrej Mohar). People of Lastovo are happy with new lighting and tourist can enjoy beautiful night skies there. Because of that, Lastovo is famous among in nature lovers.

We have heard that lighting industry from Croatia complains that amber LED luminaires are commercially available. This is not true. Here is a list of lighting companies that provide amber LED luminaires in Europe (1750K or 2200K):

Osram-Siteco	www.siteco.de/de/home.html
Schuch	www.schuch.de/
AEC-Illuminazione	www.myaec.de/
Ignia	www.ignialight.com/
Trilux	www.trilux.com/de/ amber (monochromatic)
Innolumnis	www.innolumis.com/
Access Fixtures	www.AccessFixtures.com
Disano	http://www.disano.it

The CCT of 2700K is not a problem for any manufacturer because the 2700K LED chip is the most used LED chip in indoor lighting.

We experts also know the situation in Slovenia:

In 2007, Slovenia adopted the most probably strongest light pollution law (Slovene Law) in the world. Already the next year after the adoption of Slovene Law the number of fatal injuries on the roads was reduced from 293 to 214 or by 27 %. In 2017, Slovenia had 106 fatal injuries on road. This means that after adoption of Slovene Light Pollution law the number of traffic accident fatalities has declined from 293 to 106, which is 64% reduction. **Results in Slovenia refute any claim that the reduction of upward light and reduction in the amount of light increases the number of traffic accidents.** (Source: Andrej Mohar, who is following all fatal accidents in Slovenia in last 5 years).

We experts for ALAN are concerned that the Croatian Law has no limits of amount of light using in outdoor lighting.

According to satellite images Croatia is already over illuminated with relative illumination of 92 per 1000 inhabitants. Scientific data are available here: www.lightpollutionmap.info/LP_Stats/

If we compare Croatia with other neighboring countries where people from Croatia travel or work very often:

Croatia	92	(rounded number without decimals)
Germany	38	
Austria	44	
Slovenia	44	
Hungary	45	

We could see that Croatia uses a lot of energy for outdoor lighting. For example, Croatia spends 2.42-times more on light per capita than Germany. Knowing that Croatian Law has no limits regarding illumination levels we express our concern that Light Pollution Law will not be effective in protecting the nighttime environment.

It is excellent that Croatian Law will limit correlated color temperature to 2700K and 2200K, but on the other hand following a lot of new lighting is expected. Based on knowledge from Slovenia which has the strongest law in the world, much stronger than Croatian law, there is no reduction of light pollution in Slovenia since adoption of law in 2007. According to Andrej Mohar from Dark-Sky Slovenia, the main cause is usage of 4000K LED and too strong lighting installation which is required by EN 13201 norm (the EN 13201 norm is not obligatory in Slovenia).

As currently proposed, Croatian Light Pollution Law has the following drawbacks:

has no lumen or power limits per capita per year in public lighting,

has no requirements for curfew (reduction in late hours),
has no luminance limits of billboards,
has no luminance limits of facades,
has no luminance limits of facades of shopping centers,
has no luminance limits of cultural heritage,
has no limits of spilled light over facades,
has no luminance limits of hotels/motels,
has no luminance limits of parking places,
has no luminance limits of highway services,
has no luminance/power limits of private houses,
has no illumination limits for protected buildings (bedrooms, etc.).

Given that the good aspects of the proposed Croatian Light Pollution Law are ULOR 0% and 2700K / 2200K color limitations, we experts would like to encourage Croatian authorities to further adopt adequate limitation (see above) which would prevent explosion of outdoor lighting in public and private sector.

Croatia is at a good starting point to pass exemplary legislation that would protect people, the night environment, and biodiversity for the next generation.

Without additional limitations the Croatian Light Pollution law would not be effective at all.

We the experts for artificial light at night (ALAN), night environment, outdoor lighting, biology, human health, astronomy and satellite monitoring appeal to the authorities and legislation makers of the Republic of Croatia to listen to the voice of reason and good advice coming from Croatian organizations such as the Croatian Astronomical Union and Our Sky – Association for the protection of the night sky (Dark-Sky Croatia).