How should the light pollution be controlled – an experience from the Czech Republic

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Abstract

Light pollution is perhaps the only pollution which still grows exponentially everywhere. The growth should be stopped and reversed to achieve sustainable night environment.

The goal to reduce light pollution has similarities with the efforts to reduce fossil carbon emissions. Both pollutants have been considered harmless 30 years ago. Both are very dangerous. The common key solution is energy efficiency. But it won’t go successfully without legislation giving the effective rules, which could be as simple as:

1. Shine below horizon only.
2. Use no more light then the standards demand.
3. Ensure that the amount of light can be lowered at night substantially.
4. Don’t use more then 1 cd/m^2 or 10 lux, if a safety standard does not apply.
5. Put a limit for illuminated advertisements (like 200 cd for small surfaces, 300 cd for surfaces over 5 square metres, and 500 cd for surfaces over 30 square metres).
6. Apply emergency measures for the most vulnerable sites.

Exceptions should be just

- traffic lights,
- short-time lighting,
- faint sources used by ordinary citizens.

Good experience from Lombardy, where a similar law holds since 2000. Need to document the benefits. Failure of laws using just a declaration, including the Czech one. The rules should be inside the very law, we hope to make it true in Czechia (`svetlo.astro.cz/darksky/cz_law`).

Reasons for demanding LPS, HPS or fluorescent sources.

Digital imaging photometry, glare quantification, road surfaces measurements, true amount of light at night (`amper.ped.muni.cz/light/luminance`), huge advantages of dimming the light sources (an example from Brno).

Possible opposition from industries wanting business as usual.

Sleep disturbed by light-at-night, vanished heavens (stars never noticed among strong luminaires), deprived childhood and rise of crime. Light does not help against crime, just dark hopefully.

Bad rules worse than no rules at all. Good rules, like those in Lombardy, are a hope to restore the night again.

1 Introduction

Light pollution is perhaps the only pollution still growing exponentially almost everywhere. It’s not enough just to slow down and stop the growth, but the trend should be reversed to achieve sustainable night environment.

Not an easy task, as light is not an unwanted by-product of lighting. In this respect it’s similar to carbon dioxide release from burning fossil fuels. Both these pollutants are somehow

difficult to admit by many people – thirty years ago nobody spoke about them, nobody cared, they have been considered either purely beneficial or completely harmless. However, both are polluting stuffs, very dangerous for the present and future world. Fortunately, getting on the track of declining light pollution is much easier than reducing the CO2 concentration in the atmosphere.

The key method is similar for both problems: **energy efficiency**. The same, or a lot better service can be in most cases obtained with just a fraction of the present energy consumption. There exist excellent examples like that. The task is to make such examples a general rule, so that wasting energy tremendously will become illegal or very inconvenient for future installations.

Outdoor lighting is guilty on just a tiny fraction of fossil fuel consumption. However, it's a fraction which is easy to reduce, with an immediate and very conspicuous improvement of the environment.

2 Rules for lighting

Light pollution can be reduced in a win-win way when several simple rules are obeyed.

2.1 Avoid spill light

The best known rule is: **Don't send light where not needed.** It can be formulated and quantified in various ways, the easiest one is to demand just: **Shine below horizon only**. This is the way used in most legislations. It's the only which is easy to verify and, curiously, it limits rather effectively also the light spilled outside the property to be illuminated.

2.2 No more light then necessary

The other rule is to use just that amount of light which is really needed or demanded at the place and time. There are some technical standards concerning street lighting, which could be considered to be safety standards (even if with much hesitation, due to the fact that their demands have been rising during the last century). An evident rule is then: **Use no more light then the standards demand**.

2.3 Dim it after peak hours

The standards valid in most European countries mention explicitly that the amount of light can be reduced if the traffic is low. In Czechia, they allow dimming the light to one fourth. Still, as the general public does not know that, a rule like this is needed: **Ensure that the amount of light can be lowered at night substantially**, and reduce the light output when the traffic enables that.

2.4 Usual upper limit

For some cases, there are no standards which could be considered to be safety ones – like billboard or architectural lighting. For all such cases, some limit is to be put explicitly into the law. Otherwise, with full liberty for anybody to light anything, the light pollution would

rise further on. The value used in several regions of Italy is **1 candela per square meter** (or **one nit, 1 nt** using a convenient short name for this quantity), a limit for the luminance of the surface (how much light gets to our eyes from it). An alternative limit, easier to measure and compute, is a maximum illuminance of **10 lux**.

2.5 Special upper limit

This is surely too strict for small advertisement surfaces, like shop signs. A limit for them should be dependent on their size. A reasonable limit could be given by in three steps for maximum luminous intensity of the surface: 200 cd for small surfaces, 300 cd for surfaces sized over 5 square metres, and 500 cd for surfaces larger then 30 square metres. (This is a liberal simplification of a continuous formula for luminance / 1 nt dependence on surface / 1 m^2, $\boldsymbol{L = 150 / S^{0.8}}$. The formula should be applied for surfaces larger than one square metre, for 500 m^2 it matches the common limit of 1 cd/m^2. The limit of 150 cd/m^2 is contained in the Italian road code.)

(Quite another approach on limiting the amount of light has been coined by Chris Luginbuhl in his Outdoor Lighting Handbook: a limit on total light flux produced by lamps in some area. It avoids all need of measurement – knowing numbers, wattages and kinds of lamps is enough.)

2.6 Emergency cases

The above rules are easy and profitable to follow for all new installations or reconstructions of the present lighting systems. Existing installations should be not concerned mostly. However, there are places where it is highly desirable to improve the current installations long before the schedule (not waiting decades until they die) as the harm made by them is intolerable. Nature areas of the highest degree of protection are definitely among them – if they are protected by the state, the protection should be valid at night as well and the law should demand immediate improvement where applicable. Another case are the places from which people observe the heavens (it would be sad if one generation of children would be said "unfortunately these luminaires won't be changed before 2015"). The rules for an immediate amelioration need not be very strict. The only necessity is that the strong direct light from luminaires is avoided.

Some other local cases, e.g., of glare sources dangerous to drivers and pedestrians, should be also solved – but this is a task for a local government or a good policeman rather then for a country-wide law.

3 Exemptions

Ordinary citizens using faint light sources should not be bothered, they are no significant polluters. So, **faint sources** should be exempted. The limit used in Italian regions is 1500 lumen. For a single source, it's OK, even if locally a limit half that large could be employed (like in Ketchum and Hailey in Idaho). It should be just avoided that dozens of such uncontrolled sources are used for outdoor lighting. A simple way is to limit the upward-going flux from a set of such luminaires in a small area (like an equivalent of three bare bulbs on one pole).

Another exemptions are reasonable for lighting used **just a couple of hours a year, not after the curfew times**. And of course, for **signalling purposes** to ensure safety of traffic (its goal is just opposite from lighting: the light source is to be visible).

4 Does it work?

No scientific research on it has been done as far as I know. The experience says, that the towns with such rules have lower power consumption for lighting and much more pleasant night environment, including the night sky. Vast improvements have been reported from both Idaho towns which have implemented such rules recently, demanding a change within a year, not only after the present luminaires cease to work after decades (Ketchum and Hailey). Satisfied drivers and police mention the Connecticut road lighting improvements.

However, the largest territory where all these rules (apart from the billboard lighting limits) are valid since spring 2000, is Lombardy, a region with ten million citizens in Northern Italy, around Milano. Italy is not famous for people adhering to law vigorously, or for an offensive law enforcement. Still, as reported at a conference by Rome in May, 95 per cent of new installations conform the law already. At the moment, it just slows down the rise of pollution. Decline of light pollution can be expected only after the old lighting systems will be reconstructed obeying the law. So, for a marked large-scale

improvement, we have still to wait some ten years or more.

It would be very good if some towns would reconstruct their public lighting according to the state of the art, minimising power consumption and light pollution, and doing it as a scientific project as well – documenting the situation before and after reconstruction. After the public lighting is reconstructed and new quality standards set this way, a local ordinance could ask the private owners to do the same. They should agree, when the advantages will be so obviously demonstrated.

5 The Czech law

In Czech Republic, no such rules are in force yet. The Clean Air Act, formulated as a new large law in 2001, has been amended by a goal to reduce light pollution by the House of Representatives (with the support of the Minister of Environment) at the end of its preparation. A good definition of light pollution came into the bill as well as some powers for the municipalities and an obligation for the government: to issue the very rules.

It appeared, exactly as in some Italian regions where the protection against light-at-night has been included in just a declarative way into the law, that it does not work. The executive will never adopt any effective rules, the forces protecting the business-as-usual are too strong and rich.

We hope that the House will adopt the rules instead. There are no arguments not to do that. And ever more ones emerge in favour of a really effective protection of the night environment. See ev. `svetlo.astro.cz/darksky/cz_law`.

6 Lamp types?

One more rule is present in some legislations. Such one, which forbids further use of the **mercury vapour lamps (MV**, blue-greenish ones) and allows using **metal halide lamps (MH**, bluish white) just in exceptional cases when strong light and excellent colour distinction is necessary (usually, this concerns just daytime indoor lighting which should mimick daylight). In both cases, such a rule promotes energy efficiency: the eye at light levels common in outdoor illuminated spaces has very low sensitivity for the blue part of the spectrum, abundant in the

light of these sources. Inevitably, for the same wattage, MH sources emit about twice less light (perceivable radiation) as HPS! MV sources have still lower efficiency after years of use, MH sources have a short life instead. In the same time, avoiding MV and MH means much less serious light pollution, as the blue part of the spectrum is the most harmful for wildlife and human health and increases far more the skyglow.

Some other reasons in favour of MH sources have been mentioned, but they are flawed, based on bad research.

In Czechia, the orange **high-pressure sodium lamps (HPS)** are by far the most common ones. Still, lighting people are speaking about the trend toward white light sources, to "beautify" the town centres. Perhaps, putting an obstacle to replacement of HPS by MH lamps into the law is needed, perhaps education will suffice.

6.1 LPS, fluorescent, HPS

The most efficient light source of the 20-th century, and quite probably, of at least the first half of the 21-st century, is a **low-pressure sodium discharge tube (LPS)**. It can look like a common white linear fluorescent tube, just the colour of the light is almost monochromatic yellow. Or it can have a U-shape, just much longer than common compact fluorescent sources.

The secret of its efficiency is that it emits vast majority of its light in a colour near to the maximum sensitivity of the human daylight vision, which still works in lit spaces at night.

The often-mentioned disadvantage, that you cannot distinguish colour in its light, is no large problem in many cases. Just remember that it's possible quite well to understand what a black-and-white film is about – in spite of the missing colour information. On the other side, it's a vast advantage in terms of pollution, its yellow light makes the least harm in all respects (how large is this effect on particular issues is to be investigated however). Almost non-existent blue component makes sure that such light does not interfere with the circadian rhythm of people and most animals in general, at common night light levels. **LPS** should be the prime choice for late night lighting, especially if there are some bedrooms around, if there is a serious reason why some lighting should work at all late at night.

The only serious drawback of LPS appears when narrow strips have to be illuminated from high poles without a large overhang. LPS are long, so it is difficult to direct the light along the tubes. It can be just collimated downwards, as in common linear fluorescent fixtures used indoors (with help of a grid), an option which is perfectly suitable for luminaires hanged over the axis of the street. However, such a hi-tech use of LPS is just a possibility for the future, they are not used this way now.

Another drawback is that LPS lamps are the least resistant ones against over-voltage, which reduces the lamp lives three times. LPS has to be used in dimmed or at least stabilised-voltage installations.

LPS sources have a bad reputation in regions where there are common, as they are employed within extremely poor luminaires. Thanks to their form of long tubes, the glare from seeing the sources directly is much less offensive than the glare from compact HPS bulbs... and so the glare control has been completely neglected for LPS. No wonder people perceive them as unpleasant. In new fixtures, allowing no light horizontally, it's very different.

Still, in some cases, **HPS** with their very short high-intensity discharge tube may produce less pollution. Their light can be directed very well using a sufficiently large mirror cavity. In terms of light source efficiency, they are the second best ones.

In a current situation, when electricity is cheap and ever more light is wanted everywhere, a third environment-friendly light source is rather neglected. I mean the fluorescent tubes, common in interiors.

The most effective are the **linear fluorescent tubes** – not the thick old-type ones, but the more slim ones. At a given wattage up to 40 W, they beat all non-monochromatic sources in terms of efficiency. Wherever there is no need to direct their light sideways along the length of the tube, they can be used similarly as LPS. They can even reside together in a two-lamp fixture, where the white source is used just in the evening (a small admixture of white light to the LPS light enables enough colour vision for most applications).

Single-, two- or three-fold fluorescent U-tubes with an integrated ballast (**compact fluorescent, CFL**) are becoming more and more popular for indoor use, as a replacement for hot incandescents. Their main advantage is they are available at very low wattages. In many cases, the existing fixtures can be brought into compliance with the best laws in the world just by choosing a 6W to 23W CFL instead of a 35W (or, far more often, instead of a 50W) HPS. The illumination of the ground may remain on the level demanded by standards, as the footpaths are usually overlit many times.

7 Tools

It's easy to identify the cases of most harmful pollution. Worst glaring luminaires (or overkill-illuminated billboards) cannot be simply overlooked. Everybody knows also the light domes over distant towns They are over them just in the angular sense, in 3-D it's mainly the illuminated air over the landscape between us and the town. To avoid such prominent cases of pollution, the almost horizontal light should be radically diminished, this is the most harmful component.

However, people can ask how much pollution is there, or how much it has been reduced. A quantitative answer is expected.

The only one has been offered by **The First World Atlas of the Artificial Night Sky Brightness**, a huge paper by Cinzano, Falchi and Elvidge, which became famous overnight. Disappeared beauty of night skies is documented accurately by it, at least in the large scale.

However, there are other manifestations of light pollution, and they should be measured as well.

7.1 Digital imaging photometry

Fortunately, a tool for that is becoming ever better accessible. I mean the common digital cameras, more accurately those ones, which offer data in the "raw format". Their readings are linearly dependent on the illumination of the CCD (or CMOS) chip, and getting reliable data on the true luminances of the imaged scene is rather easy. The precision at low light conditions can be well over that offered by traditional light metres. And the resulting values can be obtained in a needed degree of detail from the images afterwards, using a computer, instead of spending lots of time at night by detailed outdoor measurements.

7.2 Glare quantification

Glare counts among the most serious manifestations of light pollution. The same illumination of the ground can be perceived as being completely satisfactory or as not at all sufficient,

depending on the light which enters the eyes from obsolete directions, esp. from luminaires themselves.

There are some empirical formulas to evaluate the glare. With help of digital photography, such glare indices can be computed for any night scenes. Of course, the task is not entirely easy, as the luminance of the glaring luminaires may be million times larger than the luminances of the lit street, so making a huge range of exposures is needed.

Developing a method for that is a part of the research grant proposal offered by our team from the Masaryk University in Brno to the Czech Ministry of Environment in July 2003. The results are to be published in December.

7.3 How dark is the asphalt road?

A simple exercise of using raw data from a digital camera is determining the so-called albedo (the proportion of the non-absorbed light) of the common road surfaces. It is a matter of large practical importance, as the needed amount of light is computed so as to get enough luminance of the road, in most of Europe. By computations for asphalt roads, albedos of either 7 or 10 per cent are assumed throughout the world, according to the recommendation of both IES and CIE.

However, just look around. Most road surfaces appear black only if they are wet or in the spots oiled by faulty vehicles. Common roads made from rock grains glued by asphalt are not at all black after the first summer of use. I've found an albedo value of 12 to 15 per cent when seeking in the Internet – in an article about the urban heat islands.

Then I got our observatory's digital camera and took some pictures of the paths by the observatory and the streets below. The result: albedos are all over 11 per cent, 15 being quite common. As the Czech lighting people take 7 per cent as a base, the illumination is proposed at least twice stronger than the technical standard demands... Adhering to the standards really, not just in a hypothetical, wrong-based computation, would diminish light pollution twice, with considerable savings already at the phase of its installation or reconstruction!

7.4 Dimming according to the real needs

The general legal requirement to have and use a possibility of reducing the amount of light can be fulfilled simply by having a switch-clock (in many areas, no lighting is needed after midnight). However, an additional technology can be very helpful.

The contemporary one is called phase-cut dimming. The alternating current going to the bulbs is adapted so that some parts of the wave are cut out. In this way, discharge tubes can be dimmed to just per cents of the nominal output. To a level where, with non-glaring luminaires, there is still enough light (like by the full moon) to see the way very well, but minimum harmful consequences.

However, dimming has an important role in the peak hours of the evening as well. All new lighting systems produce at least a third more light then the lighting people take for needed, having twice the needed amount is quite common. The reason is that old luminaires with old bulbs are less efficient. And that a base for lighting projects is a hypothetical future state of the worst possible deterioration after dozens of year of use. A dimming system can keep the light levels always just on the really needed values. Savings from that are huge, light pollution can be again reduced a lot even in the evening. Lamp lives are saved as well, achieving easily 24000 hours of good function, as their premature deaths due to overvoltage are avoided, another bonus are the lowered maintenance costs.

In my town, Brno, such dimming systems are installed since several years. The main roads on the Brno outskirts are dimmed already between 8 and 9 p.m. to about one third of the evening light output (half of the power consumption). The system can be supplemented by the light measurement in future, so that the light levels (or, more accurately, road luminances) would always be just the wanted ones (now, they are very probably larger than needed; to prove this, it's a matter of our research). With a considerable light-output reserve of new lighting installations, the amount of light could be in fact raised in some circumstances, as in rain or fog...

8 Arguments

8.1 Who minds?

Imposing strict rules supplemented by further recommendations (these can be changed into obligatory rules at a local level) helps everybody and hurts nobody. Apart from "professionals" who rely on doing business as usual without learning anything new. And of course, apart from power producers which have huge surpluses of electricity all the night (this is the case of Czechia more than any other country, with a funny situation that Czech production costs are large at night as well, we have no cheap electricity from large dams). But even the producers could make profit by selling hi-tech lighting services instead of promoting more light everywhere.

8.2 Health, heavens, crime

I'll mention just some **reasons why light pollution should be reduced aggressively.**

The most serious one is **human health**. The only problem treated on a scientific level up to now is a high number of **cancers** in the rich countries. The hypothesis by Dr. Stevens from 1987 has been supported by several principal researches in the last years, with the knowledge of May 2002 concentrated in the proceedings of the symposium Light, Health and Cancer held in Cologne, Germany. What has been seldom or never investigated, is the simple question, how much is the **sleep disturbed by light-at-night**. Perhaps everybody has noticed, on an own example or on the people around him, that it is disturbed definitely, if the amount of light is as large as near the full moon. If only ten per cent of the population would sleep less well each night because of light intruding from outside, being less refreshed in the morning, it would mean tremendous consequences for national economy or road safety, not to speak about the feeling of well-being. It's rather probable that this is really so. The amount of light from outside is quite commonly ten times larger than the full moonlight. Trying to get some results regarding this problem is a part of our research project.

Maybe as serious a reason is **nature protection**, but it's a theme of another lectures.

The third important reason is **safety, much reduced by glare** of current lighting. Nobody has properly investigated how many deaths are due partly to glare, but it contributed in some extent to many of those which happened in artificially lit spaces.

The fourth reason is that the **quality of life is diminished** by not being able to enjoy evening twilight and darkness sitting on your property or in public spaces, as they are invaded by light from luminaires meant to illuminate something else, by so called **light trespass**.

The last reason is that **we have to restore the heavens**. In the towns and villages, hardly anybody notices the stars any more. We might expect that the bright ones, esp. planets, are

readily visible even in our time, the skyglow is nowhere so strong to prevent it. But having dozens of glaring luminaires around, the stars become very inconspicuous. Even the **planets may be million times fainter than the luminaires**... Experts can still find them, but children don't notice their very existence. Most European **children live entirely without the starry heavens now**.

Planets have been the most prominent objects at night, apart from the lightnings, moon and fire for all the existence of the Earth. No wonder they have been regarded as gods and that people believed (some still believe) they affect our fates. Unnoticeable gods, as well as unnoticeable heavens (believed by many to be made by the God), have hardly any influence on us.

Starry heavens have been a never-drying spring of all religions. They are a vital counterpart of the moral imperative as perceived and mentioned by Immanuel Kant. There is no good replacement for them. Still, some replacements are inevitably found by the young generation: alcohol, drugs, vandalism, crime of all kinds. All of them offer another way of escaping the boring everyday reality.

This is a hypothesis (**"drugs and crime replace stars"**) I have formulated speaking to BBC Radio 4 in spring 2001. Meanwhile, Dr. Clark from Melbourne has written a huge two-part work in which the complex interactions of light and crime are examined. The current research shows no advantage of light-at-night for reducing crime, just its effect on reducing the fear of crime is evident. On the contrary, more light seems to bring more crime with it. Another mechanisms than just an ill-ontogenesis of children and youth are in play. Crime is rising almost everywhere, what apparently helps, is less light or darkness. Going a sustainable way, reducing outdoor light to the minima needed, might well help to reduce crime again.

It's important to be aware of it. Namely, one reported reason for more (and badly aimed) light everywhere is "crime prevention" [sic]. There has been a disastrous development of this kind promoted by some lighting industry in Britain, supported unfortunately by some negligent crime investigators and lighting experts, who have together led the Home Office to an erroneous strategy. It's time to stop such a costly and counter-productive nonsense. Strict rules, forbidding doubling the light amounts each decade, would help it.

9 Conclusions

The rules given above and the reasons to implement them may be surely formulated a bit differently. One thing is, however, clear: it's far better to have no legal rules at all then such ones, which allow further rise of light pollution, further negligent lighting installations and perpetuating the current polluting lighting practice. With such bad rules, further rise of pollution proceeds with an excuse that it is completely legal, with no objections possible.

We have such an experience from Czechia already. Before the Clean Air Act has been issued, the people could ask the polluters to adapt their lighting systems, to reduce the obtrusive impacts. Now, an interpretation of the Ministry of Environment exists, that before the rules are issued, anybody can use any light, with no restrictions... The real problems of horrible lighting are not solved at all, the bad lighting practices are accelerated wherever there is a commercial interest (say, of producers of extremely polluting luminaires, like Siteco in case of Brno).

The development away from sustainability in the past 2 years in Czechia can be used as an argument to make an effective law. Two years ago, the supporters have been the astronomical institutions. Now, it should be biologists, physicians, sociologists, conservationists, expert

societies, universities, national parks, citizens and so on. We hope to succeed and become a precedent for the whole EU. Or for Canada as well. To achieve it, even your support is vital. Thank you for your morning attention...

10 Appendix: what happens in Czechia in 2003/2004

added Feb 18, 2004, after making some corrections in the text written in September

When the breakthrough symposium Ecology of the Night took place, a government-proposed amendment of the Clean Air Act had been dealt with in the Parliament.

10.1 The "lost battle"

The government proposal, prepared by the Ministry of Environment, contained many minor changes, mostly formal ones, needed in process of adopting the EU legislation. For most changes, valid reasons have been given. Together with the useful changes, the very idea of considering the light as a pollutant has been discarded from the Act... The reported reason: the Act does not contain any rules concerning light-at-night and the government does not like to issue them!

The preceding government resolution, however, had been that the Act should be changed as regards the light pollution. Nothing about that this kind of pollution should not be regulated by the Act.

So we have prepared an alternative change of the law, which put the rules into the Act, stressing the light as a serious polluting stuff. Former Minister of Environment, Miloš Kužvart, agreed to raise it. We hoped that the Ministry will agree with him, especially that the current minister, Libor Ambrozek, will support the proposal. They could simply say they would like to reduce the pollution of darkness, but somehow they did not know how to do it. Adherence to the ex-minister proposal was a perfect chance to do the right thing without losing face.

Unfortunately, they opposed the Kužvart's proposal. At this new situation, when Ministry of Environment had been against the measures to protect the night atmosphere, unlike two years earlier (thanks to the cooperation of minister Miloš Kužvart and his leading assistant Eva Tylová in 2001), the prospect to persuade the House of Representatives had been bleak. Just 15 brave MP's from some 130 which were present voted in favour of our rules. We have lost the battle.

When the Czech president will sign the bill, the Clean Air Act will contain no goal to reduce light pollution, and just a spoiled (still usable, but funny) definition of the light pollution will remain there. The only measure within the law: empowering the local governments to ban skybeamers, if they would like to do so...

10.2 Gaining Ministry on our side

This is a bad development, showing the strength of the polluting industry. As with another kinds of pollution, the only way of winning is to gain the public opinion, which cannot be neglected by politicians.

Well, perhaps we can get the key people within the ministry for the protection of night environment. They should just study the research report which has been prepared by a team of scientists recently, thanks to the ministerial grant. It's nice that the research could be done,

and it's nice that the Environment Ministry did something good as well, apart from the horrible legal step backwards. The next step could and should be forwards again, much farther than that in 2001. We can't protect the environment against the will of ministry, we have to get them as our allies.

The legal proposal submitted by Miloš Kužvart is accessible from `svetlo.astro.cz/darksky/cz_law` (together with the arguments, even if not all of them are available in English). The research report is in Czech only at the moment, at `recetox.muni.cz/noc` or directly at "my" server `amper.ped.muni.cz/noc`.

You could help to include the protection of night environment to Czech legislation again, by writing to the Minister of Environment. Don't hesitate to demand a detailed answer... See the address at `www.env.cz` (if you prefer e-mail, it's simply ministr at env.cz – in Czech, we spell ministr, not minist_e_r).

You could also thank to the ex-minister for his effort, to encourage him to further the issue.

10.3 Let's agree on the lighting rules!

One of the reasons of our failure in the 2003 Parliament has been a lack of any broad international support for the lighting rules we have proposed. Several leading experts wrote to key Czech people, but just I knew they were the best ones in the world, the politicians were not aware of that. Official institutional support would be what could help.

Now we have enough time to study and discuss which rules should be applied for the protection of the night environment (or atmosphere, as the light does not propagate through soil and to watersheds it comes almost always from the air). IDA and other conservationist's bodies could identify themselves with the simple rules explained in this lecture and given in detail in `svetlo.astro.cz/darksky/cz_law`. Or with some adapted, even better version of them, if it will be developed. No administration will create any good set of rules, this is a task of those people and institutions, who understand the problem. Who are aware that **man-made light is the most serious (being the only specific one) pollutant of night environment**, and that **to get the healthy night environment back again, the current lighting practice has to be changed profoundly**.

The original rules have been invented by the Italian pioneers and then accepted in Lombardy and Marche. I tried to simplify their rules, consulting all changes with Fabio Falchi. We believe them to be a **really minimum possible set**. Any further compromise with polluters would mean that the current adverse trend would not be reversed. This set of rules enables plenty of excellent lighting. Of course it interferes a lot with the current lighting business, but no needs of us, as users of outdoor lighting, would be affected negatively. On the contrary, adherence to the rules would ensure much better lighting services in the future, with many benefits for everybody.

If you have any proposals to change these rules (perhaps their wording, if not their meaning), please write to us. If you think them to be OK as they are, say it to others.