

LIGHT POLLUTION, HOW DANGEROUS IS IT?

In my presentation today i'm going to tell you what light pollution really is, the danger of it's consequences and how it effects us and our planet.

Light pollution, also known as photo pollution or luminous pollution, is excessive and if you ask me in most cases unnecessary direct or indirect artificial light that increases the level of brightness in the environment. The International Dark-Sky Association (IDA) has it's own definition of what light pollution is and it says, that it is any adverse effect of artificial light including sky glow, glare, light trespass, light clutter, decreased visibility at night and most importantly energy waste.

Light pollution is divided into two main groups:

First group refers to indoor light pollution as lighting in houses or apartments. It is most severe in highly industrialized and densely populated areas of North America, Europe, and Japan and in major cities in the Middle East and North Africa like Tehran and Cairo, but even relatively small amounts of light can be noticed and can create problems.

The second group represents outdoor sources which are the main pollutants. We are going to focus on this group particularly. Furthermore i'm going to divide it on more and less necessary ones.

More necessary ones are for example roadside lamps, traffic lights, vehicle lights, important road sign lights, emergency vehicle lights and so on.

Less necessary ones are for example big store and commercial sign lights and the lights that enlight statues and buildings. These lights also contribute the most to light pollution, because most of them are pointed towards the sky. That creates two major problems that are unnecessary energy waste and sky observing interference.

In the past century almost all wars that took place on our little planet were caused by energy resource deficiency. As you may know we are living in times of a big energy crisis so it is very important for us to save energy as best as we can. In the past few years we have invented a lot of new ways to save energy, for example energy saving light bulbs, dishwashers, refrigerators, washing machines and much more. One of many kinds of energy that can be saved (water wind coal gas oil...) is electrical energy. This is the most important kind of energy to most people around the globe. So if we were to work on getting rid of light pollution more effectively and would turn off some unimportant pollutants we would also save high amounts of energy. As you can imagine, reflectors that are pointed towards the sky lighting a statue or building by themselves use high amounts of electricity. Furthermore they are on all night.

The second major problem is that light pollution mostly prevents scientists to observe the sky, but it could also create a problem for you if you were to go outside and wanted to just watch some plain old stars in the sky and because of light pollution you wouldn't see any if you were to live in a big city. But let's focus on problems that scientists are dealing with.

Astronomers have a variety of ways of sky observing. Mostly they use telescopes. But telescope efficiency depends on how dark the sky is so that creates a really big problem. Like we mentioned before, if you were to look up to the sky in a big city and saw some stars you can be considered as a very lucky person. So astronomers are forced to work outside of big cities, which are mostly very polluted by light. For example today's most efficient telescope observatory La Silla observatory in Chile lays 6 hundred kilometres away from the nearest city thus meaning away from any light sources. As you can see light pollution creates a large problem for mankind because we are unable to acquire knowledge about space, other planets, any other existing life forms and other stuff that remain secret for us at the time being.

As mentioned before, we are familiar with several different types of light pollution:

- Light trespass occurs when unwanted light enters one's property, for instance, by shining over a neighbour's fence. A common light trespass problem occurs when a strong light enters the window of one's home from the outside, causing problems such as sleep deprivation or the blocking of an evening view.
- Glare
According to Bob Mizon coordinator for the British Astronomical Association's Campaign for Dark Skies, glare can be categorized into different types.
 1. *Blinding glare*, it is completely blinding and leaves temporary or even permanent vision deficiencies. It is like looking into the sun.
 2. *Disability glare* describes effects such as being blinded by oncoming car lights.
 3. *Discomfort glare* does not typically cause a dangerous situation by itself, though it is annoying and irritating. It can potentially cause fatigue if we are exposed to much time to it.
- Light clutter refers to excessive groupings of lights, which may generate confusion, distract from obstacles (including those that they may be intended to illuminate), and potentially cause accidents. Clutter is particularly noticeable on roads where the street lights are badly designed or positioned, or where brightly lit advertising surrounds the roadways. Depending on the motives of the person or organization that installed the lights, their placement and design can even be intended to distract drivers, and can contribute to accidents.
- Sky glow as the name itself says it is some kind of glow effect over big cities. It is the combination of all light reflected from what it has illuminated escaping up into the sky and from all of the badly directed light in that area that also escapes into the sky, being scattered by the atmosphere back toward the ground.

All these effects can have different consequences on animal and human health. There was a recent research in America showing that common levels of fluorescent lighting in offices are sufficient to elevate blood pressure by about eight points. Specifically within the USA, there is evidence that levels of light in most office environments lead to increased stress as well as increased fatigue that in many cases lead to worker errors. But this is a problem of over-illuminating and bad planning of lighting in the room itself and not as most people would think a problem caused by light pollution.

On the other hand some animals have been studied and examined after being exposed to unnatural light sources for a long period of time. The results showed some changes of mood and behaviour. It can confuse animal navigation, alter competitive interactions and change predator-prey relations. For those who need to be awake at night, light at night causes them to be on alert and to be slightly more aggressive (raccoons).

These effects can also create disruption of ecosystems. While light at night can be beneficial, neutral, or damaging for individual species, its presence invariably disturbs ecosystems. For example, some species of spiders avoid lit areas, while other species are happy to build their spider webs directly on a lamp post. Since lamp posts attract many flying insects, the spiders that don't mind light

gain an advantage over the spiders that avoid it. This is a simple example of the way in which species frequencies and food webs can be disturbed by the introduction of light at night.

What can we do to prevent or at least reduce it?

The method for best reducing light pollution depends on exactly what the problem is in any given instance. There are a few possible solutions. For example adjusting light sources to minimum intensity necessary to accomplish the light's purpose, turning lights off when not needed, improving lighting textures so the light is more efficient by focusing it to where is needed and that prevents it to escape in the sky, adjusting the type of lights to prevent severe light waves emitted and evaluating the necessity of lights and turning off some unimportant lights for example for commercial signs and statues.

There are several different organisations related to light pollution. One of them I have already mentioned the IDA, it was the first organisation to call attention to light pollution.

There are also a few campaigns for example Globe at Night that aspires for reducing light pollution. Unfortunately Slovenia is not part of this campaign but we have our own very similar action: "Nebo ponoči" that works just locally. Another campaign is Earth Hour which once a year organises a day in which we all turn off the lights for 1 hour and with this contribute to reduction of climate changes such as light pollution.

For my conclusion I would like to say that light pollution is not really dangerous but it can be really discomforting and disturbing and can jeopardise our scientific development and enjoyment of watching stars. It is true that it has a small effect on our health but it can easily be solved with little effort and some knowledge. It also effects ecosystems a little bit, but that level isn't even close to causing some serious damage. Overall it is not a really big and dangerous problem yet. There are much worse problems than that. But we should dedicate some of our attention to it so that it wouldn't become a serious problem which can also helps us solve other problems such as energy waste.