

Report to Sustainable Gabriola on Talk Given by Roland Dechense about Light Pollution

April 2022

SG was invited to this talk, and as far as I can tell I was the only one connected to SG to attend. The Nanaimo Astronomy Society asked for introductions of non-members, so I had to explain that I was invited through SG. Thus, I think I am sort of reasonably expected to report to SG, hence this report. I had no idea that Light Pollution is a huge political issue, even in Nanaimo. Anyway, the talk was very interesting, so here are some highlights (pun intended).

Roland Dechense is a long-time amateur astronomer and a fellow with the Royal Astronomical Society of Canada and serves on the Light Pollution Abatement committee. He is an oil and gas geologist for his day job. I think he was speaking from his office in Calgary, but maybe it was Edmonton.

Dark Preserves and Parks

There are three kinds of dark at night parks:

1. Urban Star Parks are designated low light areas near urban centers intended for good viewing of the night sky.
2. Dark Sky Preserves are areas set aside to improve "dark at night" for ecological reasons. Humans are free to use these parks if they observe low light use rules, for example, use red flashlights.
3. Nocturnal Reserves are areas set aside for dark nights for ecological reasons and use by humans is severely restricted.

All these parks and preserves have to get approval from the Royal Astronomical Society of Canada (RASC) to receive the "Dark Sky" designation. A number of Canada's national parks are Dark Sky Preserves, for example, Wood Buffalo National Park or Waterton/Glacier International Park is also an international dark sky park. BC has two of these kinds of parks: McDonald Park near Abbotsford and Cattle Point Urban Sky Park in Victoria (this park was called Cecil Park, I think, in the talk - the name I have given is from the web, fortunately the dark web was not necessary to find it).

LED Lighting

LED lights, which stands for Light Emitting Diode lights is significantly more efficient than traditional lighting in all its forms: streetlights, building lights, highway lights, advertising lights, signs, etc.

However, the efficiency of LED lights has actually led to much increased usage. Around 50% increase is widely accepted, but some estimates are as high as a 400% increase. The variation in measurement is mostly because of how the light is measured, and what is included as new light.

All nighttime artificial lighting has negative impacts. When installing lights, governments and businesses need to give much more attention to the negative impacts, than is usually done. In many cases, less light would give a better result for the light project, so more isn't necessarily better!

Design of the light fixtures and also the rated temperature of the light is critical to good performance, and less light pollution. The optimal temperature rating is around 2200 to 2700 degrees Kelvin. For example, many streetlights are much hotter than this, emitting blue white light that creates a lot of glare, and isn't very useful to the human eye.

Light Pollution

Light Pollution is unwanted or unnecessary light in urban areas and also light that is damaging to the nocturnal ecology and human health.

The Benefits of night light have been overestimated.

A. Visibility and Safety on Roadways

- It is widely accepted, based on research, that good lighting greatly improves safety on roadways in those situations where pedestrians and cyclist need to avoid road vehicles, intersections, for example.

- However, in all other situations, for example, freeways, or country roads, not normally used by pedestrians or cyclist at night, road lighting actually increases traffic accidents. In some cases the lights are poorly designed, increasing glare, but also the poles supporting the lights are involved in traffic accidents. It may be hard to believe, but according to the speaker (who seems to have done a huge amount of research on public lighting), the number of traffic accidents involving the road lighting poles is so large that it more than off-sets the benefit of the lighting!

- Even off ramp lighting doesn't help, except at the end of the ramp, where the ramp meets the crossroad in an intersection.

B. Crime and Lights

- Oddly enough there is no conclusive evidence that night lighting reduces crime rates. Mostly there is a shift from daytime crime to nighttime. Apparently, the reason for this is that human activity in lit areas is not suspicious, so criminals feel safer in a lit area. Also, it is safer to engage in criminal activity at night, when there aren't many people around, so well lit areas, at night are actually preferred by criminals. For example, in a British study, lights were turned-off in one neighbourhood, and the crime rate went down, as criminals moved to an adjacent well lit area.

- The jury is out on whether lighting even helps with surveillance cameras: the latest research is that it does not help.

- Surveillance, for example, security guards, is very effective for preventing crime, and many studies are confounded by the researchers watching an area, effectively serving as surveillance, deterring crime.

C. Other Issues with Light Pollution

- Sky Glow is very bad for astronomy and star gazing, because the light from earth is scattered in the atmosphere, making our eyes less sensitive to star light, and making the night viewing more like daytime viewing (when we can see very little light from stars or planets).

- Light Trespass happens when light from a public or private source impacts another location detrimentally. For example, one person runs their porch light all night, and the light disturbs the neighbour in some way.

Night Light and Human Health

Night light disrupts the activities of a human hormone called Melatonin. This hormone depends on different frequencies of light through the human Circadian rhythm cycle. Night light interferes in complex ways that increase the chances of many health problems, including cancer. The blue light emitted by hot LED lights is especially harmful. Since the human eye can't see very well in blue light, most of the blue light emitted by LED's is wasted anyway. So this is doubly stupid: blue light is a health risk, and doesn't help us see better (in fact, the excessive glare of hot bluish white lights make visibility worse), so much cooler LED's are greatly preferable.

Day Light Saving Time - As an aside, surprising to me, Deschense claimed that staying on standard time permanently was the least disruptive to the human Circadian Rhythm, switching back and forth between standard time and daylight saving time was the next least disruptive thing to do, and permanent day light savings time was the worst. He claimed that this was true, because most people don't completely adjust their rhythm when switching back and forth, and permanent standard time offers the best alignment between natural light and our Circadian Rhythm. He claimed that within a time zone, people tend to get up later for an 8:00 am job, as you move East across the time zone. So within a time zone people are mostly tending to get-up in the same amount of light, ie, are aligned with their Circadian Rhythm.

Night Light and Nighttime Ecology

A. Birds

- There was a lot of discussion of the detrimental effects of night light on the night ecology. Many insects and animals, and even plants need the night to be dark for their wellbeing.
- Many birds use light to navigate, for example through a forest, so well lit building are confusing, and cause a lot of accidents for birds as they fly into the buildings.
- Many birds species migrate at night for good reasons: it is cooler, cooler night air is more buoyant, there is often less wind and turbulence, and there are fewer predators. Also, there is good evidence that birds learn the star formations in the circum-polar sky and use this for navigation.
- One initiative across Canada (probably worldwide) is to create song ways: These are strings of dark night preserves and parks set along migration paths of birds, so the birds can fly in dark nights on their migrations.

B. Insects and Other Animals

- insects are attracted to light and the bats that eat them need to avoid light, so light pollution clearly stresses this dynamic. Bright, blue white light has the most impact on bats and insects.
- Daphnias eat algae in ponds, but only at night, when they are safer from predation, so night light pollution can lead to algae blooms in lakes and ponds.

C. Plants

- Night lights don't seem to help plants that much, but plants can use the blue light from LEDs that is so harmful to animals.

Actions for Reducing Night Light Pollution and Things to Consider

For people LEDs in the 2,200 - 2,700 degrees Kelvin range is best (the Kelvin temperature scale is the same as Celsius, except it starts at absolute zero. So water freezes at about 273° K, and room temperature is about 298 degrees K). Bright, bluish white streetlamps are in the 4,000 to 6,000 degree K range. So Nanaimo City Council, RDN, and IT need to be informed of the optimal light level.

Night Signs need to be turned down at night when no one is reading them.

Roadway lighting needs to be seriously reviewed, with light fixtures designed to reduce light pollution, for optimal temperature and brightness, and whether it is really needed at all.

Car headlights, especially the newer models, are often emitting harsh bluish white light that creates a lot of glare, especially for oncoming drivers.

Third party light on roadways is trespassing and may even be in violation of the street light regulation that are mostly pretty strict in Canada. Awareness of light trespassing needs to grow, so that people get away from leaving on porch lights, or at least use better designs that reduce pollution and annoyance.

Some businesses, such as gas stations, use bright lights to attract business (because the size of signs advertising businesses is usually regulated), this needs to be reduced.

There is one Dark Smart Community, Bon Accord, near Edmonton in all of Canada. Perhaps Gabriola could try for this designation and use this distinction to improve tourism. The Dark Smart Community is a designation that is still being researched by interested groups in Canada. There is a real need for Canadian made rules that take into account, bird migrations, First Nations reconciliation, etc.

Individuals can get involved by monitoring Light Pollution situations with sky light meters and making maps of problem areas. Lobbying politicians for optimal street lighting seems obvious. Unnecessary lighting, installed to prevent crime, is a tougher nut to crack, because the police are so sure it is effective. So the police have to be informed and brought into the discussion.

More Resources and Information

You can search under RASC Light Pollution to get the RASC.CA webpage and information about light pollution. You can also contact DARKSKY@RASC.CA for specific questions.