Reducing Light Pollution in Kaikōura

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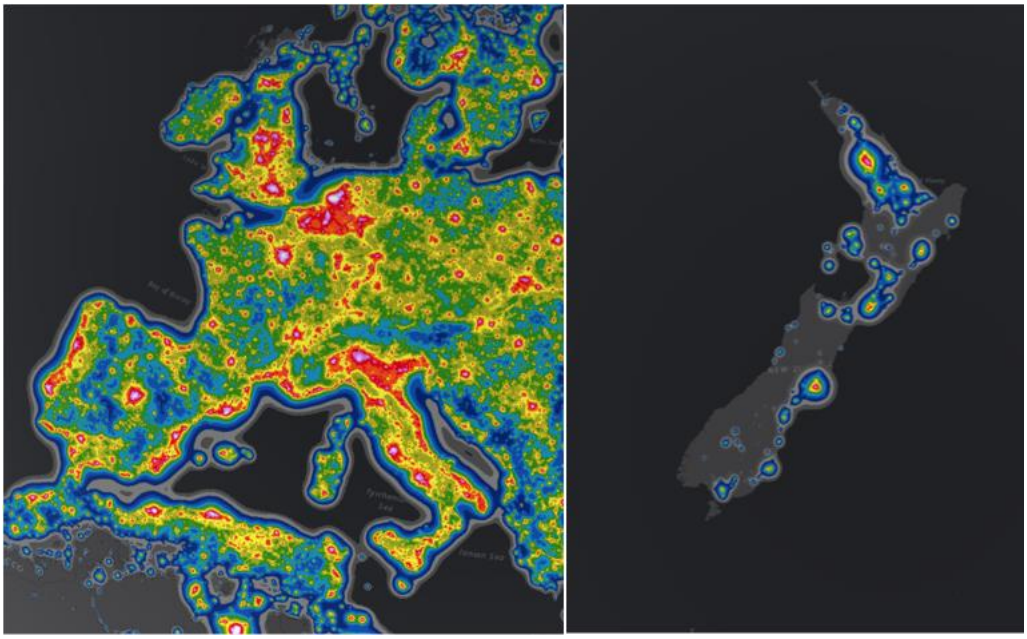
Light pollution from Kaikōura street and highway lights scatters upwards in low clouds (L.H. Field photo)

According to the Kaikōura Dark Sky Trust, understanding light pollution is the key to protecting our outstanding night sky. One of the roles of the Trust is to lead the way in managing light pollution, which, for example, causes the above scene from the Scarborough Lookout.

As with global warming, the majority of the population has had no awareness of the steady increase in the night time lighting that is spreading throughout the populated parts of the world. During the past 150 years, as street lighting increased in cities, the lighting industry has pushed to bring more and brighter illumination to human habitats, with the result that major cities are creating daytime lighting environments at nighttime. The comparison below, satellite images of lighting in western Europe compared to that of New Zealand, shows this problem. New Zealand, and particularly unique scenic locales such as Kaikōura, are directly threatened with this trend as new suburban housing expands. An additional difficulty is the introduction of LEDs to street lighting, because this new technology adds problems with extreme brightness and direct glare, often an abnormal (and unhealthy) blue light component, and uneven emission patterns onto streets. While the lower operating costs of LED street lights is the main reason for NZ streetlight retrofits, light pollution problems and wastage have increased. The Executive of the International Dark Sky Association, Ruskin Hartly, noted that: “The introduction of bright white LED light fixtures has made it simple and cheap to flood the world with more light than is needed – wasting energy and money at the same time.”



Satellite views of Europe (left) and New Zealand (right) plotting intensity of upward-directed light.

With these problems at hand, the question is: "What is light pollution?" The simple definition is **adverse artificial light at night.** Examples of adverse night lighting include a) upward shining of light which scatters in the atmosphere and decreases our ability to see and appreciate cosmos above, as with the current orange Highway 1 lights in Kaikoura, b) excessively bright streetlights with blinding glare onto pedestrians and drivers, c) unshielded security floodlights along Beach Rd or the District Council 3 Waters Depot which illuminate large surrounding areas beyond the premises, d) bright streetlights shining directly into houses, as seen along Churchill Street, Beach Road and parts of South Bay, and d) the ill-advised installation of thousands of cool white LED streetlights in Christchurch and Auckland which have increased the visible light domes above the cities, as seen from afar, instead of reducing their light pollution.

Part of understanding light pollution involves knowing the consequences that confront residents and District Councils. A major one is the dollar cost of operating lights: wastage by illuminating the sky (unshielded lights), high wattage where low wattage would suffice, and all-night illumination instead of motion-activated lighting all add to the bill, especially if it is a District Council bill being paid by residents' taxes.

Another consequence is insidious but now clearly known to medical research: the disruptive biological effect of the blue part of the spectrum in fluorescent and LED lights. Blue light controls the sleep-wake (circadian) cycle in humans and animals including terrestrial and marine invertebrates. Exposure to blue light at night prevents the body's melatonin from being produced, and melatonin triggers sleep. The lack of melatonin disrupts the natural 24-hour sleep cycle and, more importantly, the balance in production of hormones, e.g. cortisol, serotonin, and dopamine, which control stress mitigation, mood and happiness, and alertness/pleasure/muscle coordination respectively. Other blue light-sensitive hormones involve blood pressure control, cell division and body repair, and development. These health problems are not obviously alarming, such as a cut finger; they are quiet but present, and if they occur night after night (as in shift workers) the accumulative effects can worsen into irritability, anxiety and depression. Medical scientific research now links long term blue light exposure to obesity, diabetes and hypertension, as well as revealing the fact that melatonin helps to combat cancer. Similar scientific analysis has shown that the high rate of breast cancer in night shift nurses is exacerbated by cold blue-white lighting used in many hospitals. The solution to light pollution effects is advocated by the Kaikoura International Dark Sky Trust (through the IDA):

to lower the amount of blue light in the spectrum of night lights, meaning, to use warm and amber lights and avoid cool white lights in home, office and streets. This is why our new Kaikoura district Council LED retrofit streetlights are amber coloured. This is also why Microsoft added a warm white screen command to be activated in Windows 10 computers at evening time. While the general public has no awareness of these problems with night lighting, it is comforting to see that the computer industry tales it seriously.

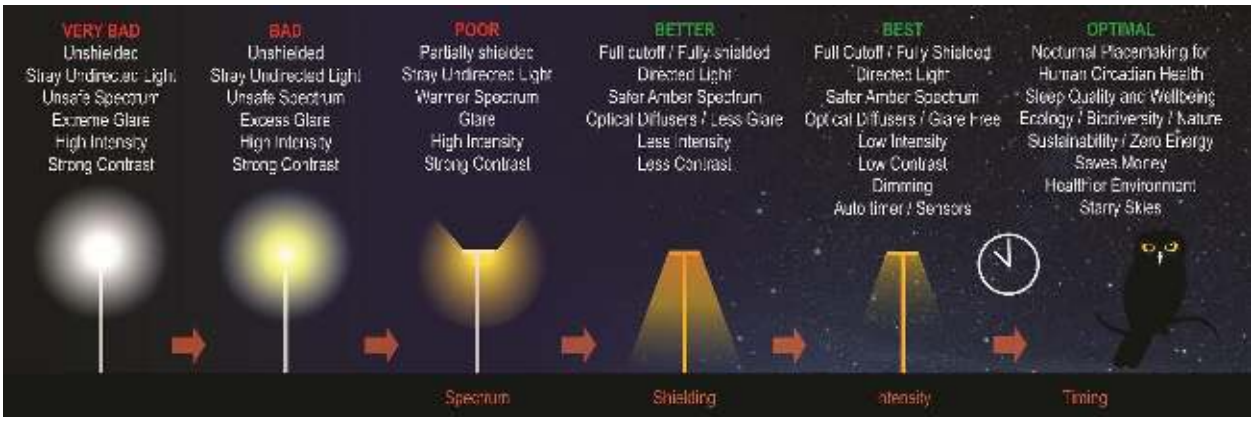
Unsurprisingly, night lighting disrupts Kaikoura's ecological environment. The effects are due to spectral properties (high blue content) and/or brightness and lack of appropriate shielding. The most familiar example is the high crash rate of Hutton's shearwaters drawn to Kaikoura bright night lights. Other effects include the disruption of the behaviour (feeding, reproduction) of nocturnal animals, including marine invertebrates and fish (why do fishing boats use brilliant white lights at night?) and the vast number of nocturnal insect species which pollinate flowers at night in New Zealand.

An unexpected consequence of very bright lights is one of safety: high direct glare lighting (e.g. LED residential/business security wall packs) may seem safe, but they blind our dark adaptation and prevent us from seeing in shadows. When moving from brilliantly lit areas to dark areas, whether car drivers or pedestrians, there will be a blind period of perception during which accidents can happen, or one cannot make out immediate obstructions or nearby people in shadows. Older people suffer from internal light fog (disability glare) in the eyes when faced with the direct glare of LED street lights and security lights.

Another consequence of light pollution in Kaikoura is the damage that it can do to our pristine night skies. The luxury of enjoying the vast overarching array of stars, Matariki, the Milky Way and the Magellanic Clouds is embedded in Maori culture, in the lure for those interested in astronomery and also in national legislation. This is a natural heritage which is easily lost due to the careless and insensitive use of night lighting in urban societies. For Kaikoura, light pollution is likely to affect our future economy if we can attain accreditation as an International Dark Sky Reserve. Such a Reserve is the gold standard target of astrotourism visitors who travel from world centers suffering from massive light pollution at night. In New Zealand, the Aoraki McKenzie International Dark Sky Reserve has attracted an enormous increase in the local economy due to the Mt John Observatory tours as well as local astrotours in the hospitality sector. It is hoped that the Kaikoura business community can follow this path, but it depends upon decreasing the light pollution in our night skies through community and Council lighting management efforts.

The simple and easy lighting management efforts involve the following: 1) *prevent any upward (above horizontal) outdoor light emission and restrict the light to its target by shielding, 2) change light bulbs/LEDs to warm or amber colour (CCT rating 1800K-2700K), 3) keep intensity low to prevent night blindness, 4) use motion sensors or timers to save energy and prevent all-night lighting.* Many communities and cities in Europe, North America, U.K and other countries are adopting such changes in their nighttime profile. Even cathedrals are being illuminated to their architecturally best advantage by cleverly hidden amber lights.

A handy reminder that summarizes these lighting management points is shown below.



The cause of light pollution and how to manage it to protect Kaikoura dark skies.

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