

## Environmental Impacts of Natural Daylight & Artificial Lighting

In recent years, a greater understanding of the impacts of infrastructure and building projects on the natural environment has led to the need for detailed assessment of lighting impacts on mammals and other fauna.

Historically, SLRHeggies lighting studies were concerned primarily with adverse impacts from building and road infrastructure projects – overshadowing, reflective glare and night-time illumination glare. These projects led to the development of sophisticated analytical tools able to quantify the impacts of both natural daylight and artificial lighting (including night-time). These tools have the added benefit of providing useful input into building energy efficiency and sustainability studies.

Heggies environmental investigations have included signature projects involving the protection of bats, birds, whales and dolphins, salmon, sea turtles and other sea life. Our studies have also included dairy cattle, thoroughbred racehorses, laying chickens, aquarium fish and domestic pets.

## What is Light Pollution?

Night lighting is becoming increasingly permanent and widespread, impinging not just on heavily-urbanised areas but on sensitive environments located at the fringes of urban development. As a result, light pollution has emerged as an important environmental issue. Light pollution can be defined as any modification of the natural light environment, especially that which causes some sort of nuisance. Well-known forms of light pollution include sky glow, light trespass and glare. Excessive night-time lighting also contributes to energy inefficiency.

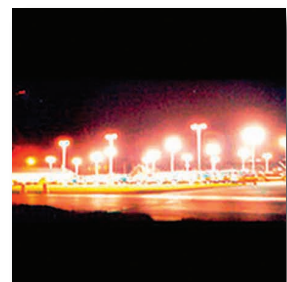
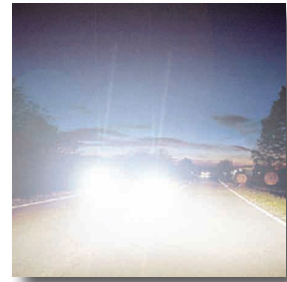
## What is Light and How is it Perceived?

Sunlight is the energy by which all life-processes on earth are ultimately driven. Light can have many different energy levels or wavelengths, the most familiar of which are the visible ones. For example, the sun appears as yellow because its light is most powerful at the visible yellow wavelength. There are many other wavelengths beyond visible light. In fact visible light only takes up a tiny fraction of the electromagnetic spectrum - sandwiched between ultraviolet light and infrared light (or “heat”).

The light registered by the eye (whether it be human or animal), and the colour of it, depends on the strength of each wavelength. A “low” colour temperature corresponds to a warm or a red-yellow appearance like incandescent lamps. Fluorescent lamps emit a white bluish light. Lighting which is high in both colour render and temperature is desirable for promoting photosynthesis, the process by which plants use light energy to produce sugar. Light with a high output in “blue colour” wavelengths promotes plant growth and health.

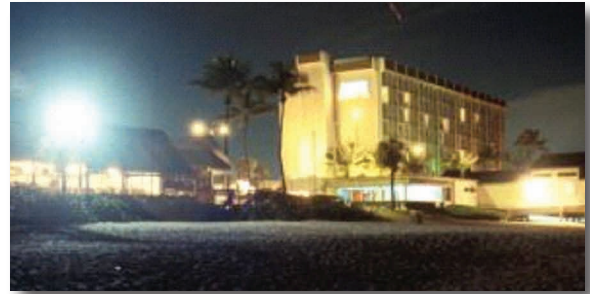
Ultraviolet or UV light can be broken up into three wavelength groups: UVA (long-wave), UVB (medium-wave) and UVC (short-wave). UVC rays pose significant danger to virtually all living organisms. At the other end, UVA rays can influence the reproductive and signalling behaviours in many animals. Most animals can “see” well into the UVA range, so light absent in UVA rays can cause stress in animals by radically altering their perception of the environment. Breeding behaviour and life span have been shown to be related to UVA input. UVB rays influence liver and kidney functioning via Vitamin D3 production and the associated metabolism of dietary calcium which is also crucial during the fertilisation phase on many animals.

Infrared radiation, where the sun produces most of its energy output, is important to most animals for thermoregulation. Thus, for example, it has been found that the best artificial source of heat for diurnal reptiles is via overhead incandescent light bulbs, all emitting high amounts of infrared light.



## What Impacts Can Light Pollution Have?

The negative effects on fauna caused by night time artificial lighting have been known for some time. Probably the best documented include the deaths of migratory birds around tall lighted structures, and those of hatchling sea turtles disoriented by lights on their natal beaches.

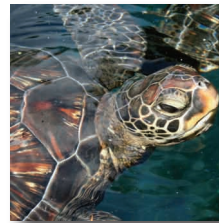


### Birds & Bats

Bats, which are nocturnal, may be affected by deserting their roost if it is illuminated, or leaving the roost later, and so having less time to feed. Birds may become confused by artificial lighting, commencing

to sing their “dawn chorus” early or even worse, disrupting their breeding cycles.

Buildings are often floodlit all night long, using upwardly facing lights, typically involving very high lux levels. It is now well known that literally millions of birds die each year as a result of bird collisions with windows, by being attracted to the light from these office blocks.



### Sea Turtles

Improper outdoor lighting is probably one of the greatest issues affecting sea turtles, with the associated light pollution impacting their nesting habits and the ability of young hatchlings to survive.

In many parts of the world, sea turtles are either classified as threatened or endangered. Brightly lit beachside roadways and building developments have dramatically altered the environments in which hatchlings find themselves and their chances of survival. Hatchlings will crawl toward artificial light sources using the same instinctive response that leads them seaward on naturally lighted beaches.

## How Can SLR Heggies Help?

SLR Heggies is a progressive firm of environmental engineers and scientists providing innovative solutions for improving and sustaining our environment. The company has been operating since 1978. With around 130 staff, Heggies is one of Australia’s largest specialist consultancies working in all states of Australia, New Zealand, Papua New Guinea, South East Asia and the Middle East.

Our engineers and scientists can help manage light pollution problems through a variety of methods:

- Understanding the various adverse illumination effects on fauna
- Carrying out lighting surveys to quantify potential adverse conditions
- Selection of fauna friendly lighting fixtures and luminaires: incandescent v fluorescent v metal halide v high pressure sodium lamps
- Selection of specialised fauna-specific low impact luminaires based on spectral (ie wavelength) characteristics and colour rendition
- Achieving balanced solutions: Minimising glare while maintaining adequate personal security
- Development of light-management environmental plans

