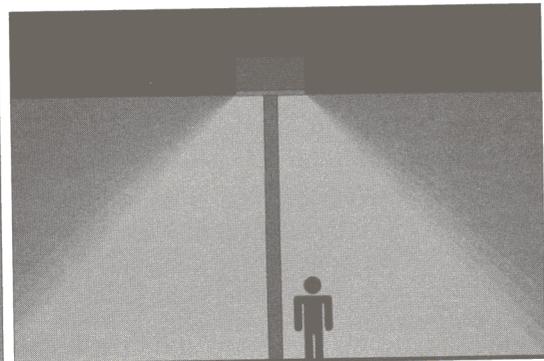
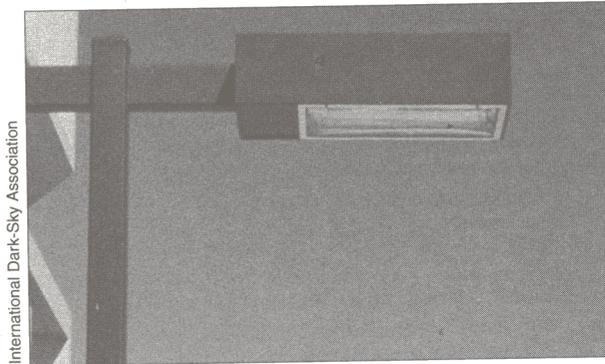


Light Pollution: Causes and Cures



Full-cutoff fixtures shield the source of light on all sides. Light is directed to the ground, not to the sky.

by Cliff Haas

LIGHT POLLUTION has only recently been recognized as a growing environmental problem, but it was already evident near populated areas almost 100 years ago. A 1908 photo of the Los Angeles basin shows that even then the city's night lighting was creating atmospheric radiance. Today we call it sky glow, and it is much worse and more widespread. Engineering has vastly improved the efficiency of electric lighting, yet we seem to have learned very little over the past century about harnessing stray light and making it work to our benefit rather than working against us. We still send over one-third of the energy used to power outdoor lighting into outer space where it serves no useful purpose. Satellite photos of Earth provide clear evidence of this, and the problem is growing rapidly as urban and suburban areas continue to expand.

Population growth and urban expansion are not the only culprits in light pollution. Over the years, we have increased the level of outdoor lighting so that we now use more and brighter lights than ever before. Consider that city streetlights today can deliver up to 100 times more illumination than the full moon. Yet in the early days of streetlighting, many municipalities considered it unnecessary to light streets on clear, moonlit nights! Twenty years ago, most gas stations were quite adequately lit at one footcandle or less, yet now it is common for people to fill up under the glare of 100 footcandles or more. Because these changes have occurred gradually, most people have accepted, tolerated, or simply not noticed them.

While municipal and commercial lighting has been getting brighter, so has residential lighting. Thirty years ago, the outdoor lighting products available to the public were limited to incandescent lamps, while mercury vapor, high-

pressure sodium, and metal halide fixtures were used only on roads and commercial properties. Today these significantly more powerful fixtures are available to everyone, and this has led to a tremendous increase in the amount of light that people apply to their properties. For instance, the homeowner who cuts energy use by replacing a 100-watt incandescent security light with a 70-watt metal halide fixture is reducing the wattage but increasing light output by nearly 300 percent. In addition to being more powerful than needed, most of these fixtures are poorly shielded. They blast light in all directions and, despite their efficiency, waste an enormous amount of energy because the light spills into areas where it is not useful.

People mistakenly believe that more light provides better safety and security, but this is

not true with most outdoor night lighting. The glare produced by bright fixtures can impair vision in much the same way that the glare of the setting sun on the horizon makes it difficult for drivers to see the road in front of them. Visual acuity is best when the illuminated area is the brightest thing in the field of view because the eye always adapts to the brightest object. When the brightest object is the light fixture itself, everything else appears darker than it truly is. For this reason, security lights can actually make it more difficult to spot an intruder, just as a chaotic jumble of lights on city streets can impair the vision of pedestrians and drivers. Furthermore, while our eyes can adapt to light over an amazing range of brightness, it takes time to adapt to darkness after exposure to intense light, and our dark-adaptation slows with age. A driver emerging from a brightly lit gas station onto a darker roadway may require a minute or longer to re-adapt to the lower light levels, and during that time may not see objects or people on the side of the road.



Sky glow already apparent over Los Angeles in 1908.

Identifying problem lights

While many cases of light pollution are the result of too much light being used for the task, the biggest cause is poorly aimed or unshielded light fixtures. Generally speaking, if you can see the source of the light (i.e., the bare bulb), it is a “bad” light, one that is likely to be obtrusive and actually causing more harm than good to the surrounding area and your visual performance. Good shielding and proper adjustment of fixtures to prevent light from shining horizontally into the eyes help to improve both safety and security.

To determine whether fixtures are a source of light pollution, view them from several locations to see how neighbors and other passers-by experience the lighting. Look for the following:

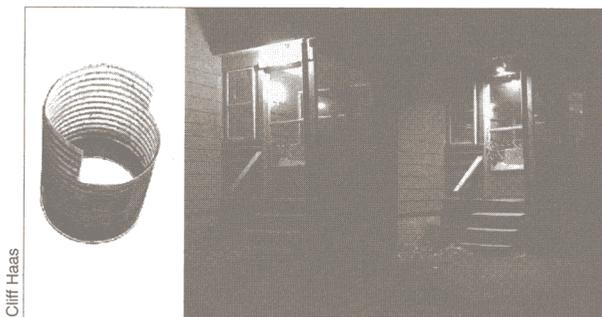
- Does bright light shine into your eyes from any point beyond the property line?
- Do lights that are intended to light a path or driveway illuminate foliage in the trees?
- Do the lights shine onto other people’s homes or property?
- Do the lights shine into the road?
- Is a shadow cast when you stand between the lights and the adjacent property?

If any of these conditions apply, chances are good that you have one or more problem lights that need shielding.

Shielding lights

Shielding outdoor lighting is just like putting shades on indoor lamps. It helps us to see much better, often allows reductions in wattage, and vastly improves our safety. Most light fixtures can be retrofitted with commercially available and relatively inexpensive shields that latch on to the fixture and require no special tools or expertise to install. You can also make your own shields and visors using simple materials such as metal flashing or large juice cans that are attached to the light fixtures with metal hose clamps. (For detailed plans, see the Light Pollution Awareness Website, <http://members.aol.com/ctstarwchr/shielding.htm>.)

Shielding a light not only eliminates glare, but in most cases also increases lighting efficiency because the light is



Left: A simple shield made from a one-quart pineapple juice can. Right: Before installation, wasted light spills upwards and outwards. Shielding the light results in a 30 percent energy savings and better illumination of the porch steps.

Cliff Haas

directed to the area where it is needed rather than scattered horizontally. In my own home retrofit, I fitted a 60-watt incandescent porch light with a shield made from a one-quart pineapple juice can. Without the shield, the amount of light reaching the porch steps had been one footcandle. After the shield was added, the light level on the steps measured 1.3 footcandles, a 30 percent gain. Since one footcandle was adequate, I could replace the 60-watt bulb with a 40-watt bulb. The stairs were

again lit to one footcandle, but I gained a 30 percent savings on my electricity bill and a significantly better visual environment without any glare.

Replacing fixtures

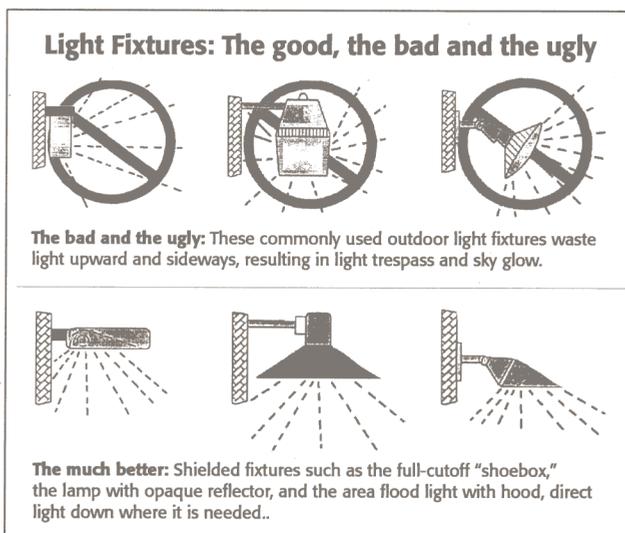
All major lighting manufacturers today offer fully shielded fixtures, known as full-cutoff luminaires, which have a recessed lamp and a flat glass lens. Because the lamp is shielded on the top and sides, and the lens does not protrude below the shield, no light is emitted upwards. Full-cutoff fixtures often allow a reduction in wattage because light that

is otherwise wasted in lighting up the sky above the fixture is reflected down where it belongs – on the ground. A variety of these fixtures are now available for municipal, commercial and residential use. While it is not economically feasible to immediately replace every glary light in use with a properly shielded fixture, many lighting ordinances are being rewritten to require that full-cutoff fixtures be used in all replacements and new installations.

Light pollution is the only form of environmental pollution that would cost much less to cure than it costs

society and the natural world by allowing it to perpetuate. We already have the solutions; we require only the public awareness and the political will to implement them. Light pollution will not be eliminated overnight, but we can begin to cure it night by night. We can start by educating ourselves, our neighbors and our elected officials to recognize the difference between more lighting and good lighting.

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International Dark-Sky Association