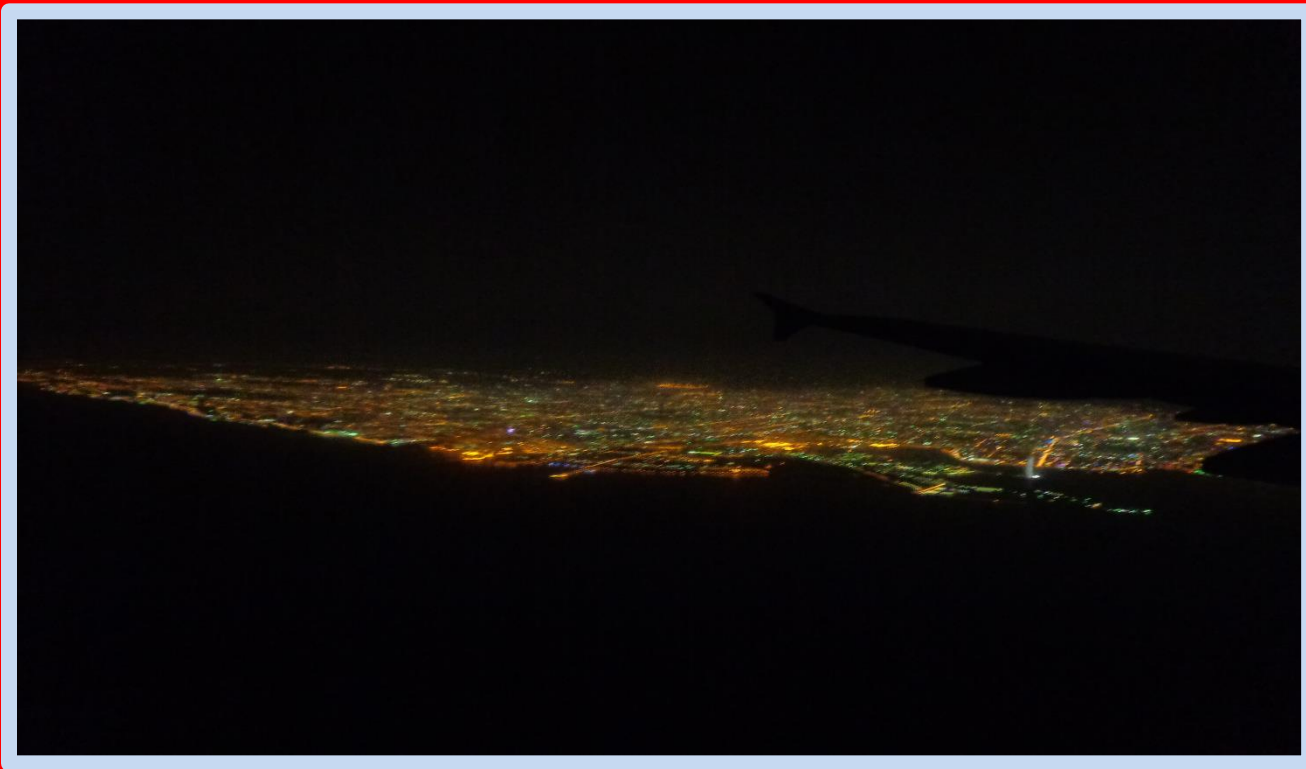


Light Pollution in ten minutes

Colin Henshaw, B.Sc., F.R.A.S., F.R.S.P.H.

Images not credited by the author.



Definition

Wasted light that has a negative effect on the environment and human health.

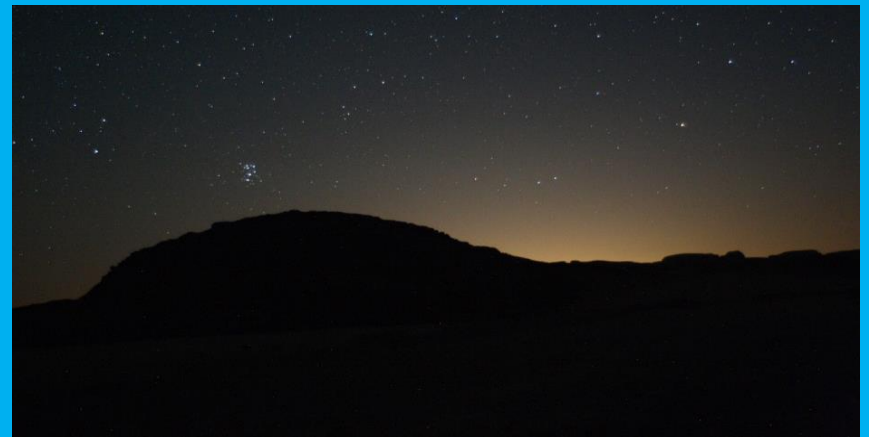
Causes:

- **Street lighting.**
- **Commercial lighting.**
- **Security Lighting.**
- **Advertising.**
- **Sports Lighting.**
- **Vanity Lighting**



Effects

- **Sky Glow** – aerosols in the atmosphere create illuminated domes of scattered light over cities that reduce stellar visibility.
- **Glare** – the blinding effect of unshielded lighting on visibility.
- **Light trespass** – unwanted light crossing property lines causing loss of amenity.

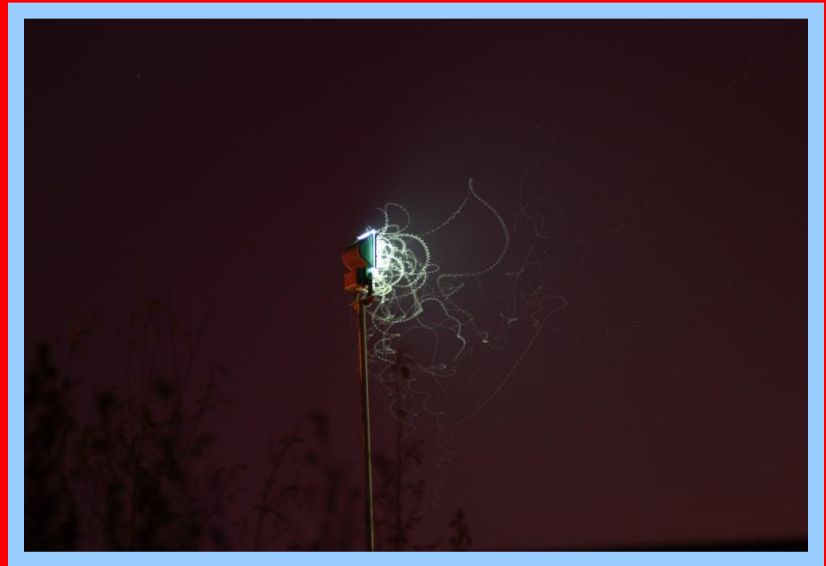


Implications

- **Environmental.**
- **Medical.**
- **Social.**

Environmental implications (1)

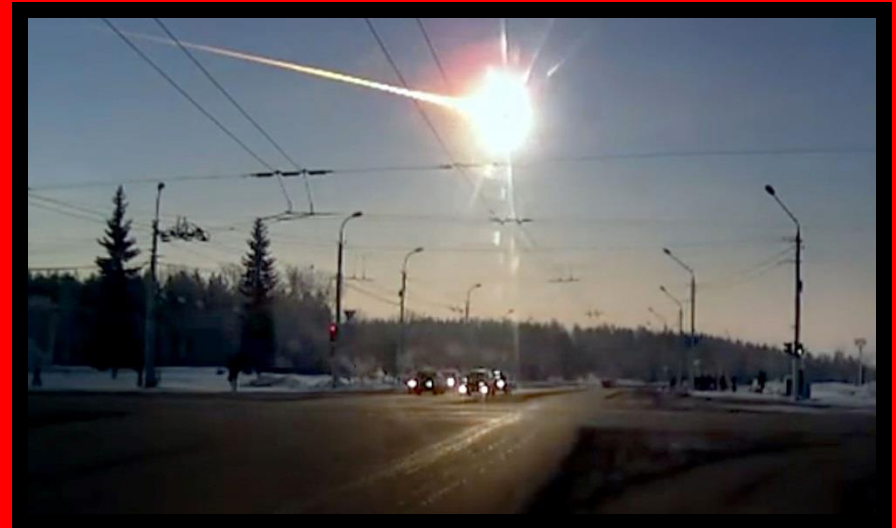
- Light, especially blue light, attracts insects and kills them.
- Higher order consumers that feed on insects decline as they have less to eat.
- Fewer insects to pollinate flowers. Reduced plant diversity. Affects crops.
- Fewer plants mean less food for insects.
- Positive feedback.
- Insects decline further. Concomitant effects on higher order consumers.



Environmental Implications (2)

Image credit: Chelyabinsk fireball: <http://cdn.phys.org/newman/gfx/news/hires/2014/thepowerofth.jpg>

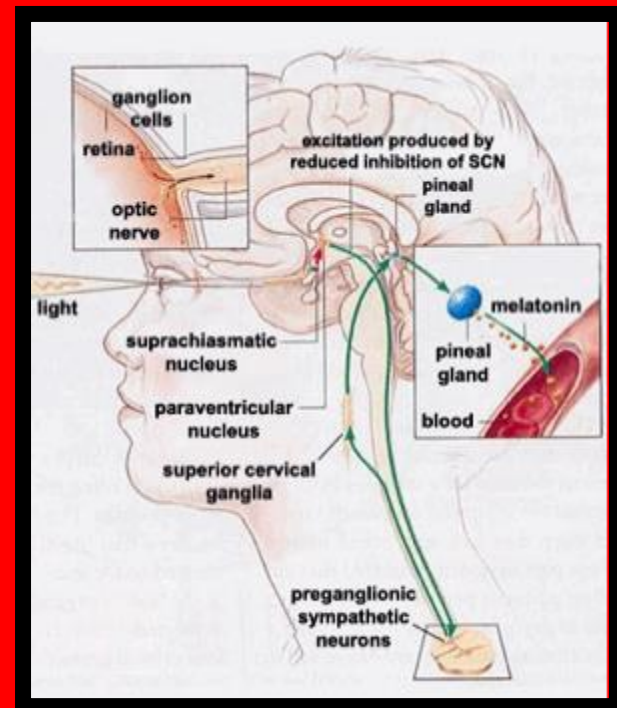
- Skyglow and light trespass reduces stellar visibility.
- Affects astronomical observation.
- Creeping global light pollution may prevent astronomers detecting the next asteroid strike.
- Contributes to increases CO₂ emissions leading to global warming and climate change.
- *60% of all electricity consumed is wasted on street lighting.*



Medical Implications (1)

Image credit: Giuliano, V.

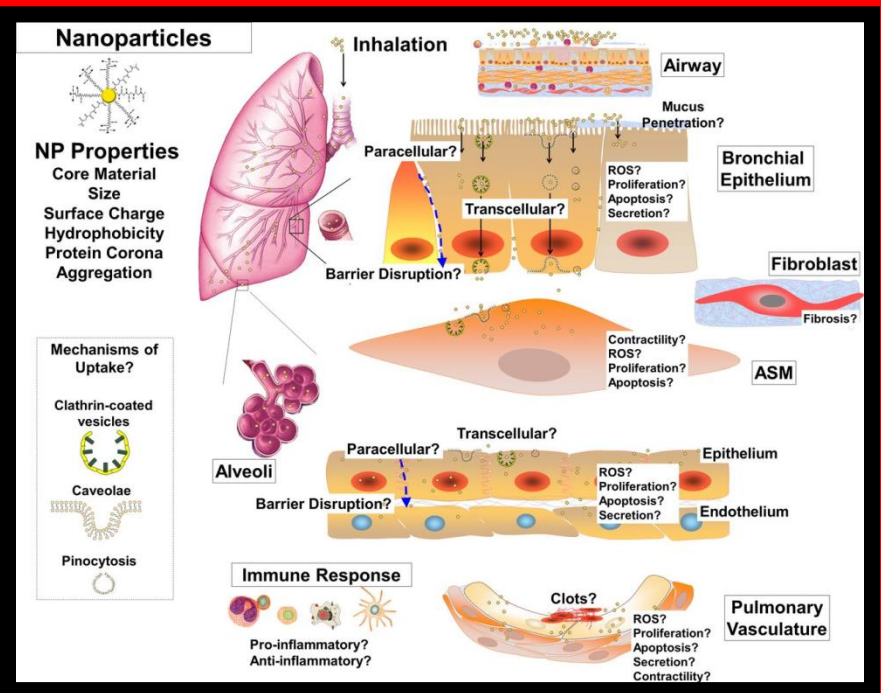
- Light, *especially blue light*, suppresses melatonin production by the pineal gland.
- Melatonin is involved in maintaining circadian rhythms – 24hr daily behaviour cycles.
- Melatonin is also oncostatic – it suppresses cancers.
- Some cancers (especially breast and prostate) more common in illuminated areas.



Medical Implications (2)

Image credit: Y. S. Prakash ,and Sadis Matalon
<http://ajplung.physiology.org/content/306/5/L393>

- Contributes to air pollution by destroying nitrate radicals that break down pollutants discharged by vehicles and factories.
- These pollutants exacerbate asthma, bronchitis, cystic fibrosis, and emphysema.
- Some energy consumed for lighting produces nanoparticles that enter the body through the respiratory and digestive systems and disrupt normal physiology.
- The deliberate floodlighting of residential properties may further lead to an increase in breast cancer.



Social implications (1).

- Neighbour disputes – householders suffer loss of amenity when light trespasses on their property.
- Crime – most crime occurs in daylight, ergo criminals need light.
- Crime drops by up to 50% where lighting curfews have been introduced.
- Drops almost to zero during power failures.



Social implications (2)

- The Lighting industry aims to maximise profits by a campaign of misinformation.
- It panders to a natural fear of the dark.
- It cons the public into believing that more and brighter lights improve safety and reduces crime. *In fact lighting encourages crime.*
- Municipalities think it is acceptable to install lighting outside properties without householders' consent.

Social implications (3)

- **Alternative methods to improve road safety should be considered before lighting is installed.**
- **Expensive. Electricity and fuel consumed must be paid for.**
- ***Lighting should only be applied sparingly, on a needs must basis, where needed, when needed, in the right amounts and using appropriate smart lighting technology.***

Social implications (4)

- Lighting that cannot be construed as useful should be eliminated.
- This includes all forms of vanity lighting:
Illuminated buildings and monuments, illuminated urban regeneration follies (crass “art” projects), illuminated advertising, skybeams and lasers.

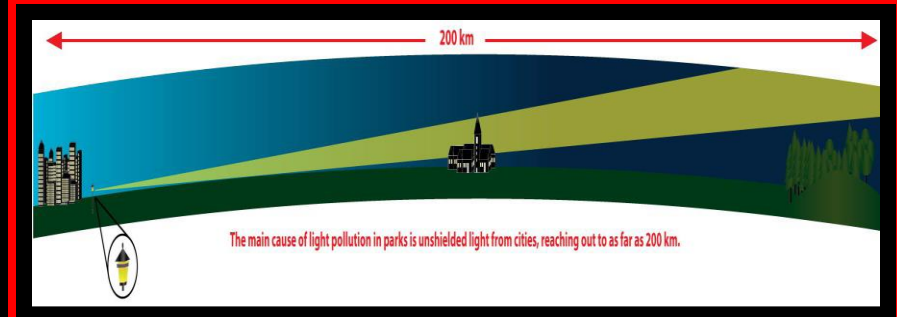


Solutions (1)

Image credit: Andrej Mohar.

http://www.darkskyparks.org/docs/Lastovo2010_Mohar.pdf

- Motor vehicles have headlights!!
- 45° full cut-off lighting to reduce sky glow and prevent illumination of the cloud ceiling due to the Earth's curvature.
- Motion operated L.E.D. lighting in residential and suburban areas. One lighting manufacturer is already developing a system based on this idea.
- Low colour temperature (ideally 2000K and not in excess of 2700K) amber coloured L.E.D.s with reduced short wavelength component.
- 11p.m. till dawn curfews in residential and suburban areas. No pre-dawn lighting. Institution of winter timetables during winter months to obviate early morning lighting.
- No street lighting in rural areas unless absolutely necessary.



Solutions (2)

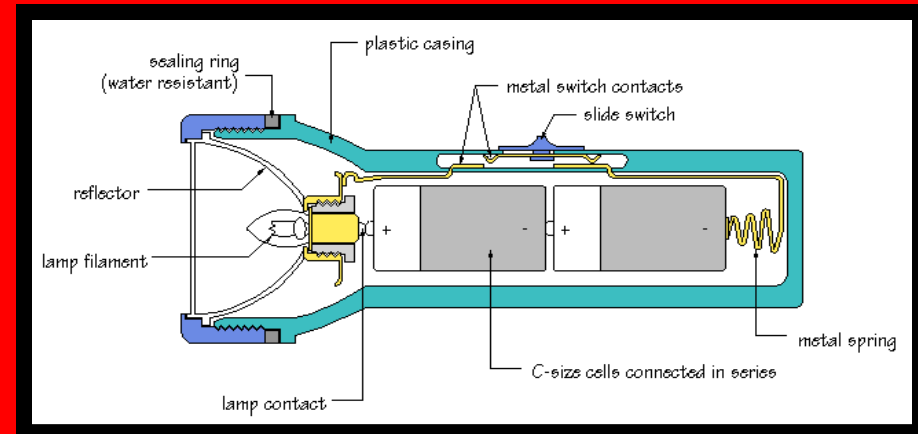
- Planners should consider alternative solutions to make roads safer:
- Cat's eyes and other reflective devices.
- Reflective signage.
- Smart signage – glow-in-the-dark road markings.
- L.E.D. solar powered, motion operated road studs.
- Concrete baffles or elevated crash barriers on motorways to eliminate the glare of oncoming traffic.
- Speed limits and speed-humps on the approaches to established hazards.
- *Most of these consume little or no energy, and require little maintenance.*



Solutions (3)

Image credit: <http://www.doctrionics.co.uk/circuits.htm>

- Pedestrians should wear bright clothing at night to make themselves visible, and should carry a torch.
- Sports facilities should be roofed over or sports enthusiasts encouraged to carry out their activities in daylight.
- Planning permission and taxes on domestic security lighting.
- Bans on vanity lighting in, or which can be seen from, residential, suburban or rural areas.
- Making light pollution a statutory nuisance in law.
- *Municipalities should remove obtrusive lighting affecting properties on request.*



May be unpopular

- **Objections to lighting management should not be subject to a referendum or a popular vote.**
- **Those concerned about loss of amenity need to be convinced that light pollution is a major threat to the environment and human health.**
- **They should realise that the prevailing situation is unsustainable and can no longer be allowed to continue.**
- ***The essence of good governance is to know what the people want, and to know what the people need, and to have the wisdom to understand the difference.***
- **In order to protect the planet, urgent remedial action is needed.**

Conclusions

- **Light pollution is very damaging to the environment and human health**
- **It can easily be remedied by good lighting practice, legislation and common sense.**
- **It can be substantially reduced without loss of amenity or reduction in security.**
- **Communities and the environment will all stand to benefit: it is a win-win situation.**
- **Thank you.**

