

Lincoln

Dark Skies

Committee

**Seeking to mitigate light
pollution and protect our
environment**



**The Lincoln Dark Skies Committee,
a subcommittee of the Planning Board
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Dark Skies Committee Members (nominated)

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Kathryn Walker: Writing and editing
Alan Sliski: Technical expert and Dark Skies advocate
Kim Bodnar: Select Board



If I cannot move heaven, I will raise hell. (Virgil, Aeneid)

Dark Skies Mission

Honoring its history as a rural, by-right farming community and its legacy of leadership in land conservation, Lincoln seeks through education and practice to further protect the natural environment by better understanding and mitigating the adverse effects of excessive artificial light on the natural world and its nocturnal wildlife.

International and MA Dark Sky initiatives

<https://darksky.org/>

<https://darksourcemass.org/about-us/idas-massachusetts-chapter/>

Has our current zoning bylaw been effective?

- Light levels have increased in Lincoln despite the adoption of new bylaws in 2012
- Not only do we have more light, but we have more blue light
- Development continues
- What are the primary concerns?

What can we do to improve conditions?

2013



2023



Artificial light at night harms our fauna

- 100 years ago, humans began to alter and disrupt the natural cycle of nights and days
- 20 years ago, LED lights introduced more white light into the night, greatly endangering ecosystems



- Blue/white light is disorienting to migrating birds, causing them to wander off course and sometimes die upon crashing into buildings.
- Glare hinders the owl's ability to see, hunt and feed, and it interferes with the nocturnal activity of frogs, toads and salamanders to breed. It can also kill beneficial insects.
- Insect pollinators are known to avoid artificially lit agricultural fields, thus endangering our food supply.
- Animals also stay away from areas affected by artificial light trespass, further diminishing their habitat that is already in severe decline.



Artificial light at night disrupts the Ecosystem



Moths rely on natural starlight or moonlight to navigate at night but become trapped in a doom spiral around artificial light, often leading to their deaths.

When moths can't breed,
The chicks of many birds can't feed.

Artificial light at night can also be harmful to human health

- Excessive light at night can interfere with sleep patterns, and bright artificial light has been linked to an increased risk of stroke, cancer and Alzheimer's disease.
 - Excessive lighting from neighbors or streetlights can illuminate large areas, possibly depriving residents from the experience of darkness on their own property.



Lincoln's library illuminates a private garden

- We're All Healthier Under a Starry Sky, Mario Motta: https://images.clubexpress.com/71141/attach/3935311_1_JOE-MarioMottapeerReview-10-2-24.pdf
- Mental and physical illness may be linked by a 'broken' circadian rhythm due to ALAN exposure. Su, K., et al. *Brain, Behavior, Immunity – Health*, Vol. 26, p. 100533.
- Excessive night lighting, especially blue light, leads to myriad deleterious health effects: <https://www.mariomottamd.com/street-lighting/>
- ALAN is associated with the prevalence of Alzheimer: <https://www.frontiersin.org/news/2024/09/06/light-pollution-increase-risk-alzheimers>
- Exposure to artificial bright light is linked to higher risks of strokes: <https://newsroom.heart.org/news/more-exposure-to-artificial-bright-outdoor-nighttime-light-linked-to-higher-stroke-ris>

The stars are the jewels of the night, and perchance surpass anything which day as to show (Henry David Thoreau)

Some areas could be improved in Lincoln

Good Examples

- Codman Farms and Estate (Fortunately, no picture could be taken because it is dark)

Some areas of concern

- Institutions
 - School
 - Library
 - Some churches
- South Lincoln mall area
 - Parking lots
 - Businesses
- Streetlights
- Private properties
 - Excessive landscape lighting
 - Doorway and porch lights
- Condo properties
 - Lincoln Ridge
 - Ryan Estate



When you reach for the stars you may not quite get one, but you won't come up with a handful of mud either. (Leo Burnett)

Safety and Security: More light is not necessarily better

- Experts agree that there is no substantial evidence that a lighter environment is a safer environment. In fact, too much lighting and glare can negatively impact safety.
- Consistent lower intensity lighting when and where needed, and motion-activated lighting would improve safety and security.

Glare from bright, unshielded lights actually decreases safety. See how glare in the closest photo makes it hard to see the man at the gate? Glare creates deep shadows, making it more difficult to see. The bright light shines into your eyes, constricting your pupils. This diminishes your eyes' ability to adapt to low-light conditions. So, is that bright light really making this area safer?



Switching off street lighting during overnight hours can reduce instances of theft from vehicles parked along streets. Tompson, L., et al.

Bright LEDs could spell the end of dark skies. <https://www.technologyreview.com/2022/08/17/1057652/outdoor-led-lighting/>

Streetlights effects on crime: <https://www.theatlantic.com/ideas/archive/2024/09/streetlights-effect-on-crime/679652/>

The stars that nature hung in heaven, and filled their lamps with everlasting oil, give due light to the misled and lonely traveler. (John Milton)

Color Temperature & Light Intensity

Color Temperature of Light (Kelvin)



- Color temperature describes the hue of the light, and it is measured in degrees of Kelvin
 - Candle flame: 1800K
 - Incandescent: 2700K
 - Day light: 5000K
 - Blue sky: 8000K-10,000K
- Intense blue light is the most disruptive to sleep and wildlife.

Light Intensity (Lumens)



- The light output of a source is measured in lumens.
 - Watts is the measure of energy used to generate light.
 - A 9-watt LED is equivalent to a 60 watts incandescent bulb
- How many lumens are needed depends on use
 - 200-500 lumens is considered sufficient to illuminate an entrance way
 - Lincoln's outdoor lighting guidance restricts a light source to 900 lumens but does not limit the number of light sources
- Illumination, measured in Lux, is what truly matters

<https://darksky.org/news/why-is-blue-light-at-night-bad>.

<https://nvlightingga.com/blog/how-bright-should-outdoor-lighting-be>

<https://www.streetlights-solar.com/how-many-lumens-do-i-need-for-outdoor-lighting.html>

International Dark Sky Lighting Guidelines

Five Lighting Principles for Responsible Outdoor Lighting



Responsible outdoor lighting is

1 Useful

Use light only if it is needed

All light should have a clear purpose. Consider how the use of light will impact the area, including wildlife and their habitats.



2 Targeted

Direct light so it falls only where it is needed

Use shielding and careful aiming to target the direction of the light beam so that it points downward and does not spill beyond where it is needed.



3 Low Level

Light should be no brighter than necessary

Use the lowest light level required. Be mindful of surface conditions, as some surfaces may reflect more light into the night sky than intended.



4 Controlled

Use light only when it is needed

Use controls such as timers or motion detectors to ensure that light is available when it is needed, dimmed when possible, and turned off when not needed.



5 Warm-colored

Use warmer color lights where possible

Limit the amount of shorter wavelength (blue-violet) light to the least amount needed.



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<https://darksky.org/resources/guides-and-how-tos/lighting-principles/>

Many a night I saw the Pleiades, rising thro' the mellow shade, Glitter like a swarm of fireflies tangled in a sliver braid. (Alfred Tennyson)

Current & Proposed Regulations

Current Language resides within Lincoln's Zoning Bylaw – applies only to new construction

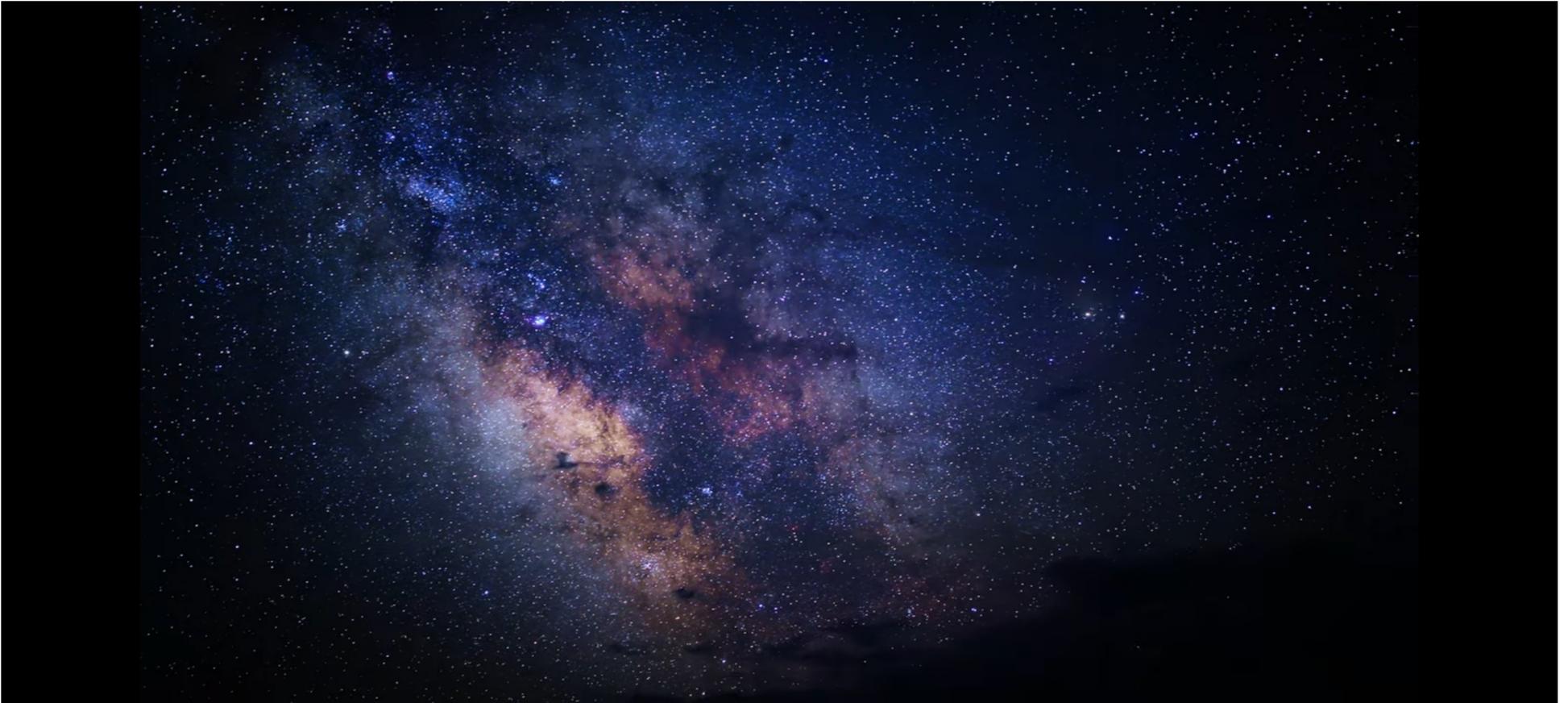
- 13.5 Exterior Lighting: All artificial lighting permanently installed in any district, shall consist only of fully shielded light fixtures and be so installed or shielded as to prevent direct light or glare from the light source from interfering with the vision of motorists or pedestrians passing in the street or streets abutting the premises and as to prevent direct light or glare from illuminating neighboring properties.
- 13.5.1 All exterior lamps shall have a Correlated Color Temperature (CCT) value of 3000K or below.

New Language Proposed for General Bylaws – applies to all properties, both public & private,

to address the following key areas of concern:

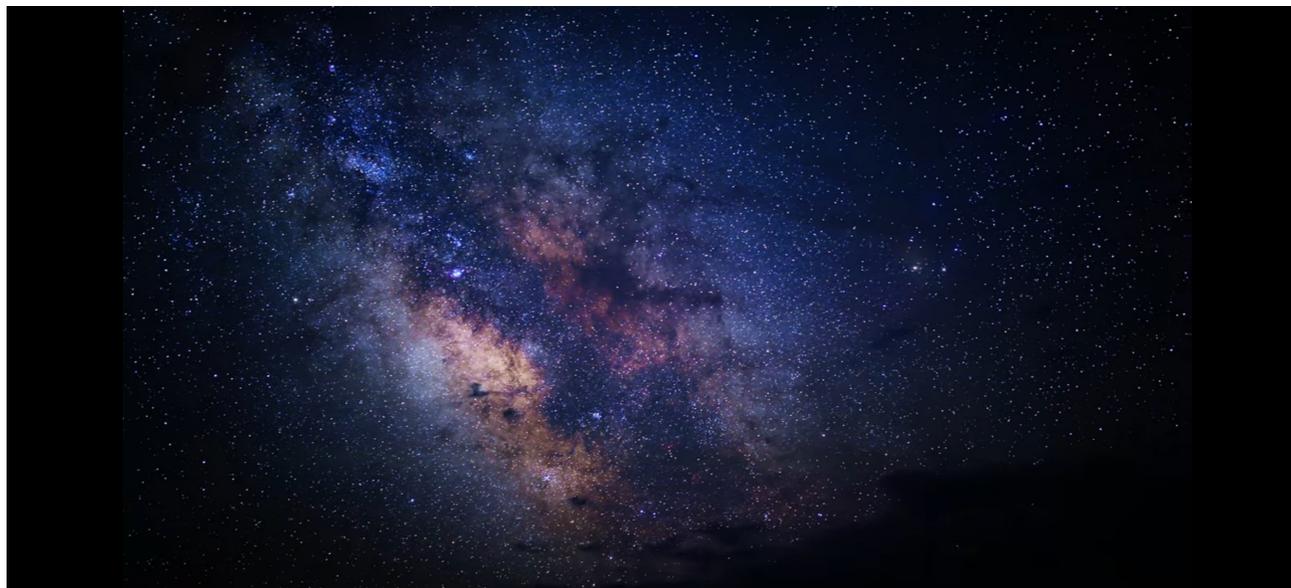
- Regulating streetlights, lighting of all parking lots & all public buildings
- Regulating lighting of commercial establishments, including limiting lighting to hours of operation
- Limiting levels of illumination by capping lumen output & Kelvin rating of light sources
- Minimizing glare by requiring a balanced approach to shielding and types of fixtures allowed
- Requiring state-of-the-art lighting controls, including timers & dimmers on all appropriate light fixtures

Next Steps?



The Milky Way as seen from Moab, Utah.
What are we missing?

Questions & Comments?



Please see us at our informational table outside.

Thank You!