

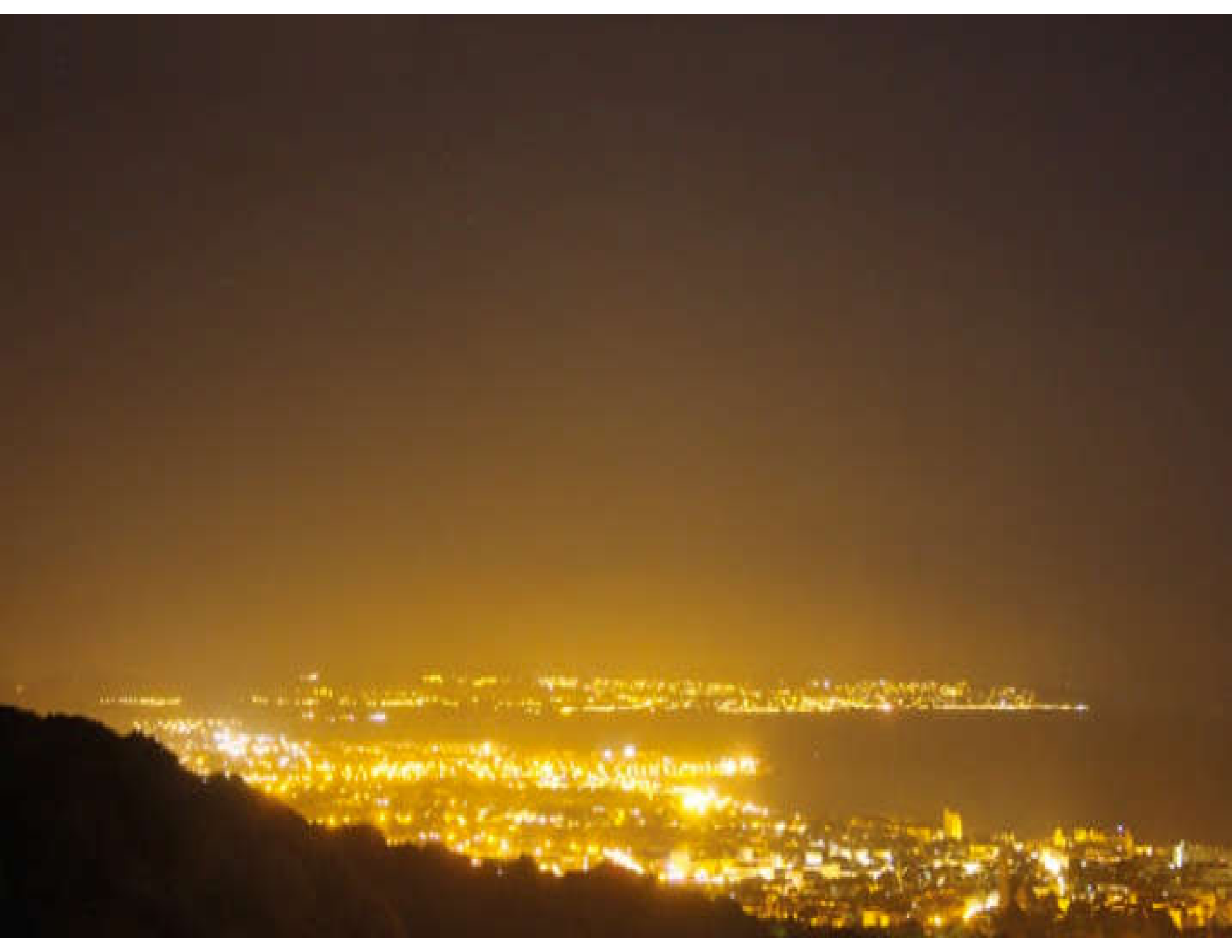


Arkansas Natural Sky Association

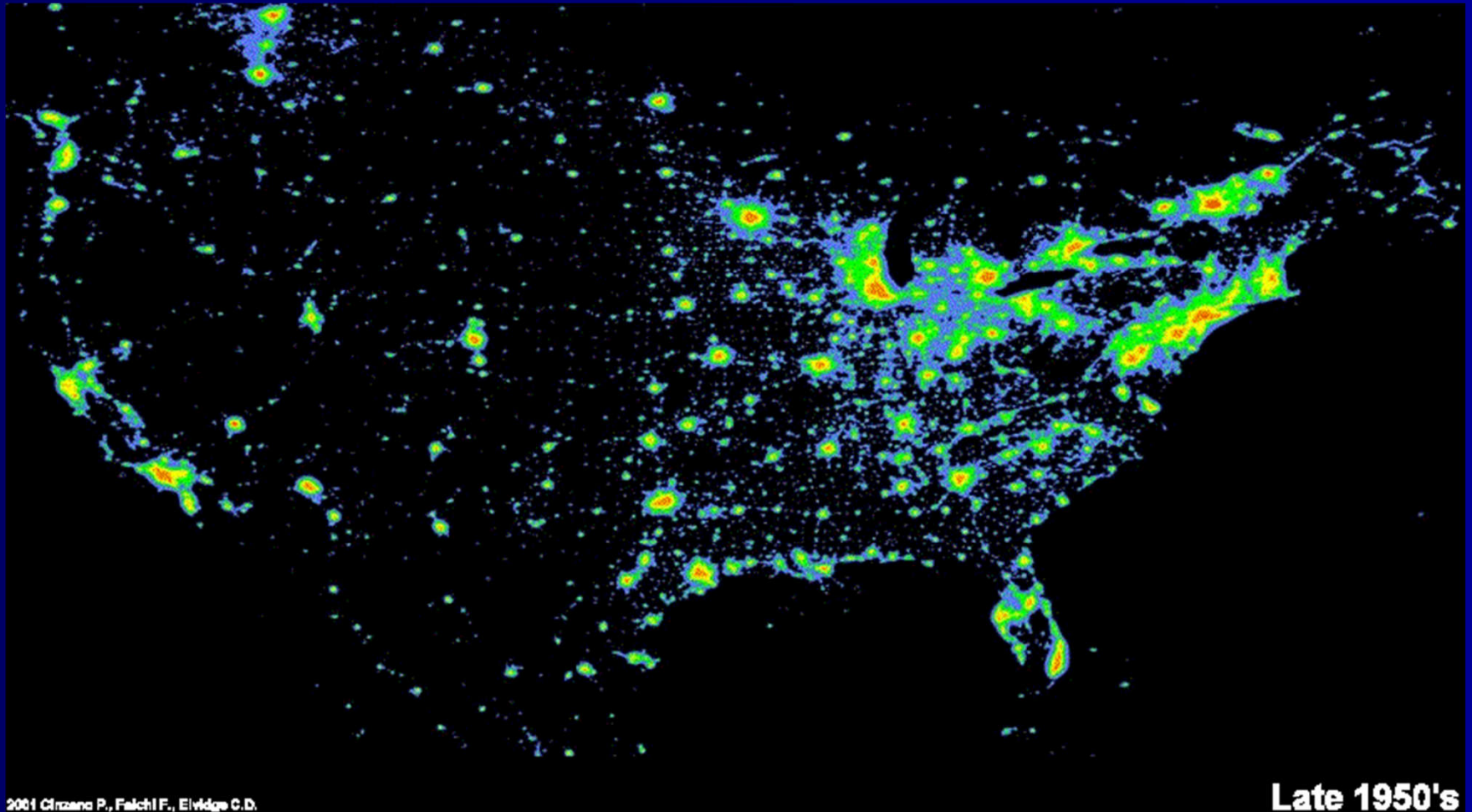
Light Pollution – An Assault on Nature at Night

The Night Sky - A Natural Heritage Resource





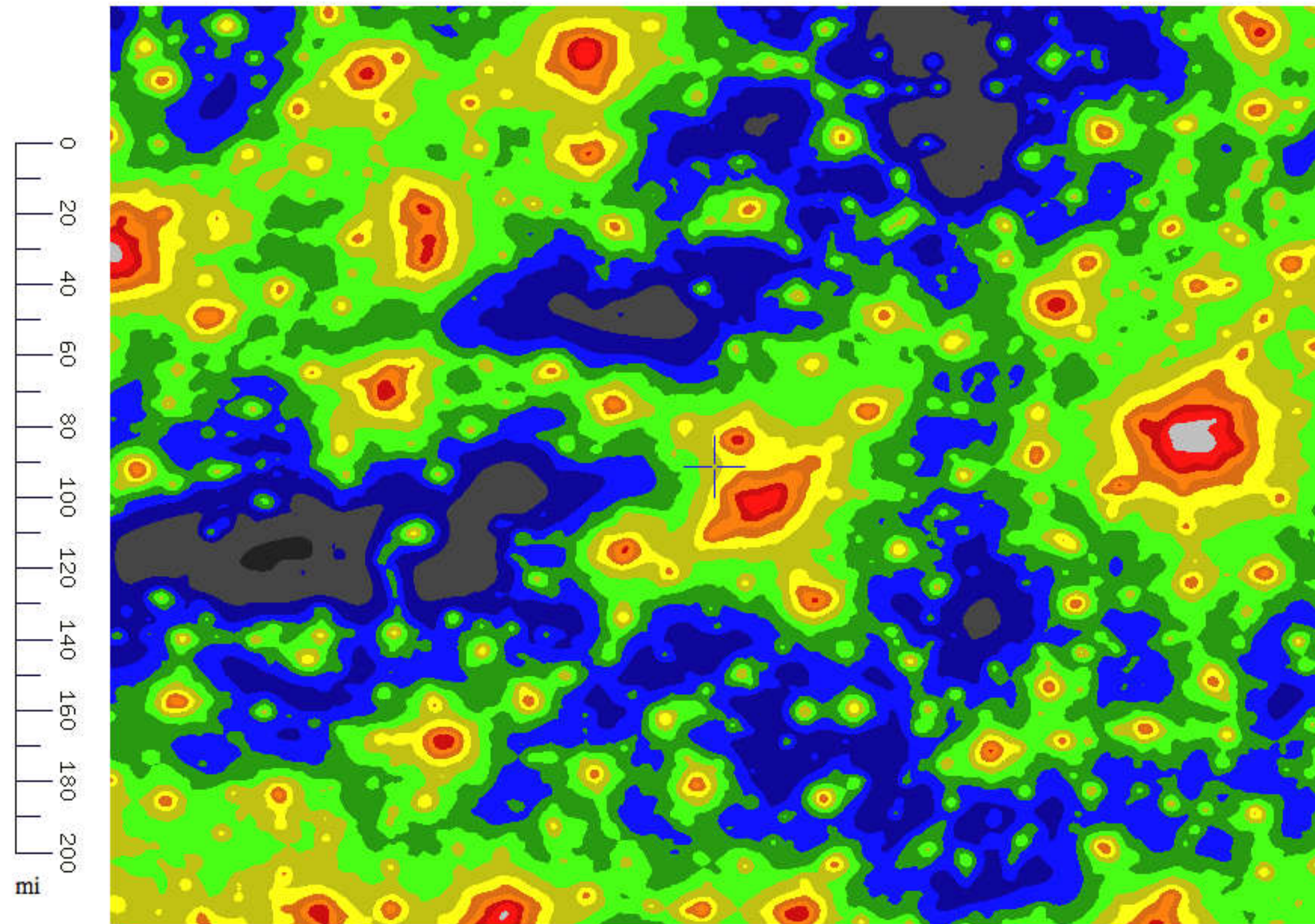
The proverbial frog in a slowly heated pan



2001 Cirzano P., Falchi F., Elvidge C.D.

Late 1950's

[\(Show all in google maps\)](#)



What is light Pollution?

- Artificial Light placed into the environment where it is not useful or harmful, typically characterized in one of four categories:
 - Glare
 - Skyglow
 - Trespass
 - Clutter

Light Pollution: What's The Harm?

- Besides hiding the stars, Light Pollution:
 - Wastes money and energy
 - Contributes to air pollution and green house gases (100 Watt bulb = <.5 ton of CO₂)
 - Alters the diurnal cycle impacting:
 - animal, plant and human health
 - Can contribute to crime and accidents
 - Creates nuisance and light trespass
 - Hides nature's grandest spectacle
- There literally is nothing good about Light Pollution

Wasted Energy

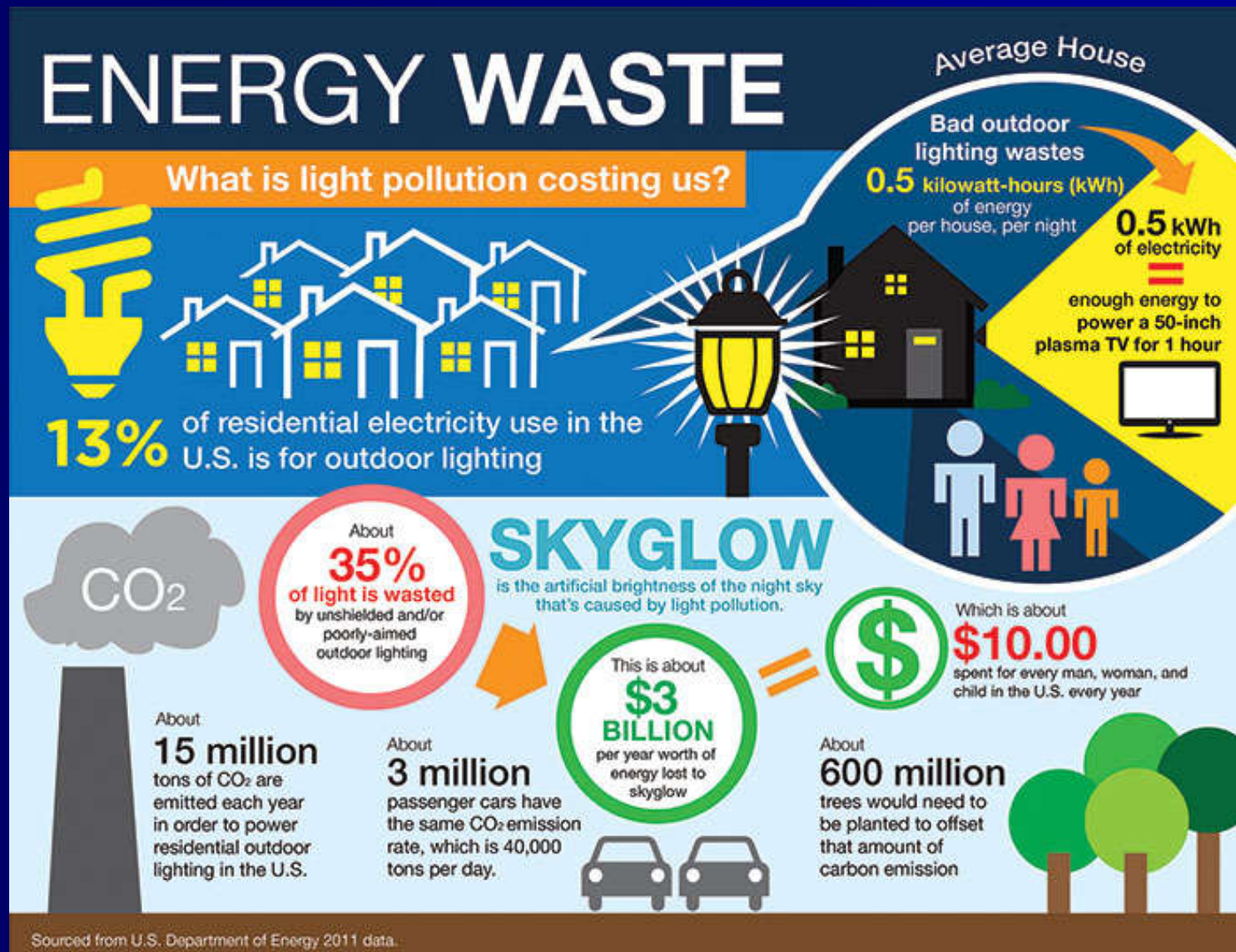


Lights at Night: Video from International Space Station, February 2012

IDA in Partnership with NOAO, NSF and IYA
Dark Skies Awareness

\$\$ & CO2

Beware Jevon's Paradox



Human Health - 2009



American Medical Association 2009:

- Light at night “. . . disrupts human and animal circadian rhythms . . .”
- Risks: diabetes, depression, obesity and cancers – breast and prostate.
- Disability (blinding): Glare is a safety hazard
- “Advocates” future outdoor lighting be “energy efficient” and “fully shielded!”

Consensus View

Light at Night Disrupts the Circadian Clock and Impairs Health

2007



Shiftwork that involves circadian disruption is "probably carcinogenic to humans"

"Epidemiological studies have found that long-term night-workers have a higher risk of breast cancer risk than women who do not work at night.

*These studies have involved mainly nurses and flight attendants. The studies are consistent with animal studies that **demonstrate that constant light, dim light at night, or simulated Chronic jet lag can substantially increase tumour development.***

Other experimental studies show that reducing melatonin levels at night increases the incidence or growth of tumours."

2012



The primary human concern with nighttime lighting include... potential carcinogenic effects related to melatonin suppression, especially breast cancer.

Other diseases that may be exacerbated by circadian disruption include:

- **Obesity**
- **Diabetes**
- **Depression**
- **Mood Disorders**
- **Reproductive problems**

2018

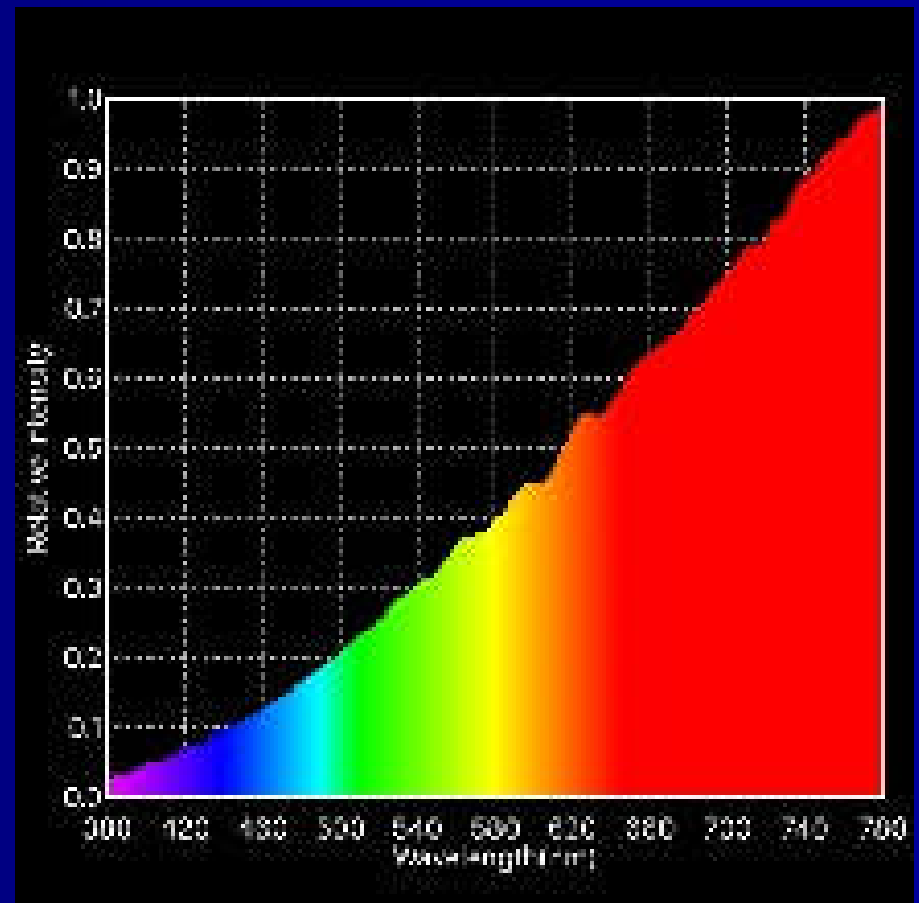
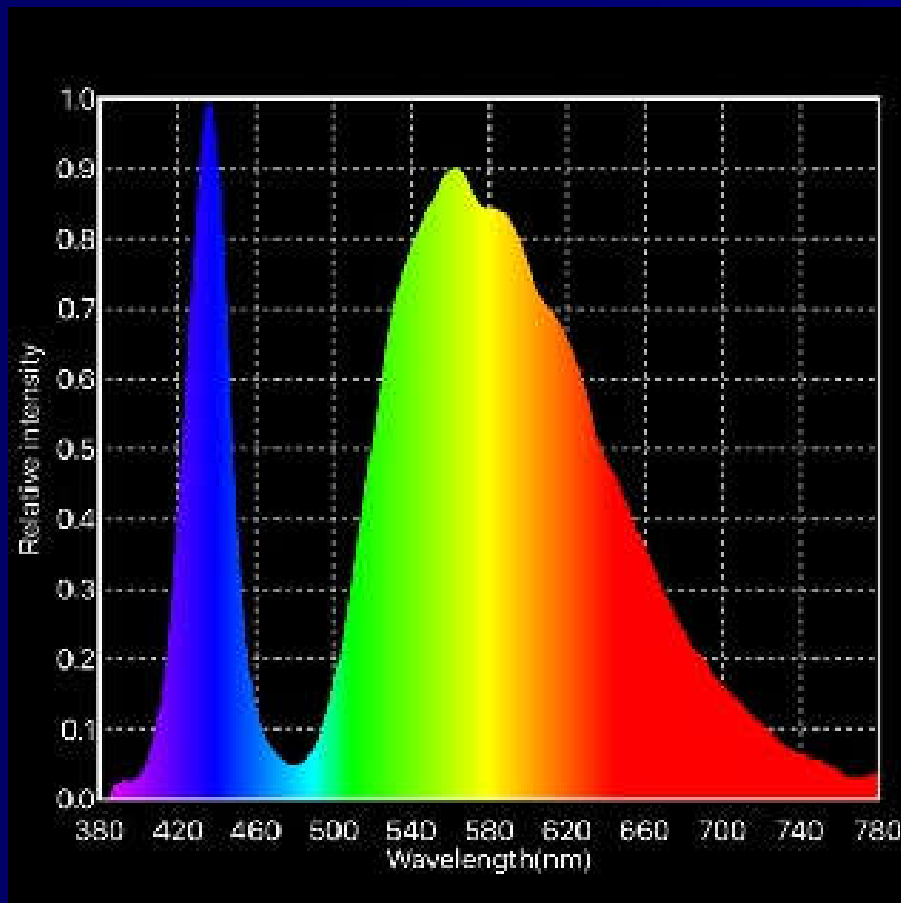


Risk of Carcinogen Report : 2018

The carcinogenic effects of blue-rich light at night that causes circadian disruption in shiftworkers and others is now officially recognized as a major health issue by the NIH National Toxicology Program

- Night shift work that causes circadian disruption is **known to be a human carcinogen** based on sufficient evidence of carcinogenicity from studies in humans.
- Excessive light at night exposure (with blue wavelengths) combined with insufficient daylight exposure that cause circadian disruption are **reasonably anticipated to be a human carcinogen.**
- **Based on 650 scientific studies**

LED 7 Using the Proper Color: The Blue Light Problem



The Health Mechanism

How exposure to **blue light** affects your brain and body

BY DISRUPTING MELATONIN, **SMARTPHONE LIGHT** RUINS SLEEP SCHEDULES. THIS LEADS TO ALL KINDS OF **HEALTH PROBLEMS**:

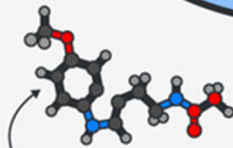
The disruption to your sleep schedule might leave you distracted and impair your **MEMORY** the next day.



A poor night's sleep caused by smartphone light can make it **HARDER TO LEARN**.



Over the long term, not getting enough sleep can lead to **NEUROTOXIN** buildup that makes it even harder for you to get good sleep.

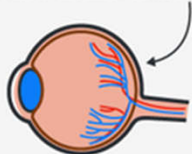


People whose melatonin levels are suppressed and whose body clocks are thrown off by light exposure are more prone to **DEPRESSION**.



By disrupting melatonin and sleep, smartphone light can also mess with the hormones that control hunger, potentially increasing **OBESITY RISK**.

There's some evidence that blue light could damage our vision by harming the **RETINA** over time – though more research is needed.



Researchers are investigating whether or not blue light could lead to **CATARACTS**.



There's a connection between light exposure at night and the disturbed sleep that come with it and an increased risk of breast and prostate **CANCERS**.



SOURCES: Nature Neuroscience; Harvard Health Publications; ACS, Sleep Med Rev, American Macular Degeneration Foundation; European Society of Cataract and Refractive Surgeons; JAMA Neurology

Blue Light Warning – 2016

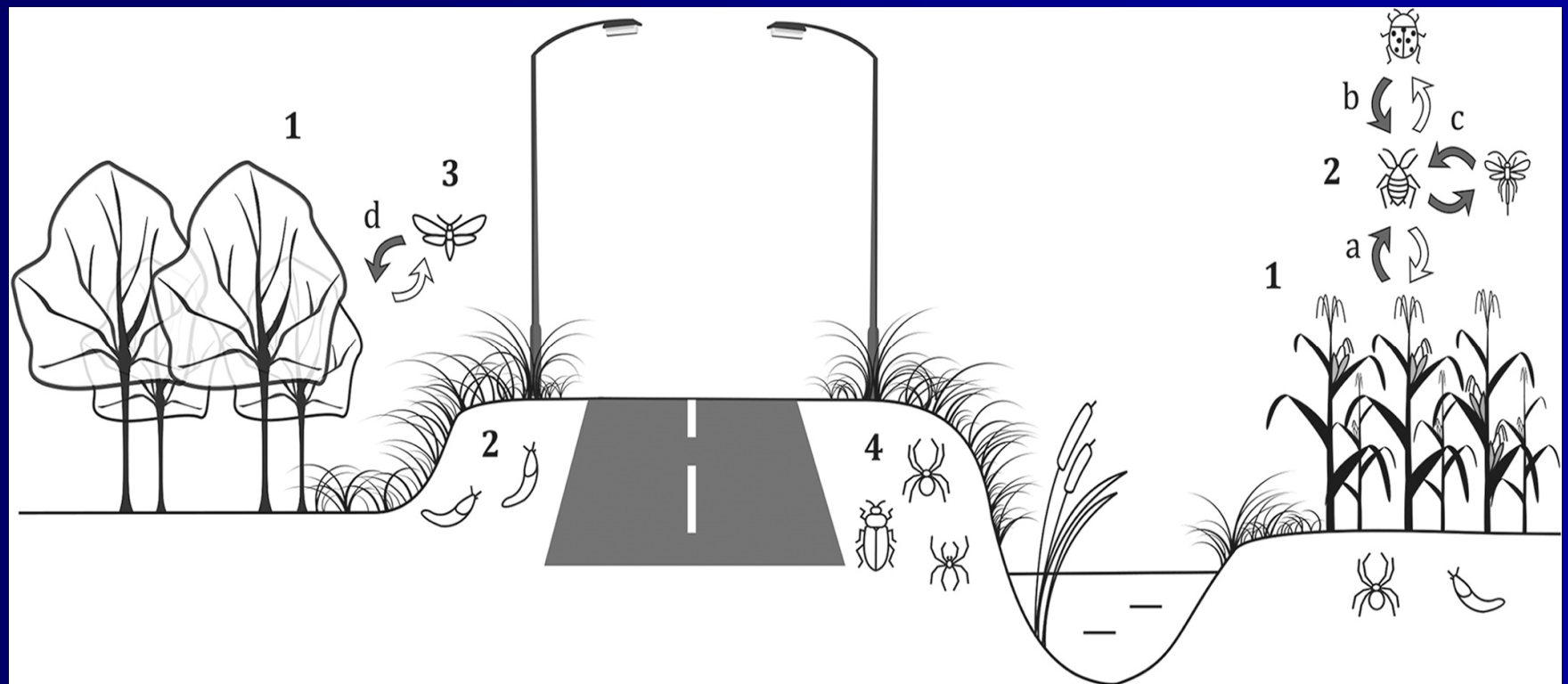


- 2016 AMA highlights the risk of blue light content of LED fixtures. Recommends avoiding:
 - fixtures with high blue content
 - unshielded fixtures
 - over-lighting
- “Here’s To Your Health” by UAMS
- Check your iphone computer apps

Plant impact – Seasonal Confussion



Insect Biomass Decline



Another Encroachment on Natural Habitat

- Navigational impacts – sea turtles, migratory birds and some insects
- Alters predator prey balance for nocturnal species
- Interferes with mating, growth, and maturation
- Shrinks habitat



Birds Phototaxis?



Bird fatal building strike surveys



Mississippi Flyway

MOST BIRDS IN NORTH AMERICA ARE MIGRATORY

70%

of terrestrial recurring
birds are migratory.

80%

of those birds migrate
at night.



INTERNATIONAL DARK SKY ASSOCIATION

 Audubon



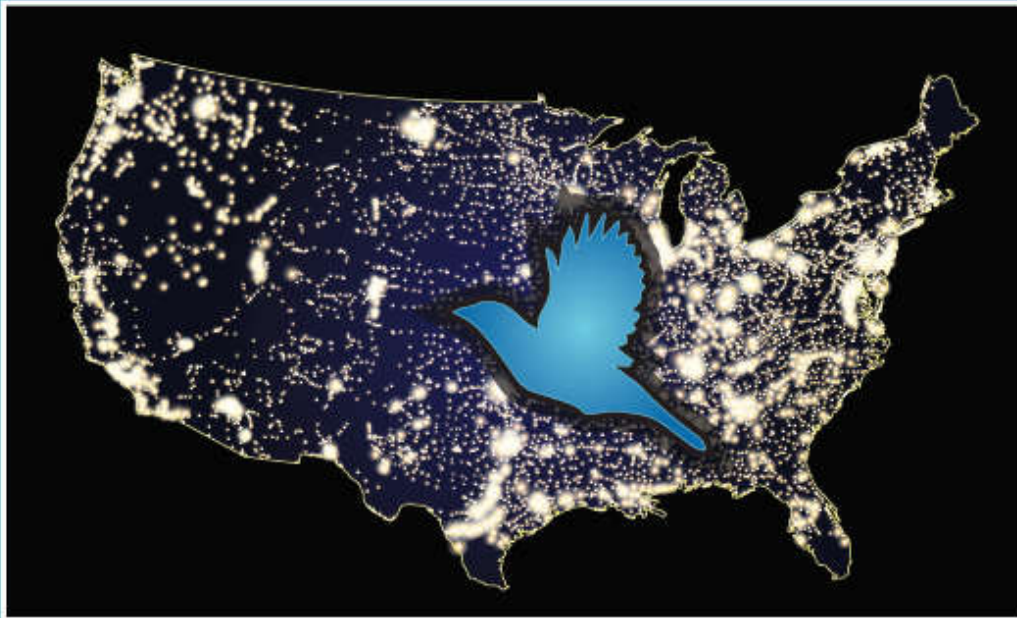
By turning off excess lighting, we can help to provide migrating birds safe passage between their nesting and wintering grounds.

 Audubon



INTERNATIONAL DARK-SKY ASSOCIATION

Lights out Heartland



Lights Out
Heartland

Irresponsible Lighting Sources

- Improperly Aimed and Shielded Fixtures.
- Over Lighting (which is poor lighting).
- Unmonitored dusk to dawn lighting.
- Failure to use timers & sensors.
- Vanity “look at me” Lighting.
- Marketing “look at me” lighting.

Unsafe Lighting: Disability Glare



Disability glare = light that blinds rather than illuminates



Photos © George Fleenor

Good visibility is the goal



© International Dark-Sky Association

Unshielded & Misdirected



Over Lighting: Utility Company "Security Lighting"

530 Lux vs. 30 Lux recommended!

Notice the darkness past the tree.

All the units have their blinds closed tight.

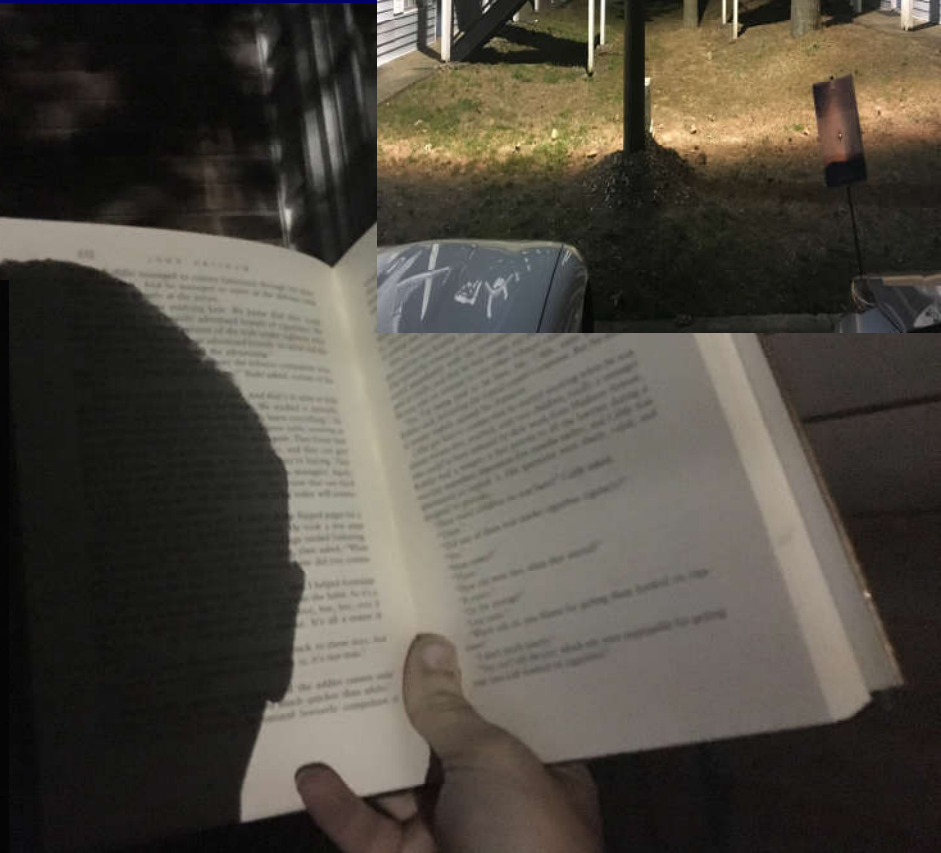
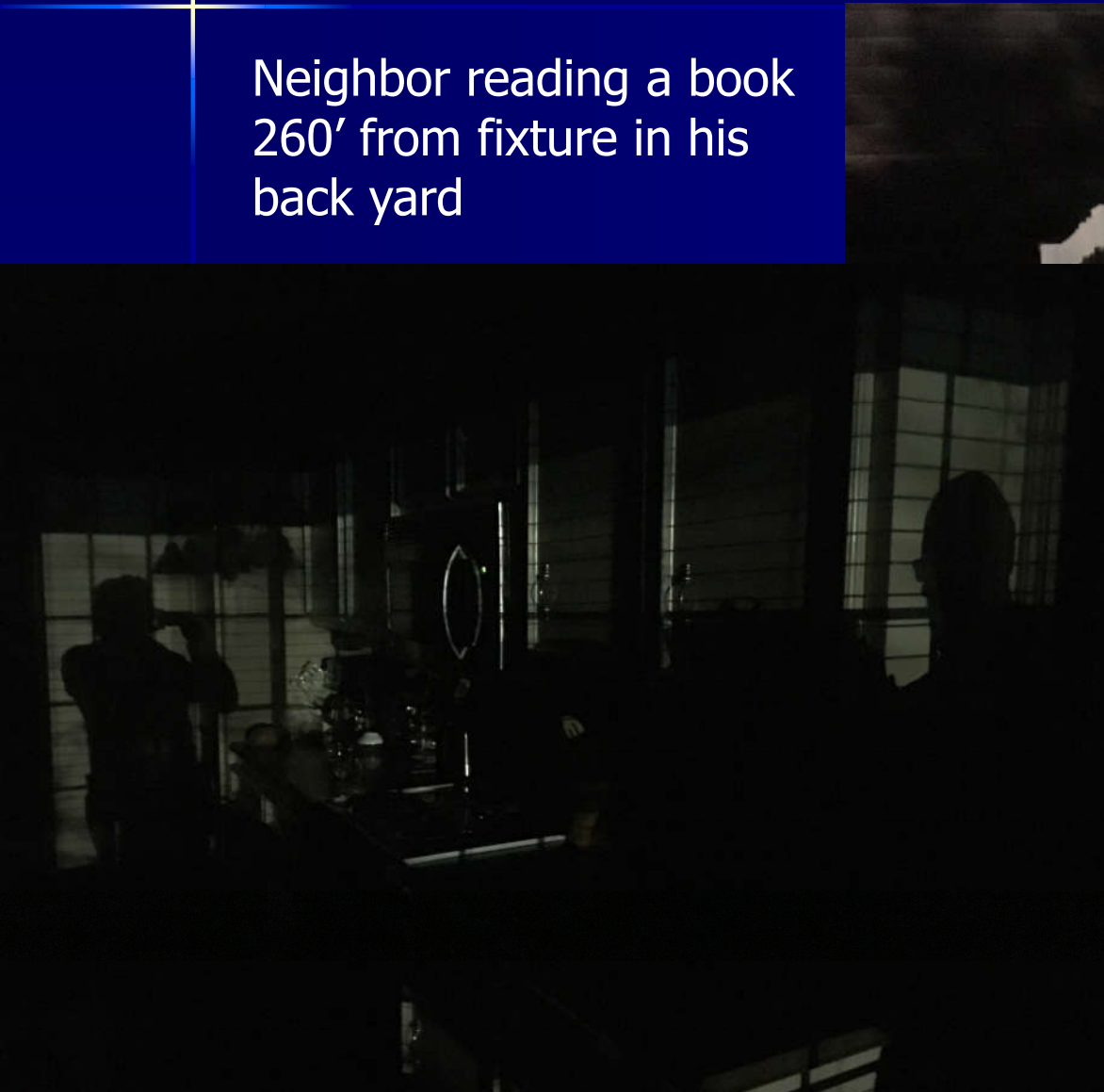
Notice shadows.

Notice light in the trees.



Light Trespass!

Neighbor reading a book
260' from fixture in his
back yard



Shadow of person taking this
picture while standing in the
kitchen window.

Over-Lighting / Marketing

Are we attracting moths, or providing necessary illumination?



Over Illumination - IES Manual on Exterior Lighting RP-33-14, section 4.6.1:

“Too often, people associate brighter light and glare with “safer” surroundings. In reality, more light and glare do not necessarily equate to better lighting. It can be easily demonstrated that too much light, or poorly directed light, actually causes a loss of visibility.”

Vanity Lighting – A garish display of Oblivious Hubris.



All in one



When & where Needed - Light & Crime: The Cockroach Theory

Safety Quiz (True or False)

1. Night lighting has been proven to reduce crime.

FALSE

2. Most property crimes occur at night. *

FALSE

3. Lighting can actually attract criminals. *

TRUE

* National Institute of Justice study (1997)

"We can have very little confidence that improved lighting prevents crime, particularly since we do not know if offenders use lighting to their advantage."



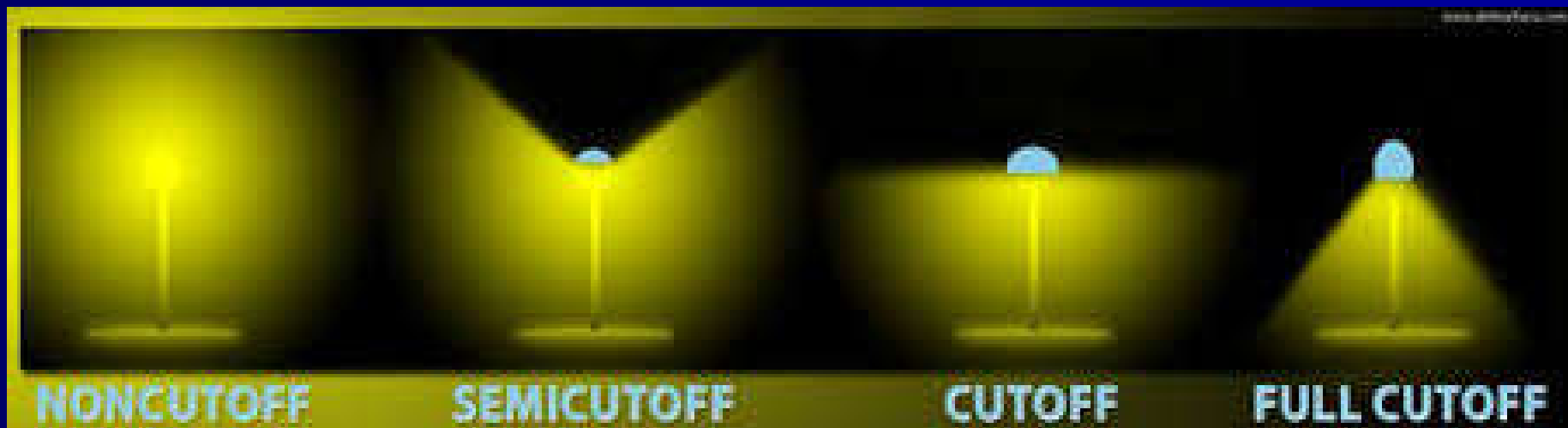
The Solution:

Responsible Lighting Principles

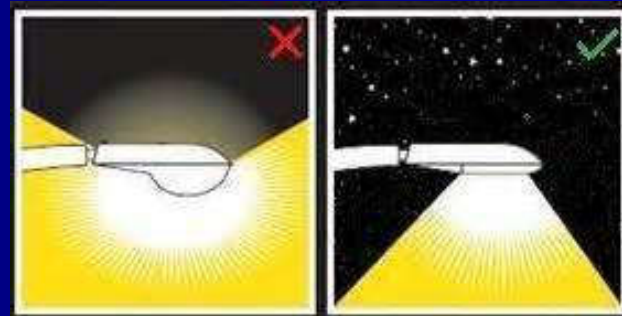
- Only light where needed (which means using efficient fully shielded properly aimed fixtures).
- Only light when needed (use curfews, motion sensors, timers and switches etc.)
- Avoid over lighting.
- Use appropriate color light for the purpose.

Where needed

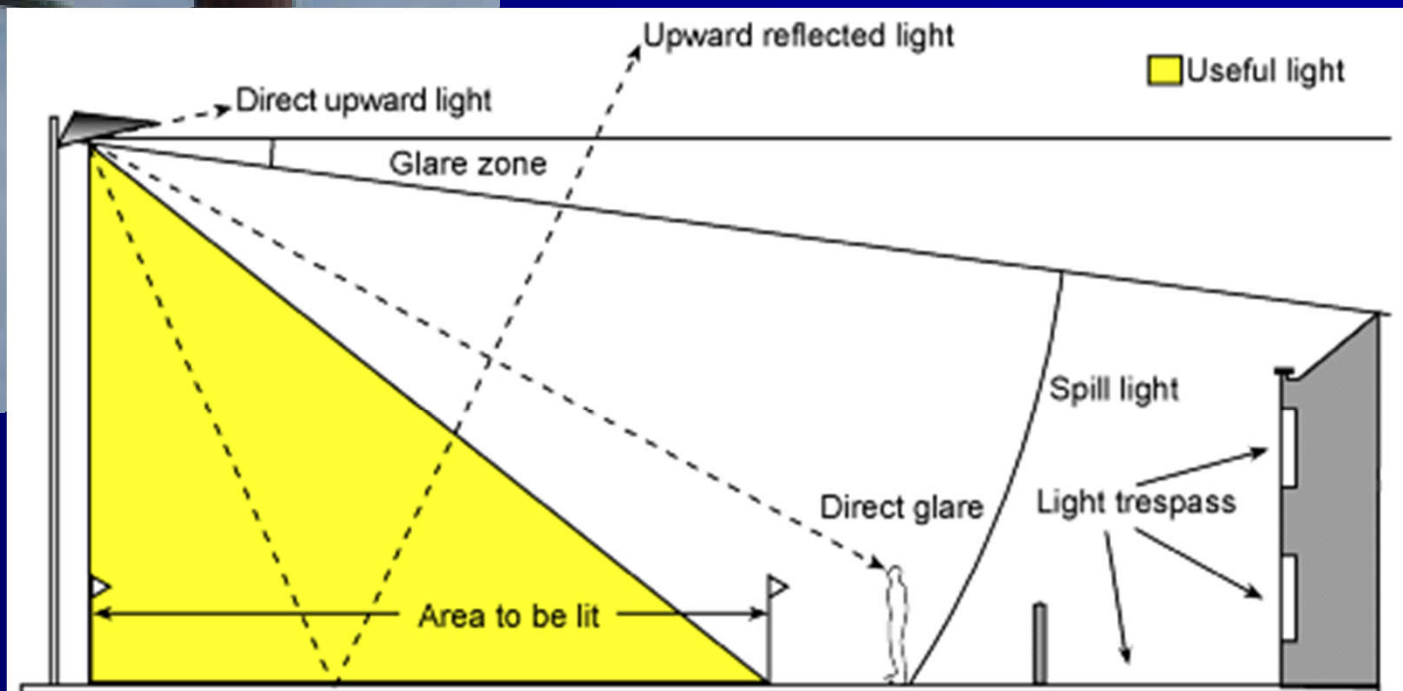
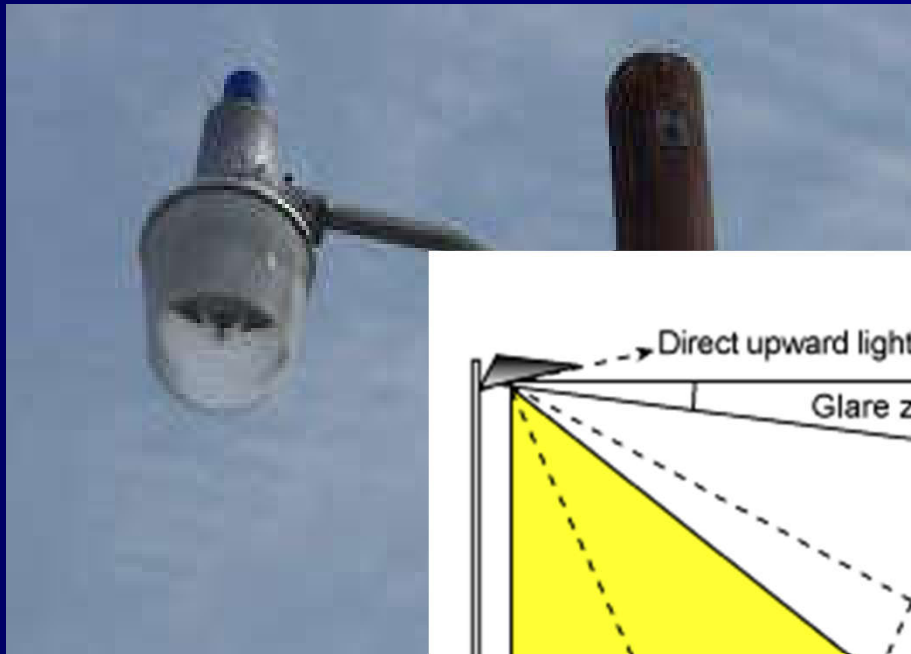
Shielding - Avoiding Waste, Up-light, Glare & Trespass



Notice Highway lighting
Subject to Fed funding
Changing styles

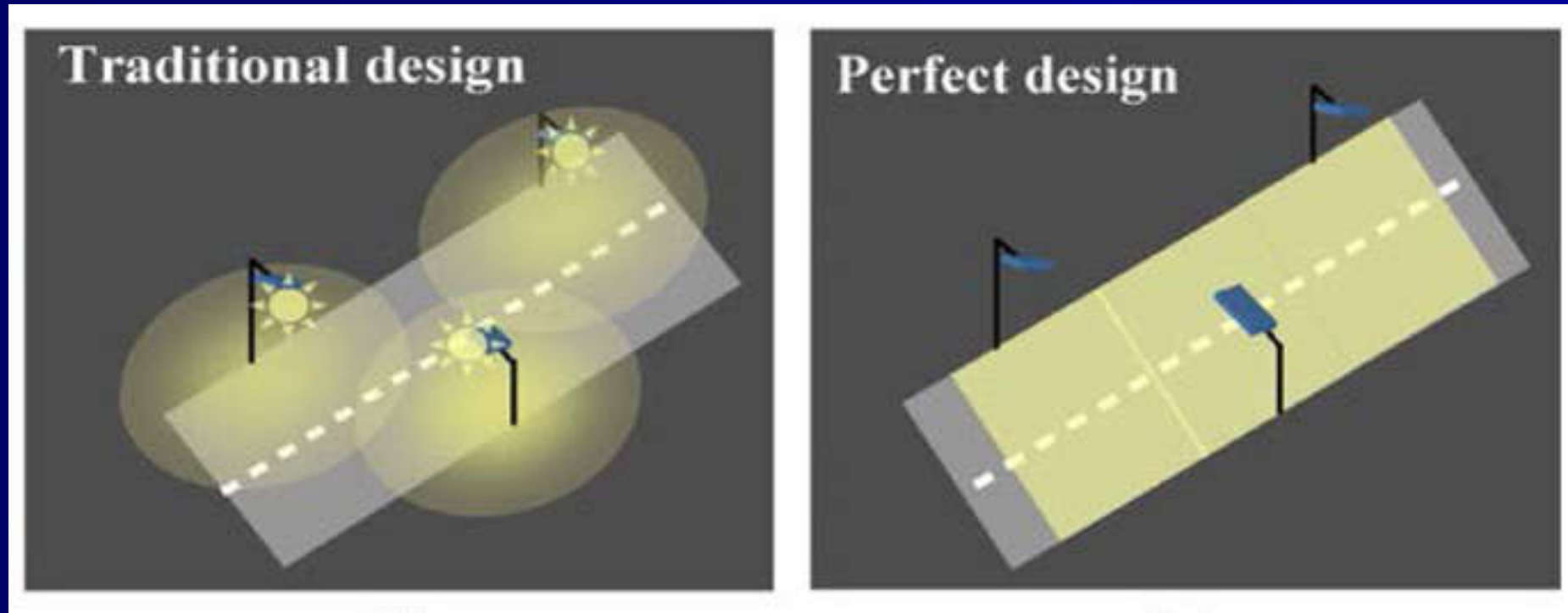


Aiming - Where Needed

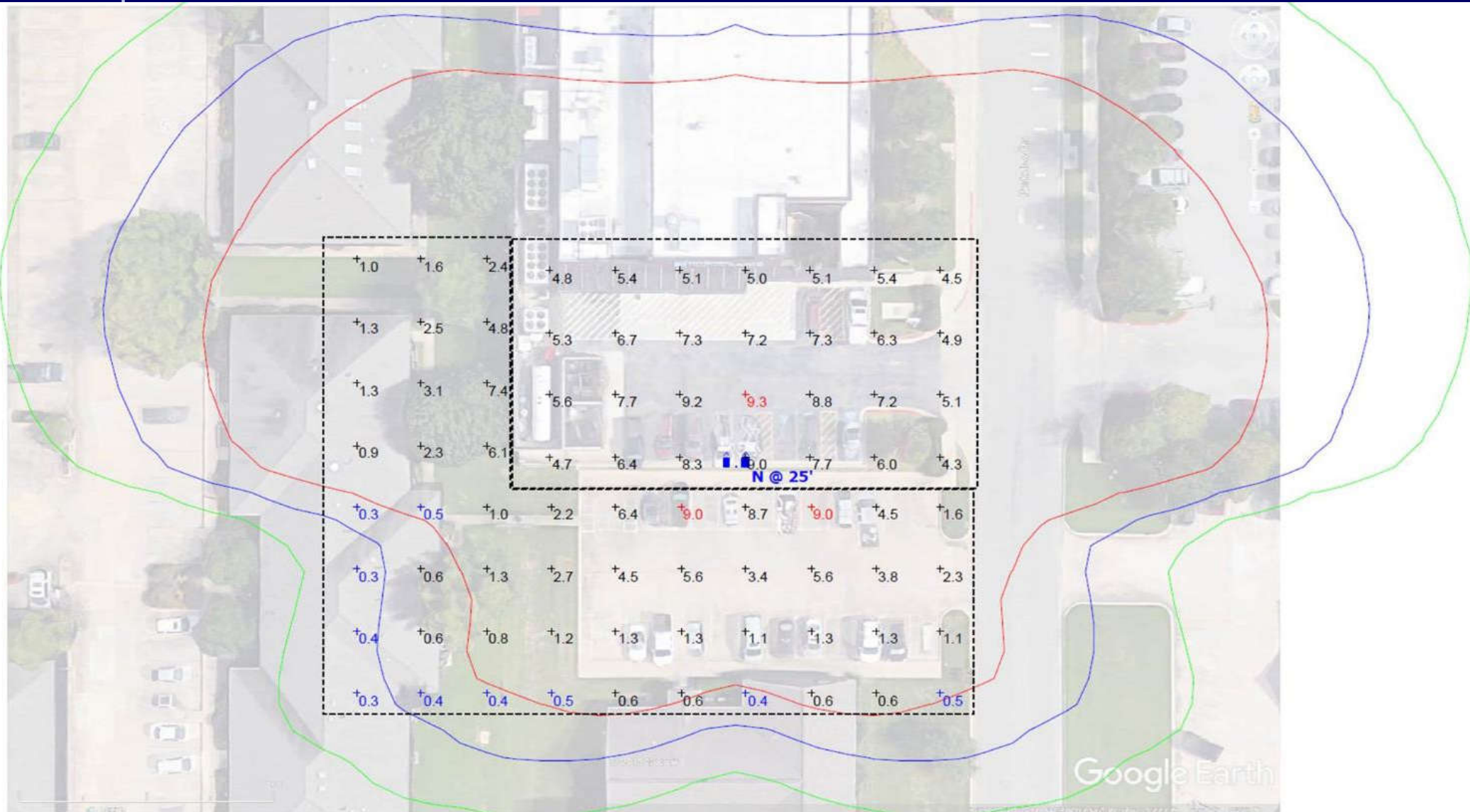


Light pollution is often caused by the way light is emitted from lighting equipment. Choosing proper equipment and carefully mounting and aiming it can make a significant difference.

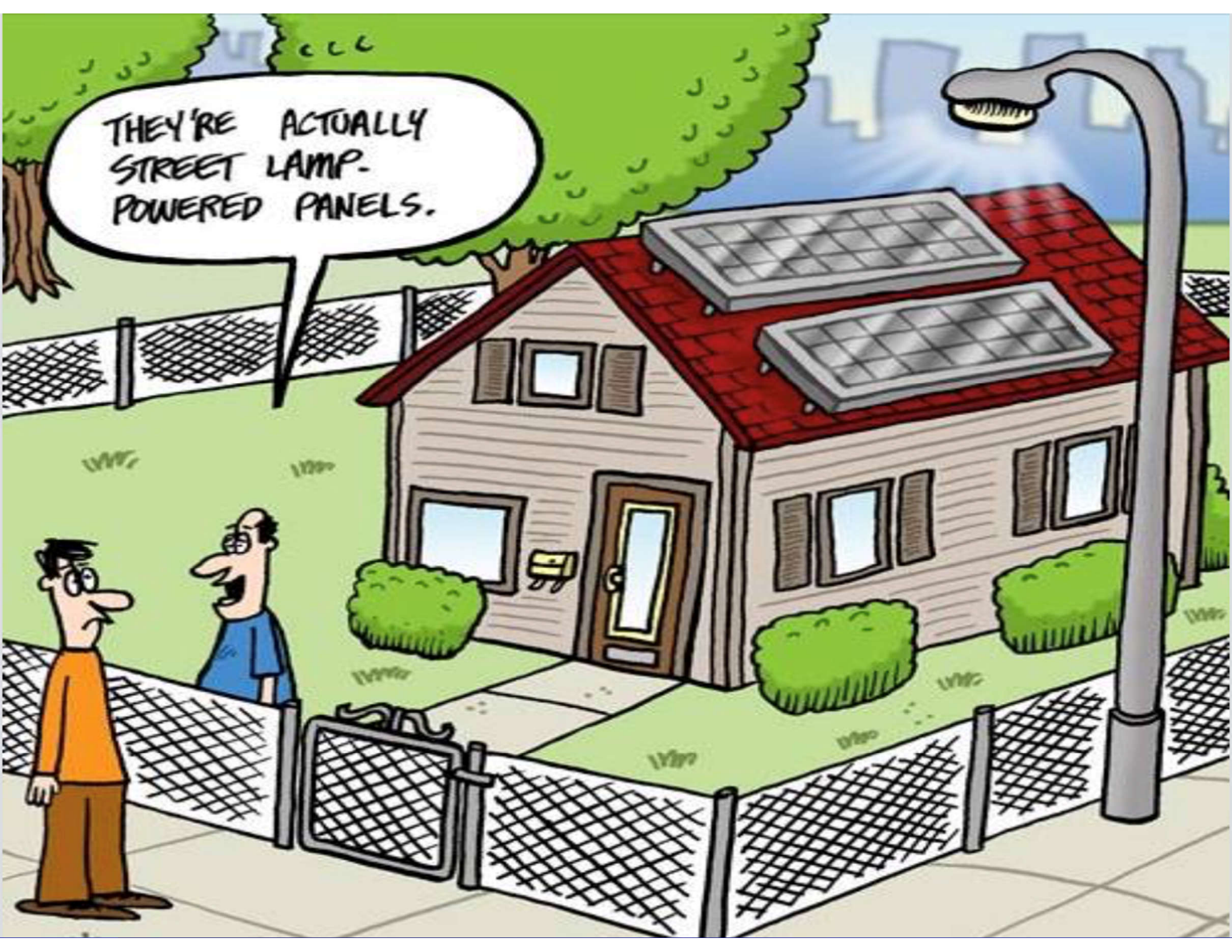
LED light can be targeted



Today Lighting Can Be Designed.



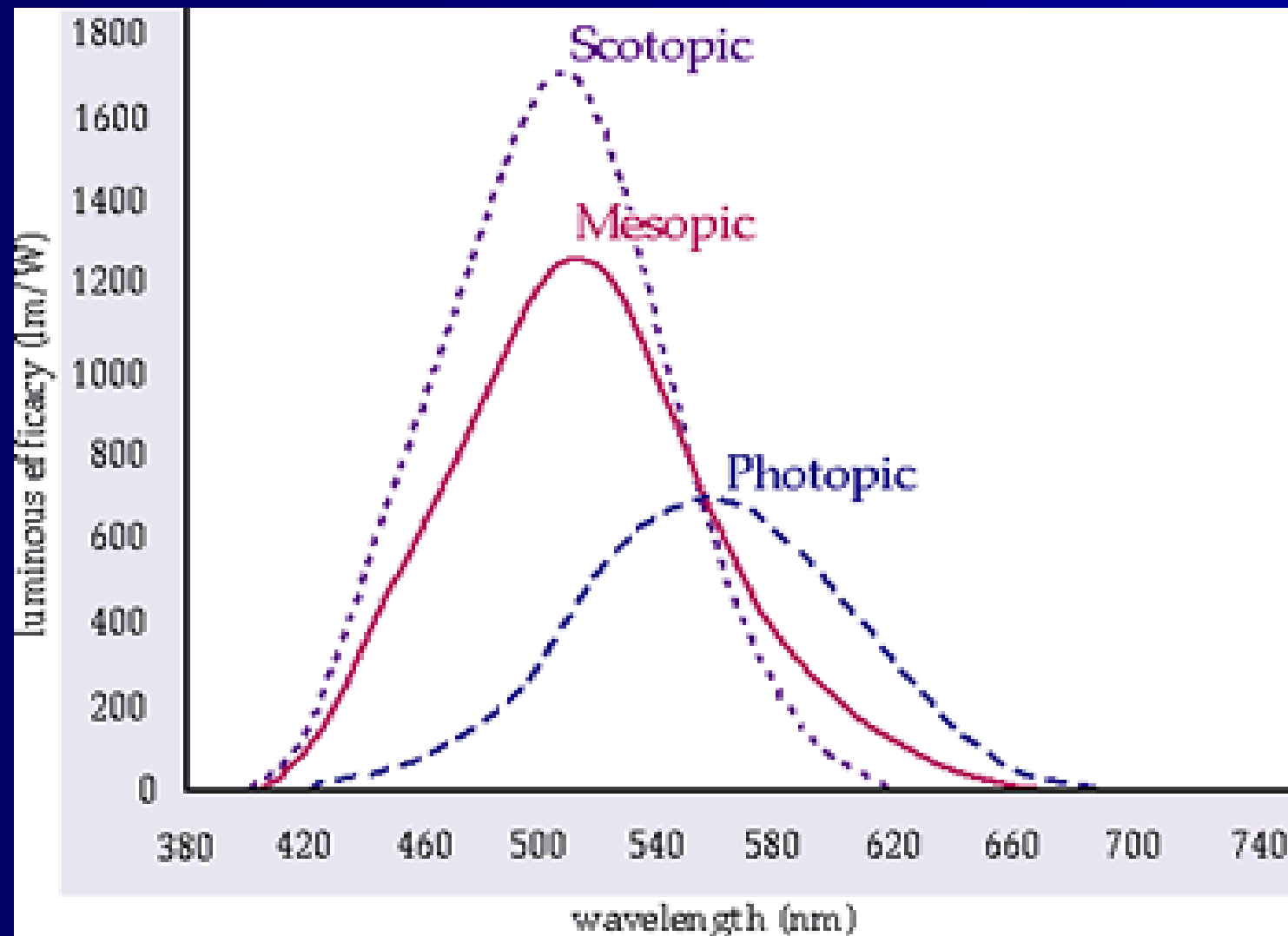
The amount needed



THEY'RE ACTUALLY
STREET LAMP-
POWERED PANELS.



The Color Factor: Not All Lumens Are Created Equal



8,040 vs 19,000 Lumens



Fixture	Lumen Rating	Useful %	Useful Lumens	#NAME?	Net Target L	S/P ratio	Vis. Useful L
100-WATT HPS	8500	27%	2295	0	2295	0.62	1422.9
70-LES 3000K	9800	72%	7056	0	7056	1.21	8537.76

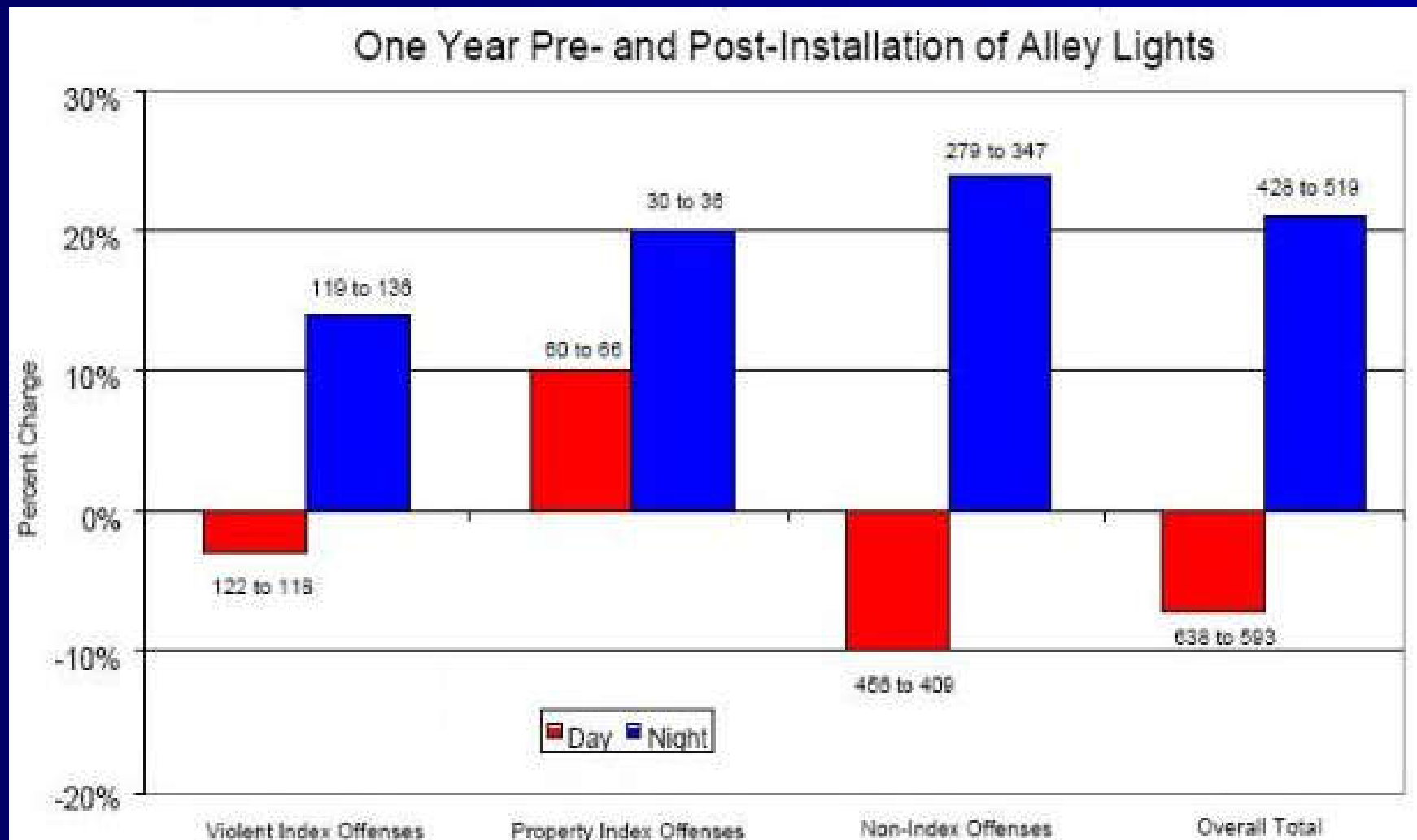
When needed

Chicago Alley Study

**Percentage Increases of Crimes
from Before Lighting Installation to After
for the Two Chicago Areas**



Chicago Alley Study



Hillcrest Daylight Raid



Porch Must Be Too Dark



Leaving the Light on and door open, makes it easy.



Static Light - Criminal's Friend

Dynamic Light - Your Friend

ring.com



Don't Fall For a False Sense of Security

Lighting is more likely to enhance security when:

- When someone is actually available to witness what is being illuminated – Just lighting some part of the world is not useful.
- When on a motion sensor.

Action Items:

- Put exterior fixtures on motion sensors
- Install actual security systems.

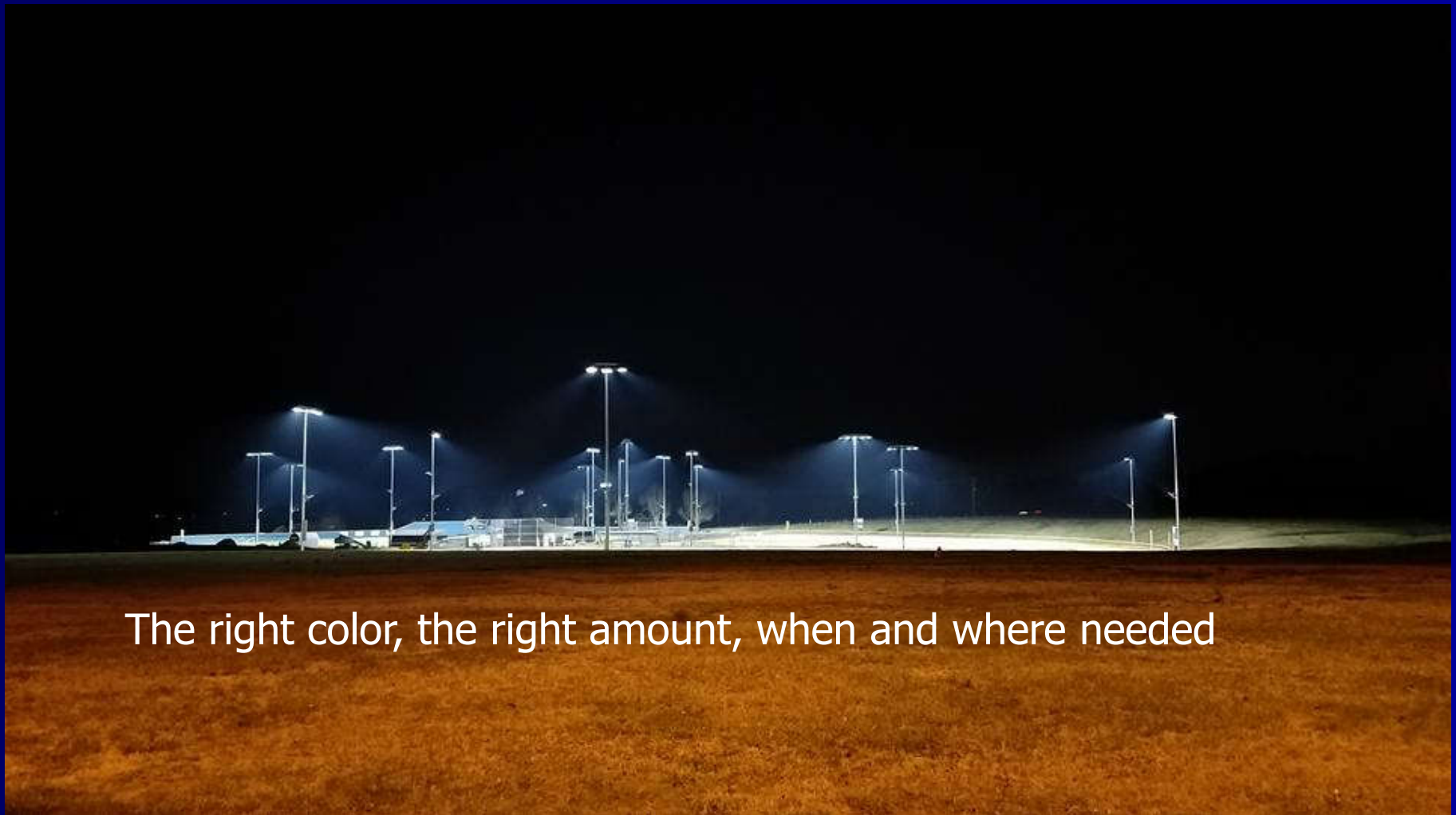


Proper color



The Goal

Functional Lighting



The right color, the right amount, when and where needed

The Role of a City Outdoor Lighting Ordinance



Notable Lighting Ordinance Overview

- 1st lighting ordinance Flagstaff, AZ 1973.
- IES has two “model” ordinances.
- 2021 Germany passes national lighting controls to protect insect population.
- Pittsburg first “dark-sky” ordinance 2021.

AR Lighting Ordinances

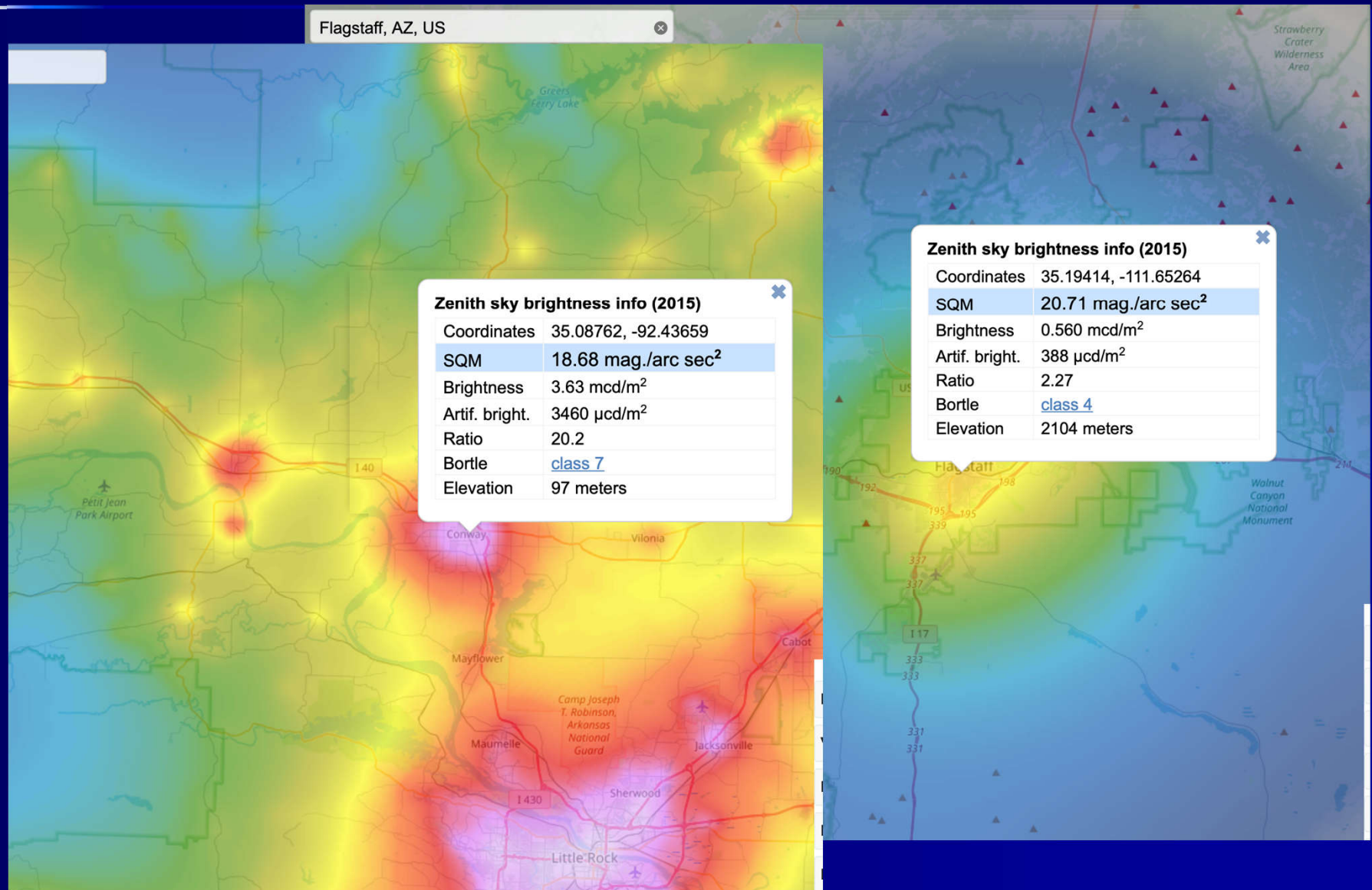
- Aside from the state's outdoor lighting shielding law:
 - Fort Smith
 - Fayetteville and Harrison
 - Bentonville
 - Springdale
 - Little Rock, some DOD's have minimal restrictions

The Comprehensive Lighting Ordinance

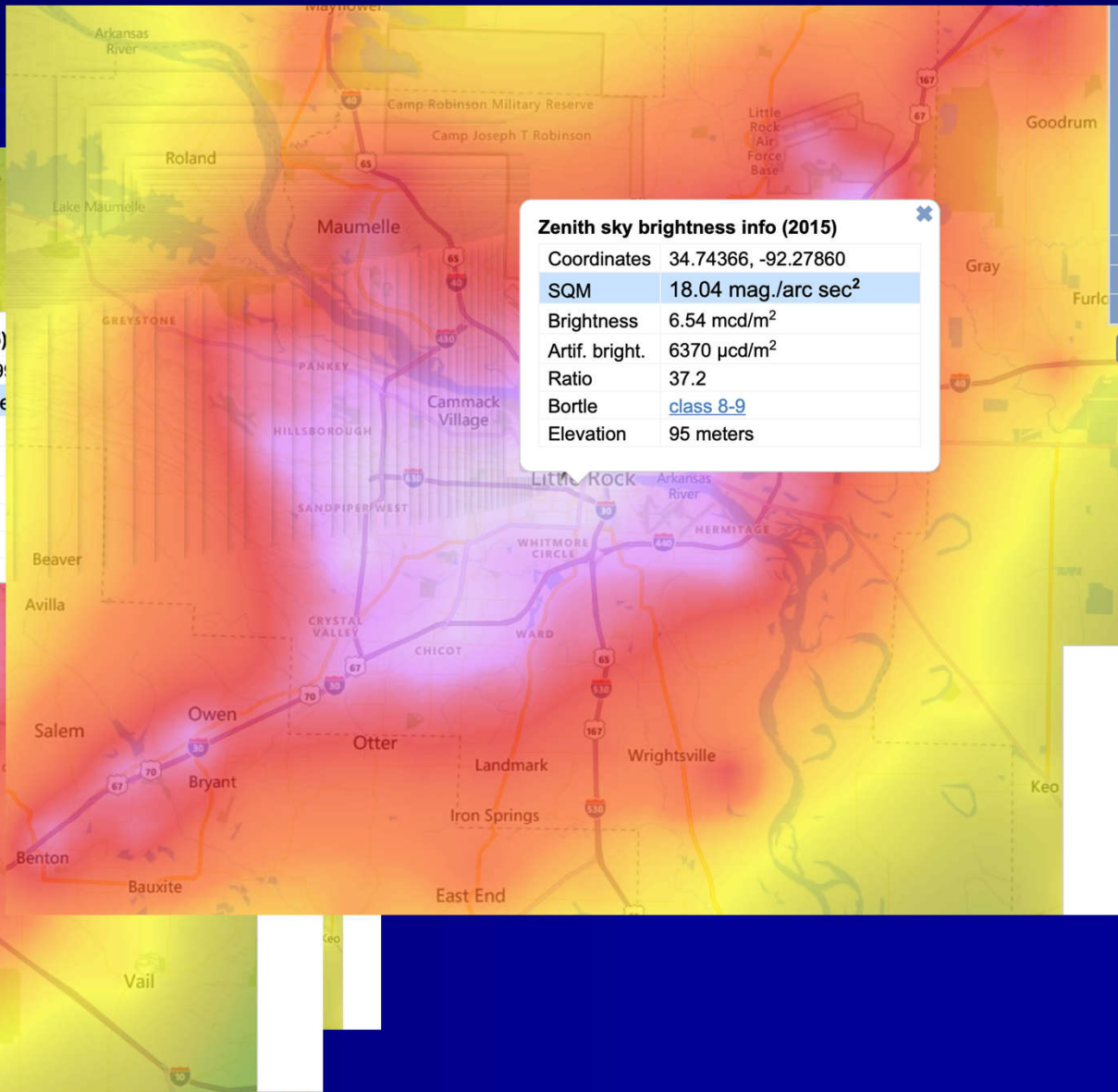
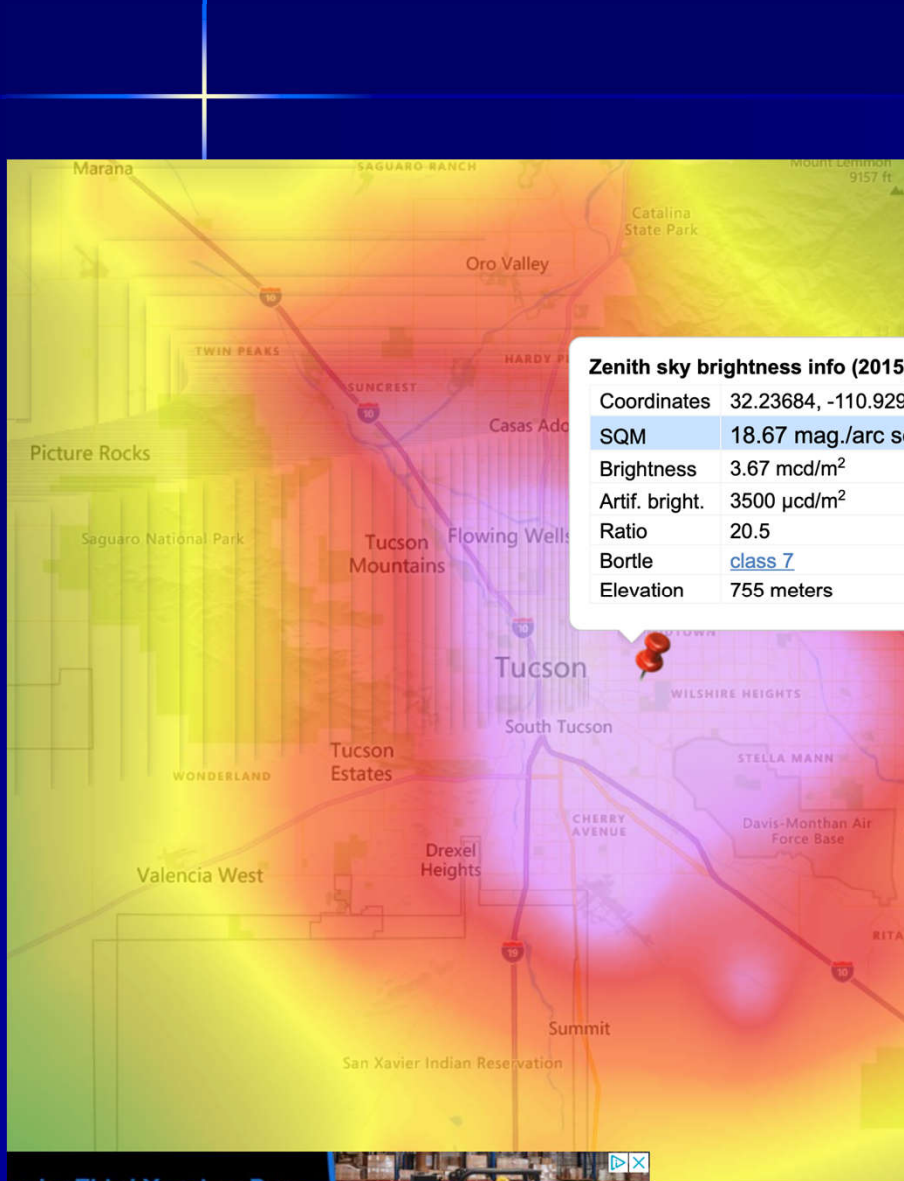
- Shielding
- Trespass
- Types of lighting permitted
- Color Temperature
- Zoning lumen limits per area or fixture
- Illumination levels
- Curfews

Flagstaff vs. Conway

Six time brighter sky



Little Rock Vs Tucson



Proposed for Little Rock

<https://darkskyarkansas.org/ansa-model-city-ordinance-lr/>

- Shielding
- Trespass
- Types of lighting permitted
- Color Temperature
- ~~Zoning with lumen limits per area~~
- ~~Illumination levels~~
- ~~Curfews~~

Proposed City Ordinance

- Shielding and Aiming to Avoid up light
- Prohibit Offensive Trespass
- Reduce Blue Light
- Special Treatment of Accent, landscape and walkway Lighting
- Prohibits flashing, blinking and fluctuating or animating features

Ordinance Details

- Shielding and aiming
 - Full Cutoff, no light above horizontal
 - Exceptions for landscape, architectural, motion sensor lighting.
 - Trespass, uses IESNA TM 11 – 2000 to establish objectionable trespass.
- Color Temperature 3000* or less.

Major Exemptions

- All lighting required by other laws
- Existing lighting
- Holiday lighting
- Except for light trespass, all single and duplex housing
- Motion sensor and temporary lighting

Other Major Limitations

- Exempts city lights where compliance is more expensive.
- Allows variance of color where a law requires another color or professional opinion supports the need.
- Exempts signs.

Flagstaff from above



Picture from: <https://skyglowproject.com/dark-sky-movement/>

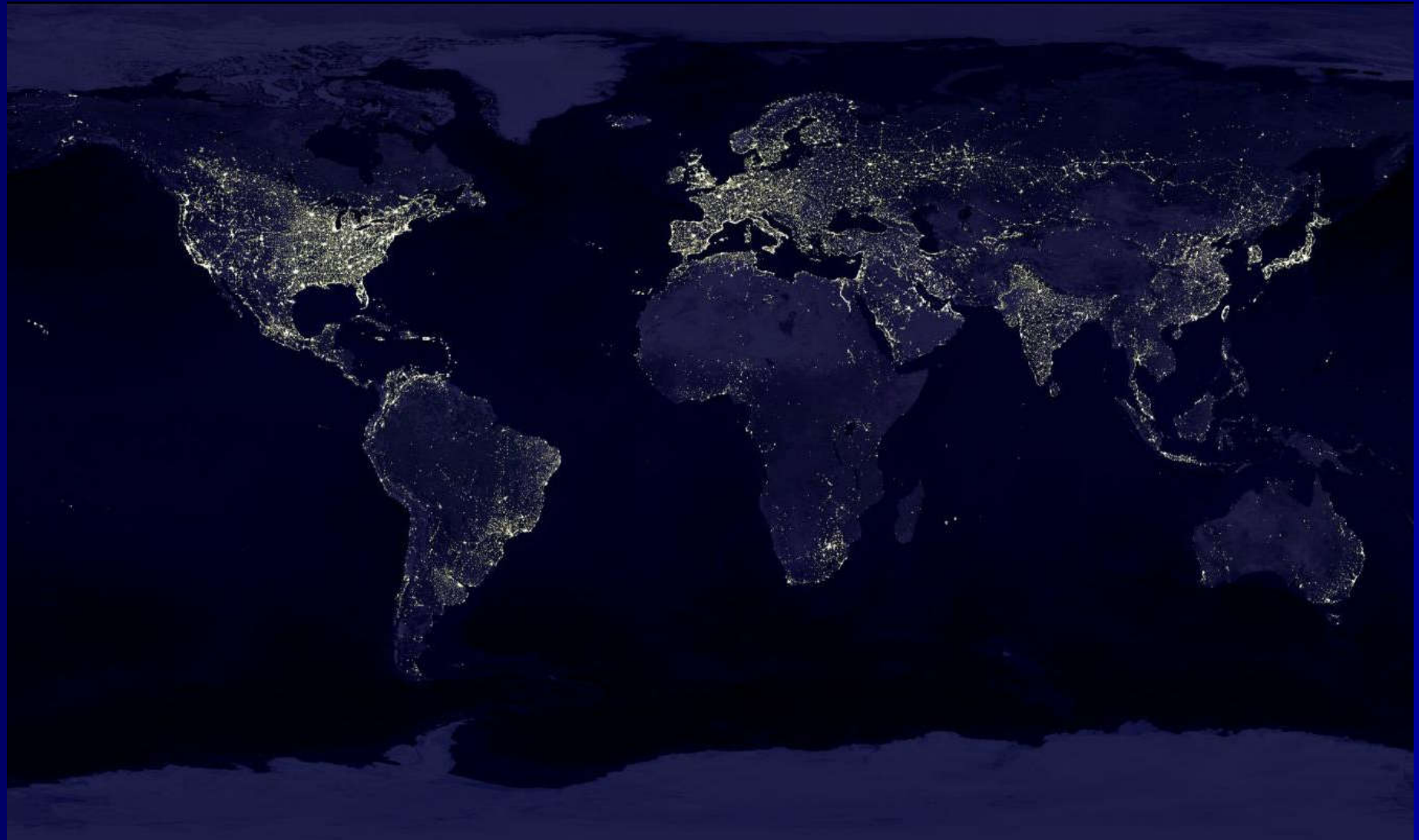
Flagstaff street scene



Little Rock - light as you will



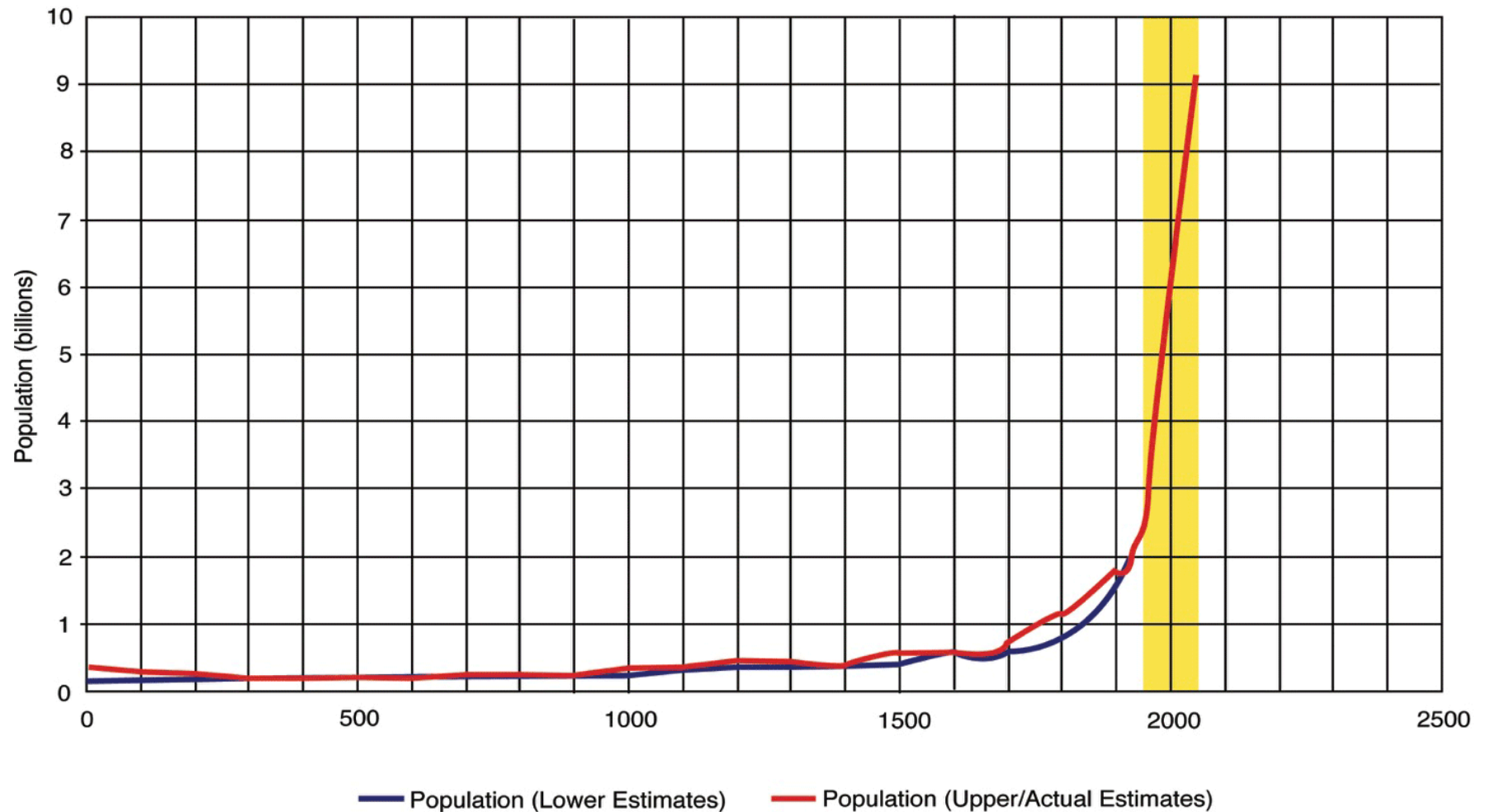
A Visual Indicator of a Larger Global Problem



The Exploding Population X Exploding Technology =

Historical Estimates of World Population

Source: U.S. Census Bureau



Carbon: A Related Co-Indicator of Disruption

Latest CO₂ Reading

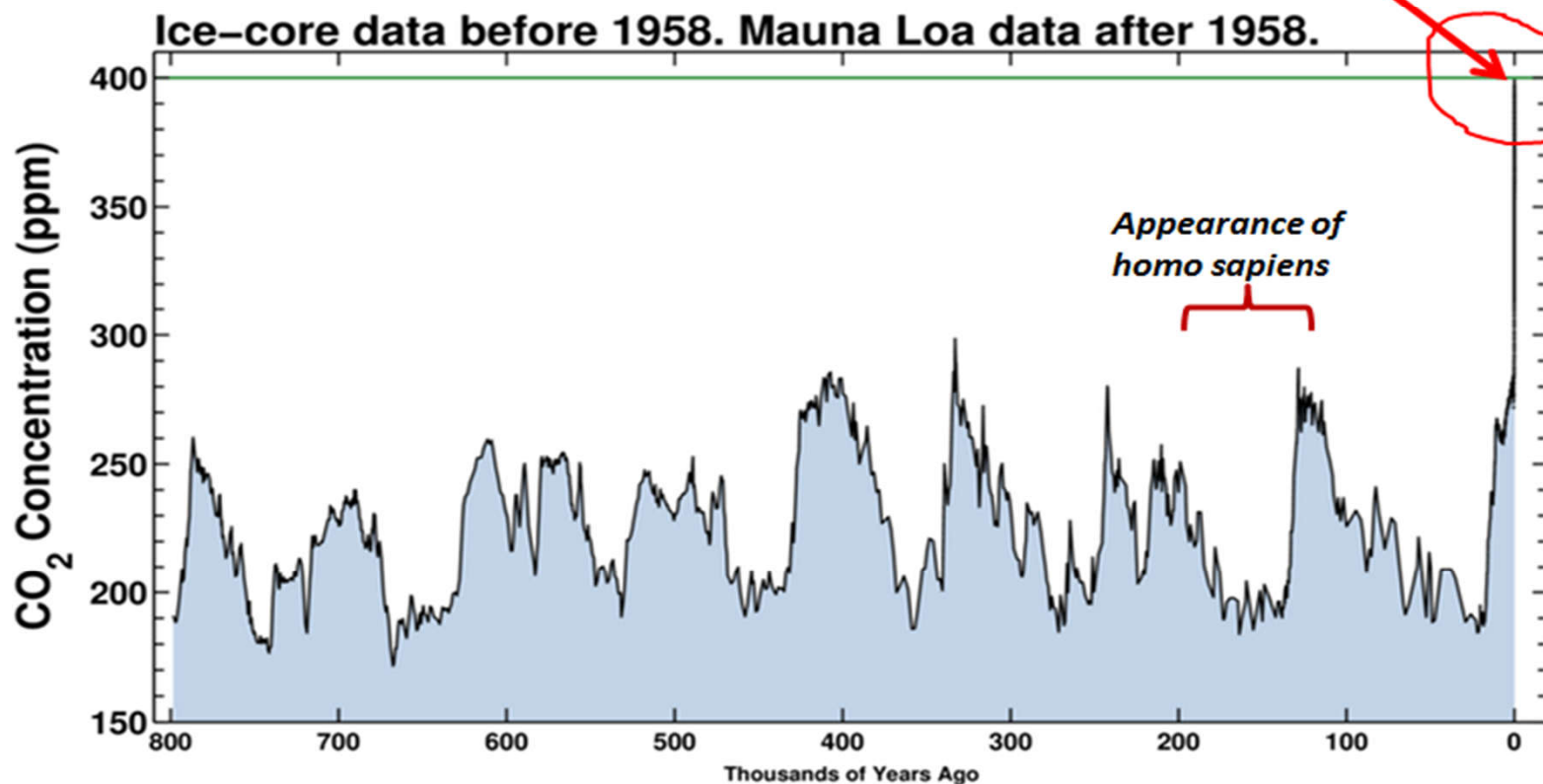
396.26 ppm

December 03, 2013

December 03 instrument

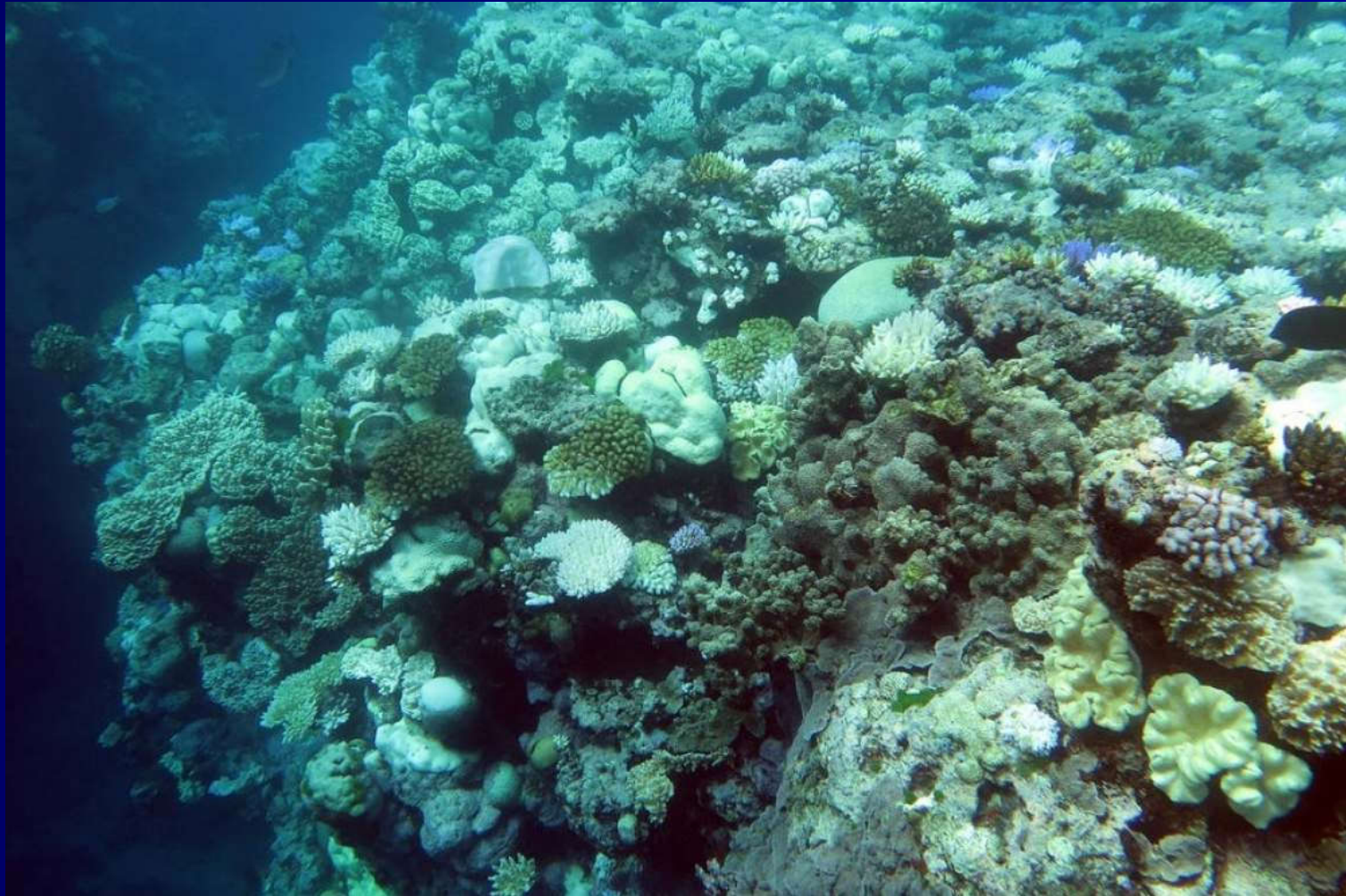
Operational

YOU ARE
HERE

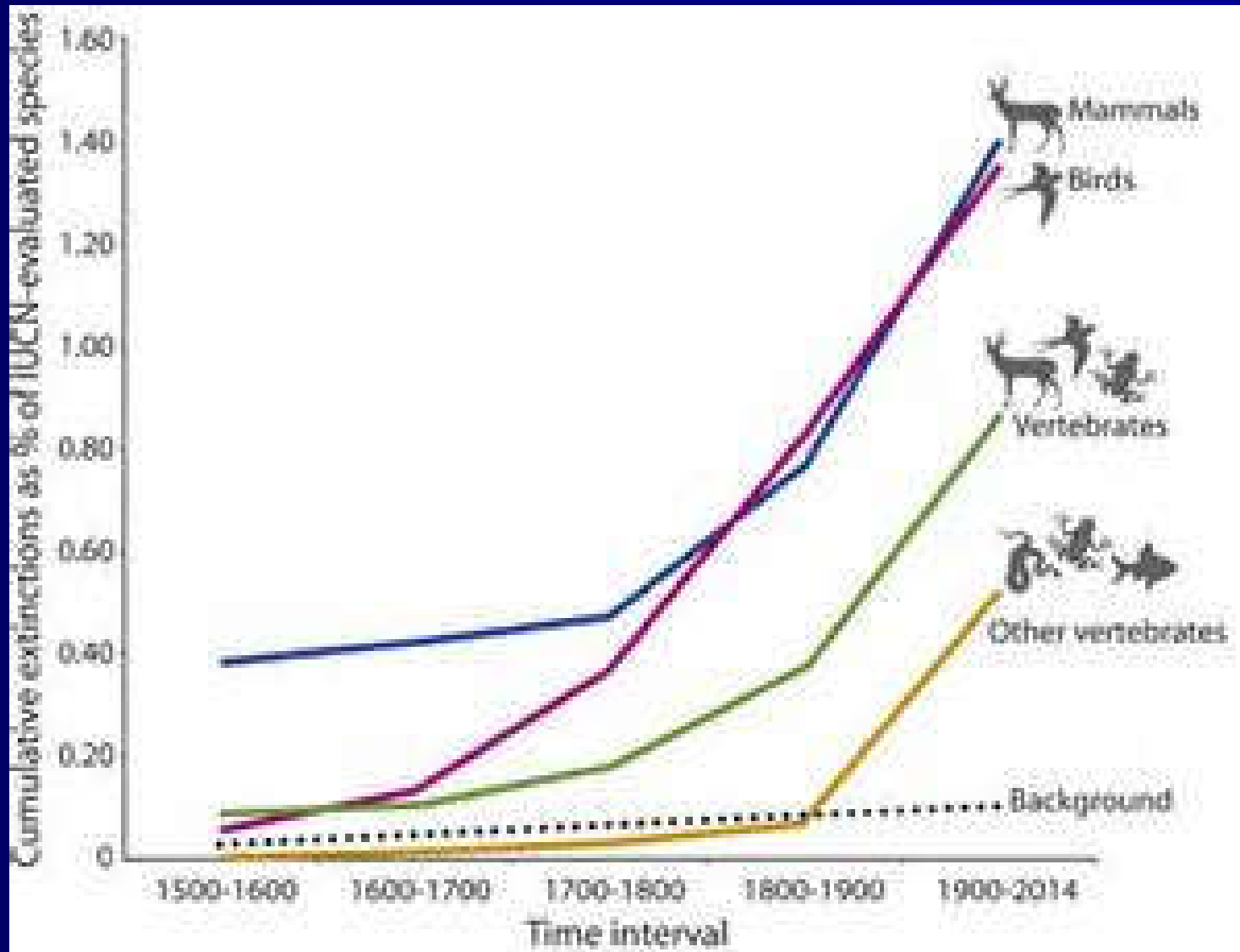


Source: <http://keelingcurve.ucsd.edu/>

Warming Acidifying Oceans



Extinctions



Human Impact an Existential threat



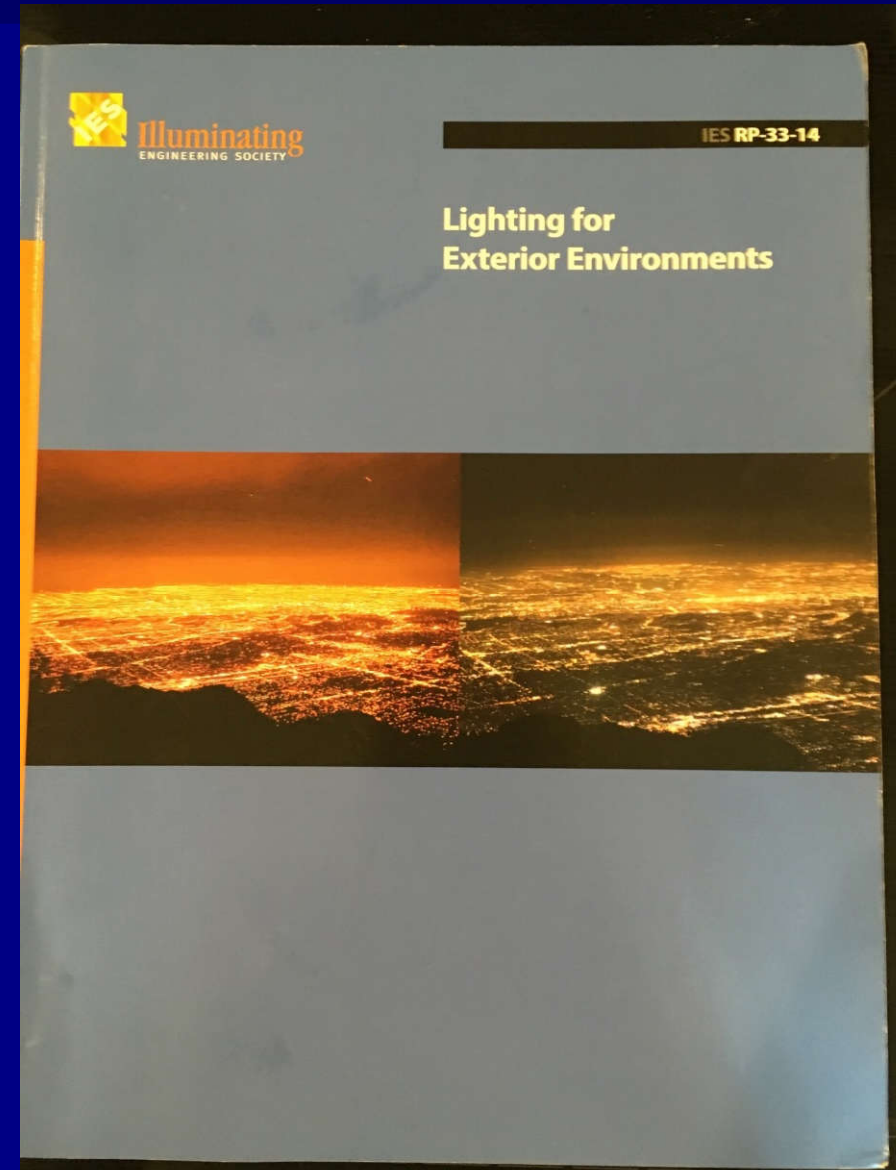
A Renewed Cultural Revolution is Needed



What Are We Asking?

Implement rational science based lighting policies using ordinance and industry practices built around the recommendations contained in relevant IES publications:

Provide lighting only when and where it is needed to meet identifiable public and private purposes while minimizing costs, pollution and other environmental impacts.



What You Can do at Home

<https://darkskyarkansas.org/responsible-lighting/>

- Ask yourself if lighting is really needed. If so, determine what area has to be lit, how much illumination is needed, and when is the lighting required.
- Turning off non-essential lights when not needed using motion sensors (ideal for security purposes), timers and switches.
- Adjust outdoor lights so that they do not trespass on your neighbors' property where it is wasted and perhaps not wanted.
- Choose luminaires that have a flat lens that completely shades the lamp (full cutoff).
- Complain to those responsible for irresponsible lighting.

<https://idsw.darksky.org/activities/dark-sky-friendly-home/>



THIS IS A DARK SKY FRIENDLY HOME

The outdoor lights around this home are "neighbor, nature, and night sky friendly" and meet IDA's criteria for Dark Sky Friendly Home Lighting.

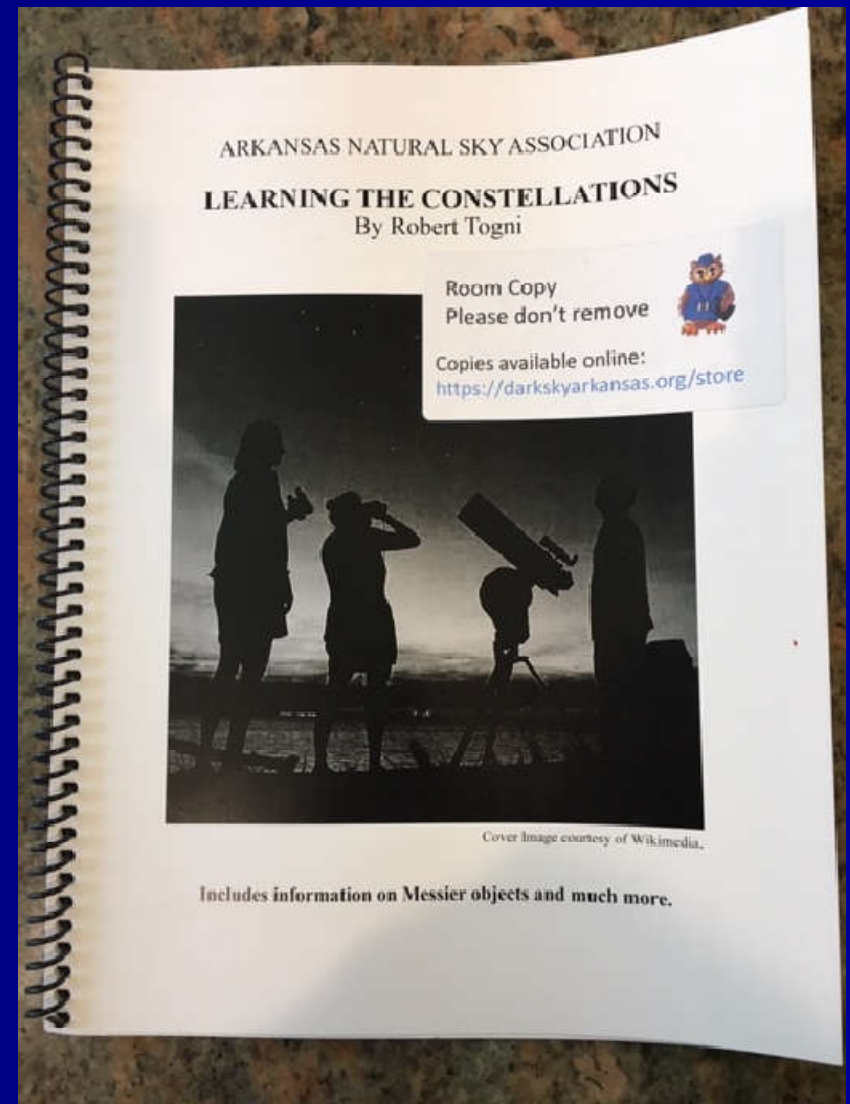


INTERNATIONAL DARK SKY ASSOCIATION

www.darksky.org

What Else You Can Do

- Join IDA and ANSA
- Join ANSA's Facebook Group page
- Join ANSA's mobilize.io list
- Attend our Dark-Sky Festival & get out under the stars yourself.
- Lobby for responsible lighting ordinance in your community.



Intangible Loss

