

Preserving the Dark Skies of Maine

Robert Burgess, President, Southern Maine Astronomers



February 14, 2024

Winter Wisdom Series

“Silently, one by one, in the infinite meadows of heaven, Blossomed the lovely stars, the forget-me-nots of the angels.”

Evangeline, A Tale of Acadie, Henry Wadsworth Longfellow



Greg Rakozy



- Free Monthly meetings with distinguished speakers in astronomy, astrophysics, space flight
- Free public star parties with telescope viewing, laser-pointer constellation tours, and short talks
- Outreach to schools and non-profits with shared interest in dark skies and open spaces
- Headquartered at 179 Neptune Drive, Brunswick Landing

www.southernmaineastronomers.org

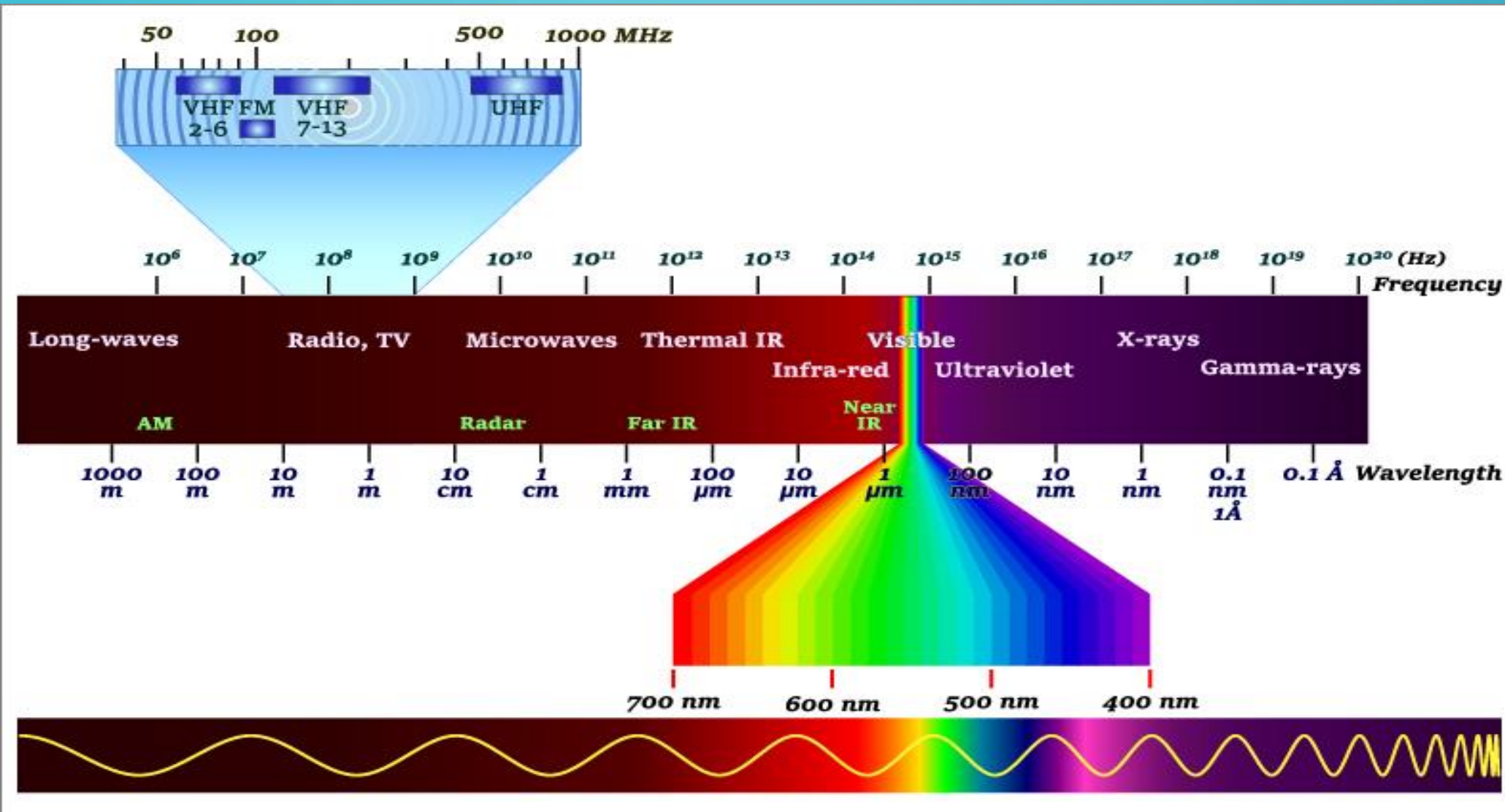
WHAT IS LIGHT POLLUTION?

- **Light pollution is the human-made alteration of outdoor light levels from those occurring naturally.**

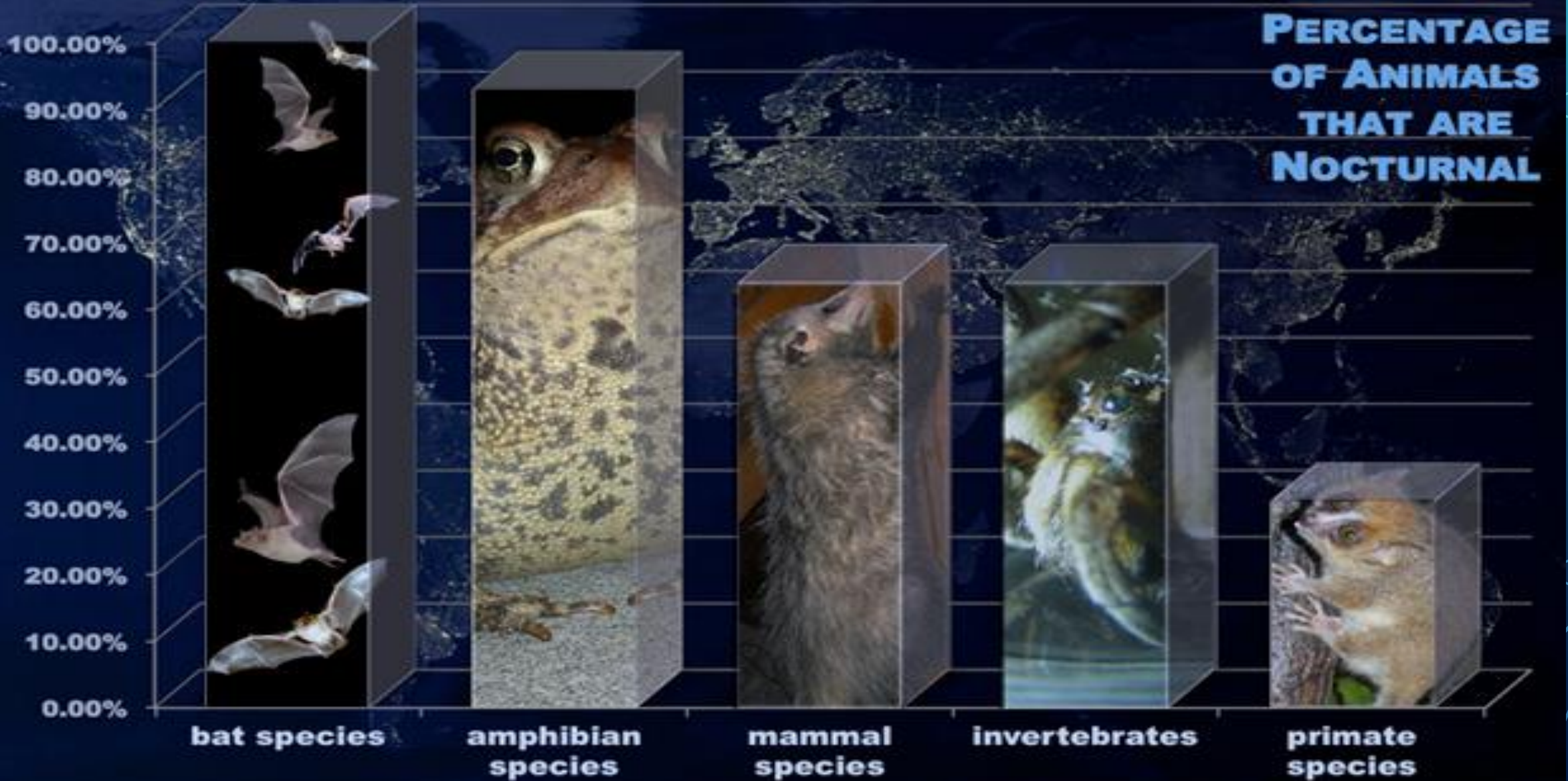
Its effects:

- Adverse impact on environments
- Sky Glow and loss of the night sky and cultural heritage
- Glare (potentially dangerous interference with people's sight while walking or driving)
- Light Trespass (unwanted light shining onto a neighbor's property or into their home)
- Higher Taxes and Prices
- Global Warming

The Electromagnetic Spectrum



COMPATABILITY WITH THE NATURAL WORLD



Estimated that 60% of all animal life on Earth is nocturnal

EFFECTS ON ANIMAL HABITATS AND BEHAVIORS

Birds

- Artificial light can deceive birds as to the arrival of spring causing them to become sexually mature at the wrong time, hatching their young before food sources and insects are abundant thereby affecting the survival of their young.
- Migrating Birds - navigation disrupted; **one billion** die from exhaustion and impacts with buildings while migrating and otherwise.



EFFECTS ON ANIMAL HABITATS AND BEHAVIORS

Insects – numbers are decreasing – urbanization, global warming, insecticides, large scale farming/single crop cultivation, disappearing forests and artificial light at night.

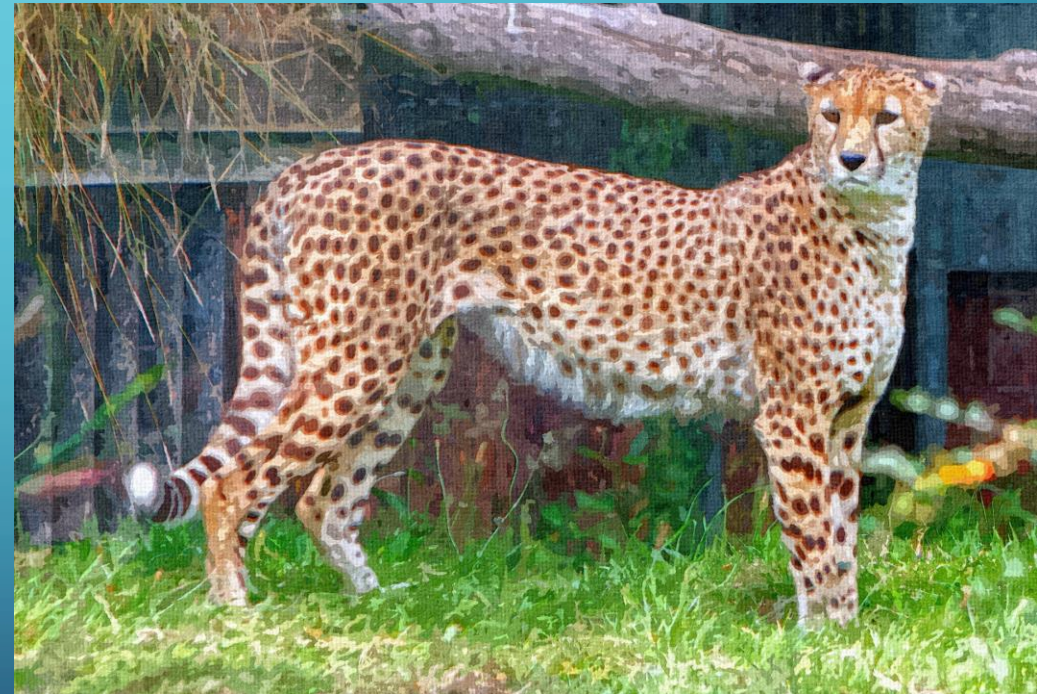
- Half of insects are nocturnal and need darkness to find food and find mates. Artificial light disrupts, drawing them to light; easy prey. Many are pollinators of night blooming plants.
- Ghost moths' mating is disrupted because under artificial light the contrast of their wing colorization is not as apparent as under natural light .
- Birds and insects use parts of the spectrum we cannot see – in the shorter wavelengths of ultraviolet that is disrupted by artificial light.



EFFECTS ON ANIMAL HABITATS AND BEHAVIORS

Mammals – Most of the world's 6,000 species of mammals are twilight creatures, moving around at dawn or dusk for feeding and mating. Artificial light disrupts the predator/prey balance and mating behavior.

- Cheetahs are now known to do half their hunting at night.



EFFECTS ON ANIMAL HABITATS AND BEHAVIORS

- Marine and estuarine life
- Sea Turtles – drawn away from safety of the ocean
- Predator/ prey of small fish/wading birds
- Clown Fish will not lay eggs unless dark.
- The reproduction of corals is light sensitive.
- Fish, crabs and mollusks depend on lunar cycles and are light sensitive



EFFECTS ON PLANT LIFE

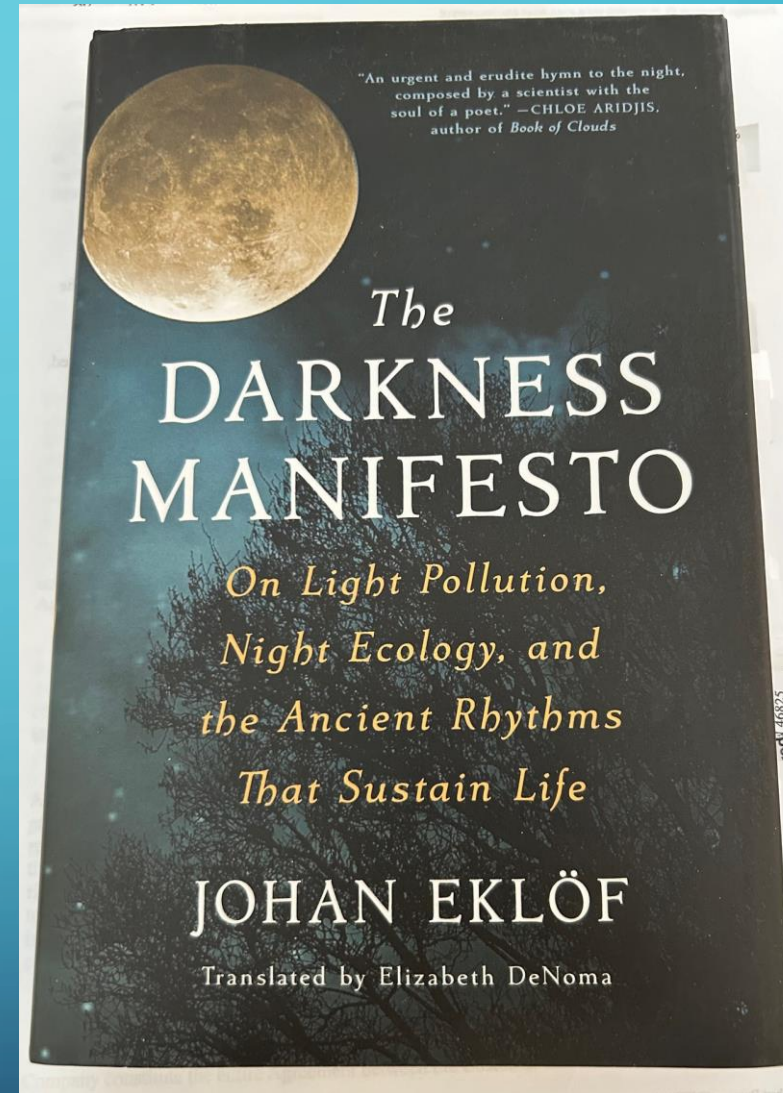


How Artificial Light Affects Soybean Maturation: Note semicircles of green at base of streetlight, while remainder of field is turning brown (as it should) at maturity

Ben Tankersley / Alabama Cooperative Extension Service

ADDITIONAL INFORMATION

Expansive explanation of the variety of how a wide variety of bats, birds, invertebrates, primates and other mammals depend on darkness for their survival





8/9

City/Inner
City Sky

7

City/
Suburbia
Transition

6

Bright
Suburban
Sky

5

Suburban
Sky

4

Suburban/Rural
Transition

3

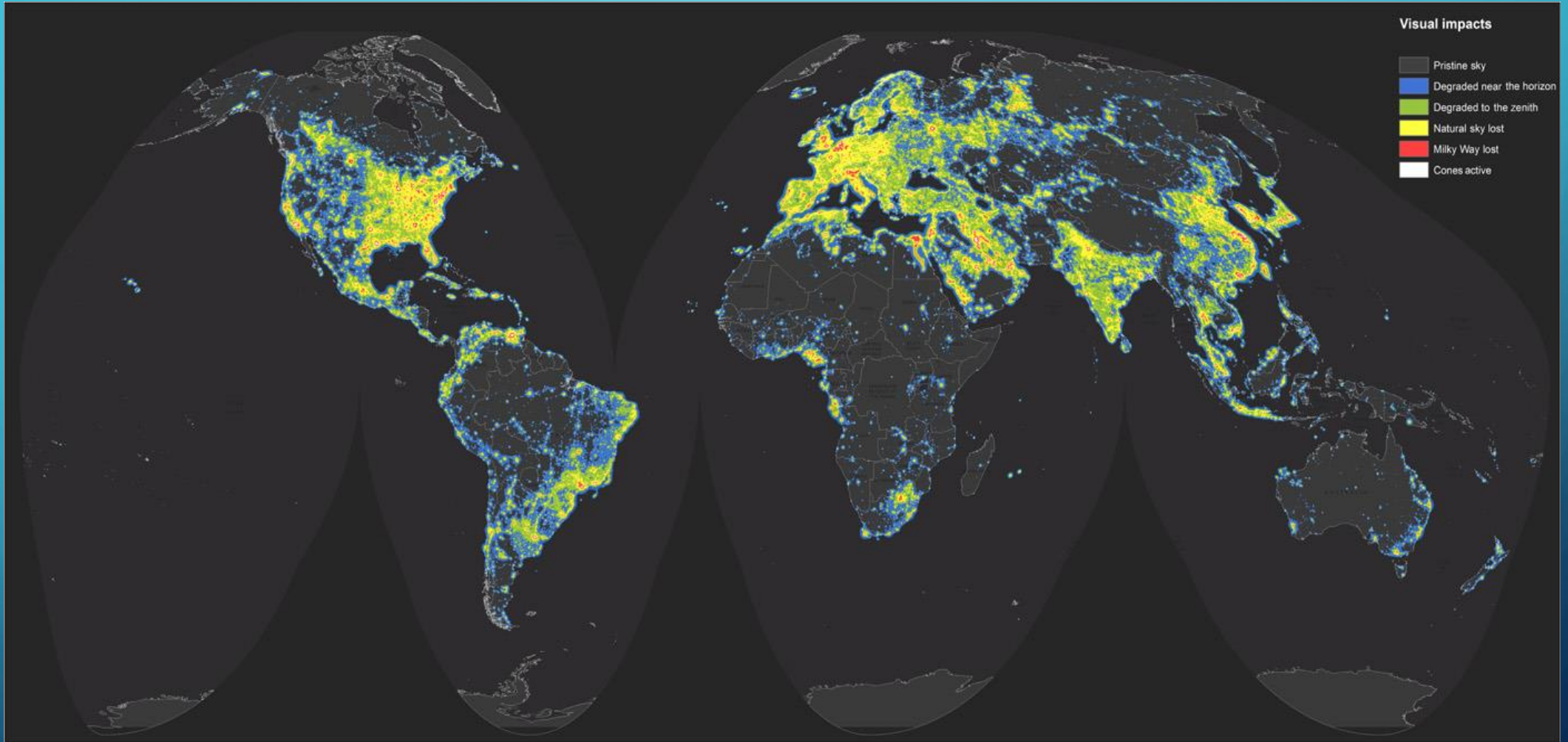
Rural Sky

2

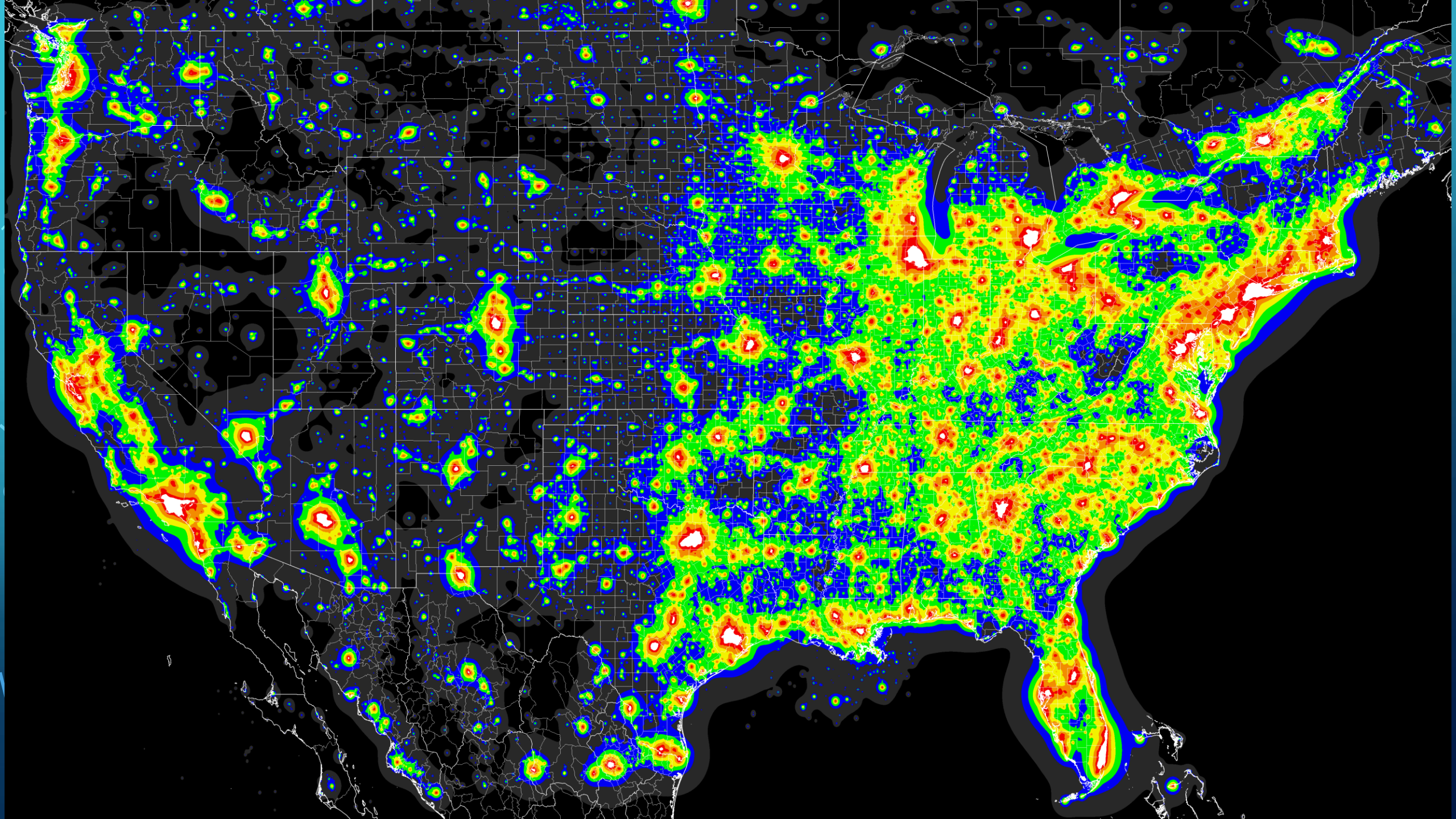
Dark-Sky
Site

1

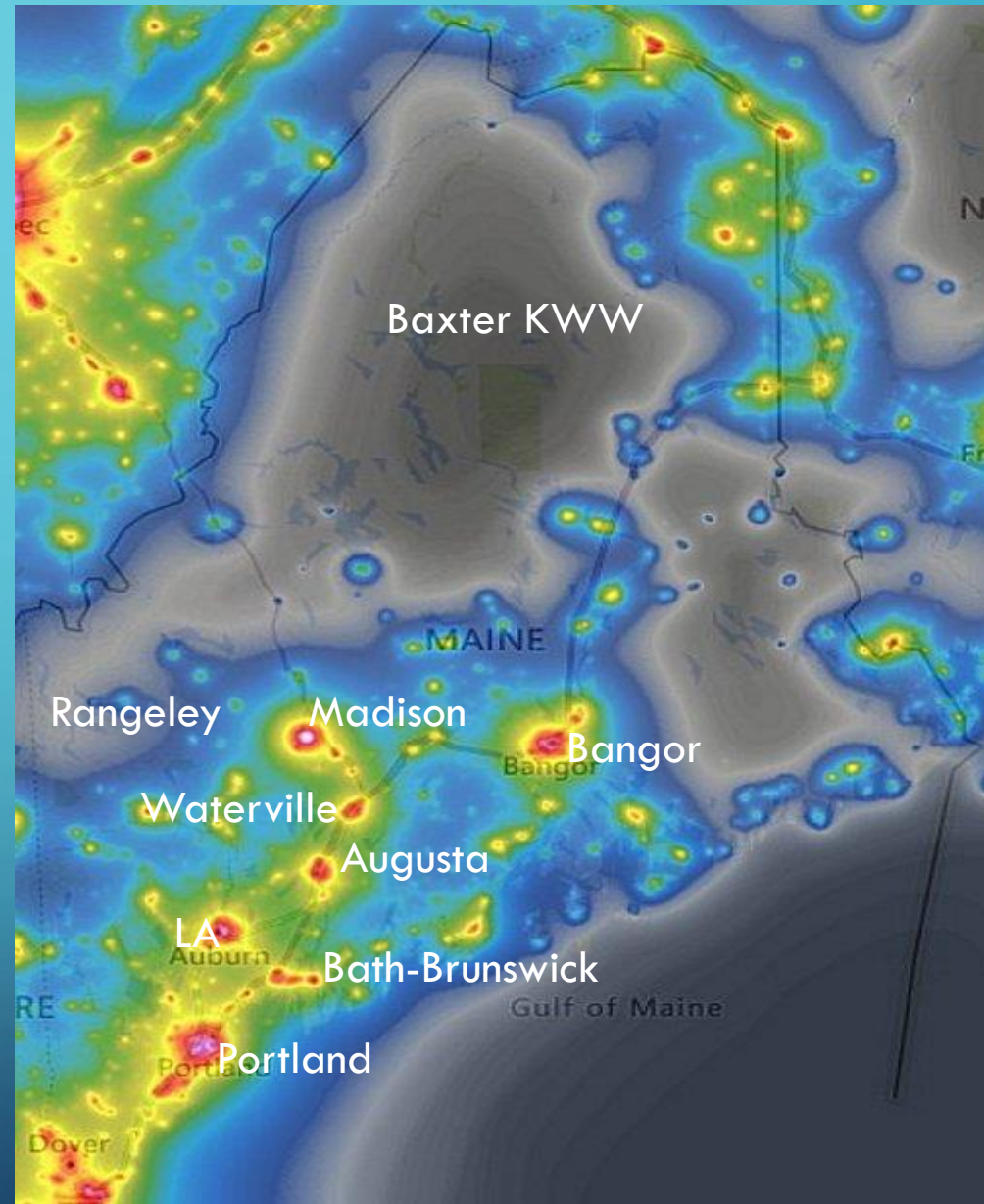
Excellent
Dark-Sky
Site



Worldwide Light Pollution – New World Atlas of Artificial Night Sky Brightness



MAINE LIGHT POLLUTION

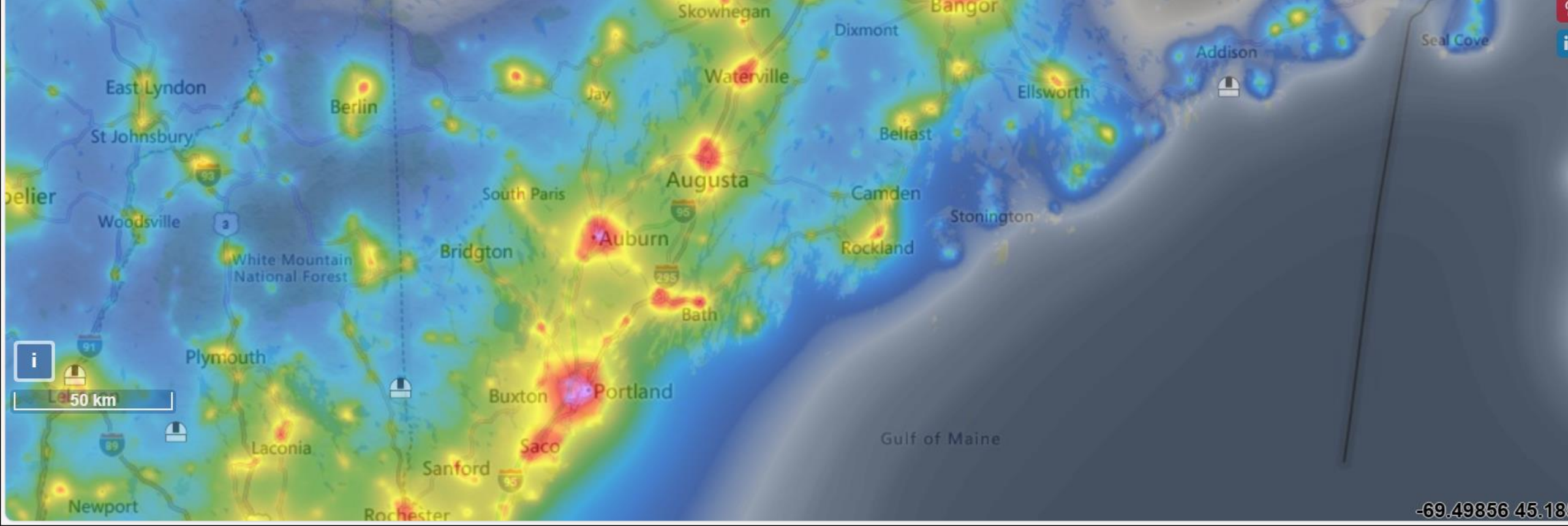


Backyard Farms



42 acres

- +
- 📍
- 🖨️
- ?



EFFECTS ON THE NIGHT SKY AND CULTURAL HERITAGE

SKY GLOW



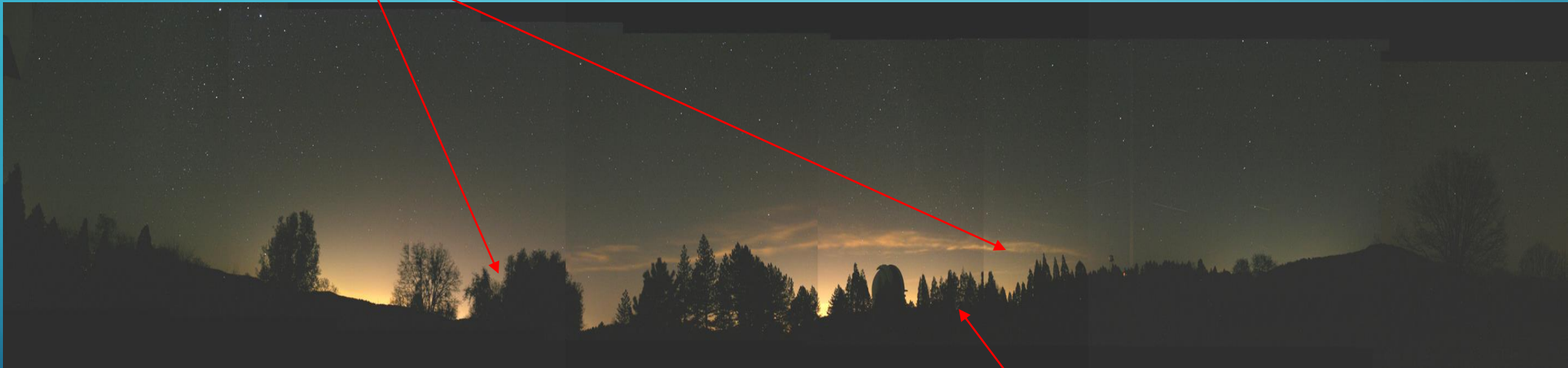
Big cities



Small towns

EFFECTS ON THE NIGHT SKY AND SCIENTIFIC RESEARCH - SKY GLOW AND LOSS OF ASTRONOMICAL "HABITAT"

Light Dome from San Diego County area



Mount Palomar Observatory

Loss of Cultural Heritage / Loss of Awe



Wow!



Mehhh....

AWE AND INSPIRATION

“For my part I know nothing with any certainty, but the sight of the stars makes me dream.”

– Vincent van Gogh

Van Gogh painted his famous “Starry Night” in Saint Rémy, France, in 1889. Now, the Milky Way can no longer be seen from there. If he were alive today, would he still be inspired to paint “Starry Night”?





DEFENDING THE DARK

PRESERVING THE NIGHT SKY IN MAINE

OUR COLLECTIVE NEED FOR DARK SKIES IN A LIGHT POLLUTED WORLD
CREATED BY: TARA ROBERTS ZABRISKIE

<https://www.pbs.org/video/defending-the-dark-ybnlvw/>

EFFECTS ON HUMAN HEALTH AND THE ENVIRONMENT

Disruption of Circadian Rhythm:

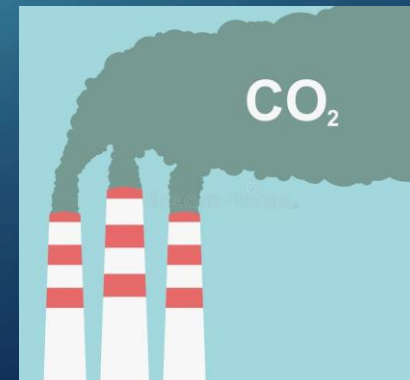
- affects melatonin production
- Research reported in The Journal of Neuroscience and Journal of the National Cancer Institute
- AMA report on Impact of Excessively Blue Light in street lighting

Air Quality:

- More energy consumption caused by waste leads to more fossil fuel consumption, more particulate matter in the atmosphere and more greenhouse gasses; impacts on respiratory ailments such as asthma, lung cancer, etc.

EFFECTS ON GLOBAL WARMING AND COSTS

- Outdoor lighting uses about 120 terawatt hours of electricity, mostly to illuminate streets and parking lots – enough to meet New York City’s entire energy budget for two years!
- IDA estimates about 30% of all outdoor lighting is wasted mostly due to lights that aren’t properly shielded. That adds up to about \$3.3 billion in wasted expense and the release of 21 million tons of carbon dioxide per year.
- Applying this to Maine in 2023, about 202 million kilowatt hours are wasted on lighting per year, costing more than \$26 million.



EFFECTS ON QUALITY OF PLACE - OVERLIGHTING



Would you want to live in this apartment building/condo?

EFFECTS ON QUALITY OF PLACE - OVERLIGHTING



No Stars Visible
On Clear Night

Light Trespass

Street Sign Not Easily Readable Due to Glare
This creates a Serious Safety Issue

EFFECTS ON QUALITY OF PLACE – AND TAXPAYER EXPENSE



EFFECTS ON QUALITY OF PLACE – LIGHT TRESPASS



EFFECTS ON DRIVER AND PEDESTRIAN SAFETY: GLARE



www.delmarfans.com

GLARE

Visual impairment that occurs when the light source is brighter than the light your eyes are accustomed to.

GLARE

(SEE THE FOREGROUND SIGNS?)



EFFECTS ON PUBLIC SAFETY AND CRIME



Bad Security Lighting:

Glare from Light

Dark Shadows

EFFECTS ON PUBLIC SAFETY – DANGER IN THE SHADOWS?



SURPRISE! An Assailant might not be visible to a police officer



Light polluted sky

Visible night sky




UNACCEPTABLE
Unshielded

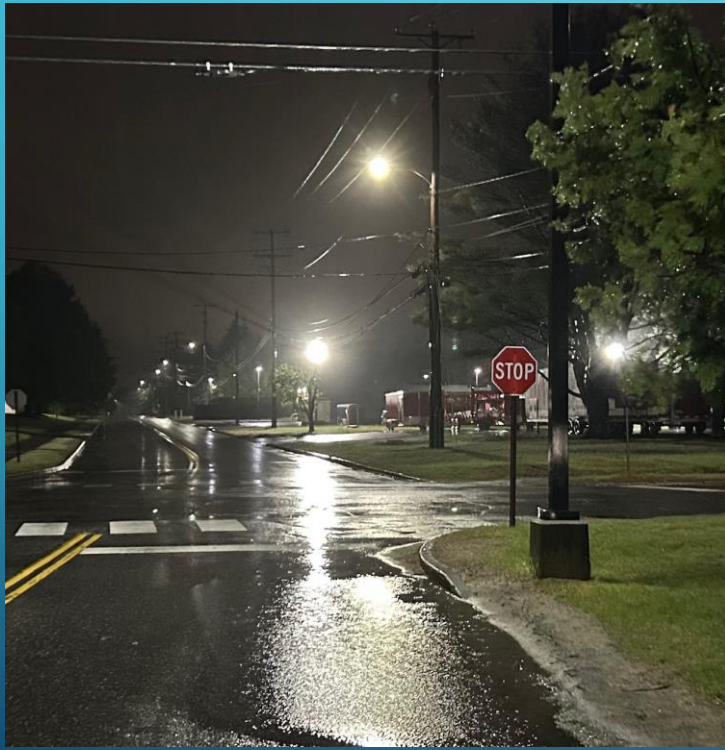
VERY BAD

BAD

BETTER
Fully shielded

 **BEST**
Fully shielded + timer
or motion sensor

EVEN WITH AN ORDINANCE REQUIRING FULL CUT-OFF WE CONTINUE TO SEE THESE KINDS OF FIXTURES AROUND TOWN. SOME MAY BE GRANDFATHERED, OTHERS NOT.



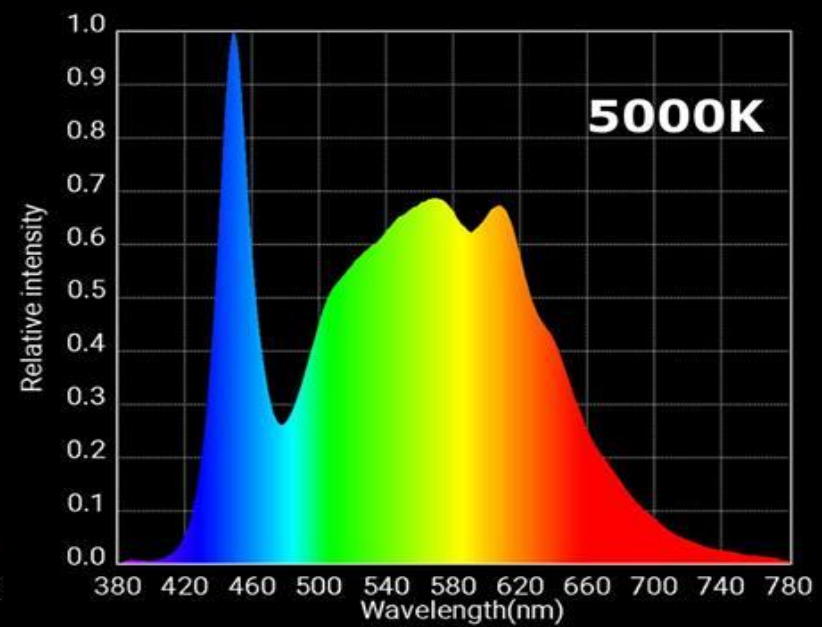
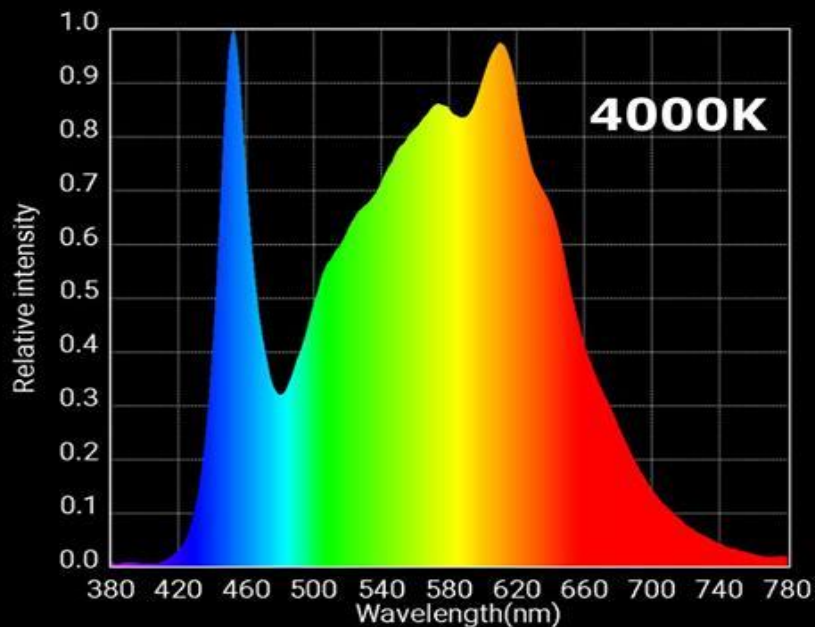
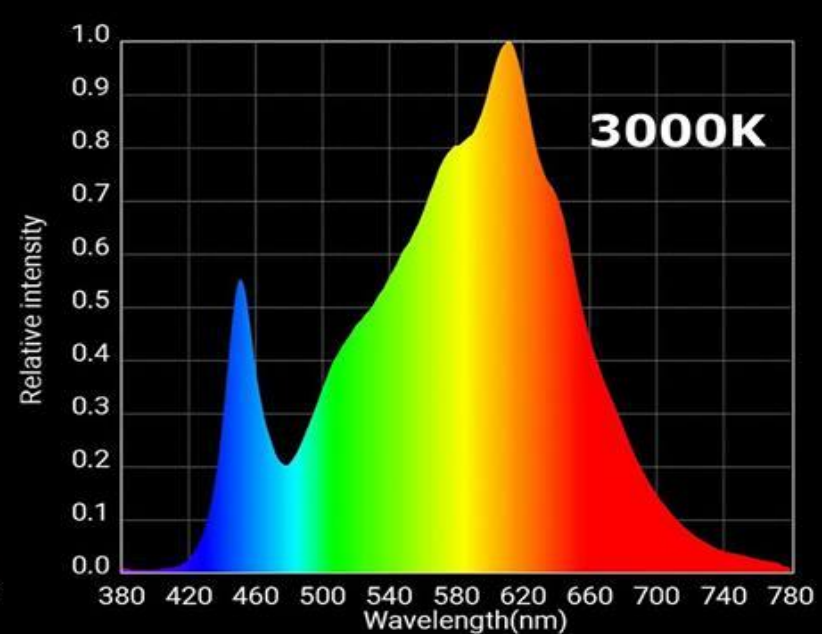
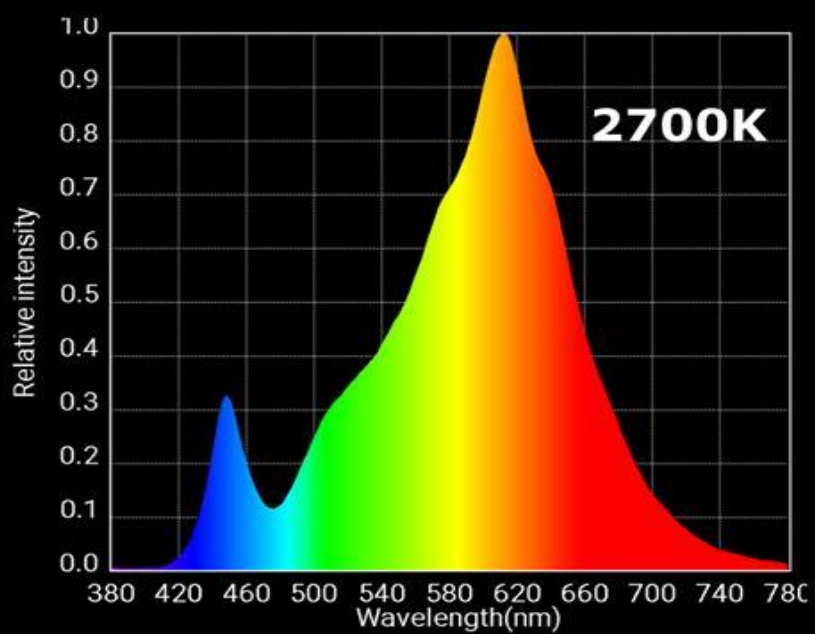
Light Emitting Diodes - LEDs



LED – LIGHT EMITTING DIODE

- Solid state design – silicon chips versus filament
- Developed in 1950's
- Highly efficient; long life, little heat, little degradation of output
- Early versions were in color
- White introduced in 2000's; heavy in the blue spectrum
- Phosphors added to absorb blue and reradiated in the center of the visual spectrum; little loss in lumen output

WHY 3000K (OR LESS) – Note The Blue Spike





DarkSky

Dark-Sky

International

(formerly International Dark Sky
Association)

www.darksky.org

MAKING SMART CHOICES FOR OUTDOOR LIGHTING



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

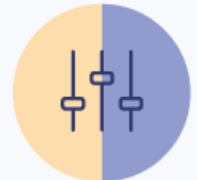
Use shielding and careful aiming to target the direction of the light beam so that it points downward and does not spill beyond where it is needed.



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.



DARK SKY MAINE



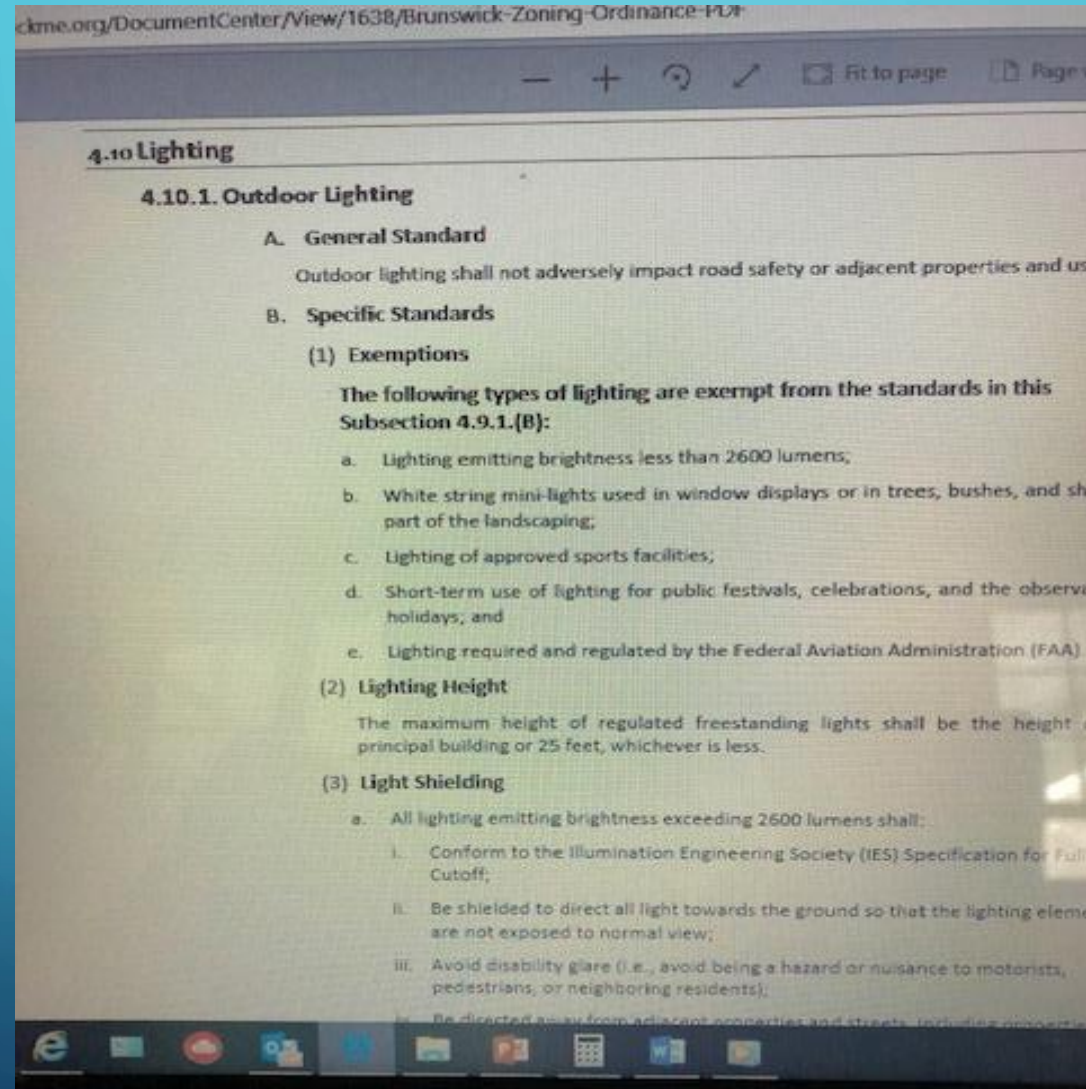
- Established 2020 as part of achieving the KWW Dark Sky Sanctuary designation
- 501(c)(3) non-profit
- Public education
- Star Parties & Virtual Events
- www.darkskymaine.org

Brunswick Zoning Ordinance



Adopted by Brunswick Town Council
August 7, 2017

Brunswick Zoning Ordinance – 1 page on Lighting out of 276 pages



GLOBE AT NIGHT

Observing schedule 2024



The poster features a dark blue background with a starry sky and a large image of Earth from space showing city lights. At the top left is a grid of yellow and blue dots. The text 'Globe at Night 2024' is prominently displayed. A calendar-style grid lists observing periods. Below this is the website URL and a call to action. Three bullet points describe the event's goals. At the bottom, logos for NSI, NOIR Lab, DarkSky, and AURA are shown.

Globe at Night 2024

Jan 2 – 11	Jun 26 – Jul 5
Jan 31 – Feb 9	Jul 26 – Aug 4
Mar 1 – 10	Aug 26 – Sept 4
Mar 31 – Apr 9	Sept 24 – Oct 3
Apr 28 – May 7	Oct 24 – Nov 2
May 28 – Jun 6	Nov 22 – Dec 1
	Dec 22 – 31

WWW.GLOBEATNIGHT.ORG
Get Out and Observe
the Night Sky!

- Engage people worldwide in observing the nighttime sky.
- Encourage students and families to participate in citizen-science with a hands-on learning activity.
- Gather light pollution data from an international perspective to monitor sky brightness and its effects.

Can you see the stars?

NSI | NOIR Lab | DarkSky | AURA

Cherry Springs State Park – Pennsylvania – Dark Sky Camping Every New Moon Weekend



Why not Maine? Bradbury Mountain State Park – Mt. Blue State Park

Go From This



To This – Glare Isn't Necessary!



AND THIS – Proper Scale, Illuminance And Color Temperature in Public Spaces and Parking Lots



AND THIS: GOOD LIGHTING IN NEIGHBORHOODS

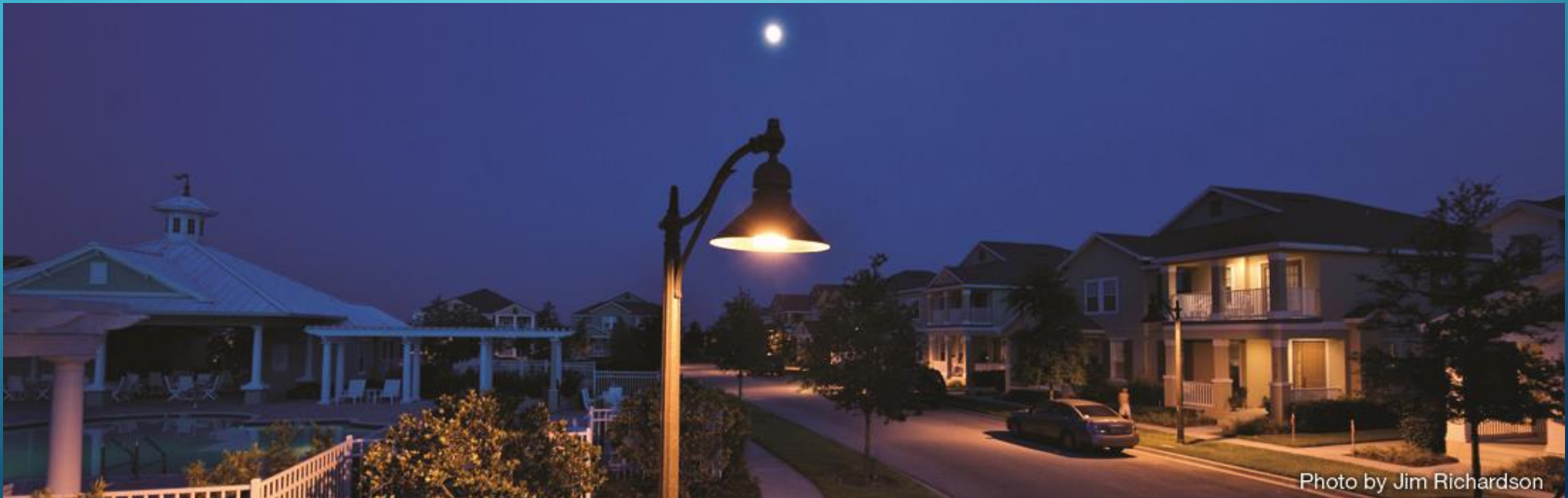

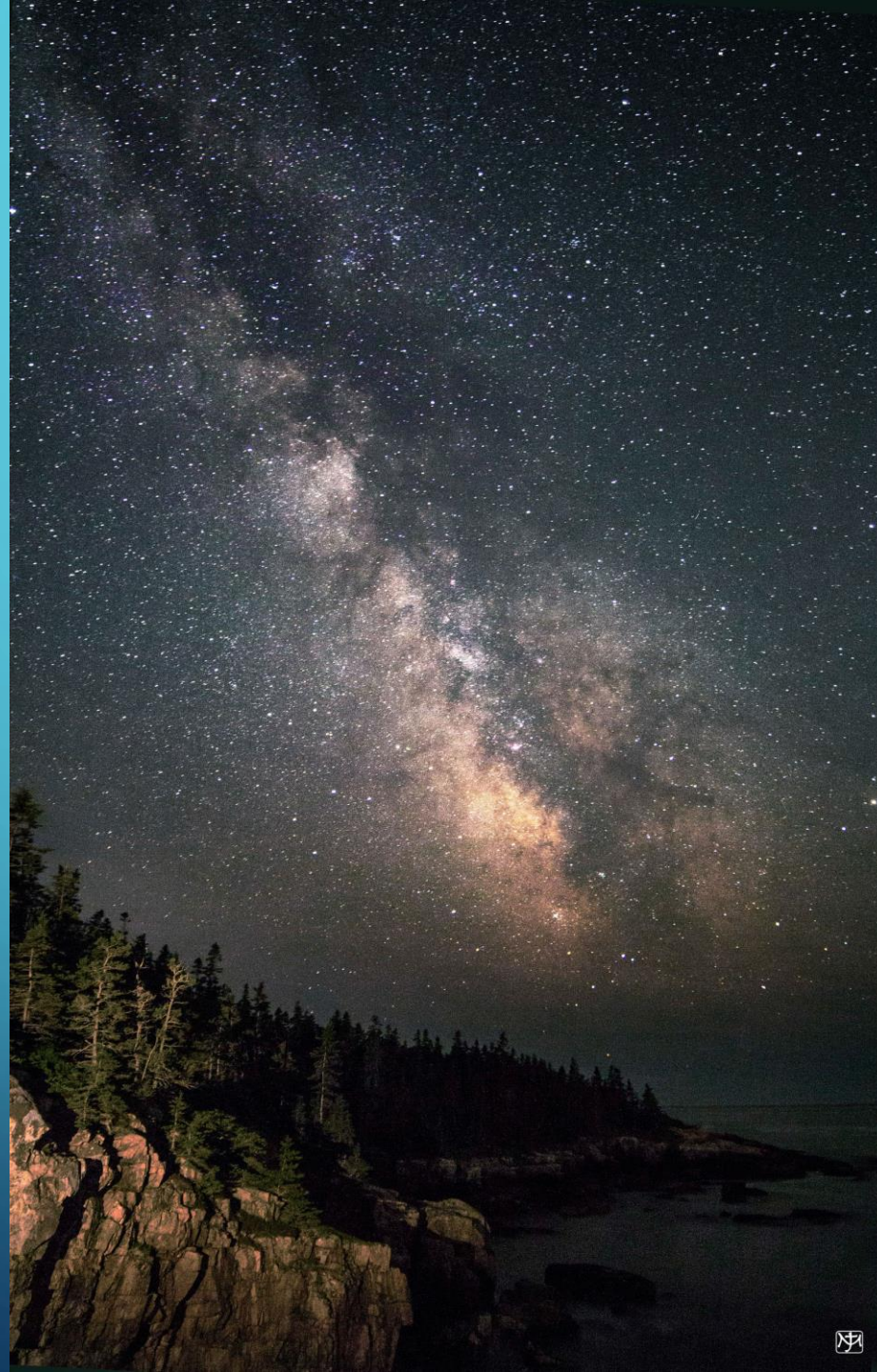


Photo by Jim Richardson



Raven's Nest
Schoodic Point
Acadia National Park



Photography by John Meader



Blessing or Curse? Challenge from “Above”



Starlink Satellite



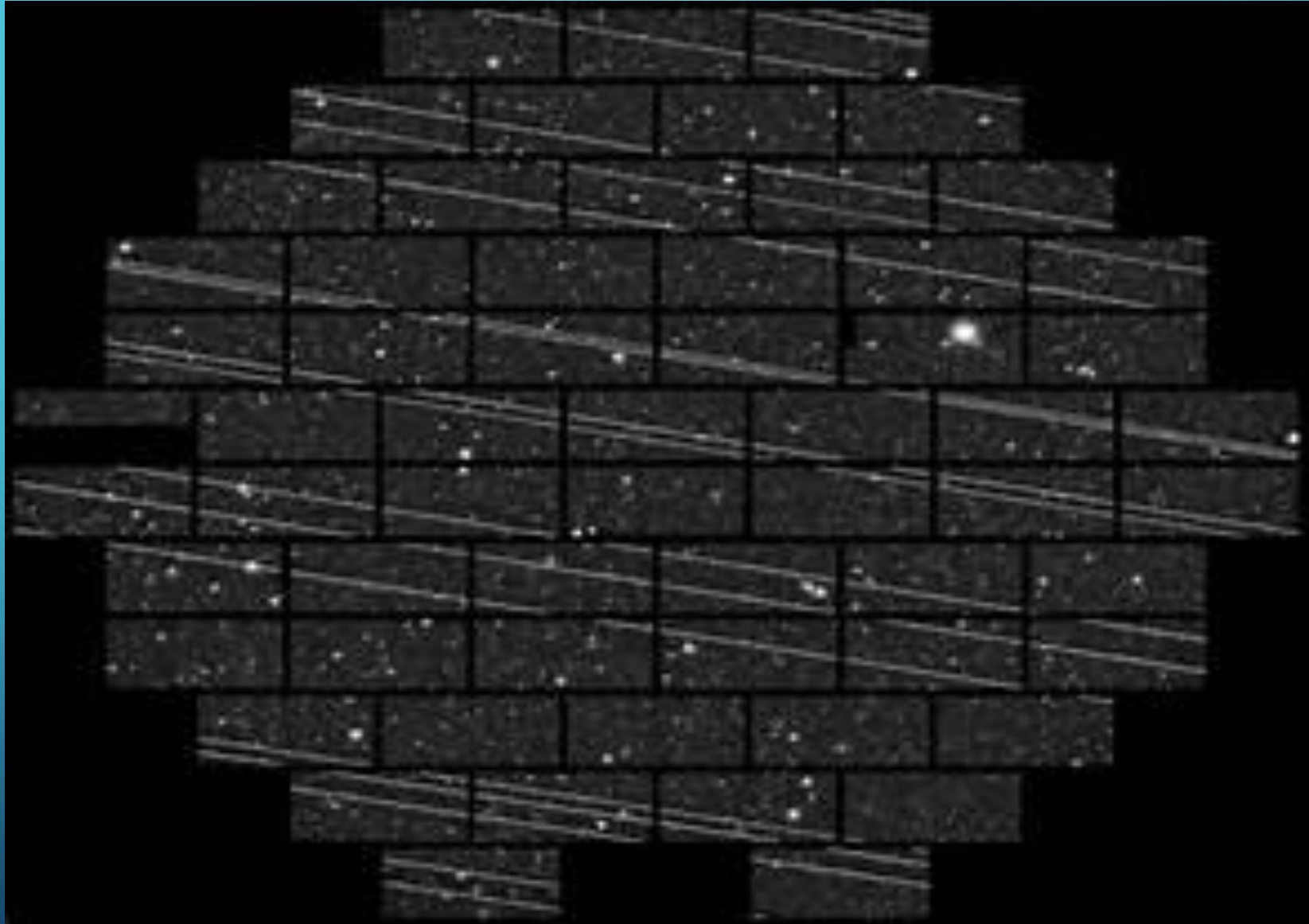
Starlink Array of 60+ satellites
– pre-deployment

Train of Starlink satellites after deployment and before achievement of planned orbits

22:55:21 24/05/19
0933.5 0953.5



Satellite trails



DSI DESIGNATIONS OF DARK SKY PLACES

SANCTUARIES & RESERVES

- **International Dark Sky Sanctuaries:** 18 worldwide (9 in US) – remote areas, few threats to it – **Katahdin Woods & Waters National Monument (2020)**
- **International Dark Sky Reserves:** 22 worldwide (1 in US) nearest to us is Mont Megantic in Quebec (first ever). 34 surrounding communities adopted lighting regulations to control the spread of light pollution around the observatories and the area

PARKS, COMMUNITIES & PLACES

- **International Dark Sky Parks:** 120 on six continents – exceptional dark sky places that are protected for their cultural, scientific or educational value – **the AMC Maine Woods (100 mile Wilderness) (2021)**
- **International Dark Sky Communities:** 46 communities – places where through comprehensive regulation of outdoor lighting, public education and citizen support dark skies are actively preserved
- **Urban Night Sky Places:** 9 worldwide – a park or open space amidst large urban environs where planning and design promote authentic nighttime experience despite surrounding light pollution.