

Celebrating the Night

The multiple benefits of dark sky protection

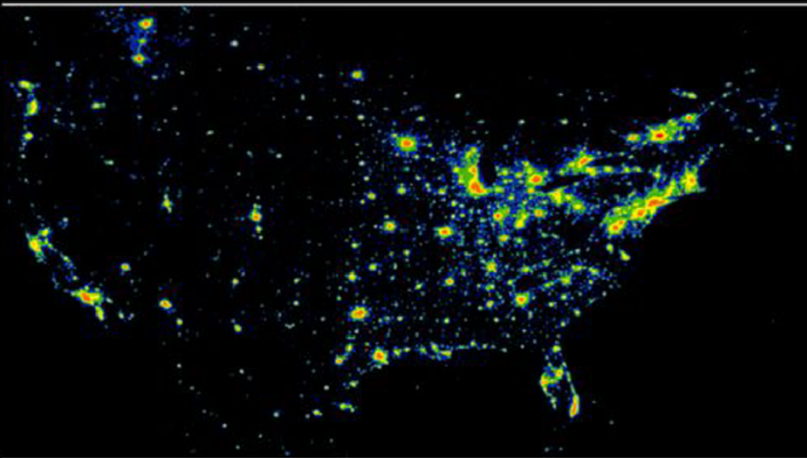




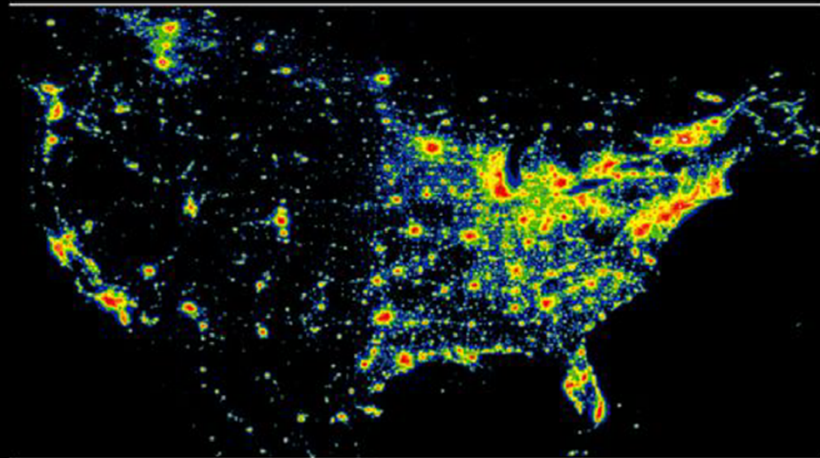
**Many CAST
communities
are fortunate!**

**80% of the world's
population CANNOT
see the Milky Way
from where they live.**

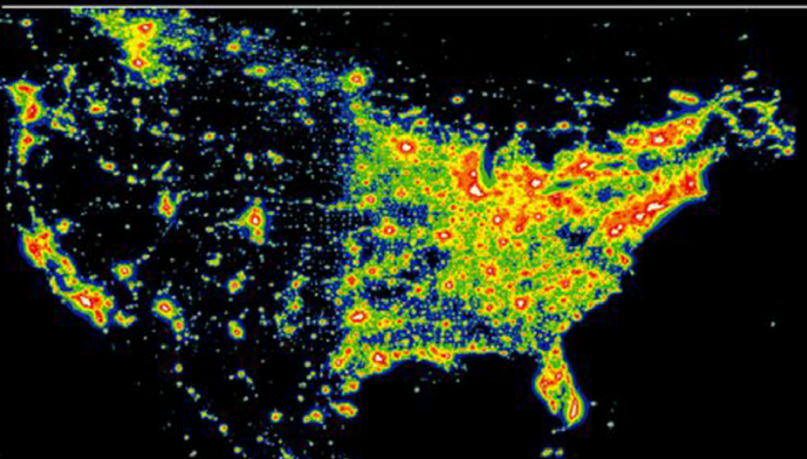
**99% of USA and
European residents live
under light polluted
skies.**



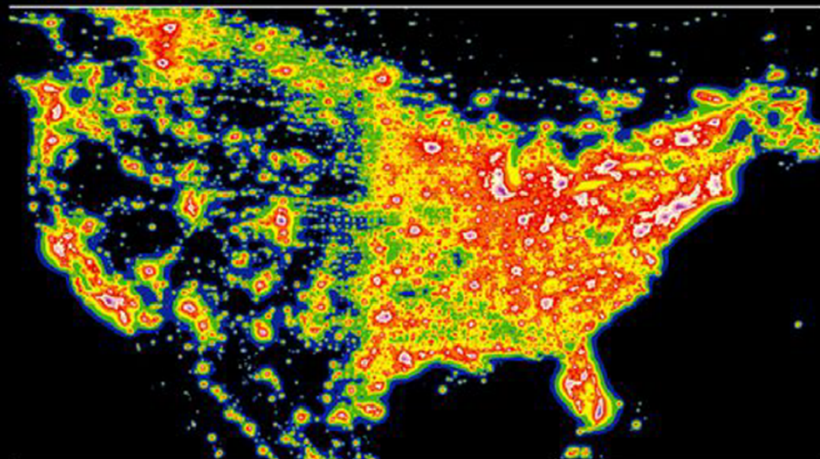
Late '50



Middle '70

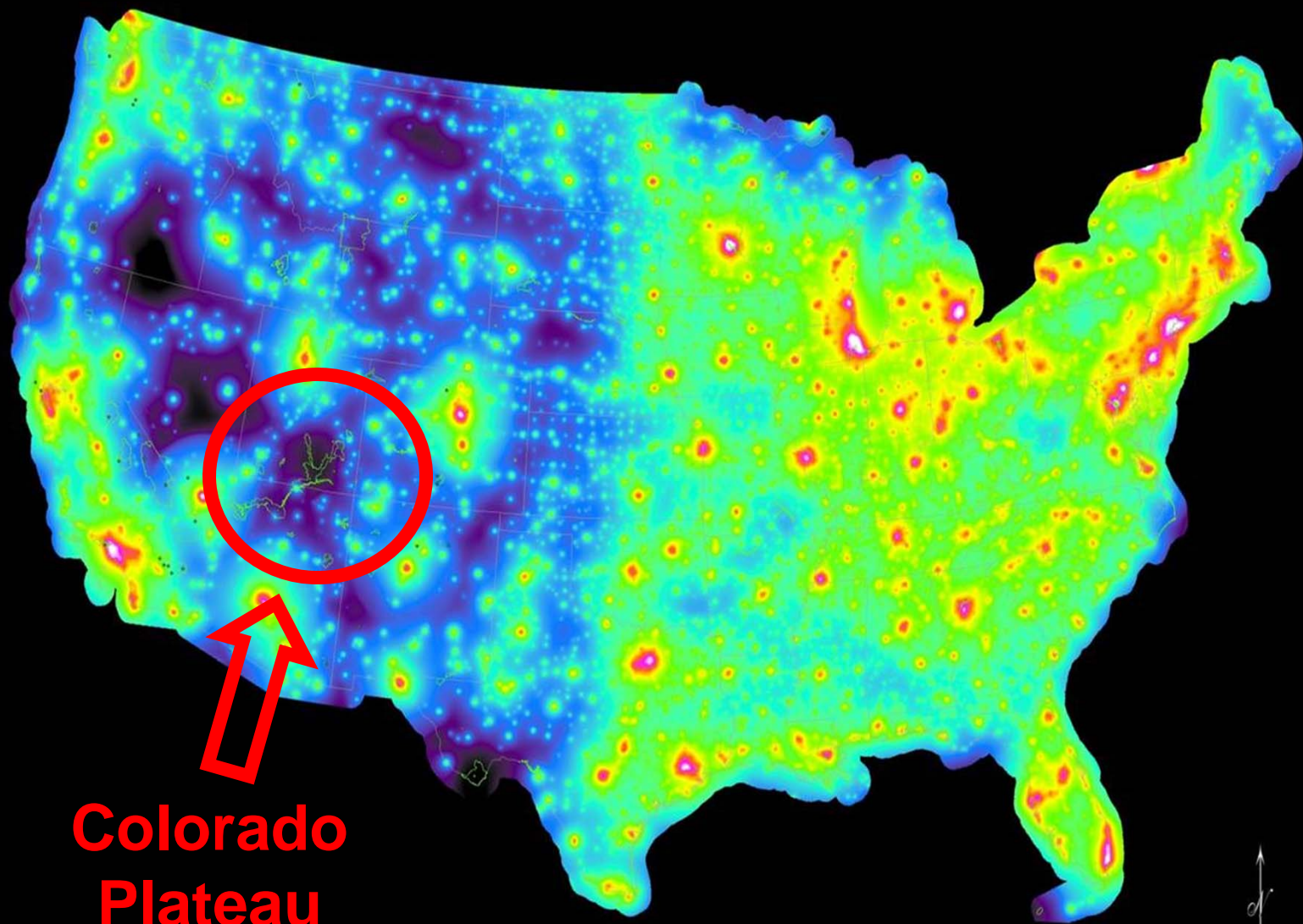


1997



2025

The Exponential Growth of Light Pollution



**Colorado
Plateau**

*NPS Natural Sounds and Night Skies
Division*

3000 BC
CANDLES



1700s
OIL LAMPS

1790s
GAS LIGHTING

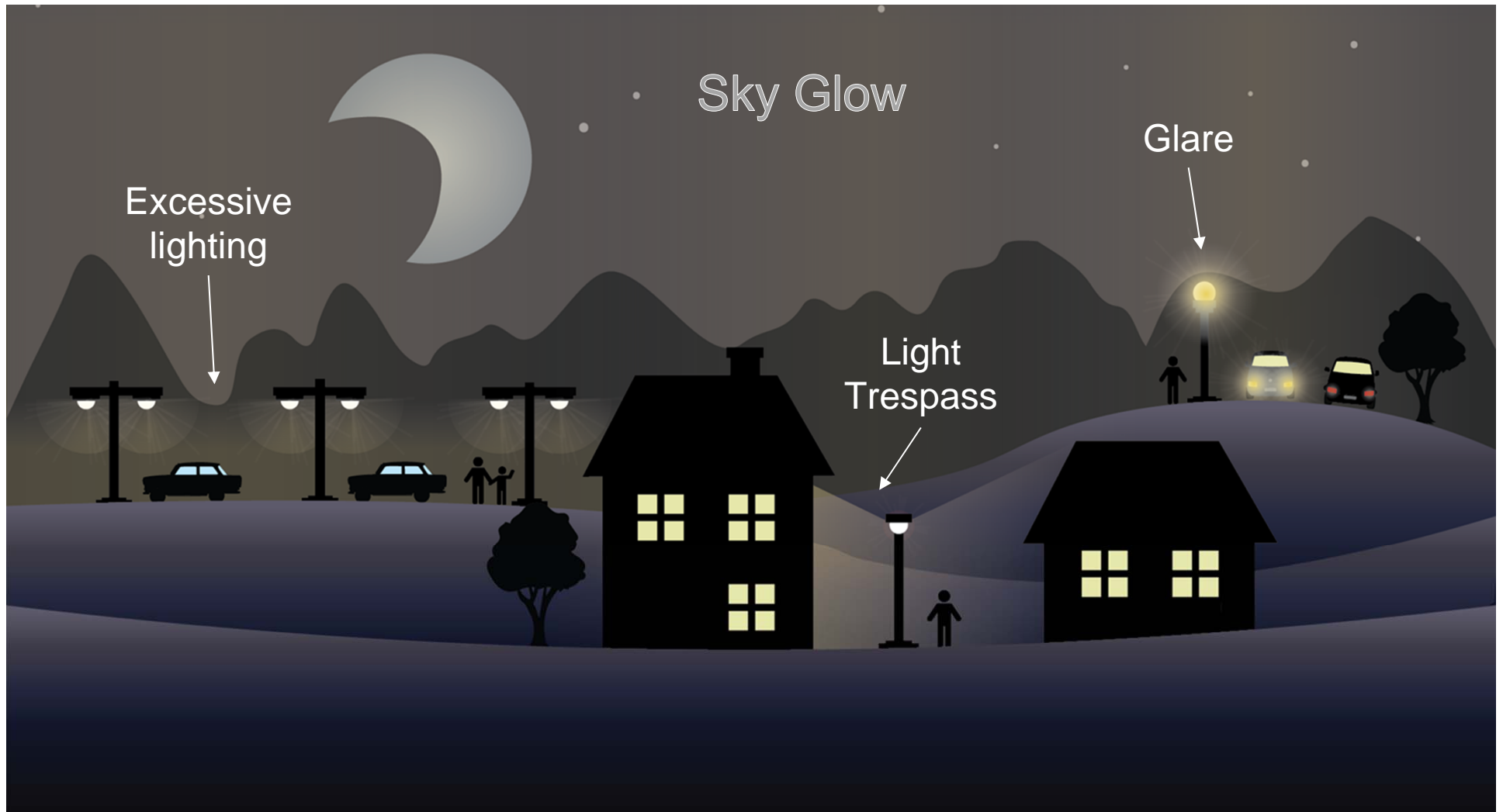


1880s
ELECTRIC LIGHTING

1960s
LED LIGHTING



**an introduction to
light pollution**



Sky Glow

Excessive
lighting

Glare

Light
Trespass

Light Pollution:

“Any adverse effect of artificial light, including sky glow, glare, light trespass, light clutter, decreased visibility at night, and energy waste.”

- International Dark Sky Association (IDA)



Light Pollution:

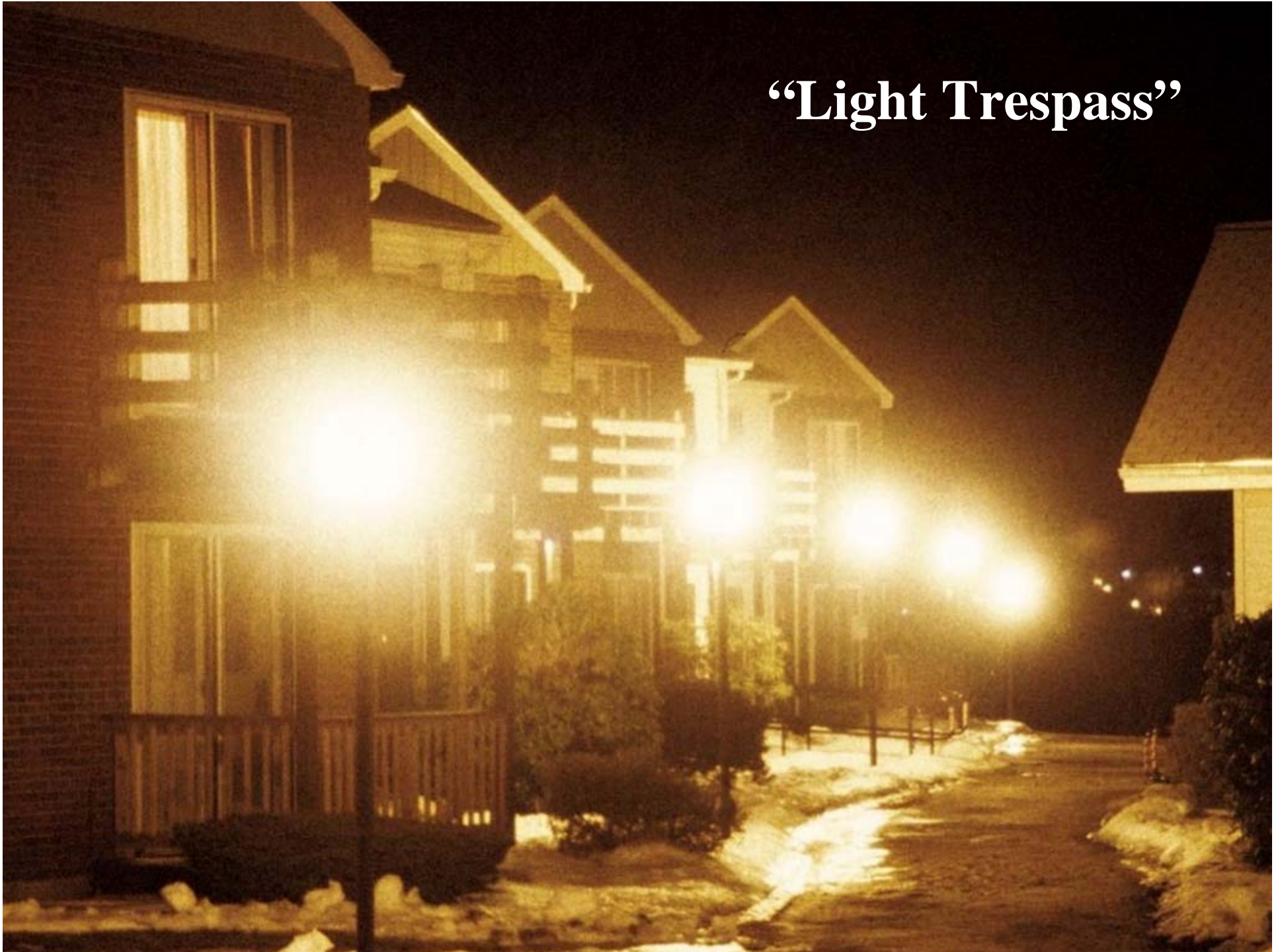
“Any adverse effect of artificial light, including sky glow, glare, light trespass, light clutter, decreased visibility at night, and energy waste.”

- *International Dark Sky Association (IDA)*



“Sky Glow”

“Light Trespass”



A photograph showing the silhouettes of a group of people standing on a balcony or walkway, looking out at a sunset over a body of water. The sky is a gradient of orange, yellow, and blue. The silhouettes of the people are dark against the bright horizon. Some people are holding cameras or phones, and one person is holding a telescope. The overall mood is peaceful and contemplative.

The Multiple Benefits of Darkness



Ecosystem Functionality

- Wildlife use natural light as a resource and source of information about their environment.
- Altered behaviors, foraging areas, and breeding cycles
- Hormone regulation, reproduction, adaptation, and survival

Bliss-Ketchum et al. (2016)
Ciach and Fröhlich (2019)



Energy Savings

- **60%** of outdoor lighting is wasted as unneeded, overlit or poorly aimed lighting.
- In the United States, approximately **one-third of all lighting is wasted**, and estimates suggest that nearly **\$7 billion** dollars of energy is wasted as light pollution annually.
- Light Pollution adds **21 million tons** of carbon dioxide to the atmosphere each year.



Human Health

- Artificial light-at-night (ALAN)
- Blue light spectrum
- Circadian disruption and physiological processes
- Sleep-wake disorders, psychiatric disorders, cardiovascular diseases, immunological disorders, metabolic disorders, obesity and cancer progression

MYTH:
MORE LIGHTING
IS SAFER



REALITY:
WELL DESIGNED
LIGHTING IS SAFER



A group of people are sitting on a wooden fence in a dark, rural landscape at night. The sky is filled with stars, and the Milky Way is visible. The scene is dark, with the only light source being the stars and the moon. The people are silhouetted against the bright sky. The fence is made of wooden posts and rails. The background shows rolling hills and a clear night sky.

Socio-Cultural

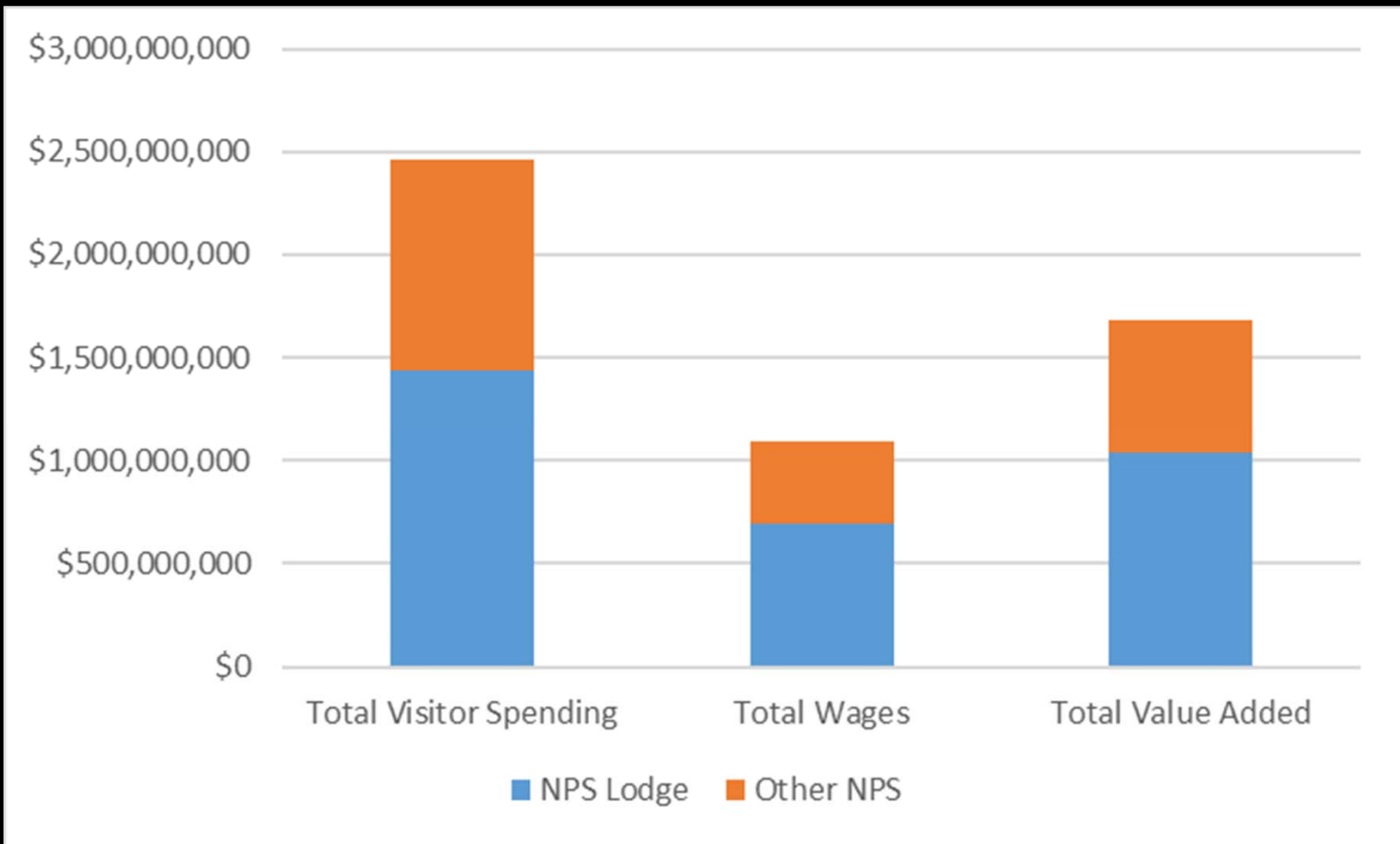
- Ancient traditions
- Form meaning
- Pioneer heritage and rural character
- Future generations

The background of the slide features a photograph of two people in silhouette. On the left, a person is looking through a telescope. On the right, another person's profile is visible, looking towards the same direction. The sky is a deep blue with a small, bright light source, possibly the moon or a star, visible in the distance. The overall mood is contemplative and focused.

Economic Value

- Intermountain West
- Gateway communities
- Increased visitor spending
- Not seasonally dependent
- One of the most sustainable forms of tourism

Projected Economic Impacts of Dark Skies at NPS Units in the Colorado Plateau Dark Sky Cooperative (Time Period: 2014 – 2024 in 2013 \$)



(Adapted from Mitchell & Gallaway, 2015)

Why Dark Skies?

Safety

Health

Ecology

Energy



Cultural heritage

Rural Character

Economic Benefits

Protecting Moab's dark sky

(It has been a journey)



Eight of the World's Best Destinations for Stargazing

Where to find the clearest, darkest skies – from Pennsylvania to the Canary Islands



NamibRand Nature Reserve in Namibia. (Frans Lanting/Corbis)

By **Lindsey Olander**, [Travel + Leisure](#)

MAY 5, 2015 | UPDATED: JULY 25, 2017



558

The immensity of the universe is beautiful and humbling—the stars remind us of billions of lives spent in astronomer Carl Sagan's



Travel trends for 2019: dark skies

Megan Eaves
Lonely Planet Writer

SHARE



As Earth grows ever more populous and cities expand, opportunities for humanity to look up at the rest of the universe decrease. Across the planet, travellers are now seeking out the

TRAVEL

THE GETAWAY

Your Next Trip? It's Written in the Stars

Resorts, parks and attractions in the United States, Canada, Mexico and beyond are expanding the galaxy of what has become known as astrotourism.

The New York Times ...aining dark skies where they npolluted view of the stars.

ie Milky Way. A meteor streaking across the
ing primal about watching the night sky.
ore wanderlust than pondering the vastness
ath a sky full of constellations. Sadly, visual



w from the Manning Park Resort in British Columbia. Jon Ross

By Elaine Glusac

Sept. 3, 2018



Like watching the sunset, seeking out the Big Dipper in the night

Astro Events as Catalysts



Friends of Arches and Canyonlands National Parks



Moab Dark Skies

Friends of Arches and Canyonlands National Parks

**Grand County Community &
Economic Development Director**

Moab Dark Skies





Friends of Arches and Canyonlands National Parks

Grand County Community & Econ Development Director

International Dark-Sky Association

Moab Dark Skies



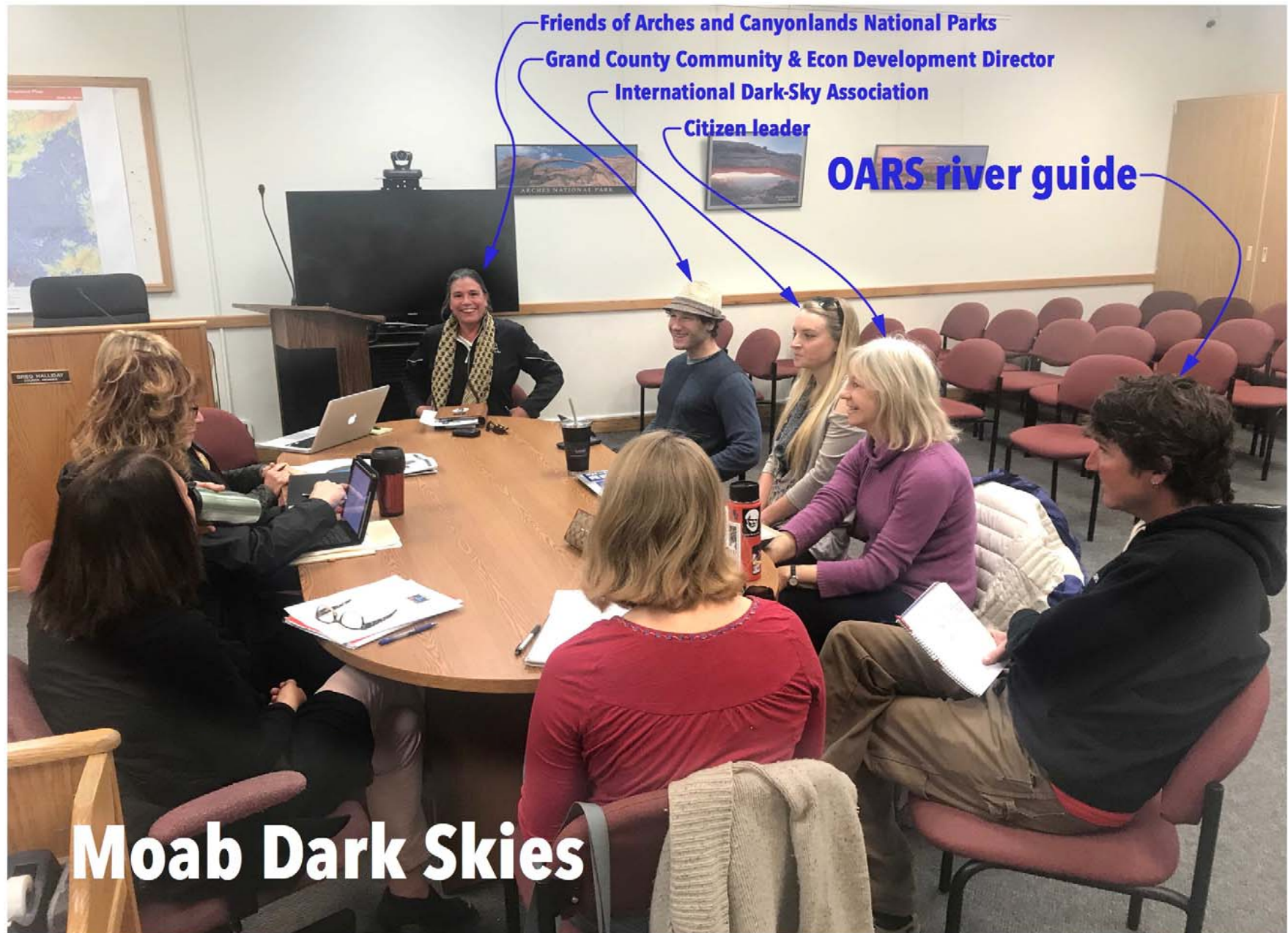
Friends of Arches and Canyonlands National Parks

Grand County Community & Econ Development Director

International Dark-Sky Association

Citizen leader

Moab Dark Skies



Friends of Arches and Canyonlands National Parks

Grand County Community & Econ Development Director

International Dark-Sky Association

Citizen leader

OARS river guide

Moab Dark Skies



Friends of Arches and Canyonlands National Parks

Grand County Community & Econ Development Director

International Dark-Sky Association

Citizen leader

OARS river guide

Rocky Mountain Power

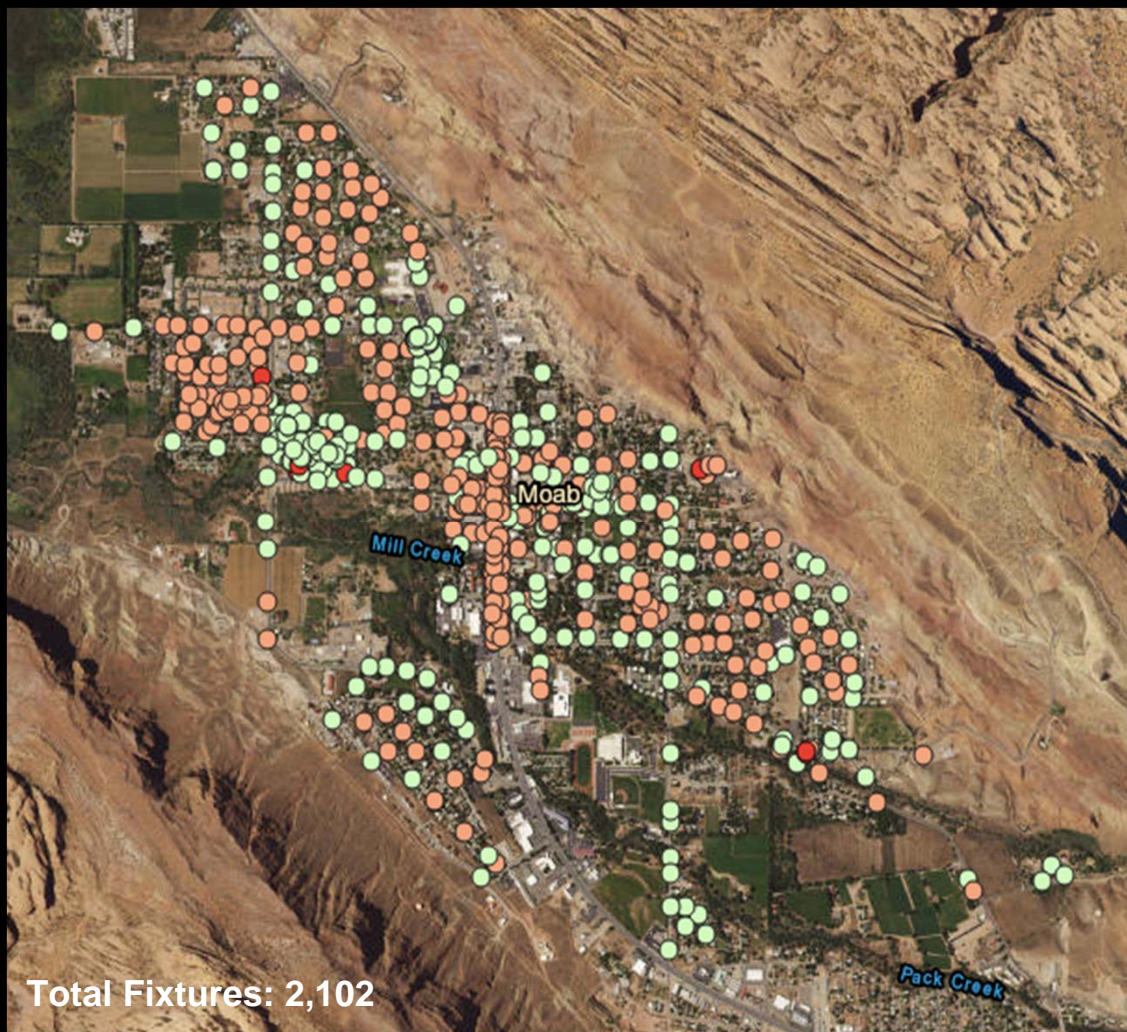
Moab Dark Skies





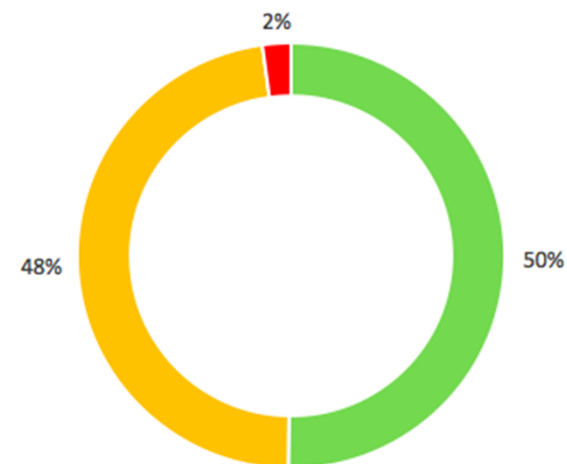


Moab Lighting Inventory



Moab City
Fixture Shielding (On At Night)

■ Fully Shielded ■ Partially Shielded ■ Unshielded



Importance of Interpretation and Events



The Moab Dark Skies Group
Cordially invites you to
The Public Officials Star Party

The event will include a Dutch
Oven dinner and dark sky
presentation.

On April 9, 2018 at 6:30PM
At the Grand County High School
Ballfields

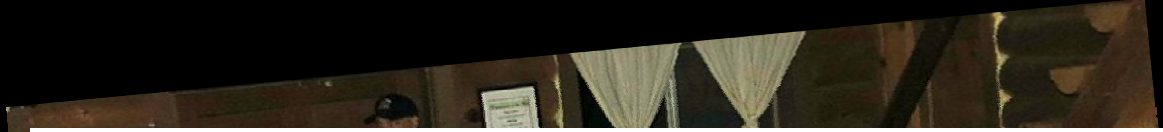
Telescope viewing and star gazing
will commence at dark.

Please RSVP at
<https://goo.gl/dVxC2g>
By March 30, 2018



Jacob W. Frank -
NPS

Education: residents and visitors

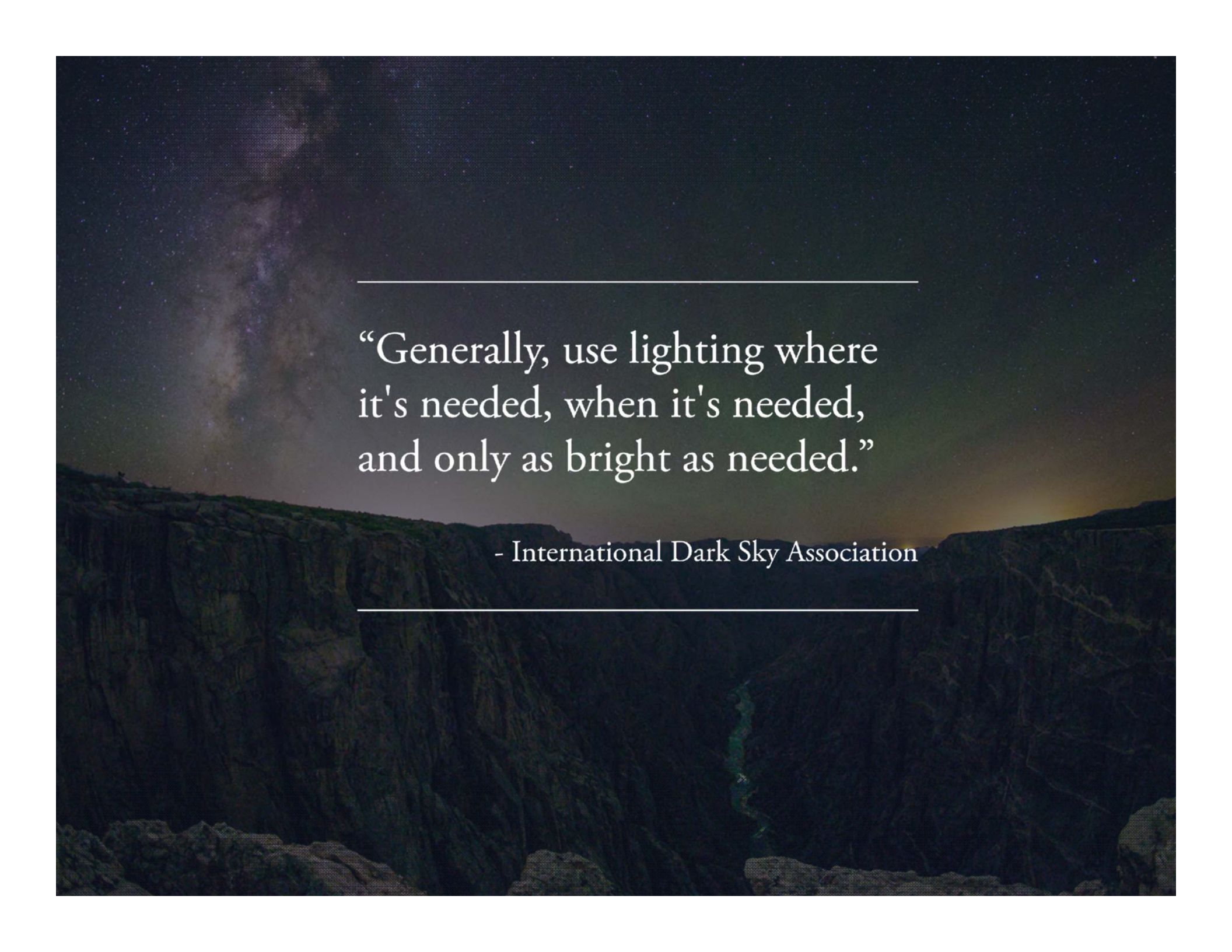


“I have lived in The Bronx my entire life. I am 15, and this is the first time I have truly seen stars. They are magical. I will always remember this trip.”

(SPLORE participant 2010)



Junior Ranger
Night Explorer



“Generally, use lighting where
it's needed, when it's needed,
and only as bright as needed.”

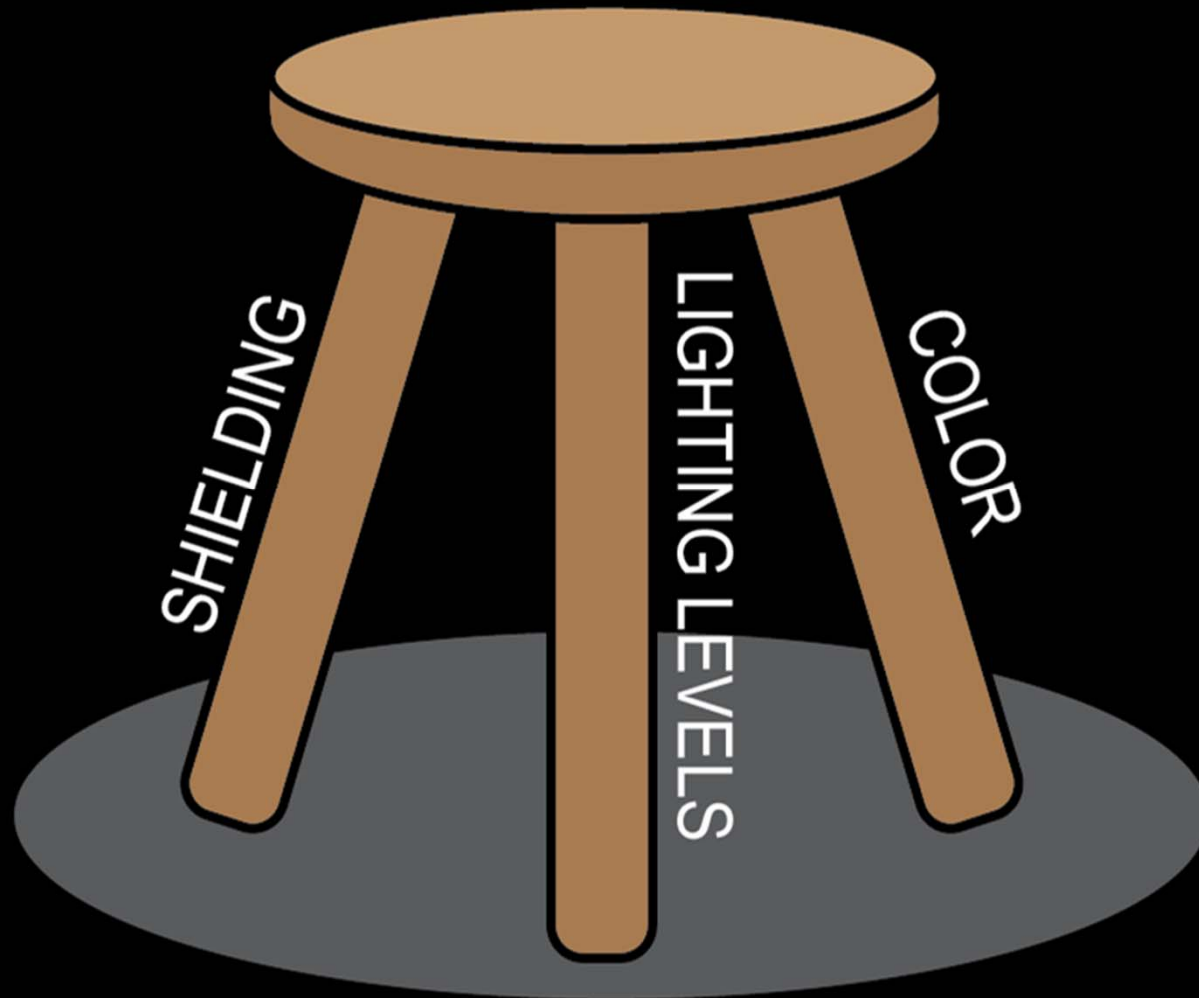
- International Dark Sky Association

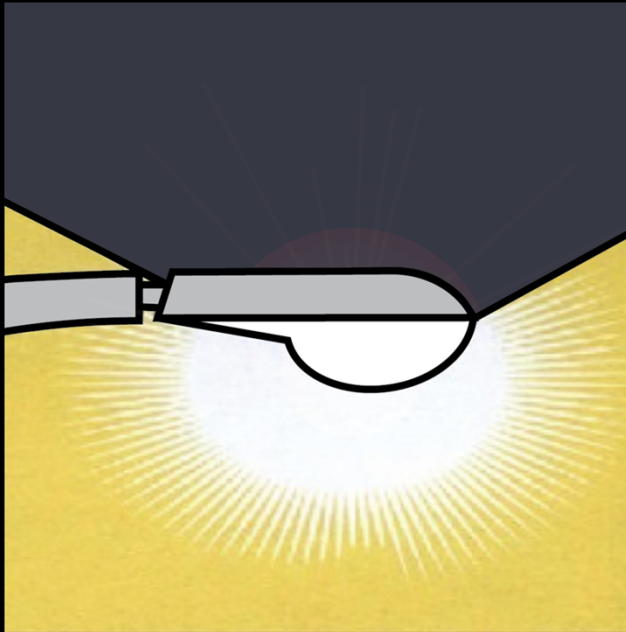


Purpose of Lighting Code

- Limit light pollution and nuisance
- Promote energy conservation
- Improve night-time public safety
- Minimize lighting impacts on health
- Improve and unify the night-time appearance of community
- Maintain (semi-) rural atmosphere

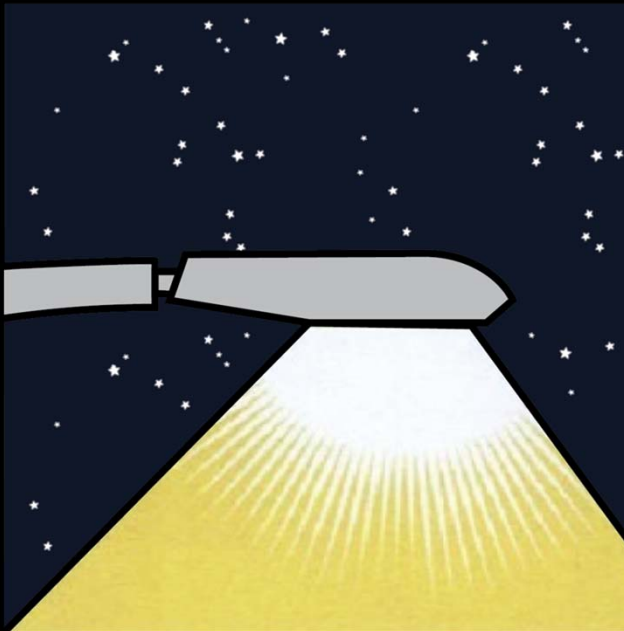
The Three-Legged Stool

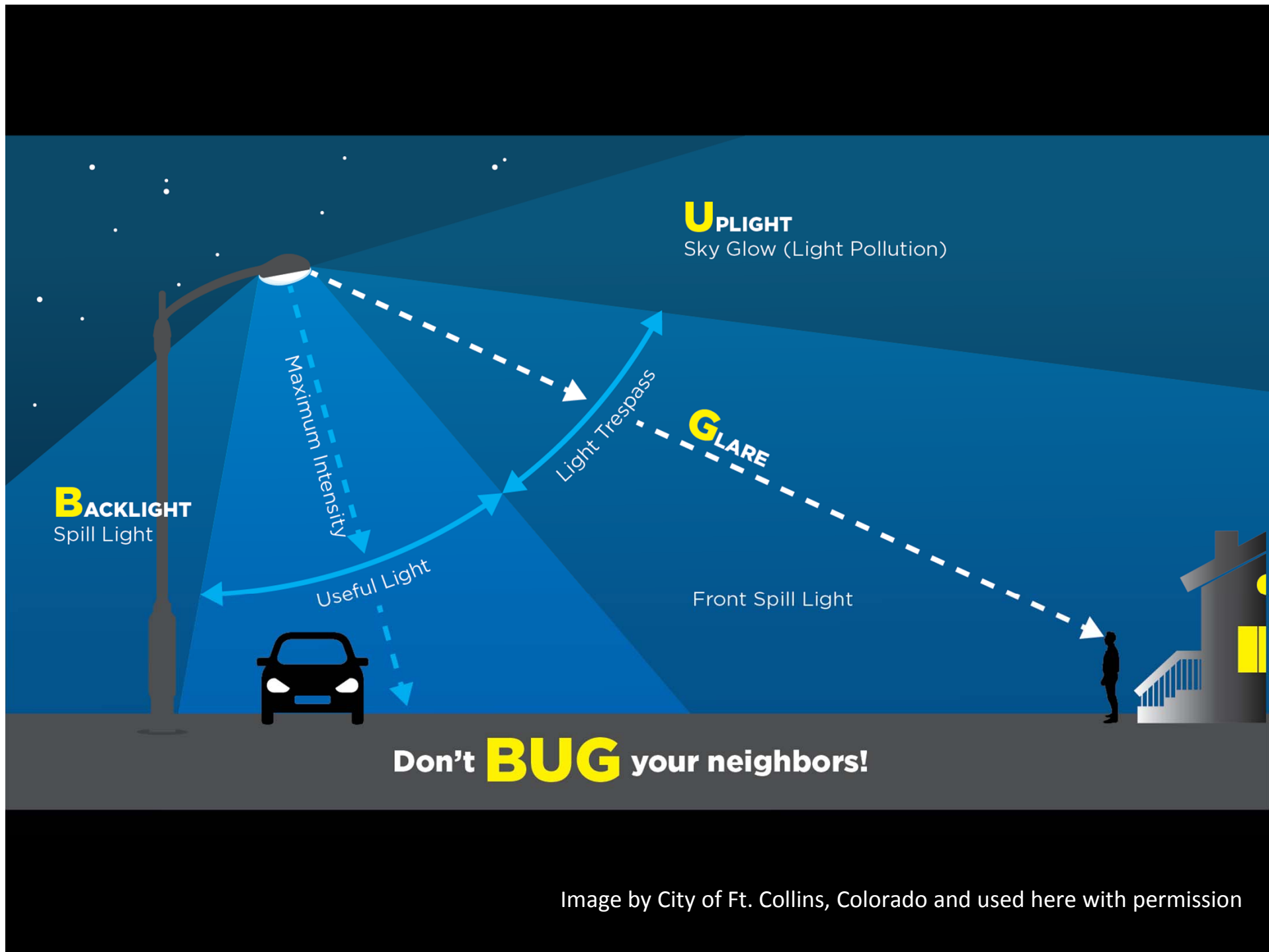




Fully-shielded fixtures

- Prevent light from shining where it is unwanted and unneeded
- Direct light towards the intended subject
- Can be purchased or retrofitted

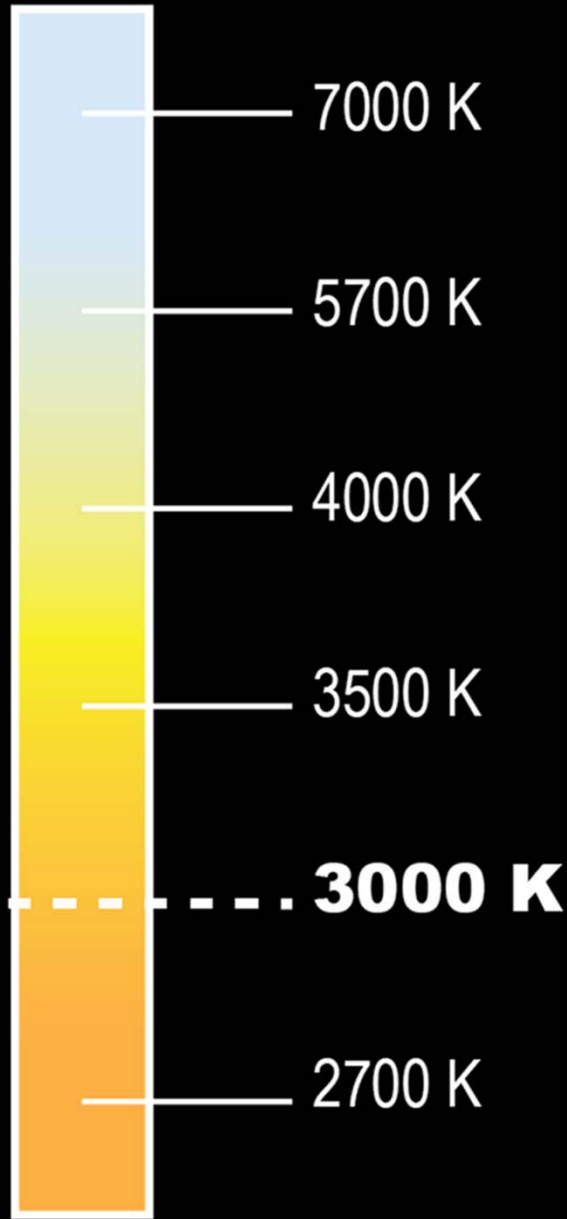




Amount of Light



- Design for appropriate lighting levels
- Maximum light outputs (residential vs. commercial)
- You MUST address signage!
- Lighting curfews
- Use timers, motion sensors, dimmer switches where appropriate
- Special lighting circumstances and exemptions

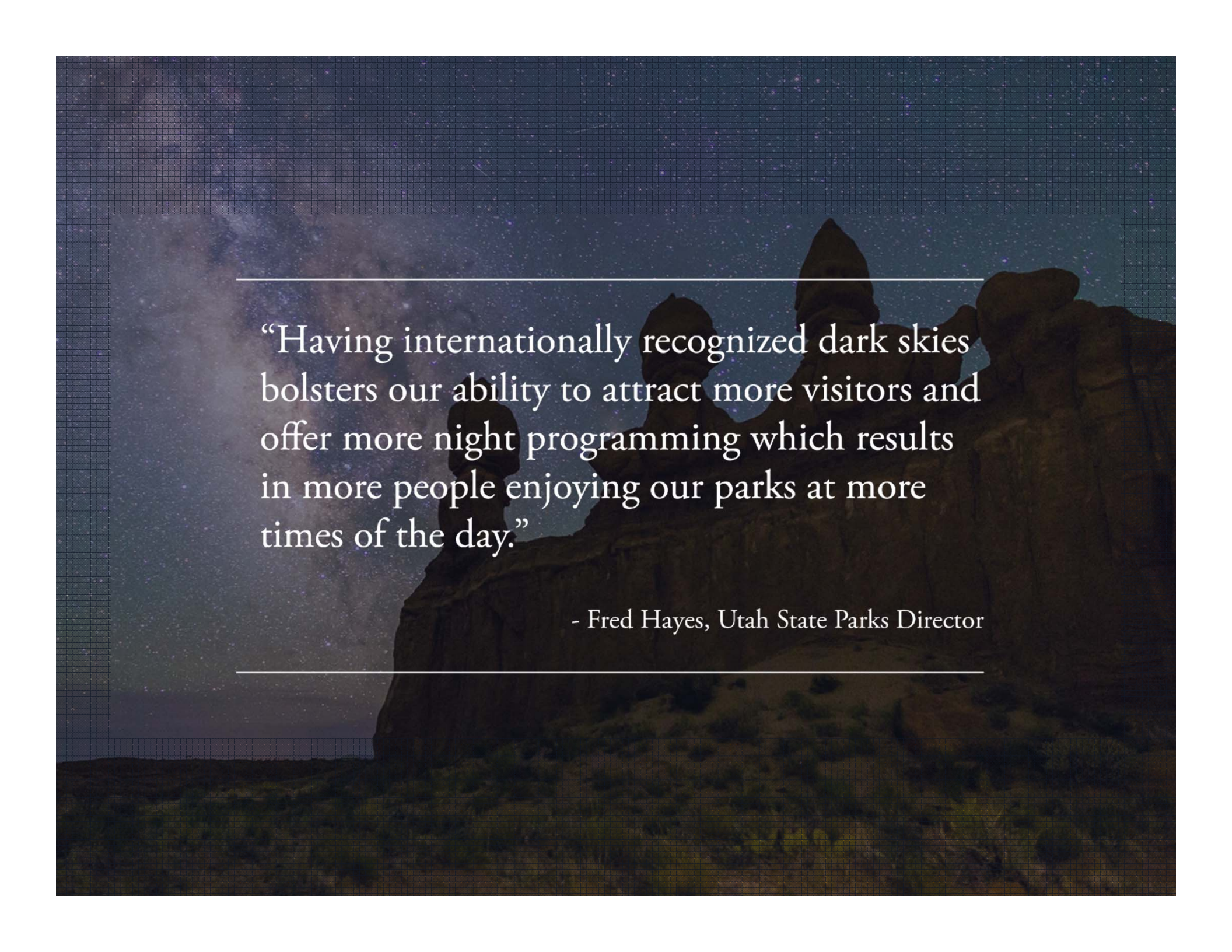


Lighting Color

- Avoid blue-rich lighting
- Warm, amber colored-light is best
- 3000 Kelvin is the threshold

Trade-offs

- LEDs more energy efficient, but less night-sky friendly
- Amber LEDs = shorter life



“Having internationally recognized dark skies bolsters our ability to attract more visitors and offer more night programming which results in more people enjoying our parks at more times of the day.”

- Fred Hayes, Utah State Parks Director

The Times-Independent

Serving Southeast Utah since 1896

News ▾ Obituaries Opinion ▾ Outdoors Red Devils All cat

Arches certified as International Dark Sky Park

Designation is culmination of 10-year effort to preserve night skies; will bolster astronomy-based tourism



The Times-Independent

Serving Southeast Utah since 1896

News ▾ Obituaries Opinion ▾ Outdoors Red Devils All categories

City okays dark sky ordinance

New rules effective immediately

By Carter Pape
Aug. 16, 2019

Moab City Council approved within city limits similar to the Grand County Council.

ments and most major y rules, which aim to reduce the properties inside city limits. The ents, residential and commercial st 2024.

The Times-Independent

Serving Southeast Utah since 1896

News ▾ Obituaries Opinion ▾ Outdoors Red Devils All categories

Majority vote approves dark skies code

By Doug McMurdo
Apr. 3, 2019

The Grand County Council voted 6-0 with one recusal to adopt amendments to the outdoor lighting and sign illumination section of county land use code at Tuesday's meeting.

Public support for the changes has been nearly unanimous, with most

www.visitutah.com/places-to-visit
Dark Sky Parks - Astro Tourism | Visit Utah

LIFE UTAH ELEVATED
USA

DARK SKY PARKS

DARK SKY PARKS

Enjoy some of the best stargazing in the world

Of the more than 60 certified or in-process International Dark Sky Parks and Communities that are part of a catalog of the finest dark skies in the world, the highest concentration are in Utah, including two national parks, four state parks, four national monuments and one dark sky community. Learn more about stargazing in Utah

CAPITOL REEF
Temple of the Moon at Capitol Reef National Park.

Feedback

ATTRACTIONS
ACTIVITIES
LODGING + CAMPGROUNDS
AREA INFO + SERVICES
TRANSPORTATION
Local
BLOG
CONTACT
EVENTS
SUBMIT
SELECT LANGUAGE
f t y
REQUEST FREE TRAVEL

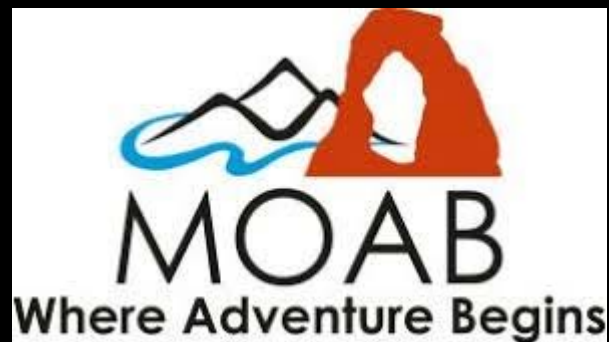
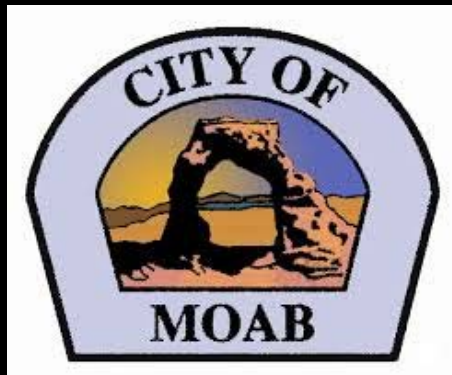
Moab's Amazing Night Skies

Visitors from around the world come to experience Moab's dark skies.

Introduction

The public lands surrounding Moab have some of the darkest skies remaining in the contiguous 48 United States. As few as one in ten Americans lives in an area where they can see the estimated 2,500 stars that should be visible under normal conditions. In many cities, the night sky is completely obscured by the glow of urban settlement. At Arches National Park, the naked eye is sufficient to witness a wealth of stars. Under the right conditions, common binoculars may even reveal the rings of Saturn.

A ***voluntary*** effort to link communities,
businesses, state agencies, federal
agencies, and citizens





Moab Information

Moab Links
Lodging
Restaurants
Live Music
Menu Guide
Shopping
SE Utah Real Estate
Attractions & Activities
Tours / Rentals
SE Utah Parks
Health & Wellness
Moab Services
Museums
Clubs and Organizations

Current Calendar (Home)
Yearlong Event Calendar

Monthly Articles

Astrology
Business Happenings
Cycling Happenings
Dark Sky Happenings
Gallery Happenings
Geology Happenings
Healthy Happenings
Museum Happenings
Nature Happenings
Non-Profit Happenings
Pet Happenings
Science Happenings
Shopping Happenings
Stunts, Stars, Legends
Sustainability Happenings
Motorized Happenings
Water Adventures

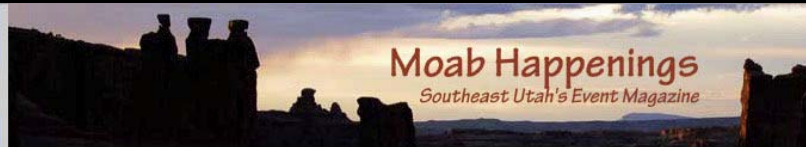
Article Archive

Schedules

KZMU Program Schedule

Arts in Moab

Moab Art Walk
Moab Arts Council
Moab Arts Festival
MARC (Moab Arts & Recreation Center)
Moab Artist Studio Tour
Moab Photo Symposium
Red Rock Arts Festival
The Dust Magazine



DARK SKY HAPPENINGS - August 2019

The Moab Dark Skies was established by the Friends of Arches and Canyonlands Parks in conjunction with the National Park Service and Utah State Parks Division of Natural Resources. Dark skies are a valuable and rare resource that millions of people throughout the world never get to see. Discover ways to appreciate and conserve Moab's unique and rare dark skies here at home. The universe is right overhead in our backyards!

Darkness Is Best for a Good Night's Rest

The sixteenth century English playwright Thomas Dekker wrote "Sleep is the golden chain that ties health and our bodies together". Even in the 1500s people understood that there was an intractable link between sleep and our health. And now, in the twenty first century, we have a multitude of studies supporting what Dekker and others knew to be true. But our knowledge goes so much deeper than that. We now understand the important balance between bodily functions like melatonin production, a good-night's rest, long-term health, and how our environment shapes it all.

In Thomas Dekker's time, and through prior human history, people slept differently than they do today. Historian Roger Ekirch explained in his book "At Days Close: Night in Times Past", that before the invention of the electric light bulb people slept in two shifts lasting four hours each called first sleep and second sleep. These two sleeps were separated by a period of "quiet wakefulness" late at night.

But this all changed in the late 1800s with the invention of the electric light bulb. Most of us are now exposed to artificial light at nighttime, interrupting our natural cycle of light and dark. This in turn changes how we sleep. The key to understanding this might be the hormone melatonin. This hormone is secreted by the pineal gland at night, and is known for helping to regulate our biological clocks. The melatonin makes us sleepy, and therefore helps us to get a good night's rest. However, when exposed to artificial light at night our bodies melatonin levels drop significantly.

When we stay up late with the lights on, playing on our phones, or watching TV, our body doesn't receive the natural cues to start the production of melatonin. This can interrupt our sleep causing us to sleep less, or develop sleep disorders. And as Dekker knew, when we don't sleep well, our health and our bodies suffer.

So turn off those lights and let the night sink in. If you're lucky enough to live where you can still see the stars, go outside and enjoy them. Curl up on a warm summer's eve and watch for shooting stars. You may find that it is more than just your sleep that improves!

Moon Happenings

Aug 7 - First Quarter at 11:30 am

Aug 15 - Full Moon at 6:29 am

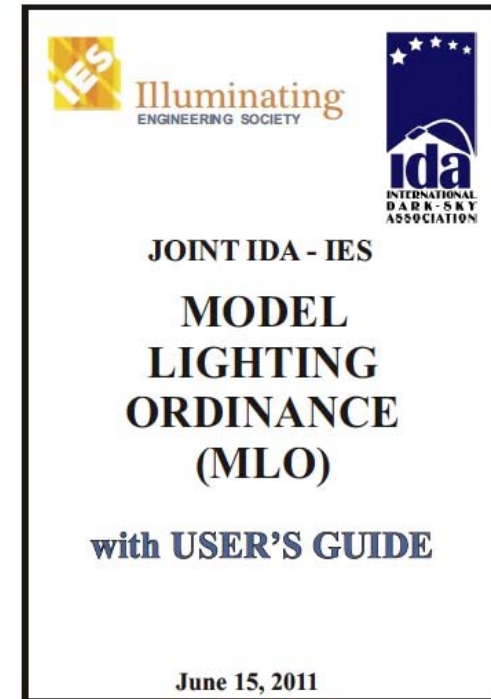
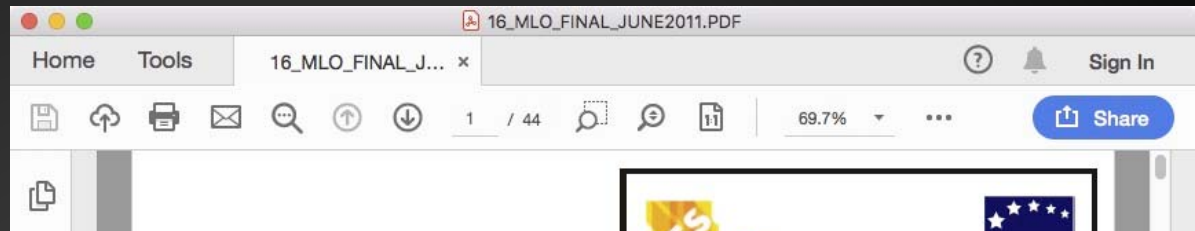
Sunrise-Sunset for August
(The time of sunrise and sunset assumes a flat horizon. Actual time may vary depending upon the landscape.)

DATE	SUNRISE	SUNSET
1	6:20 am	8:28 pm
2	6:21 am	8:27 pm
3	6:22 am	8:26 pm
4	6:23 am	8:25 pm
5	6:24 am	8:24 pm
6	6:25 am	8:22 pm
7	6:25 am	8:21 pm
8	6:26 am	8:20 pm
9	6:27 am	8:19 pm
10	6:28 am	8:18 pm
11	6:29 am	8:17 pm
12	6:30 am	8:15 pm
13	6:31 am	8:14 pm
14	6:32 am	8:13 pm
15	6:33 am	8:11 pm
16	6:33 am	8:10 pm
17	6:34 am	8:09 pm
18	6:35 am	8:07 pm
19	6:36 am	8:06 pm
20	6:37 am	8:05 pm
21	6:38 am	8:03 pm
22	6:39 am	8:02 pm
23	6:40 am	8:01 pm
24	6:41 am	7:59 pm
25	6:41 am	7:58 pm
26	6:42 am	7:56 pm
27	6:43 am	7:55 pm
28	6:44 am	7:53 pm
29	6:45 am	7:52 pm
30	6:46 am	7:50 pm
31	6:47 am	7:49 pm

Sustained Education & Advocacy

**Involve your
business
community**





Grand County Land Use Code

Help Text Size: -A +A SHARE

Search Code Search

+ Advanced Search

- ☐ 6.6 Outdoor Lighting **Revised 6/19**
 - ☐ 6.6.1 Purpose **Revised 6/19**
 - ☐ 6.6.2 Scope and Applicability **Revised 6/19**
 - ☐ 6.6.3 Definitions **Revised 6/19**
 - ☐ 6.6.4 Fully Shielded Fixture Requirements **Revised 6/19**
 - ☐ 6.6.5 Total Light Output **Revised 6/19**
 - ☐ 6.6.6 Lighting Hours **Revised 6/19**
 - ☐ 6.6.7 Lighting Color **Revised 6/19**
 - ☐ 6.6.8 Specialized Outdoor Lighting Conditions and Standards **Revised 6/19**
 - ☐ 6.6.9 Application and Review Procedures **Revised 6/19**
 - ☐ 6.6.10 Amortization of Nonconforming Outdoor Lighting **Revised 6/19**
- ☐ 6.7 Drainage
- ☐ 6.8 Floodplains, Natural and Historic Drainages
- ☐ 6.9 General Site Planning Standards
 - ☐ 6.9.1 General
 - ☐ 6.9.2 Hazard Areas
 - ☐ 6.9.3 Slope Conditions
 - ☐ 6.9.4 Limitations on Site Disturbance
 - ☐ 6.9.5 Restoration of Disturbed Areas
 - ☐ 6.9.6 Wildfire
 - ☐ 6.9.7 Defensible Space
 - ☐ 6.9.8 Ridgeline Standards
 - ☐ 6.9.9 Grading, Revegetation and Restoration
- ☐ 6.10 Compatibility Standards **Revised 11/16**

B. All exterior outdoor lighting installed after the effective date of this section in all zones in the County shall conform to the requirements established by this section. This section does not apply to indoor lighting.

C. All existing outdoor lighting that does not meet the requirements of this section and is not exempted by this section shall be considered a nonconforming use or part of a nonconforming structure subject to the five-year amortization schedule outlined in Section 6.6.10B.3.

[Ord. 588, 2019.]

6.6.3 Definitions **Revised 6/19**

"Accent or architectural lighting" means lighting of building surfaces, landscape features, statues, and similar items for the purpose of decoration, ornamentation, creation of visual hierarchy, sense of liveliness, or other purpose unrelated to safety, business operation, or essential lighting function.

"Backlight" means all the light emanating behind a luminaire.

"BUG rating" means backlight, uplight, and glare rating, which exists on a scale of zero to five and describes the light output of a luminaire.



Additional Lessons

- Property rights
- Cost of lighting retrofits and community support fund
- Standards more akin to building code
 - Unfamiliar territory for planning commissioners?
- Nomenclature matters
 - Define luminous flux
 - B.U.G. vs. foot-candles
- Graphics = citizen comprehension

“When we talk individually, we can discuss specific lighting needs and what can be done to get there. Without individuals and associations working together, the last remaining dark areas on the planet could well disappear without anyone noticing.”

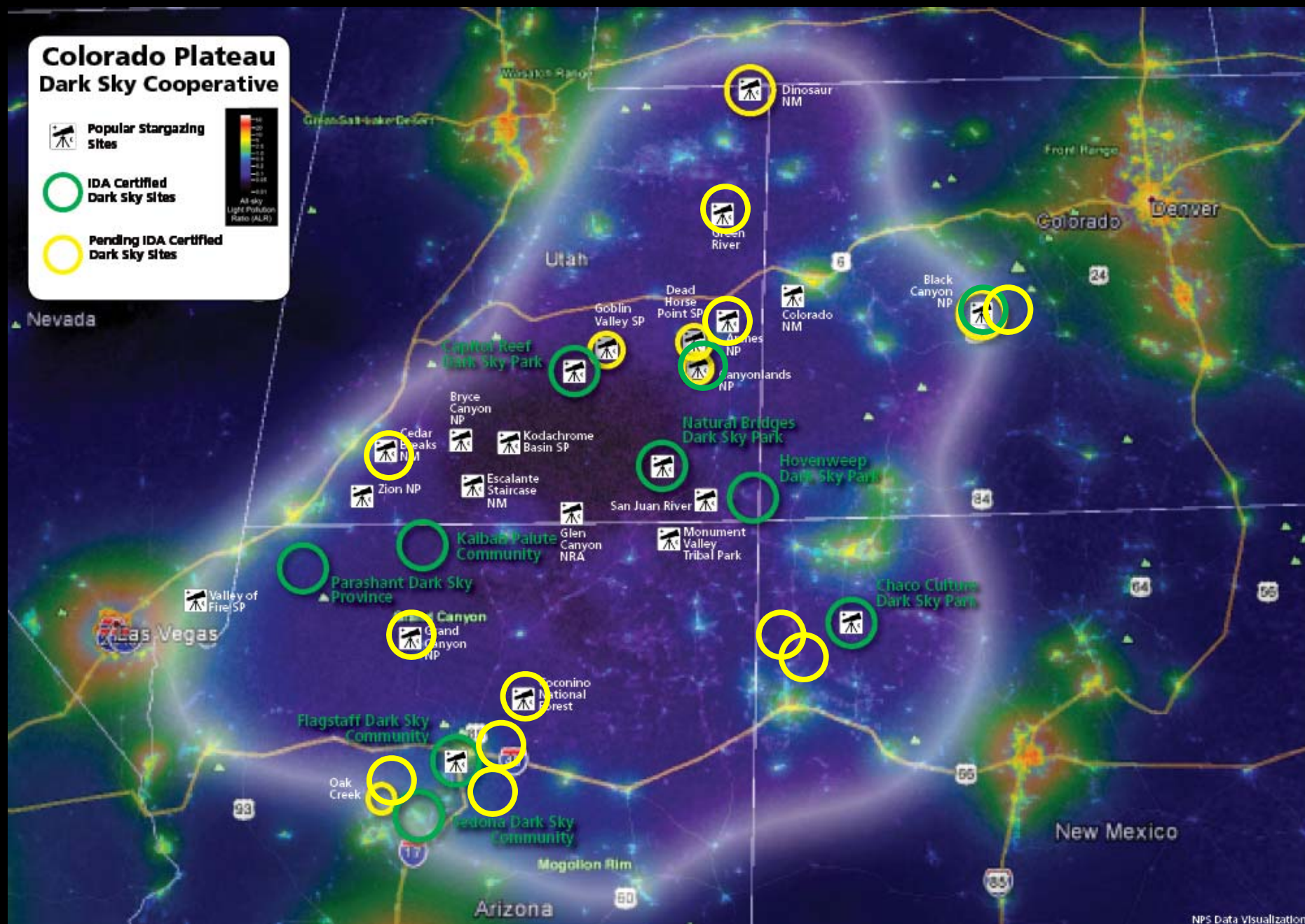
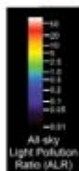
- Mary Bedingfieldsmith

Colorado Plateau Dark Sky Cooperative

 Popular Stargazing Sites

 IDA Certified Dark Sky Sites

 Pending IDA Certified Dark Sky Sites



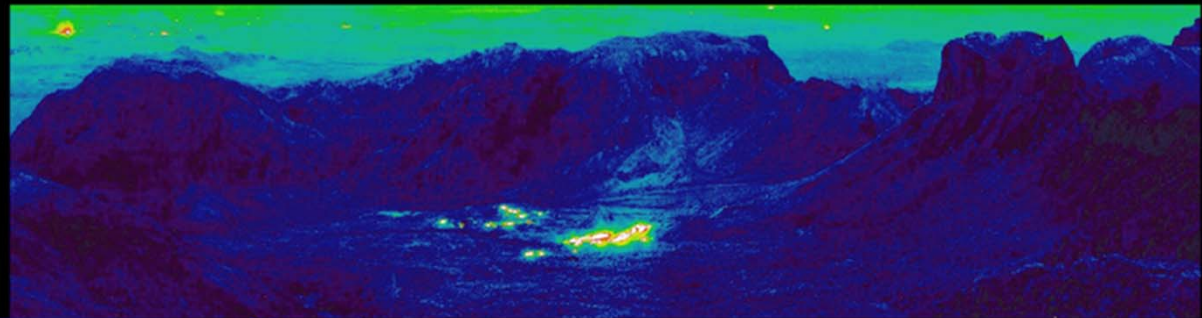
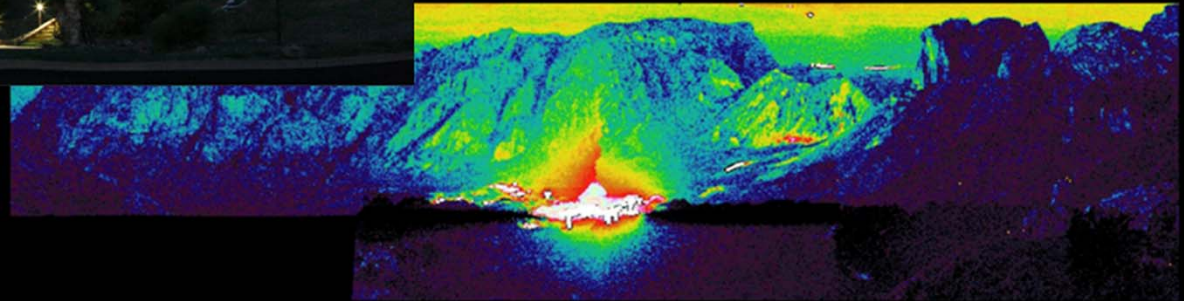
Build Partnerships



**Dark Skies & Emerging Technologies:
Matching Supply & Demand through Innovation and Opportunity
High Country Conference Center – Flagstaff, AZ
August 19-20, 2014**



Set a good example: retrofit public facilities



Designations: International Dark Sky Places



Toast to the sky!

Zacharia Levine, AICP

Grand County Community & Economic Development
zlevine@grandcountyutah.net

Kalen Jones

Moab City Council & With Gaia Design
kjones@moabcity.org