

# Hill Country Dark Sky Reserve



**A place for all of us under the starry nights of the  
Texas Hill Country**

# The Starry Night



Vincent van Gogh, 1889



# The Starry Night



2015 ?

# What is Light Pollution?

**Excessive or inappropriate outdoor lighting. Common forms include:**

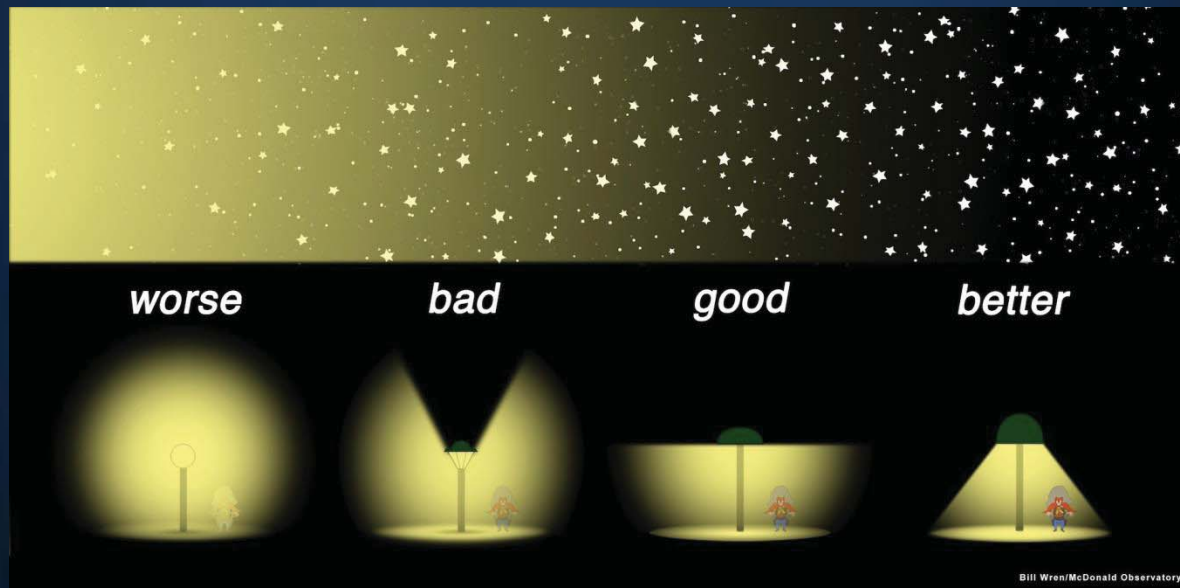
- Glare
- Sky glow
- Light trespass
- Light clutter



City of Fredericksburg 2013

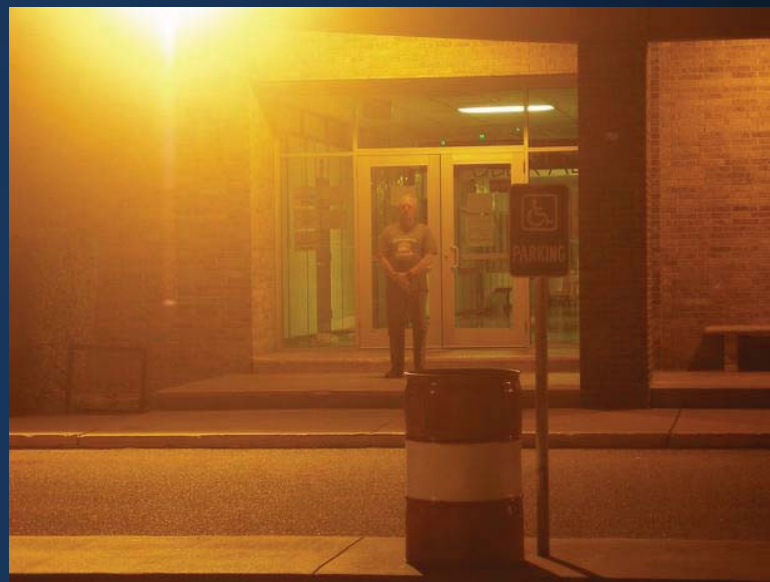
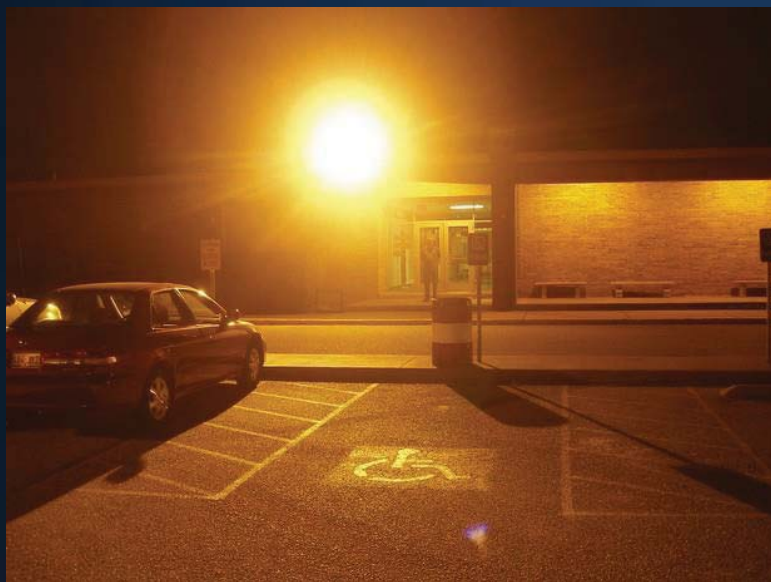
# Light Pollution is Easy to Fix

- Install lighting only when and where needed
- Use fully shielded fixtures
- Install low power LED fixtures
- Use energy saving features such as dimmers, timers and motion detectors



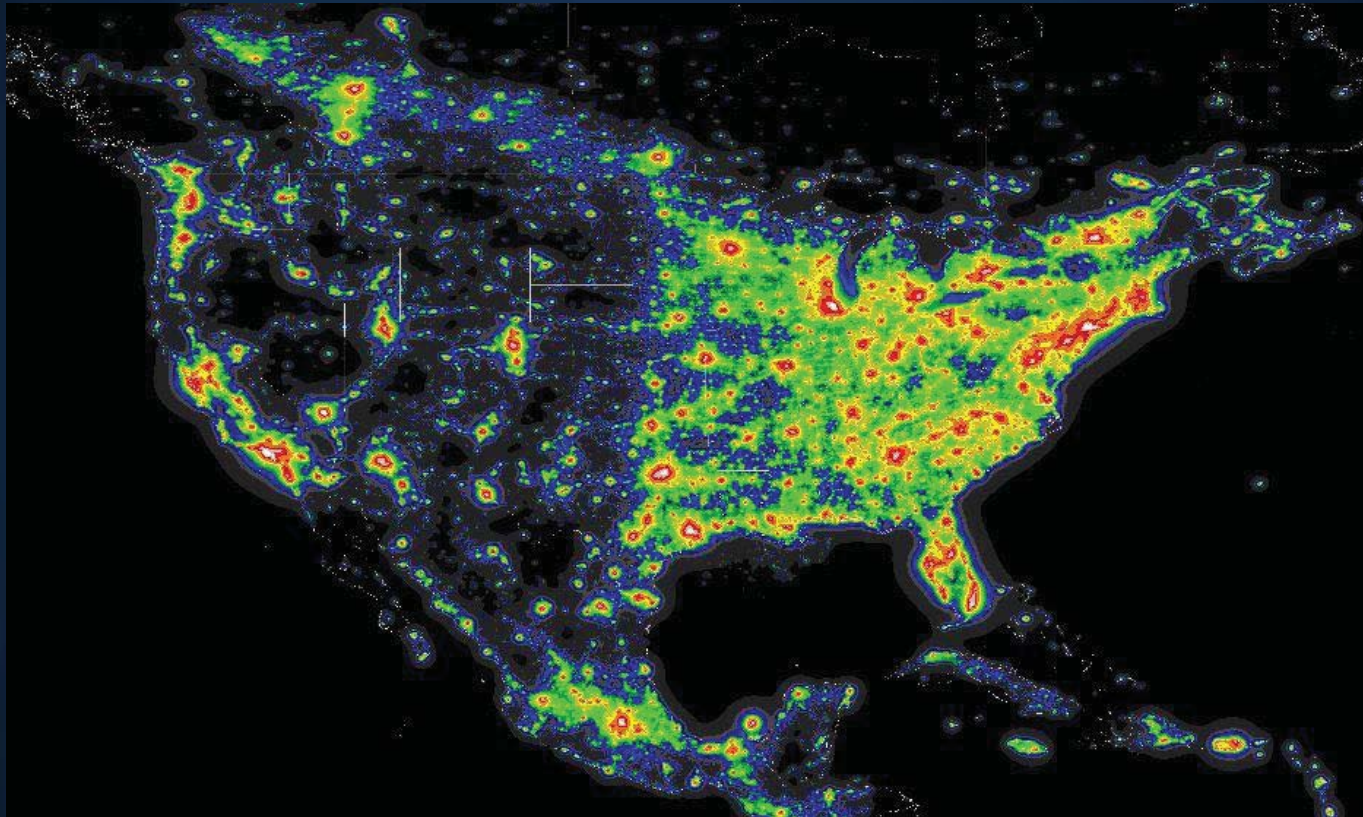


# Better Lighting Improves Safety



Glare detracts from safety

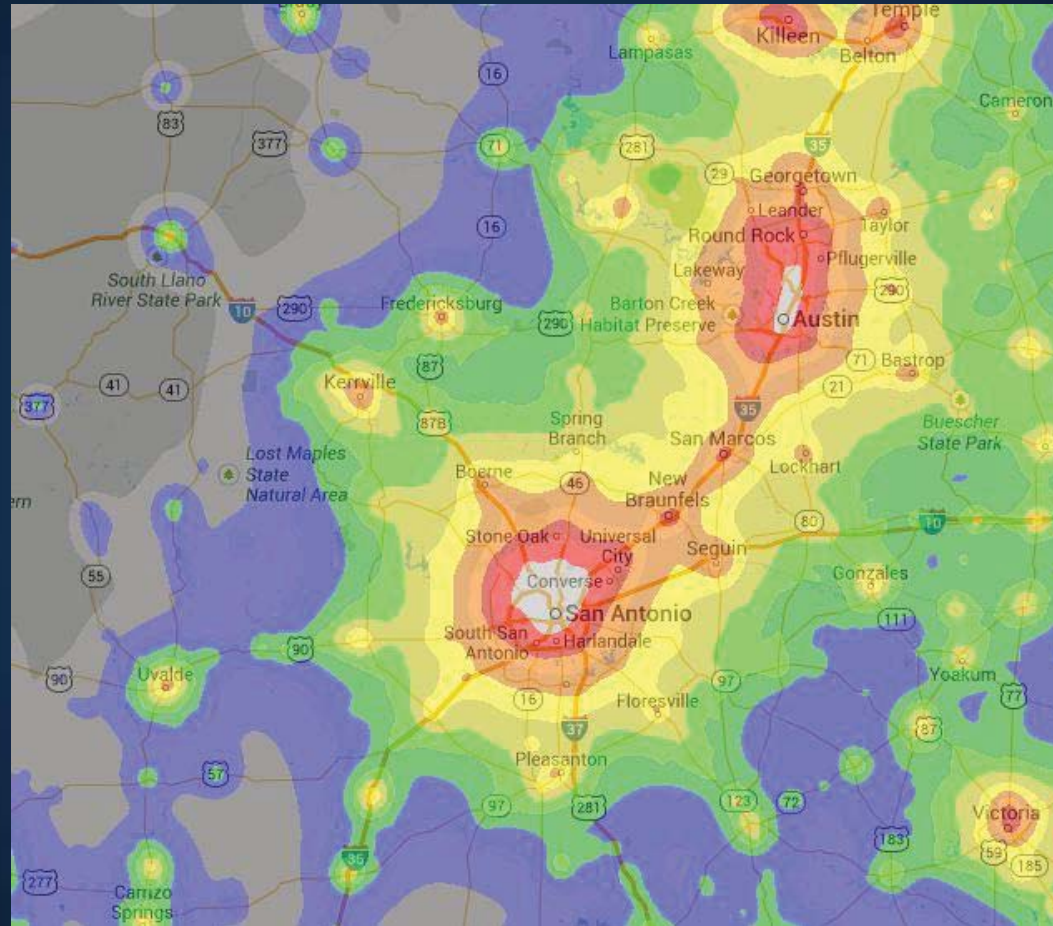
# Texas Hill Country is on the Edge of Night



**Dark skies have virtually disappeared from the eastern half of the U.S.**

**Satellite data from World Atlas of the Artificial Night Sky Brightness**

# Texas Hill Country is on the Edge of Night



**Light Pollution Map for the Texas Hill Country  
Bortle Scale**



# Hill Country Starry Nights are a Significant Natural Resource





# **Growing Efforts to Preserve our Hill Country Starry Nights**

- **Enchanted Rock designated as an International Dark Sky Park**
- **Adoption of lighting codes in cities close to Enchanted Rock**
- **Dripping Springs designated as a Dark Sky Community**
- **Support and Education efforts by Hill Country Alliance, McDonald Observatory, Texas Parks and Wildlife Department, concerned citizens, businesses, Friends of Enchanted Rock and CTEC**
- **Proposed Dark Sky Reserve designation by the International Dark Sky Association**

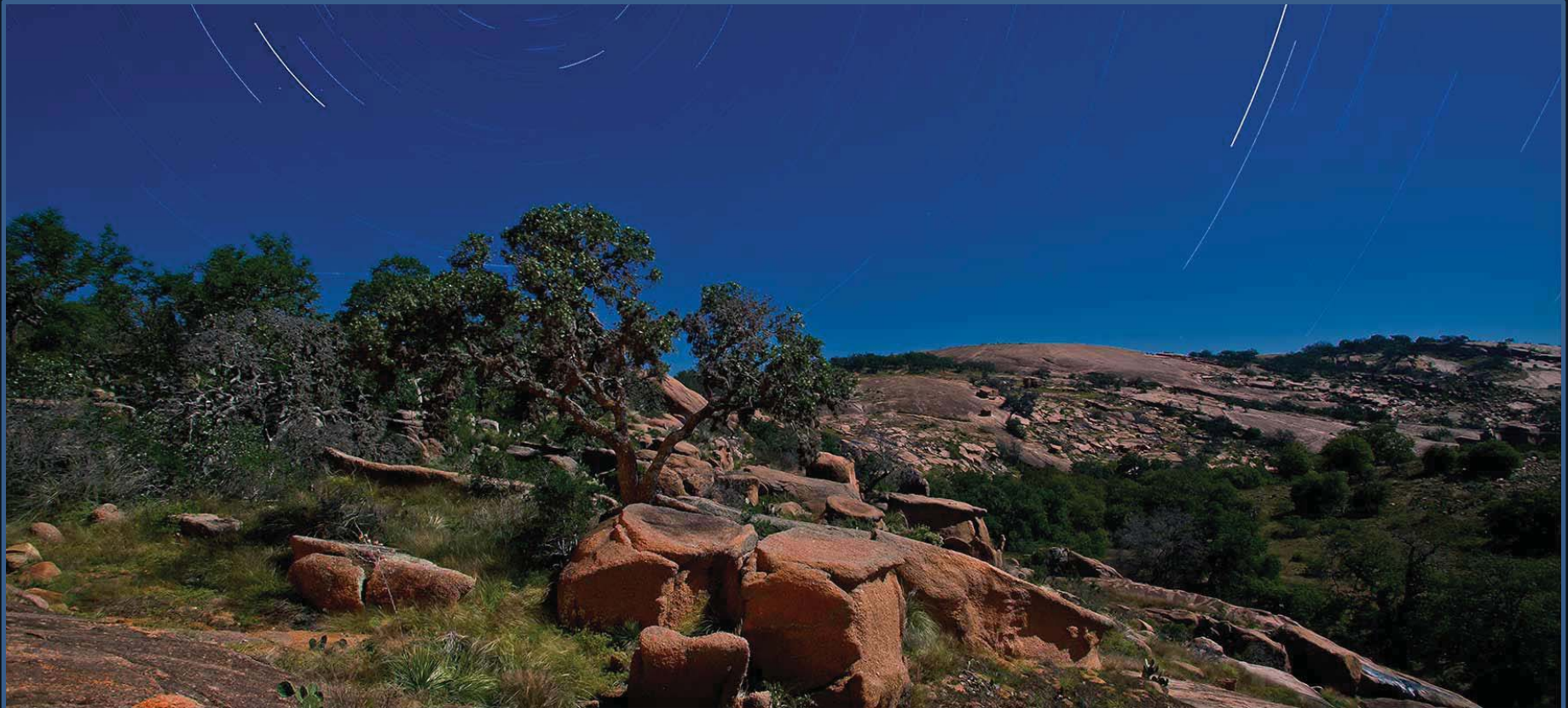




**ENCHANTED ROCK  
INTERNATIONAL DARK SKY PARK**

[www.darksky.org](http://www.darksky.org)

An International Dark Sky Park is a location of exceptional night time beauty, dark skies education, and preservation of the nighttime environment. Each Dark Sky Park has gone above and beyond the requirements as stated in the International Dark Sky Park Guidelines.







# Gold Tier Dark Sky Park

Enchanted Rock and Copper Breaks, which were awarded the highest “Gold Tier” night skies status by the International Dark Sky Association, join Big Bend National Park and the City of Dripping Springs as the only locations in Texas to have earned the coveted Dark Sky Places recognition.



	 Gold
Artificial Light and Skyglow	Typical observer is not distracted by glary light sources. Light domes are only dim and restricted to sky close to horizon.
Visual Limiting Magnitude	Equal or greater than 6.8 under clear skies and good seeing conditions
Bortle Sky Class	1-3
Observable Sky Phenomena	The full array of visible sky phenomena can be viewed—e.g. aurora, airglow, Milky Way, zodiacal light, and faint meteors
Unihedron Sky Quality Meter	21.75 or above

# Outdoor Lighting Guidelines

## Enchanted Rock Lighting Inventory

Location	Light Ref. #	Fixture	Application	Shielded	Special Purpose <600 Lumens	Conforms with G-OL
Manager's House	MGR - 1	1 fixture (2 bulbs)-26 watt flood, CFL fully shielded.	Security, house egress ingress, switched, only used as needed, normally off.	YES	No	Yes
	MGR - 2	1 fixture-26 watt flood light, CFL, fully shielded.	Security, house egress ingress, switched, only used as needed, normally off.	YES	No	Yes
	MGR - 3	2 fixtures-25 watt incandescent yellow bug lights, fully shielded.	Security, house egress ingress, switched, only used as needed, normally off.	YES	No	Yes
	MGR - 4	1 fixture-40 watt incandescent white light, shielded under porch roof	Security, front door egress ingress, switched, only used as needed, normally off.	YES	No	Yes
Assistant Manager's House	AMRas-1	1 fixture (2 bulbs)-25 watt incandescent yellow bug lights, fully shielded.	Security, carport egress ingress, switched, only used as needed, normally off.	YES	No	Yes
	AMRas-2	1 fixture (2 bulbs)-26 watt flood light, CFL, fully shielded.	Security, backdoor egress ingress, switched, only used as needed, normally off.	YES	No	Yes
	AMRas-3	1 fixture-100 watt LPS with shield.	Highway access to pavilion parking lot, area security. On at dusk with photocell. Pending change to be switched use only.	YES	No	Yes
	AMRas-4	1 fixture (1 bulb)-25 watt incandescent, yellow bug light, fully shielded	Security, front door egress ingress, switched, only used as needed, normally off.	YES	No	Yes

## 3.2 Lighting Prescriptions for Zone 1

7000 lumens is the maximum allowable lamp output (except for emergency lighting). In most cases 500 – 1600 lumens will be sufficient.

Residential Surrounds (Superintendent's House and Assistant Manager's House)	
Maximum Lamp Lumens	1600 lumens
Recommended Light Type	Fully shielded
Recommended Illumination Area	Light dispersal limited to residential boundary
Recommended Duty Cycle	Mix of switches for (for occasional use) and motion sensors.

Comfort Station Building (Restroom Facility)	
Maximum Lamp Lumens (watts)	1600 lumens
Recommended Light Type	Fully shielded
Recommended Illumination Area	Light dispersal limited to entrance of restroom facility and doorways.
Recommended Duty Cycle	On from dusk to dawn to accommodate overnight camping.

Comfort Station Area Lighting	
Maximum Lamp Lumens (watts)	7000 lumens
Recommended Light Type	LPS, fully shielded
Recommended Illumination Area	Light dispersal limited to parking area and for events near Comfort Station
Recommended Duty Cycle	Switched, used only for events and when campers are coming off trails and into parking area.

# Lighting Inventory

## Lighting Inventory Photographs

Manager's House (Park Superintendent)



Outside Light Carport  
Photograph Reference: MGR-1



Outside Light Security  
Photograph Reference: MGR-2



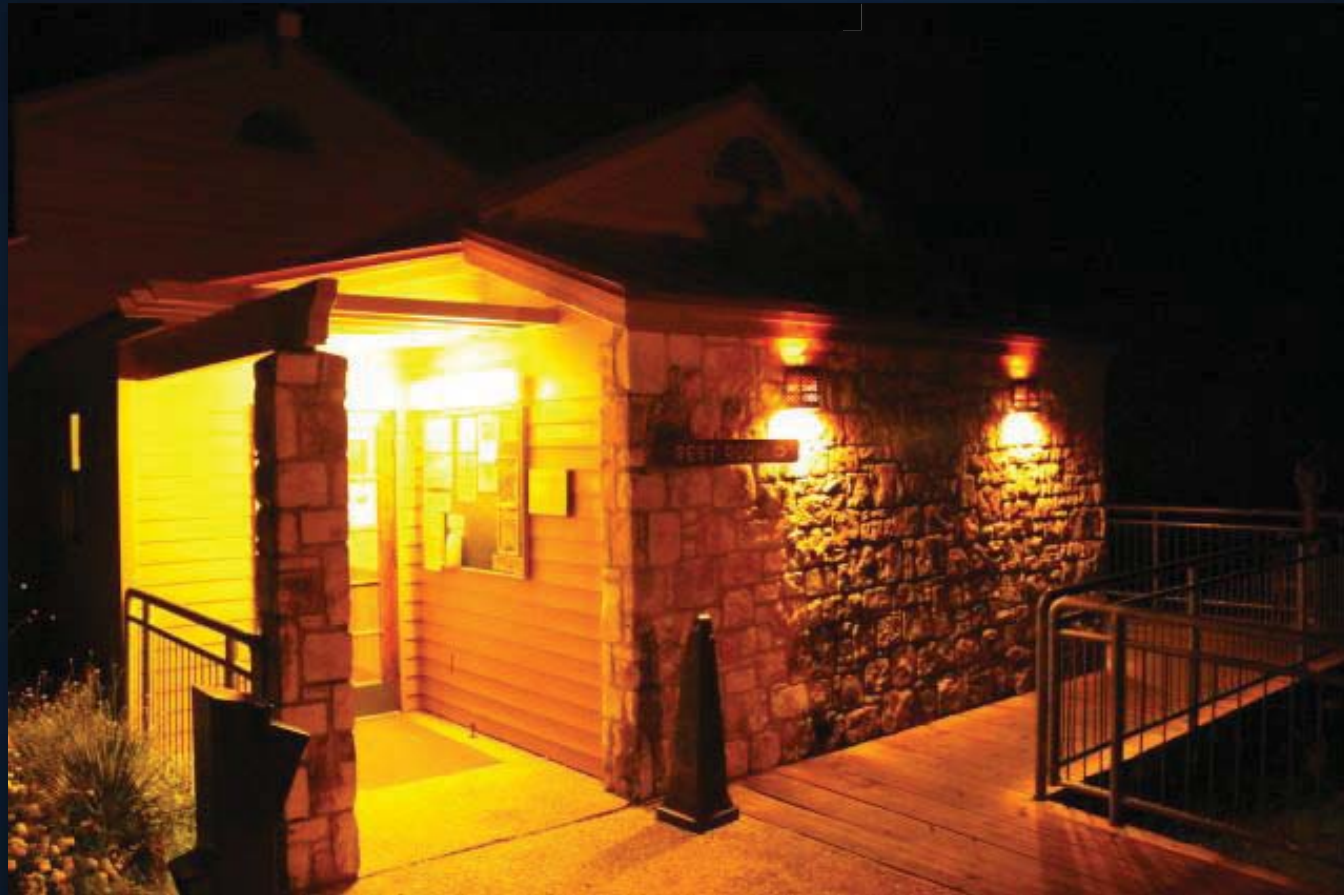
Backdoor Light  
Photograph Reference: MGR-3



Front Door Light  
Photograph Reference: MGR-4



# Lighting Improvement and Retrofit Before



# Lighting Improvement and Retrofit After



# Lighting Improvement and Retrofit Before





# Lighting Improvement and Retrofit After

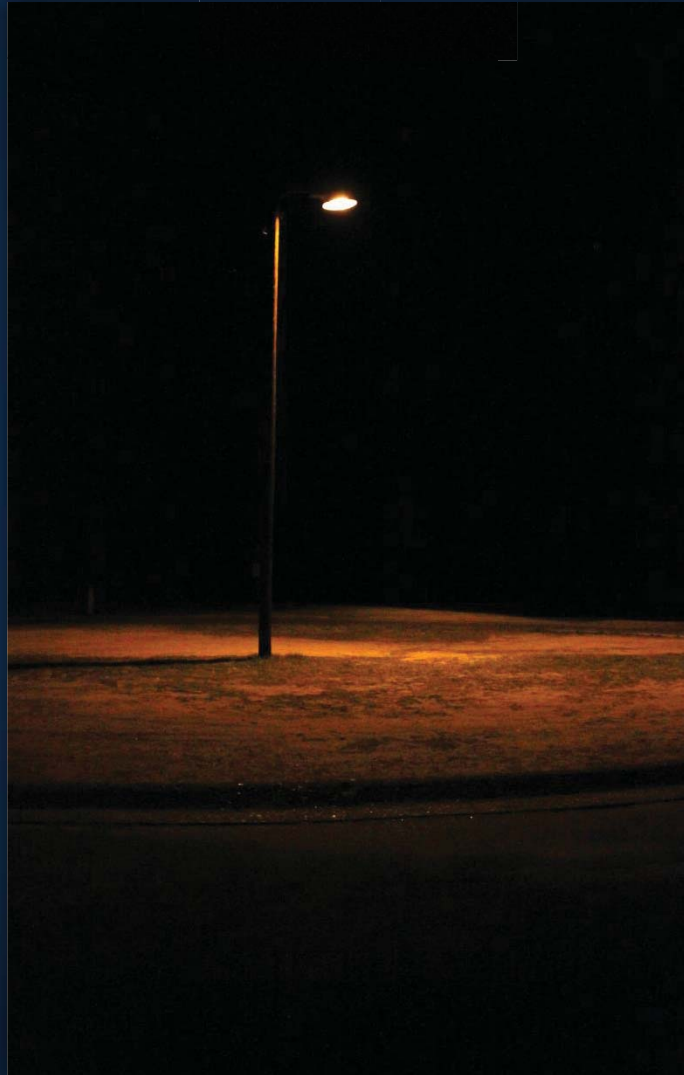


# Lighting Improvement and Retrofit

## Before



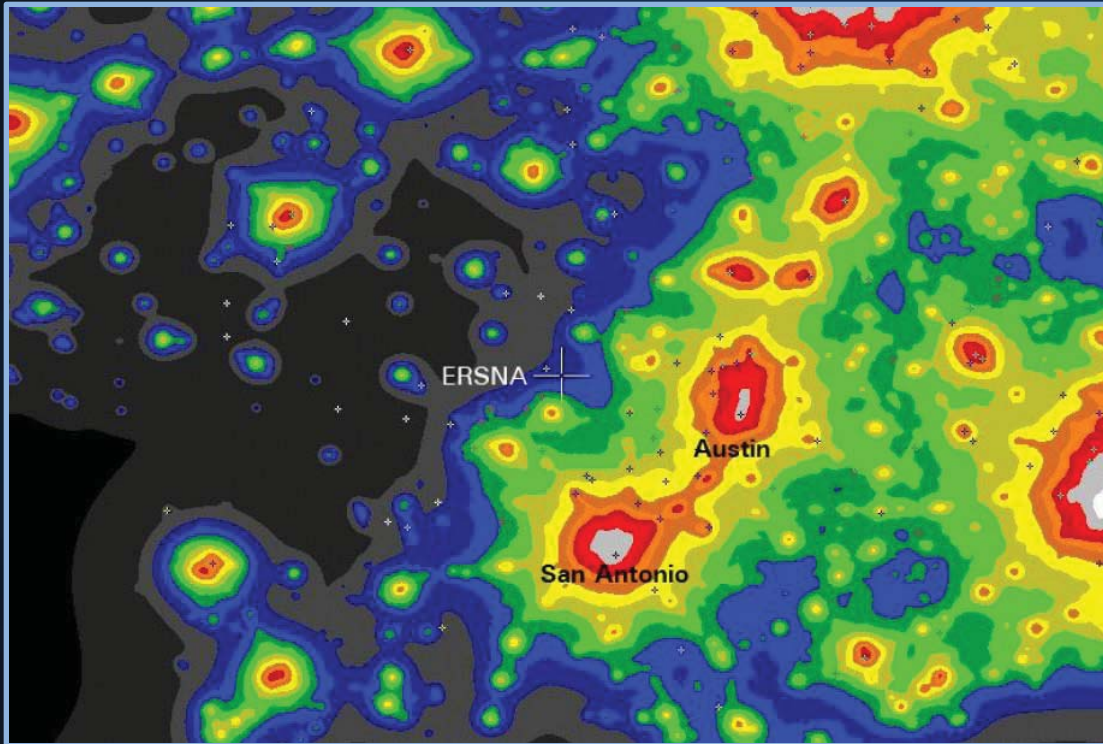
# Lighting Improvement and Retrofit After





# Sky Quality at Enchanted Rock

## Bortle Scale and location of Enchanted Rock

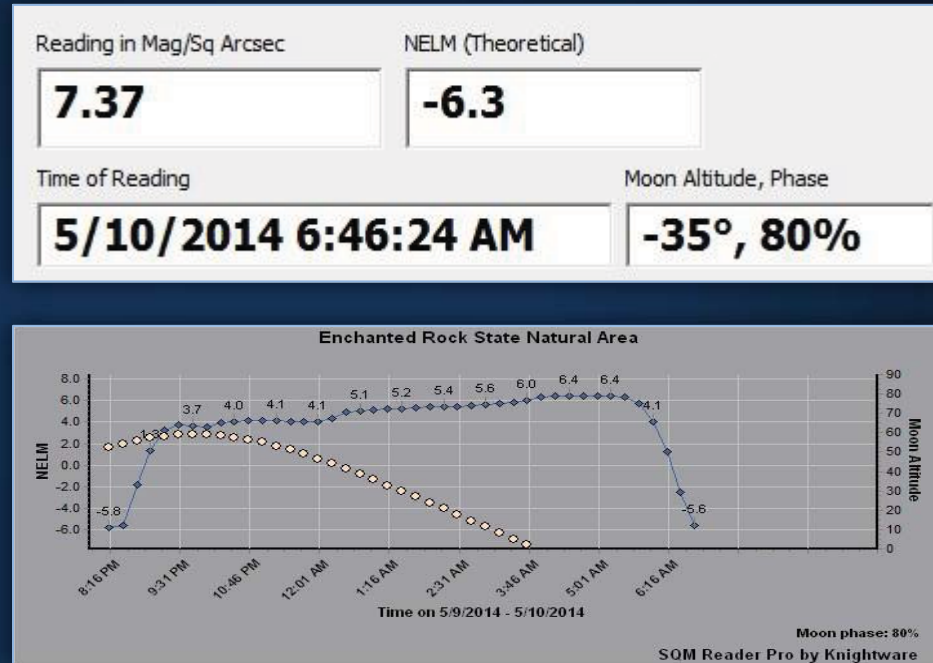


Bortle Scale	Title	
1	Excellent Sky Site	Dark
2	Typical Dark Sky Site	True
3	Rural Sky	
4	Rural / Suburban Transition	
4.5	Suburban Sky	
5	Bright Suburban Sky	
6 - 7	Suburban / Urban Transition or Full Moon	
8 - 9	City Sky	

<http://www.skyandtelescope.com/astronomy-resources/light-pollution-and-astronomy-the-bortle-dark-sky-scale>

# Sky Quality at Enchanted Rock

## Sky Quality Monitoring Station

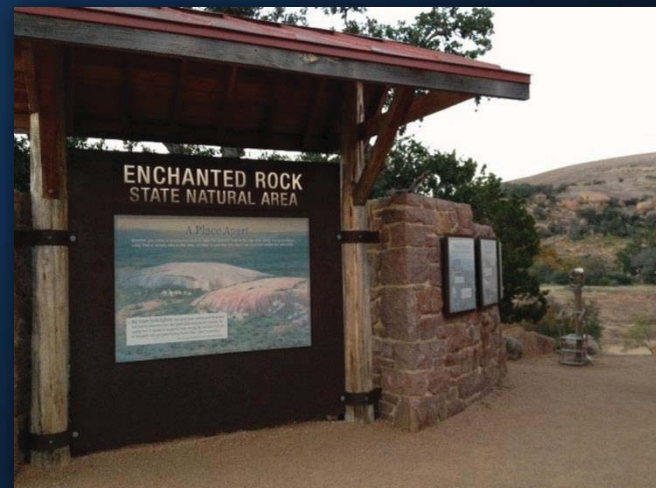


Enchanted Rock's sky quality monitoring station is the only one in the state of Texas at either a national or state park.

Measurements are posted to the Enchanted Rock website every 15 minutes.

# Interpretive Programs and Education

- Dark Sky Interpretive Program Curriculum
- School and Children Outreach
- Rock Star Parties
- Moon Walks with a Ranger
- Better Lights for Starry Nights
- Dark Sky Education Board
- Enchanted Rock Website
- Park Owned Telescope





# Texas State Park's Commitment to Dark Skies



**"One of our most valued attributes in Texas is its natural beauty," says Texas State Parks Director Brent Leisure. "This beauty is not limited to the light of day, but extends into the night sky where Texans can enjoy a front-row seat to the splendor of the universe."**

**State parks and natural areas offer some of our very best public venues to experience this heavenly show."**



**Brent Leisure**  
**Director, Texas State Parks**

# Continuing Efforts: Hill Country Dark Sky Reserve

An IDA International Dark Sky Reserve is a public or private land possessing an exceptional or distinguished quality of starry nights and nocturnal environment that is specifically protected for its scientific, natural, educational, cultural, heritage and/or public enjoyment.

Reserves consist of a core area meeting minimum criteria for sky quality and natural darkness, and a peripheral area that supports dark sky preservation in the core.

There are a number of Dark Sky Reserves established in other countries, but so far there are no International Dark Sky Reserves established in the U.S.

Currently, there are efforts to establish Dark Sky Reserves around McDonald Observatory and in the Texas Hill Country.

# Continuing Efforts: Hill Country Dark Sky Reserve





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ERSNA designated  
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Fredericksburg City  
Council adopts  
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# Continuing Efforts: Hill Country Dark Sky Reserve

Mason City Council  
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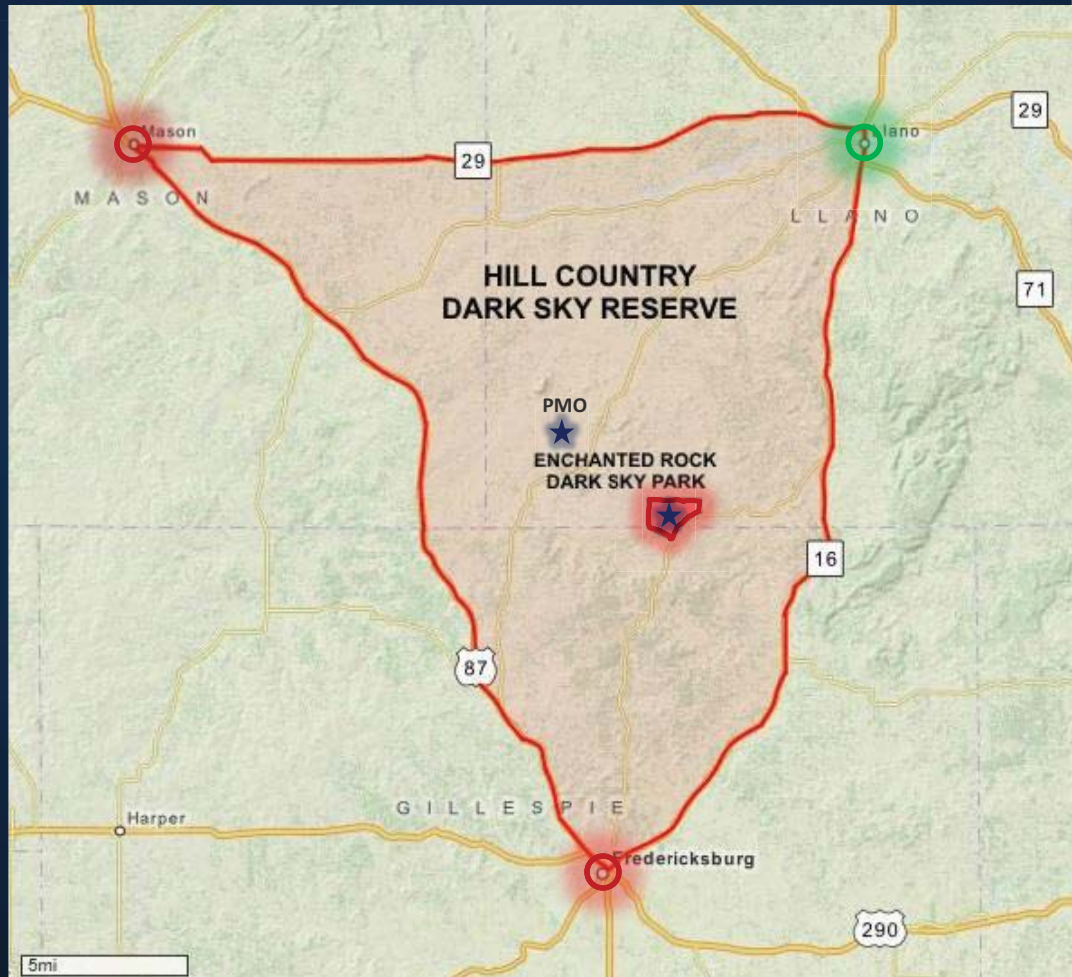
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**Permanent Sky  
Quality measuring  
stations installed  
at ERSNA and PMO**



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# Continuing Efforts: Hill Country Dark Sky Reserve

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**Permanent Sky  
Quality measuring  
stations installed  
at ERSNA and PMO**

**Consideration of  
installation of  
permanent Sky  
Quality measuring  
stations in each  
city**



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# Continuing Efforts:

## Features of Hill Country Dark Sky Reserve

Establish Enchanted Rock as the “core” of the Reserve

Fredericksburg, Llano and Mason will form initial boundaries of Reserve

Establish foundation for expansion of Reserve

Provide for promotion of eco-tourism

Night sky education programs



Establish website to assist with education programs

Collaboration with educational institutions, businesses and others, including McDonald Observatory, Texas Parks and Wildlife Department, Wildlife Management Coops, public schools, Friends of Enchanted Rock, public utilities.

# Continuing Efforts: Support for Hill Country Dark Sky Reserve



Central Texas Electric  
Coop provides service  
in 11 Texas counties,  
including those in the  
Dark Sky Reserve  
area.





# Continuing Efforts: Support for Hill Country Dark Sky Reserve



**Recently, CTEC  
adopted a resolution  
supporting Dark Sky  
Initiatives**

Central Texas Electric Cooperative, Inc.

## Resolution Supporting Dark Skies Initiative

September 1, 2015

Loth and Lehmborg reported on the current Dark Skies Initiative in the hill country and CTEC's position in supporting such effort. Following discussion, a motion was made by Director Keese and seconded by Director Lehmborg as follows:

WHEREAS, the Central Texas Electric Co-op ("the Cooperative") recognizes the Texas Hill Country for its diverse ecosystems, ethics for land stewardship, rich cultural heritage, and breathtaking scenic beauty; and

WHEREAS, the influx of people into the region over the years and accompanying light trespass from area lighting fixtures has been steadily on the rise, and these factors have impacted the natural environment and the quality of life of the people of this region; and

WHEREAS, a number of cities in the Texas Hill Country have adopted outdoor lighting codes to promote better outdoor lighting, minimize light pollution and protect the beauty of the Hill Country night skies; and

WHEREAS, Enchanted Rock State Natural Area was recently designated a Dark Sky Park by the International Dark Sky Association and is an important natural resource worth protecting by promoting better outdoor lighting around the Enchanted Rock area; and

WHEREAS, the Cooperative is committed to protecting the beauty of the night skies;

NOW, THEREFORE, BE IT RESOLVED BY THE BOARD OF DIRECTORS OF THE COOPERATIVE, that the Cooperative shall promote outdoor lighting fixtures and practices that follow current guidelines for efficient, non-intrusive lighting and will educate and encourage landowners, businesses, residential communities, and public entities in its service area to join in this commitment in the manner and to the extent the Chief Executive Officer deems appropriate; and

BE IT FURTHER RESOLVED, that the Chief Executive Officer or his designee is authorized to take such actions as needed to implement this resolution.

Kothmann called for a vote on the motion that carried unanimously.



# Continuing Efforts: Support for Hill Country Dark Sky Reserve



CTEC has been installing security lights on poles at member request since the 1960s

The original lights were MV“ barn type” lights

In 2005, CTEC discontinued purchasing MV lights and began ordering HPS “cobra head” design lights (considered dark sky compliant)

This year, in March 2015, CTEC discontinued purchasing HPS fixtures and began purchasing 48W LED fixtures as the standard area light.

CTEC’s current lighting program in the Dark Sky Reserve area consists of installing new 48W LED Dark Sky compliant fixtures and repairing/replacing existing fixtures

## Dark Sky Reserve

In examining the triangle area designated as the Hill Country Dark Sky Reserve (see attached map), CTEC has determined that it has the following approximate number of lights and fixture designs.

<u>Type of Fixture</u>	<u>No. Of Fixtures</u>	<u>Dark Sky Compliant</u>
175 W-MV	41	Not Compliant
400 W-MV	3	Not Compliant
100W-HPS	201	Not Compliant
<b><u>Total</u></b>	<b><u>245</u></b>	<b><u>Not Compliant</u></b>
175 W-MH	13	Compliant
100 W-HPS	173	Compliant
250 W-HPS	4	Compliant
48W-LED	2	Compliant
<b><u>Total</u></b>	<b><u>192</u></b>	<b><u>Compliant</u></b>

## Current CTEC Lighting Program

CTEC’s current lighting program consists of installing new 44W-LED light fixtures and repairing/replacing the existing light fixtures described above in the historical discussion. CTEC continues to replace bulbs and photocell controls on all existing lights. Fixtures that require repairs other than bulbs and controls are replaced with newer, Dark Sky compliant LED fixtures. Previous to the purchase and installation of the new LED fixtures, HPS compliant fixtures were used to replace non-compliant, older units.

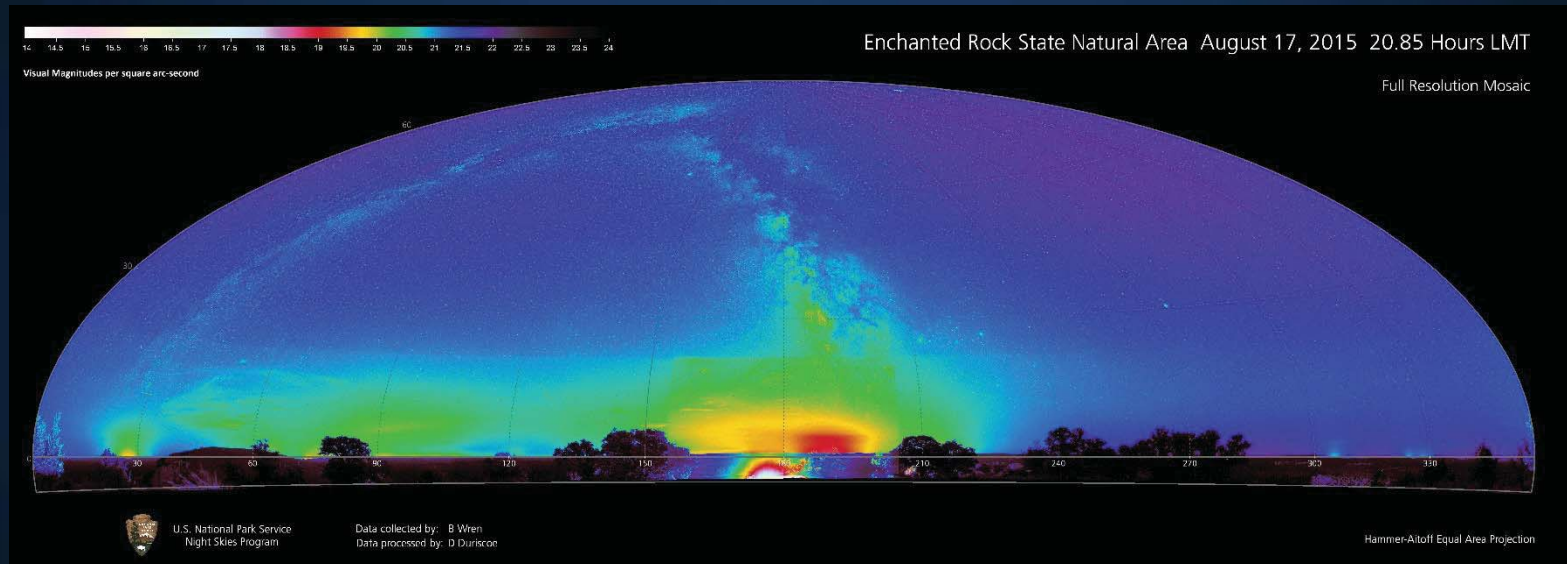
For the area designated as the Reserve, CTEC replaces any non-compliant fixture with a new LED compliant fixture if a service call is received to repair an older, non-compliant fixture.

# Current Efforts: Support for Hill Country Dark Sky Reserve



**In August 2015, Bill Wren from McDonald Observatory took measurements from the top of Enchanted Rock using equipment from the National Park Service to establish a baseline for light pollution from anthropogenic sources.**

# Current Efforts: Support for Hill Country Dark Sky Reserve



The measurements show celestial light sources as well as man made light sources.

Celestial light sources can be removed to reveal only man made light sources (light pollution)



# Current Efforts: Support for Hill Country Dark Sky Reserve

Better Lights for Starry Nights



Milky Way over Pedernales Falls State Park

Photo credit: Christopher V. Sherman





Questions?