International Dark Sky Park Application for Cedar Breaks National Monument

A full moon night reveals some of the terrestrial and celestial scenery awaiting visitors to Cedar Breaks National Monument (Photo: Zach Schierl/NPS)

Contents

Nomination Letter

Board of Directors
International Dark-Sky Association
3224 North First Avenue
Tucson, AZ 85719

Re: IDSP Designation of Cedar Breaks National Monument

November 15, 2016

To the IDA Board Members:

Our Northern Utah IDA chapter is honored to nominate Cedar Breaks National Monument (named in August 1933 by Franklin D. Roosevelt) as an International Dark Sky Park (IDSP).

Sitting at over 10,000 feet in elevation - the top of the Grand Staircase - Cedar Breaks NM is a dramatic place to view the astonishingly dark skies of the Colorado Plateau.

We note, especially, the close relationship between Cedar Breaks NM and Southern Utah University (SUU) which supports dark sky events and research at the nearby monument. SUU is represented on the Committee for Dark Sky Studies (based at the University of Utah), with which our chapter is affiliated.

We have also been impressed by the extensive history of astronomy programs and staff commitment to modeling dark sky lighting and building public awareness of common sense dark sky principles.

Our nomination is an enthusiastic endorsement of IDSP designation; we would be pleased to answer any questions the Board may have.

Sincerely,

Janet Muir
IDA Ogden Valley Chapter

Letter of Support from Park Superintendent

United States Department of the Interior
NATIONAL PARK SERVICE
Cedar Breaks National Monument
2390 West Highway 56, Suite #11
Cedar City, Utah 84720

November 9, 2016

IDA Board of Directors
International Dark-Sky Association
3225 North First Avenue
Tucson, Arizona 85719

To the IDA Board of Directors,

As Cedar Breaks Superintendent, I enthusiastically support International Dark Sky Park designation for Cedar Breaks. As a resident of Southern Utah for the past thirteen years, I have personally experienced the noticeable loss of the brilliant starry skies that my family experienced when first exploring our new home. As I got to know my neighbors and other residents, I was surprised by the number of people who commented about how much the magnificent starry skies enhanced their overall appreciation of living among this beautiful landscape.

Dark skies are a precious resource being rapidly lost around the world. Cedar Breaks is a rare and important sanctuary of natural darkness in an ever brightening sea of light. Its high altitude and minimal light pollution offers visitors from Las Vegas, Salt Lake City, and around the world the chance to easily experience the night the way that our ancestors would have just a few short centuries ago. Our interpretive astronomy programs have become increasingly popular over the past decade as more and more people have begun to recognize and appreciate the unique opportunity afforded them at Cedar Breaks. We now regularly draw more than 200 people to our summer star parties, and for an increasing number of local residents, a summer is not complete without a trip to Cedar Breaks to view the stars.

Whether it is to save money and energy, strengthen our cultural heritage that is rooted in the stars, improve habitat for nocturnal wildlife, or simply so that our children can grow up being inspired by the sight of the Milky Way, dark night skies are a resource worth preserving. Light pollution has already stripped many of us of these opportunities, making places like Cedar Breaks increasingly important in the effort to preserving the remaining dark places around the world. Without places like Cedar Breaks and other International Dark Sky Places, we risk losing the night sky, as well as the sense of wonder, perspective, curiosity and beauty that comes with it. Our goal is that visitors to Cedar Breaks might leave with a better understanding of what we have to lose, and knowledge of simple actions that they can take themselves to protect dark skies in Southern Utah and beyond.

As we began to grow the dark sky program at Cedar Breaks, and offer more "star parties", I became more educated about the actions we could all take to protect this resource. It also became clear to me that the only way for these actions to have any real impact was to find a way to reach out to our regional gateway communities, invite them to learn about dark skies, and realize that this was not "someone else's" responsibility. The relatively simple and cost effective steps that

each one of us can take have the power to change how both future park visitors and residents will experience this spectacular resource. This became the motivating factor from which our "Master Astronomer" project was born.

Cedar Breaks will debut its "Master Astronomer" program this winter, a first-of-its-kind workshop that aims to foster a greater connection between citizens of southern Utah and the night sky. This and other efforts would not be possible without the continued support of our partners at the local level. Southern Utah University and the Intergovernmental Internship Cooperative has allowed us to hire skilled students who are instrumental in allowing us to broaden our dark sky education efforts and accommodate increasing numbers of people at summer star parties. Our dedicated staff, both seasonal and permanent, and past and present, understands the importance of the dark night skies at Cedar Breaks, and are dedicated to working together and preserving it for future generations

Like all dark places, the night sky at Cedar Breaks is threatened. We hope that International Dark Sky Park designation for Cedar Breaks will further raise awareness of dark sky protection among monument visitors and our local community. Thank you for your consideration, and all that you do to help protect dark skies around the world.

Sincerely,

Paul Roelandt
Superintendent
Cedar Breaks National Monument

1. Park Description

Cedar Breaks National Monument (CEBR) was established on August 22, 1933 by President Franklin D. Roosevelt. The monument is administered by the United States National Park Service (NPS), and is located in southwestern Utah approximately 13 miles east of Cedar City and 220 miles SSW of Salt Lake City. The monument was created in order to protect the spectacular cliffs, canyons and scenery of the Cedar Breaks Amphitheater (Fig 1) and the high alpine ecosystem on the Markagunt Plateau. Today, the monument protects 6,155 acres of land ranging in elevation from 8,100' to 10,662', making Cedar Breaks NM one of the most easily accessible high altitude units in the NPS. All land below the amphitheater rim (the majority of the monument) is recommended wilderness. There are no private inholdings within the monument boundaries.

Figure 1-Cedar Breaks Amphitheater at sunset (Photo: Zach Schierl/NPS)

Cedar Breaks NM is almost completely surrounded by the Dixie National Forest, managed by the United States Department of Agriculture (USDA), including the congressionally designated Ashdown Gorge Wilderness to the west. Road access to the monument is via Utah Highway 143 which crosses the northeast corner of the monument, and Utah Highway 148 which runs along the eastern edge of the monument, connecting Hwy 143 with Utah Highway 14 to the south (Fig 2). Much of the monument consists of the extremely steep and rugged terrain of the Cedar Breaks Amphitheater which contains no maintained trails or routes and can only be accessed on foot.

The area to be designated as an International Dark Sky Park includes the entirety of Cedar Breaks National Monument, as shown on the following map:

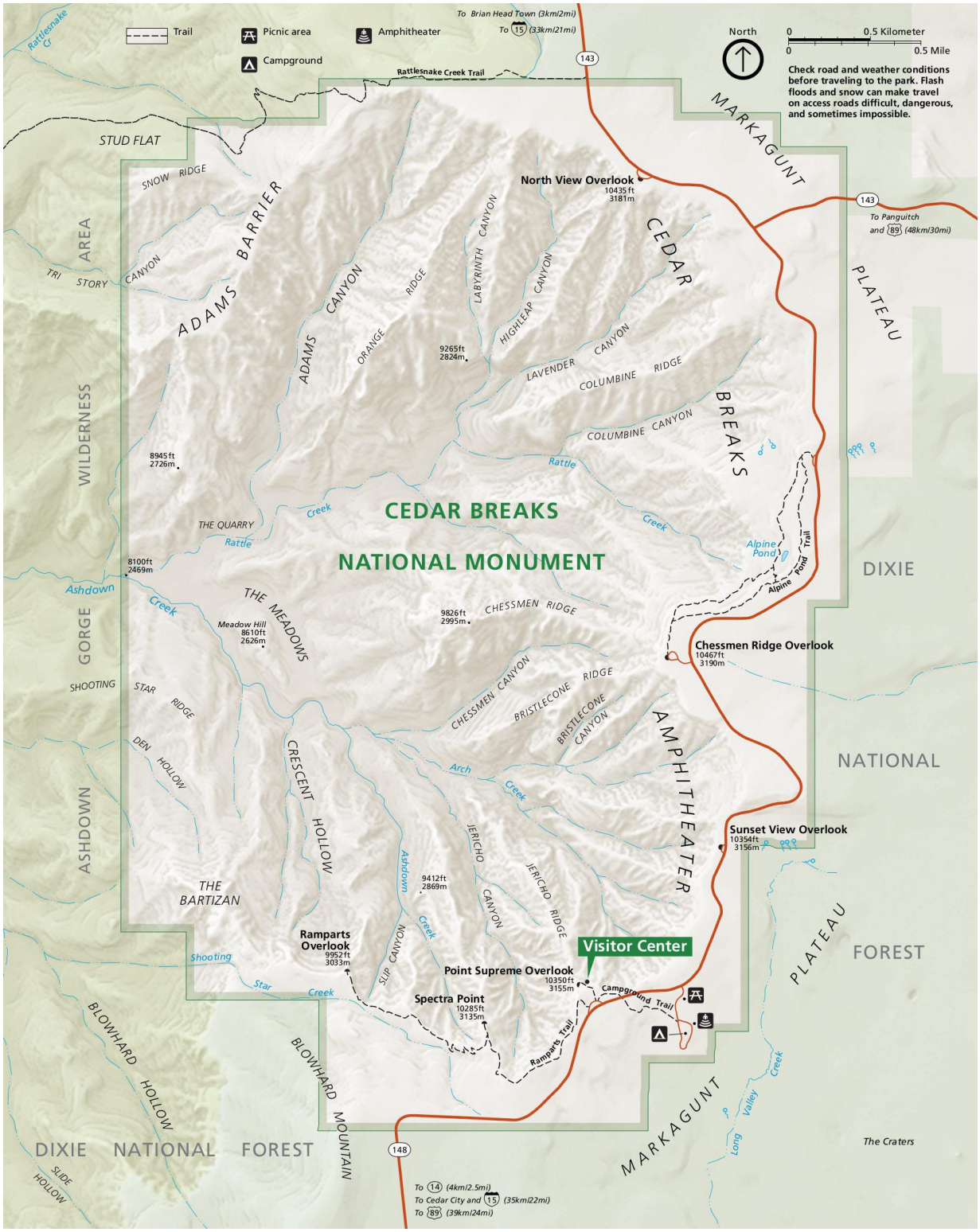


Figure 2-Map of Cedar Breaks National Monument

Park Resources

Geology: Cedar Breaks is named for the rugged escarpment or "breaks" cut into the Claron Formation, a layer of sedimentary rock deposited in an ancient lake basin that covered much of southwestern Utah during the Eocene epoch. Over the past 10 million years, movement along the Hurricane Fault has elevated the land to the east of Cedar City to an elevation of up to 11,000 feet above sea level, forming the modern-day Markagunt Plateau. This uplift of the plateau has exposed the soft rocks of the Claron Formation to weathering and erosion, sculpting a 2,500 foot high, four mile wide, westward-facing amphitheater. The amphitheater is a magnificent scene containing towering hoodoos, terraced cliffs, arches, and windows, all cut into the vibrantly colored strata of the Claron Formation. Cedar Breaks' combination of an exceptional rate of erosion, high elevation, and brilliantly colored rock formations make it a geologic treasure.

Ecology: Cedar Breaks National Monument protects a variety of distinctive flora and fauna, including intensely beautiful summer wildflower displays, ancient bristlecone pines more than 1,600 years old, and a variety of subalpine wildlife. These species have adapted to the severity of climate and weather on the high elevations of the Markagunt Plateau, contributing to the resilience and integrity of the greater subalpine ecosystem.

Many of the monument's resident wildlife species, including, but not limited to bats, red fox, jackrabbits, mountain lions, and porcupines, are nocturnal, and require a naturally dark photic environment at night in order to thrive.

History: Cedar Breaks lies within the traditional homeland of the Southern Paiutes. According to their oral traditions, they have always been here. Archaeologists have documented sites of ancestral American Indians or their habitations within and surrounding Cedar Breaks dating back more than 10,000 years. Cedar Breaks protects evidence of some of the highest elevation prehistoric sites within the national park system, representing the astonishing ability of humans to adapt to extreme and at times harsh environments.

Weather and Climate: The rim of Cedar Breaks amphitheater sits at over 10,000 feet in elevation. On average, Cedar Breaks receives 33.6 inches of precipitation and roughly 15 feet of snow annually. Summertime highs average between 60 and 80°F. Nighttime lows often dip into the 30s and 40s°F. Temperatures drop below freezing about 250 nights out of the year. Thunderstorms frequently develop on summer afternoons and the high altitude means that weather can change rapidly during any time of year.

Visitor Services

Visitor services at the monument include a visitor center and bookstore housed in a small cabin (built by the Civilian Conservation Corp in 1937), a 25-site campground, picnic area, hiking trails, and several scenic viewpoints along Highways 143 & 148. There are no food or lodging facilities within the monument. The closest towns are Brian Head (year-round pop: ~100, 10 minutes) and Cedar City (pop ~30,000, 35 minutes).

Over the past five years, Cedar Breaks National Monument has received an average of approximately 630,000 visitors per year, mostly between the months of June and October. While the monument is open year round, heavy winter snows limit access in the winter. The section of UT Hwy 143 that passes through the northeast corner of the monument is maintained during the winter. However, access to the visitor center, campground, and most other visitor facilities is via Utah Highway 148, which is closed in the winter. Automobile access to the majority of the monument is thus limited after the first significant snowfall of the year, and can thereafter be accessed only by snowmobile, ski, or snowshoe.

Cedar Breaks experiences very high visitation for a national monument of its size, in part due to its close proximity to I-15, and the fact that Cedar Breaks is located on the "Grand Circle" of southwestern national parks and monuments. Cedar Breaks was home to a rustic lodge, originally built and operated by the Utah Parks Company, until the mid-1970s, and is often visited as part of an itinerary including Zion, Bryce Canyon, Grand Canyon, and other regional attractions.

Cedar Breaks National Monument is open 24 hours/day and 365 days/year. Apart from the challenges of accessing the monument during the winter months, there are no restrictions or limitations on visitors accessing the monument at night to enjoy the dark night skies on their own. As of 2016, the monument charges an entrance fee when visitor services (visitor center, restrooms, etc) are open (Memorial Day to Columbus Day) which is currently $5 per person age 16 or older.

2. Description of Night Sky Resources

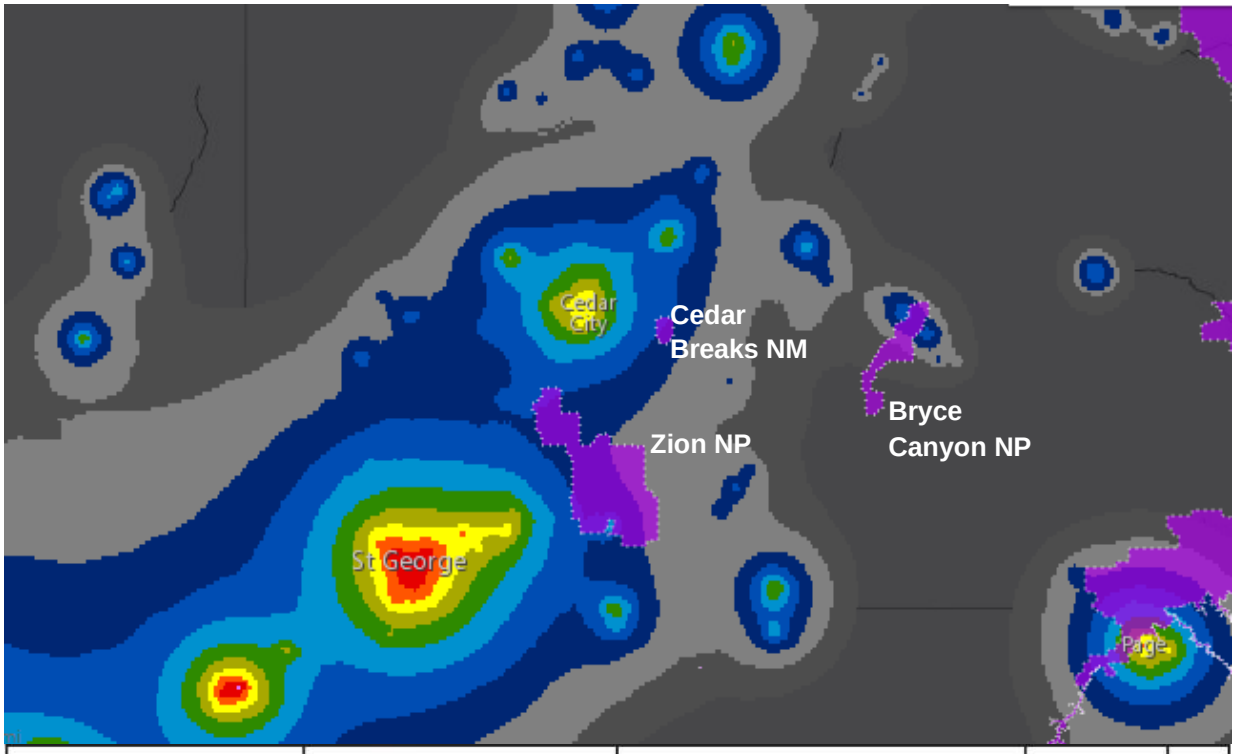
Current Conditions

The high elevation, clean air, remote location, and minimal development in and around Cedar Breaks National Monument combine to produce night skies of superb quality. Cedar Breaks is located within a day's drive of Los Angeles, Las Vegas, St. George, and Salt Lake City, yet is far enough from these population centers that the night sky remains extremely dark. This makes Cedar Breaks uniquely positioned to educate a diverse audience about the importance of preserving the night sky and the benefits of natural darkness.

Sources of light pollution within the monument itself are limited to non-existent. There are fewer than a dozen structures in use within the monument, all of which are either not regularly lit at night or utilize night-sky friendly lighting fixtures (see lighting inventory, section 6). The most significant source of artificial light at night visible from Cedar Breaks is the skyglow originating from the nearby municipalities of Cedar City (13 miles W), St. George (54 miles SW), and Brian Head (2 north of monument boundary) (Fig 3).

Figure 3-Three 360° panoramas of night sky conditions taken from Point Supreme Overlook within Cedar Breaks National Monument on 11/2/16. Images were taken with identical camera settings, except for those noted in the captions. The top image (ISO 1600) most closely approximates the appearance of the light domes as seen with the naked eye (the Brian Head/Parowan light dome is visible, but barely to the dark adapted eye) (Photos: Zach Schierl/NPS)

Despite the presence of skyglow from the aforementioned towns and cities, the night sky at Cedar Breaks remains very dark. Figure 4 (from the New World Atlas of Artificial Night Sky Brightness, Falchi et al. 2016) shows that the ratio of artificial night sky brightness to natural night sky brightness at Cedar Breaks is low compared to most of southwestern Utah. The bright and dark blue color bands in which Cedar Breaks lies indicates that the amount of artificial light in the night sky is only 4%-16% higher than natural conditions.



Ratio to natural brightness	Artificial brightness (µcd/m²)	Approximate total brightness (mcd/m²)	Color	
<0.01	<1.74	<0.176	Black	
0.01–0.02	1.74–3.48	0.176–0.177	Dark gray	
>0.02–0.04	>3.48–6.96	>0.177–0.181	Gray	
>0.04–0.08	>6.96–13.9	>0.181–0.188	Dark blue	
>0.08–0.16	>13.9–27.8	>0.188–0.202	Blue	
>0.16–0.32	>27.8–55.7	>0.202–0.230	Light blue	
>0.32–0.64	>55.7–111	>0.230–0.285	Dark green	
>0.64–1.28	>111–223	>0.285–0.397	Green	
>1.28–2.56	>223–445	>0.397–0.619	Yellow	
>2.56–5.12	>445–890	>0.619–1.065	Orange	
>5.12–10.2	>890–1780	1.07–1.96	Red	
>10.2–20.5	>1780–3560	>1.96–3.74	Magenta	
>20.5–41	>3560–7130	>3.74–7.30	Pink	
>41	>7130	>7.30	White	

Figure 4-Portion of the "New World Atlas of Artificial Night Sky Brightness" showing modeled sky brightness conditions for southwestern Utah. Purple areas are units of the US National Park Service (Falchi et al. 2016)

Visual Observations

From Cedar Breaks NM, the moonless night sky is sufficiently dark that the Milky Way is easily visible from horizon to horizon and shows great detail and structure (Fig 5). Light domes are limited to the horizon (Fig 3) and are comparable in brightness to the brightest portions of the Milky Way. Deep-sky objects such as M31, M15, M22, and M8 are easily visible to the naked eye on a moonless night. The zodiacal light can also be seen under favorable conditions. The high elevation of Cedar Breaks also contributes to the superb night sky viewing. Using the Bortle Dark Sky Scale, the skies of Cedar Breaks fit the description of a Class 2 or Class 3 sky.

Figure 5-The summer Milky Way seen from Point Supreme at Cedar Breaks National Monument. Blue light on the horizon is not skyglow, but rather light from a rising waning gibbous moon. (Photo: Zach Schierl)

Sky Quality Meter Monitoring

In order to quantify current night sky conditions at Cedar Breaks, the monument purchased an IDA approved Unihedron Sky Quality Meter (SQM, "wide-angle" version) in early 2016 and began a regular night sky monitoring program shortly thereafter. Trained Cedar Breaks interpretive staff record SQM measurements on each clear, moonless Saturday evening during the summer months following public astronomy programs. Periodic winter measurements will also be recorded as weather and sky conditions permit.

Since beginning the monitoring program, SQM measurements from the Visitor Center have typically been in the 21.70-21.80 mag/arcsec^2 range, indicating a nearly pristine night sky at the zenith (Table 1). Degradation of the night sky at Cedar Breaks is predominantly due to light domes within about 20 degrees of the horizon to the west and north, which are not captured by the SQM.

Table 1: Cedar Breaks National Monument Sky Quality Meter (SQM) Observations				
Local Date & Time	**Location**	**Temp (°C)**	**Average SQM reading (mags/arcsec^2)**	**Comments/sky conditions**
6-24-16 23:12	Point Supreme Overlook	16	**21.67**	Very hazy, but clear
6-25-16 23:20	Point Supreme Overlook	18	**21.79**	Pretty clear, some haze
7-2-16 23:04	Point Supreme Overlook	11	**21.81**	Clear, with intermittent lightning to north
7-23-16 23:00	Point Supreme Overlook	16	**21.69**	Clear
11-2-16 21:22	Point Supreme Overlook	5	**21.32**	Bright airglow present in photographs (see Fig 3)

A sky quality survey was conducted on September 26, 2016, in which SQM measurements were taken at a dozen locations throughout the monument and surrounding areas on the same evening (Table 2). The location of these points is shown in Figure 6. The survey was conducted on a clear, moonless evening following the end of astronomical twilight to ensure that the sky was dark. The method suggested by the IDA (http://darksky.org/idsp/sky-quality-survey/) was used. At each location, five measurements were taken with the SQM and the results averaged to produce the sky luminance values given in Table 2.

These data show that night sky luminance across Cedar Breaks National Monument is quite consistent. Sky luminance increases slightly at the northern end of the monument, likely due to increased skyglow from Brian Head Town just outside the monument's northern boundary. Note that all the measurements presented here are from the eastern portion of the monument, which is the only part accessible by road. The western portion of the monument is about two miles closer to Cedar City, but is not accessible by road or trail so staff has not yet been table to take SQM measurements from this part of the monument. One measurement was taken at Cedar Canyon Campground (U.S. Forest Service) which is located just southwest of the monument. Even though this location is closer to Cedar City, the sky quality was comparable to the measurements

taken within Cedar Breaks, indicating that the western portions of the monument are not likely to be significantly brighter.

Table 2: Cedar Breaks National Monument Sky Quality Meter (SQM) Survey (9-26-16)				
Local Time	**Location**	**Temp (°C)**	**Average SQM reading (mags/arcsec^2)**	**Comments/sky conditions**
21:00	*Cedar Canyon CG (COMPARISON)*	*20*	***21.51***	*Clear, Milky Way directly overhead*
21:11	UT 148, South Boundary	19	**21.51**	Clear, Milky Way directly overhead
21:16	Visitor Center/Pt. Supreme	19	**21.49**	Clear, Milky Way directly overhead
21:20	Picnic Area/ Campground	18	**21.54**	Clear, Milky Way directly overhead
21:24	Sunset View	17	**21.50**	Clear, Milky Way directly overhead
21:30	Chessman Ridge	17	**21.52**	Clear, Milky Way directly overhead
21:34	Winter Ranger Station (Yurt)	17	**21.47**	Clear, Milky Way directly overhead
21:38	UT 143, east boundary	17	**21.49**	Clear, Milky Way directly overhead
21:42	North View	16	**21.46**	Skyglow from Brian Head Town visible
21:47	UT 143, north boundary	16	**21.46**	Clear, Milky Way directly overhead
22:34	*Cedar City, UT (COMPARISON)*	*20*	***19.88***	*Many unshielded lights nearby*
21:52	*Brian Head Town (COMPARISON)*	*17*	***21.13***	*Many unshielded lights nearby*

Note that the sky luminance values obtained during the sky quality survey on 9/26 are ~0.25 magnitudes brighter than the average value obtained during regular monitoring throughout summer 2016 (Table 1). This is likely because the summer Milky Way (in particular, the Cygnus/Aquila region) was directly overhead during the sky quality survey, whereas earlier in the summer this region of the sky was closer to the horizon. The Unihedron website (http://www.unihedron.com/projects/darksky/faq.php) states that the Milky Way can add 0.1-0.3 magnitudes of luminance when directly overhead. This should be taken into account when interpreting the sky quality survey measurements.

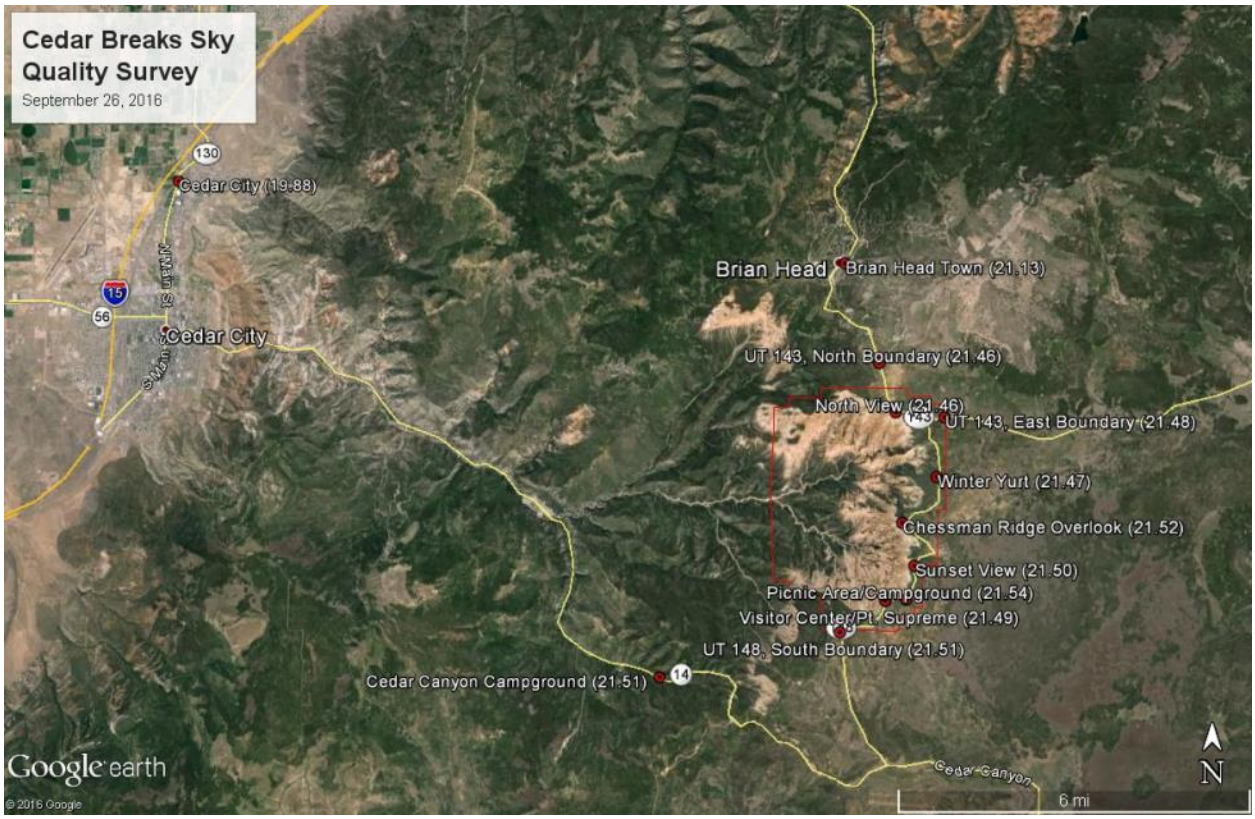
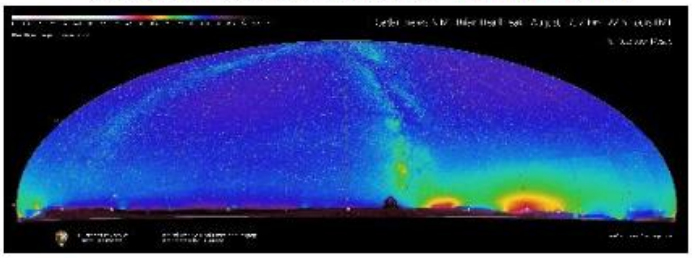
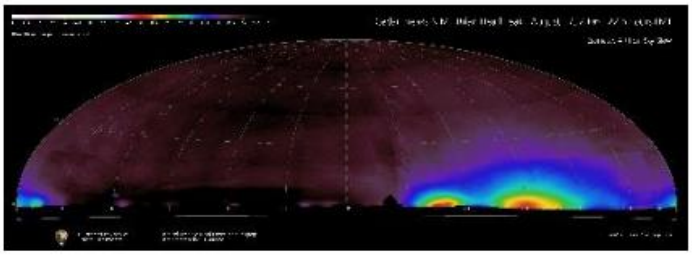


Figure 6-Map showing the location and values of SQM measurements taken during a sky quality survey of Cedar Breaks National Monument on 9/26/16.

NPS Night Sky Team Data

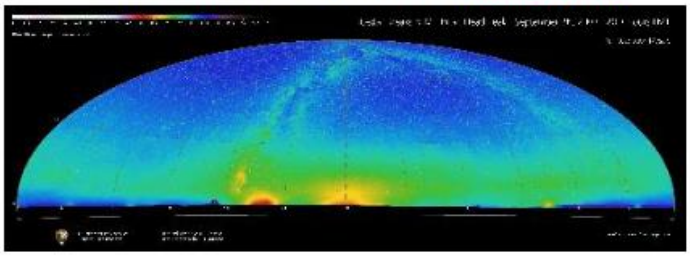
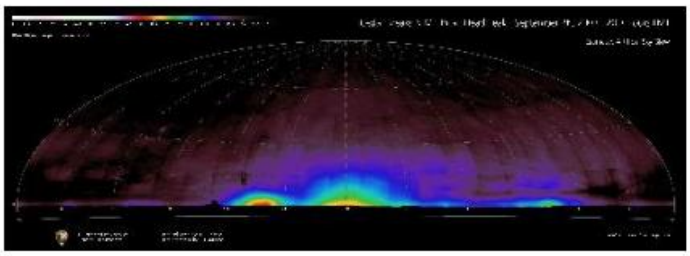
All-sky photometry data were collected by the NPS Night Sky Team in 2003 (Chad Moore) and 2006 (Dan Duriscoe) from the summit of Brian Head Peak, just outside the northern boundary of the monument. Brian Head Peak was chosen because there are few locations within the monument proper that allow an unobstructed view of the horizon in all directions. The brightest sources of skyglow in these data sets were the light domes originating from Cedar City and St. George. Skyglow and glare from Brian Head Town, just 1.5 miles north of the peak, is also prominent in these data sets. However, Brian Head Peak is immediately adjacent to Brian Head Town, so the amount of artificial light from this source is much greater than it would be from a location (such as Point Supreme) that is within the monument proper. The images and indicators from this data are shown below. For a full explanation of these reports, see https://www.nps.gov/subjects/nightskies/skydata.htm

Category	Details	Observed and Estimated Artificial Sky Brightness Mosaics
Park:	Cedar Breaks NM	Click on either image for a high resolution view --THESE ARE LARGE FILES
Site Name:	Brian Head Peak	
Longitude:	-112.83	
Latitude:	37.63	
Elevation (m):	3450	
Date (LMT):	17-Aug-2006	
Time (LMT Hours):	22.53	
Camera:		
Lens:		
Observers:		
Air temp. (°C):	8.3	
R. H. (%):	56.0	
Wind Speed (mph):		
Extinction Coeff. (mag/airmass):	0.10	
NELM:		
Bortle Class:		
Synthetic SQM:	21.52	
SQI All- sky:	77.9	
SQI to Z.A. 70°:	82.4	
Number of stars visible:	4600	

NARRATIVE:

Photometric Indicators

Indicator	Observed		Estimated Artificial		Light Pollution Ratio (Artificial/Natural)
Sky Luminance Measures					
	mag/ arscec^2	µcd/ m^2	mag/ arscec^2	µcd/ m^2	
Zenith	21.42	293	23.30	51	0.30
Mean all-sky	21.21	356	22.40	117	0.47
Brightest	18.82	3,178	18.90	2,939	17.19
Darkest	21.79	206	> 24.5	< 17	< 0.10
Median	21.38	300	22.99	68	0.27
Illuminance Measures					
	mags	milli-lux	mags	milli-lux	
Horizontal	-6.41	0.93	-4.90	0.23	0.29
Max Vertical	-6.32	0.85	-5.49	0.40	1.00

Category	Details	Observed and Estimated Artificial Sky Brightness Mosaics
Park:	Cedar Breaks NM	Click on either image for a high resolution view --THESE ARE LARGE FILES
Site Name:	Brian Head Peak	
Longitude:	-112.83	
Latitude:	37.68	
Elevation (m):	3453	
Date (LMT):	26-Sep-2003	
Time (LMT Hours):	20.68	
Camera:	Apogee	
Lens:	Nikon 35mm 1.2	
Observers:	D Duriscoe	
Air temp. (°C):	3.3	
R. H. (%):	20.0	
Wind Speed (mph):	8	
Extinction Coeff. (mag/airmass):	0.12	
NELM:	6.6	
Bortle Class:	3	
Synthetic SQM:	21.14	
SQI All- sky:	**81.7**	
SQI to Z.A. 70°:	**87.4**	
Number of stars visible:	**3500**	

NARRATIVE: Site located near the west edge of the summit of Brian Head Peak, north of the shelter about 200 feet. Seeing good, transparency good, slight haze, fire smoke to the southwest over the Kaibab plateau. The sky appears bright from airglow, 10 degrees above the horizon has a blue green color to the east. Nevertheless, excellent definition in the Milky way near the zenith, gegenschein easily visible. Breezy, high altitude hinders visual observations. Light domes of Cedar City and St. George are prominent to the west and southwest, extending to 30 and 20 degrees above the horizon, respectively. Salt Lake City area light dome fairly small but very obvious and bright. Town of Brian Head has very annoying unshielded lights, excessive for such a small town, illuminating the mountain.

Photometric Indicators

Indicator	Observed		Estimated Artificial		Light Pollution Ratio (Artificial/Natural)
Sky Luminance Measures					
	mag/ arscec^2	µcd/ m^2	mag/ arscec^2	µcd/ m^2	
Zenith	21.27	338	24.34	20	0.11
Mean all-sky	20.82	508	22.62	96	0.38
Brightest	18.95	2,811	19.06	2,553	14.93
Darkest	21.43	287	> 24.5	< 17	< 0.10
Median	20.92	459	23.11	61	0.24
Illuminance Measures					
	mags	milli-lux	mags	milli-lux	
Horizontal	-6.80	1.33	-4.62	0.18	0.22
Max Vertical	-6.53	1.04	-5.21	0.31	0.77

The benefits of the dark nighttime environment at Cedar Breaks are not limited to astronomers and stargazers. While preserving dark night skies is perhaps the most visible reason for the establishment of dark sky parks, there are many other important benefits as well.
An environment that is relatively free of artificial light at night is also important for maintaining a healthy ecosystem for nocturnal wildlife, an important consideration for the National Park Service. Furthermore, a growing body of medical research shows that excessive exposure to artificial light at night can suppress production of the hormone melatonin and contribute to various human health issues. Well-designed outdoor lighting can also decrease energy usage, which is related to the National Park Service's efforts to reduce its contributions toward climate change.

Future Conditions

While skies at Cedar Breaks are currently quite dark, nearby municipalities (in particular Cedar City and St. George) are experiencing rapid growth. According to the U.S. Census Bureau, the population of Washington County (home to St. George) increased by 10% (to 138,115) from April 2010 to July 2014, making it one of the fastest growing counties in the United States.

There is concern that, without a move towards more efficient and well-designed outdoor lighting, the dark skies of Cedar Breaks NM and other nearby protected areas (such Bryce Canyon National Park, Zion National Park, and Grand Canyon National Park) will become increasingly threatened. Educating citizens in the region about this rapidly growing threat to Southern Utah's world-famous dark skies is the primary goal of Cedar Breaks' robust astronomy and night sky education program (Section 3) and our efforts to seek International Dark Sky Park status.

In order to monitor future change in night sky quality at Cedar Breaks (and to comply with goals set forth in the monument's foundation document, see Section 4), Cedar Breaks management has committed to continue making regular SQM measurements. Trained interpretive staff and/or interns will continue to take SQM measurements following public astronomy events at the monument. Interpretive or natural resource staff will also repeat the sky quality survey at least once per year, ideally in the fall, and take winter measurements as weather and sky conditions permit.

3. Dark Skies Education & Outreach

Astronomy and Dark Sky Interpretive Programs

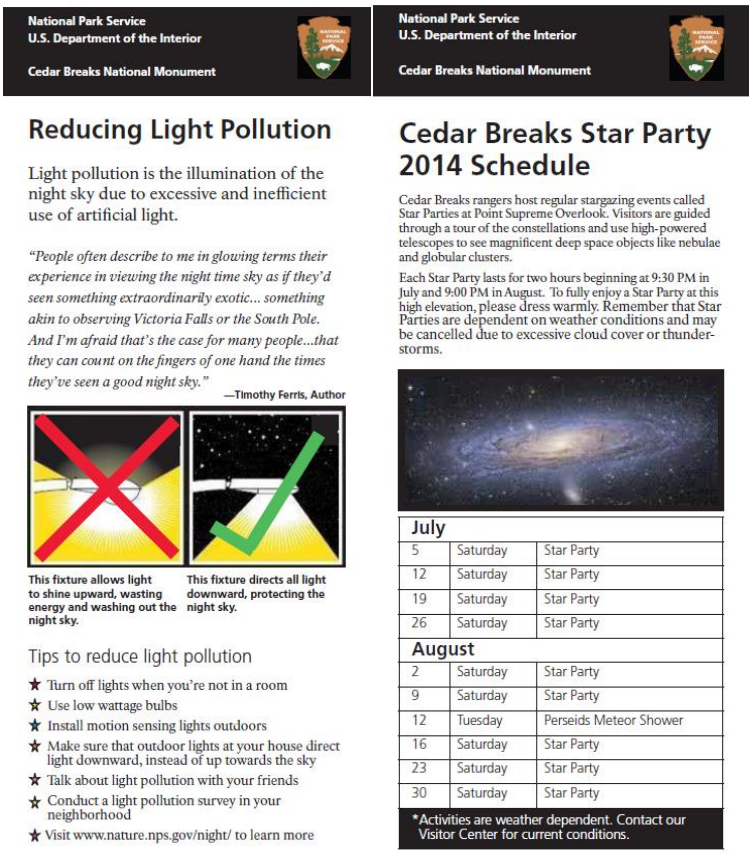
Cedar Breaks National Monument has a robust astronomy and dark skies interpretation program. Cedar Breaks began offering occasional astronomy programs to monument visitors in the mid-2000s, often with the assistance of rangers and volunteers from nearby Bryce Canyon National Park. By the summer of 2009, astronomy and stargazing programs had become a regular part of the monument's interpretive programming and have since grown to become the monument's most popular events. Cedar Breaks has purchased several telescopes and pairs of astronomy binoculars for use in educating the public about the monument's night sky resources. Cedar Breaks is currently home to the highest regularly scheduled astronomy programs in the entire national park system, which take place at an altitude of 10,350 feet.

Figure 7-"Dark Ranger Dave" Sorensen discusses the importance of dark night skies prior to a summer star party at Point Supreme (Photo: Zach Schierl/NPS)

During the summer months (typically Memorial Day to Labor Day), Cedar Breaks hosts ranger-led astronomy programs ("star parties") at Point Supreme Overlook every Saturday night. These programs begin at sundown with an interpretive talk on astronomy or dark sky preservation (Figs 7 & 8), followed by viewing of celestial objects through telescopes and constellation tours. Each astronomy program emphasizes the importance of dark skies and the role that natural darkness plays in a healthy ecosystem. Astronomy programs are often supported by NPS volunteers and/or volunteers from local astronomy clubs and societies.

Figure 8-Leesa Ricci, Cedar Breaks Dark Skies Intern, leads an interpretive program about the connection between Cedar Breaks geology and the night sky during a summer star party at Cedar Breaks (Photo: Zach Schierl/NPS)

Figure 9-Attendees at a Cedar Breaks astronomy program wait for the skies to darken (NPS Photo)



National Park Service
U.S. Department of the Interior

Cedar Breaks National Monument

Reducing Light Pollution

Light pollution is the illumination of the night sky due to excessive and inefficient use of artificial light.

"People often describe to me in glowing terms their experience in viewing the night time sky as if they'd seen something extraordinarily exotic... something akin to observing Victoria Falls or the South Pole. And I'm afraid that's the case for many people...that they can count on the fingers of one hand the times they've seen a good night sky."

—Timothy Ferris, Author

Tips to reduce light pollution

- ★ Turn off lights when you're not in a room
- ★ Use low wattage bulbs
- ★ Install motion sensing lights outdoors
- ★ Make sure that outdoor lights at your house direct light downward, instead of up towards the sky
- ★ Talk about light pollution with your friends
- ★ Conduct a light pollution survey in your neighborhood
- ★ Visit www.nature.nps.gov/night/ to learn more

National Park Service
U.S. Department of the Interior

Cedar Breaks National Monument

Cedar Breaks Star Party 2014 Schedule

Cedar Breaks rangers host regular stargazing events called Star Parties at Point Supreme Overlook. Visitors are guided through a tour of the constellations and use high-powered telescopes to see magnificent deep space objects like nebulae and globular clusters.

Each Star Party lasts for two hours beginning at 9:30 PM in July and 9:00 PM in August. To fully enjoy a Star Party at this high elevation, please dress warmly. Remember that Star Parties are dependent on weather conditions and may be cancelled due to excessive cloud cover or thunderstorms.

July		
5	Saturday	Star Party
12	Saturday	Star Party
19	Saturday	Star Party
26	Saturday	Star Party
August		
2	Saturday	Star Party
9	Saturday	Star Party
12	Tuesday	Perseids Meteor Shower
16	Saturday	Star Party
23	Saturday	Star Party
30	Saturday	Star Party

*Activities are weather dependent. Contact our Visitor Center for current conditions.

Figure 10-Example of a brochure produced by Cedar Breaks to advertise astronomy programs and highlight solutions for reducing light pollution *(Note: since 2014, Cedar Breaks has begun offering astronomy programs every Saturday from Memorial Day to Labor Day)*

Attendance at astronomy programs in the early years of the program ranged from 20-50 people. As word has spread about the darkness of the night skies at Cedar Breaks and the quality of the experience offered by staff, attendance at summer star parties now regularly exceeds 100 visitors on clear nights and can reach 200 or 300 on holiday weekends and for special events such as the Perseid Meteor Shower. In the summer of 2016, a total of 2192 visitors attended 22 evening astronomy programs at Cedar Breaks. An additional 5467 visitors were reached by our Astronomy VIPs (volunteers) via daily solar telescope viewing, informal night sky programs in the campground, and roving interpretation. For the past several years, astronomy events have consistently been the best attended interpretive programs at Cedar Breaks, a trend also observed at many other national parks and monuments where similar programming is offered. While many attendees at these programs are visitors from across the country and around the world, staff has also noted an increasing number of attendees that are residents of Southern Utah or the Las Vegas area who come to Cedar Breaks specifically to attend these astronomy programs and view the night sky.

In conjunction with many other national parks, the monument offers a Junior Ranger "Night Sky Explorer" program where young visitors to the monument can complete activities related to astronomy and the night sky and receive a patch upon completion. On Saturday afternoons during the summer season, rangers lead an in-person Junior Ranger program with an astronomy or dark skies theme. Topics of these programs range from observing the Sun and learning about the different types of light that it emits, to constructing a scale-model of the solar system along a rim trail.

Cedar Breaks often hosts special astronomy programs for events such as meteor showers and eclipses. Ranger-led full moon hikes along the rim of Cedar Breaks amphitheater are offered monthly in the summer and the monument will begin offering full moon snowshoe hikes in the winter of 2016/2017. In addition to these formal astronomy programs, Cedar Breaks National Monument is open 24 hours/day and 365 days/year; thus there are no restrictions on visitors accessing the monument at night to enjoy the dark night skies on their own.

Community Outreach & Partnerships

While summer astronomy programs at Cedar Breaks are extremely popular, monument staff also works diligently to bring the message of dark sky protection to surrounding communities via outreach events and partnerships with a variety of other agencies and organizations.

In the winter months when Cedar Breaks is snowbound, the monument partners with Brian Head Ski Resort in the gateway community of Brian Head, UT, to host a series of winter star parties at Navajo Lodge (Fig 11). These events have historically been well-attended; the events in February and March 2016 both drew over 100 individuals despite very cold temperatures and partly cloudy skies. These events offer an opportunity to educate residents of an important gateway community partner, as well as visitors to the ski resort from across the United States, about the importance of dark sky preservation.

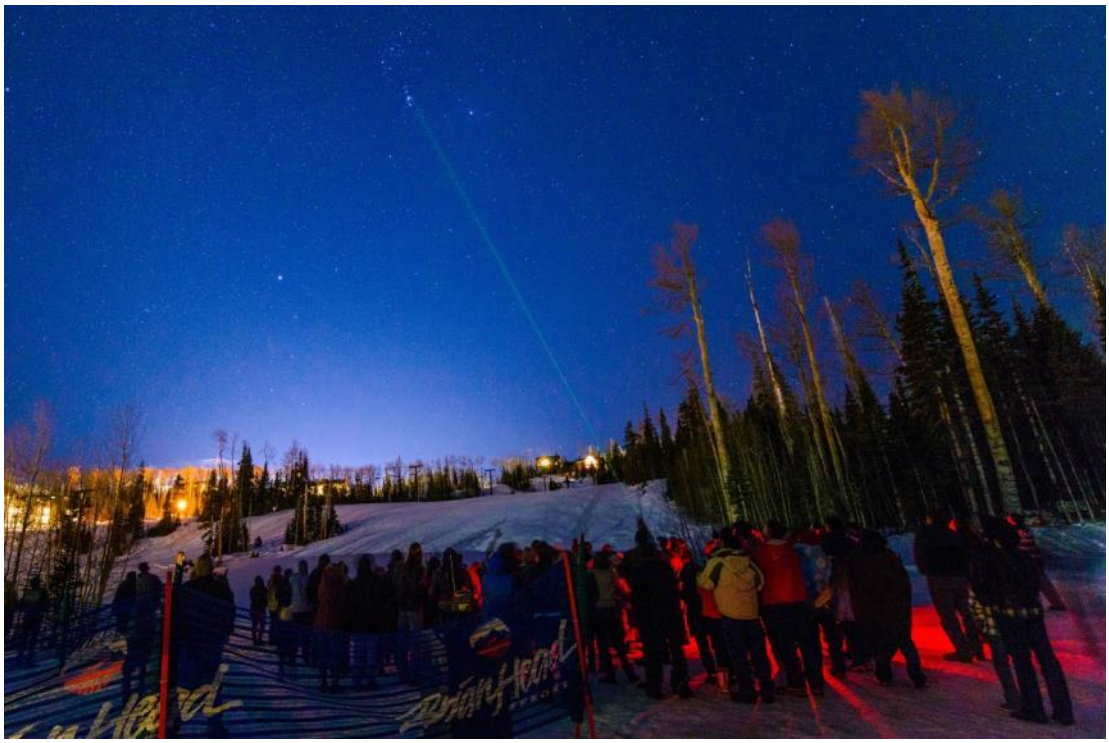


Figure 11-Cedar Breaks rangers lead a winter astronomy program at Brian Head Ski Resort (Photo: Mike Saemisch)

In August 2016, monument staff presented an astronomy program at the Duck Creek Campground on the nearby Dixie National Forest. Plans are in the works to provide astronomy and dark skies training to Forest Service staff and volunteers in Spring 2017 so that they can begin hosting their own astronomy programs on the Markagunt Plateau in summer 2017. Due to the small size of the Cedar Breaks campground, many overnight visitors to the Cedar Breaks area stay in one of the nearby Forest Service campgrounds, making this an importance audience to reach out to about the importance of dark skies in the area. As time permits, Cedar Breaks astronomy rangers lend their expertise by assisting other parks in the region with astronomy events, most recently leading a night sky photography workshop and telescope viewing at the 2016 Great Basin National Park Astronomy Festival, and operating telescopes and leading constellation tours for the 2016 Navajo Bridge Star Party in Glen Canyon National Recreation Area.

Cedar Breaks staff frequently hosts astronomy programs and/or gives presentations on dark sky preservation to a variety of groups throughout southwestern Utah. Recent dark sky programs have been provided for Southern Utah University (Day in the Parks, Semester in the Parks, and the Outdoor Education Lecture Series), the Southern Utah Space Foundation, the Kwiyamuntsi Paiute Youth Camp, the St. George Astronomy Group, Boy and Girl Scout troops, local youth groups, and the town of Springdale, UT (gateway community for Zion NP). The Cedar Breaks Dark Skies Coordinator also serves on the education and outreach committee for the Great Basin Observatory, the first research grade observatory in a U.S. National Park. The goal of the

observatory is to bring astronomical research and an awareness of the benefits of protecting dark skies to students and citizens across the Great Basin region, including Cedar City.

Figure 12-Dark Sky booth at the Southern Utah University STEAM Festival in Cedar City (Photo: Zach Schierl/NPS)

Using results from dark sky monitoring at Cedar Breaks to educate the public about changing night sky conditions in Southern Utah is also a priority of the monument's outreach efforts. Cedar Breaks recently developed an interactive exhibit for a booth at the annual Southern Utah University STEAM festival that interprets SQM measurements taken at various locations around Southern Utah by converting the SQM sky luminance data into an approximate number of stars visible to the naked eye. Using a large banner depicting various sky conditions, the exhibit allows the public to directly compare the view of the night skies at places like Cedar Breaks with the view from rural, urban, and suburban areas of southwestern Utah (Fig 12). The exhibit also allows the public to play a game using a working mock-up of a residential light fixture. Visitors must use real light bulbs and fixtures in an attempt to light their front door while keeping the night sky and surrounding environment dark, and using as little energy and money as possible (Fig 13).

Figure 13-Zach Schierl, Cedar Breaks Education Specialist, teaches elementary school students about light pollution and dark-sky friendly lighting at the Southern Utah University STEAM Festival in Cedar City (Photo: Shannon Eberhard/NPS)

Online & Social Media

In July 2016, Cedar Breaks was voted the winner of USAToday's "Best National Park Night Experience" online contest (http://www.10best.com/awards/travel/best-national-park-night-experience/), garnering more votes than several other well-known dark sky parks.

Posts highlighting the dark skies and astronomy programs at Cedar Breaks are typically among the most "liked" on the monument's social media channels and can reach thousands of users, providing a powerful medium for monument staff to share messaging about dark skies (Fig 14).

In 2016, the astronomy program at Cedar Breaks was featured in a segment of the KUED (PBS) documentary on Utah's National Parks: *Beyond the Crowds* (http://www.kued.org/whatson/year-the-parks/national-parks-beyond-the-crowds)

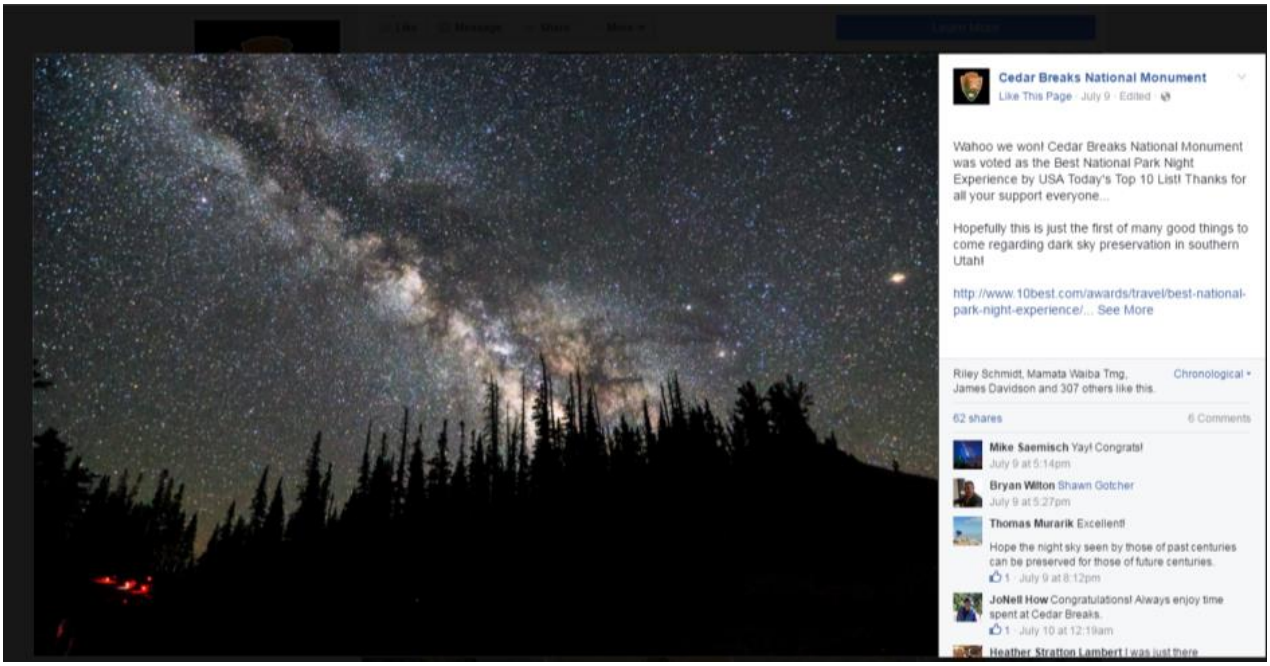
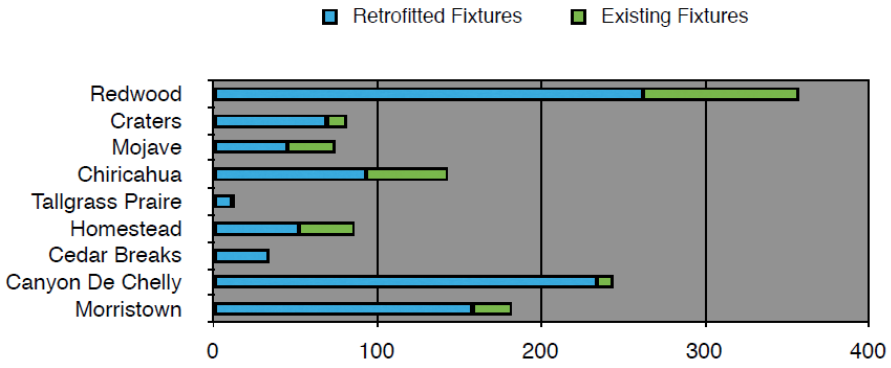


Figure 14-A post on the monument's Facebook page announcing Cedar Breaks as the winner of USAToday's "Best National Park Night Experience" contest.

Interpretation of Monument Lighting

In 2011, Cedar Breaks engaged in a cooperative agreement with IDA (through the NPS Night Skies Program) to inventory and retrofit much of the monument's outdoor lighting. As a result of this partnership, all 34 lighting fixtures in the monument at the time (some have since been removed or modified) were retrofitted to be night sky friendly, resulting in an 90% reduction in installed wattage (Fig 15).

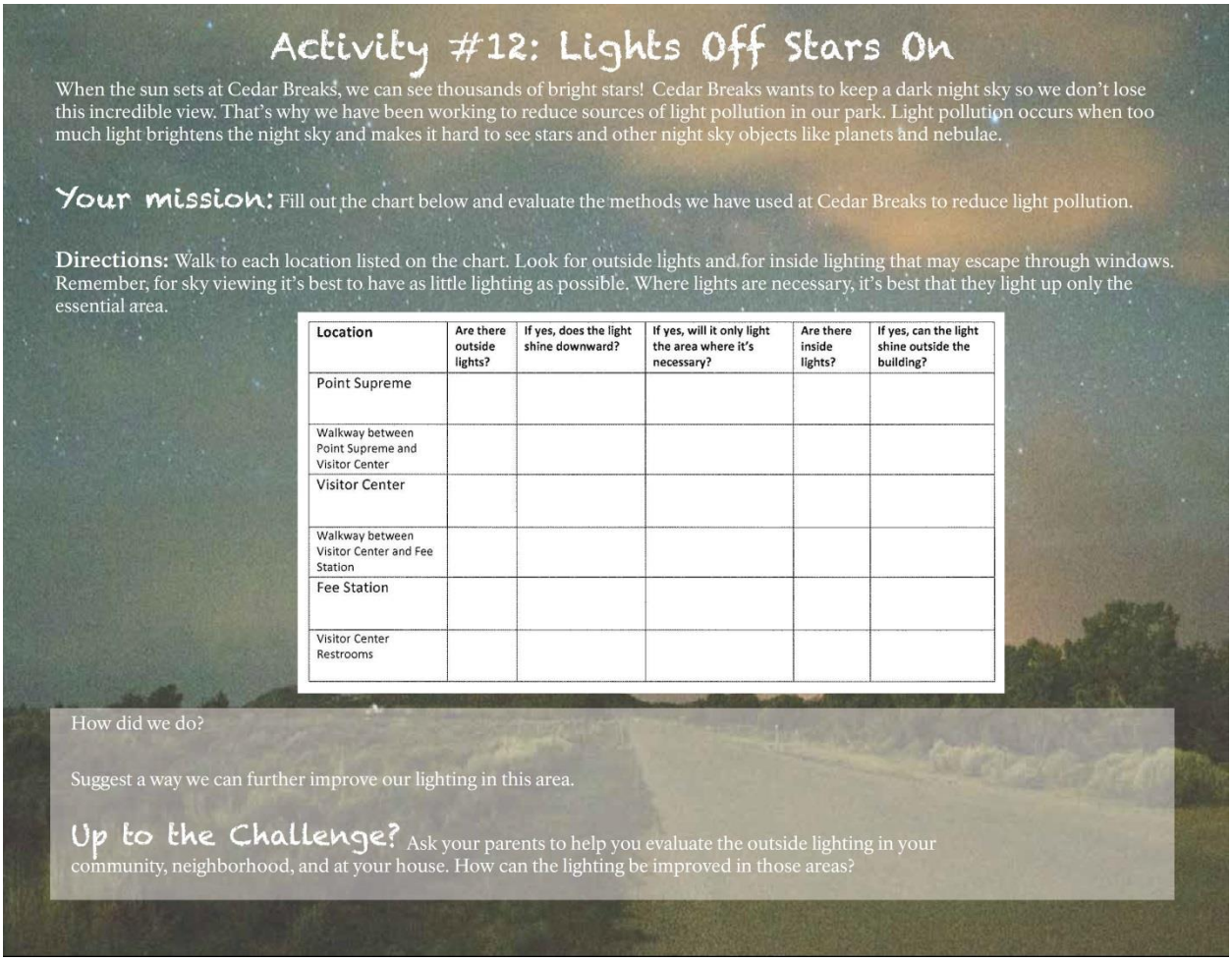
Much of this lighting, such as the recessed canisters at the fee station, and fully shielded floodlights at the ranger station, is highly visible to the public in the evening and is highlighted during interpretive night sky programs, along with the significant decrease in energy usage that was realized after the retrofits. Highlighting this lighting allows visitors to see a concrete example of dark-sky friendly lighting and potential energy savings, concepts that are only discussed in abstract or with slides during many astronomy programs. On cloudy nights when telescope viewing is impossible, monument staff has also taken visitors on short walks to look at and discuss the dark-sky friendly lighting (and the few remaining non-compliant fixtures) within the monument.



Park	Old Energy Usage	New Energy Usage	% Energy Savings
Redwood	13207 W	1545 W	88%
Craters of the Moon	2821 W	271 W	90%
Mojave	5904 W	283 W	95%
Chiricahua	11175 W	382 W	96%
Tallgrass Prairie	1141 W	86 W	92%
Homestead	5494 W	209 W	96%
Morristown	9006 W	680 W	92%
Canyon De Chelly	14884 W	1170 W	92%
Cedar Breaks	1938 W	187 W	90%

Figure 15-Data from the IDA/NPS Cooperative agreement final report, showing that all existing light fixtures at Cedar Breaks were retrofitted in 2011 to be dark sky friendly and the associated energy savings.

In addition, the Cedar Breaks Junior Ranger activity booklet includes an activity where the prospective Jr. Ranger must go to various locations within the monument, and analyze the quality of the light fixtures (Fig 16).



Activity #12: Lights Off Stars On

When the sun sets at Cedar Breaks, we can see thousands of bright stars! Cedar Breaks wants to keep a dark night sky so we don't lose this incredible view. That's why we have been working to reduce sources of light pollution in our park. Light pollution occurs when too much light brightens the night sky and makes it hard to see stars and other night sky objects like planets and nebulae.

Your mission: Fill out the chart below and evaluate the methods we have used at Cedar Breaks to reduce light pollution.

Directions: Walk to each location listed on the chart. Look for outside lights and for inside lighting that may escape through windows. Remember, for sky viewing it's best to have as little lighting as possible. Where lights are necessary, it's best that they light up only the essential area.

Location	Are there outside lights?	If yes, does the light shine downward?	If yes, will it only light the area where it's necessary?	Are there inside lights?	If yes, can the light shine outside the building?
Point Supreme					
Walkway between Point Supreme and Visitor Center					
Visitor Center					
Walkway between Visitor Center and Fee Station					
Fee Station					
Visitor Center Restrooms					

How did we do?

Suggest a way we can further improve our lighting in this area.

Up to the Challenge? Ask your parents to help you evaluate the outside lighting in your community, neighborhood, and at your house. How can the lighting be improved in those areas?

Figure 16-Activity #12 in the Cedar Breaks Junior Ranger activity booklet, which introduces visitors young and old to the concept of dark sky friendly lighting.

Staffing & Future Plans

Cedar Breaks employs a seasonal "Dark Ranger" who has led the monument's star parties for the past several years. In 2016, the monument hired for the first time a year-round (term) Dark Skies Coordinator to oversee night sky outreach and education efforts, as well as develop a "Master Astronomer" workshop to be offered to residents of Southern Utah in order to increase public understanding and awareness of the dark sky resources in the region. The Master Astronomer program is a hands-on, interactive 40-hr workshop modeled after the successful "Master Gardner" and "Master Naturalist" programs being taught across the country and will debut with a pilot workshop in February 2017. Participants will learn about astronomy, the night sky, dark sky preservation, and effective communication and teaching techniques, thus enabling them to educate their communities about the importance of preserving dark skies in Southern Utah.

In 2016 the monument also hired a dark skies intern through the Southern Utah University Intergovernmental Internship Cooperative (IIC) to help develop the Master Astronomer Program and assist with dark sky outreach and education.

For the past several summers, Cedar Breaks has hosted a pair of volunteers from the National Park Service's "Astronomy VIP" program. These astronomy volunteers live and work at Cedar Breaks for about one month and help educate visitors about astronomy and the importance of protecting dark skies. In addition to assisting with evening astronomy programs, these volunteers also set-up solar telescopes during the day to allow visitors a safe look at sunspots and prominences on the Sun (Fig 17).

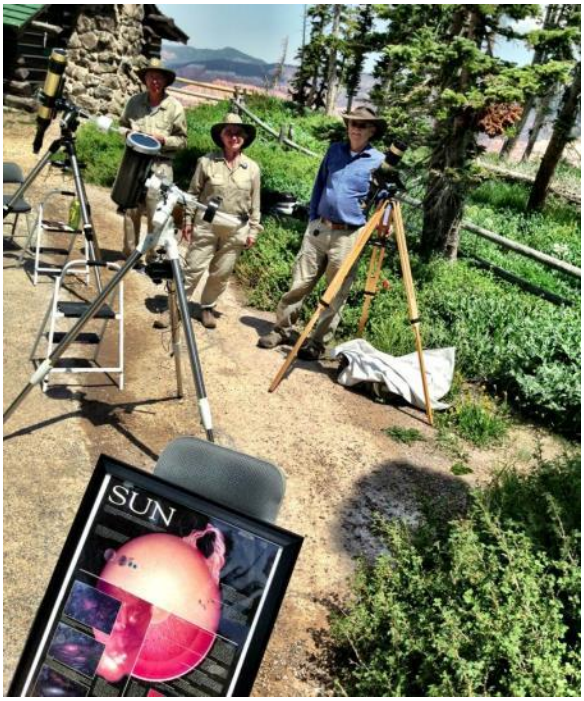


Figure 17-Cedar Breaks astronomy volunteers lead daytime solar viewing sessions during the summer season (Photo: Jim Hill)

The presence of a year-round position devoted to educating the public about astronomy, dark skies, and nocturnal ecology is rare in the NPS and shows the commitment that Cedar Breaks has made to protect the exceptional night sky resources both within the monument and throughout the region. The monument continues to seek new ways to partner with other federal agencies, state, county, and local governments, Southern Utah University, and other astronomy groups in the region to advance the issue of dark sky preservation.

In future years, Cedar Breaks also plans to diversify the types of interpretive astronomy programs it offers in order to offer new ways for visitors to connect with the night sky. Options for future programming include an annual "astronomy day" in conjunction with partner groups, night sky photography workshops, guided full moon snowshoe hikes, and a citizen science program where visitors can assist in making measurements of night sky quality using SQMs and the Dark Sky Meter app.

4. Management Documents

NPS Management Policies Supporting Dark Skies

2006 Management Policies

Section 4.10 Lightscape Management: The Service will preserve, to the greatest extent possible, the natural lightscapes of parks, which are natural resources and values that exist in the absence of human-caused light. The absence of light in areas such as caves and at the bottom of deep bodies of water influences biological processes and the evolution of species, such as the blind cave fish. The phosphorescence of waves on dark nights helps hatchling sea turtles orient to the ocean. The stars, planets, and earth's moon that are visible during clear nights influence humans and many other species of animals, such as birds that navigate by the stars or prey animals that reduce their activities during moonlit nights.

Improper outdoor lighting can impede the view and visitor enjoyment of a natural dark night sky. Recognizing the roles that light and dark periods and darkness play in natural resource processes and the evolution of species, the Service will protect natural darkness and other components of the natural lightscape in parks. To prevent the loss of dark conditions and of natural night skies, the Service will minimize light that emanates from park facilities, and also seek the cooperation of park visitors, neighbors, and local government agencies to prevent or minimize the intrusion of artificial light into the night scene of the ecosystems of parks. The Service will not use artificial lighting in areas such as sea turtle nesting locations where the presence of the artificial lighting will disrupt a park's dark-dependent natural resource components.

The Service will:

- restrict the use of artificial lighting in parks to those areas where security, basic human safety, and specific cultural resource requirements must be met;
- use minimal-impact lighting techniques;
- shield the use of artificial lighting where necessary to prevent the disruption of the night sky, natural cave processes, physiological processes of living organisms, and similar natural processes.

The decision about whether or not to install artificial lighting in particular circumstances is left to the discretion of the superintendent and is made through the planning process.

Call to Action (2012)

The Director's Call to Action Report is a guideline for employees and partners that contains specific goals and measurable actions, and charts a path towards unified goals:

Action 27: Starry, Starry Night: "Lead the way in protecting natural darkness as a precious resource and create a model for dark sky protection by establishing America's first Dark Sky Cooperative on the Colorado Plateau in collaboration with other federal agencies, partners, and local communities."

Figure 18-The Milky Way from Cedar Breaks amphitheater (Photo: Mike Saemisch)

Cedar Breaks Management Documents Supporting Dark Skies

Cedar Breaks National Monument Foundation Document (2015)

In additional to the above agency-level policies, Cedar Breaks National Monument is committed to doing its part to protect the exceptional dark sky resources found within the park and the greater Southern Utah region. The importance of dark night skies as a component of the visitor experience at Cedar Breaks is referenced in several location in the monument's foundation document (Nov 2015), which exists to provide basic guidance for planning and management decisions. In the section describing the significance of the monument, the foundation document states:

> "Visitors experience a diversity of recreational and educational opportunities within the quiet solitude, colorful beauty, **dark night skies**, and endless vistas of the monument, through cross-country skiing, snowshoeing, and snowmobiling, viewing the spectacular summer wildflowers and watchable wildlife, backcountry hiking redrock canyons and streams below the amphitheater, or appreciating the changing colors of autumn."
> "High-Quality Scenic Vistas, **Dark Night Skies**, and Soundscapes. Clean air and largely undeveloped viewsheds allow visitors to find beauty year-round in the vivid colors of the amphitheater, dramatic rock formations, stunning vistas of towering Brian Head Peak and

> the more distant ranges. On the high plateau, alpine meadows brimming with wildflowers and ancient forests provide a stark contrast with the ruggedness found in views of the breaks. **The dark and brilliant night skies** and natural soundscapes at Cedar Breaks **are of superb quality** in part due to the high elevation and remote location of the monument."

High-Quality Scenic Vistas, Dark Night Skies, and Soundscapes are also identified in the "Fundamental Resources and Values" section:

> "Clean air and largely undeveloped viewsheds allow visitors to find beauty year-round in the vivid colors of the amphitheater, dramatic rock formations, stunning vistas of towering Brian Head Peak and the more distant ranges. On the high plateau, alpine meadows brimming with wildflowers and ancient forests provide a stark contrast with the ruggedness found in views of the breaks. The **dark and brilliant night skies** and natural soundscapes at Cedar Breaks are of superb quality in part due to the high elevation and remote location of the monument.

Finally, night skies are a component of two of the eight primary interpretive themes identified for Cedar Breaks in the foundation document:

- **"Night Sky:** The **dark night sky at Cedar Breaks** has deep natural, cultural, and scenic importance, a vanishing resource prominent in many visitors' values."

- **"**Wilderness: The remote location, solitude, natural sounds and views, **and the pristine dark night sky** of Cedar Breaks reveal the character and beauty of true wilderness and the benefits of preservation and stewardship."

5. Cedar Breaks National Monument Lighting Management Plan (LMP)

Purpose

The Foundation Document for Cedar Breaks National Monument identifies "dark night skies" as an important resource value for the monument. This plan establishes a set of practices by which Cedar Breaks NM will preserve its dark night skies, minimize impacts to the nocturnal environment, and maintain an environment of safety and security for both staff and visitors.

This Lighting Management Plan (LMP) serves as the foundation for preserving naturally dark skies at Cedar Breaks National Monument, and will be the guiding document for future decisions regarding alterations of existing outdoor lighting and/or installation of new outdoor lighting within The Monument. The LMP is based on best practices in night-sky friendly lighting design, NPS management policies, and the *Guidelines for Outdoor Lighting in RASC Dark-sky Preserves and IDA Dark Sky Places*. It ensures that the purpose, intensity, spectrum, and directionality of all outdoor lighting at Cedar Breaks is carefully considered in order to preserve a natural photic environment to the greatest extent possible.

At this time, there are currently no dark-sky ordinances at the state, county, or local level that regulate outdoor lighting at Cedar Breaks National Monument. Given the remote location of Cedar Breaks, poorly designed lighting within the monument could have a significant negative effect on the quality of the night skies within the monument. While the guidelines set forth here apply only to lighting within Cedar Breaks, we hope to serve as a model example of night-sky friendly and energy efficient outdoor lighting that can be used by nearby municipalities.

This plan will be periodically reviewed and updated to incorporate the latest scientific findings and any changes in park management.

Lighting Zones

Cedar Breaks National Monument is divided into two lighting zones. These zones indicate the extent of permissible outdoor illumination:

Zone 1
This includes areas within 200 feet of development. This zone includes areas around the Visitor Center, Ranger Station, Maintenance Building, residential areas, the campground, and other developed areas. Land included in Zone 1 comprises less than 2% of Cedar Breaks National Monument. This zone is a Standard Lighting Zone (SLZ)

Zone 2 includes all undeveloped areas of the monument (over 98% by land mass). This is designated as a Natural Darkness Zone (NDZ).

- **Zone 1**, where a reasonable amount of outdoor lighting is deemed necessary for safety and operational purposes. This zone is limited to the area surrounding the Visitor Center, Ranger Station, campground, and staff residences near the southern boundary of the monument (Fig 19). Outdoor lighting in this area, while permissible, must confirm to the guidelines set below, and should be restricted to the extent that safety is not compromised. Zone 1 is a Standard Lighting Zone (SLZ).
- **Zone 2**, where permanent lighting fixtures are prohibited, consists of the remainder of the monument, including all areas managed as wilderness. No permanently inhabited structures exist in this zone and much of it is land below the amphitheater rim. The wilderness character of this zone necessitates that no permanent lighting fixtures be allowed here. Zone 2 is a Natural Darkness Zone (NDZ). Any lighting needs in this zone will be addressed on a temporary basis (i.e. flashlights). Minimizing light trespass into this zone is also paramount to preserving its character.

Lighting Standards

Each zone has a different set of lighting standards. These standards will be followed for all new lighting installations. Existing outdoor lighting, will be evaluated and brought into compliance with these standards as time and resources allow.

Zone 1 (SLZ):

Outdoor lighting is permissible for convenience, safety, and security within this zone provided compliance with the following standards:

1) Light fixtures will be used only where needed for specific purposes or tasks. Lighting that has no specific purpose will be removed.
2) Lighting fixtures will be fully shielded and lighting will only be directed toward the ground, thus minimizing glare and/or light trespass.
3) Fixtures will be installed with the intent of illuminating only the area specific for that task. (i.e. Lights intended to lead people safely into a building will be shielded, as much as practicable, from illuminating vegetated ground or other places superfluous to safe travel.)
4) Lighting will incorporate the use of timers and motion sensors where using such devices will reduce outdoor lighting while providing for safety and security.
5) The correlated color temperature (CCT) of lamps shall not exceed 3000K in order to minimize sky glow and the impact on nocturnal wildlife.
6) Light output will be minimized, but, where applicable, will comply with Section 7.8.1.3 of NFPA 101, Life Safety Code, and International Building Code Section 1006.2. Means of egress will be illuminated to at least an average light level of 1-footcandle, with a minimum of 0.1-footcandle to meet building code requirements.
7) Energy efficiency will be considered when selecting bulbs. LED based lamps will be used whenever possible. CFL's are not recommended.

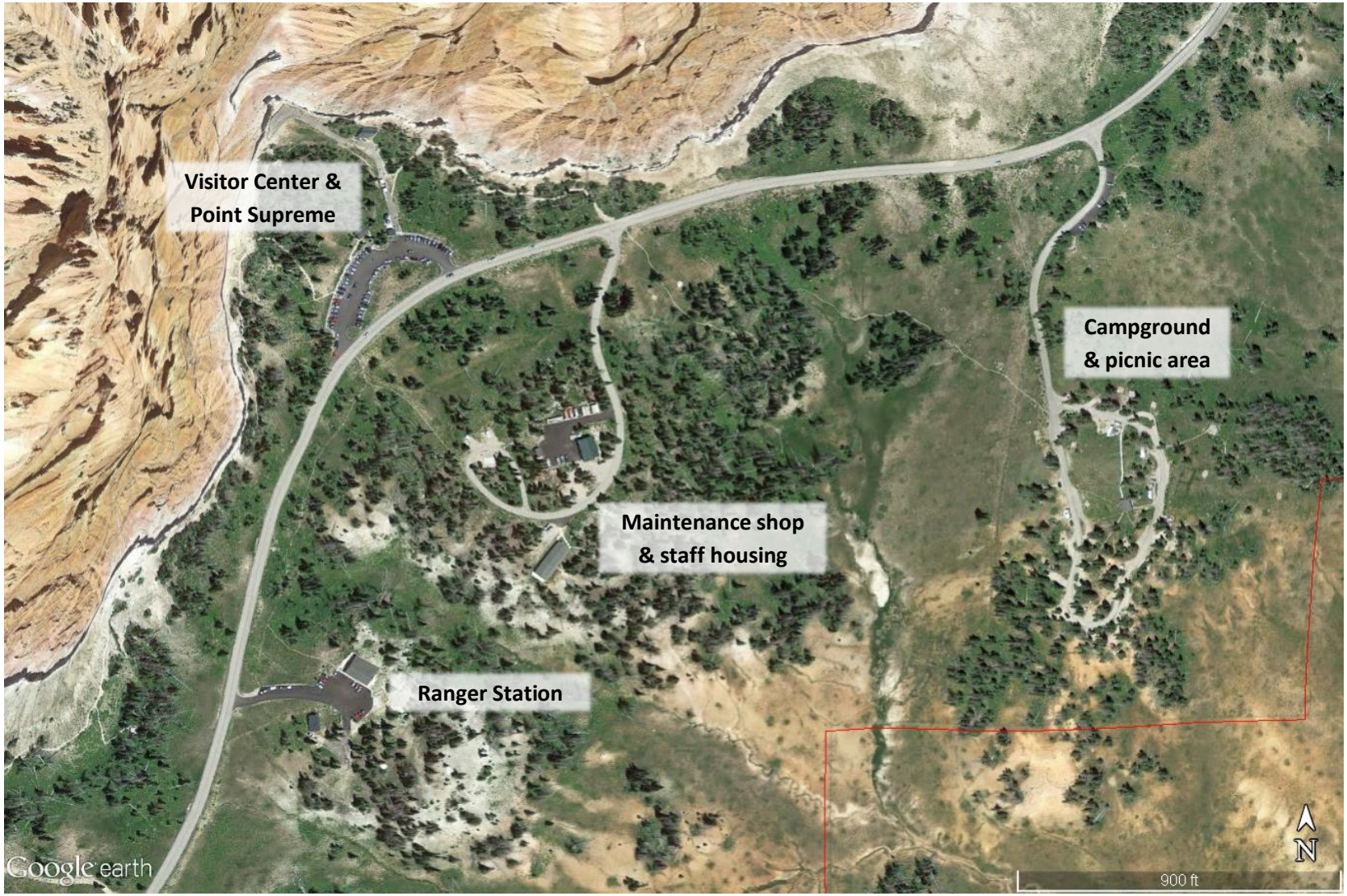


Figure 19-Satellite image of developed area at Cedar Breaks National Monument (see Figure 2 map for location within the monument) Zone 1, where permanent outdoor lighting is permitted, encompasses all areas within 200 feet of development. The remainder of the monument is Zone 2 where artificial lighting is not permitted. Red line is the monument boundary.

Zone 2 (NDZ):
Permanent lighting fixtures are not permitted in this zone. No lighting fixtures currently exist within this zone. Care will be taken to prevent light trespass from Zone 1 into Zone 2 in order to preserve the light-free and wilderness character of this area.

Note: These standards shall apply to all current and future development within the monument, but do not apply in emergency situations, in which case the requirements of the LMP are suspended temporarily.

Conclusion

Cedar Breaks is dedicated to setting the standard for night-sky friendly outdoor lighting in Southern Utah, in order to protect the dark night skies of the Monument and as a means to facilitate education and discussion about night sky preservation in the surrounding region. Any future development will comply with this LMP and be compatible with NPS Management Policies.

6. Park Lighting Inventory

Due to its small size and limited development, Cedar Breaks National Monument has a very modest lighting footprint. All outdoor lighting is confined to the area around the Visitor Center, campground, ranger station, and staff residences (Fig 19). A current (September 2016) inventory of outdoor lighting in the monument is included below.

There are currently 32 outdoor lighting fixtures within Cedar Breaks National Monument, many of which are currently not in use. 85% of all outdoor light fixtures at the monument are currently in compliance with the Cedar Breaks Lighting Management Plan (Section 5). All five of the fixtures that are not in compliance are not in use at the time of this application. Supplies have been purchased to retrofit three of the five non-compliant fixtures (as well to improve several other fixtures) and installation will occur in Spring 2017 when the monument is once again accessible by vehicle. The remaining two non-compliant fixtures will either be removed or retrofitted within five years of IDSP designation.

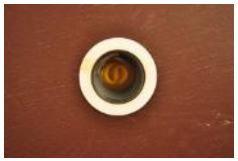
Note that no outdoor lighting whatsoever is used at the monument during the winter recreational season, which runs from approximately mid-October through mid-May. During this time, all visitor services at the monument are winterized and do not use outdoor lighting. During the winter recreational season, a "yurt" serves as a winter ranger station, serving cross country skiers, snowmobilers, and snowshoers. The yurt only occasionally uses temporary sources of lighting, such lanterns and flashlights.

Most of the night-sky friendly lighting at Cedar Breaks was installed following a cooperative agreement with the International Dark Sky Association in 2011 to analyze and develop a plan to retrofit the monument's outdoor lighting. As a result of this partnership, all 34 lighting fixtures in the monument at the time (two of these have since been removed) were retrofitted to be night sky complaint, resulting in an estimated 90% reduction in installed wattage.

In addition to the permanent fixtures described here, the monument also uses several dozen temporary red solar powered LED lights to light sidewalks during evening astronomy programs.

Not included in the lighting inventory are several unshielded light fixtures on the office building in Cedar City home to the administrative offices of the monument. At present, Cedar Breaks does not have control over these lights (the monument leases office space in the building), but will attempt to work collaboratively with the owner of the building to install fixtures that are dark sky friendly.

ID #	Photo	Location	Application	Fixture	Lamp	Watts	Fully-Shielded?	Controls	Compatible with LMP?
1		Ranger Station Exterior W	Area light, walkway illumination	Fully shielded floodlight	Yellow CFL	13W	YES	Motion sensor + indoor switch	YES
2		Ranger Station Exterior N	Area light	Fully shielded floodlight *(currently broken)*	Halogen PAR	90W	YES	Motion sensor	YES **Not in Use**
3		Ranger Station Exterior E	Area light	Fully shielded floodlight	Halogen PAR	90W	YES	Motion sensor	YES **Not in Use**
4		Ranger Station Exterior S	Area light, walkway illumination	Fully shielded floodlight	Halogen PAR	90W	YES	Motion sensor	YES **Not in use**
5-7		Ranger Station Porch	Porch illumination	Wall mount with exposed bulb	Amber LED	6W	YES, by overhang	Inside switch	YES

8		Ranger Station Entry	Egress/ ingress	Recessed canister	Yellow CFL	13W	YES	Switch inside ranger station	YES
9		Caretakers Cabin	Egress/ Ingress, porch illumination	Ceiling mount with exposed bulb	Halogen	52W	NO	Inside switch	NO **Not Currently in Use** Retrofit planned
10-11		Campground Restrooms (North side)	Ingress/egress, walkway illumination	Recessed canister	Yellow CFL	5W	YES	Inside switch	YES
12		Campground Restrooms Utility Door	Ingress/egress, walkway illumination	Recessed canister	Yellow CFL	5W	YES	Inside switch	YES
13-14		Campground Restrooms (South side)	Ingress/egress, walkway illumination	Recessed canister	Yellow CFL	5W	YES	Inside switch	YES
15-16		Fee Station	Area light, walkway illumination	Recessed canister	Yellow CFL	5W	YES	Inside switch	YES Supplies purchased for retrofit with red LEDs (install Spring 2017)

17		Visitor Center Porch	Area light, ingress/egress	Ceiling mount w/exposed bulb	N/A	N/A	YES, by overhang	Inside switch,	YES **Not in use** Supplies purchased for retrofit with fully shielded ceiling mount canister and red LED (install Spring 2017)
18		Pt Supreme Restrooms SE Wall	Area light, walkway illumination	Unshielded wall pack	Yellow CFL	5W	NO	Inside switch,	NO **Not in use** Supplies purchased for retrofit with fully shielded wall mount canister and red LED (install Spring 2017)
19-20		Pt Supreme Restroom entrances	Area light, ingress/egress	Unshielded wall pack	Yellow CFL	5W	NO	Inside switch	NO **Not in use** Supplies purchased for retrofit with fully shielded wall mount canister and red LED (install Spring 2017)
21-30		Staff Residences	Ingress/egress, walkway illumination	Recessed box	Yellow CFL	5W	YES	Switch inside residences	YES
31		Maintenance Building	Area light	Wall mount with exposed bulb	N/A	N/A	NO	Inside switch	NO **Not in use** Retrofit planned
32		Maintenance Building front door	Ingress/egress	Fully shielded wall pack	Soft White LED	?	YES	Inside switch	YES

7. Letters of Support

September 23, 2016

Board of Directors
International Dark Sky Association
3223 North First Avenue
Tucson, Arizona 85719-2103

Re: Letter of Support for Cedar Breaks National Monument to obtain Dark Sky Park status

Dear IDA Board of Directors:

Brian Head Town would like to offer its support for Cedar Breaks National Monument to receive International Dark Sky Park status with the International Dark Sky Association. We are located only a few miles from Cedar Breaks. Viewing of the night sky from Cedar Breaks National Monument is outstanding. I feel being close to 10,000 feet in elevation and having very little light in the National Park helps to contribute to the clear night skies observations. We have a local photographer that has some beautiful pictures of the Milky Way, taken from Cedar Breaks National Monument.

I know Cedar Breaks National Monument holds "star parties" every weekend throughout the summer and the feedback we get from visitors is excellent. Cedar Breaks National Monument is the ideal place, not only for experienced astronomers, but for novice ones as well. In my opinion, it offers some of the best star-gazing opportunities in the world!

I also feel, if Cedar Breaks National Monument receives the Dark Sky Park status, it will help with tourism in our community. This will be one more exciting reason to visit our beautiful area.

Once again, we offer our full support to Cedar Breaks National Monument as they seek the International Dark Sky Park designation. Thanks for your consideration of this wonderful National Park's application.

Sincerely,

Bret Howser, Manager
Brian Head Town

Brian Head Town
56 North Hwy 143
Brian Head, UT 84719
(435) 677-2029
www.brianheadtown.utah.gov

CEDAR CITY • BRIAN HEAD
TOURISM BUREAU
581 N. Main, Cedar City, UT 84721

September 23, 2016

Board of Directors
International Dark-Sky Association
3223 North First Ave.
Tucson, AZ 85719

RE: Cedar Breaks National Monument Application For International Dark Sky Park Status

Dear International Dark Sky Association members:

On behalf of the Cedar City-Brian Head Tourism Bureau, I enthusiastically support the application submitted by Cedar Breaks National Monument to become an International Dark Sky Park. We have a close working relationship with Cedar Breaks National Monument on many projects including a regional initiative to "Explore Five More" which encourages visitors of the regions popular, highly impacted national parks to visit lesser known areas. We also have worked closely with the Cedar Breaks staff over the years on educational programs and interpretation to improve the visitor experience, including night sky programing.

Cedar Breaks night skies are truly wondrous and a resource worthy of protection and designation. Recently, USA Today newspaper readers voted Cedar Breaks as the "2016 Best National Park Night Experience"; a testament to the amazing commitment of Park staff to astro-tourism and the engaging programming they have developed. We are so committed to Cedar Breaks efforts in so much that we've outlined an initiative to encourage our communities to consider dark skies conservation in their city planning and ordinances to preserve this resource for generations to come. We are also retro fitting our Iron County Visitor Center with appropriate exterior lighting and fixtures to reduce our light emissions.

Thank you for considering the Cedar Breaks National Monument application. The Cedar City-Brian Head Tourism Bureau believes that the International Dark Sky Park designation will conserve a valuable resource, provide an outstanding opportunity to educate the public on our incredible night sky and provide an economic boost for our region. Please contact me if you need additional information regarding our support. You may contact me at 435-586-5124 to discuss further.

Sincerely,

Maria Twitchell

Maria Twitchell, Executive Director
Cedar City-Brian Head Tourism Bureau

Telescopes to Go

6333 MS Hwy 413
French Camp, Mississippi 39745
E-mail: jhill6333@gmail.com
662-547-6970

James G. Hill
NASA/JPL Solar System Master Educator
Ole Miss Office: Physics/Astro Dept.
Lewis Hall 122, University, MS38677

September 25, 2016

To: the Board of Directors of the International Dark Sky Association

Re: the application for "International Dark Sky Park" status for
Cedar Breaks National Monument

Before semi-retiring to teach planetary astronomy at the University of Mississippi, I was director of Rainwater Observatory & Planetarium in Mississippi for almost 30 years and a member of IDA. I worked with Clanton Associates and used IDA materials to improve the darkness of the night sky near our observatory in central Mississippi.

I have spent much of the past 8 summers sharing the sky in Utah at Bryce Canyon and Cedar Breaks as an "Astro Volunteer in the Parks". Cedar Breaks has made great advances in the last 5 years to become a place where thousands of people experience clear dark skies each season. Park lighting has been retrofitted toward IDA standards and seasonal rangers have been trained to share the sky. My wife and I do solar viewing, evening star gazing, and campground programs for over 6,000 in the weeks we are at Cedar Breaks. At over 10,000 feet we are the highest elevation star parties in the National Park System.

Zach Schierl, the coordinator of astronomy activities at Cedar Breaks, is a gem. He spent several years at Lowell Observatory as an educational outreach person and is highly qualified and enthusiastic. The park superintendent, Paul Roelandt, is visionary and a strong supporter of the astronomy program.

Though a small park, Cedar Breaks has spectacular vistas, clear air, and is not too far (or close) to major tourist destinations such as the Utah Shakespeare Festival in Cedar City and Brian Head resorts. It easily reachable about 25 miles off Interstate Hwy 15.

Designation of Cedar Breaks National Monument as an "International Dark Sky Park" would encourage even more people to appreciate and enjoy the sky that the public rarely gets to see.

Thank you for your consideration.

James G. Hill

Promoting Astronomy and Science Education

Colorado Plateau Dark Sky Cooperative

2282 S. West Resource Blvd
Moab, UT 84532

September 30, 2016

VIA ELECTRONIC COPY ONLY- NO HARD COPY TO FOLLOW

Board of Directors
International Dark-Sky Association
3223 North First Avenue
Tucson, Arizona 85719-2103

Dear IDA Board of Directors:

The Colorado Plateau Dark Sky Cooperative is pleased to support the Cedar Breaks National Monument (CEBR) International Dark Sky Park nomination. The Monument is located in one of the most remote regions in the continental U.S., and offers an exceptional, unfettered view of the dark night skies over the Colorado Plateau. The dark skies of CEBR have immense value to astronomical viewing, cultural resources, and wildlife conservation in the region. For the last several years, CEBR has engaged local partners to host numerous astronomy events and star parties that are free to the public. In addition, CEBR International Dark Sky Park designation would assist in the conservation of dark night skies in neighboring Dixie National Forest, Grand Staircase-Escalante National Monument, Bryce Canyon National Park, and Zion National Park.

As an essential piece of the Colorado Plateau Dark Sky Cooperative, CEBR is taking lighting, conservation, and educational steps to fulfill the mission of the NPS Call To Action #27, Starry Starry Night. This voluntary initiative forms America's first Dark Sky Cooperative, and links communities, tribes, businesses, state/federal agencies, and citizens in a collaborative effort to celebrate the view of the cosmos, minimize the impact of outdoor lighting, and ultimately restore natural darkness to the area. CEBR International Dark Sky Park designation would bring further awareness and legitimacy to the Cooperative.

We fully support the efforts of Cedar Breaks National Monument as they seek designation of the Cedar Breaks International Dark Sky Park. Such efforts to conserve dark skies will benefit park visitors, nearby communities, and future generations. Should you have any questions, please contact Nate Ament at 435-719-2349.

Sincerely,

Nate Ament
Colorado Plateau Dark Sky Cooperative Coordinator

SOUTHERN UTAH UNIVERSITY

Community Engagement Center
417 W. 200 South
Cedar City, UT 84720
435/865-8341
mulderink@suu.edu

November 9, 2016

Re: Cedar Breaks National Monument Designation as an International Dark Sky Park

To Whom It May Concern:

I am pleased to write a letter of strong support on behalf of Cedar Breaks National Monument (CBNM) and its application for designation as an International Dark Sky Park. Over the past year, I have happily joined colleagues from Southern Utah University (SUU) and our local Cedar City community to discuss the positive benefits of Dark Sky preservation. I have met and corresponded with Zach Schierl and Paul Roelandt of CBNM to discuss the many ways that southern Utah could benefit from Dark Sky partnerships. I want you to know that Paul Roelandt has been a mainstay of community-engaged learning programs for years, and in 2009 SUU and the Utah Campus Compact named Paul as our "Civically Engaged Community Partner." We view CBNM as a true community treasure and resource.

In my capacity as Director of SUU's Community Engagement Center, my goal is to facilitate and strengthen all campus efforts that integrate service-learning and community outreach into their programs. I am excited to see many potential learning opportunities for our students and community through Dark Sky programs. At SUU, we have a relatively new School of Integrative and Engaged Learning (SIEL) that can assist with non-credit and credit-bearing courses to the public. SUU was named in 2010 as a Carnegie Community Engaged Institution, and we take seriously our role as a public university that promotes campus-community partnerships. We also seé potential for our own students to benefit through CBNM programs linked to our nationally-recognized experiential education program, The EDGE (Education Designed to Give Experience). In short, SUU and the Community Engagement Center could enhance our educational and community programs if CBNM is granted Dark Sky status.

Thank you for your consideration, and please don't hesitate to contact me with questions or concerns.

Sincerely,

Earl F. Mulderink III, Ph.D.
Director of Community Engagement Center & Professor of History

November 14, 2016

Board of Directors
International Dark Sky Association
3233 North First Avenue
Tucson, AZ 85719-2103

To: IDA Board of Directors

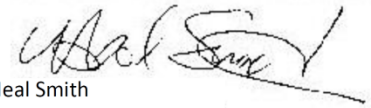
My name is Neal Smith. I have been a Cedar City Utah resident for almost 13 years and have visited Cedar Breaks many times. As a volunteer around town I become involved in many projects and organizations. As an Editorial Board member I have written about Dark Sky.

I became aware of Dark Sky years ago during a visit to Flagstaff, AZ. The issue instantly registered with me at the time as we had lived in Southern California and near Chicago, Illinois. One only has to look up not to see stars.

Things are much better in Cedar City, but even in our small town, one can only see a couple of thousand stars. Cedar Breaks has a wonderful sky with over 5,000 stars in view, more if you look toward the east.

Anything you can do to save our night sky will be a blessing to our future generations.

Please designate Cedar Breaks “Dark Sky”.



Neal Smith
1466 S Cross Hollow Drive
Cedar City, Utah 84720

GARY R. HERBERT
Governor
SPENCER J. COX
Lieutenant Governor

State of Utah
DEPARTMENT OF NATURAL RESOURCES
MICHAEL R. STYLER
Executive Director
Division of State Parks and Recreation
FRED HAYES
Division Director

Board of Directors
International Dark Sky Association
3223 North First Avenue
Tucson, Arizona 85719

RE: Accreditation Application – Cedar Breaks National Monument

Dear IDA board of directors,

Sand Hollow State Park Complex is pleased to support Cedar Breaks National Monument officials in their efforts to apply for certification as a Dark Sky Park.

Cedar Breaks is known locally for its pristine unobstructed views of the dark sky resource. The National Park Service has been at the forefront of preserving this resource for generations and application for Dark Sky designation solidifies their commitment.

Cedar Breaks is in our back yard and provides our families and others the opportunity to enjoy the vastness of space from earth. We appreciate your consideration for designating Cedar Breaks National Monument as an IDA Dark Sky Park.

Sincerely

Stephen Studebaker
Assistant Manager
Sand Hollow State Park Complex

Sand Hollow State Park Complex, 3351 South Sand Hollow Rd, Hurricane, UT 84737
telephone (435) 680-0715 • facsimile (435) 256-6544 • TTY (801) 538-7458 • *www.stateparks.utah.gov*

United States Department of the Interior

NATIONAL PARK SERVICE
INTERMOUNTAIN REGION
12795 West Alameda Parkway
P.O. Box 25287
Denver, Colorado 80225-0287

IN REPLY REFER TO:
IMR-RSS-NR (1242)

Board of Directors
International Dark-Sky Association
3223 North First Avenue
Tucson, Arizona 85719-2103

Dear IDA Board of Directors:

As the National Park Service Intermountain Region's Natural Sounds & Night Skies Coordinator, I am pleased to support the nomination of Cedar Breaks National Monument (CEBR) as an International Dark Sky Park (IDSP). It is primarily known for a spectacular scenic landscape of multicolored rock formations inside a vast natural amphitheater, with rim over 10,000 feet above sea level. It was established by presidential proclamation of Franklin D. Roosevelt on August 22, 1933.

Cedar Breaks has outstanding qualifications for IDSP certification, including regional leadership efforts with potential benefits that extend well beyond its borders. Cedar Breaks has been holding astronomy events for at least 10 years, with regular astronomy and stargazing programs since the summer of 2009. The primary vehicle access to night sky interpretation sites is via Utah Routes 143 and 148, which traverse the high elevation rim of the monument. Given its proximity to Interstate 15, the Brian Head resort, and other tourism draws, Cedar Breaks constitutes an ideal location to expose visitors to high elevation astronomy.

Although the naturally dark skies of Cedar Breaks could be threatened by lighting associated with population growth in Cedar City and other nearby areas, Cedar Breaks staff are engaging in important efforts to protect the night skies in the park and beyond. The monument's superintendent, Paul Roelandt, took the uncommon step of hiring a dedicated Education Specialist & Dark Skies Coordinator, Zach Schierl, who is already engaging with a number of southern Utah communities, including Cedar City, Springdale, and St. George, in order to restore the area's dark skies. Zach Schierl's important education and outreach efforts far exceed the minimum requirements outlined in IDSP Guidelines document sections B(v) and C. As an example, the Master Astronomer Program, currently in its pilot launch, is being formulated to achieve the following important goals:

- Foster an appreciation of the dark night sky and knowledge of astronomy
- Educate and inform citizens/ civic leaders in Southern Utah on night sky benefits and current threats, enabling participants in turn to educate their communities
- Cultivate a passionate, knowledgeable group of community volunteers
- Create a curriculum and associated educational materials that can be used as tools by other parks and communities

The Intermountain Region's Natural Resources Division has supported membership in the International Dark Sky Association (IDA) since July 2011. As the region's Natural Sounds & Night Skies Coordinator, I appreciate the efforts of IDA and the opportunity to collaborate with the worldwide network of committed individuals who care deeply about preserving the beauty and heritage of our night skies. We fully support the efforts of Cedar Breaks National Monument as it seeks IDSP certification. We believe its nomination and ongoing efforts to conserve dark skies will benefit park visitors, nearby communities, and public land resources for future generations.

Sincerely,

11/14/2016

X Randy Stanley

Natural Sounds & Night Skies Coordinator
Signed by: National Park Service

Randy Stanley
Natural Sounds & Night Skies Coordinator, Intermountain Region, Natural Resources Division

cc: Paul Roelandt, Superintendent, CEBR
Zach Schierl, Education Specialist & Dark Skies Coordinator, CEBR
Kurt Fristrup, Science & Technology Branch Chief, NSNSD, WASO
David Vana-Miller, Resource Stewardship Program Manager, IMR-NR

15 November 2016

To whom it may concern,

I am a photographer and amateur astronomer and my wife is the winter star party coordinator with Brian Head Resort. We live a few miles outside Cedar Breaks National Monument (CBNM). and are writing in support of CBNM's application for International Dark Sky Park status. Besides photographing the daylight scenery of the park, we have learned of the extraordinary night sky photography and viewing in CBNM. At over 10,000 feet, the elevation lifts the skies above the desert haze into the incredibly clear air of the monument. We have used the monument to observe and photograph the stars, meteors, and the International Space Station with spectacular results. We were able to show this night resource to a travel writers conference with the result being a picture and ranking in USA Today noting CBNM as one of the 10 best areas to view the heavens in the US. We have also shared our skies in the unique and very popular winter star parties at Brian Head Ski Resort. We strongly believe and support CBNM achieving this deserving designation.

Thank you,

Mike & Julie Saemisch
Brian Head, Utah
saemisch@mac.com
(435) 770-7751

November 15, 2016

Board of Directors
International Dark Sky Association
3223 North First Avenue
Tucson, Arizona 85719-2103

Re: Letter of Support for Cedar Breaks National Monument

Dear IDA Board of Directors:

The Cedar Breaks National Monument is a beautiful dark sky area in our Southern Utah region, even though it is only 20 minutes away from Cedar City. Right now they are seeking a dark sky park status, and I would like to support this decision. I am currently the president of the Southern Utah Space Foundation (a non-profit dedicated astronomy education and outreach), and have worked closely with the dark sky coordinators at the monument, particularly Zachary Schierl.

Not only is the monument an inspiring place for locals and tourists to recreate, its 10,000 foot elevation makes it a unique environment for wildlife in this region. Protecting the night sky for future generations, as well as for the fauna on the mountain, is important, and I have seen no one work harder to achieve that goal than Mr. Schierl and the "Dark Rangers" at Cedar Breaks.

In addition to the IDA Dark Sky status application, the Cedar Breaks team is putting forward a master astronomer's program in early 2017, to reach out to the community and teach people how to protect night skies. This program will help to ensure many more people get involved in improving dark sky conditions.

In conclusion, I have witnessed firsthand the work the Cedar Breaks team is doing to protect the night skies, and believe they have done everything within their power to increase dark skies in the area, including the areas surrounding the breaks.

Thank you for your time and consideration,

Sincerely,

Leesa Ricci, President
Southern Utah Space Foundation

November 16 2016

Dear IDA Board of Directors:

What a privilege it is for the St. George Astronomy Group to be associated with the rangers at Cedar Breaks National Monument.

I want everyone to have the chance to experience the wonder of seeing the night sky at Cedar Breaks. It is in this spirit that I lend my whole-hearted support to Cedar Breaks National Monument for certification as an official Dark Sky Site.

We as an Astronomy Club in the area have spent time at night with the rangers at Cedar Breaks. The rangers here do a fantastic job of showing the night sky to many thousands of visitors each year. Cedar Breaks has one of the darkest skies in the United States and a Staff committed to making the public aware of what a treasure dark sky is.

Staff employees routinely offer night programs that feature educational walk and talks concerning light pollution, constellations, meteor showers and phases of the moon. These programs are popular with people camping and coming to the National Monument. Cedar Breaks draws people from all over who drive out just to participate in the beauties of the night sky.

Cedar Breaks is leading the way on dark skies and astronomy for the National Parks. They are initiating a new Master of Astronomy Certification training for interested people in the area.

We had the privilege of having the Cedar Breaks rangers come and talk to our astronomy club and they did a great job of talking about the night sky and how we can keep it. They gave us some great ideas on working with cities and individuals on combating light pollution.

I do hope you will grant Cedar Breaks National Monument its Dark Sky certification as soon as possible. They deserve it. Please do not hesitate to contact me if the need arises.

Dark skies to you,

Mark Shelton
St. George Astronomy Group President

SUU SOUTHERN UTAH UNIVERSITY
Department of Physical Science

351 W. University Blvd.
Cedar City, UT 84720
Phone: (435) 586-7900
Fax: (435) 865-8051
www.suu.edu/cose/physci

November 17, 2016

Dear IDA Board of Directors:

I am writing to inform you of my support for Cedar Breaks National Monument's application to earn a Dark Sky designation. Southern Utah is known for its natural wonders, but the wonders of the night sky are often overlooked. A Dark Sky designation for Cedar Breaks would help the residents of and visitors to Southern Utah understand the value of dark sky locations, which provide sanctuary from the glare of modern civilization.

As an assistant professor of physics at Southern Utah University, as well as the director of SUU's Ashcroft Observatory, I help the public learn to appreciate dark skies and their importance to humans as well as other species. My efforts in educating the public have been greatly supported by the staff of Cedar Breaks as we have worked together to help the public gain a greater appreciation for the night sky as well as the public's ability to influence the quality of those skies.

The staff of Cedar Breaks National Monument are developing a pioneering Master Astronomer program that seeks to educate the public about the value of dark skies. A Dark Sky Park designation would help support these efforts by demonstrating to the people and visitors of Southern Utah that protecting the night sky is an important endeavor. Furthermore, such a designation would help the public, especially residents of Cedar City, understand that dark skies can be found right in their own backyard, and the wise use of lighting can directly impact those dark skies.

Sincerely,

Cameron Pace
Assistant Professor of Physics
Southern Utah University
cameronpace@suu.edu

Zion Natural History Association
Zion National Park
Springdale, UT 84767

435-772-3264
www.zionpark.org

November 17, 2016

Board of Directors
International Dark-Sky Association
3223 North First Avenue
Tucson, Arizona 85719-2103

Dear IDA Board of Directors:

Zion Natural History Association, the official non-profit partner of Cedar Breaks National Monument, is pleased to support Cedar Breaks National Monument officials in their application for International Dark-Sky certification.

For decades our organization has worked shoulder to shoulder with the National Park Service at Cedar Breaks to help enhance the visitor experience at this marvelous place. Cedar Breaks stands at the pinnacle of Southwestern Utah where the headwaters of the Virgin River emerge, flowing southward to carve Zion Canyon. The Monument is beloved to hundreds of thousands of visitors each year who come from across the continent and around the world, and in recent years has been discovered to be just as special by night as by day.

In our role of giving aid to Cedar Breaks National Monument, we enthusiastically look forward to what this designation would mean for the future of Cedar Breaks. It truly is a unique place which deserves the recognition, the validation, and the protection this certification would give it.

As we look forward to finding new and innovative ways to sustain Cedar Breaks for future generations, this Dark-Sky designation will help us tell a more compelling story and garner even deeper support for one of the most wonderful places on the planet.

Sincerely,

Lyman Hafen
Executive Director

SUU SOUTHERN UTAH UNIVERSITY
Outdoor Engagement Center 435-586-7829 www.suu.edu/uc/outdoor/
351 West University Boulevard Cedar City, UT 84720

November 17, 2016

Board of Directors
International Dark Sky Association
3223 North First Avenue
Tucson, AZ 85719

Dear IDA Board of Directors,

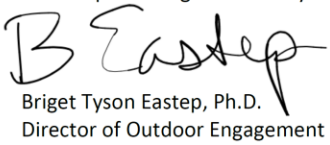
The Outdoor Engagement Center at Southern Utah University (SUU) fully supports Cedar Breaks National Monument's Dark Sky Park nomination. The Outdoor Engagement Center and Cedar Breaks National Monument has enjoyed a long term partnership creating opportunities for education and advocacy for our region's natural resources, including our dark sky. We believe Cedar Breaks' designation as a Dark Sky Park will further our work.

Over the past few years Cedar Breaks National Monument has taken a leadership role in bringing dark sky advocacy to the attention of many decision makers in our area. This influence has contributed to SUU and Cedar City re-considering lighting. Southern Utah University has been updating their lighting with lights pointing down, improving safety and protecting our dark sky. I believe with this designation; Cedar Breaks will continue their work in advocating for dark skies.

In addition, Cedar Breaks National Monument has created many dark sky learning opportunities for visitors, region residents, and SUU students. SUU looks forward to continuing our work offering education opportunities in partnership with Cedar Breaks. For example, last year SUU hired two new astronomy professors who are both involved with education and outreach through operating an observatory, offering astronomy courses, building a major, and serving on several observatory and dark sky boards or committees. With this designation, I believe Cedar Breaks will be an asset to the astronomy professors developing programs.

Other programs with SUU and Cedar Breaks involvement include Cedar Break's Master Astronomer program and Great Basin Observatory's Education and Outreach Committee. Again, we see these new programs being strengthened by Cedar Break's designation and look forward to sharing our resources to meet the goals and ambitions of these programs. We welcome Cedar Break's designation to add to our program's assets and need to educate and advocate for dark skies in our region.

Thank you for considering Cedar Breaks National Monument as a Dark Sky Park. We fully support Cedar Breaks' work in protecting the dark sky as an important natural and education resource in our region.



Briget Tyson Eastep, Ph.D.
Director of Outdoor Engagement and Associate Professor of Outdoor Recreation

SUU SOUTHERN UTAH UNIVERSITY
Department of Physical Science
351 West University Blvd.
Cedar City, UT 84720
(435) 586-7900
fax (435) 865-8051
www.suu.edu/sci/physci

Nov. 18, 2016

IDA Board of Directors
International Dark Sky Association
3223 North First Avenue
Tucson, Arizona 85719

Dear Board Members:

I am writing this letter in support of the application applied for by Cedar Breaks National Monument to be awarded the designation of a dark sky National Park. I am very much in support of this designation, as I have sweet memories of spending many hours as a high school and college student stargazing at the monument in years past, as the skies then were the best I had ever seen, and still remain so to this day, having spent a lifetime of star gazing from other sites around the country, and around the world, Peru, Philippines, and Hawaii. The experiences at Cedar Breaks changed the course of my life, and caused me to pursue a career in astronomy, spending a lifetime of sharing astronomy with others, even from Cedar Breaks, Glen Canyon Recreation Area, North Rim of the Grand Canyon, Cuzo, Peru, Mandaue, Philippines, and other National Parks in Utah and Nevada, as well as with my high school students in the Salt Lake City area and my students at SUU over my 32 year tenure here. I would hope, that we might preserve this natural resource of the night sky for others who will follow, to be able to have a similar, life changing experience that I had in my young life, by being awe struck at the beauty, promise and wonder of a pristine night sky from Cedar Breaks.

I recall the first night my friend and I hauled my newly completed homebuilt 10" reflector, together with a step ladder to reach the eyepiece, to Cedar Breaks in the early summer of 1968. We set it up on the walk way between the parking lot and the visitor center, and waited for darkness to fall. We observed many things that night, but the one I still vividly remember was the great globular cluster M 13 in Hercules. It was brighter than I had ever seen it before, and fully resolved into thousands of individual stars, and, after observing it for many minutes, it took on a three dimensional appearance! I have never seen it from any other place, even with the same telescope, that it looked three dimensional! Both of us saw the effect that night.

We would take the telescope up to the monument over the course of the summer, and met some of the maintenance people there, and shared the view through the telescope with them. They offered to let us leave the telescope there at the maintenance sheds over the summer, so we wouldn't have so far to haul it every time we came up. That was the beginning of a lifelong relationship with the folks at Cedar Breaks National Monument. I saw for the very first time from the Breaks, a shadow of one of the moons of Jupiter transiting the disk of Jupiter, and, at the time, didn't realize what it was, but soon found out after doing a little research.

When teaching High School in the Salt Lake area, Cedar Breaks offered to pay my gas to come down and present two star parties with the same telescope, which I did, as I recall in the late 1970's. Since

then, I have participated in many star parties held there, with many different observers traveling there for the perfect skies. There are a group of friends I met at Cedar Breaks from Southern California, and for the last 20 years or so, have come up nearly every year and spent a week camping at Cedar Breaks specifically to star gaze. They too have testified to the quality of skies here, and have counted more stars in the Pleaides open cluster with the naked eye, than from any other place which they have observed from.

I recall of attending a meeting of the American Astronomical Society in the early nineties, I think, and the keynote speech was on locating the site for the new Keck 400 inch telescope. At the end of the talk, the speaker invited anyone who knew of a high peak that the committee may not be aware of or had not considered, to come up and suggest it, so I went up and suggested Brian Head peak (just outside the Cedar Breaks boundary). He replied that they were aware of it, but they were concerned about the development of the ski resort and town there in very close proximity to the peak. As it turned out, Wheeler Peak in Nevada was one of the top three picks to locate the telescope, the other two being Hawaii, and I think the Canary Islands. But soon after, Wheeler Peak was incorporated into the newly formed Great Basin National Park, and so was removed from the list of consideration. The telescope today is at Mauna Kea, Hawaii. My point is, that world renowned Astronomers are aware of our dark, night skies, and it is my belief that we should do all we can do that is reasonable and prudent to protect this valuable resource.

I continue to this day to support and participate in star parties and other astronomy related activities held at Cedar Breaks and Brian Head, and give back to others the awesome experience of the night sky at ten thousand feet! That experience is worth all our best efforts to protect it for future generations!!

Sincerely,

Brent A. Sorensen
Associate Professor of Physics, Emeriti
Southern Utah University
Cedar City, Utah 84720

8. Acknowledgements

Contributors

- Zach Schierl, CEBR Education Specialist & Dark Skies Coordinator
- Shannon Eberhard, CEBR Visual Information Specialist
- Jim & Helen Hill, CEBR Astronomy VIPs
- Bryan Larsen, CEBR Acting Resource Manager
- Adam Petersen, CEBR Facilities Manager
- Leesa Ricci, CEBR Dark Skies Intern
- Paul Roelandt, CEBR Superintendent
- Mike Saemisch, Brian Head, UT Resident and Photographer
- Kerry Soltis, former CEBR Astronomy Ranger
- Dave Sorensen, CEBR Seasonal Astronomy Ranger
- Ken Watson, CEBR Chief of Education & Visitor Services

Special Thanks To

- Bob Meadows, Jeremy White, Dan Duriscoe, & Karen Trevino, NPS Natural Sounds and Night Skies Division
- Nate Ament, Colorado Plateau Dark Sky Cooperative Coordinator
- Janet Muir, Committee for Dark Sky Studies, IDA Ogden Valley Chapter
- Nick Myers, Black Canyon of the Gunnison NP Park Ranger & Astronomy Coordinator
- Randy Stanley, IMR Natural Sounds & Night Skies Coordinator
- Past and present Cedar Breaks National Monument staff

References

Black Canyon of the Gunnison National Park Lighting Management Plan

Capitol Reef National Park Lighting Management Plan

Cedar Breaks National Monument Foundation Document, November 2015

Cedar Breaks Retrofit Plan, International Dark Sky Association, 2011

Duriscoe, D. 2015. NPS Night Sky Quality Monitoring Report, Cedar Breaks NM, Brian Head Peak, 26-Sep-2003. Available at http://www.sierranights.com/nightsky/reports/CEBR030927.html

Falchi, F., Cinzano, P. & Duriscoe, D., 2016. The New World Atlas of Artifical Night Sky Brightness. *Science Advances,* 2(6), p. e1600377.

Guidelines for Outdoor Lighting in RASC Dark-sky Preserves and IDA Dark Sky Places (retrieved from: http://ida.darksky.org/assets/documents/RASC-IDA_GOL_November_2012-Final.pdf)

IDA\NPS Outdoor Lighting Cooperative Agreement, Summary of Work, 2013

Moore, C. 2015. NPS Night Sky Quality Monitoring Report, Cedar Breaks NM, Brian Head Peak, 17-Aug-2006. Available at http://www.sierranights.com/nightsky/reports/CEBR060818.html

National Park Service Interim Outdoor Lighting Guidelines (retrieved from: https://www.nps.gov/nabr/learn/nature/upload/NPSInterimOutdoorLightingGuidelinesDraft.pdf)