PAGE CITY COUNCIL
WORK SESSION
JULY 27, 2016

A Work Session of the Page City Council was held at 5:30 p.m. on July 27, 2016, in the Council Chambers at City Hall in Page, Arizona. Mayor Bill Diak presided. Vice Mayor John Kocjan, Councilors Mike Bryan, Scott Sadler, Levi Tappan, Korey Seyler and Dennis Warner were present.

Mayor Diak called the meeting to order.

Staff members present: City Manager, J. Crystal Dyches; City Attorney, Joshua Smith; Administrative Assistant Lona Shugart; Planning and Zoning Director, Robin Crowther; and Community Development Director, Kim Johnson.

Discussion pertaining to a Dark Sky presentation

Mayor Diak introduced Nate Ament.
Mr. Ament is from the National Park Service, and over the last four years he has been with the Colorado Plateau Dark Sky Cooperative. Nate has served as liaison between 35 plus national and state parks, and over 75 partners while fostering stewardship of night sky resources across the region. During this time, Nate has assisted 15 parks and communities in their International Dark Sky Place application process, and coordinated numerous night sky related events. Nate holds a B.S. in Environmental Science, specializing in restoration issues and water resources. As a graduate student at Colorado State University, he conducted research in invasive species ecology and remote sensing technology at the Natural Resource Ecology Lab in partnership with the USGS and NASA. Nate vividly remembers watching a brilliant fireball from high in the Andes on one of the darkest nights in his memory.

Mayor Diak introduced Dr. John Barentine.
Mr. Barentine is an Arizona native and comes to IDA from the "dark side" of science – professional astronomy. He grew up in Phoenix and was involved in amateur astronomy from grade school. Later, he attended the University of Arizona beginning research at the National Optical Astronomy Observatories and National Solar Observatory headquarters in Tucson. From 2001-2006 he was on the staff of Apache Point Observatory in New Mexico, serving first as an observing specialist on the Astrophysical Research Consortium 3.5 meter telescope, and then as an observer for the Sloan Digital Sky Survey. He obtained a master's degree in physics at Colorado State University and a master's and Ph.D. in astronomy at the University of Texas in Austin. John has contributed to science in fields ranging from solar physics to galaxy evolution while helping develop hardware for ground-based and aircraft-borne astronomy. Throughout his career, he has been involved in education and outreach efforts to help increase the public understanding of science. He is the author of two

books on the history of astronomy, *The Lost Constellations* and *Unchartered Constellations*. The asteroid (14505) Barentine is named in his honor.
Mr. Nate Ament gave a power point presentation pertaining to "The Dark Skies of Page and Glen Canyon, and the opportunity to preserve the dark skies." The dark sky presentation is attached hereto and by this reference made a part of herein.

There was discussion.

Dr. John Barentine gave a presentation regarding "Estimating the Potential Economic Value of the Night Skies Above the Colorado Plateau". A handout was provided and is attached hereto and by this reference made a part of herein.

There was discussion.

ADJOURN
The meeting was adjourned at 6:33 p.m.

Lona Shugart
Acting City Clerk

William R. Diak
Mayor

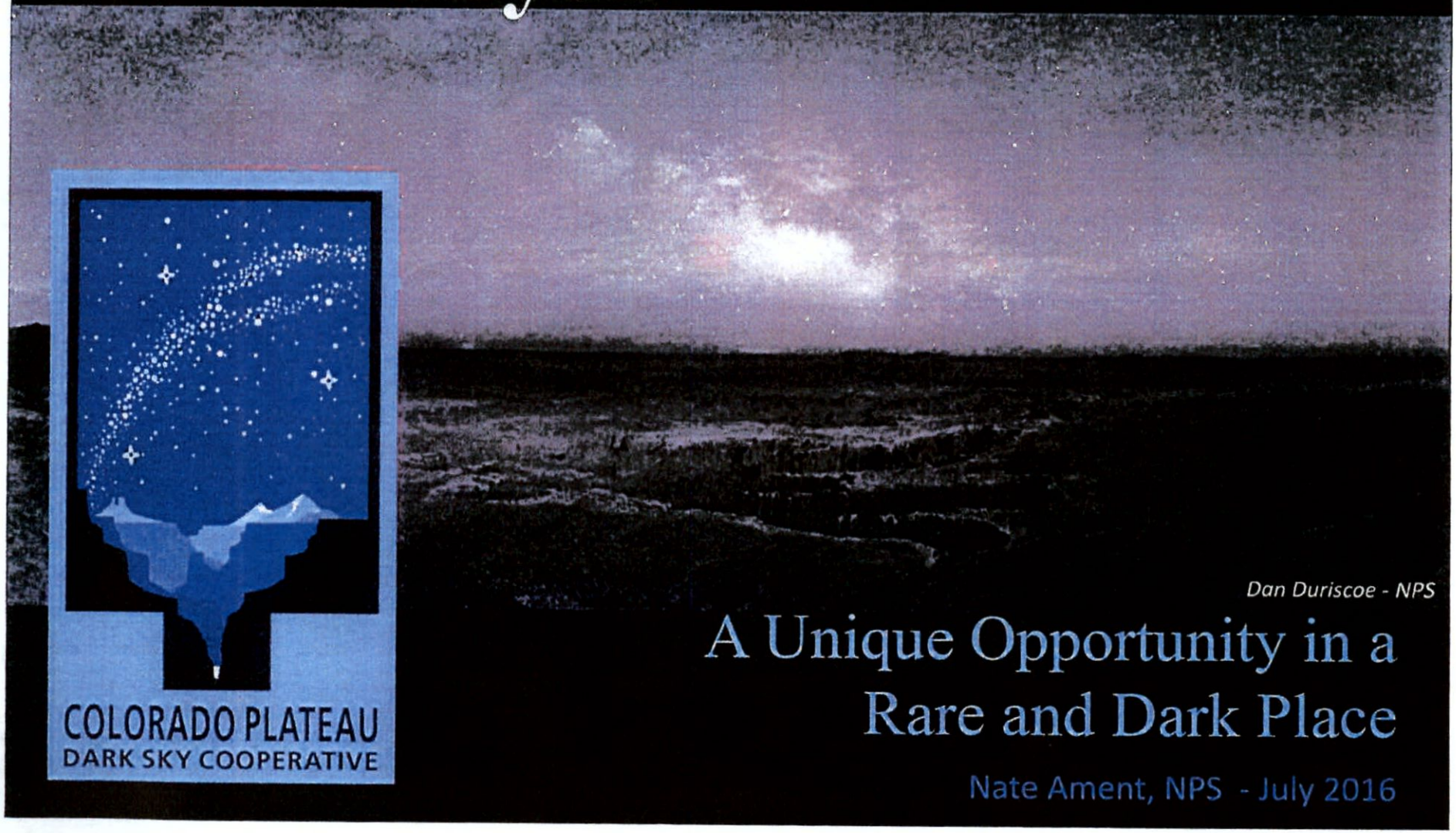
CERTIFICATION

I hereby certify that the foregoing minutes are a true and correct copy of the minutes of the City Council Special Meeting, held on the 27th day of July, 2016. I further certify that the meeting was duly called and held and that a quorum was present.

Dated this 10th day of August, 2016

Lona Shugart, Acting City Clerk

The Dark Skies of Page and Glen Canyon



COLORADO PLATEAU
DARK SKY COOPERATIVE

Dan Duriscoe - NPS

A Unique Opportunity in a Rare and Dark Place

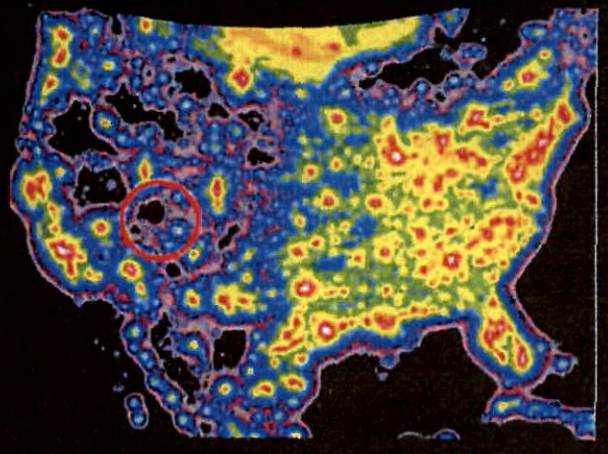
Nate Ament, NPS - July 2016

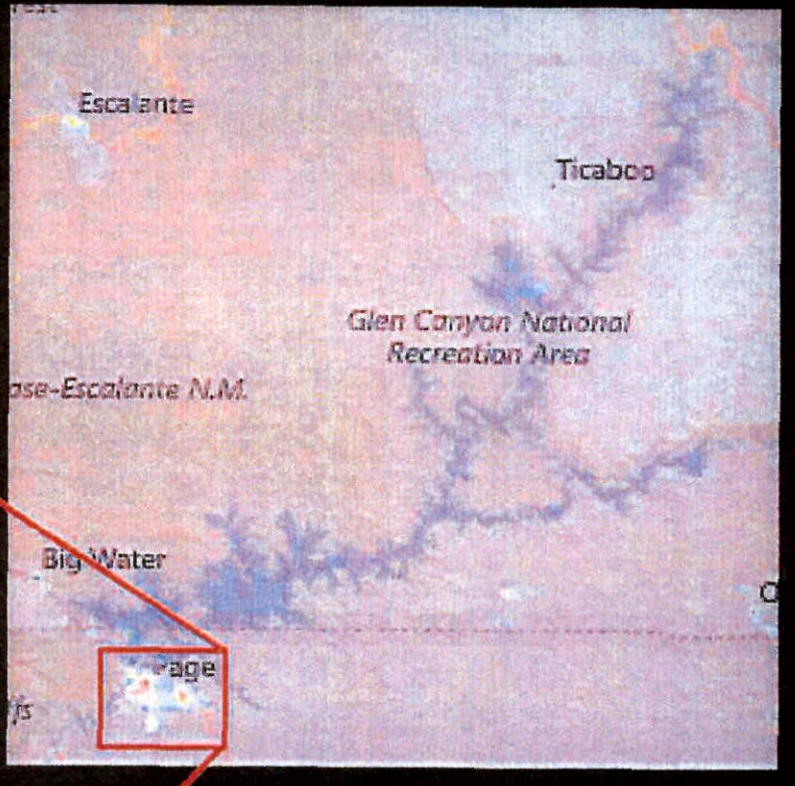
Why?

Since 1996, more than half of the world lives in an urban environment...

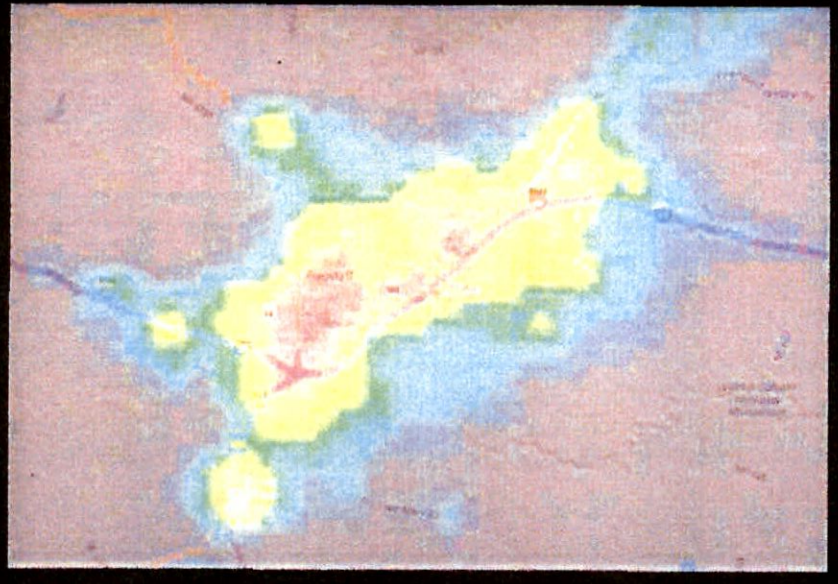
4/5 of the U.S. population cannot see the Milky Way from where they live...

Surrounded by the darkest skies in North America





Flagstaff, AZ

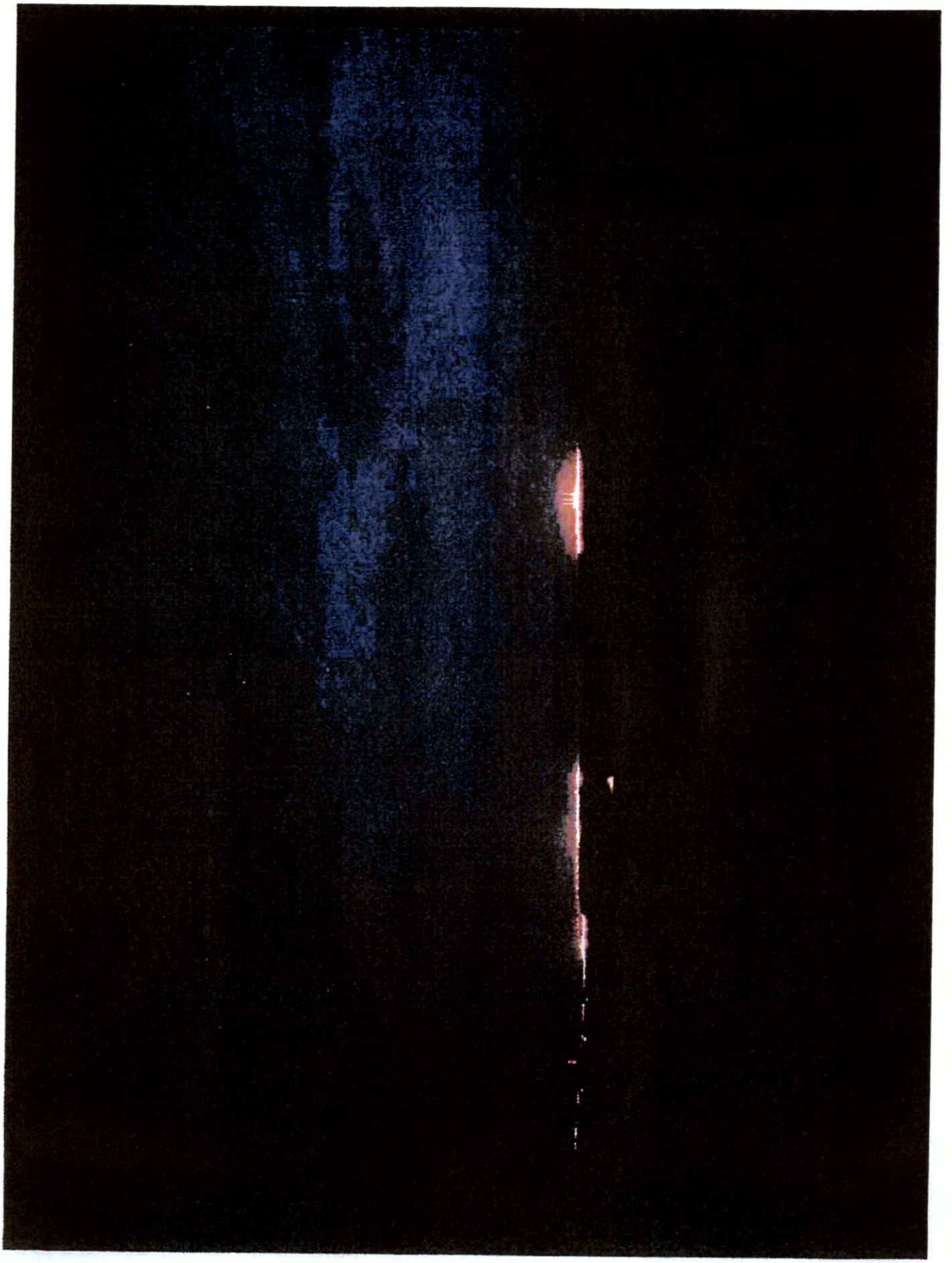


Population ~ 70,000

Page, AZ

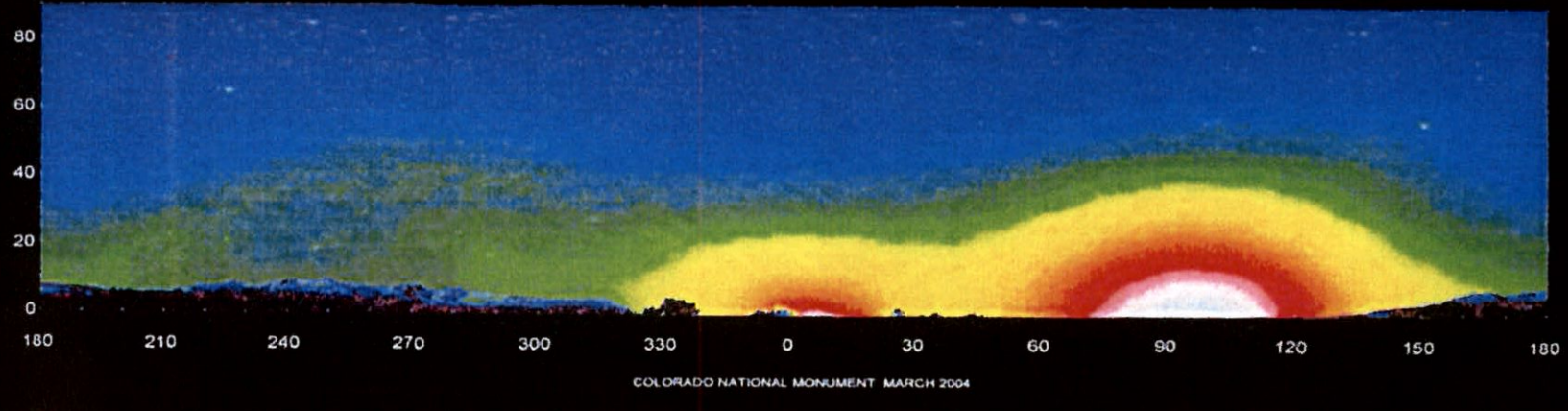
Population ~ 7,000

Same Scale



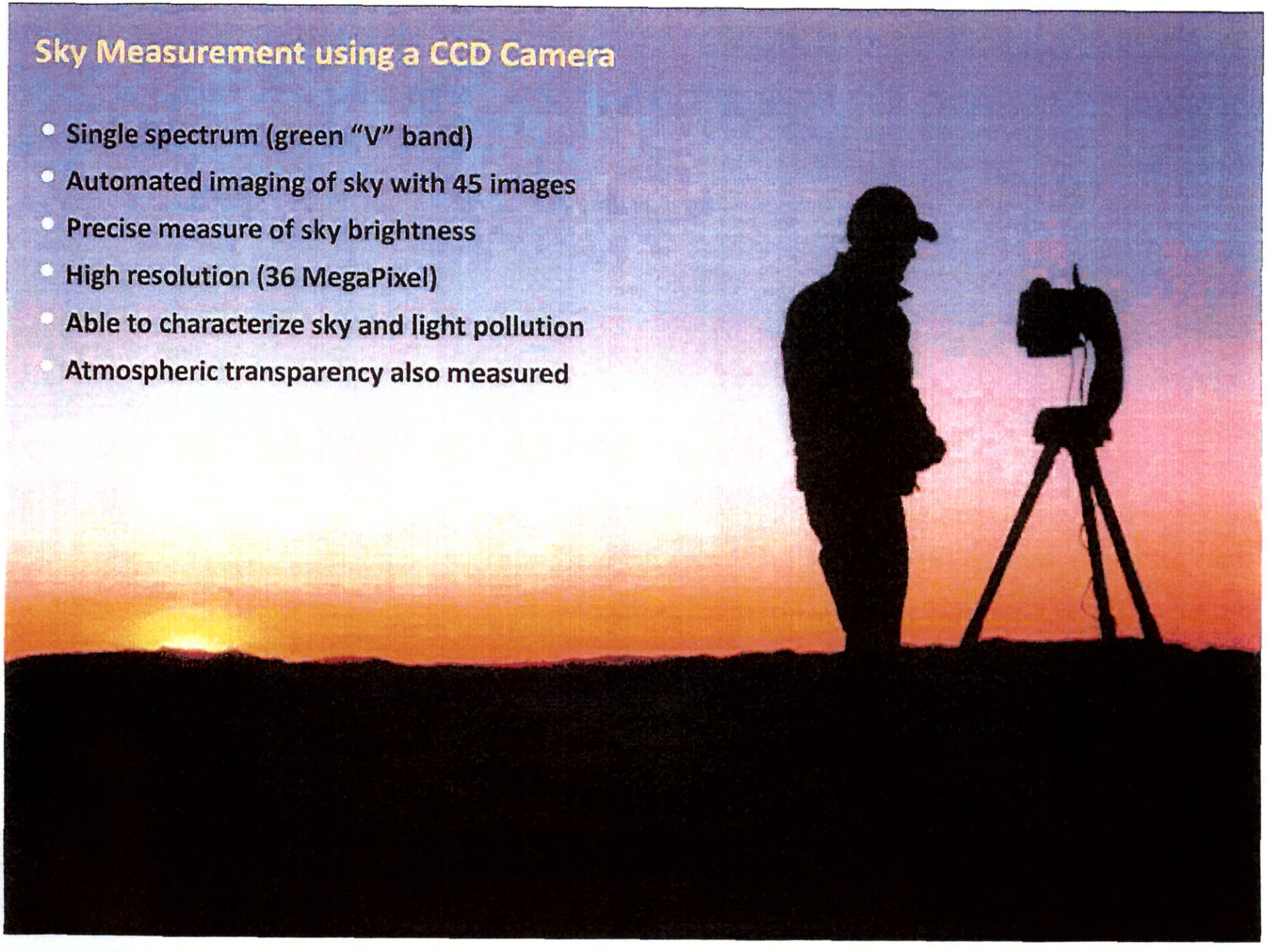
How do we measure anthropogenic (human-produced) light?

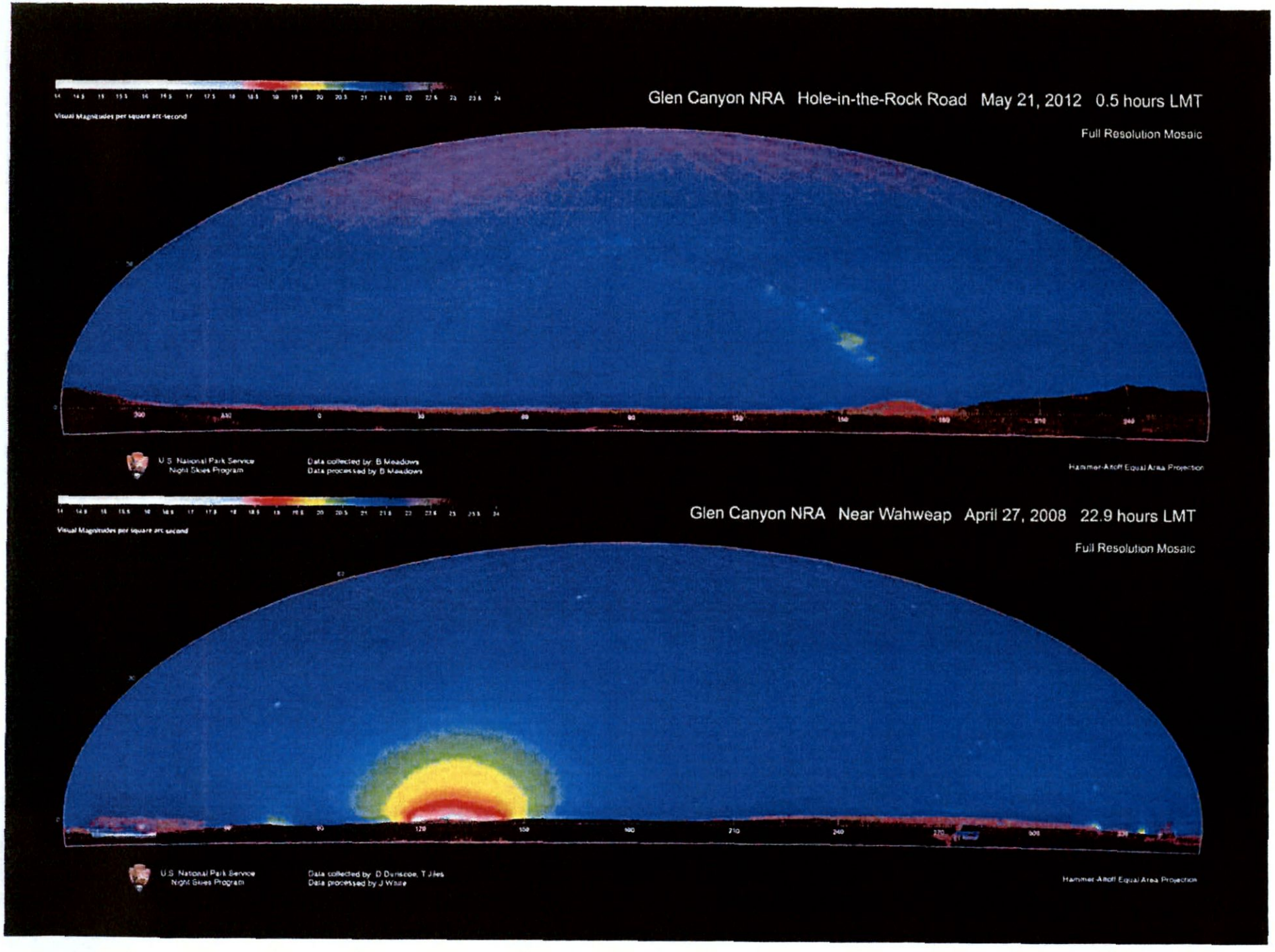
NPS Night Sky Team – Based in Ft Collins, CO

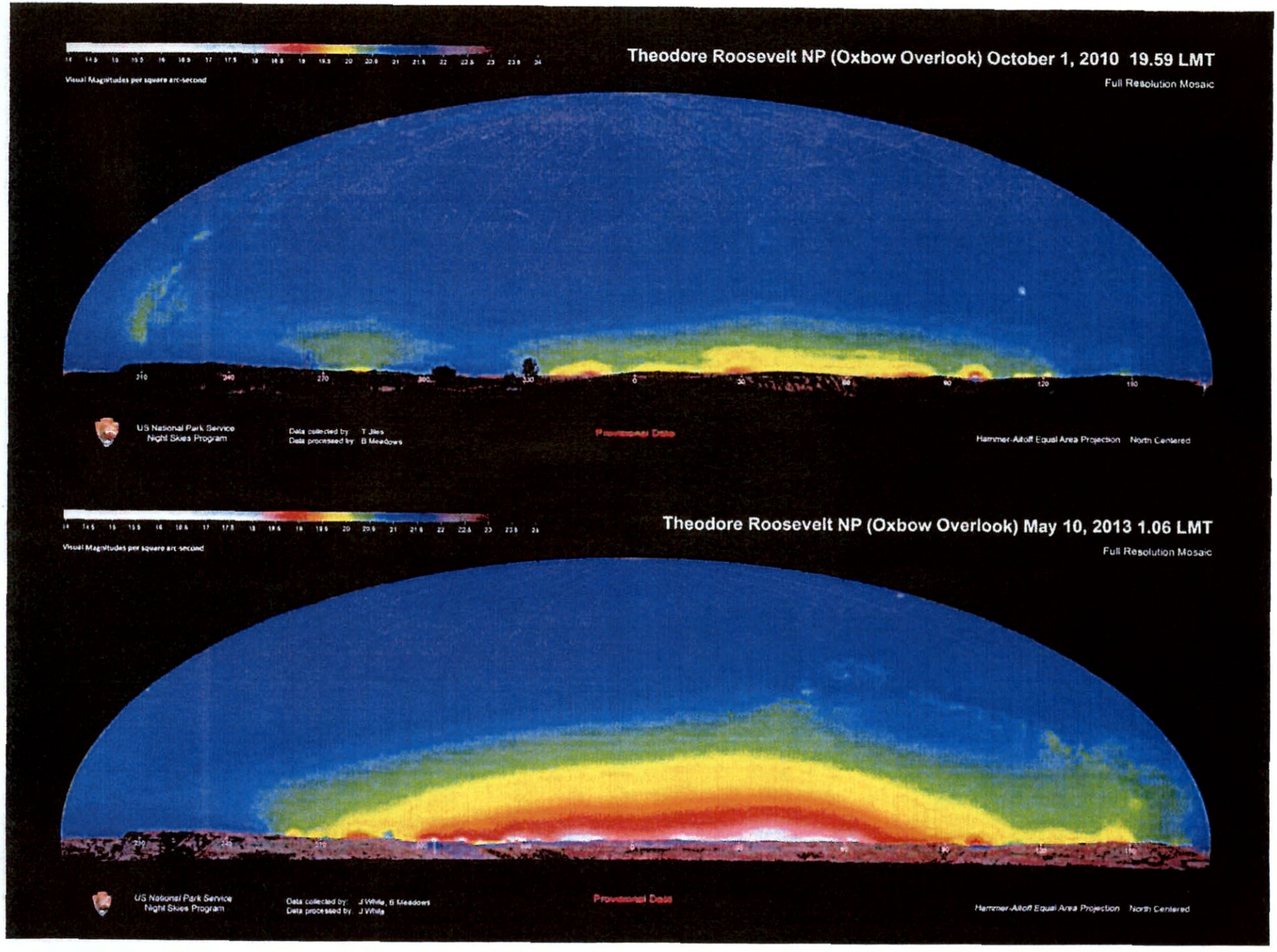


Sky Measurement using a CCD Camera

- Single spectrum (green "V" band)
- Automated imaging of sky with 45 images
- Precise measure of sky brightness
- High resolution (36 MegaPixel)
- Able to characterize sky and light pollution
- Atmospheric transparency also measured




Visual Magnitudes per square arc-second
Glen Canyon NRA Hole-in-the-Rock Road May 21, 2012 0.5 hours LMT
Full Resolution Mosaic
U.S. National Park Service
Night Skies Program
Data collected by: B Meadows
Data processed by: B Meadows
Hammer-Aitoff Equal Area Projection
Visual Magnitudes per square arc second
Glen Canyon NRA Near Wahweap April 27, 2008 22.9 hours LMT
Full Resolution Mosaic
U.S. National Park Service
Night Skies Program
Data collected by: D Duriscoe, T Jiles
Data processed by: J Wade
Hammer-Aitoff Equal Area Projection

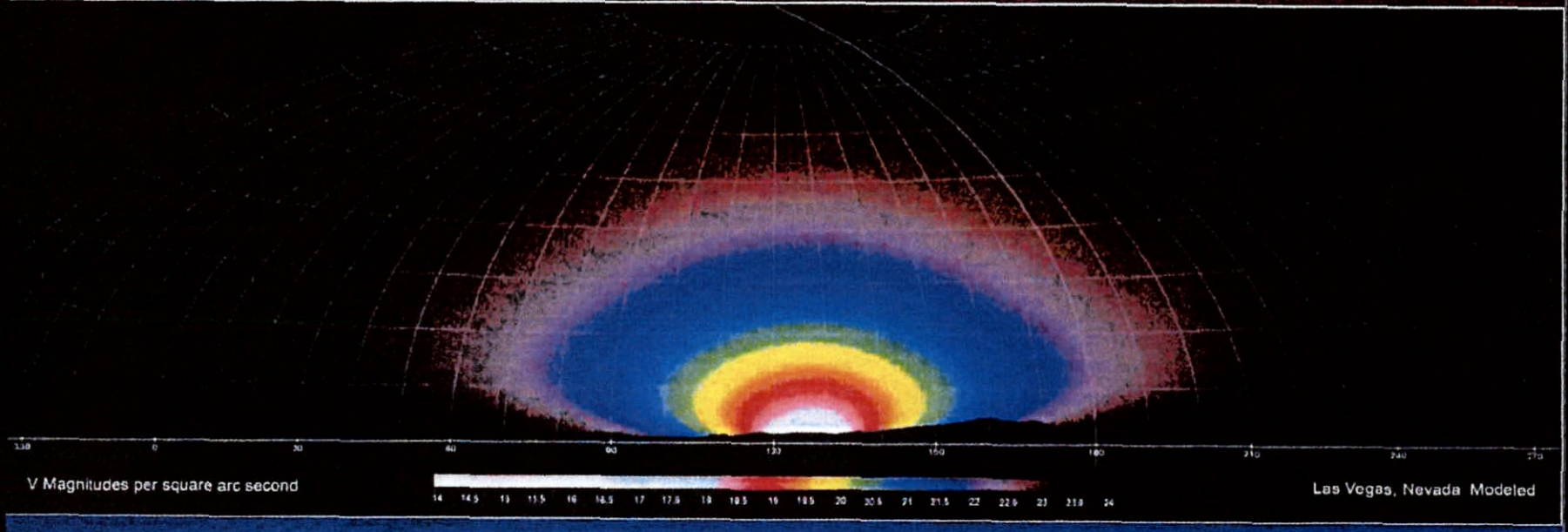

Theodore Roosevelt NP (Oxbow Overlook) October 1, 2010 19.59 LMT
Full Resolution Mosaic
Visual Magnitudes per square arc-second
US National Park Service
Night Skies Program
Data collected by: T Jiles
Data processed by: B Meadows
Provisional Data
Hammer-Aitoff Equal Area Projection North Centered
Theodore Roosevelt NP (Oxbow Overlook) May 10, 2013 1.06 LMT
Full Resolution Mosaic
Visual Magnitudes per square arc-second
US National Park Service
Night Skies Program
Data collected by: J White, B Meadows
Data processed by: J White
Provisional Data
Hammer-Aitoff Equal Area Projection North Centered

Las Vegas, Nevada Modeled Current Anthropogenic Sky Glow

Population (2010 census)	Lumens per capita (VIIRS)	Estimated Lumens per capita (model fit)	Percent uplight
1,757,861	7680	6528	10.0

Lumens/capita ratio to Flagstaff

3.15



Distance to City Center 67.0 km

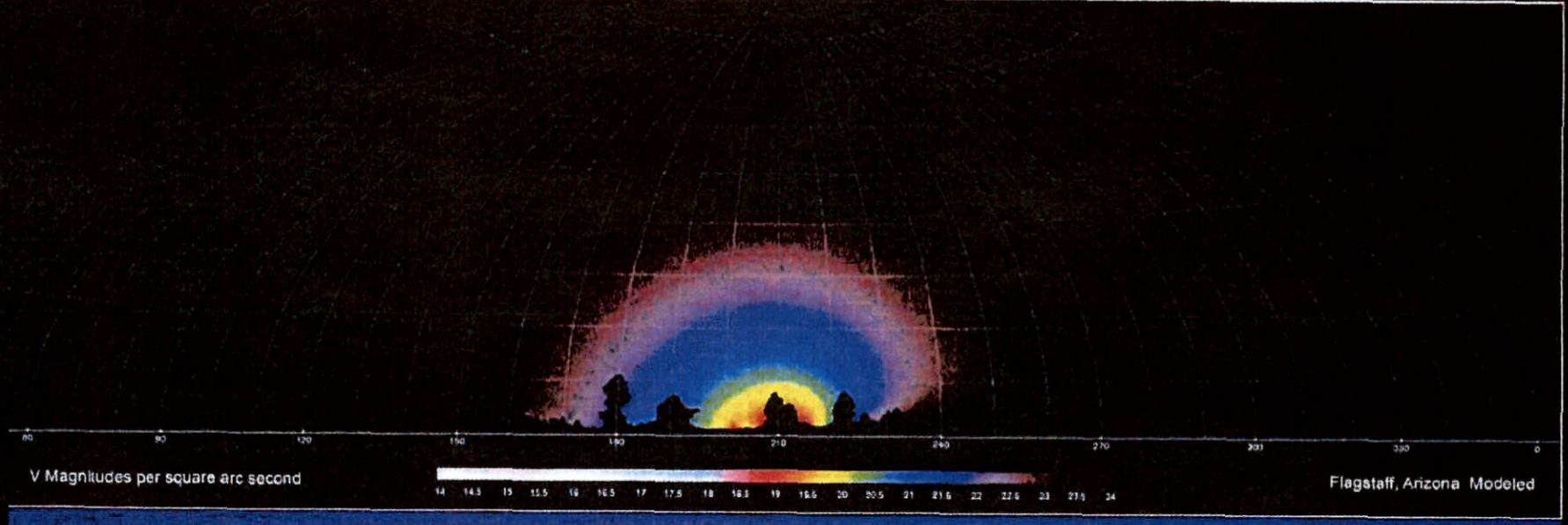
Flagstaff, Arizona Modeled Current Anthropogenic Sky Glow

Population (2010 census)	Lumens per capita (VIIRS)	Estimated Lumens per capita (inventory)	Percent uplight
75,785	2075*	2075	8.0

Lumens/capita ratio to Flagstaff

1.0

* Calibration point



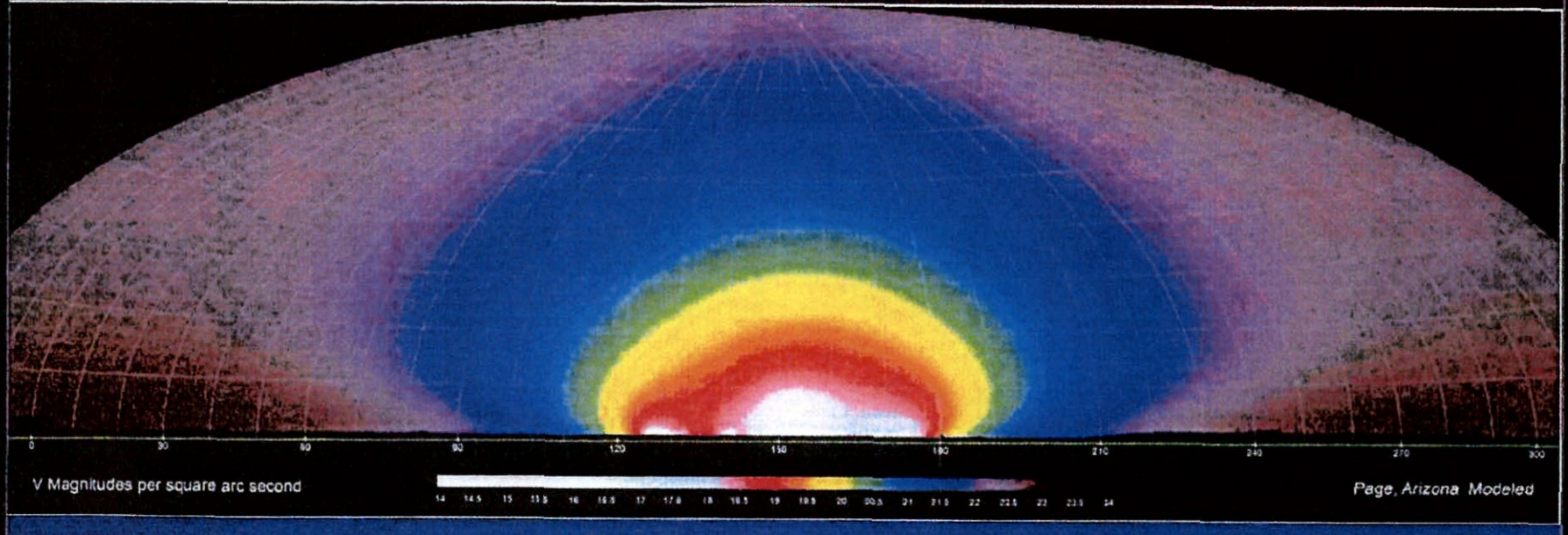
Distance to City Center 21.8 km

Page, Arizona Modeled Current Anthropogenic Sky Glow

Population (2010 census)	Lumens per capita (VIIRS)	Estimated Lumens per capita (model fit)	Percent uplight
8,690	10,368	5702	10.0

Lumens/capita ratio to Flagstaff

2.75



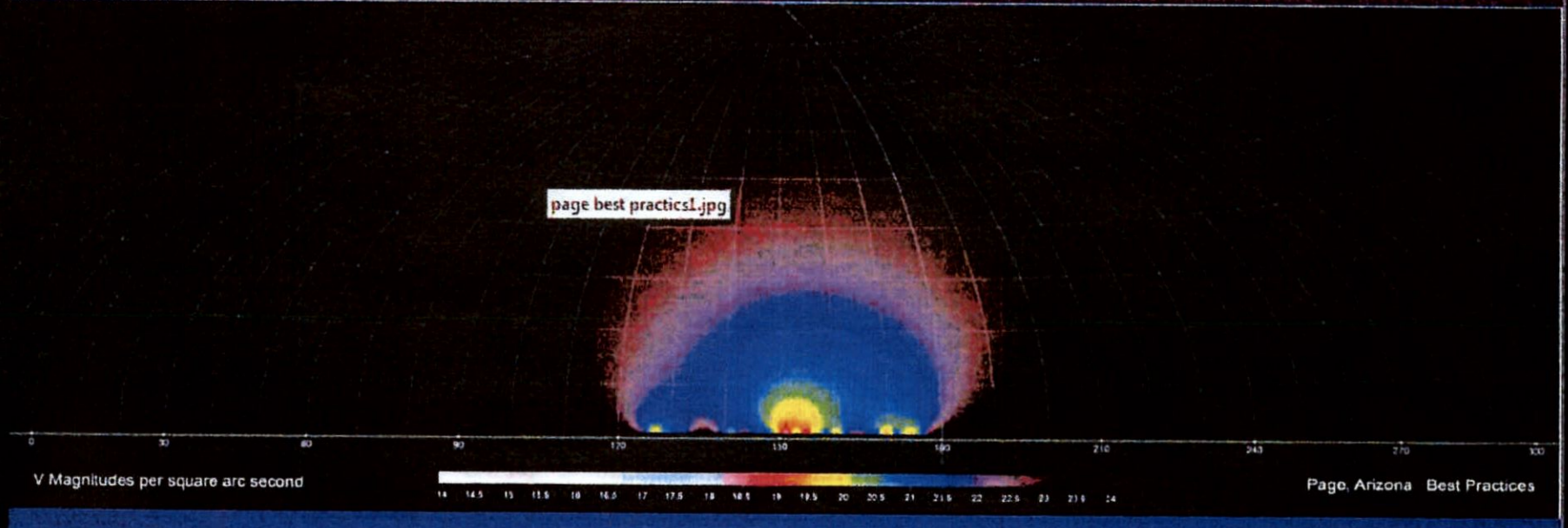
Distance to City Center 8.1 km

Page, Arizona Modeled Best Practices Anthropogenic Sky Glow

Population (2010 census)	Lumens per capita (VIIRS)	Estimated Lumens per capita (best prac.)	Percent uplight
8,690	--	2075	0.0

Lumens/capita ratio to Flagstaff

1.0

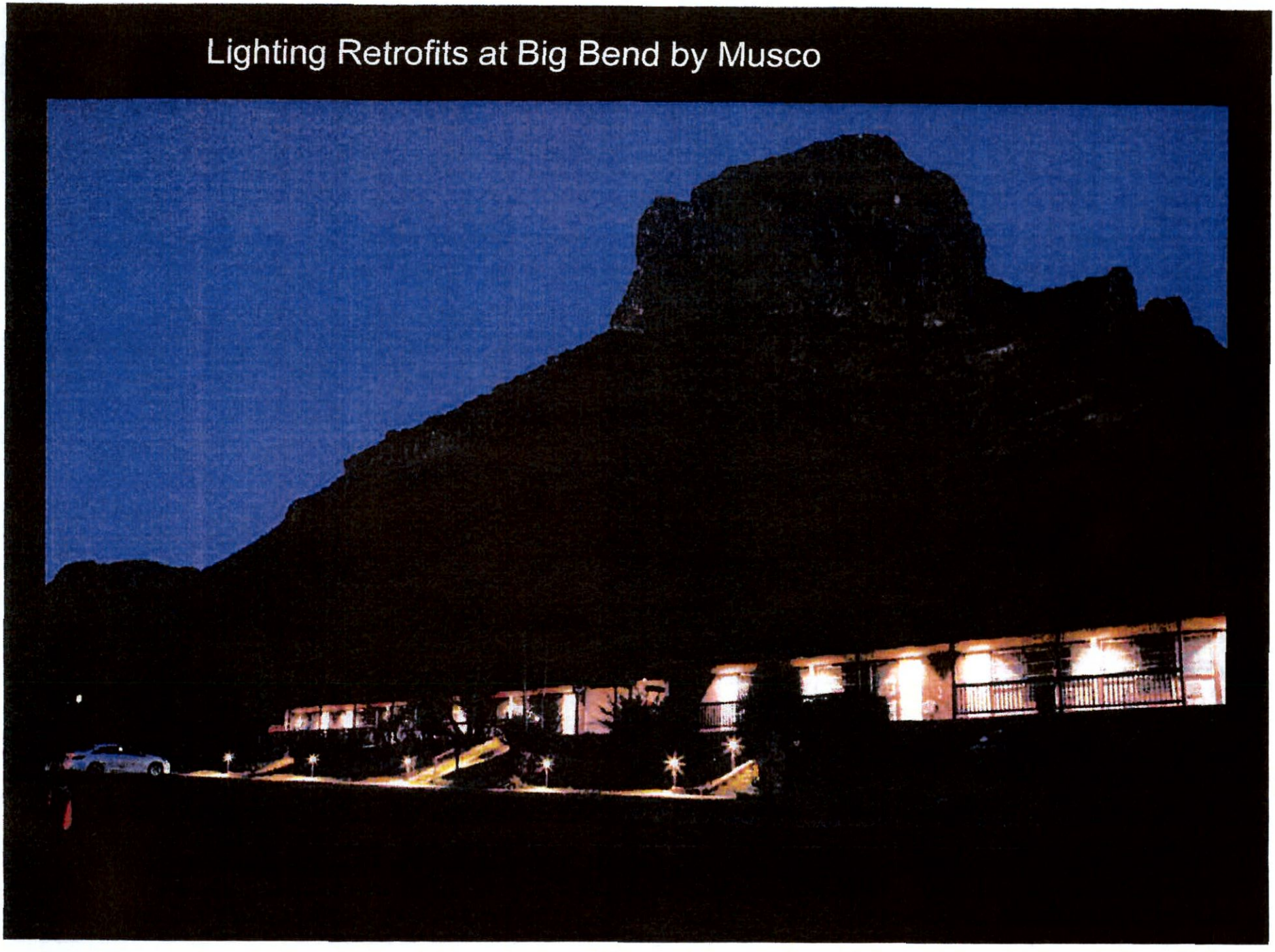


Distance to City Center 8.1 km

Night Sky Friendly Lighting

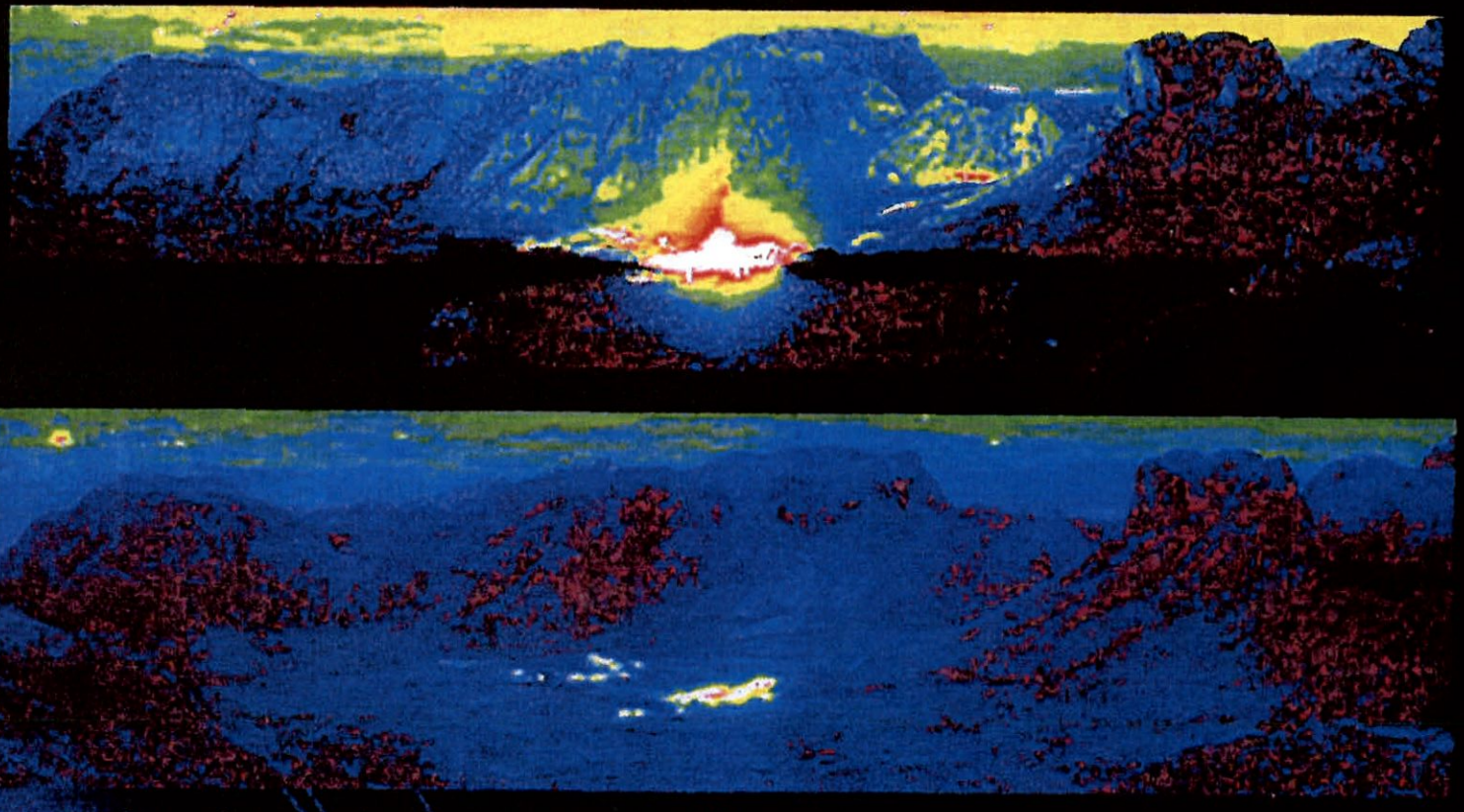
- Use light only where needed
- Use light only when needed
- Shield light to reduce glare and improve efficiency
- Use yellow / amber light when practical
- Use the minimum necessary for the task
- Use energy efficient lamps

Lighting Retrofits at Big Bend by Musco



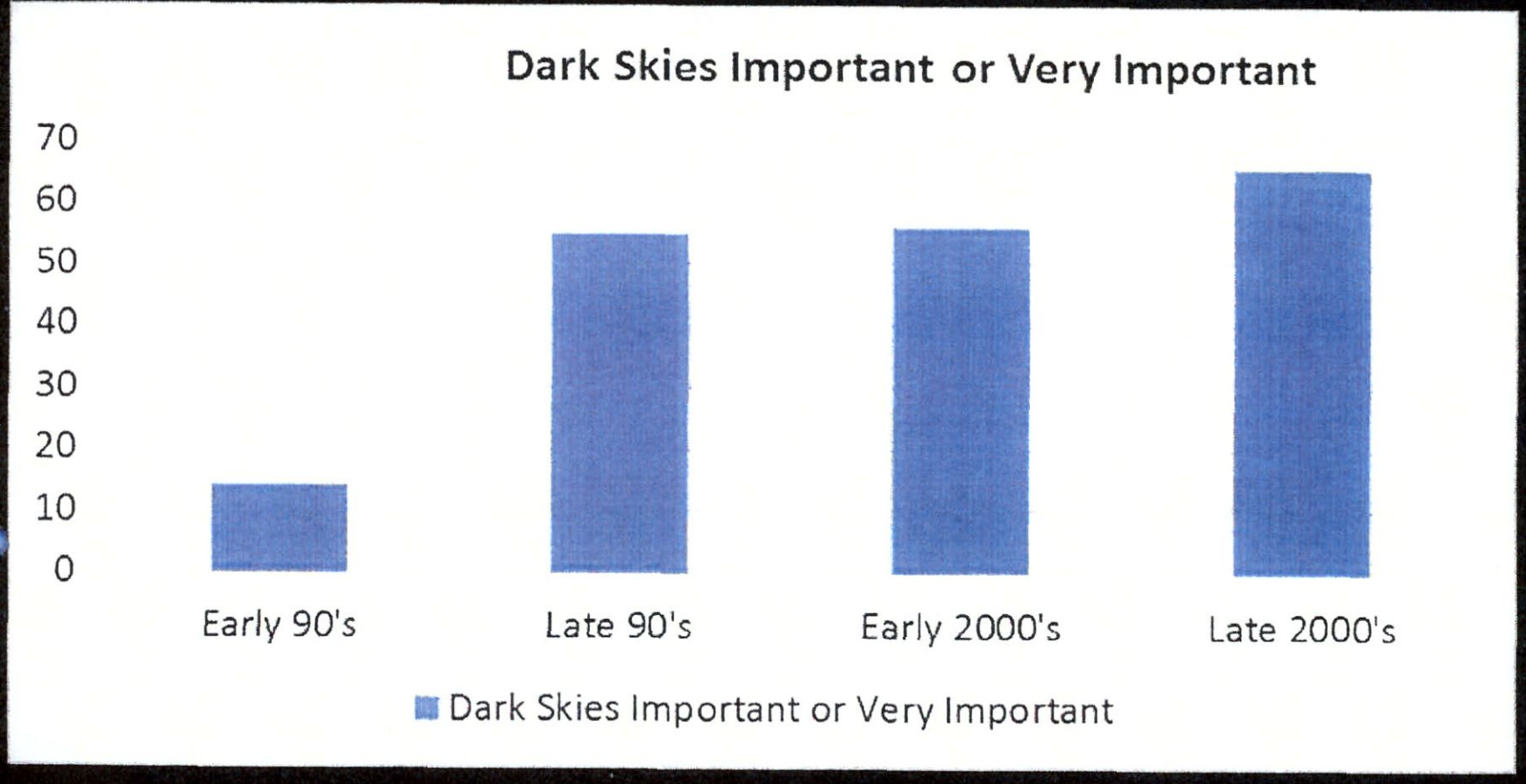
Chisos Basin, Big Bend NP – **98%** reduction in wattage, energy consumption, and associated CO2 emissions

Panorama from Emory Peak 2003 (top) and August 2011 (bottom)



False color enhances dynamic range, two different cameras are not calibrated exactly to each other, but approximately so. 2003 a clearer night, distant landscape brighter.

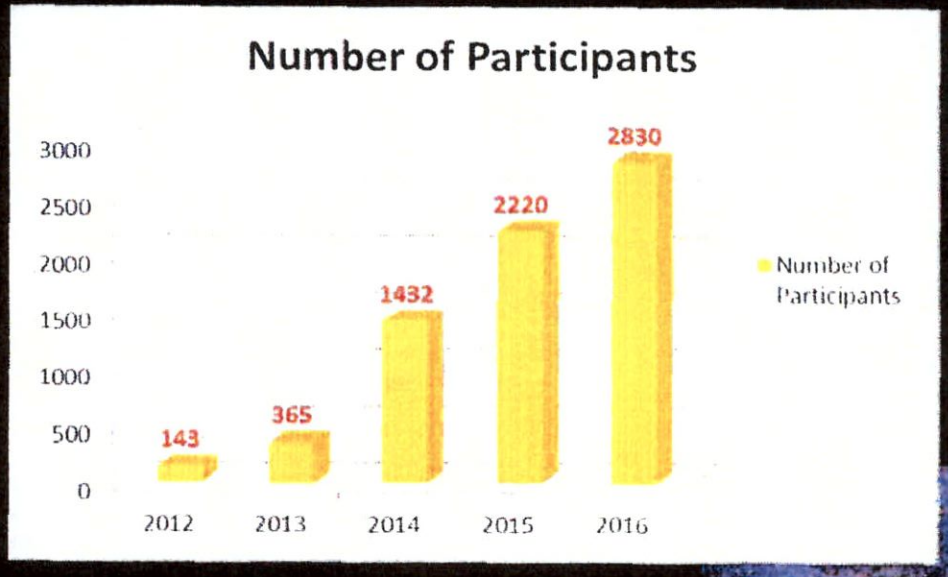
Importance to NPS visitors

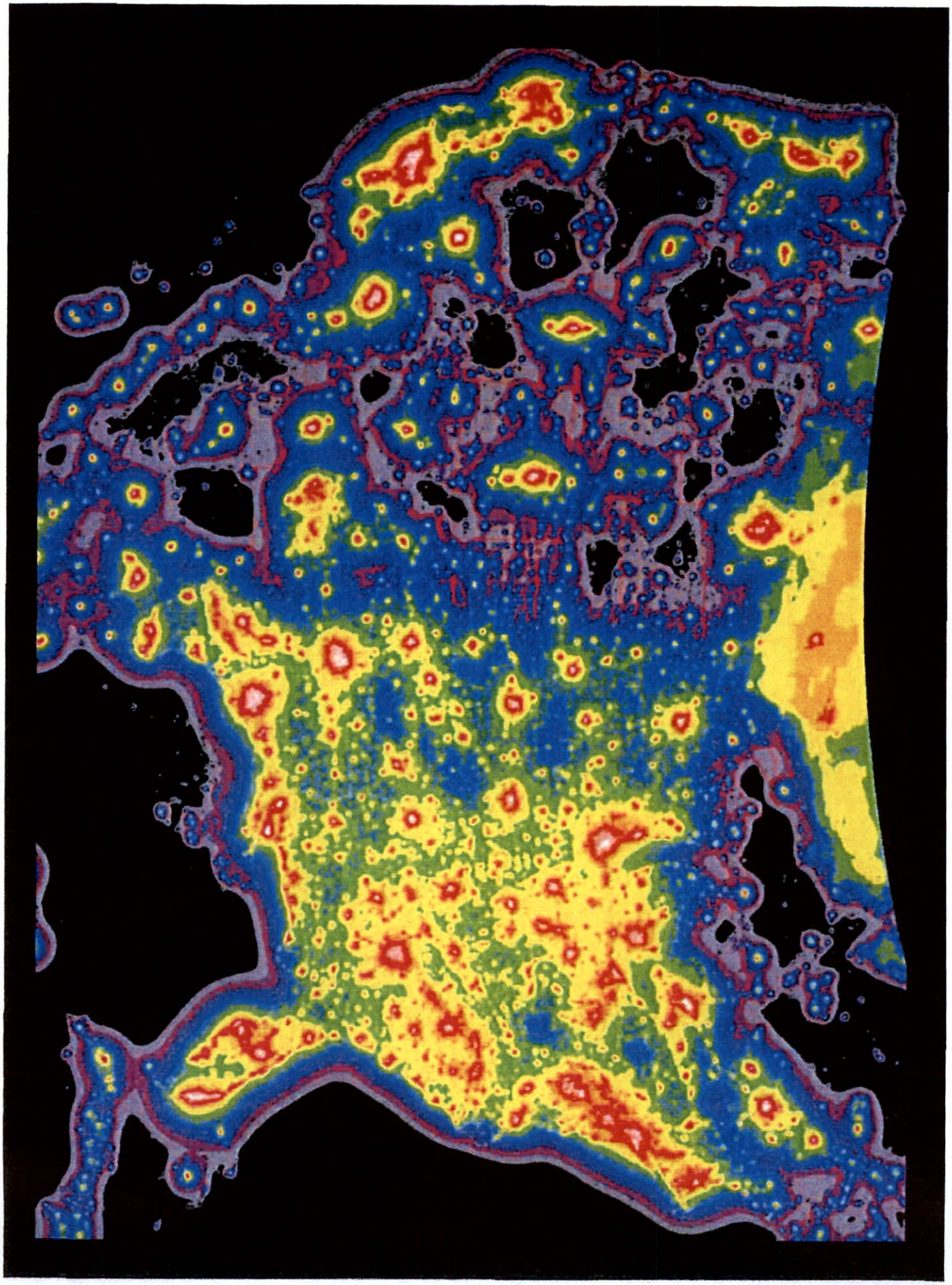


(Mitchell & Gallaway, 2015)

Astronomy programs are consistently the most popular ranger led programs

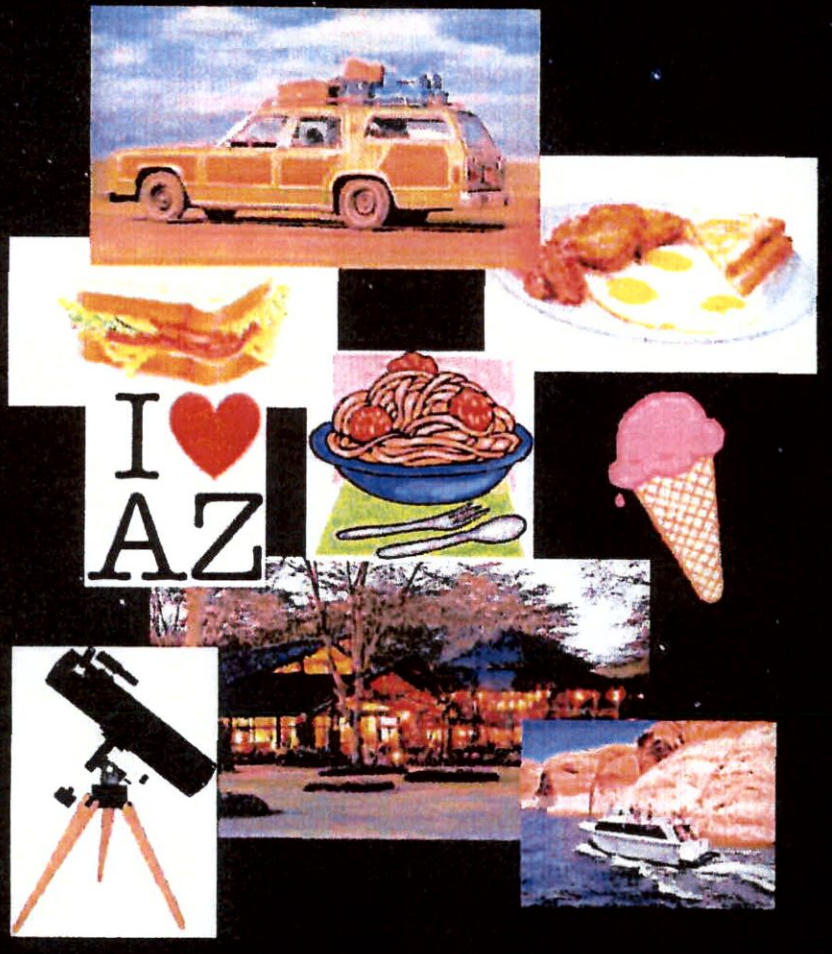
Rapid increase in popularity in Moab area parks





Astrotourism

Day Visit = $90

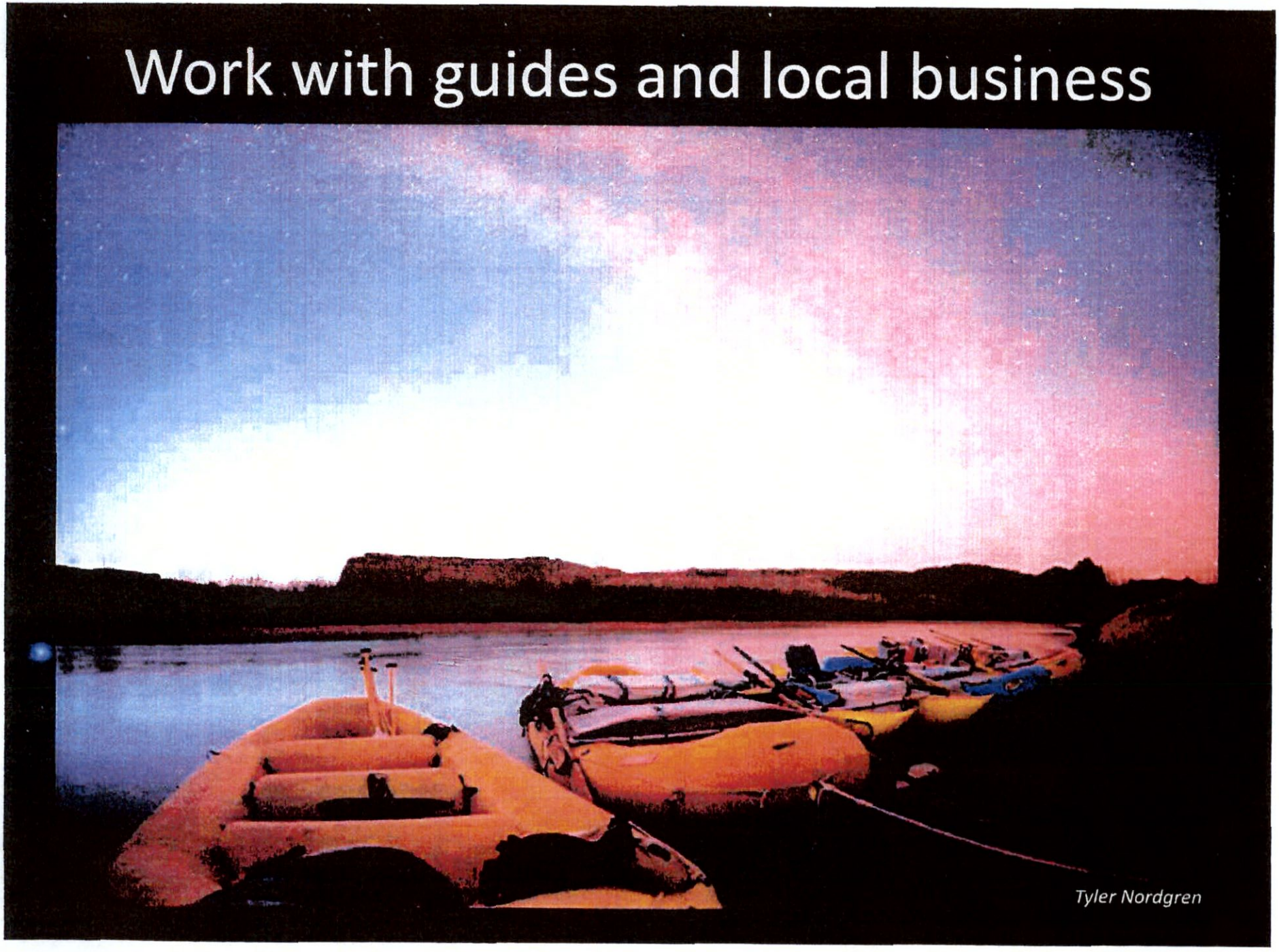


Overnight Visit = $270-$390

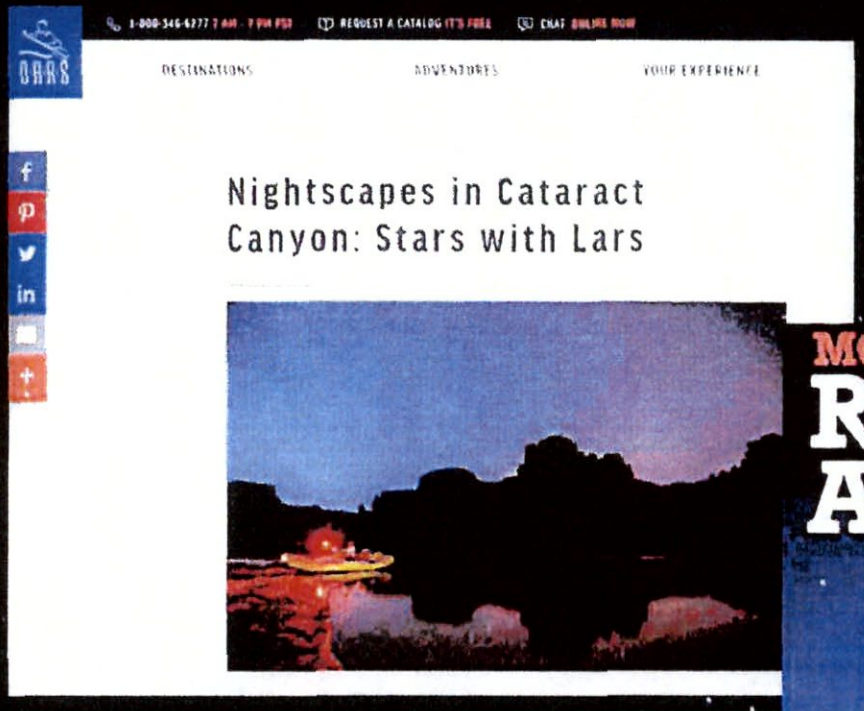
Estimating Potential Economic Value

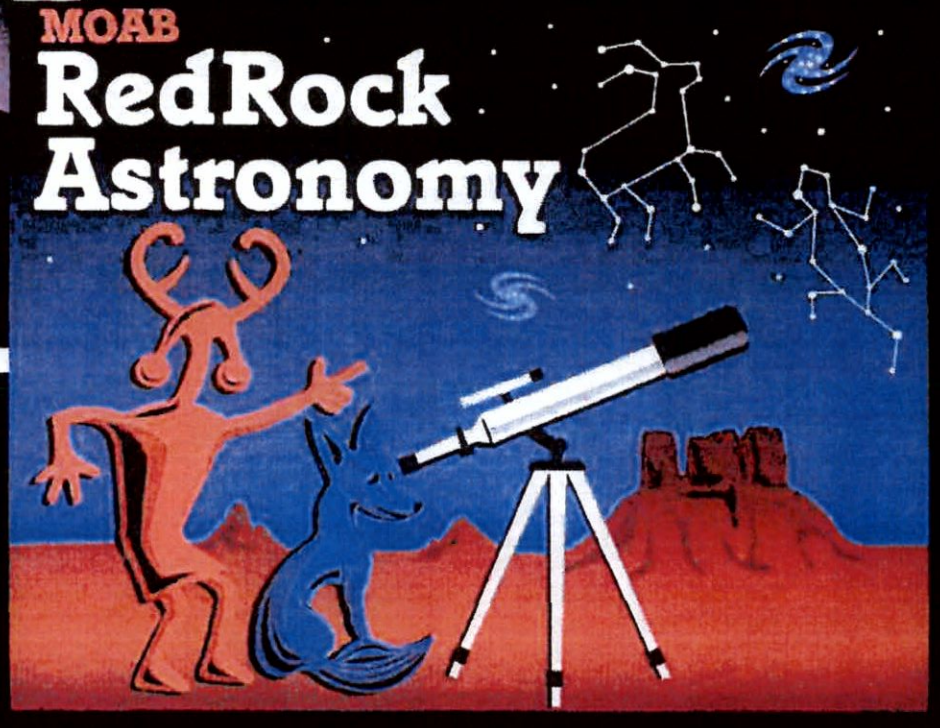
- Spending per party increase from $90 to $270-390 (day vs. overnight)
- Change represents an additional $2.5 billion value added to Colorado Plateau economies over 10 years
- Increase the **# of** visitors during the off-peak seasons and provide a longer more sustained period of tourism activity

Work with guides and local business



Tourism Opportunities





Tourism Opportunities

Deseret News

Southern Utah expects some stellar tourism

Moab Dark Skies

Live and Play under the Milky Way

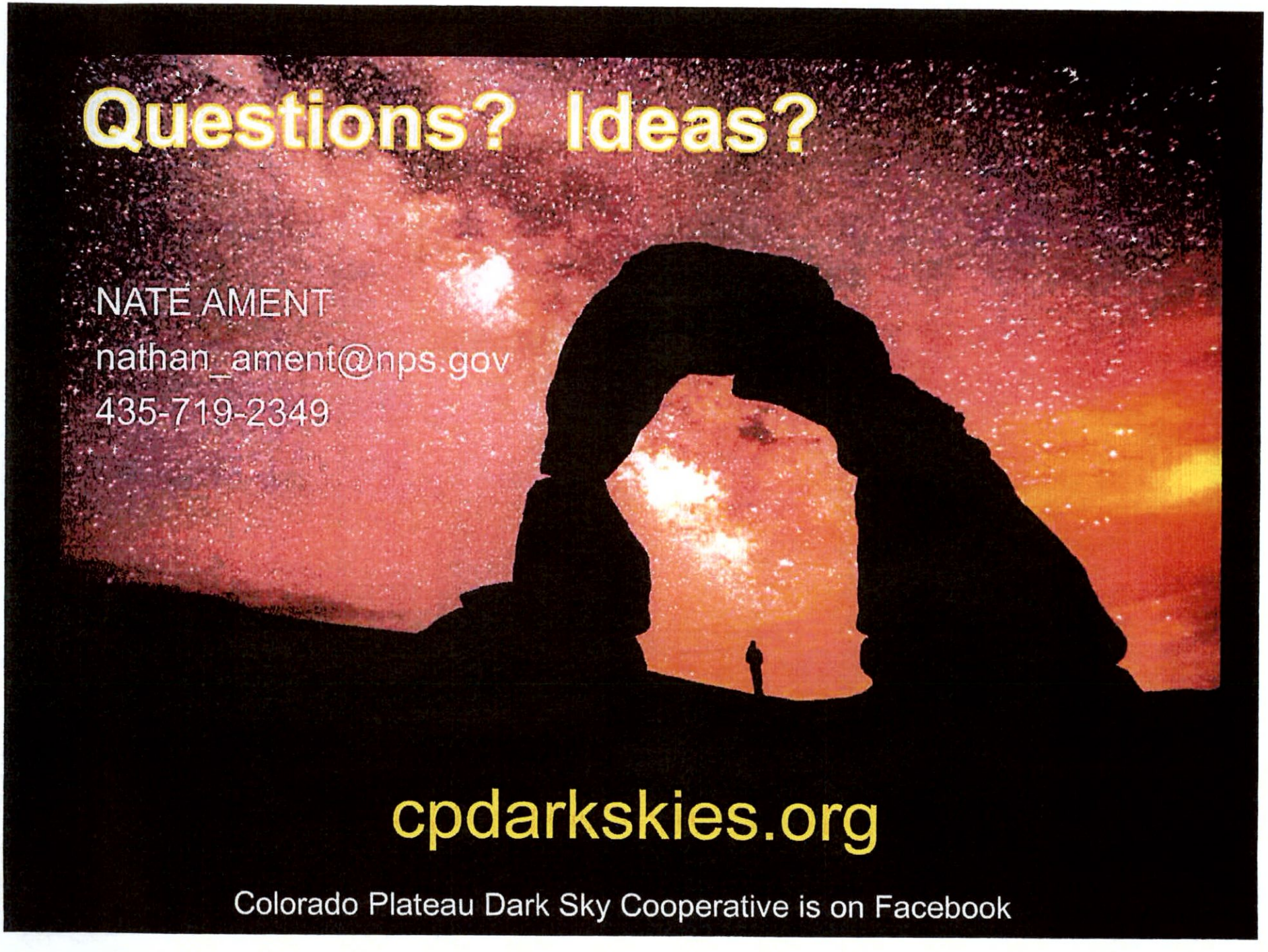
YOUR PARK
after · dark
A NATIONAL PARKS CENTENNIAL EVENT
02-11-16

Astrotourism and Economic Benefits

- Bryce Canyon (2012) – Astronomy related attendance accounted for over 50,000 visits and $2 million contributed to local economies
- Tourism office campaigns have increased some park visitation by up to 30% (Mighty Five- Zion)

International Dark Sky Parks / Places

Wally Pacholka / AstroPics.com


Questions? Ideas?
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435-719-2349
cpdarkskies.org
Colorado Plateau Dark Sky Cooperative is on Facebook