

## **Minutes Oracle Dark Skies Committee September 11, 2014**

The Application for International Dark Skies Park status for Oracle State Park was submitted to the International Dark Skies Association on 18 July 2014.

Announcement of acceptance for the Park should be released in October or November. Press releases will be sent out from them.

It is suggested that the Celebration Party be planned for November - December, 2014.

Suggestions for the party include:

- Smokey the bear- National Forest
- Oracle Fire Department
- Bat program

Hard copies of the proposal will be printed after it is finally approved, so any required changes can be added. Copies should go to Oracle Public Library, LSPWA, Oracle State Park, Oracle Dark Skies Committee, Arizona State Parks. The Historical Society says they don't need one.

### Community Outreach

Weasner presented a slide show and video at the Hacienda, Saddlebrooke Ranch, on 5 August and 55 people attended.

The host asked about what the management company could do for better lighting, so Mike will be advising if they need more assistance.

GLOW - last Saturday, 6 September, Mike presented a table of information by himself because Auerbach was ill. He didn't set up a telescope because it was cloudy. Many people stopped to get information. Many visitors were very excited about the project. Some visitors didn't understand the concept. Weasner's demonstration with the snake "hiding in the light" vs. effective lighting was effective.

Since the table will be set up each date of GLOW, helpers were requested.

- Sep. 13 - some will work around hours they will already be there.
- Oct 4 - Charlotte
- Oct 11 - Evaline

### Upcoming events:

Star Party at

- Kartchner Caverns - Sep. 20, 2pm - after dark - lots of telescopes, talks and presentations.
- Catalina State Park - October 18 at 6 pm. It will include Native American Night Sky Stories.

See both and future events as they come up at Arizona State Parks' page devoted to Star Party, astronomical events: <http://azstateparks.com/starparty/index.html>

### To be planned

Following Weasner's experience at the Flagstaff summit (see below), he suggests a similar Dark sky event in Oracle or Pinal County in 2015. This would include information from businesses, astronomical associations, volunteer groups, those wishing to set up their own dark sky programs and so forth.

Oracle State Park was dedicated in Oct.1995, so an event that month could coincide with a 30-year celebration. It was opened to the public in October 2001.

#### Community projects:

- Weasner presented the concept of “Day-burners” = lights left on in the daytime. This may happen because the owner forgets to turn off the light in the morning or leaves it on so as not to forget to turn it on at night. Also, in some cases, old switches are failing so can't be easily turned on and off.
- Weasner is still working on the Jones Outdoor Advertising billboard problem lights. He has spoken to a Department of Transportation person who might be able to help or advise.
- Wood Field is still in discussion at the Pinal County level.
- Circle-K - Weasner showed the manager a brochure from Cree (company) which he had obtained at the summit. It features a Circle-K with improved lights. Mike is still working with him. The Cree Circle K web page is here:

<http://www.cree.com/Lighting/Applications/Indoor-and-Outdoor-Applications/Petroleum-Convenience-Store/Circle-K-Columbus-IN>

The Cree brochure (PDF) is here:

<https://www.creelink.com/exLink.asp?108038840H49Z88I30503291>

#### Future programs

- Ranger Rinio has been considering programs on the effects of artificial light on Wildlife - and on women's health.
- Weasner presented a point about bats, in particular - if you like your Margaritas, you don't want the bats to have too much light at night.
- Insect problems that could be helped by lighting was discussed: Scorpion problem = white lights OFF means fewer bugs around that the scorpions eat, so you won't have as many scorpions. Also, inside you may not have as many kissing bugs if you do not have white/blue light on at night. Bringing in an expert on this topic from U of A / Biosphere 2 was discussed.
- A program and/or workshop in Night-time photography and/ or Pleine-aire art at night came up.
- A program on owls was suggested. Perhaps with information about how they are affected by artificial light.

#### Brochures

- The Dark Skies program will be in the Oracle State Park brochures to be printed soon (thanks Val Bembenek). These will go to official visitors' centers around the state.
- It was suggested that Oracle Dark Skies Committee might want to have their own brochure.
- Weasner volunteered to talk to the Oracle Visitors' Center about representation there.

Programs by Oracle Dark Skies: Places where programs could be offered include:

- Starizona
- Biosphere 2
- Rotary, etc. in San Manuel
- Saddlebrooke - Friends of the Library.

Weasner reported on the **Summit program at Flagstaff** to which he was a delegate from the Arizona State Parks and where he was a panel member at one session.

- **See attachment.**

Weasner wondered if Resolution Copper would be a good candidate as a sponsor. It was pointed out that they have sponsored other things under the Copper Corridor Economic Development Committee.

Rinio proposed some dates for the acceptance party **Nov 15/ 22; Dec. 13** (a Saturday. which is also 12/13/14. Full moon is Dec. 6.

The next ODSC meeting will be called as needed.

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Signed,

Evaline J. Auerbach, Recorder

Signed,

Mike Weasner, Chair

Atch: Dark Skies Conference Trip Report for Arizona State Parks

## **BLINDED BY THE LIGHT: A SUMMIT AND CALL TO ACTION TO PROTECT OUR NIGHT SKIES**

18-20 August 2014, Flagstaff, AZ

<https://www.keystone.org/darkskies>

**Attendees** (in alphabetical order; 1 to many from each company, organization, agency):

AdC Consulting  
ALR  
Arizona Dept of Transportation  
Arizona Optics Industry Association (AOIA)  
Arizona State Parks (Mike Weasner)  
Benya Burnett Consulting  
Bryce Canyon National Park  
Bureau of Land Management  
C&W Energy Solutions  
City of Flagstaff  
Cochise County Community Development  
Daktronics  
Dark Sky Partners, LLC  
Demanddrop  
Denali National Park  
DeTect, Inc.  
Eaton Corporation  
Economic Collaborative of Northern Arizona  
Flagstaff Police Dept  
Grand Canyon Association  
Hubbell Lighting - Beacon Lighting  
Hudbay  
International Dark-Sky Association  
International Sign Association  
Kaibab Paiute Tribe  
Kane County  
Keep Sedona Beautiful  
Lamar Advertising  
Lowell Observatory  
McDonald Observatory  
MMT Observatory  
Monrad Engineering Inc.  
National Optical Astronomy Observatory  
National Park Service  
National Parks Conservation Association  
PAG  
Park Rangers for Our Lands  
Petrified Forest National Park  
Philips Lighting  
Pima County Dept of Transportation

PIO  
SAO - Whipple Observatory  
Steward Observatory, UofA  
Taylor RyMar Corporation  
The Keystone Center  
Town of Sahuarita  
University of Arizona  
University of Connecticut  
US Naval Observatory  
Virginia Tech University  
Western Energy Project  
Western Energy Project  
Woodson Engineering & Surveying  
Yuma County Development Services

### **Day 1, 1pm-4pm, "Dark Skies, Good Lights"**

City Council Chambers, Flagstaff City Hall

An overview of lighting and the effects of outdoor illumination on dark skies. Presenters: Jim Benya, Deborah Burnett, Chris Luginbuhl.

Goal: prevent wasted energy, high cost of maintenance, lost of night sky, health affects.

Dr. Deborah Burnett (Benya Burnett Consulting): Circadian Connection. Circadian System involves entire body and all cells. 24 hour and annual cycles, sleep cycles. Manages body energy management system. Photosynthetic system: use of light and dark. There is a molecule (ATP) that is necessary to body's energy management and is sensitive to light. Visible spectrum is key to body and plant actions. Body proteins are sensitive to various wavelengths. Some control blood pressure and artery/vein size, and much more. Insects are also affected by different wavelengths of light. Major wavelengths for circadian response is blue region. Must also consider spectral power spectrum. Every organ has a Circadian rhythm (biological, physiological, and neuroendocrine) and all are tied to 24 hour day-night cycle and sleep/wake cycle. Eye has visual detectors and not just for sight. Some sensors go to brain as sight and some to other areas of brain as Circadian System inputs. Circadian Desynchronization can result in: breast cancer, Alzheimer's disease, Parkinson's Disease, diabetes, and much more. Fish and bats are also susceptible to Circadian Desynchronization. Even blind people are affected negatively by light pollution. See AMA-H Policy 135.937 on adverse health effects of nighttime lighting.

Chris Luginbuhl (US Naval Observatory): Visible sky glow caused by atmospheric scattering. Eye can do a 10 million to 1 range day to night. Eye most sensitive in daytime to 550nm (3 types of cones = color), nighttime 500nm (1 rod = B&W). For street-lighting and moonlight uses a combination of cones & rods. Discussed types of lighting and their spectra and how they affect sky glow. Low Pressure Sodium has the least impact to both eye and instruments. (But high maintenance and low energy efficiency.)

Jim Benya (Benya Burnett Consulting): Discussed basic lighting terms and physics of light. Solutions may not be ideal for everyone but can be great for everyone. Lumens of light is based on photopic vision. Cones=photopic vision. Rods=scotopic vision. Both=mesotopic vision. Candle=12.6 lumens. 60W bulb=800 lumens. Office lighting=3000 lumens. Lux=lumens per sq

meter. Luminance = reflected light. Day = 100,000 lux. Moonlight Full = 0.1 lux. Starlight on clear night = 0.01 lux or less. Indoor lighting during day is typically lower than artificial indoor lighting used at night! Electric light spectra is not like the natural (sun) light spectra. Nearly all LED lighting is closer to natural light spectra except has a blue spike and a "valley of cyan". Many LEDs are marketed as "like moon light" but in fact are not. High Pressure Sodium lighting in use by about 90% of outdoor lighting but is bad. LEDs are currently the best lighting from all aspects except for efficiency vs spectrum, glare and shielding, aiming/candlepower, replacement or recycling, sustainability, value. And they are VERY bright. 75% of energy that goes into LED is converted heat. 25% is light. LED bulb packages should have a Lighting Facts label (see [www.lightingfacts.com](http://www.lightingfacts.com)). Striving for ~3000K color temperature. Good alternatives to older LEDs: Filtered LED (FLED), Phosphor-converted or narrow band amber LED (PCALED, NBALED). FLED removed the bad blue spike. Illuminating Engineering Society (IES) Handbook (2011) is better at dark sky responsible lighting than previous standards. There are many standards and codes, not all good or in agreement with other. Energy codes typically prevent over lighting. LED lighting can be more uniform over a large area which results in less bright lights needed. The IES standard has lighting zones from dark rural areas to cities. Shielding of today's LED street lighting is not adequate and has a backlighting problem.

Chris Luginbuhl (US Naval Observatory): Discussed Flagstaff Lighting Code. It addresses light pollution management. Zone sizes and lumens caps are based on dark sky management, NOT on lighting needs or practices. KISS principle applied with a very small number of standards (33). The solutions have proven to be workable for businesses and residents in Flagstaff. Designers have to think outside the box. It has worked for 25 years and produced measurable success. See [www.flagstaffdarkskies.org](http://www.flagstaffdarkskies.org).

### **Day 1, 7pm-9pm, "Opening Reception"**

Lowell Observatory

Much interaction with attendees and experts.

### **Day 2, 7:45am-8am, "Welcome"**

High Country Conference Center

Flagstaff Mayor Jerry Nabours, Congresswoman Ann Kirkpatrick (AZ CD-1)

Introduction: Todd Bryan (The Keynote Center)

Before the session started I had a brief chat with Representative Ann Kirkpatrick. She is appreciative of what we are doing in Oracle and for Arizona State Parks. She wants to come to the Oracle State Park "International Dark Sky Park" designation celebration.

Welcome by Mayor Nabours. He talked about the importance of dark skies to Flagstaff. He noted that the political will exists to pursue dark skies.

Rep Kirkpatrick talked about her background (both her parents were amateur astronomers) and her support of dark skies. She discussed the importance of the astronomy business to Arizona. Then there was an introduction of the conference purpose and structure by Todd Bryan, Keystone Center.

### **Day 2, Session 1, "Opportunities and Challenges for Dark Sky-Preserving Lighting" 8am-8:30am, Keynote, "Dark Skies and Emerging Technology"**

Chad Moore (Night Skies Program Manager, National Park Service)

Began talk with the engrained dark sky influence on humans. Dark skies are the least protected of our natural resources. Darkness is a critical aspect of many creatures. NPS measures the dark sky quality at many locations. Showed all-sky photographic images of good and bad skies. Light domes of large and small cities clearly seen. Solutions difficult to implement but benefits are immediate. Have done studies and modeling showing dramatic improvements from achievable light mitigation. Compared "watershed" to a new concept of "lightshed". Recommended considering the broad impact of unneeded lighting. Less light actually accomplishes more. Mentioned community support and local pride for dark skies. Did note that there does exist a "cultural fear of darkness", but that is changing with new dark-sky compliant lighting technologies.

### **8:35am-9:09am, "Dark Skies and Health"**

Richard Stevens (Professor and Cancer Epidemiologist, University of Connecticut) Showed a very effective comparison satellite photos of USA at night today vs 500,000 years ago (a black screen). Dim days in buildings and light at night results in Circadian Disruption. Somewhat technical presentation on the Circadian System and impacts of the light environment on body functions and processes at the gene, molecular, and hormone levels. 5-10% of mammalian genes are clock controlled (the 24 hour cycle). Resets happen daily and annually. Light pollution interrupts these resets. Connections to breast cancer (and other cancers like prostate), obesity, diabetes, mood/depression, and more. Physiological effects have been demonstrated. DNA damage may be occurring as well from nighttime lighting. Artificial daytime interior lighting can affect our reactions to night lighting. Sleep is not important to melatonin processes; darkness IS important. Exposure to room light or blue screens (computer, tablets, etc.) prior to bedtime suppresses melatonin onset and duration. Waking up in the middle of the night is normal but stay in the dark to avoid interrupting the Circadian System.

### **9:10am-9:40am, "Dark Skies and Public Safety"**

Ron Gibbons (Director, Center for Infrastructure-Based Safety Systems, Virginia Tech) Talked about lighting and safety. Most pedestrian deaths occur around sunset. Next most pedestrian deaths occur after DST change in the fall. His group is doing lots of measurements around the country on roadway lighting. Getting good results. Lighting has not affected run-off-road crashes. Need to have "adaptive lighting" which responds to time, traffic flow and counts, road conditions, and surrounding conditions. Trying to get incorporated into standards. Studies showing lowered energy costs from dimming roadway lights with no impact on safety. Seeing is NOT improved with the new high intensity blue headlamps. Old style headlamps ARE BETTER for safety.

## **Day 2, Session 2, "Strategies, Tools, and Challenges for Dark-Sky Lighting"**

### **10:14am-11:45am, Panel, "Dark-Sky lighting: Needs and Challenges"**

Panelists: Richard Green (Steward Observatory), Jeffrey Baumann (City of Flagstaff), Rosie Pepitoe (National Park Service), Chris Monrad (Monrad Engineering), Jim Benya (Benya Burnett), William Wren (McDonald Observatory), Lance Diskan (Flagstaff Dark Skies Coalition), Mike Weasner (Arizona State Parks), Shelly Smith (BLM), Jessica Garcia (Clanton & Associates)

Different constituents perceive different needs from lighting. It is vital for various parties (astronomical, municipal, recreational, land managers, ecological, etc) to air their needs and desires in order to allow a comprehensive discussion to occur.

Since I was on the Panel I wasn't able to get much in the way of notes. But I did capture these important points:

Property values are influenced by unwanted outdoor lighting.  
Utility companies DO have a role to play in the light pollution mitigation solutions.  
When discussing light pollution with Native American Tribes do not use the term “dark”; it has a bad cultural connotation. Instead tie light at night impacts to their “winter stories”.  
There are differences in how cultures react to light: i.e., the Chinese “light” = “wealth”.

### **12:30pm-1pm, "Public Lands and Night Skies"**

Carl Rountree (Director, National Landscape Conservation System, BLM)  
He is responsible for managing multiple use lands while conserving natural resources. Talked about "Landscapes at Night". In the past only thought about "landscapes by day". Policies have not addressed dark skies. Some local efforts have begun considering dark skies. Colorado Plateau Dark Sky Cooperative has been key to having collaborative effort. Have implemented best management practices for visual impacts. Have done nighttime lighting assessments. Seeing competition among nearby businesses as to who can reduce their lighting the most. (This competition idea was brought up many times at the Conference.) Working on partnerships with other Federal agencies, state and local governments, tribes, industry, etc. Updating visual management guidelines and policies. Improving training and inspiration.

### **Day 2, Session 3, "Exploring Issues and Options: Breakout sessions"**

#### **1:30pm-5pm, Discussion Groups**

- A - "Supply: Of the many available choices, encourage the development of efficient dark-sky preserving lighting, including improved LED"
- B - "Policy: Management, regulation, incentives"
- C - "Demand: Increasing public action and education, creating regional areas of demand"

I attended the Policy session. The following are just some of the thoughts there were expressed during the discussion:

- Pima County has a standing outdoor lighting committee that meets frequently, monitors lighting, and makes recommendations.
- Developed needs that must have tools to implement.
- Need more research on spectral power.
- Need statewide and federal policies, ordinances. IES BUG practice is a good starting point for standards.
- Need more info on life cycle costs.
- More partnerships and cooperation between enforcing jurisdictions.
- Successful policy must have buy-in and support.
- Incentives required.
- Education required.
- Value to Community.
- Enforcement.
- Flexibility can be applied but still follow intent of policies.
- Standards and metrics needed.
- Need approach to deal with private property rights while still compliant.
- Create political win-win scenarios.
- Economic benefits to businesses and communities.
- Choose to become dark-sky compliant before standards/codes are available.
- When does lighting become light pollution? Need a way to quantify that.
- Raise public awareness and develop PR plan.

Implementation tools (enforcement, incentives, plan review, etc). More research needed.

Suggested tools and techniques: Community values oriented education. PR plan. Reach out to youth. Use approach of "how light pollution mitigation benefits YOU not Me".

Research needed: economics, health, degrees of light pollution, city vs rural, funding needed.

Incentives: agencies could form citizen committees to acknowledge and reward good businesses/residents. Awards need not be monetary but can be plaques or other public acknowledgements. Public acknowledgements can result in increased business.

Enforcement needs to be consistent and simple (can you see the bulb?).

Standards: environmentally responsible lighting.

Have working group to determine determine what's out there and what's needed.

### **8pm-9:30pm, Field Trip”**

See installations of different types of lighting in Flagstaff

A bus took us to different locations around the City of Flagstaff to see various types of roadway lighting installations: old LPS (amber), newer white LED, and newest Filtered LED (FLED; narrowband amber). We saw first hand the lighting conditions each of these provided: glare, backlight, coverage. FLED was the best but expensive upfront. Also learned more about "day burners": businesses and individuals tend to leave lights on in the daytime because they forget to them off (or on), lights and switches fail due to cycling, or because no off switch was designed in. All of which are energy wasting and if not needed at night, can contribute to the light pollution problem.

### **Day 3, Session 3 Conclusion, "Plenary discussion - Presenting Recommendations"**

Prior to the start of day's session I met with Joanne Kendrick from the "Keep Sedona Beautiful" organization and the Chair of the Sedona Dark Skies Committee to go over how the Oracle State Park "International Dark Sky Park" nomination package was created. That will assist her in preparing the package for Red Rock State Park. I offered her my assistance as they proceed with Red Rock.

### **8:30am-10am, Group Reports, "Paths to Adoption of Emerging Technology"**

Supply Group report: did not know that Low Pressure Sodium (LPS) lighting has a shorter life (why was this a secret?). Many requirements based on outdated ways of doing things. More research needed. There is a mixed level of knowledge about issues and more knowledge is needed across sectors. Need to explore lighting options at different points of the spectrum (including multiple bands), need to better understand trade offs between lumens/watts & spectral bandwidth, more info needed on adaptive lighting advantages, costs must be considered. Include other interests in discussions (mining, freight hauling, rail, etc). Need to include lighting context in designs/implementation (eg, location, best choice available now, or what could be better eventually, don't use a short term solution as it will become permanent).

Policy Group report: public awareness (values of communities, real experiences with dark skies, education has a negative connotation, listen more than talk, PR plan, finding advocates, conferences/meetings, more advocacy from federal government, youth programs). Research (safety, economics, need more data from smaller communities, is color rendition important?, sociology, costs of compliance, property values, does dark skies bring in new business, need better definition of light pollution, funding, ecological). Implementation (incentives for extraordinary performance, competition for best or least lighting, committee identifies these and publishes list and presents certificates, enforcement should simple and consistent, can you see

the bulb, what are you trying to achieve, don't pick on just one light but do entire neighborhood). Standards/policy (lighting: where/when to apply, statewide difficult but needed, outlined plan to pursue, need seamless zones across state boundaries on Colorado Plateau).

Demand Group report: obstacles (not everyone has the same idea of what's needed for dark skies, need to raise awareness about total problem not just astronomy, need code updating, goal is simple but solutions are complex, rebound effect as lighting getting cheaper they use more). Optimum ways to engage and educate (use nomenclature that avoids NIMBY "not in my backyard", relate to people's needs, let people experience natural darkness, mobilize youth, we have an "Earth Day" so why not an "Earth Night"). Stakeholders needs (children, medical community, creative artists/musicians connection to night sky, tourism, astro-tourism, wilderness night sky connection). Leadership (need to scale up IDA, International Year of Light event, Globe at Night, other groups like AMA, AARP, help people to communicate the message). Resources needed (apps for smartphones, use social media, studies, internships, and much more).

### **12:30pm-1pm, "Dark Skies and the IDA"**

Scott Kardel (Acting Executive Director, International Dark-Sky Association, IDA)

Talked about the mission of IDA: to have responsible lighting at night. Now has a new page of Artificial Light At Night (ALAN) research literature database. Briefed on International Dark Sky Places, some requirements and benefits. IDA can help Parks and Protected Areas with plans and implementations. Use appropriate amount of light, not just more light. In UK, lighting efficiency doubled 1950-2000, but amount of lighting per capita increased fourfold (not good).

### **Day 3, Session 4, 1:30am-5:30pm, "Plenary discussion - Taking Action"**

#### **Objective 1, "Supply: Of the many available choices, encourage the development of efficient dark-sky preserving lighting, including improved LED"**

Lighting Zones: the IES BUG system does not address all concerns. Narrowband LED (NBALD) seems to be the desirable solutions with appropriate shielding and brightness. Is light pollution credits sharing a worthwhile concept? Current good lighting policies (Pima County, Flagstaff, Model Lighting Ordinance) are good, but improvements are needed to lower overall light pollution. Need pamphlets for individual homeowners, business owners, school administration to show what they could do to minimize impacts; show how to avoid light trespass on your neighbor's property, how to limit your light to exactly where you need it (a pathway), and when to limit use (time in operation).

#### **Objective 2, "Policy: Management, regulation, incentives"**

Lighting industry has been growing at 6% per year. Near-term goal needs to keep overall lighting at current levels or lower. Need to show cross discipline benefits (health, economics, etc). Research priorities: health, safety, economics. Need a broadly accepted definition of light pollution. Need to partner with Home & Garden shows and magazines; great opportunity for reaching a large segment of the public. Might be better to change terminology from "dark sky friendly lighting" to "environmentally responsible lighting" or "quality lighting". Need to phrase message as a "positive" outcome. Need local lighting dealers education on dark sky awareness to advise their John Q Public customers.

**Objective 3, "Demand: Increasing public action and education, creating regional areas of demand"**

Need a "Coalition for Responsible Lighting". Tie into UNESCO Year of Light. Based on this conference would prepare a draft document for the Coalition, send to all attendees, and have a convening conference call. Have a publicly available web site with all the info. Arizona Optics Industry Association ([www.aoia.org](http://www.aoia.org)) includes a broad base of 300 companies and institutions in Tucson, Phoenix, and other cities. (Could be an excellent consulting resource for Arizona State Parks.)

5:30pm-6pm, Wrap-up

Flagstaff was proud to host this event to showcase their 50 years of being a leading community in dark sky preservation. Dark skies, sustainability, and safety are three values totally endorsed by residents and businesses in Flagstaff. They have succeeded in finding the "sweet spot" that meets all three values.

My perspective: This was a valuable and incredibly successful conference. The technical aspects of lighting, the issues, and the various solutions discussed were very applicable to all attendees. As a result of my attending I can now bring current insights to Arizona State Parks for incorporation into a system-wide Lighting Plan update and to individual Parks as they pursue "International Dark Sky Park" status. In addition to the conference content, I also made connections with many like-minded people. In fact, many of them approached me to learn more about what we are doing and how we can form partnerships to facilitate all our efforts.



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