Activities from the Dark Skies Rangers and Globe at Night Programs

Connie Walker

National Optical Astronomy Observatory (NOAO)
Our Stellar Constellations are becoming Urban Constellations
How to bring awareness & a desire to slow down the increase in light pollution?

(Cinzano, Falchi, and Elvidge 2001)
Los Angeles in 1908 & 1988, as seen from Mt. Wilson Observatory
With Light Pollution & Without
Light Pollution affects...

Energy, Safety & Cost

Astronomical Research

Human Health

Wildlife
Examples of Good & Bad Lighting and How Many Stars You Can See
Dark Skies Rangers Activities
www.globeatnight.org/dsr/

Explorer

Protector

Advocate

Ranger
Activities include
Light Shielding Demo
The Light Shielding Demo

Simulates a night time scene using
The Light Shielding Demo
Unshielded and Shielded Lighting
3 Types of Light Pollution

- Glare
  - Too much background light
  - Reduces visibility

- Light Trespass
  - Light spills into an area where it is unneeded and/or unwanted

- Sky Glow
  - Upward directed light reflects off of particles in the sky reducing visibility of stars
By Using Shielded Fixtures

You...

And therefore...
Sequenced Activities

Spectra of Lights

- Use the diffraction gratings & spectroscopes to examine different types of lights.
- Discuss the similarities and differences found.

School Outdoor Lighting Audit

- An activity to audit the outdoor lighting around a school building to evaluate the energy efficiency & provide better solutions.

Compact Fluorescent and Halogen
Spectra of Lights
<table>
<thead>
<tr>
<th></th>
<th>Incandescent Bulb</th>
<th>CFL Bulb</th>
<th>LED Bulb</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wattage</td>
<td>40 W</td>
<td>9 W</td>
<td>7 W</td>
</tr>
<tr>
<td>Lumens</td>
<td>550 lumens</td>
<td>550 lumens</td>
<td>400 lumens</td>
</tr>
<tr>
<td>Lumens/Watt (Efficacy)</td>
<td>14 lm/W</td>
<td>61 lm/W</td>
<td>57 lm/W</td>
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</tbody>
</table>
Light Sources

Spectra of five common lighting sources

- Metal Halide
- Light Emitting Diode
- Incandescent
- High Pressure Sodium
- Low Pressure Sodium

Wavelength (nanometers): 400 - 650
LAMPS and FIXTURES
Types of Lamps

- Incandescent
- Fluorescent
- Light Emitting Diode (LED)
- High Intensity Discharge
High Intensity Discharge Lights

Including:
Types of Luminaires

Column mounted fittings:

Wall mounted lanterns:

Lighting bollards:

Recessed fittings:
EXAMPLES OF GOOD AND BAD LIGHTING
EXAMPLES OF GOOD AND BAD LIGHTING
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EXAMPLES OF GOOD AND BAD LIGHTING
EXAMPLES OF GOOD AND BAD LIGHTING
Prior Floodlighting

Credit: Monrad Engineering, Inc. & Musco Lighting
After Green Generation Lighting®

Credit: Monrad Engineering, Inc. & Musco Lighting
EXAMPLES OF GOOD AND BAD LIGHTING
School Outdoor Lighting Audit
School Outdoor Lighting Audit

- Targeted at secondary school students
- Encourages students to monitor lights in their schools and neighborhoods
- Students learn about:
  - Lighting design
  - Energy consumption
  - Environmental issues
- Gives students the tools needed to take action to help improve lighting design
Outdoor Lighting Audit

Data Gathering and Observation

- Students choose an area of campus or a neighborhood
- Inventory the lights
- Identify types of light, shielding (if any) and illumination area

Calculating the Energy Used, etc

Graphing the Energy Used, etc

Planning a New Lighting Plan

- Include Photos of Spectra (taken with camera & diffraction grating)
"The Night You Hatched" and "Do They See the Light?"
Wildlife Activity

“The Night You Hatched”
Children explore the impact of light pollution on sea turtles and other wildlife.
"Constellation at Your Fingertips" and "Magnitude Readers"
Preparing for Globe at Night

“Constellation at Your Fingertips”
An activity with glow-in-the-dark puffy paints on transparencies (& a UV light) to visualize the constellation, Orion (or Cygnus), at night.

“How Light Pollution Affects the Stars” (Magnitude Reader)
An activity on how many stars are lost due to light pollution, and the concept of stellar magnitudes and limiting magnitudes.
Globe at Night
Globe at Night
http://www.globeatnight.org
Citizen-scientists record the brightness of the night sky by visually matching the appearance of a constellation like Orion with star maps of progressively fainter stars or using meters to obtain more precise measurements.

Measurements are reported on-line and resulting maps of all worldwide observations are created.

Over the last 8 years of 10-day GLOBE at Night campaigns, close to 100,000 measurements have been contributed from over 115 countries.

Globe at Night
http://www.globeatnight.org
Steps to Observe (unaided eye observations)
http://www.globeatnight.org/observe.html

Step #1.

Step #2

Step #3.

Step #4.

Step #5.
Match Night Sky to a Magnitude Chart.

Estimate cloud coverage.

Fill out the observation sheet.
Simple Report Form

Measurements
- downloadable
- in various formats
- for use with Google Earth
- can be the basis of research
- can be used for classroom or science fair projects
- can inform development of public policy
GLOBE AT NIGHT
Citizen Science Campaign
To Measure Night Sky Brightness

2014 campaign dates:

January 20 - 29, 2014
February 19 - 28, 2014
March 21 - 30, 2014
April 20 - 29, 2014
May 19 - 28, 2014

globeatnight.org
To collect lots of Globe at Night data more efficiently, Tucson participates in “Adopting a Street”.
Projects Done by Students

Elementary & middle school students near South Bend, IN
Research Experiences for Undergraduates Program

Preference of Lesser Long-Nosed bats to avoid Tucson city center.
Projects

Students can

- Compare data over time (changes, trends)
- Compare data on population density
- Use in a lighting survey
- Search for dark sky oases
- Monitor ordinance compliance
- Study affects of light pollution on animals or plants
- Study affects on human health
- Study affects on safety, security, energy consumption, cost

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