

Saving Dark Skies

One Light at a Time

Lake Frederick Conservation Club

RLEP

2 October 2023

Presentation Overview

- Who is RLEP?
- What is a 'dark sky'?
- Why are dark skies important?
- Light pollution impact on wildlife
- What is RLEP doing about it in Rappahannock County?
- How to save dark skies one light at a time
- 5 principles of responsible outdoor lighting
- Examples of positive change
- What can you do?



Who is RLEP?

- **Rappahannock League for Environmental Protection**
- Mission: RLEP is dedicated to preserving the natural resources and rural character of Rappahannock County
- Formed in 1970 to challenge Potomac Edison's plans to erect huge towers for high voltage transmission lines
- Region's longest-serving conservation group
- Continues to challenge threats to our rural community
- Conducts forums on environmental issues in the county
- Creates educational opportunities for county youth
- Provides input to the County's Comprehensive Plan
- Promotes community involvement and collaboration

9
Inner City sky

7
Suburban/urban
transition

5
Suburban sky

3
Rural sky

1
Excellent dark
sky site

What is a Dark Sky?

Altair

Rasalhague

IC 33

IC 4665
Cebalrai

Sabik

Jupiter

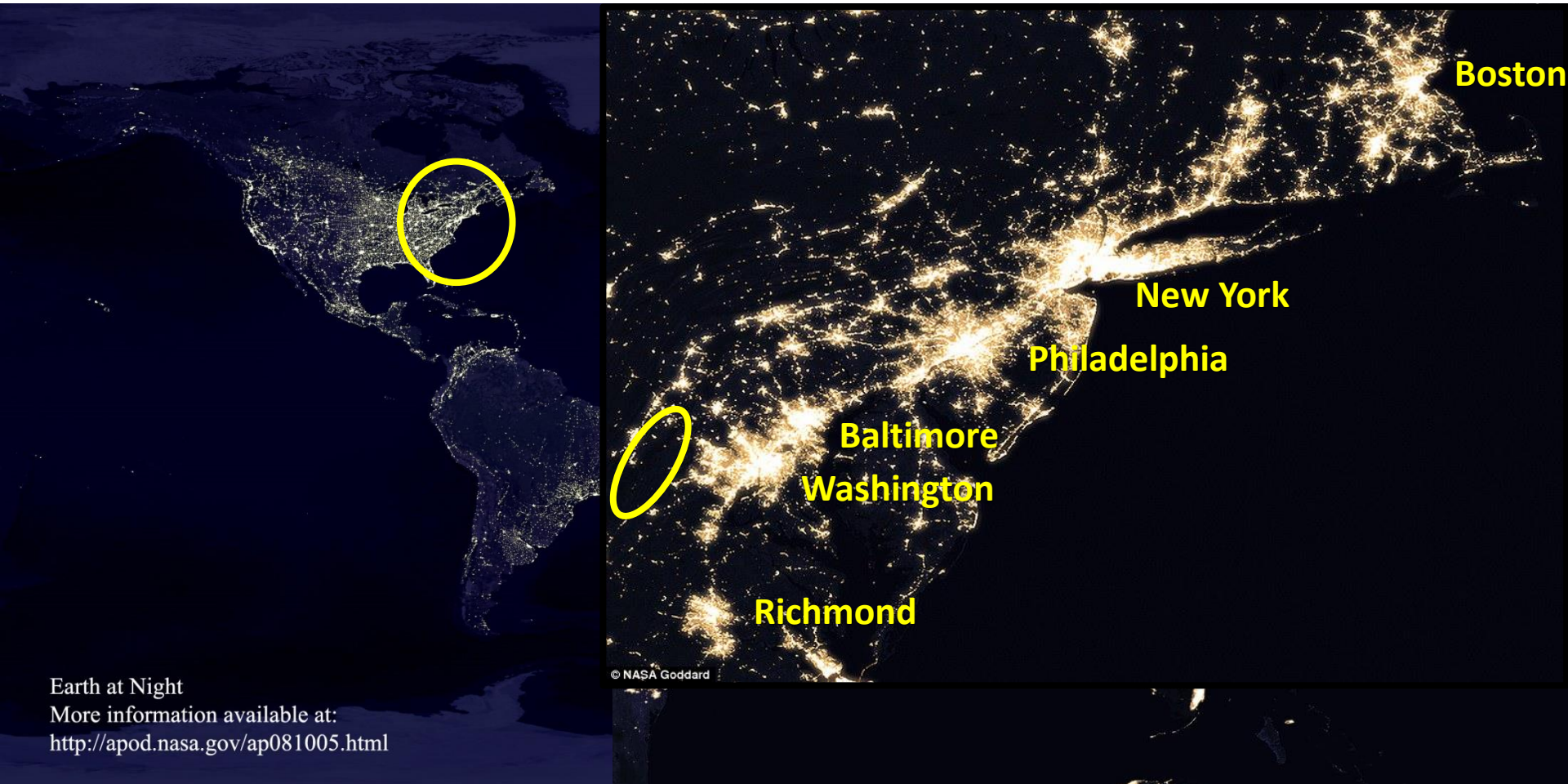
Nunki

NGC 6530

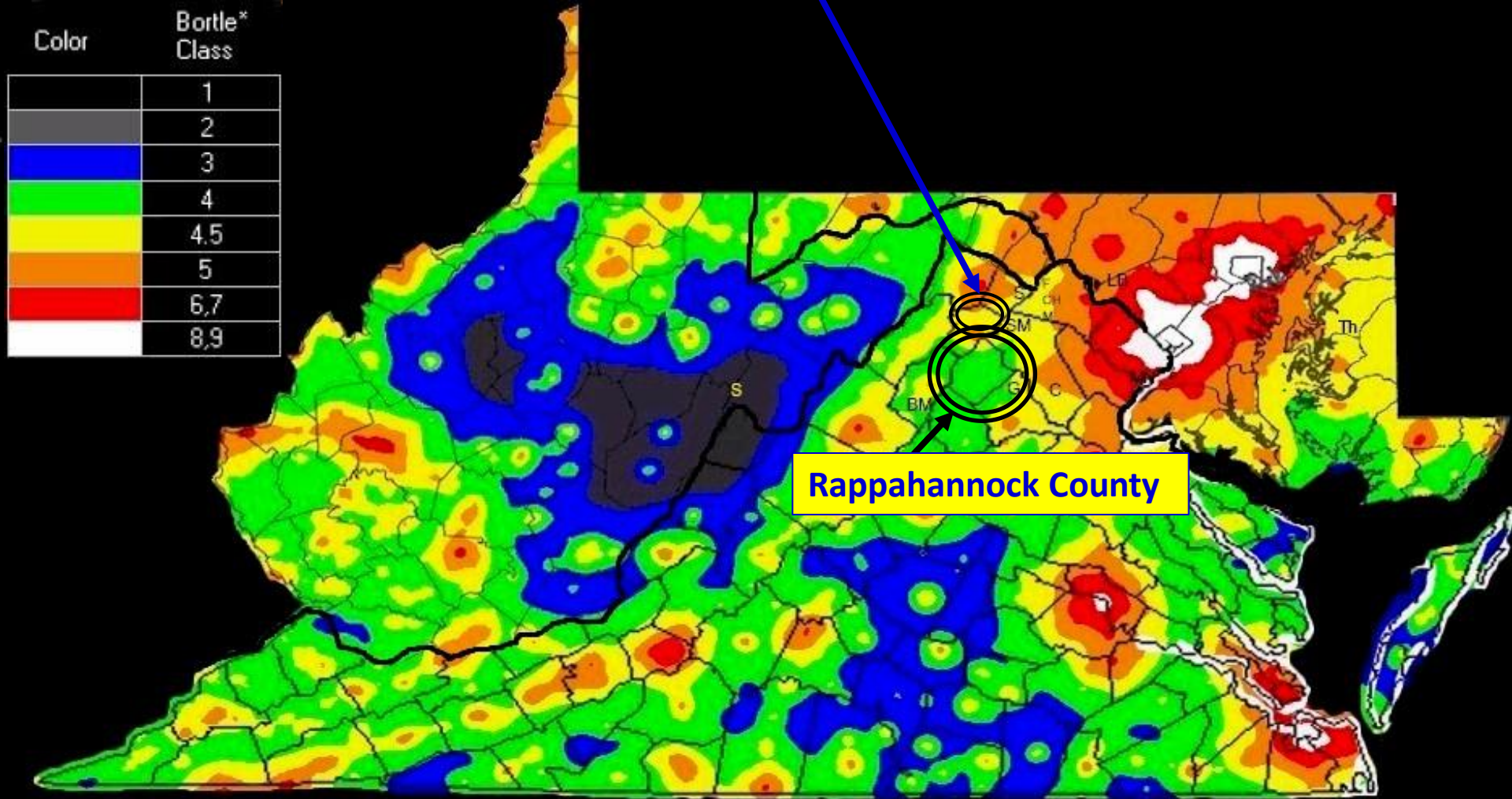
Edia

Where is the Dark Sky?

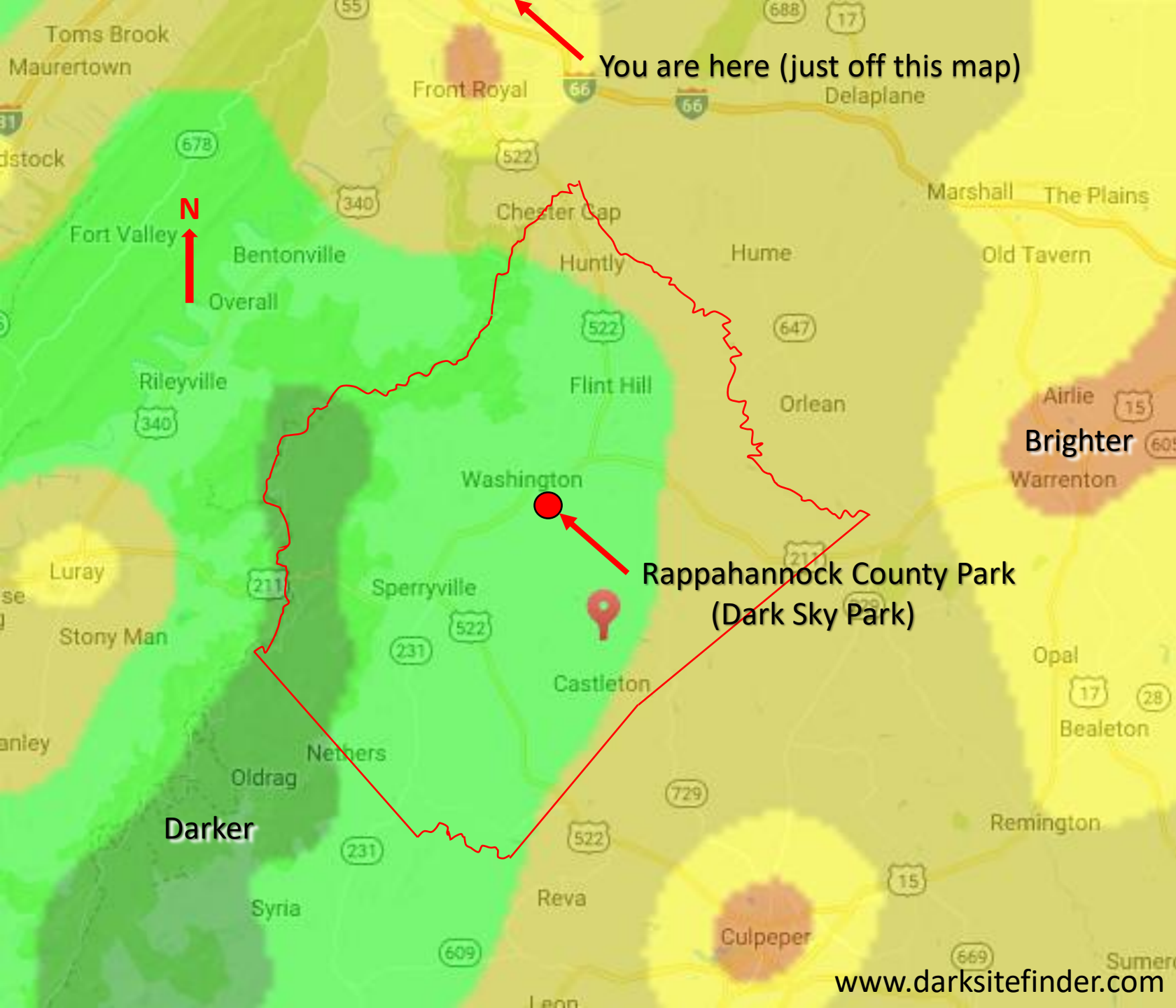
(80% of Americans can't see the Milky Way anymore – National Geographic)



Where Are You?



**2019 Light Pollution Map with Rappahannock County Highlighted
(dark, but not as dark as parts of West Virginia)**



Dark Skies Map of Rapp. County

2023

Winchester



Front Royal

Front Royal

You are here

Woodstock

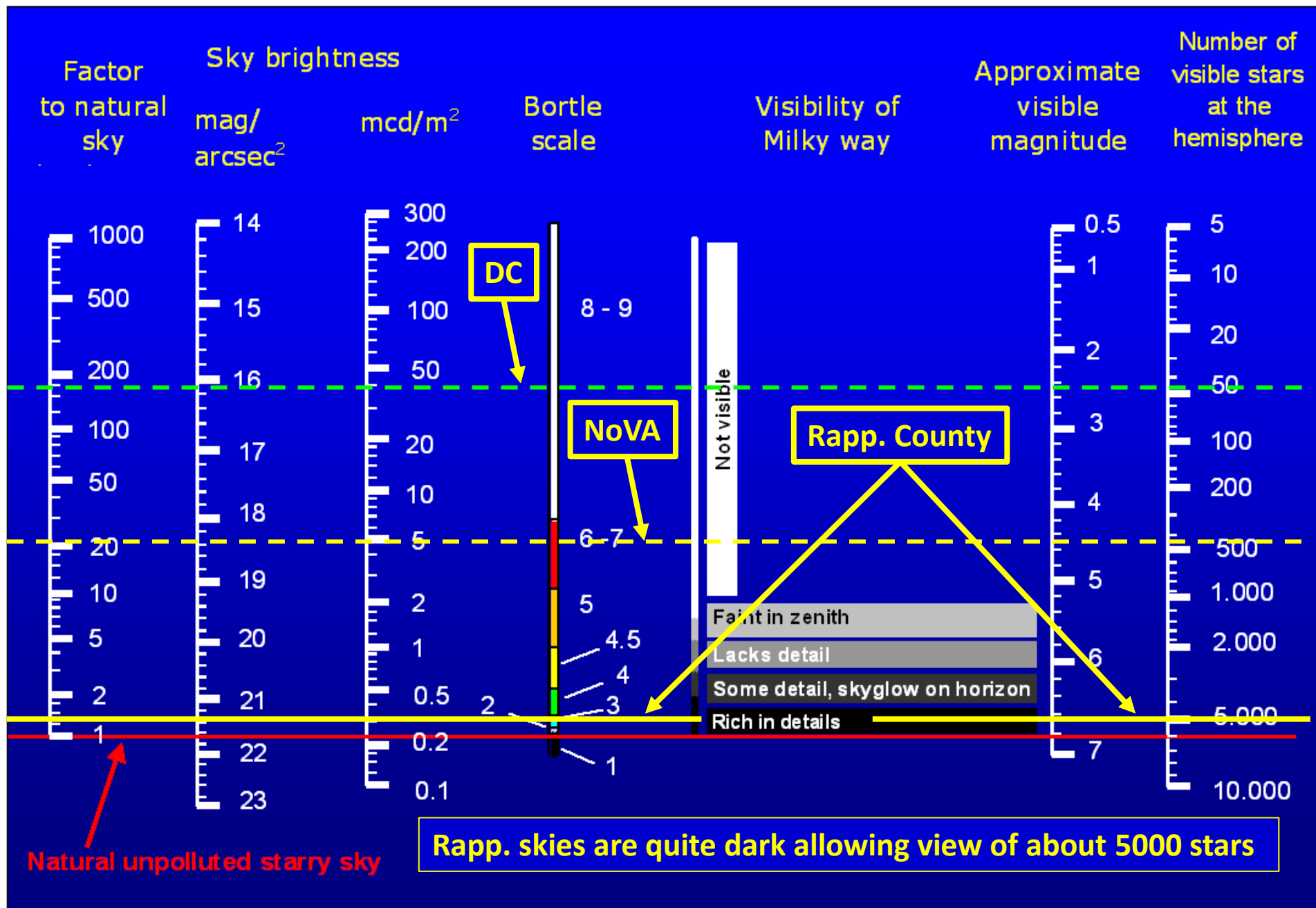
Luray

Warrenton

Harrisonburg

Culpeper

Harrisonburg





Skies as seen from the Rappahannock County Park

Sept. 16, 2017

Washington, VA

(courtesy of Joyce Harman)

Front Royal



Skyglow being generated from Kitchen side of Ira Needles megamall by intense LED parking lot lights left on all night (ground reflection).



Sky Glow



Impairs



Viewing



Stars







Torney Van Acker

Why Are Dark Skies Important?

- Fosters curiosity about the universe around us
- Reduces need to generate electric power
- Saves money at the personal and national level
- Reduces crime
- Improves human health
- Reduces impact of light on wildlife
 - Foraging
 - Reproduction
 - Predators
 - Migration
 - Food chain effects

Impact on Wildlife

- Fireflies - Bright lights
 - Decrease their activity
 - Make it harder for them to find mates
 - Make it easier for predators to find them
- Bird Migration
 - One-fourth have disappeared since 1970
 - Rest and feed during day, fly at night, navigation helped by natural light from sky and horizon
 - Lights may also attract them away from normal migration route
 - Waste of energy → lower chance of getting to breeding areas
 - 1 million birds die daily from window collisions, more than half of these at night disoriented by lights
 - May 19, 2023: 878,600 birds over Rappahannock, heading north (birdcast.info)
 - “Lights Out” programs implemented in selected cities

Impact on Wildlife

- Sea turtle hatchlings
 - Normally head for the bright horizon over the ocean
 - Unless they see brighter lights on land and go wrong way
- American toads
 - Streetlights attract more insects and toads, death by cars
 - Juveniles more active under lights, but grow more slowly, delaying maturity and reproduction
 - Adults less active in artificial light – disoriented?
 - Harder to find breeding ponds
- Salamanders
 - Decreased activity, feed less, probably grow more slowly

Impact on Wildlife

- Bats

- Some bats avoid lights — fear of predators like owls?
- Lights may interfere with their movement corridors
- Lights may interfere with perception of nightfall and delay nightly feeding forays
- Some species are attracted to the insects around the lights

- Other mammals

- Mice seem to avoid lights or show decreased activity levels
- Omnivores (raccoons, opossums) show 20% less activity in lighted areas of Chicago
- Bright lights reduce coyote howling but may increase activity
- Bears and coyotes may habituate to brighter lights

- Plants

- Appears to affect seasonal rhythms of plants/trees (complex)

RLEP Action Plan for Dark Skies

“... dedicated to preserving the natural resources ...”

- • Protect Rappahannock’s night skies by encouraging citizens to voluntarily reduce their use of artificial outside light at night
- • Offer citizens free outdoor lighting replacements with shielded dark sky friendly lighting fixtures
- • Work with Rappahannock Electric Cooperative to offer free leased light replacement to members
- • Obtain a “Dark Skies Park” designation from the International Dark-Sky Association (IDA) for the Rappahannock County Park
- • Distribute “Saving Dark Skies” brochures/inserts



Brightness

How to Save

Necessary?

Dark Skies

Shielding

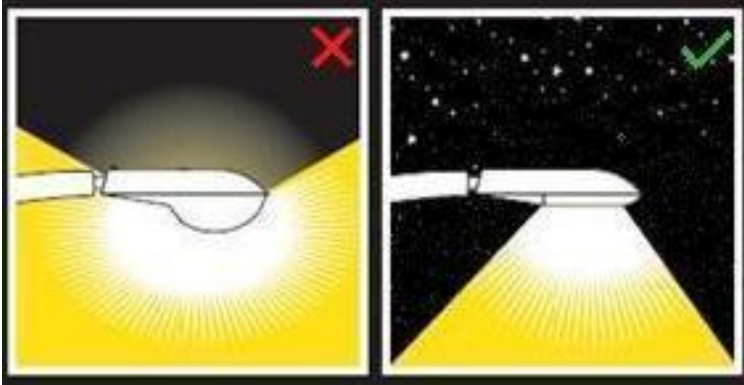
One Light at a

Color

Time

Controls

Fully Shielded Lighting: Targeted, Efficient, Safe

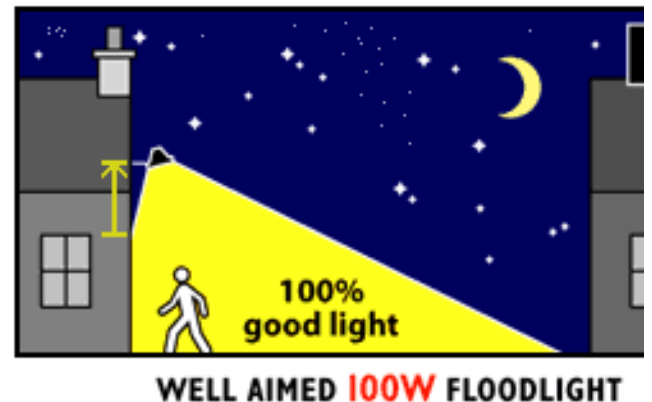


No light above the horizontal
Reduces sky glow, see stars
Reduces light trespass and glare

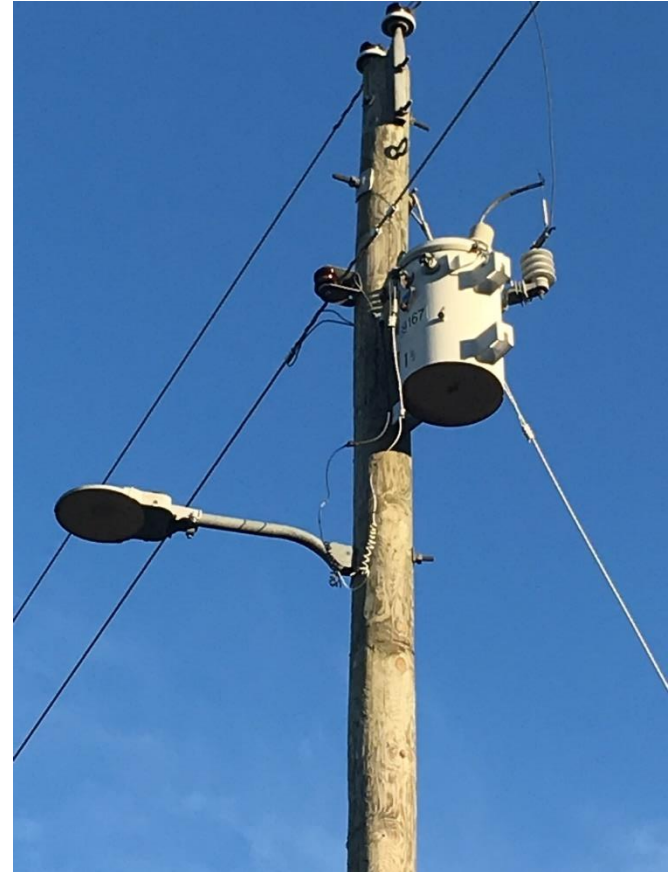
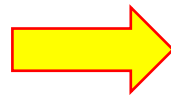


Directs light power to desired areas
Better coverage for safety, security
Allows lower wattage lighting (\$\$)

\$3B/year (\$10 each) in the US is going directly into the nighttime sky via unshielded outdoor lights - IDA

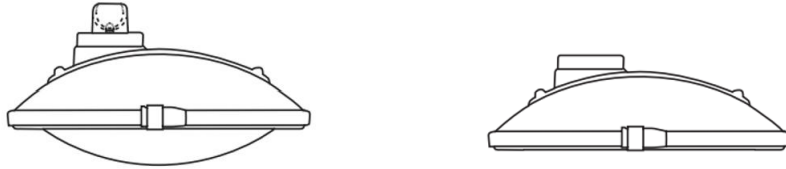


Unshielded vs. Fully Shielded Fixtures

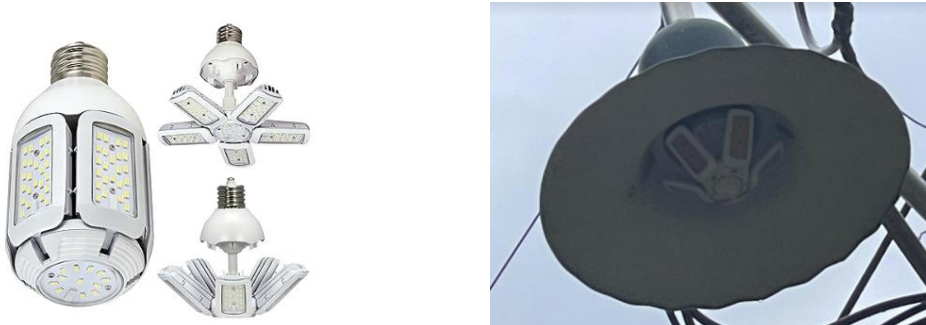


Typical Design Concerns

- Teardrop or dome lens below edge of shield vs. flat



- Petal LEDs incorrectly oriented



- Excessively high poles or higher than neighbor



How Shielded Lighting Reduces Glare

- The image below is a test site for fully-shielded street lights.
- At right; the same lights shown in comparison to the existing unshielded lights.



IDA in Partnership with NOAO, NSF and IYA
Dark Skies Awareness



Unshielded lights can cause driver night blindness



Joyce Harman

Journal of Epidemiology and Community Health (2015):
Street lights don't prevent accidents or crime, but do cost a lot of money

BRIGHTER Does NOT Mean “Safer”



Glare from bright lights creates shadows where intruders can hide.



“We can have very little confidence that improved lighting prevents crime.”

— National Institute of Justice

Visibility Should Be The Goal



Lighting at the
Front Door

Get the Light
Right



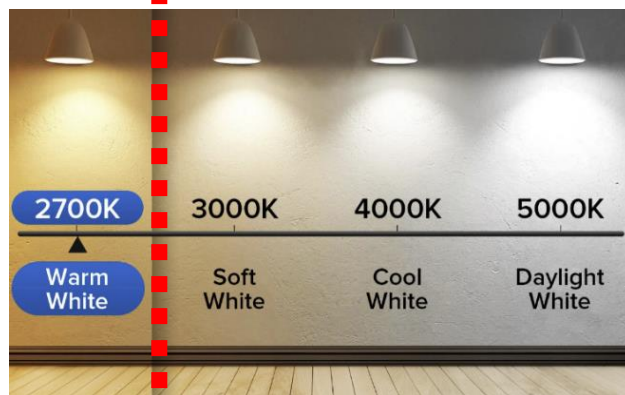
Light Color is Important: 3000K or Less is Best



Why Light Color is Important

- Bright white lights contain a high proportion of blue light that makes it difficult for the eyes to focus
 - Shorter wavelength, light scatters inside eyes
 - Eyestrain and loss of night vision (disability glare)
 - Aging eyes especially vulnerable
- Bright white light from unshielded lights can affect the human circadian (24-hour) rhythm
 - Leads to no dark downtime
 - Disrupts brain wave patterns, hormone (melatonin) production and cell regulation
 - Can lead to insomnia, depression, cancer, diabetes and cardio-vascular disease
- Causes disoriented animal behavior
 - Foraging habits, reproduction, vulnerability to predators

Light Color Comparisons



Lighting Controls Can Reduce Impacts

- Diffuser lens
 - Reduce point source glare
- Photo sensors
 - Activate at dusk, turn off at dawn
- Motion detectors
 - Activates lighting on demand for a preset duration
- Timers
 - Hardwired (part of power circuit)
 - Programmable (configure as required)
- Dimmers
 - Hardwired controls (requires additional wiring circuit)
 - Programmable (configure as required)
- Scheduling
 - Set light intensity for specified blocks of time
 - Available on selected programmable light fixtures

5 Principles of Responsible Lighting

- **Useful** → All light should have a clear purpose
 - Is it really needed, consider the light's impact
- **Targeted** → Only direct light where it is needed
 - Use shielding and careful aiming of light footprint
- **Intensity** → No brighter than necessary
 - Use lowest lighting level required, employ diffusers
 - Be mindful of surface reflectivity throwing light upwards
- **Color** → Select warmer color light spectrum
 - Limit blue light component by selecting 2700K or less
- **Controlled** → Use light only when useful
 - Photo sensors to activate night time use
 - Motion detectors to trigger illumination for security lighting
 - Timers or programming to set lighting schedule
 - On/off switch

“Dark Sky” Does Not Mean “Dark Ground”



Before

Get the Light Right



After

“Dark Sky” Does Not Mean “Dark Ground”

Before

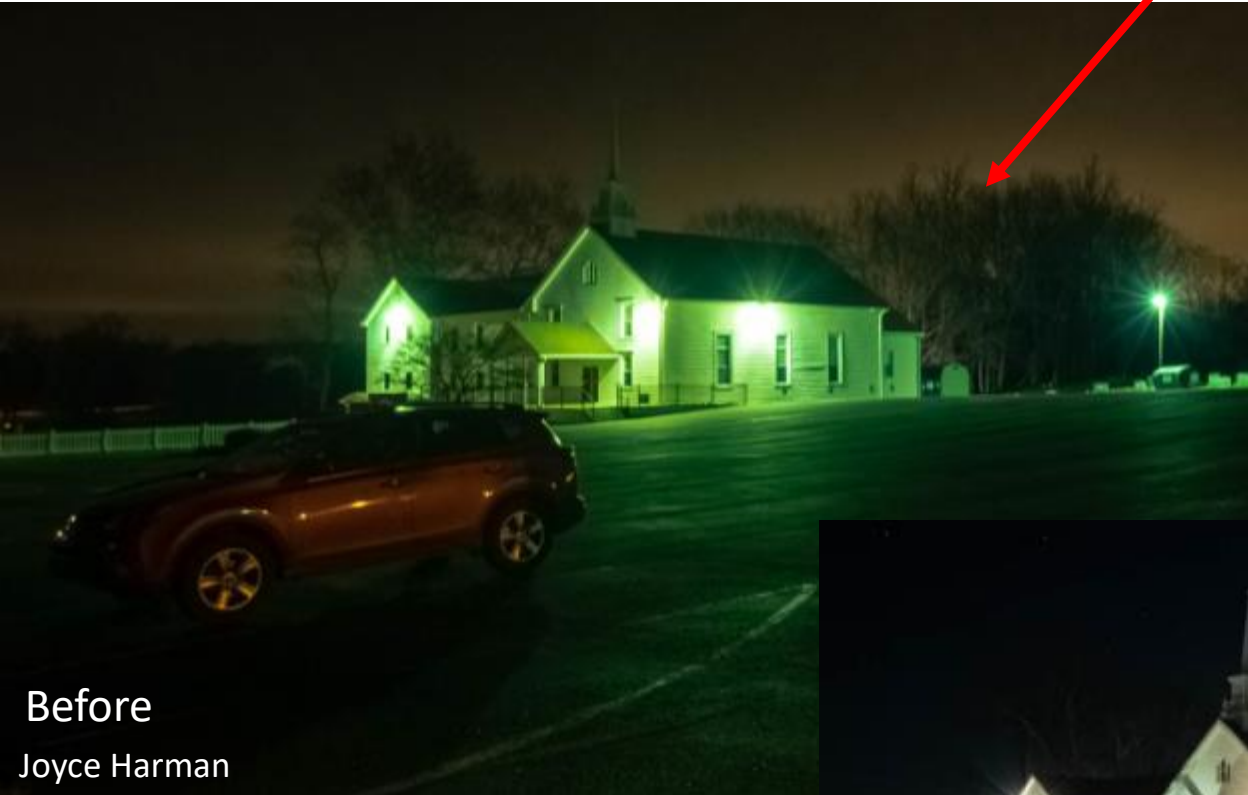


“Dark Sky” Does Not Mean “Dark Ground”

Before



Local Church Lighting Before and After



Before
Joyce Harman

Note reduction of
lighting on
surrounding trees



After
Joyce Harman

Local Library Lighting Before and After



What Things Can You Do?

- Limit outdoor lighting to only what is “necessary”
- Install lighting fixtures meeting the criteria established by Dark-Sky International
 - Fully-downshielded (no light above the horizontal)
 - Soft light color (3000K or lower – 2700K preferred)
 - Select wattage according to what is “necessary”
- Consider addition of timers or motion sensors
- Contact the electric company and request all new outdoor street lighting be dark-sky friendly
- Work with authorities on local lighting policies
- Enjoy the Milky Way, meteor showers and fireflies