



Broward County  
Environmental Planning  
and Community  
Resilience Division

# *Welcome*

## Sustainability Stewards Workshop

### Night Friendly Lighting

Oct 11, 2017



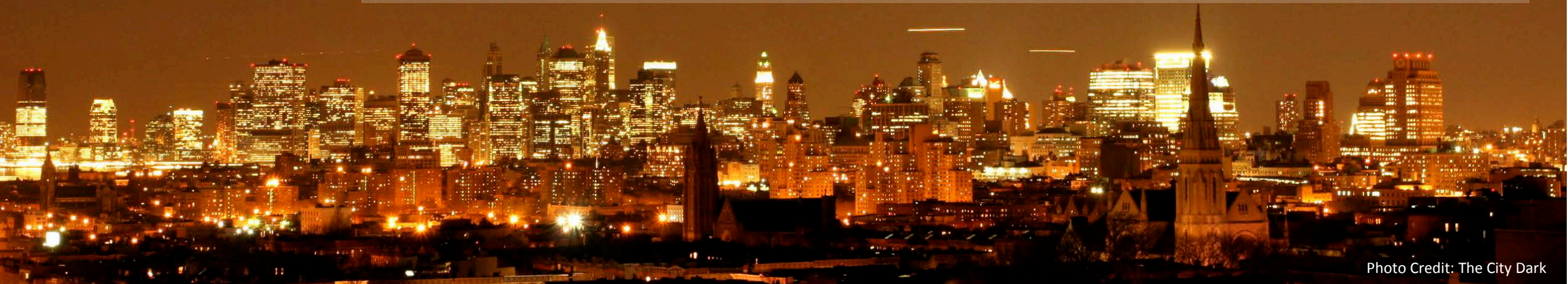
Photo Credit:  
The City Dark





# Agenda

- 1 pm Check in
- 1:15 **Welcome**
- 1:20 Brief history of lighting regulation on coasts
- 1:30 **Why it matters beyond turtles: energy, human health, GHG, safety, costs**
- 1: 50 FDOT Lighting Criteria
- 2:05 **Break & education trunk demonstration**
- 2:15 Collier County case study
- 2:30 **Panel of local lighting ordinances (process, pushback, lessons learned)**
- 2:50 What to look for in an ideal ordinance
- 3:00 **Break out groups: Compare codes, find exemplary model language**
- 3:40 Monitoring & next steps: Maps, STAR guidelines, and new Light Quality Meters
- 4 pm **Adjourn**







# Where we have been...

2015 = *We began to educate the public and create a dialogue with local planners, architects, recreation managers, and others*

SSB Movie Night with IDA and BAPA

2016 = *Development of technical resources and a policy framework*

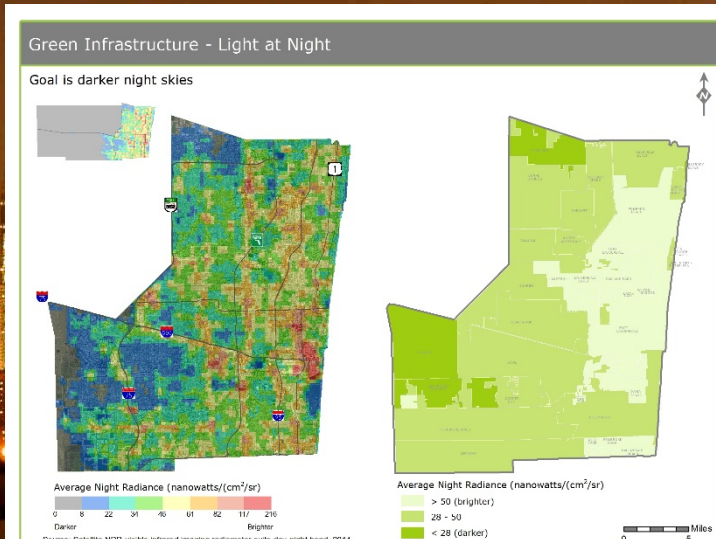
Incorporation of Night-friendly skies in the Green Infrastructure Map Series

Inclusion of Night-friendly skies in the County Land Use Plan through Broward NEXT

**An Inspiring Movie Night among Stars and Fireflies**

*This event is free and open to the public, thanks to the generosity of the sponsors:*

Broward APA  
 Anne Kolb Nature Center  
 Broward County Environmental Planning and Community Resilience Division  
 International Dark-Sky Association  
 Point of View (POV)  
 Zoological Lighting Institute



**BROWARD COUNTY LAND USE PLAN 2016**

**TEXT AMENDMENT PCT 16-9**

**SECTION 3: RECOMMENDED PRACTICES**

**NEW POLICY 3.6.8** Local land use elements and development codes should include design guidelines to promote use of light only where needed thereby limiting excess light and reducing glare and to create a safe and pedestrian scaled lit environment, utilizing Night Friendly Lighting or Dark Sky principles outlined in the Model Lighting Ordinance by International Dark-Sky Association and the Illuminating Engineering Society of North America, or other local resources, for the purpose of creating appropriate outdoor lighting standards that reduce energy use, increase public safety, and protect human health and wildlife.





## Where we are going...

County-wide Light Quality Monitoring Program  
Broward County Natural Night Sky Ordinance  
Annual Dark Sky Camping Trip  
Integration with STAR assessment  
Youth Engagement and Citizen Science  
Collaborative approach to non-jurisdictional issues

*Broward's Inaugural*  
**Camping Under the Stars**  
March 25<sup>th</sup>, 2017

**Sustainability Stewards of Broward. Join us for our first Camping Trip!**  
This is a continuation of our Dark Sky initiative. Come with family & friends, and enjoy the Milky Way like you did as a kid. Join us for much needed inspiration in pursuit of policy to reduce light pollution. Big Cypress National Preserve celebrates their recent Dark Sky accreditation with an amazing [Astronomy Program](#). Last month they had over 400 attendees! Our group will also have a special meeting with park staff to discuss their inspiration (and lessons learned) from becoming first U.S. national preserve to earn [Dark Sky Park Accreditation](#).

Make your camping reservations at <https://www.recreation.gov>

(You can drive in just for the event, or stay the night. Many overnight options exist. Midway campground has electricity, Burnis Lake is only 8 minutes from the visitor center, and hotels and lodges are available in Everglades City, also only 8 minutes away.)

If you plan to come, please RSVP to [jherwitz@broward.org](mailto:jherwitz@broward.org)

While overnight accommodations will be made individually, there will be optional groups activities arranged that you may want to participate in. A phone/email list will keep us all up to date prior to the trip, and connected throughout the weekend.

*Looking forward to stargazing together! All*

**Proud Certified**  
**4-STAR Community**  
Sustainable Environment • Strong Economy • Vibrant Community

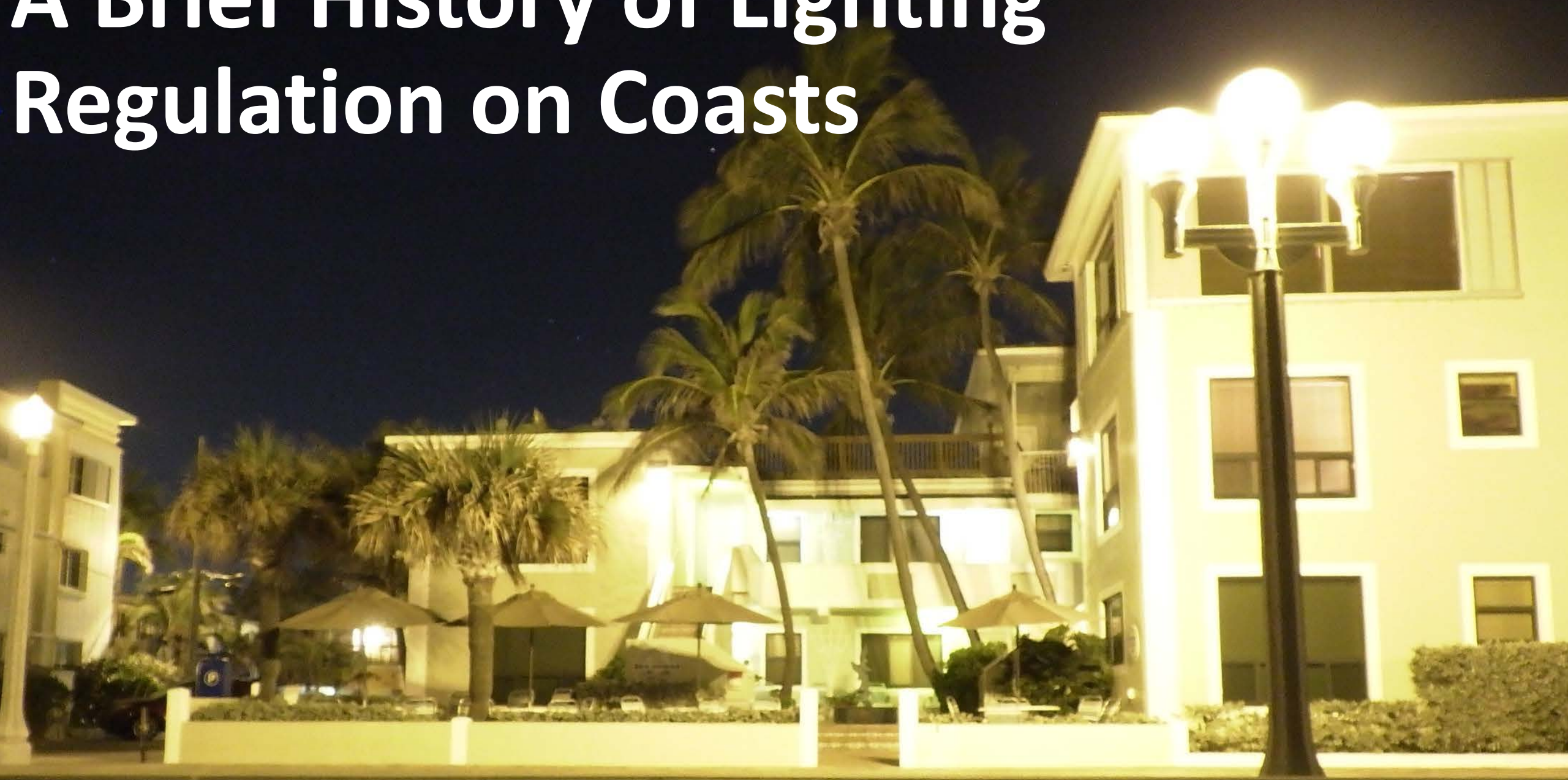
Recognized for National Excellence in Sustainability  
[4-STAR.Broward.org](http://4-STAR.Broward.org)



Photo Credit:  
The City Dark



# A Brief History of Lighting Regulation on Coasts



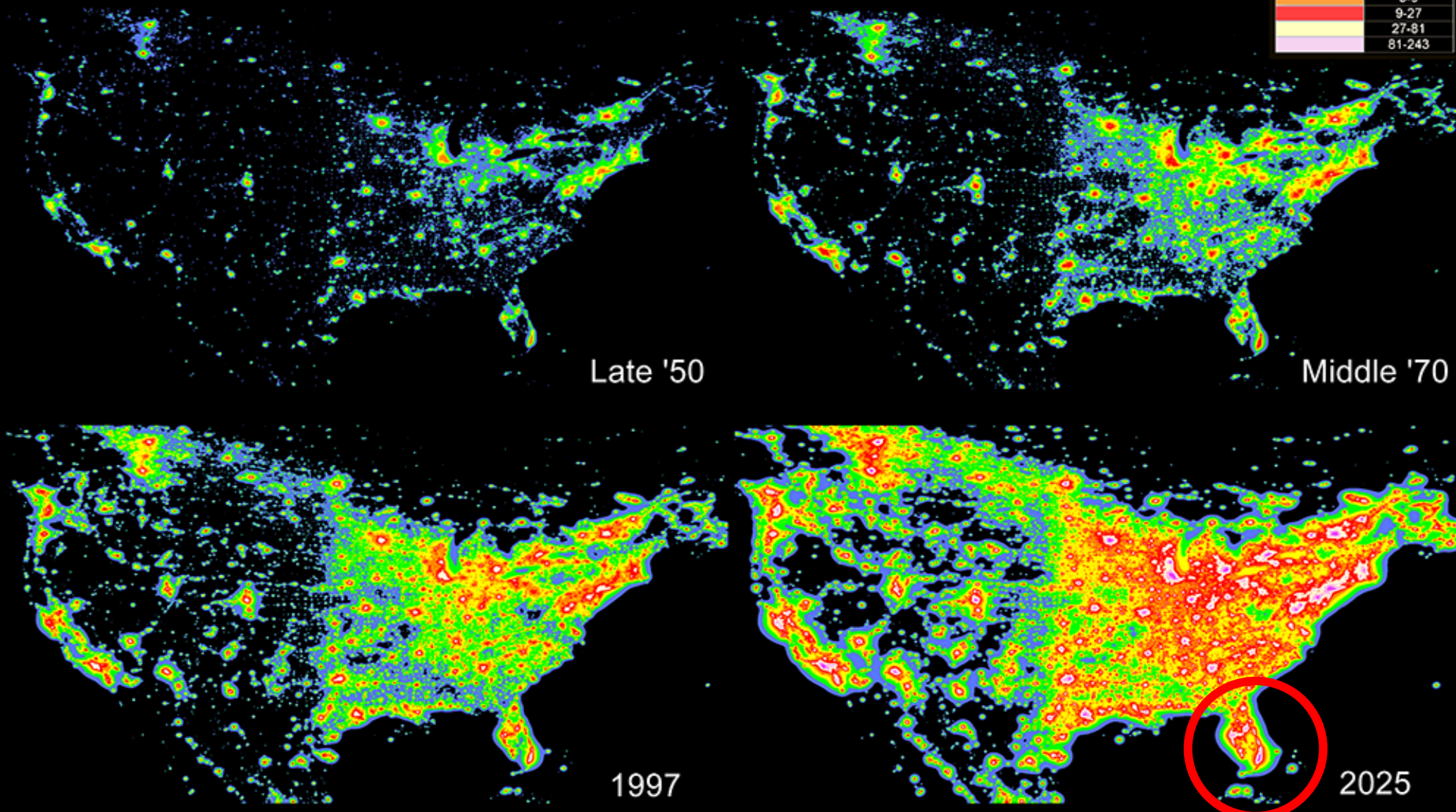


# Artificial Night Sky Brightness due to Light Pollution in North America

## A preliminary picture of the growth from 1950 to 2025

Artificial night sky brightness at zenith, at sea level, for standard clean atmosphere as fraction of the average natural night sky brightness

Blue	<11%
Light Blue	11%-33%
Green	33%-100%
Yellow	1-3
Orange	3-9
Red	9-27
Light Purple	27-81
Dark Purple	81-243







Lake Okeechobee

West Palm Beach

Cape Coral

Sanibel Island

Fort Lauderdale

Miami

Virginia Key

Everglades National Park

Biscayne National Park

Homestead

Image © 2013 TerraMetrics  
Data SIO, NOAA, U.S. Navy, NGA, GEBCO  
© 2013 Google

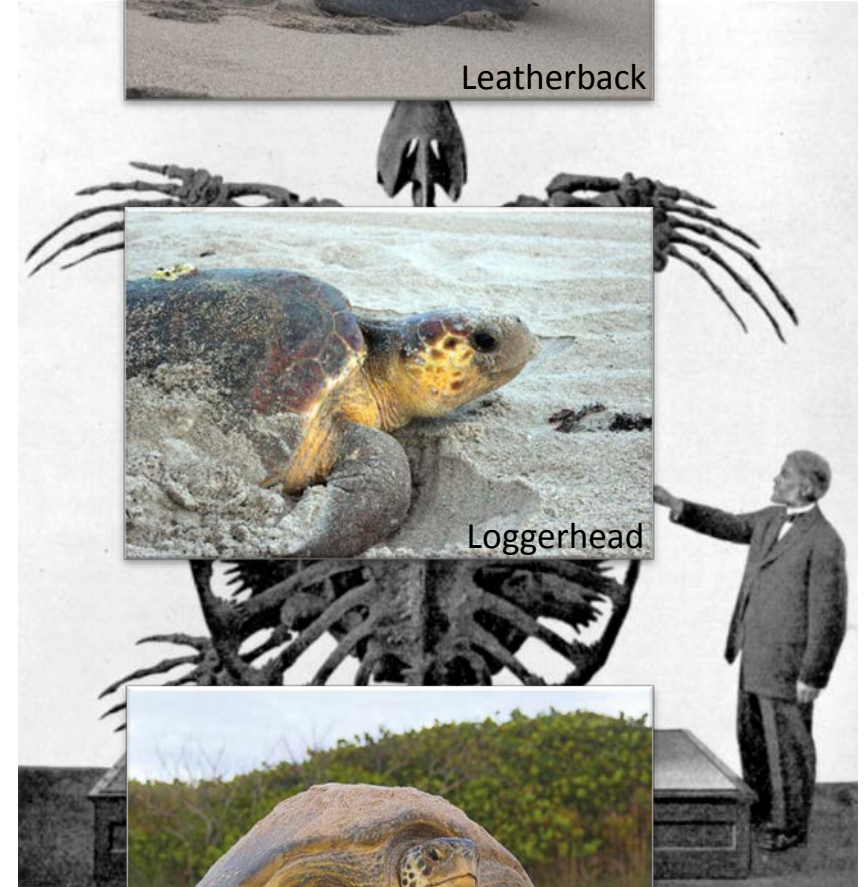
Google earth

26°07'07.50" N 80°33'01.28" W elev 7 ft eye alt 190.16 mi



# Sea Turtle Biology Basics

- Large marine reptiles
  - Breathe air
  - Lay eggs on land (sandy beach)
    - Up to 8 clutches per season, 100 eggs in each
- “Living dinosaurs”
- Seven species of sea turtle worldwide
  - Five utilize Florida’s waters → foraging, migrating
  - Three utilize Florida’s beaches → nesting
    - Leatherbacks, loggerheads, green turtles
    - Season spans March 1 – October 31 annually





# Sea-finding: Then and Now



100 million years ago



Present day

# Artificial Lighting: Impacts to Sea Turtles





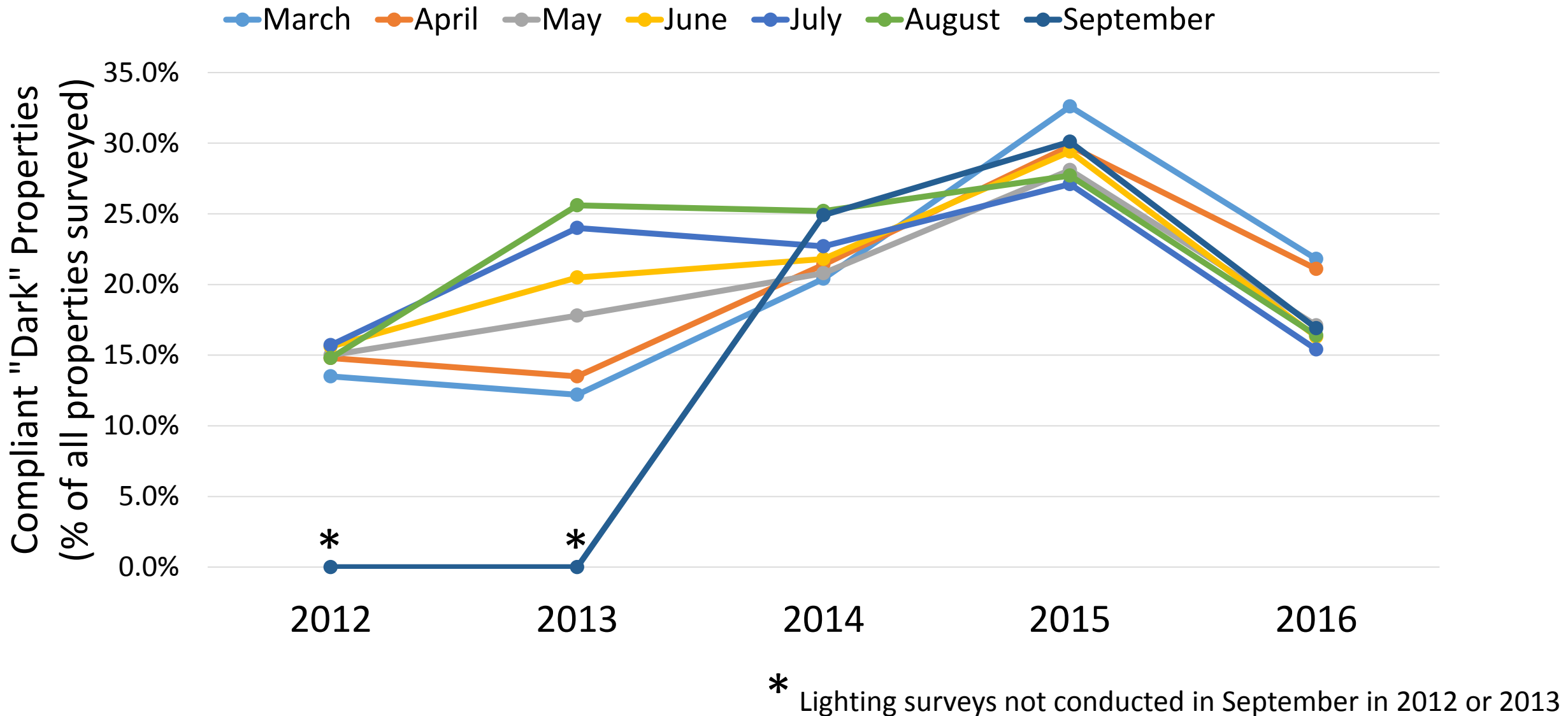
# Reducing Artificial Light in Broward County

- Broward County Beach Lighting Management Plan (1997)
  - Tools, procedures, and strategies
- Broward County Land Use Plan modification
  - Enact and enforce lighting ordinance (1999-2011)
  - Turn off beachfront lighting during nesting season
- Monthly beach lighting surveys
  - Provided to Code Enforcement





# Lighting Ordinance Compliance 2012-2016





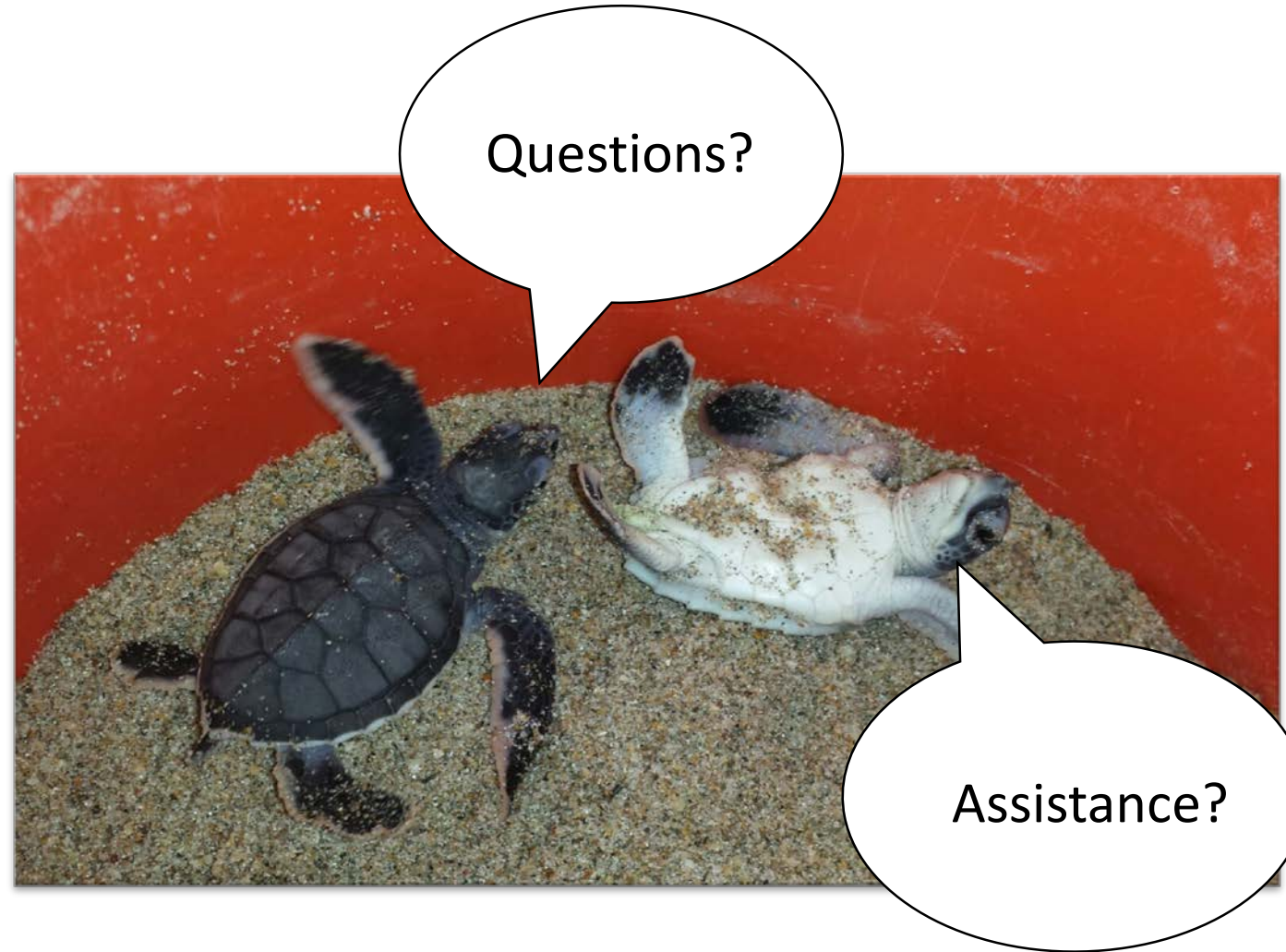
# In Summary...

- Increased population → increased development → increase in artificial light
  - Especially near the coasts in south Florida
- Sea turtles can be negatively impacted by artificial light
  - Disorientations, decrease in nesting
- Coastal lighting ordinances adopted in Broward County
- Full compliance is low, but increasing each year
  - Continuing outreach
  - Encouraging retrofits



# Thank You!

- Contact information
  - Stephanie Kedzuf
  - [skedzuf@broward.org](mailto:skedzuf@broward.org)
  - 954-519-1255
- Questions/assistance
  - General sea turtle inquiries
  - Lighting ordinance questions
  - Lighting retrofit assistance





# BENEFITS OF DARK SKIES

KIRT RUSENKO, PHD

CITY OF BOCA RATON

INT. DARK-SKY ASSOC.- S. FLORIDA





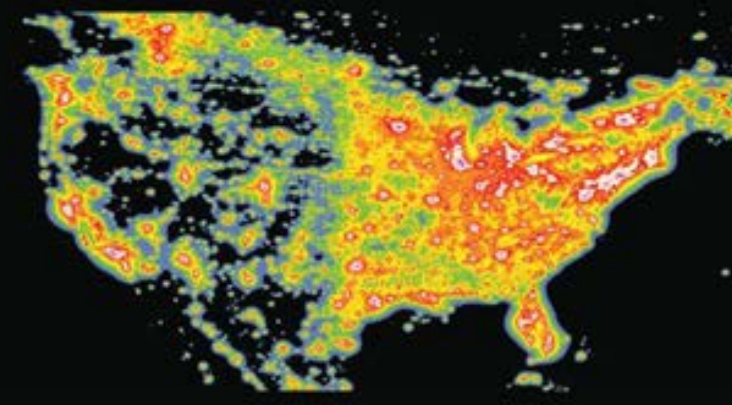
Late 1950s



Mid 1970s



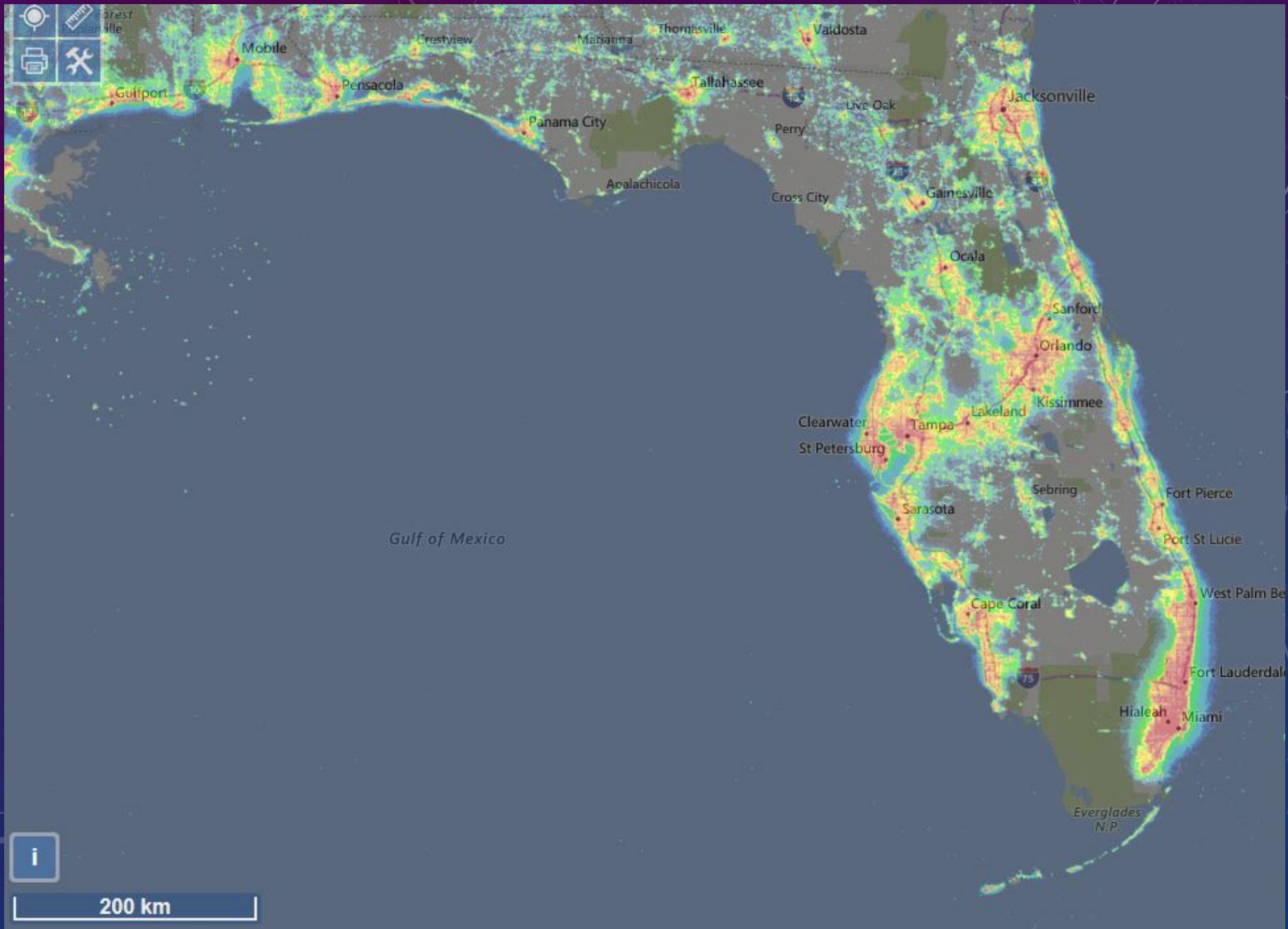
1997

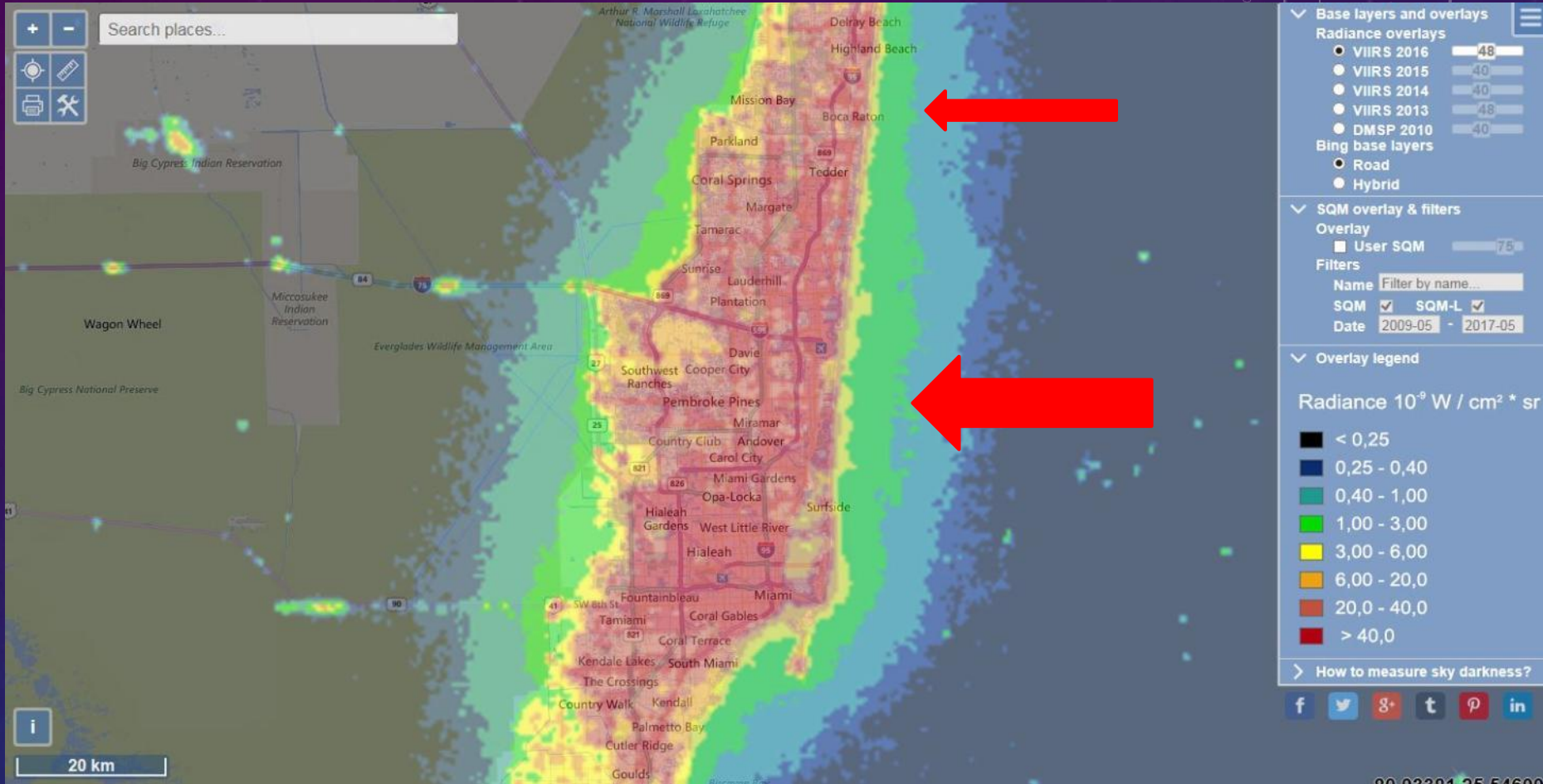


2025







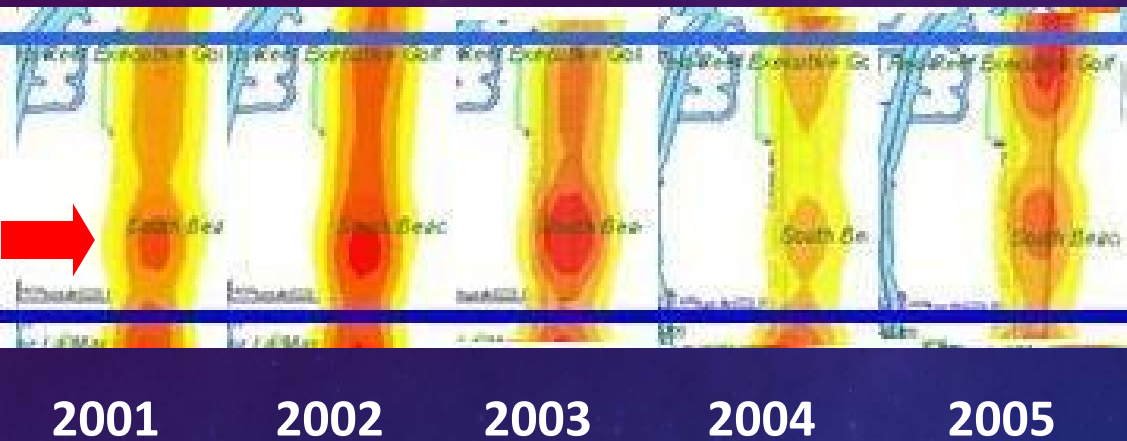




# SOUTH BEACH PARK SKY GLOW

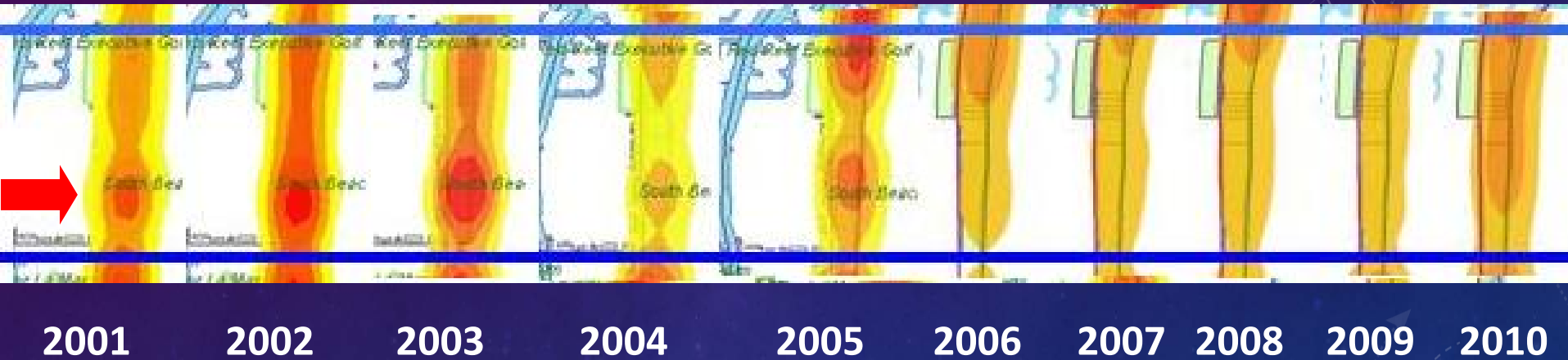


# Total Crawl Densities South Beach Park





# Total Crawl Densities South Beach Park



# AREA OF CRAWL ACTIVITY





# AFTER HURRICANE WILMA- OCTOBER 2005





# SKY-GLOW DISORIENTATIONS





# DISORIENTATION SITE, UNLIT CITY PARK



# Glare interferes with good vision

**Unshielded lighting-veiling illuminance**



**It's hard to see in the presence of glare caused by unshielded lighting.**

**Can you see the pedestrians walking in front of your car?**

**Shielded lighting**



**With shielded lighting the glare is reduced significantly.**

**Safety is improved.**



# Just Because You Have Light Doesn't Make You Safe!



**Bright Unshielded Lights Can  
Actually PREVENT You From  
Seeing Dangers Nearby**







Anyone want this house as a neighbor? More likely to be robbed!

Can anyone see the steps?





# BAD LIGHT EXAMPLES



Globe



Jelly-Jar



Carriage



Carriage

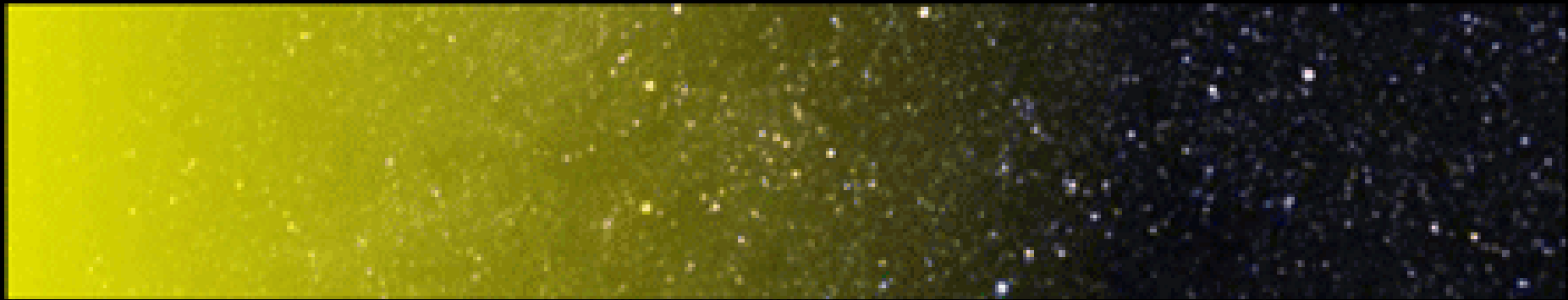


"Nautical"



Globe

# FIXTURE TYPE IS IMPORTANT

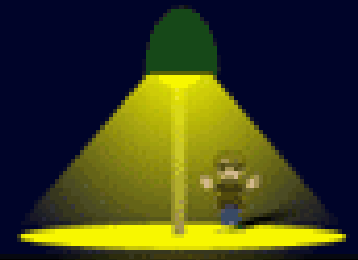
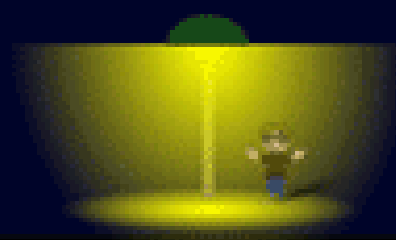
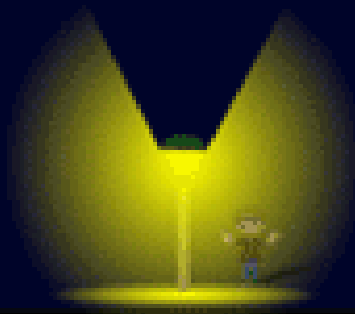


**very bad**

**bad**

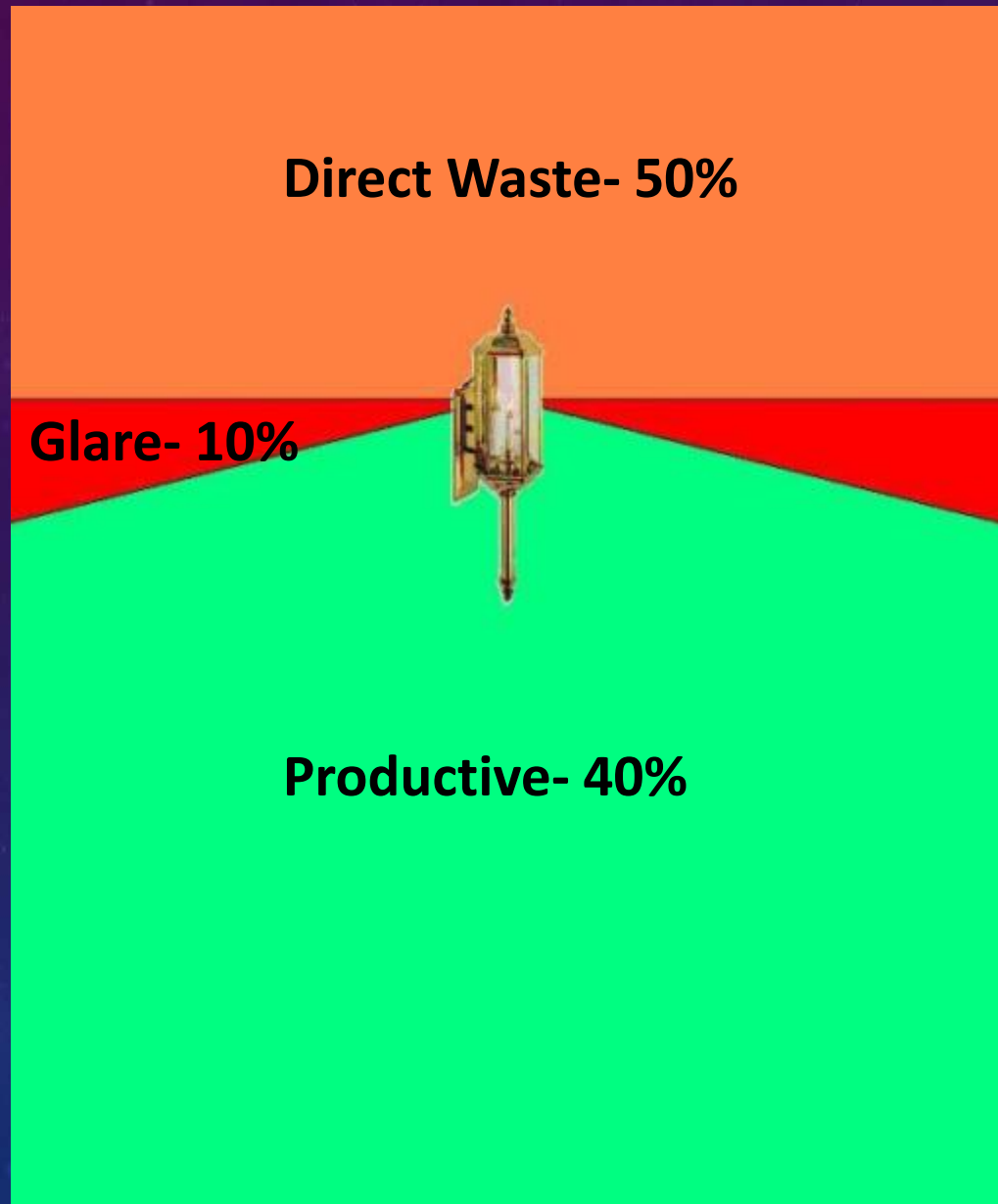
**better**

**best**





# These Fixtures Waste Lots of Energy= \$\$\$\$\$

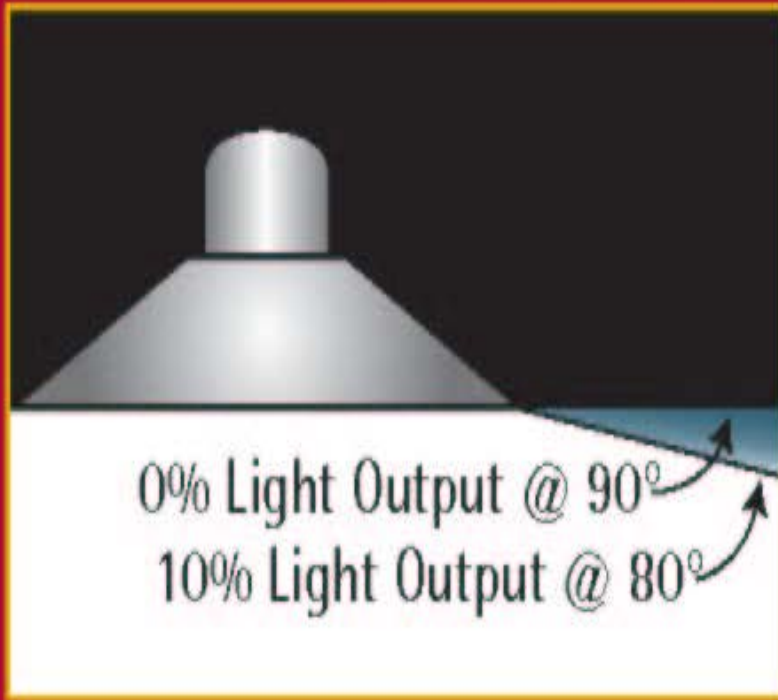


# GOOD LIGHT EXAMPLES





# “Full Cut-off” Fixture



- Light aimed towards the ground with none allowed to directly radiate over a 90° angle.
- A maximum of 10% of the numeric value of the lamp lumen output radiates over an 80° angle.
- No direct uplight.
- Managed light flow that minimizes light trespass.
- Efficient target lighting, no direct contribution to uplight.



*Acorn*



*Refractor Acorn*

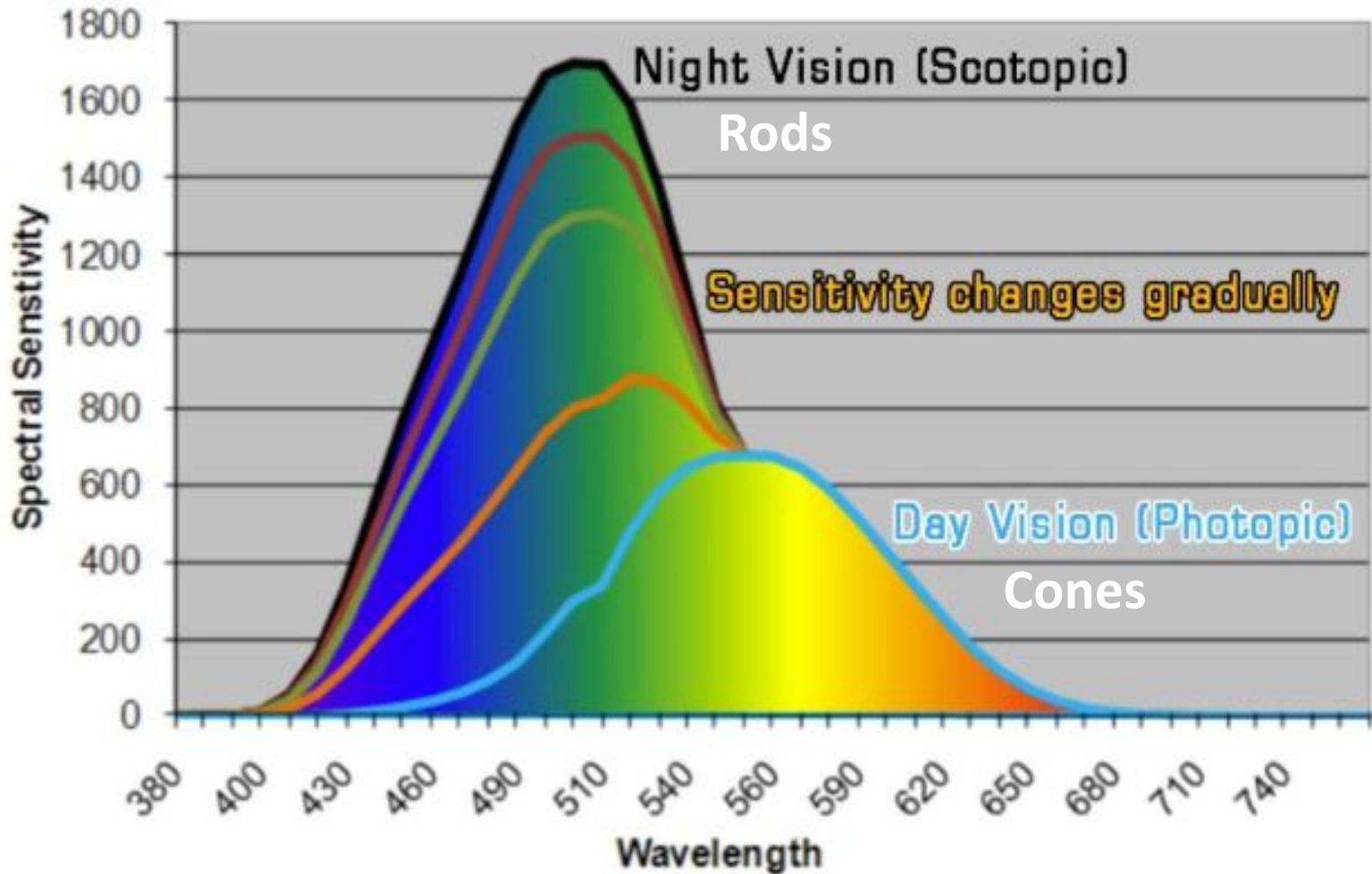


*Promenade™ Series*

**Full Cut-Off**



# Spectral Sensitivity



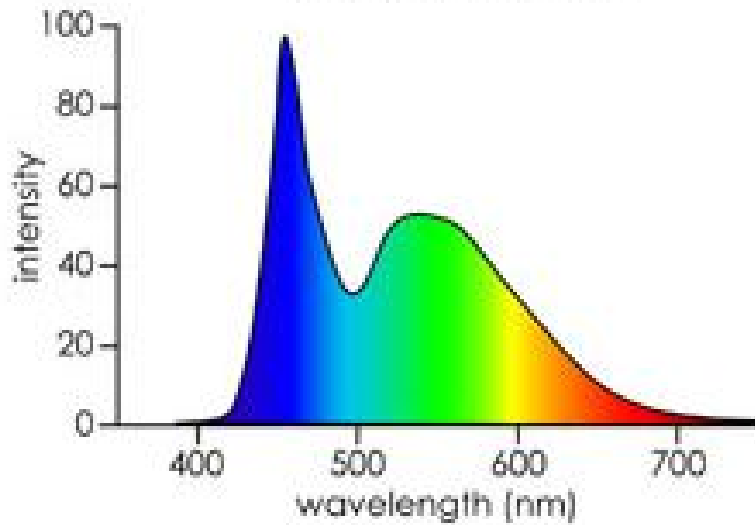




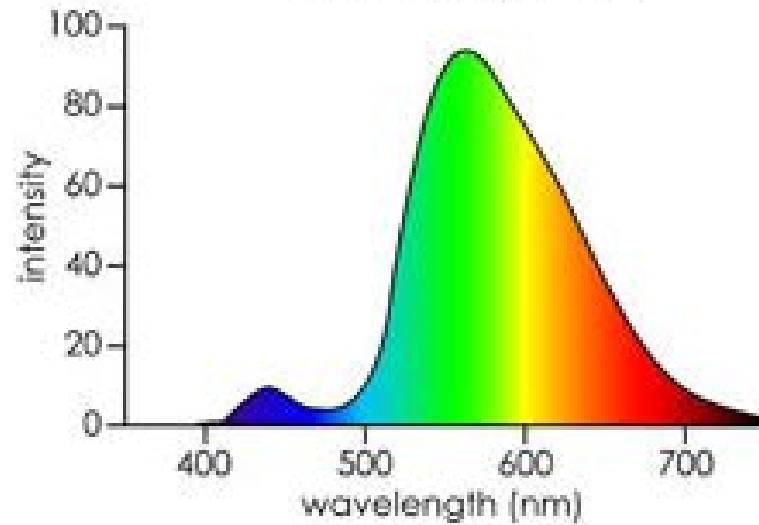


# LED SPECTRA

## Cool White LED



## Warm White LED





# THE AMERICAN MEDICAL ASSOCIATION RECOMMENDS 3000 KELVIN OR LESS FOR OUTDOOR LIGHTING (WARM)

Kelvin Color Temperature	2700K	3000K	3500K	4100K	5000K	6500K
Associated Effects and Moods	Ambiant Intimate Personal	Calm Warm	Friendly Inviting	Precise Clean Efficient	Daylight Vibrant	Daylight Alert
Appropriate Applications	Living/Family Rooms Commercial/ Hospitality	Living/Family Rooms Commercial/ Hospitality	Kitchen/Bath Light Commercial	Garage Commercial	Commercial Industrial Institutional	Commercial Industrial Institutional

**KICHLER.**


**40w**

REPLACEMENT  
REEMPLAZO

USES ONLY 2.5w  
UTILIZA SOLAMENTE 2.5w

Indoor\*\*  
Interior\*\*

Not Suitable For  
Enclosed Fixture  
No Apto Para  
Ensamblados Encerrados

  
DIMMABLE  
REGULABLE

AMBER WHITE  
AMBAR BLANCO  
2200K

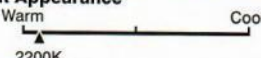
**Lighting Facts** Per Bulb

**Brightness** 180 Lumens

**Estimated Yearly Energy Cost** \$0.30

Based on 3 hrs/day, 11¢/kWh  
Cost depends on rates and use

**Life**  
Based on 3 hrs/day. 9.13 years

**Light Appearance**  
Warm  Cool  
2200K

**Energy Used** 2.5 watts

# Lighting Facts

 Per Bulb

**Brightness** 180 Lumens

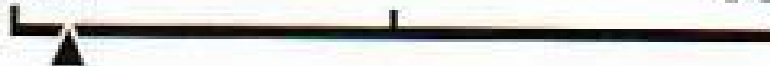
**Estimated Yearly Energy Cost** \$0.30

Based on 3 hrs/day, 11¢/kWh  
Cost depends on rates and use

## Life

Based on 3 hrs/day. 9.13 years

## Light Appearance

Warm  Cool  
2200K

**Energy Used** 2.5 watts





# DEERFIELD BEACH



11/18/04 20:37  
100 T10  
10000 0A 20.000  
11/18/04 20:37



On which street  
would you feel  
safer?

Poorly designed  
street lights actually  
decrease visibility!

The production of  
wasted light costs  
~\$110,000,000,000  
per year globally.



# LIGHT & MELATONIN

- **Intense light suppresses nocturnal melatonin in everyone** (Lewy et al., *Science*, 210:1267, 1980)
- **Spectrum** (Brainard et al., *J Neurosci*, 21:6405, 2001)
  - Blue light most effective disrupter (~446-477 nm)
  - Red light least effective disrupter (>600 nm)
- **Dose-response; the higher the intensity, the greater percent reduction in nocturnal melatonin** (McIntyre et al., *J Pineal Res*, 6:149, 1989)
- **Women may be more sensitive to suppressive effect of light than men** (Monteleone et al., *J Neural Transm*, 102:75, 1995)



A startling portrait of humanity's first migrants p. 958

Beware the spreading mosquitoes p. 971

Unraveling the origin of mega-earthquakes p. 1027

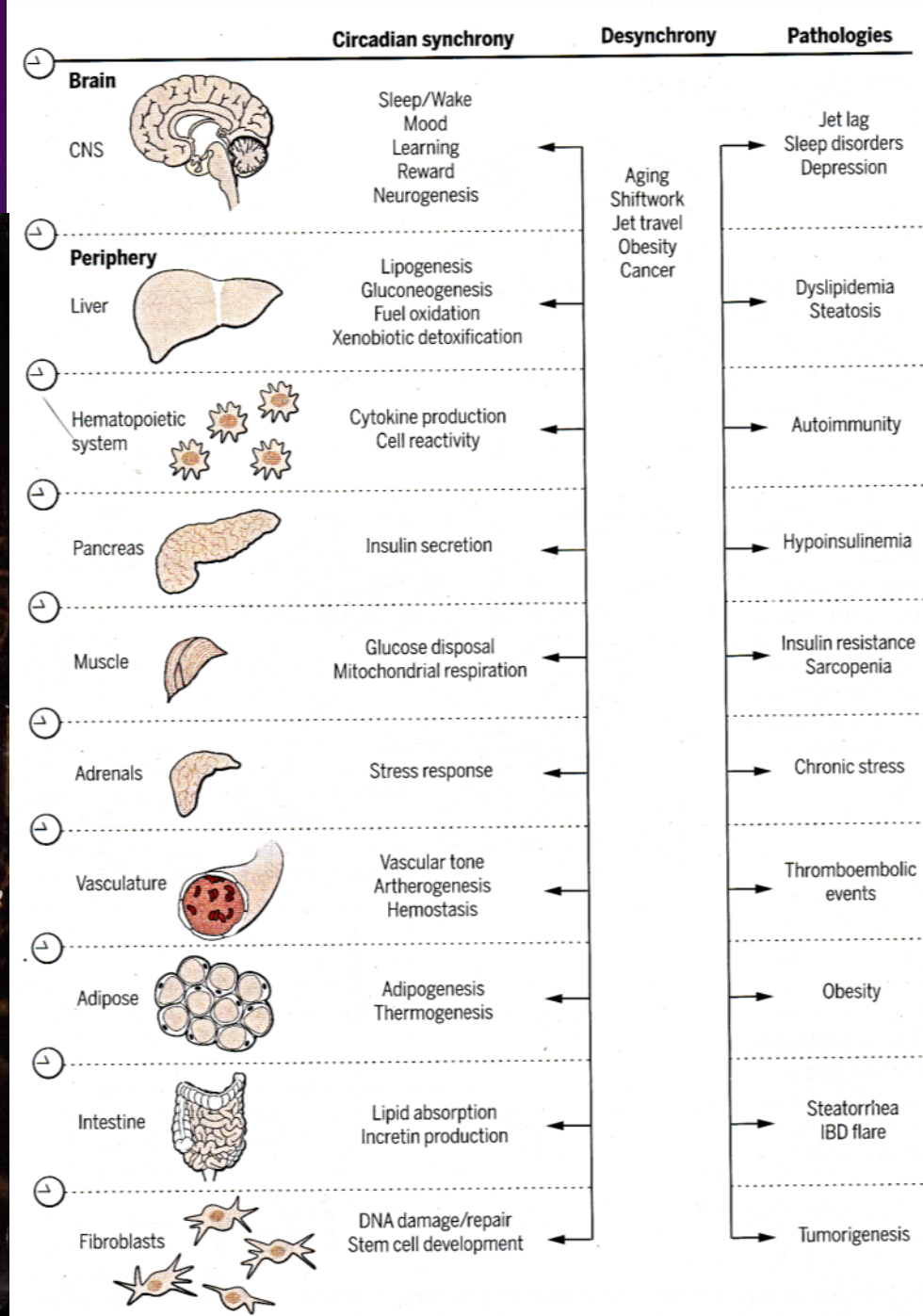
# Science

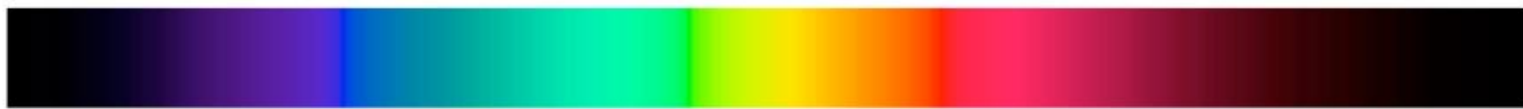
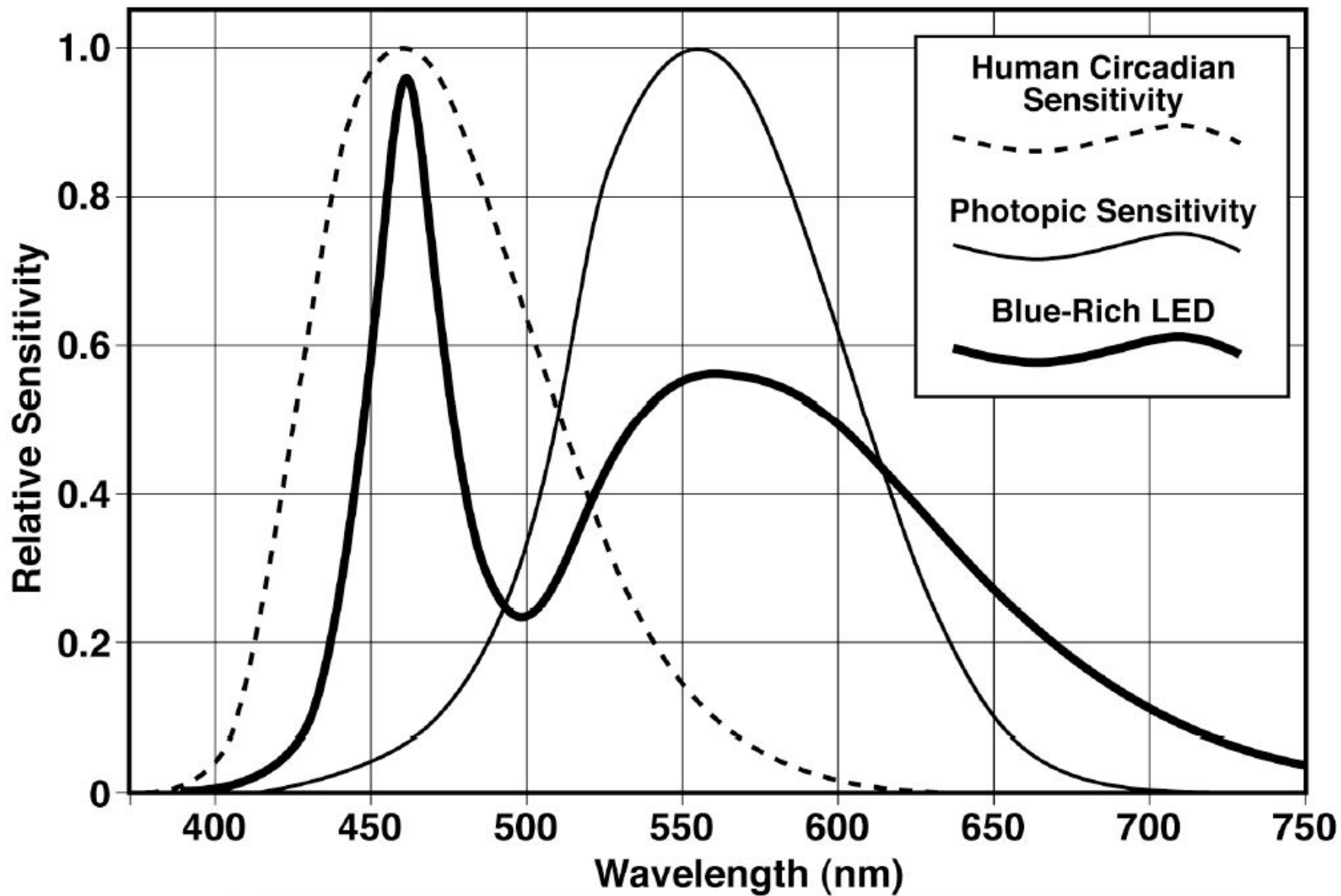
\$15  
25 NOVEMBER 2016  
sciencemag.org



SPECIAL ISSUE  
**STAYING ON TRACK**

How circadian rhythms influence physiology and health





Violet

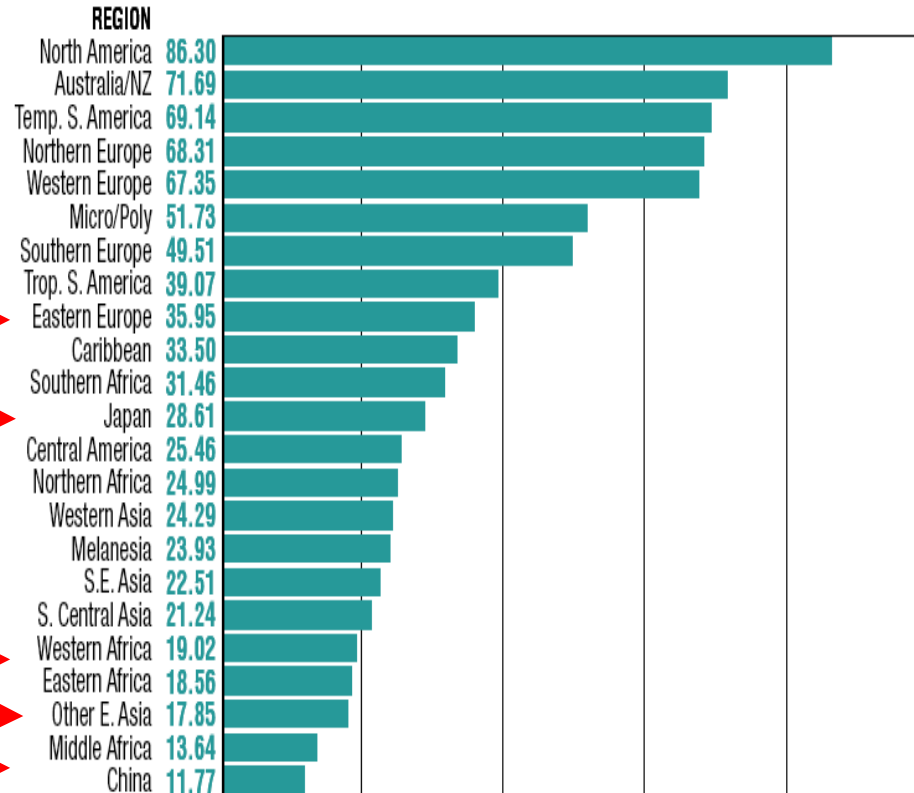
Blue

Green Yellow

Red

# Breast Cancer Incidence/100,000 women/year

Figure 5  
Incidence of Breast Cancer in Females by World Region



U.S. & W. Europe →

Eastern Europe →

Japan, 1999 →

Africa →

Japan, 1950s →

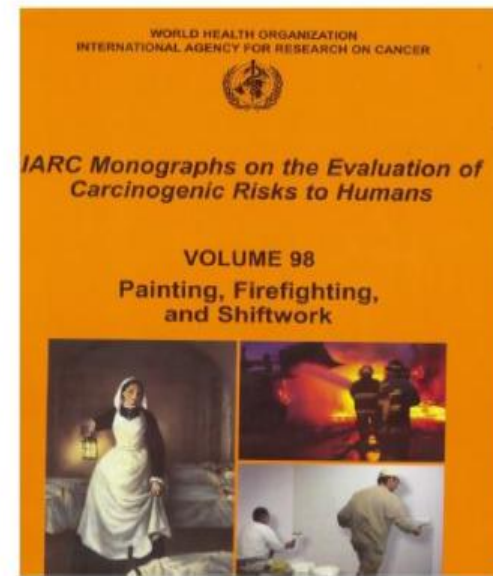
China →

0

50

100





**Cancer in humans**

8 studies on BC

**Limited evidence**

in humans for the carcinogenicity (BC) of shiftwork that involves night work

**Cancer in experimental animals**

55 studies

**Sufficient evidence**

in experimental animals for the carcinogenicity of light during the daily dark period (biological night)

**Mechanistic data**

**Mechanisms in animals are highly likely to be operative in humans!**

**Overall evaluation**

**"Shiftwork that involves circadian disruption is probably carcinogenic to humans (2A)"**

37

Kræftens Bekæmpelse

# LD+A

The magazine of the Illuminating Engineering Society of North America

The Anatomy of  
**Light & Health**

October 2016 [www.ies.org](http://www.ies.org)

\*\*\*\*\*334  
704798  
DR KIRTI M. RUSEKARO  
CITY OF BOCA RATON  
GUMBO LIMBO NATURE CENTER  
1801 N OCEAN BLVD  
BOCA RATON FL 33432-1946  
P-2 P137

**Circadian Metric  
Proposed**

**Color Tuning  
for Seniors**

**Restorative  
Residence**



# HOW CAN A LIGHTBULB CHANGE YOUR LIFE?



Biological LED  
Lighting Solutions

LightingScience®





A safe solution for lighting beachfront properties.



MyNature Coastal™



Introducing a breakthrough innovation for **PROTECTING SEA TURTLES**

Definity Digital™  
MyNature Coastal LED



Definity Digital  
It's all possible with light.™



# SLEEPY BABY™

## HEALTHY™ LED NURSERY SLEEP LAMP

Happy Baby, Happy Parents!



### HELPS TO NATURALLY REGULATE YOUR CIRCADIAN RHYTHM

*The Sleepy Baby® lamp helps regulate your child's circadian rhythm and aids in the production of Melatonin - a natural hormone needed for sleep. This is essential in helping your child develop a healthy sleep pattern.*

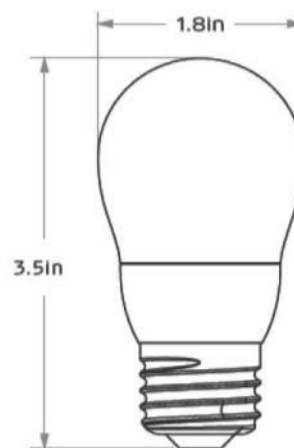
### PROPRIETARY SPECTRUM TO ENCOURAGE NATURAL SLEEP

*Through the use of our patented light spectrum technology, Sleepy Baby® eliminates certain known "blue-sky" light waves known to energize you and disrupt sleep patterns, helping your baby go to sleepy naturally. Your baby will fall asleep faster, stay asleep longer and go back to sleep quicker!*

### STANDARD BASE FITS MOST HOUSEHOLD LAMPS

## HAPPY BABY, HAPPY PARENTS

Our Sleepy Baby™ Biological LED Nursery Lamp creates the perception of darkness for your infant's internal clock, while providing the perfect light output so you can care for your little one. The proprietary LED spectrum works with your baby's natural circadian rhythm to help them fall asleep faster, stay asleep longer and fall back asleep quicker if awoken in the middle of the night. Plus, it supports your baby's natural melatonin production- a hormone needed to regulate their internal clock and help them develop a healthy sleep cycle.



# GOODNIGHT®

## HEALTH™ LED SLEEP LAMP

Astronaut Approved and Ready for all Mankind!



### HELPS TO NATURALLY REGULATE YOUR CIRCADIAN RHYTHM

*The Good Night® lamp's technology assists your body in the production of the Melatonin - a natural hormone needed for sleep - and helps to regulate your body's circadian rhythm.*

### PROPRIETARY SPECTRUM TO ENCOURAGE NATURAL SLEEP

*Through the use of our patented light spectrum technology, Good Night® eliminates certain known "blue-sky" light waves known to energize you and disrupt sleep patterns.*

### STANDARD BASES FITS MOST HOUSEHOLD LAMPS

## WANT A BETTER NIGHT'S SLEEP?

Did you know the light bulb that's been in your bedroom lamp since...well...forever just might be getting in the way of your body making Melatonin – the hormone that helps you fall asleep? Many people spend \$200 per year on sleeping pills, or up to \$1200 on sleep therapy. It's time for a better solution. The Good Night™ LED lamp, originally developed for NASA astronauts on the International Space Station, lets melatonin do its thing and helps to regulate your body's natural circadian rhythm. So when you're ready to sleep, your body is too.





# GOODDAY™ A19

## HEALTH™ LED ALERTNESS ENHANCING A LAMP

*Boost Your Energy Naturally*



### FEEL MORE AWAKE AND HAVE ENHANCED PERFORMANCE

*The GoodDay™ technology is the only patented lighting solution on the market proven to boost energy, promote overall alertness and enhance performance.*

### PROPRIETARY SPECTRUM TO ENHANCE NATURAL ALERTNESS

*Through the use of our patented light spectrum technology, GoodDay™ identifies specific "blue-sky" light helping your body achieve a safe, natural energy!*

### IDEAL FOR EVERYDAY USE AND FOR THOSE WITH SEASONAL AFFECTIVE DISORDER (SAD) AND DELAYED SLEEP PHASE DISORDER (DSPD)

## BOOST YOUR ENERGY, NO CAFFEINE REQUIRED!

Our GoodDay™ bulb is the only biologically-correct LED lighting solution proven to give you more energy, promote alertness and enhance performance with our patented, stimulating blue-enhanced spectrum. This technology was first developed for NASA for use by its Astronauts on the International Space Station. It's an all-natural way to get that boost you crave throughout the day. Ideal for everyday use and for those affected by Seasonal Affective Disorder (SAD) and Delayed Sleep Phase Disorder (DSPD).



THANK YOU!  
IS THIS STUFF REALLY NECESSARY?



## Our Mission

The Department will provide a safe transportation system that ensures the mobility of people and goods, enhances economic prosperity and preserves the quality of our environment and communities.



## Why we do what we do?

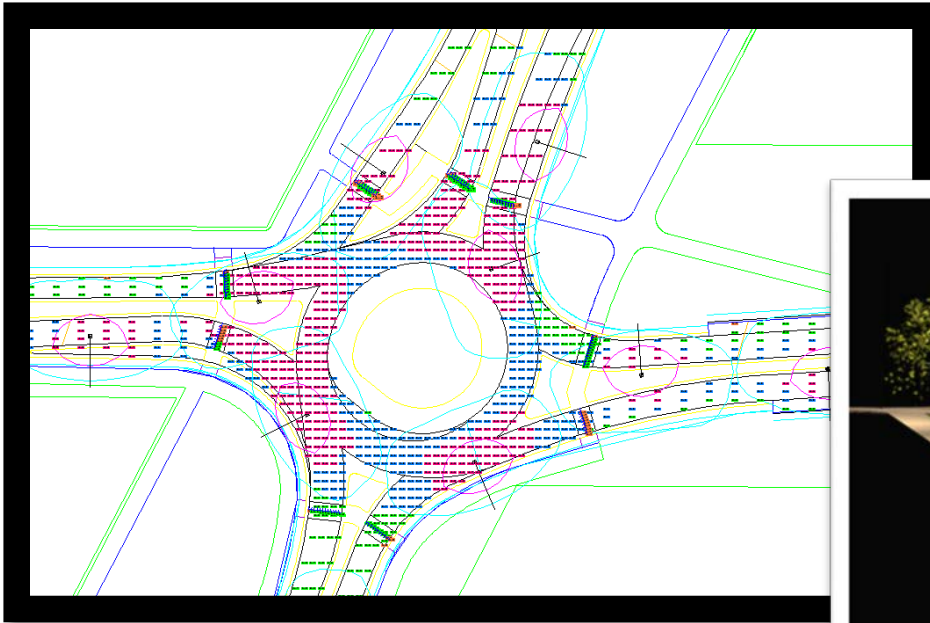
- **Pedestrian Safety**
  - Intersections
  - Midblock Crossings
  - Crosswalks
  - Sidewalks
- **Driver Safety**
  - Intersections
  - Interchanges
  - Roadways
- **Complete Streets Initiatives**
  - Sidewalks
  - Shared Use Paths
- **Requests by Municipalities**



# FDOT Illuminations

## How we do what we do?

- 2D & 3D Computer Aided Drafting & Modelling



# FDOT Illuminations

## FDOT Lighting Criteria

Florida Design Manual 2018  
Chapter 231- Lighting



Table 231.2.1 Lighting Maintained Values

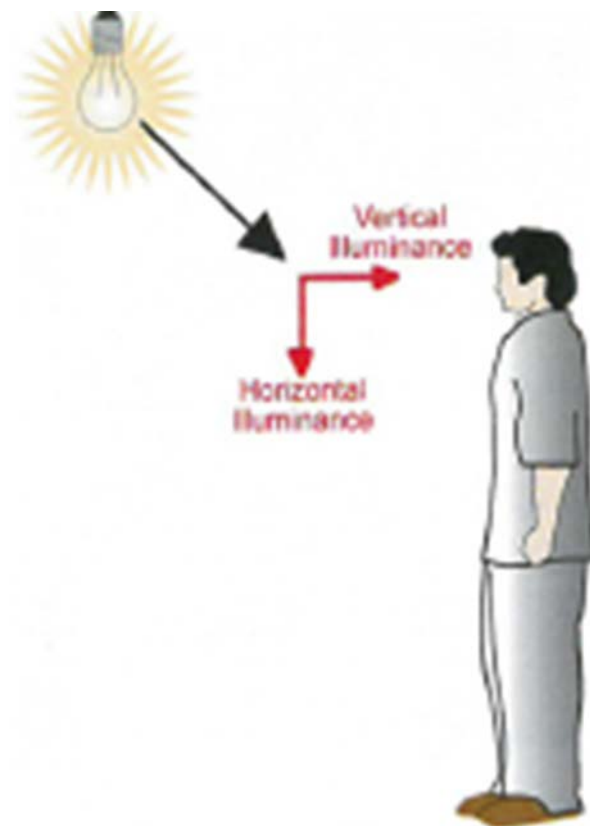
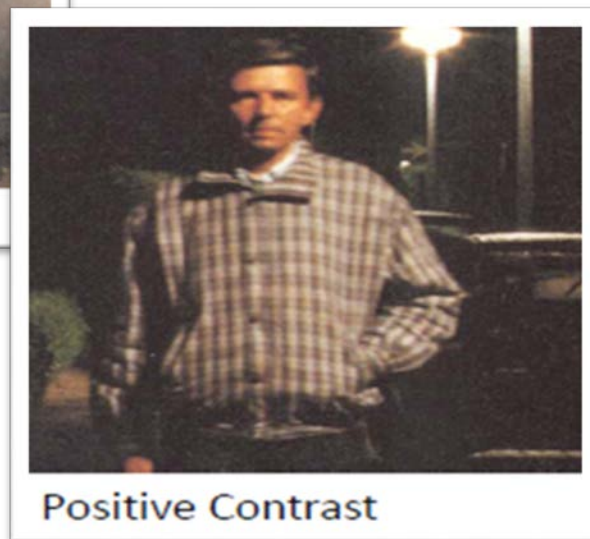
Roadway Classification Or Project Type	Illumination Level Average Initial Foot Candle		Illumination Uniformity Ratios		Veiling Luminance Ratio
	Horizontal (H.F.C.)	Vertical (V.F.C.)	Avg./Min.	Max./Min.	$L_{V(MAX)}/L_{AVG}$
<b>Conventional Roadway Lighting</b>					
Interstate, Freeways and Expressways	1.5	N/A	4:1 or Less	10:1 or Less	0.3:1 or Less
Arterials and Collectors	1.5				
Other Roadways	1.0				
<b>High Mast Roadway Lighting</b>					
All Roadway Classifications	0.8 to 1.0	N/A	3:1 or Less	10:1 or Less	N/A
<b>Signalized Intersection Lighting</b>					
New Reconstruction	3.0	2.3	4:1 or Less	10:1 or Less	N/A
Lighting Retrofit	1.5	1.5			
<b>Midblock Crosswalk Lighting</b>					
Low Ambient Luminance	N/A	2.3	N/A	N/A	N/A
Medium & High Ambient Luminance		3.0			
<b>Sidewalks and Shared Use Paths</b>					
Facilities Separated from the Roadway	2.5	N/A	4:1 or Less	10:1 or Less	N/A
<b>Sign Lighting</b>					
Low Ambient Luminance	15-20	N/A	N/A	6:1	N/A
Medium & High Ambient Luminance	25-35				
<b>Rest Area Lighting</b>					
All Roadways and Parking Areas	1.5	N/A	4:1 or Less	10:1 or Less	N/A



# FDOT Illuminations

## FDOT Lighting Initiatives

- Vertical Illumination Criteria at crosswalks

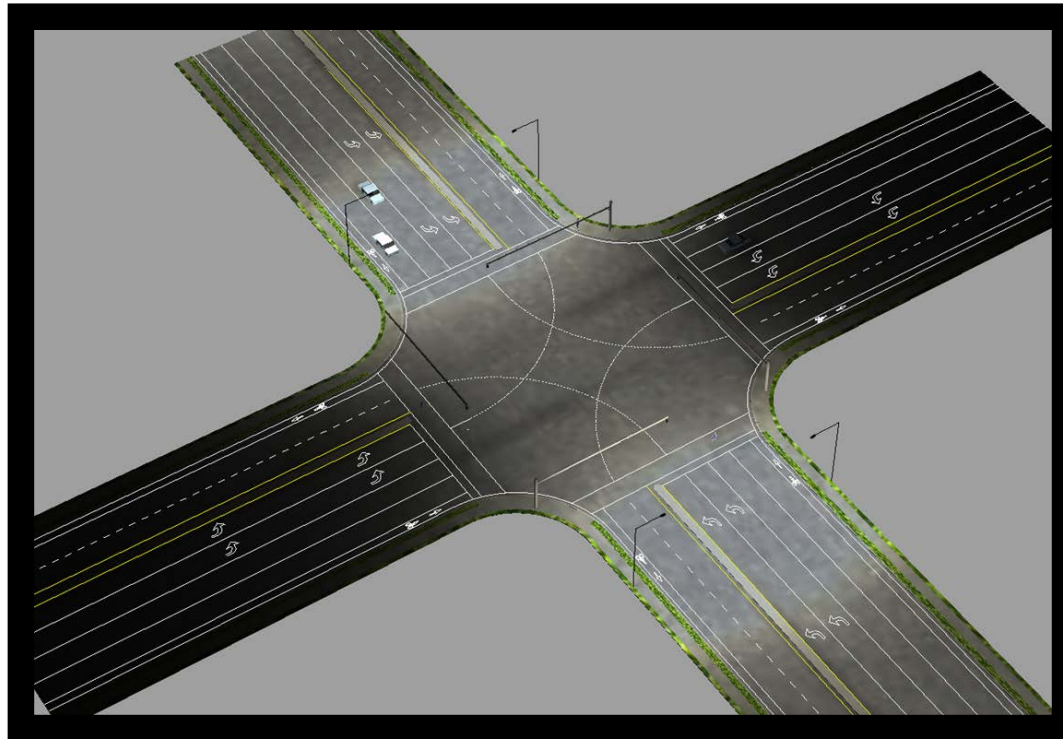


# FDOT Illuminations

## FDOT Lighting Initiatives

- Intersection Retrofits

To improve illumination levels at signalized intersections within corridors that have high frequency of nighttime pedestrian crashes



# FDOT Illuminations

## FDOT Lighting Initiatives

- Intersection Retrofits





# FDOT Illuminations

## FDOT Lighting Initiatives

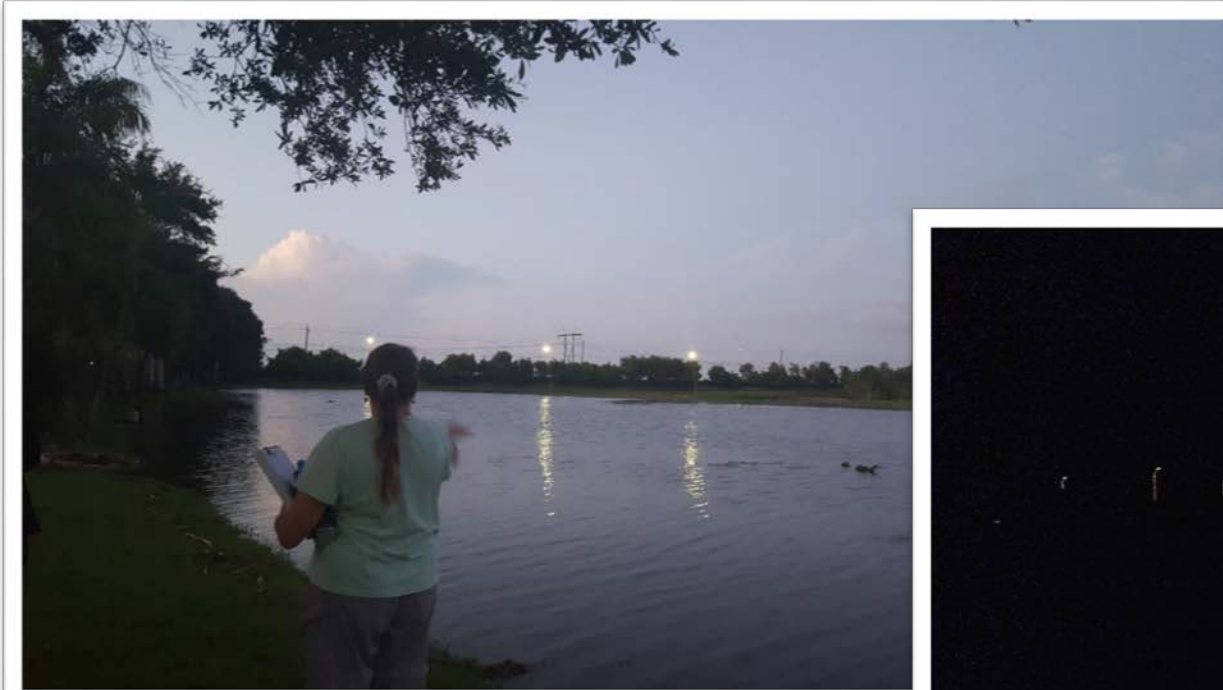
- HPS to LED Transition



# FDOT Illuminations

## Context Sensitive Considerations

- Installation of shielded fixtures near residential areas



# FDOT Illuminations

## Context Sensitive Considerations

- Sea turtle lighting and seasonal light control.





# FDOT Illuminations

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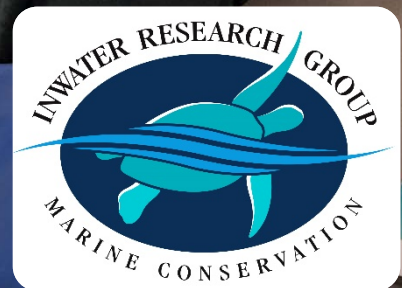


# Darker Skies, Darker Beaches

- Four Lessons in Rolling Trunk
- Lighting Impacts
- Align with State Standards
- FREE
- Borrow up to 3 Weeks
- Available to Broward Teachers
- Part of Statewide Program

*“When I told them they were engineers who would design lights to help turtles, they were hooked!”*

*-Mollie Mukhamedov, Teacher, Morningside Elementary*

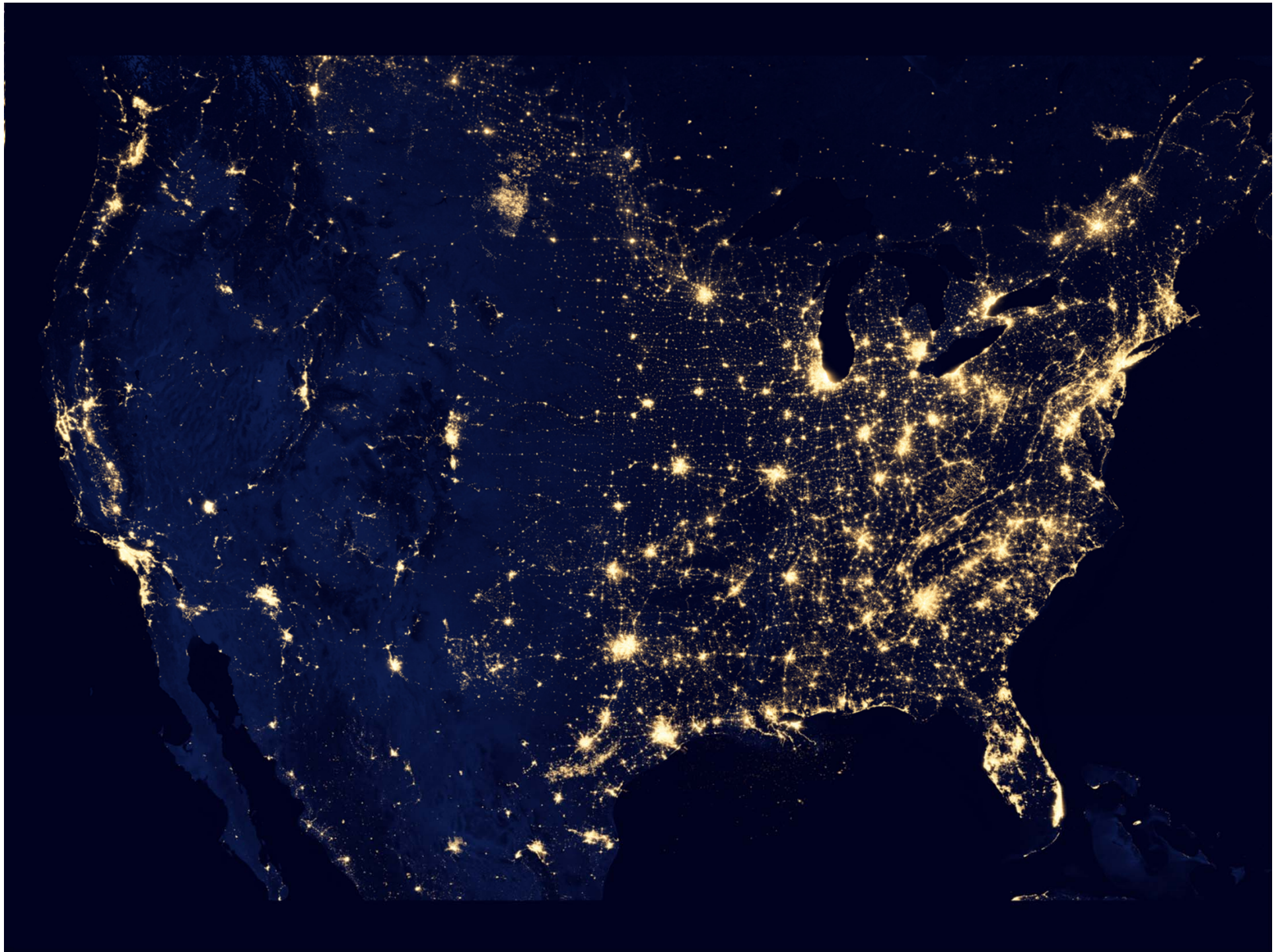


Katharine J. Hendrickson  
khendrickson@broward.org  
(954) 357-5113

**Application Link:**

<https://goo.gl/forms/gqZx6ldKYCyUKng03>

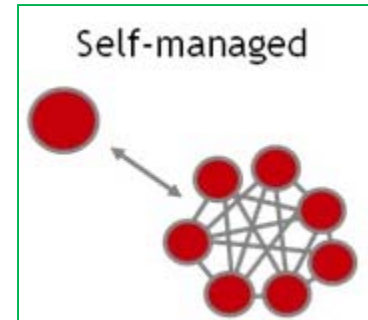






# Collier County Lighting Team Overview

- Created in April 2016
- Comprised of major lighting stakeholders within the County
- Tasked with:
  - Assessing the current state of lighting in Collier County
  - Researching best practices for lighting standards and policies
  - Developing standards for County owned/maintained sites and structures
  - Analyzing Return On Investment (ROI) for potential retrofit projects
  - Laying the foundation for Land Development Code updates



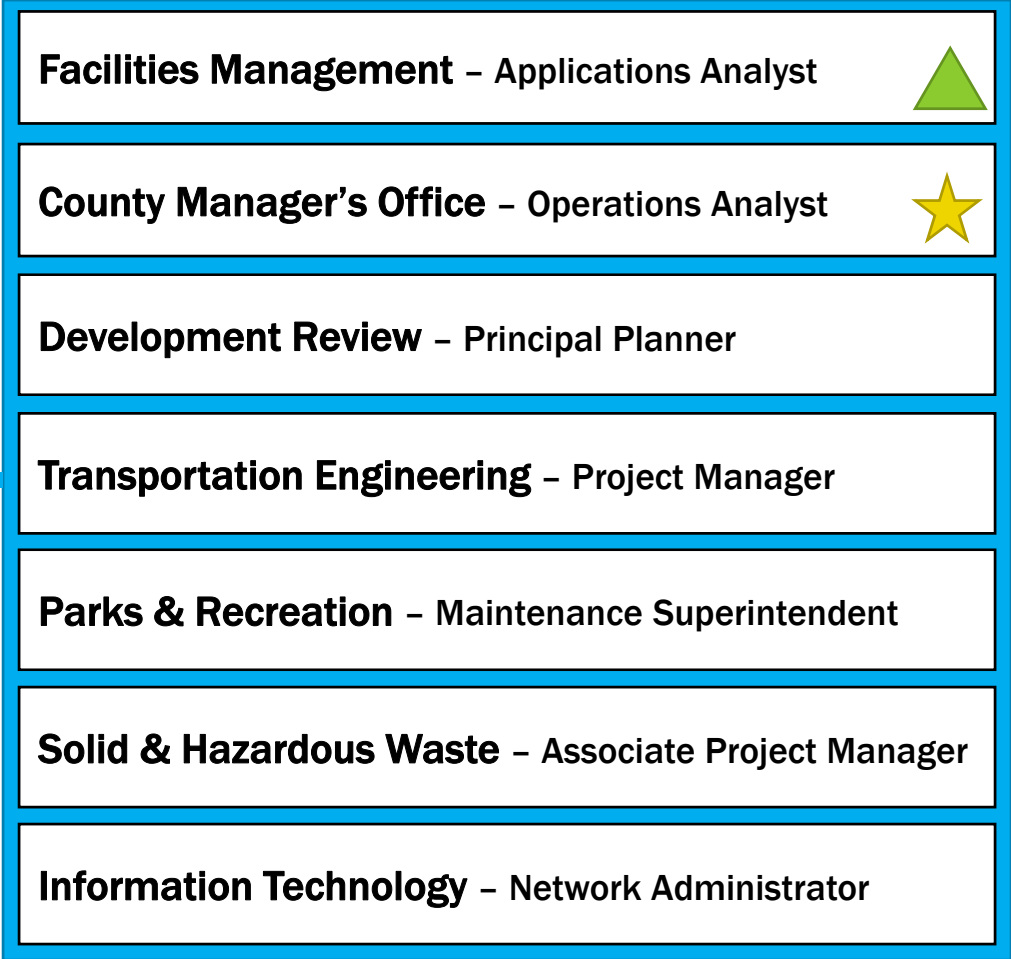
# Collier County Lighting Team Structure

**County Commissioner**  
Project Initiator

**Deputy County Manager**  
Project Sponsor / Champion

**IDA & Sheriff's Office**  
Stakeholders / Partners

## Self-Managed Team



# Vision, Mission, and Guiding Principles



**Vision:** To be a leader in community lighting standards and practices, while protecting and preserving the natural environment and view of the night sky.

**Mission:** To develop standards, policies, and codes that effectively, efficiently, responsibly, safely, and securely illuminate Collier County.

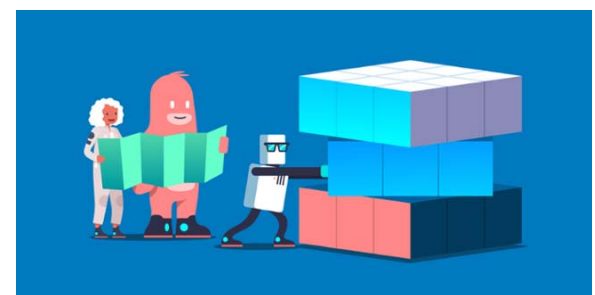
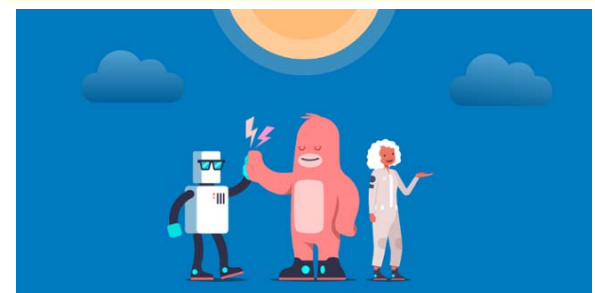
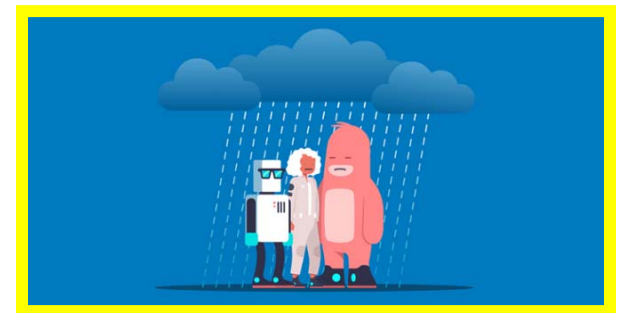
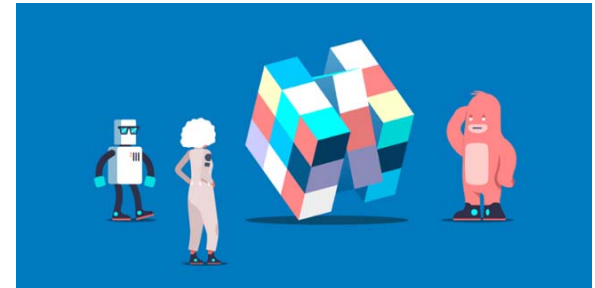
## Guiding Principles:

- Lighting designs should minimize light trespass/pollution and impact on neighboring properties and natural habitats while ensuring safety, security, utility, productivity, commerce, livability, and enjoyment.
- Lighting equipment should be responsibly selected and sourced through careful consideration of the short and long-term financial, environmental, and social costs incurred through lighting.
- Energy and resources should be conserved to the greatest extent possible.
- Designs should be practical as well as financially and technologically feasible, based on industry-acceptable best practices.
- Lighting systems should be properly implemented, maintained, and managed.



# Self-Managed Team Process

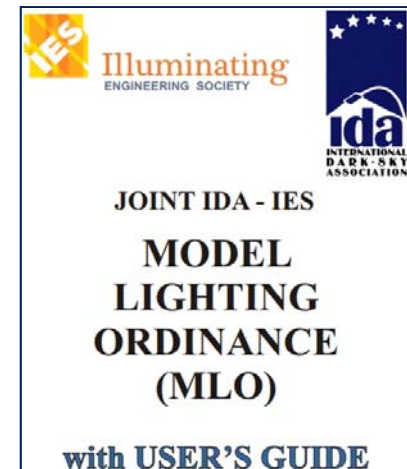
- Project Scope and Project Plan
- Vision, Mission, and Guiding Principles
- Common Language and Understanding
- Research
- Individual & Group Deliverables



# Standards/Policy Framework

## Lighting Zones (LZ)

[IES/IDA Model Lighting Ordinance]



## Site Types for LZ Classifications

[U.S. D.O.D “Unified Facilities Criteria”]

UFC 3-530-01  
01 April 2015

Table 4-1. Lighting Zones and DoD Applications.

<i>MLO Lighting Zones</i>	<i>Title</i>	<i>DoD Installation/Application</i>	
LZ0	No Ambient Lighting	<b>Training areas</b> Night vision training areas, endangered waterfront areas and other areas where there is expected no nighttime activity.	

# Collier Lighting Standards Applicability



- Sites and structures owned and/or maintained by the BCC Agency
- Designed to be *prospective* and will not require immediate retrofits
- Does not apply to private businesses or residences (at this time)



# Lighting Restrictions by Zone

Lighting Zones	Light Reduction <b>R</b> = Required / <b>V</b> = Voluntary	Maximum Light Output Percentage
LZ0	<b>R</b> - 1 Hour after close of business	25%
LZ1	<b>R</b> - 1 ½ Hours after close of business	25%
LZ2	<b>R</b> - 2 Hours after close of business	50%
LZ3	<b>V</b> - 2 Hours after close of business	50%

# LED Lighting Evaluation



## FACTS

- The world is moving to LED
- Longer Lifespan = Bad Lighting Decisions Last Longer
- Not everyone is concerned about the night sky

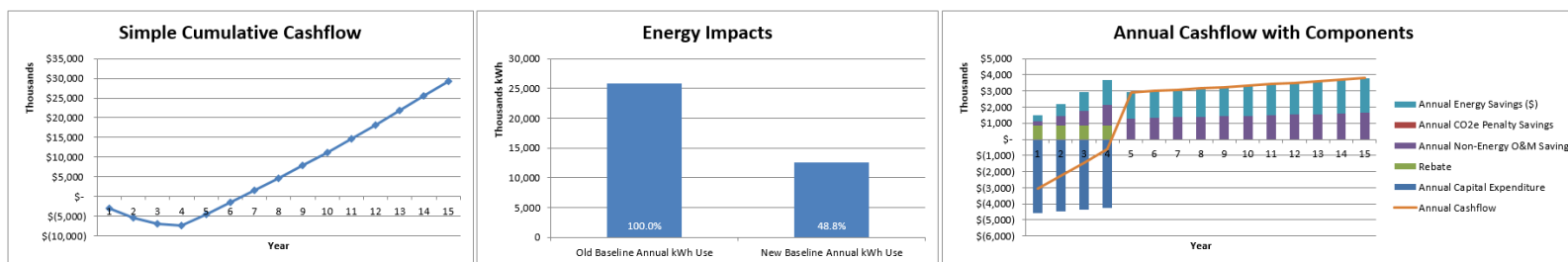
## OPPORTUNITIES

- LED transition creates the urgency for policy change
- Win over policymakers by appealing to their purse strings
- New technologies can benefit everyone (*even sea turtles*)

# Lighting Retrofits That Make Cents

## US DOE Municipal Solid-State Street Lighting Consortium

### Street and Parking Facility Lighting Retrofit Financial Analysis Tool



- **Our General Findings:**
  - **Decreased maintenance costs**
  - **~ 60% energy savings**
  - **~ 5 to 7 year break-even point for retrofit projects**



# Communicating Night Skies with Policymakers

## Learn/Research Where They Stand

1. Start with Vision, Mission, and Guiding Principles
2. Keep it Simple
3. Be Visual
4. Show Them the \$\$ *Before* the Flora & Fauna
5. Let Your Stakeholders Speak



## **Example: Roadway Lighting ROI**



- **Fixtures to Replace: 4,958**
- **Total Undiscounted Capital Expenditure: \$3,850,000**
- **Break-even Point: 5 to 7 Years**
- **Total Discounted Savings (20 Years): \$3,600,000**
  - **Annual Undiscounted Energy Savings: \$345,000 (60%)**
  - **Annual Undiscounted O&M Savings: \$158,000**

## **Example:** Basic Principles of Efficient & Effective Lighting

- Use light only when you need it
- Be no brighter than necessary
- Only light intended areas
  - Limit glare, light trespass, and skyglow



**GLARE**



**LIGHT TRESSPASS**



**SKYGLOW**



## **Example:** Lighting Basics for Crime Prevention and Safety

- Allow for the detection of potential threats
- Don't spotlight potential victim(s)
- Avoid harsh shadows and glare
- Uniformity of light is more important than overall light levels



# Questions?

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©Dave Shelton - [www.daveshelton.com](http://www.daveshelton.com)



Broward County  
Environmental Planning  
and Community  
Resilience Division

# *Broward County Night Friendly Lighting*

## Monitoring and Next Steps



Photo Credit:  
The City Dark





# STAR

*Sustainability Tools for Accessing and Rating Communities*



## **BUILT ENVIRONMENT**

**BE-1: Ambient Noise & Light**

10 available points

**Preliminary Step, identify at least 3 target areas that will be evaluated for ambient light achievement in Outcomes 2 and 3. The target areas should include at least 1 commercial area or corridor, 1 residential or mixed-use neighborhood, and 1 natural area that contain species or ecosystems sensitive to light.**

Selected locations should be based on a formal study or community planning process that establishes quantifiable targets for reducing excess noise and light. Alternatively, the applicant may select areas that are experiencing ambient noise or light pollution issues as indicated by a high number of noise or light pollution complaints or where sensitive species are known to exist. For verification, list the target areas that will be evaluated for ambient noise and ambient light achievement, and upload a map showing the selected areas.





# STAR

*Sustainability Tools for Accessing and Rating Communities*

## Outcome 2: Light in the Community

= Show progress toward locally identified ambient light targets for light glare and/or light trespass

## Outcome 3: Light in the Night Sky

= Achieve a sky glow at or below 4 in the Bortle Dark-Sky Scale where the Milky Way is still visible in residential areas, or a Sky Quality Meter reading of 21.2 or greater as measured by a handheld Sky Quality Meter (SQM) device or app.

Or

= Achieve certification as an International Dark Sky Community



# STAR

*Sustainability Tools for Accessing and Rating Communities*

## Outcome 2: Light in the Community

= Show progress toward locally identified ambient light targets for light glare light trespass

# IMPLEMENTATION

Show progress toward locally identified ambient light glare and/or light trespass targets for each commercial, natural, and residential area identified. Collect, demonstrate, and justify locally determined metrics. (Partial credit is available)

### Examples might include:

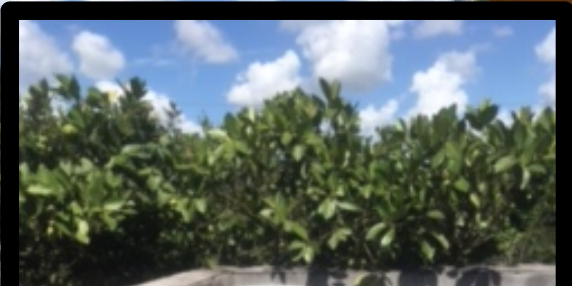
- decreased average levels of illuminance (lux) or luminance (cd/m<sup>2</sup>) in target areas;
- decreased numbers of light glare/trespass complaints in target areas;
- concerted efforts to shield unshielded lights, reduce the luminance level of lighting, or install lights that properly direct lighting in target areas.



# Sky Quality Meter



Anne Kolb



Here at Fern Forest!



Markham Park

# STAR

*Sustainability Tools for Accessing and Rating Communities*

## Outcome 3: Light in the Night Sky

= Achieve a sky glow at or below 4 in the Bortle Dark-Sky Scale where the Milky Way is still visible in residential areas, or a Sky Quality Meter reading of 21.2 or greater as measured by a handheld Sky Quality Meter (SQM) device or app.

## MEASUREMENT

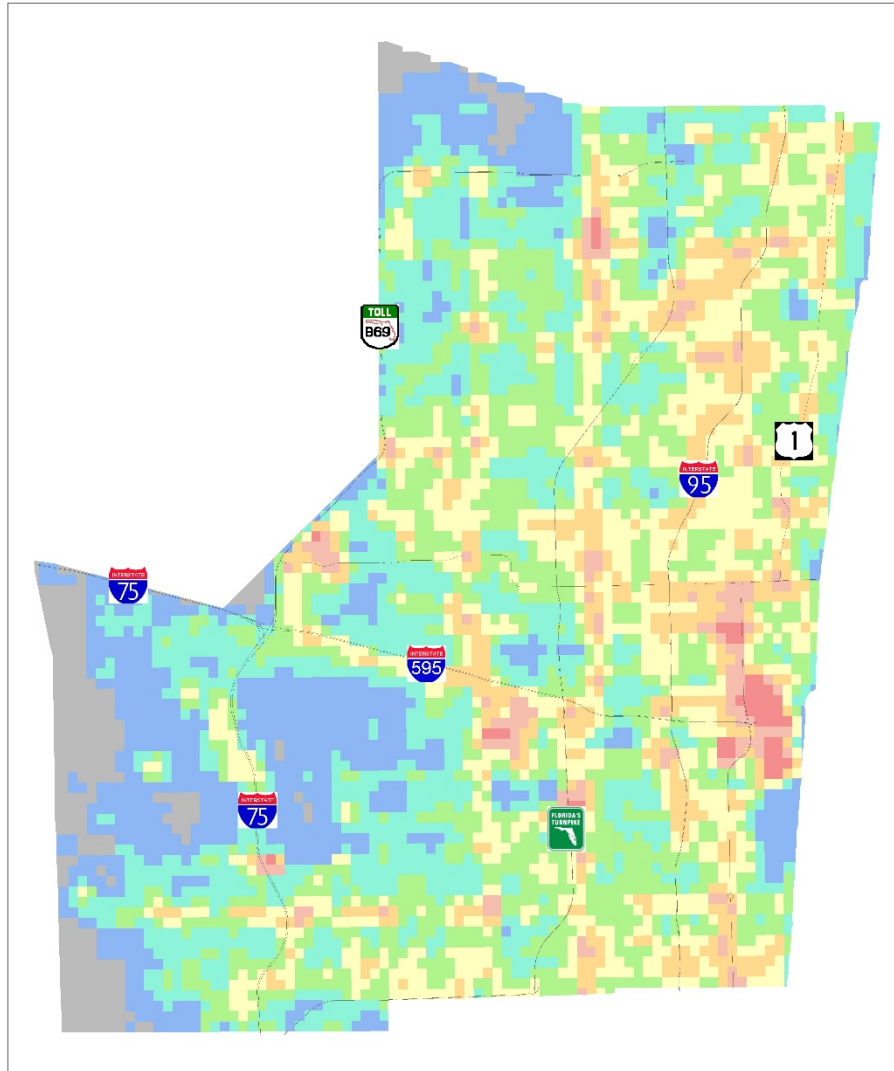
Readings should be taken in at least 3 different seasons within the past year to establish the average rating or measurement.

(Partial credit is available)

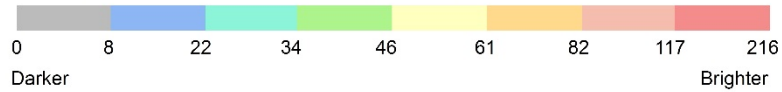


Photo Credit:  
The City Dark





Average Night Radiance (nanowatts/(cm<sup>2</sup>/sr))



Source: Satellite NPP, visible infrared imaging radiometer suite day-night band, 2014  
Map provided for informational purposes only. Not to be used for legal boundary determination.

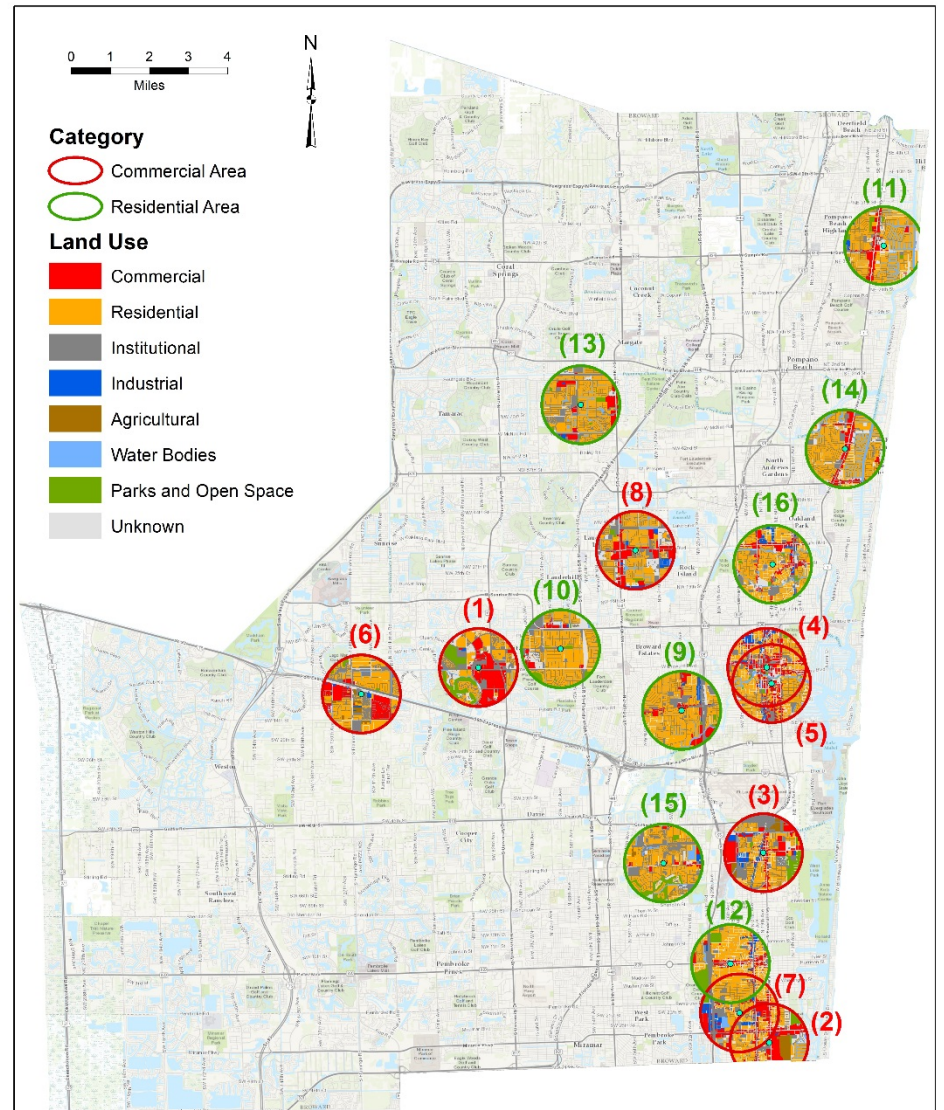


Category

- Commercial Area
- Residential Area

Land Use

- Commercial
- Residential
- Institutional
- Industrial
- Agricultural
- Water Bodies
- Parks and Open Space
- Unknown



**Commercial Areas**

- (1) West Regional Library
- (2) Hallandale Beach Branch
- (3) Dania Beach Paul Demaio Branch
- (4) Main Library
- (5) Broward County Law Library
- (6) Young at Art Museum
- (7) Foster Park Micro-Library
- (8) Lauderdale Lakes Branch

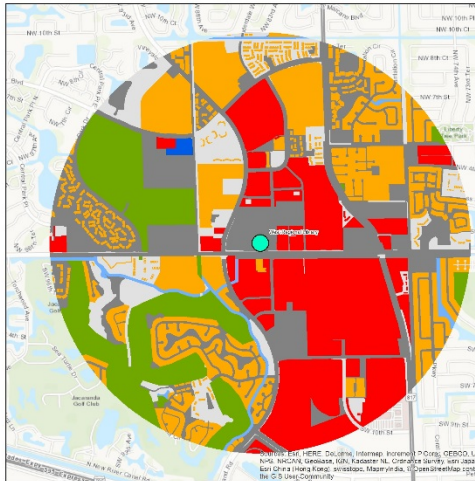
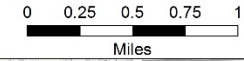
**Residential Areas**

- (9) Riverland Branch
- (10) Helen B. Hoffman Plantation Library
- (11) Doreen Gauthier Lighthouse Point Library
- (12) Hollywood Branch
- (13) North Lauderdale Branch
- (14) Imperial Point Branch
- (15) Stirling Road Library
- (16) Richard C. Sullivan Public Library of Wilton Manors

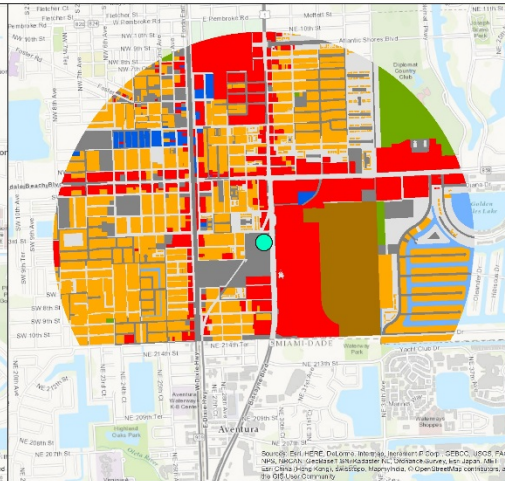
Map provided for informational purposes only.  
Not to be used for legal boundary determination.  
Land uses are based on parcel data from the  
Broward County Property Appraiser



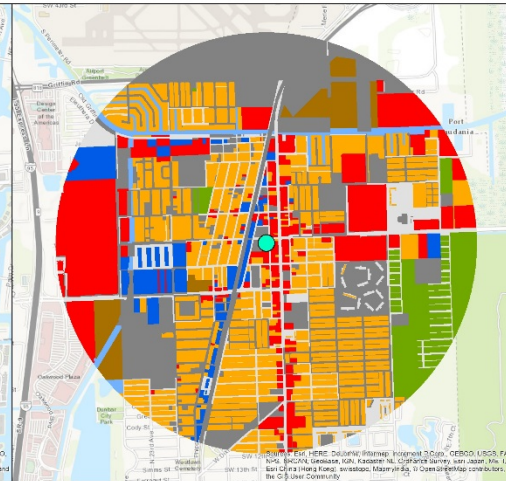
# Potential Light Meter Locations - Commercial Areas



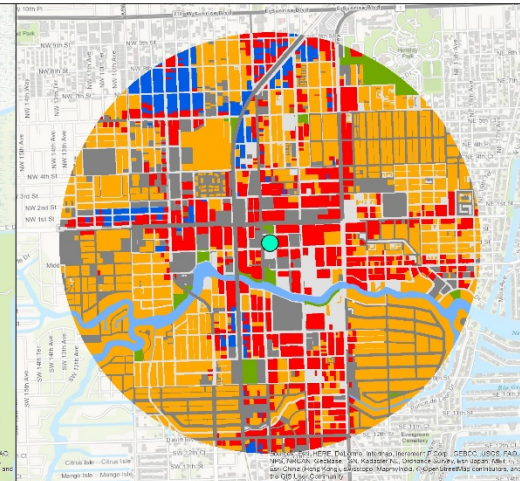
**(1) West Regional Library**  
 Plantation, FL  
 Commercial Area = 22.6%  
 Light Intensity = 50.1



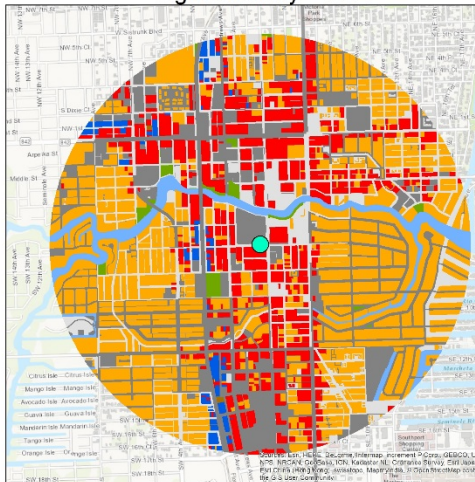
**(2) Hallandale Beach Branch**  
 Hallandale Beach, FL  
 Commercial Area = 21.6%  
 Light Intensity = 67.3



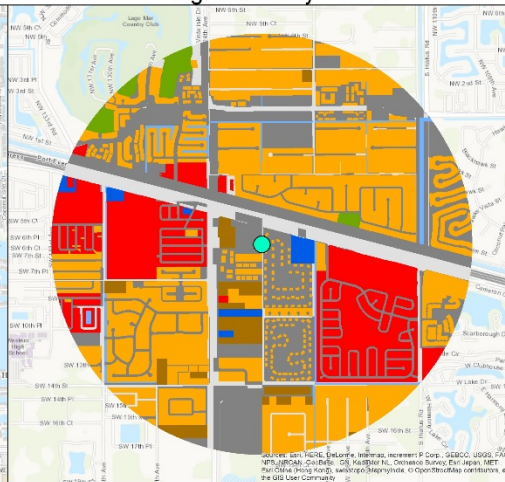
**(3) Dania Beach Branch**  
 Dania Beach, FL  
 Commercial Area = 16.7%  
 Light Intensity = 50.2



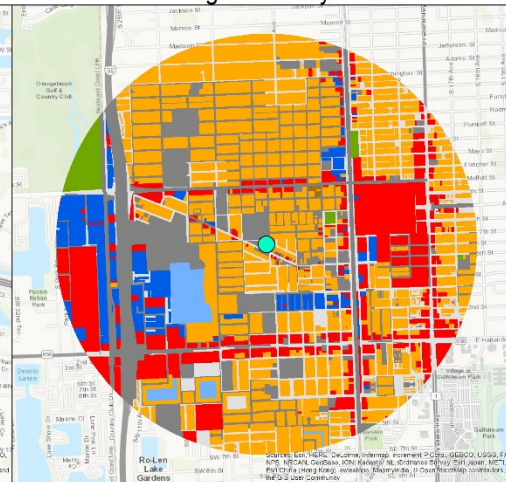
**(4) Main Library**  
 Fort Lauderdale, FL  
 Commercial Area = 16.7%  
 Light Intensity = 87.1



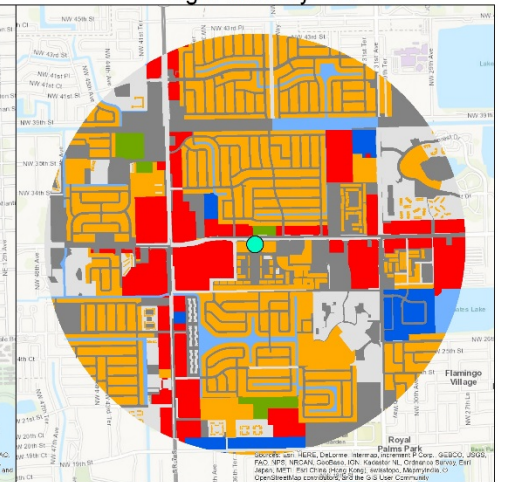
**(5) Broward County Law Library**  
 Fort Lauderdale, FL  
 Commercial Area = 16.0%  
 Light Intensity = 81.6



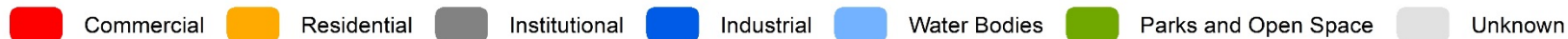
**(6) Young At Art Museum**  
 Davie, FL  
 Commercial Area = 15.8%  
 Light Intensity = 35.3



**(7) Foster Park Micro-Library**  
 Hallandale Beach, FL  
 Commercial Area = 15.6%  
 Light Intensity = 59.3



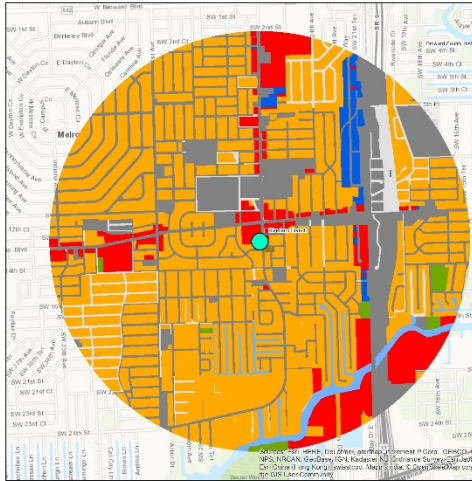
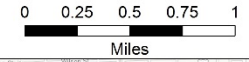
**(8) Lauderdale Lakes Branch**  
 Lauderdale Lakes, FL  
 Commercial Area = 14.5%  
 Light Intensity = 52.5



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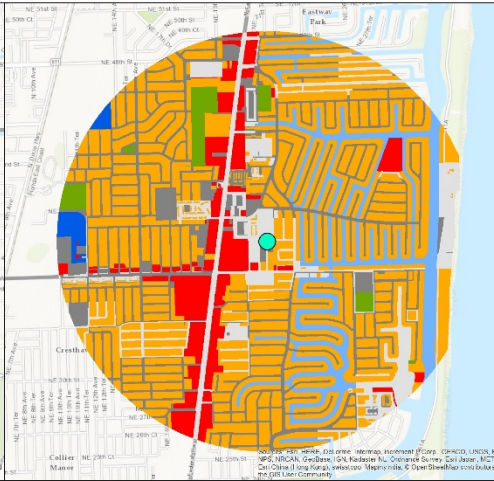
# Potential Light Meter Locations - Residential Areas



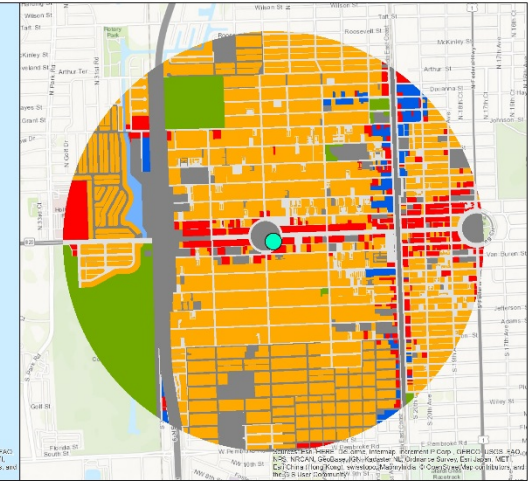
**(9) Riverland Branch**  
Fort Lauderdale, FL  
Residential Area = 54.7%  
Light Intensity = 44.2



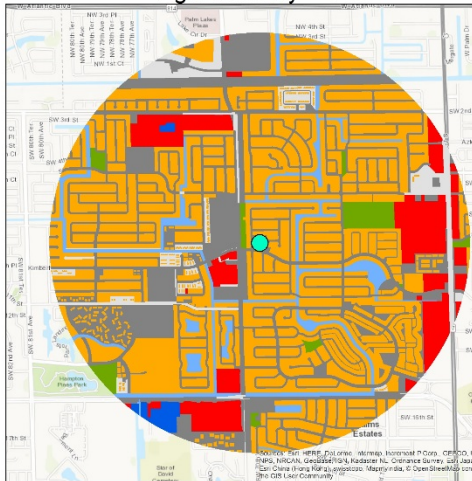
**(10) Helen B. Hoffman Plantation Library**  
Plantation, FL  
Residential Area = 53.4%  
Light Intensity = 35.5



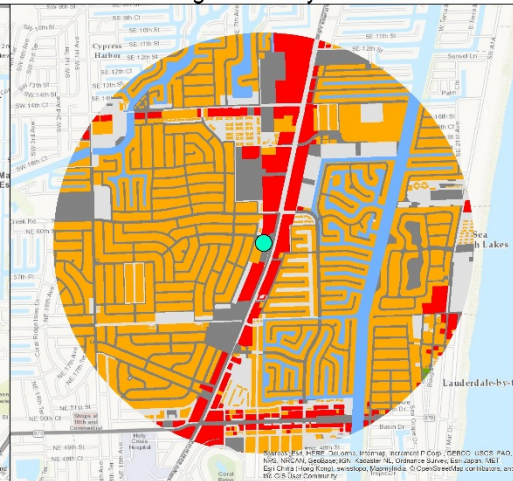
**(11) Doreen Gauthier Lighthouse Point Library**  
Lighthouse Point, FL  
Residential Area = 50.0%  
Light Intensity = 42.2



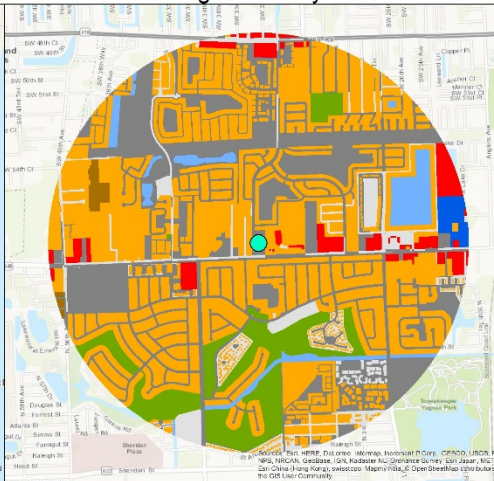
**(12) Hollywood Branch**  
Hollywood, FL  
Residential Area = 49.2%  
Light Intensity = 48.1



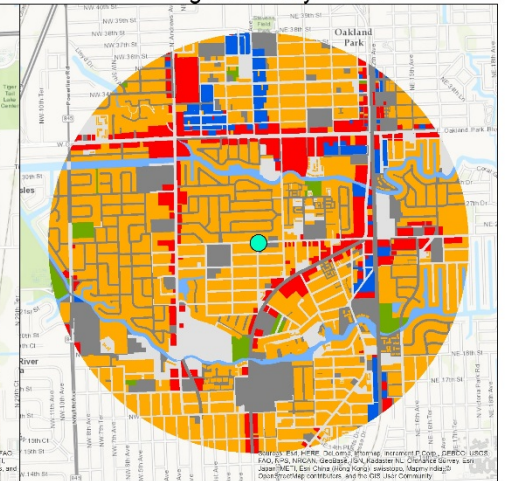
**(13) North Lauderdale Branch**  
North Lauderdale, FL  
Residential Area = 49.2%  
Light Intensity = 39.4



**(14) Imperial Point Branch**  
Fort Lauderdale, FL  
Residential Area = 47.9%  
Light Intensity = 44.8



**(15) Stirling Road Library**  
Hollywood, FL  
Residential Area = 47.8%  
Light Intensity = 33.9



**(16) Richard C. Sullivan Public Library**  
Wilton Manors, FL  
Residential Area = 47.1%  
Light Intensity = 51.9



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