
Energy · Quality · Controllability
Light Pollution Research Meets Control Technology: What You Need to Know
December 10, 2025
designlights.org

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Agenda
2:00 PM: Welcome, Agenda Review, Introductions & DLC QPLs
2:05 PM: When Cities Never Sleep
2:20 PM: Network Lighting Controls
2:35 PM: Digital Twins + NLCs
2:50 PM: Q&A
2

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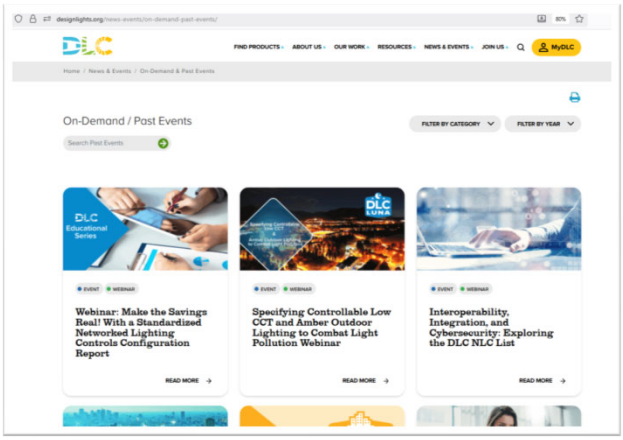
Welcome!

- **Slides and recorded webinar will be posted** on the *DLC News & Events* page at https://designlights.org shortly after today's presentation
- All attendees are automatically muted



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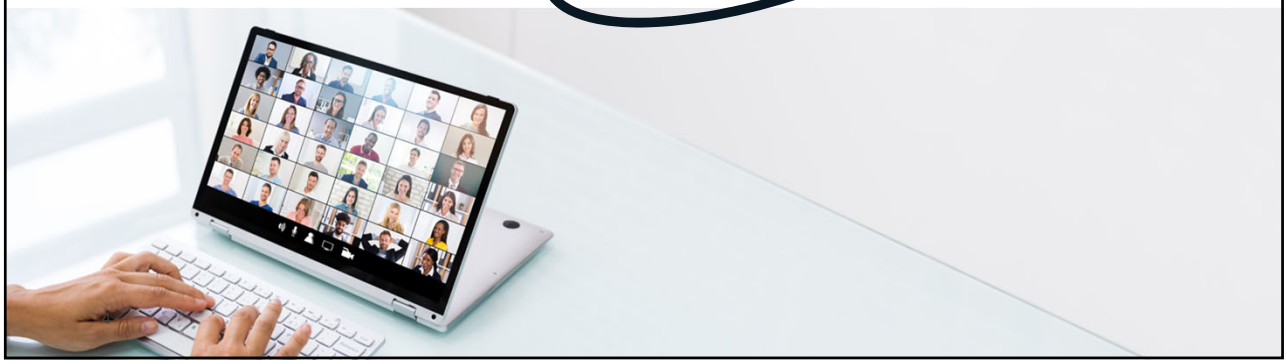
Webinar Orientation

- **Questions will be held until the end during a live Q&A**
  - **Use the Question pane (not Chat) to submit for Q&A**



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The DesignLights Consortium is an independent, nonprofit organization providing decision makers with data and resources on quality lighting, controls, and integrated building systems to reduce energy, carbon, and light pollution.

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Speakers

Leora Radetsky
DLC

Lin Meng
Vanderbilt University

Michael Davidson
Synapse Wireless

Nick Mesler
Evari Consulting

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Lighting + controls in application

The right light × At the right time = Save energy and reduce light pollution

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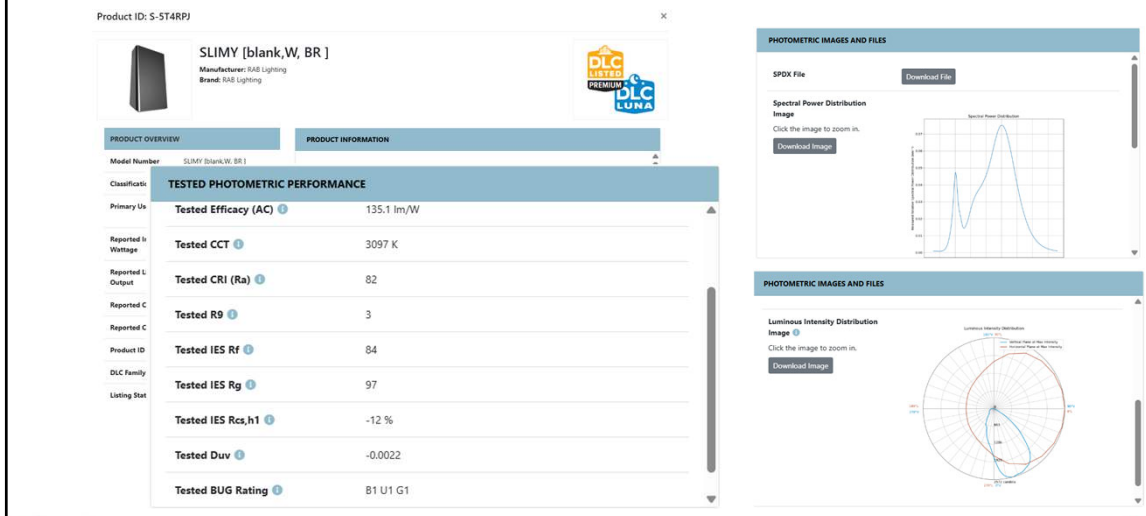
Selecting responsible outdoor lighting products



Example of a LUNA V1 listing

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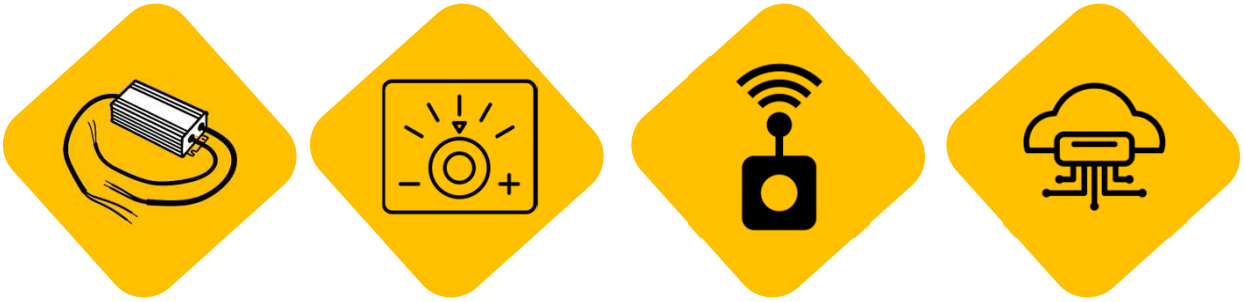
Using controls NLCs to save more energy and further reduce light pollution

- Controls Options Tables in LUNA V2 listings enable deeper reductions



Driver information

Dimming type and min. level

Integral controller and/or sensor

Link to DLC NLC-listed product(s)

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Impacts of light pollution
Lin Meng

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When Cities Never Sleep: How Artificial Light at Night Shapes Trees, Allergies, and Urban Sustainability

Lin Meng, Ph.D.

Department of Earth and Environmental Sciences
Vanderbilt University

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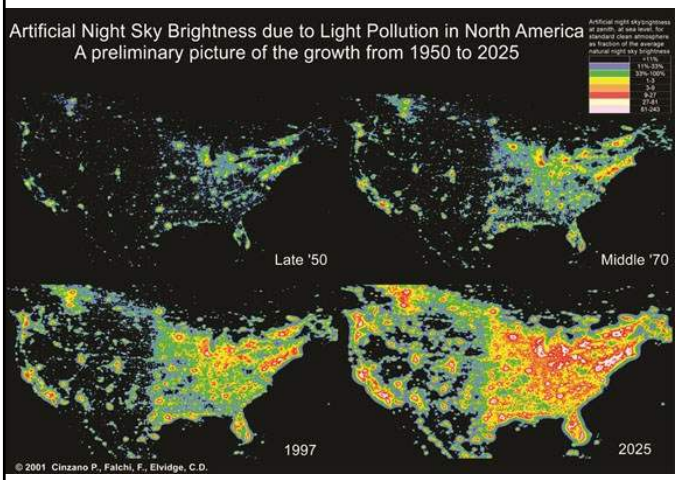
Increasing artificial light at night (ALAN)



Cinzano, P., Elvidge C. 2003. Night sky brightness at sites from satellite data. Memorie della Società Astronomica Italiana, 74, 456-457.

- Urban night skies are getting brighter by 9.6%/year due to expanding cities and widespread LED adoption.
- ALAN alters the natural day–night cycle that organisms depend on for timing growth and seasonal events.
- Even low-intensity light can produce biological effects that humans do not notice.

Understanding ALAN impact is essential for managing the urban ecosystem, public health, and long-term sustainability.

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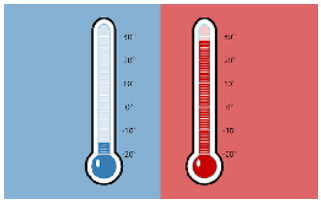
Environmental cues for tree growth



Temperature

Day length

Plant phenology

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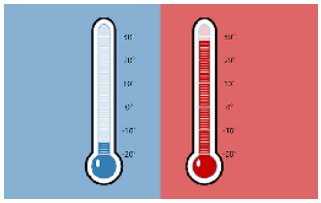
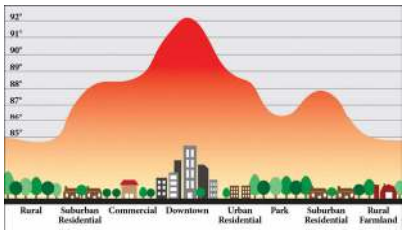
Altered urban environments



Temperature

Day length



Urban heat island

Artificial light

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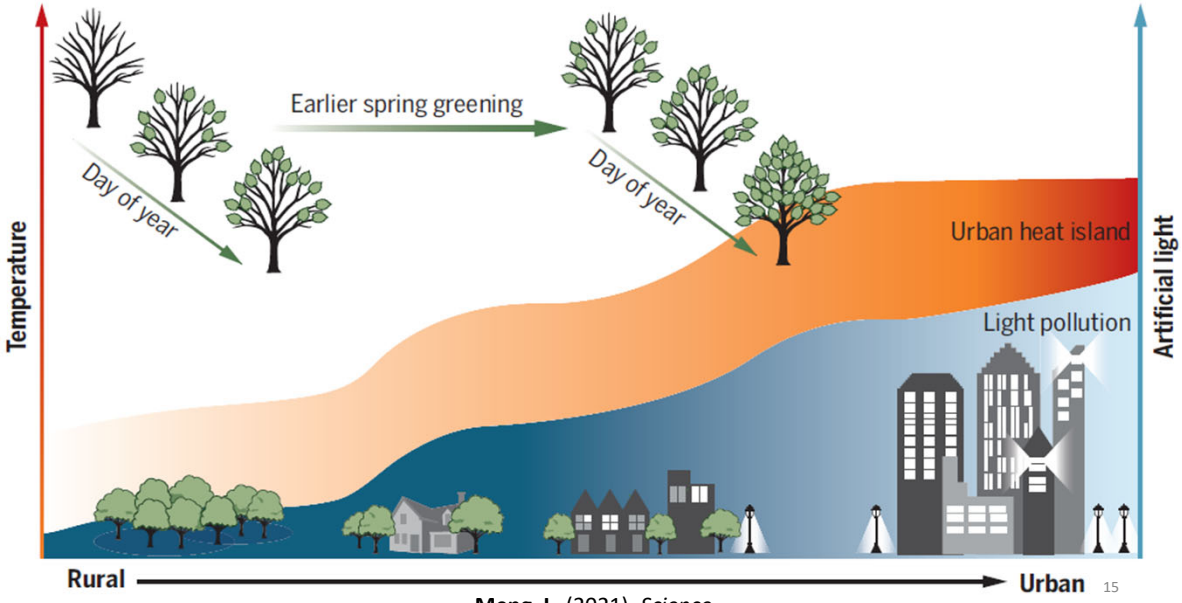
Whether artificial light affects plant phenology?



Meng, L. (2021). *Science*.

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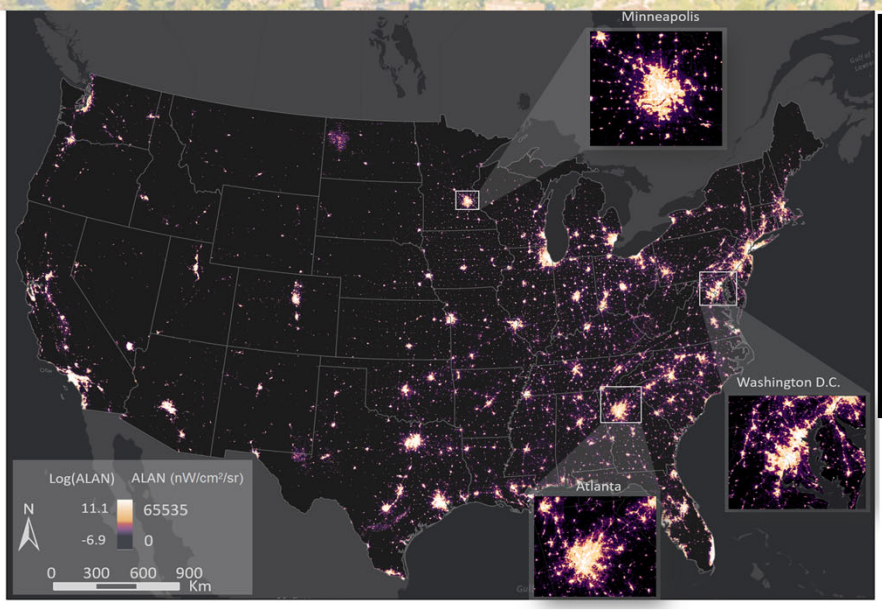
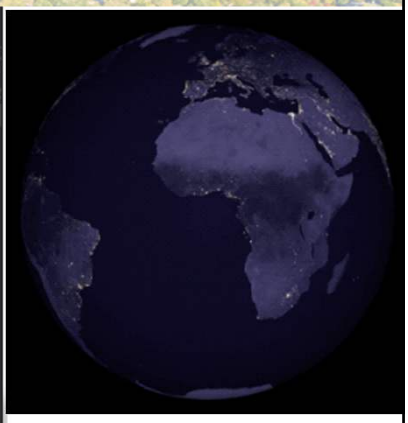
NASA Black Marble ALAN product





Meng Lin, et al. *PNAS Nexus* (2022)

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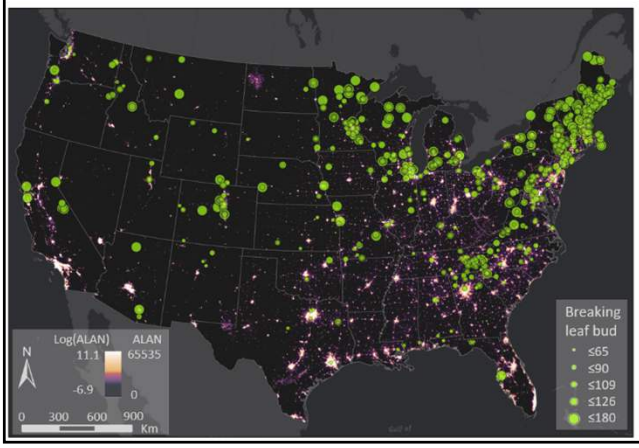
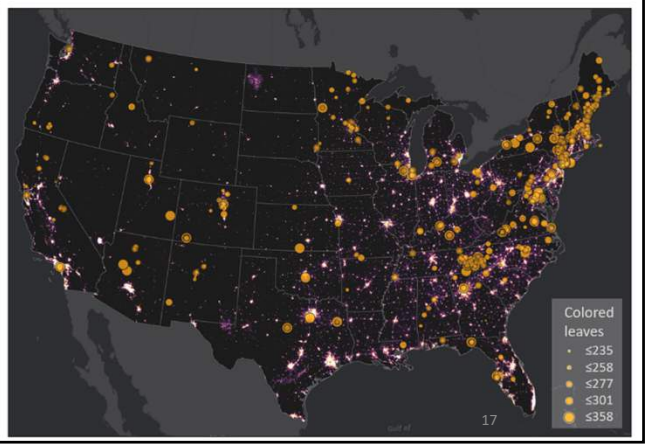
USA National Phenology Network

- Citizen science program
- Breaking leaf buds: 2952 records, 17 species
- Colored leaves: 2148 records, 23 species





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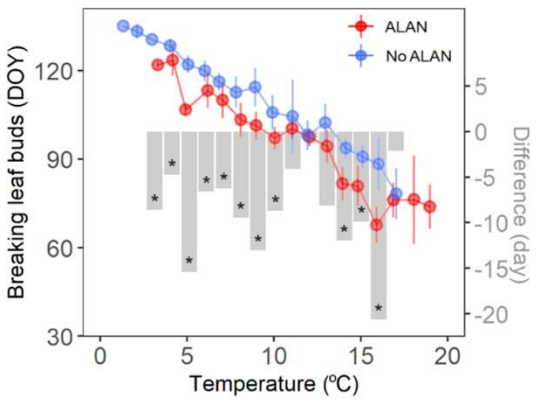
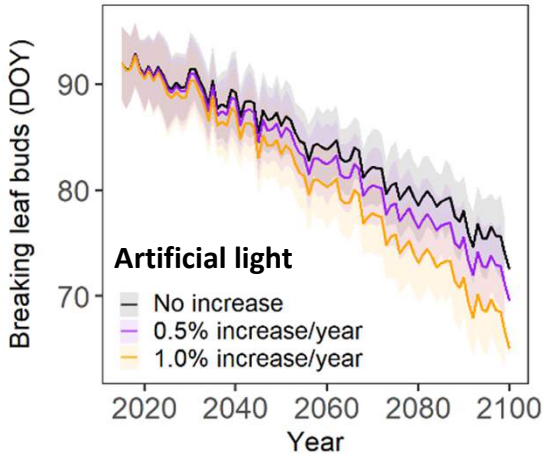
ALAN leads to earlier spring leaf-out





8.9 ± 6.9 days (mean ± SD) earlier

1% increase: 7 days, 40% warming effect

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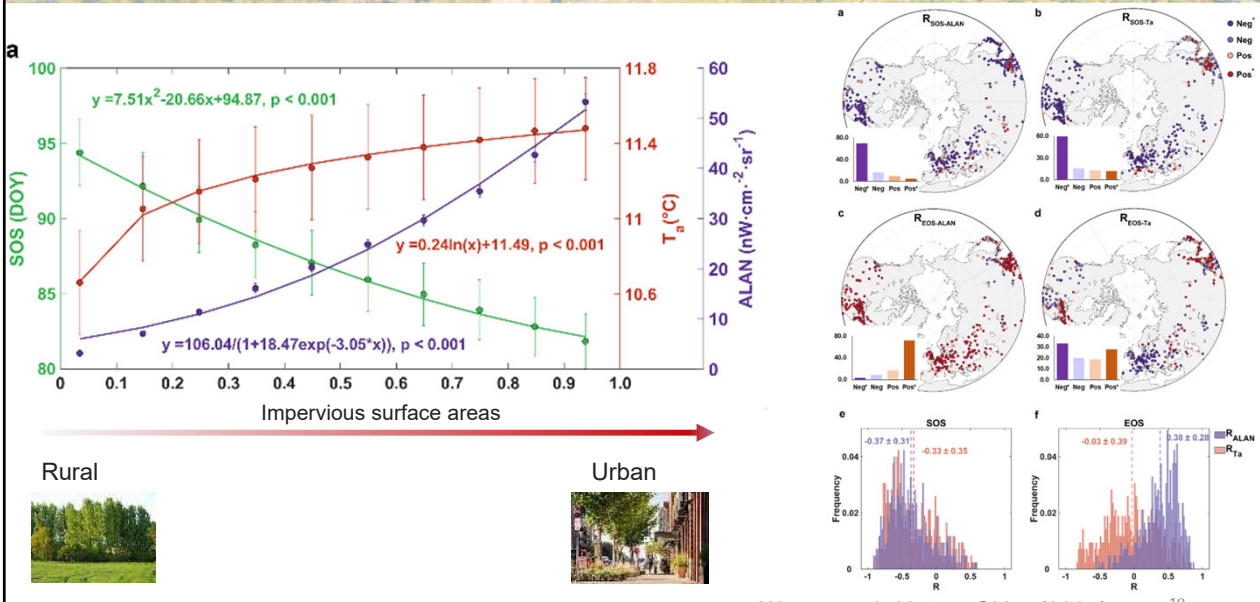
ALAN outweighs temperature effect



Wang, et al. *Nature Cities* (2025)

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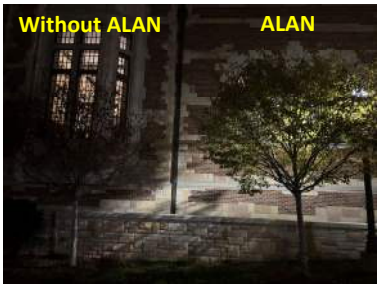
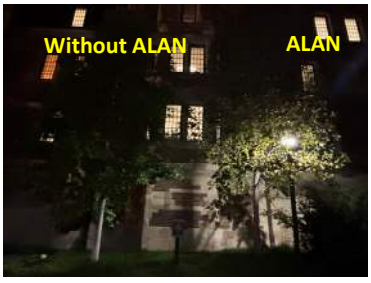
Species-specific response to ALAN



Hornbeam:

ALAN **delays** leaf fall, **reduces** stomatal conductance.



Liriodendron:
ALAN **advances** leaf fall, **increases** stomatal conductance.

Yi and Meng et al., (In preparation).

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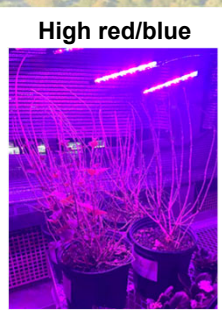
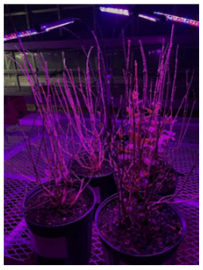
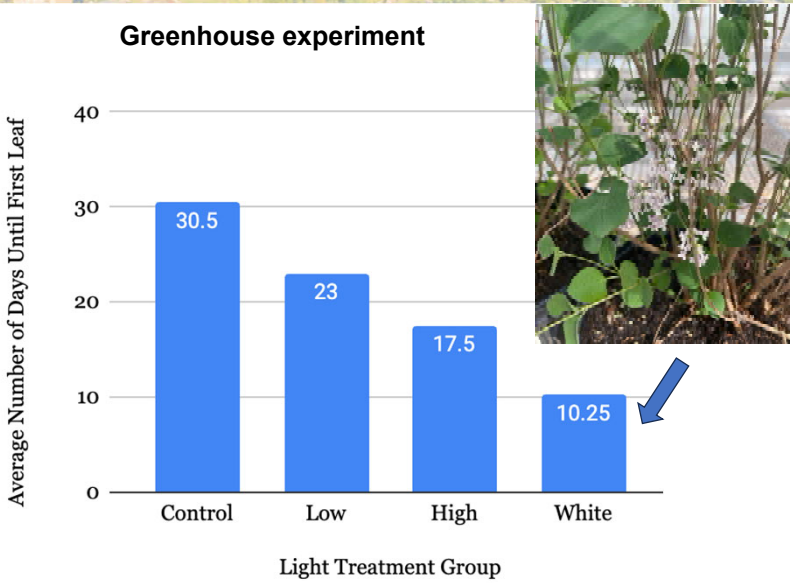
Critical threshold of ALAN







Bishop and Meng et al., (In preparation).

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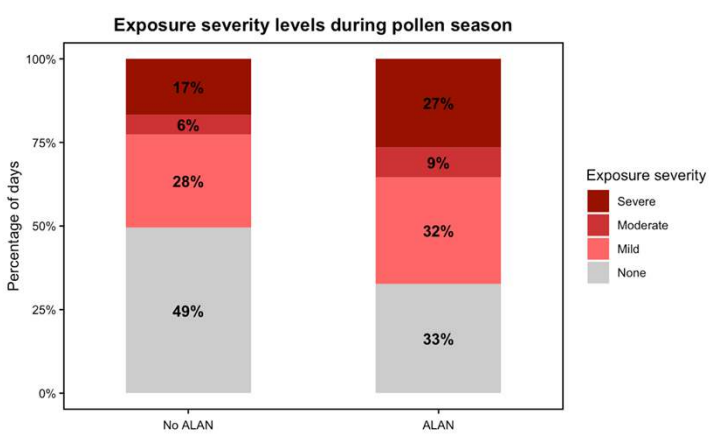
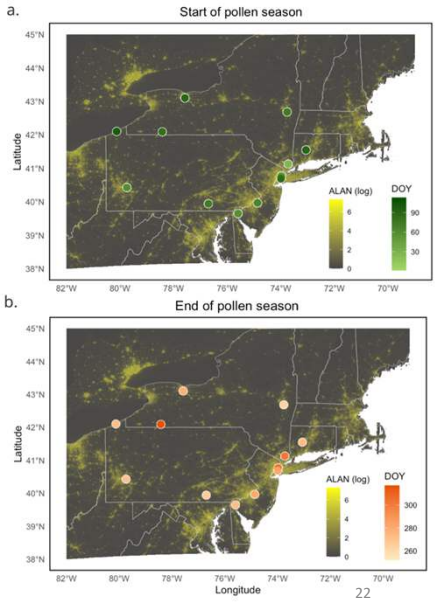
Higher pollen exposure under ALAN





- Earlier and longer pollen season under ALAN
- Higher exposure severity level under ALAN

Brandt Geist et al. PNAS NEXUS (under review).

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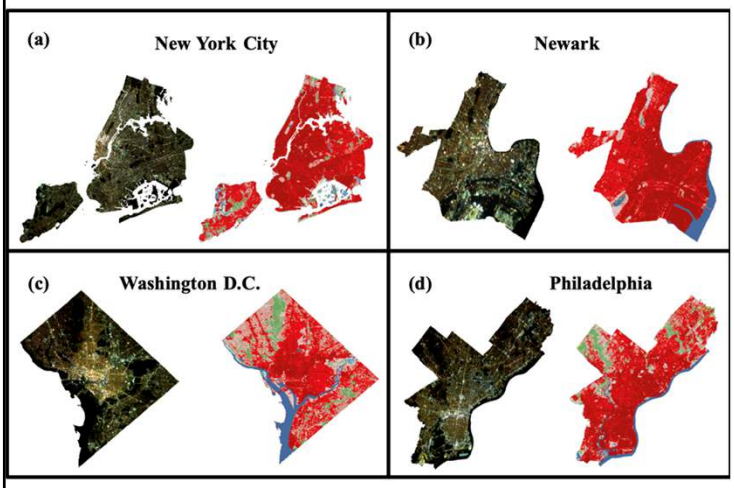
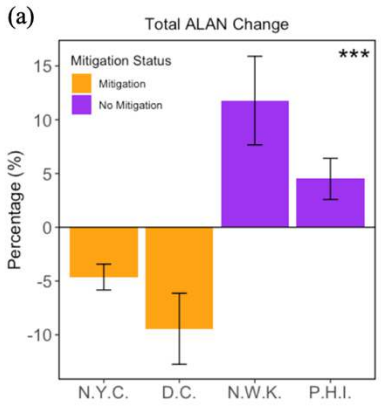
Impact of ALAN mitigation policy in NYC and D.C.

With ALAN policy **Without policy**





- Decreased ALAN at cities with policy
- Reduced impact on plant phenology

Brandt Geist et al. PNAS NEXUS (under review).

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Conclusions

- ALAN alters tree timing and extends pollen seasons.
- These shifts affect human allergies and urban ecosystems.
- Smarter, targeted lighting can reduce negative impacts.
- Managing nighttime light supports healthier, sustainable cities.

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The Poetry of Science

"this is sixth form poetry, not Keats or Yeats"

POETRY PODCAST ABOUT CONTACT

Artificial Rhythms

June 17, 2022 by Sam Illingworth

Turning from the sun
our planet tries to sleep,
its marbled surface blemished
by the humming need
of a billion pinpricks of light.
Snoozing saplings start to stir,
their dreams distorted
by the never-ending break of day.
Blooming buds jump morning cues
to catch delayed displays
of lagging leaves,
their colours changed forever
in the suspended senescence
of this disordered life.

https://thepoetryofscience.scienceblog.com/3566/artificial-rhythms/

Thank you!

Contact me:
Lin.meng@Vanderbilt.edu
X: @menglinmet

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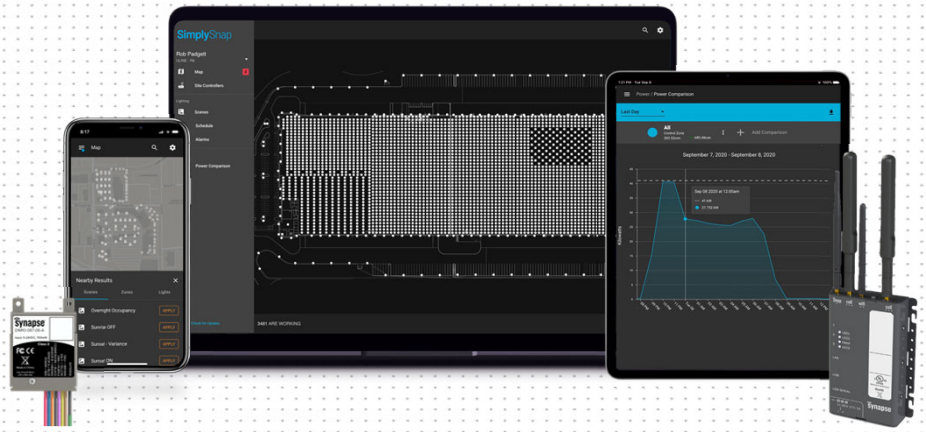
SimplySnap
Lighting Management

Simple.
Flexible.
Reliable.



synapse
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SimplySnap
Lighting Management

Darky Sky isn't just about better fixtures

- Networked Lighting Control is a must
- Adjust Light Output to the Environment
- Zoning, Grouping, High End Trim
- Adaptive Schedules
- Diagnostics keep Lights Running
- LLLC Persistence is another Level of Protection
- Cloud Capability allows remote scheduling

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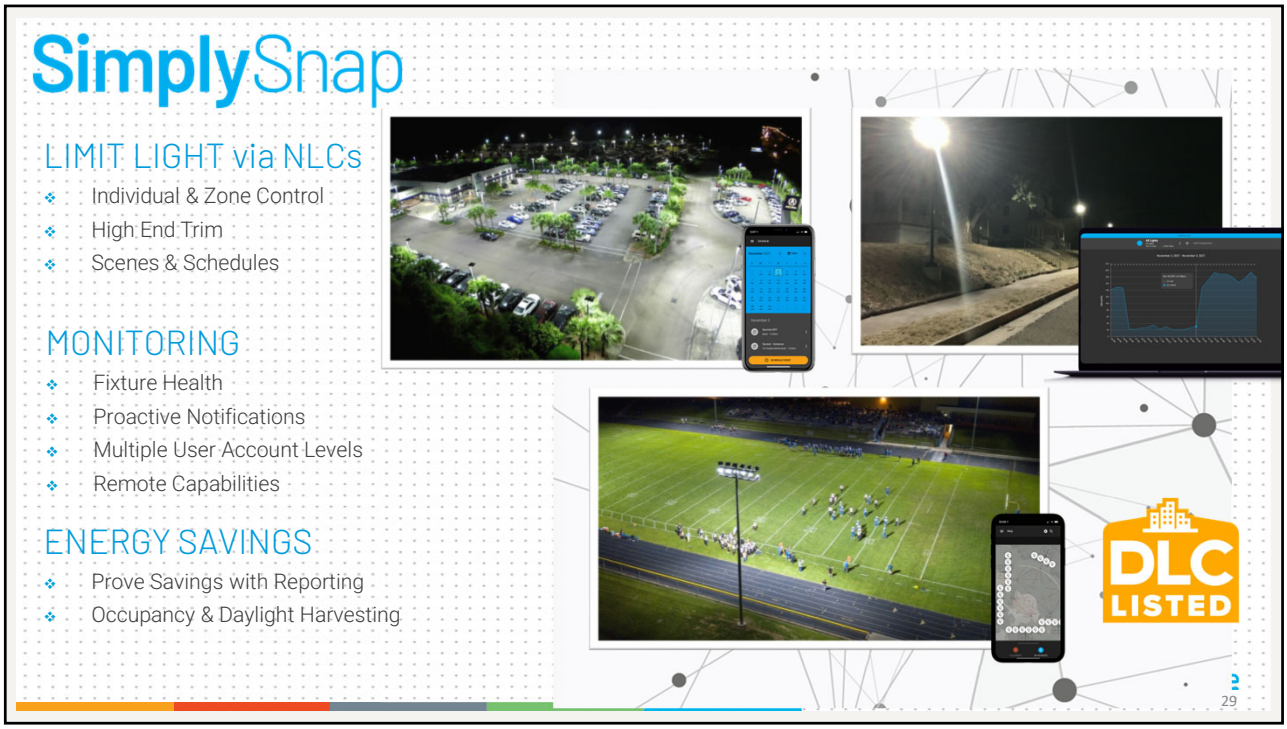
SimplySnap
LIMIT LIGHT via NLCs
Individual & Zone Control
High End Trim
Scenes & Schedules
MONITORING
Fixture Health
Proactive Notifications
Multiple User Account Levels
Remote Capabilities
ENERGY SAVINGS
Prove Savings with Reporting
Occupancy & Daylight Harvesting
DLC LISTED
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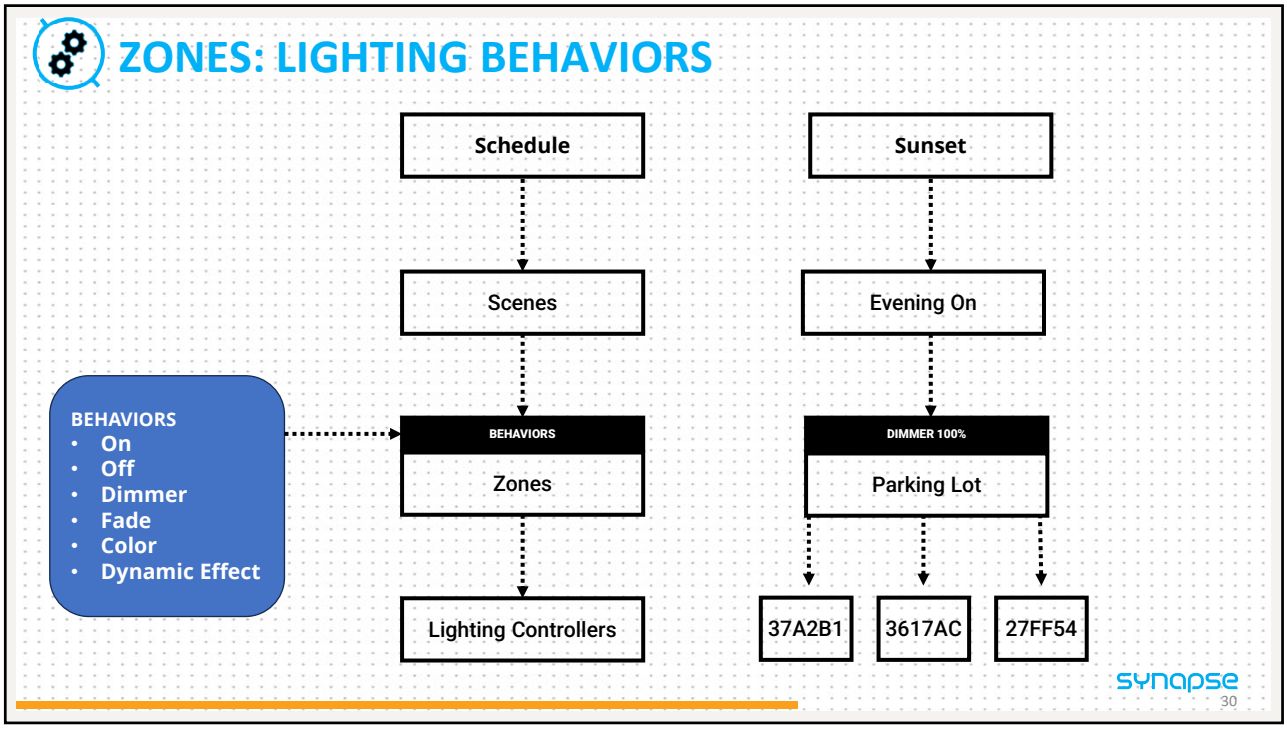
ZONES: LIGHTING BEHAVIORS
Schedule
Scenes
BEHAVIORS
Zones
Lighting Controllers
Sunset
Evening On
DIMMER 100%
Parking Lot
37A2B1
3617AC
27FF54
BEHAVIORS
On
Off
Dimmer
Fade
Color
Dynamic Effect
synapse
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⚽ Sports Lighting (Community / School Fields)

Time	Light Level	Strategy
Practice/Game Period	100%	Full-play lighting
Event End → 30 min	30–50%	Clearing area safely
After 30 min	Off	Hard curfew prevents sky glow

✓ Best practice: program auto-shutdown tied to scheduler/event calendar
✓ Spectral shift to <3000K during low-mode if tunable

🛣️ Roadways (Adaptive Traffic-Based)

Condition	Light Level
Normal traffic	100%
Low traffic (nighttime)	40–60%
Very low traffic (late night)	20–30%
Zero activity	10% standby or off

🚶 Parks + Trails

Time	Light Level	Strategy
Sunset – 10:00 PM	60–80%	Recreational use
10:00 PM – Sunrise	0–20% + Motion activation to 60–80%	Minimize wildlife disruption

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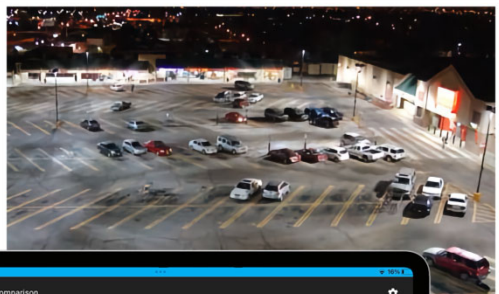
Key Benefits

- Save ~40% on energy consumption w/ occupancy sensors & flexible schedules
- Prove Compliance with Highly accurate power monitoring vs Calculated Power.
- Power Monitoring indicates are the lights working?
- Power Monitoring allows verification of the right amount of light
- Monitor the state & health with Reports and email alerts



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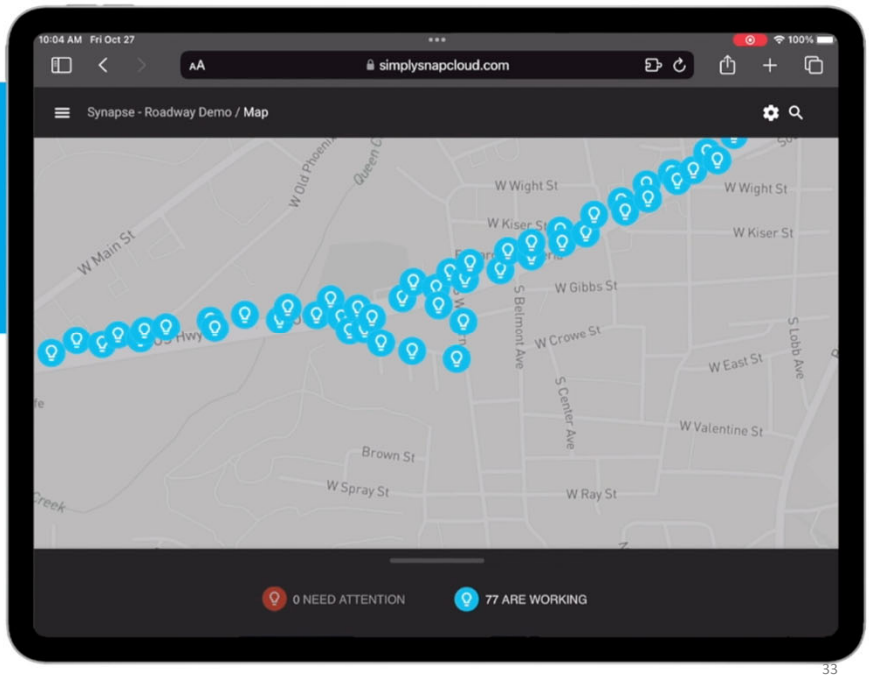
Fixture failure detection

Automatically monitor for and alert on fixture power issues and driver errors



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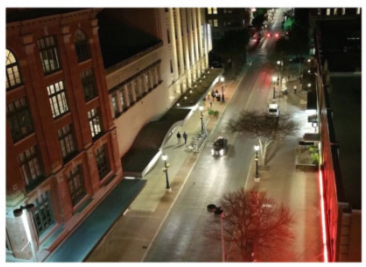
Key Benefits – Municipal & roadway

- Scalable deployment models
- Track assets across the municipality
- Immediate e-mail alerts, as well as hourly, daily or weekly reporting of fixture outages
- GPS, Tilt & Photocell built-in to twist lock nodes
- AC & DALI/D4i twist lock controller options
- Diagnostics, Help Pinpoint Lights if lights stuck on
- Interoperable with other systems via OnPrem or Cloud API



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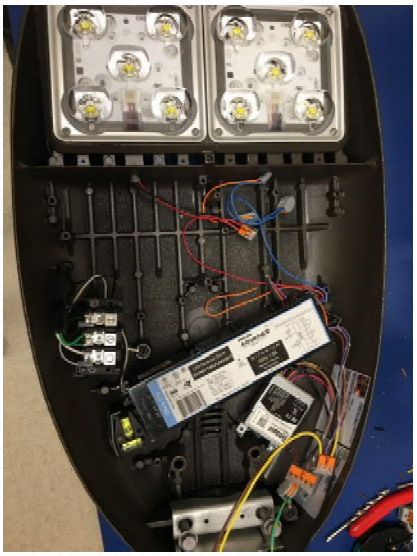
Asset Management w/ D4i

- Improved LED driver information in UI
  - Short address, GTIN, Manufacturer, Color Channel, Serial Number
- D4i asset data
  - End Customer defined part number, CCT, CRI, Wattage, Mfg. Part Number, etc.
- Customer defined Info
  - Turtle, Desert, Forest, Loading Dock, etc.



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LLLC Persistence

- If the Gateway loses power. After 15 minutes
  - Lights will use Day Light / Dark to function
- Lights will go to 30% at Dusk. Off at Dawn
- With Presence Control,
  - Lights to 80% with Motion,
  - Shortly after, back to 30%
- When Gateway comes back, Lights return to schedules
- Must have this extra layer of Protection against Light Bombs

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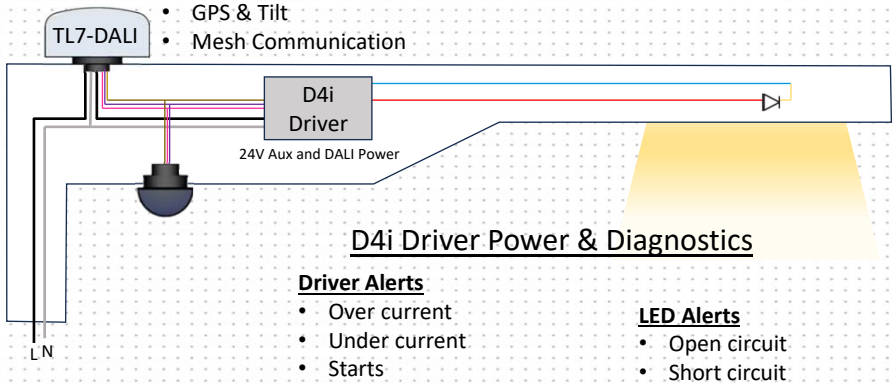
NEMA C136.41/Zhaga Socket

2-Node D4i Architecture

With DC Controllers, Fewer Components, Fewer Failures

TL7-DALI-DC D4i
- Photocontrol
- GPS & Tilt
- Mesh Communication



D4i Driver Power & Diagnostics

Diagnostics

Driver Alerts
- Over current
- Under current
- Starts
- Power output limitation
- Over temp

LED Alerts
- Open circuit
- Short circuit

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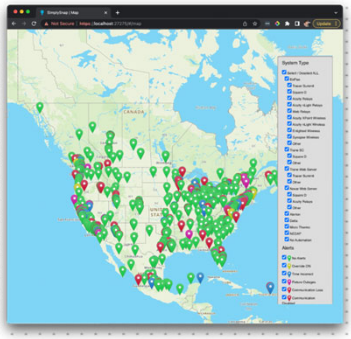
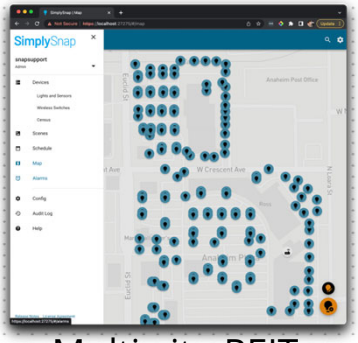
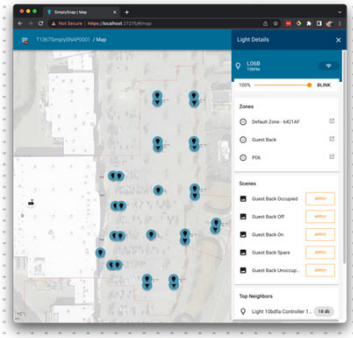
Scalable Deployment Models Aid Seasonal Adjustments with Migration



- Nationwide footprint
- 636 Locations
- 350,000 Lights
- Indoor & Outdoor



- Multi-site REIT
- 151 Locations
- 3,464 Lights
- Outdoor



- Big Box Retailer
- 1,117 Locations
- 32,193 Lights
- Outdoor

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SUMMARY

Dark Sky Benefits — Powered by Smart Lighting Controls
Smart Controls = Right Light, Right Place, Right Time

- Reduce Sky Glow
- Enhance Energy Efficiency
- Protect Wildlife & Human Health
- Improve Safety When It Matters
- Reduce Light Trespass
- Prove Compliance

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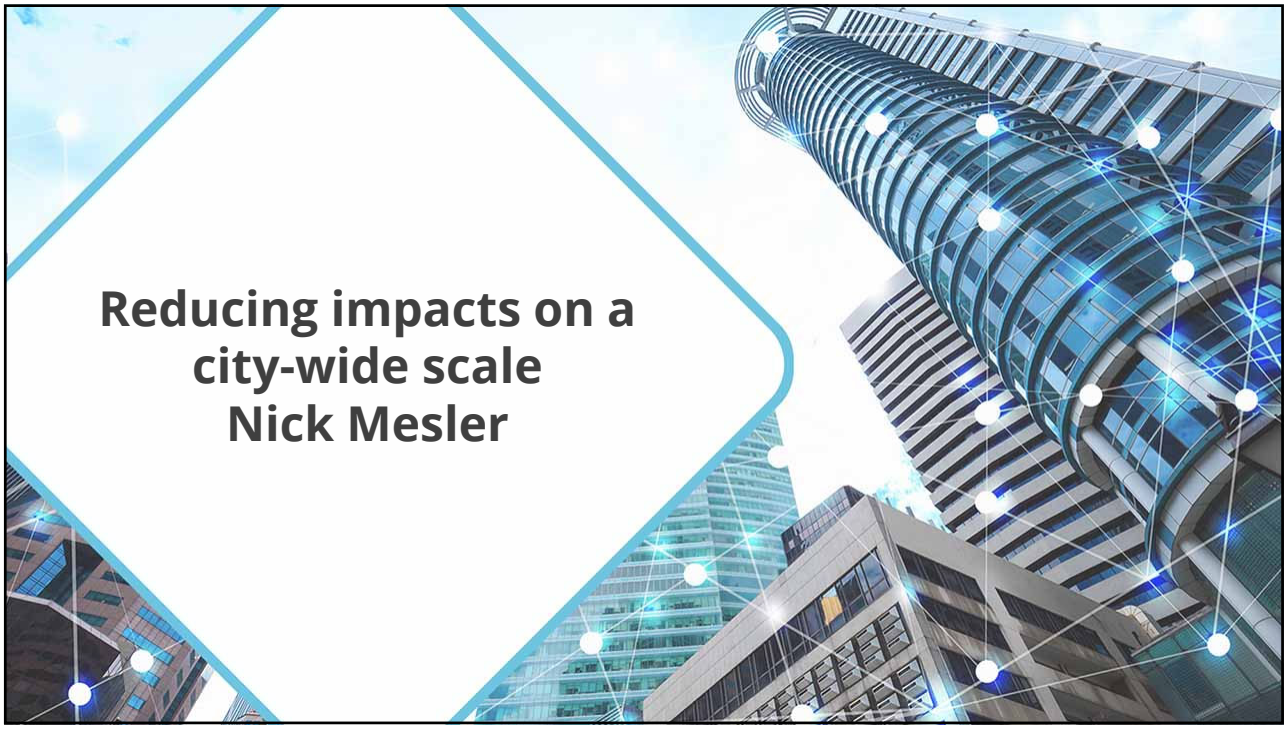

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Digital Twins + NLCs >>
Mitigating Light Pollution
EVARI Consulting
DBE CERTIFIED ENTERPRISE
SBE CERTIFIED ENTERPRISE
esri Silver
aws partner network
EVARI
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Introduction
Nick Mesler, PE, TE, CFLC
Director of Business Solutions
Evari Consulting, Inc.
• A "plangineer"
• Background in Traffic/Transportation Engineering/Planning
• Specialized in Street Lighting Digital Twin Delivery and Street Light Master Planning
• Street Lighting Data Collection and Design
• Primarily LED Conversion Projects & SLMPs
• Projects spanning AK, CA, FL, HI, MA, MD, MS, OR, PA, RI, TN, TX, UT, WA, WI, WY
• https://www.ledsmagazine.com/architectural-lighting/article/14303211/industry-insights-cities-can-help-reverse-redlining-effects-by-deploying-quality-streetlighting
EVARI
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TODAY'S AGENDA

- Digital Twin Applications
- Problem Solving
- Controls Integration

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Street Lighting: Social Benefits (Comfort and Placemaking)

San Diego Gaslamp

Bourbon Street, NOLA

Anamosa, Iowa

Waikiki Beach, HNL

- Improved Visibility
- Feeling of Security
- Ambiance
- Accentuates architecture
- Encourages social gatherings
- Supports nighttime economy
- Reflects local character

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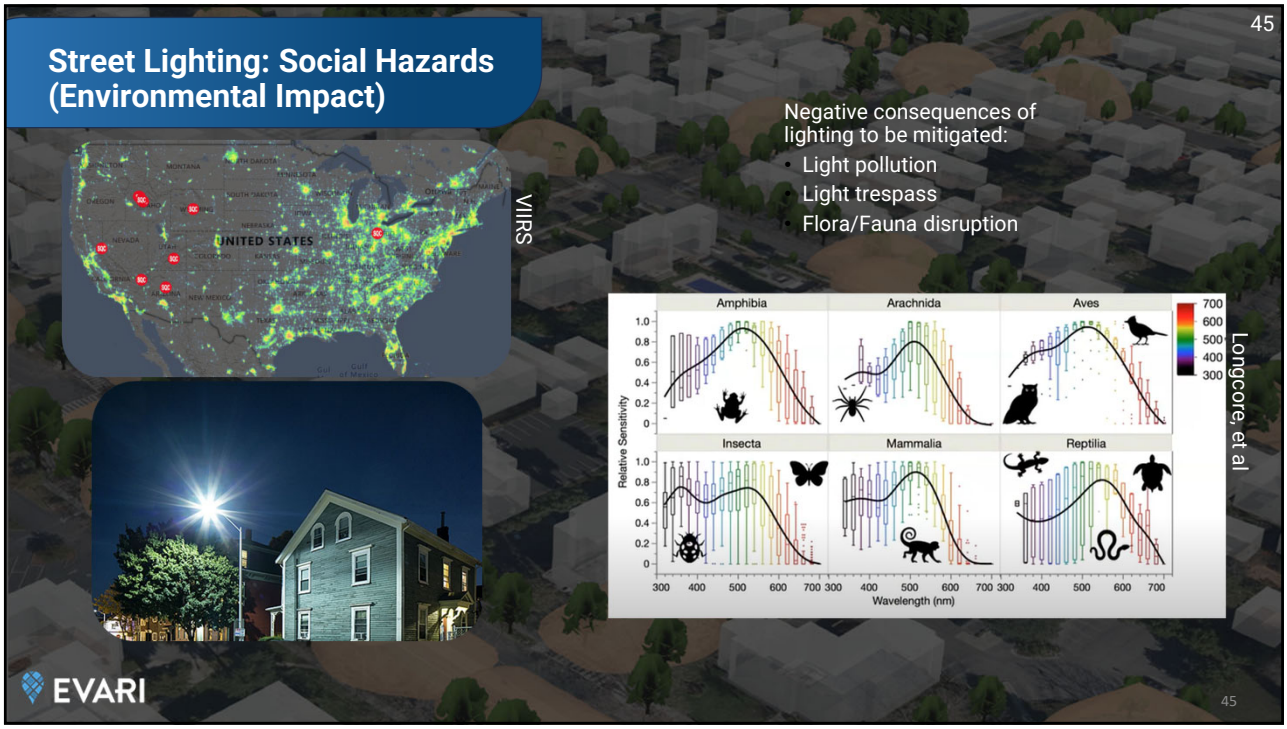
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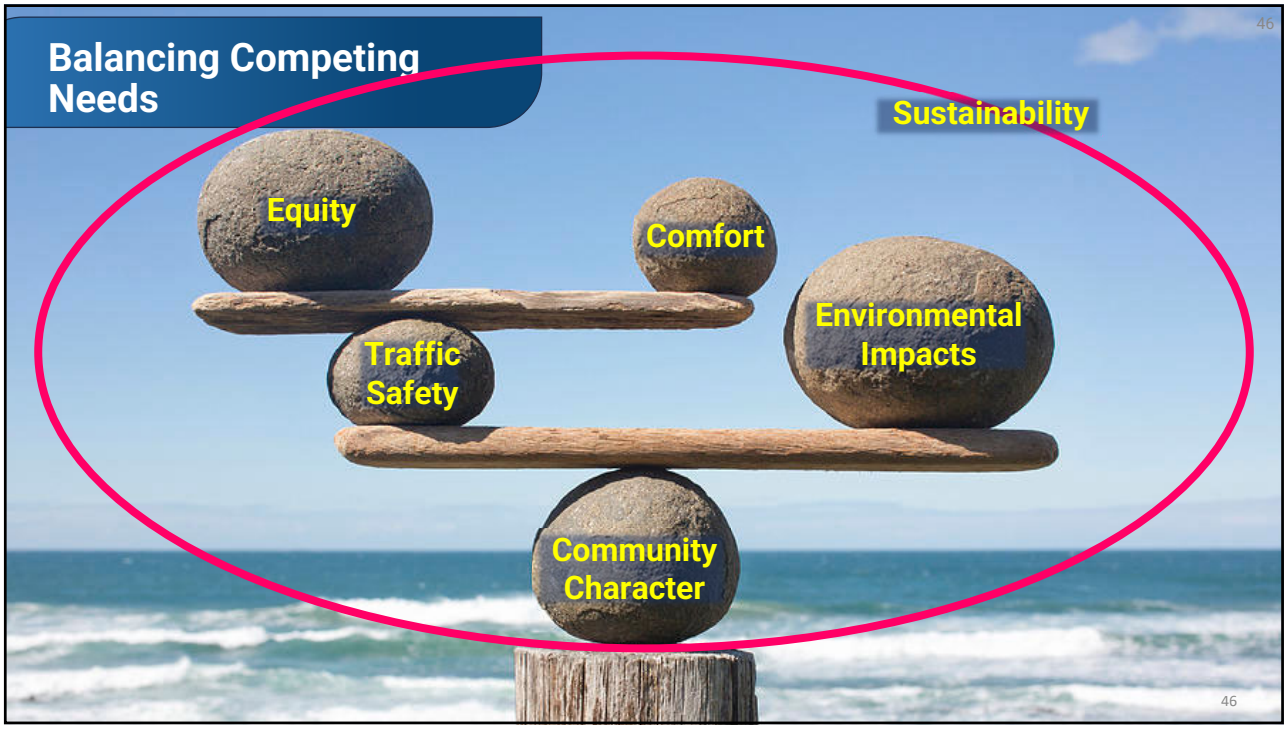
Street Lighting: Social Hazards (Environmental Impact)
Negative consequences of lighting to be mitigated:
• Light pollution
• Light trespass
• Flora/Fauna disruption
VIIRS
UNITED STATES
Amphibia
Arachnida
Aves
Insecta
Mammalia
Reptilia
Relative Sensitivity
Wavelength (nm)
Longcore, et al
EVARI
45

45


46
Balancing Competing Needs
Sustainability
Equity
Comfort
Environmental Impacts
Traffic Safety
Community Character
46

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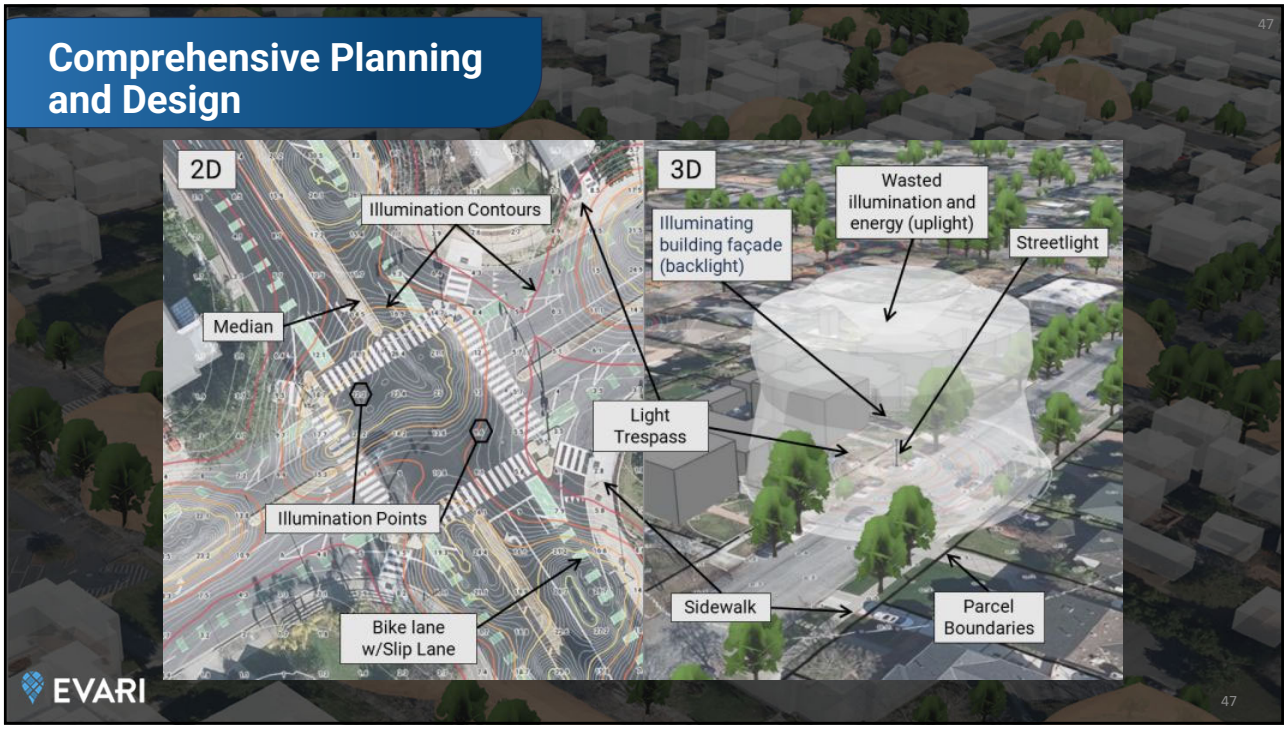
Comprehensive Planning and Design
47
2D
Illumination Contours
Median
Illumination Points
Bike lane w/Slip Lane
3D
Illuminating building façade (backlight)
Wasted illumination and energy (uplight)
Streetlight
Light Trespass
Sidewalk
Parcel Boundaries
EVARI
47

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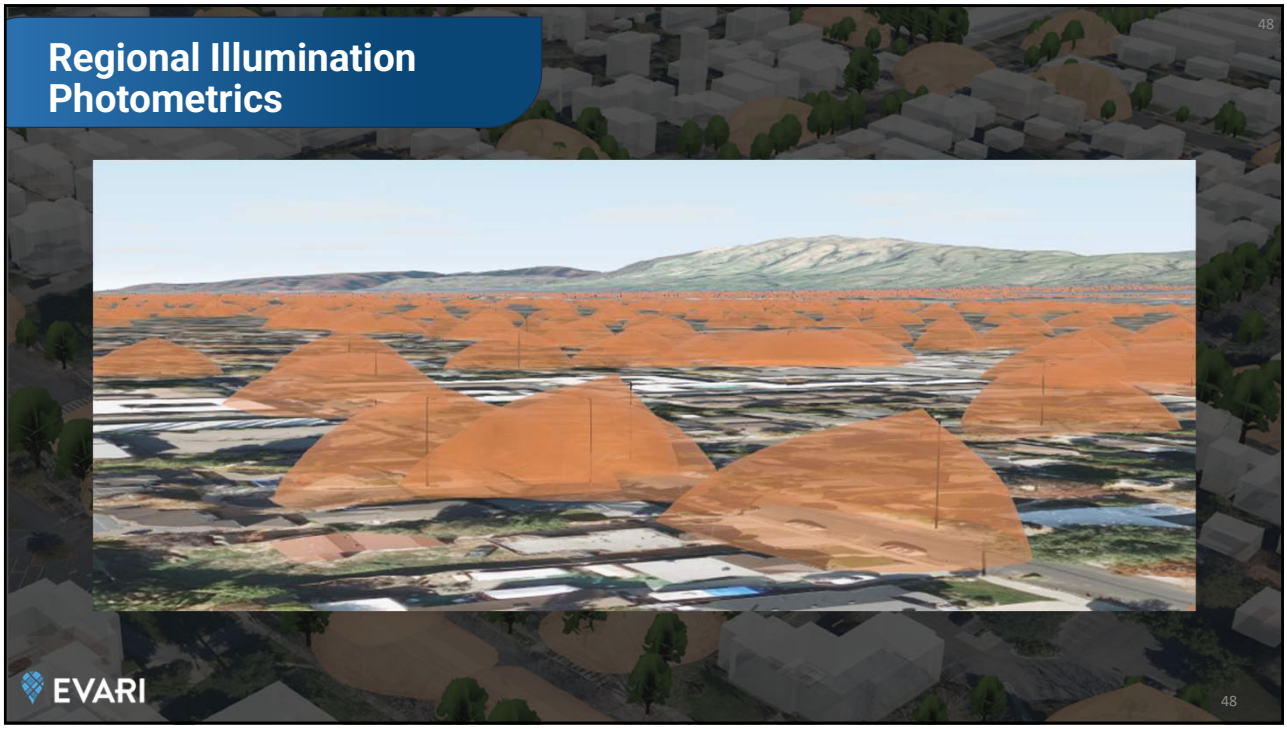
Regional Illumination Photometrics
48
EVARI
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Time-Based Design

Table 11.X Illuminance Lighting Design Criteria for Streets, Bicycle lanes, Buffer-Separated Lanes, and Shared Streets where Luminance is not applicable such as curves, short blocks and inconsistant luminaire spacing

Street and Pedestrian Conflict Area		Pavement Classification (Minimum Maintained Average Valuues)			Average Uniformity Ratio Eavg/Emin	Max Veiling Luminance Ratio Lvmax/Lavg
Street Classification	Pedestrian Activity Classification*	R1 lux/fc	R2 & R3 lux/fc	R4 lux/fc		
MAJOR	HIGH	12.0/1.1	17.0/1.6	15.0/1.4	3.0	0.3
	MEDIUM	9.0/0.8	13.0/1.2	11.0/1.0	3.0	0.3
	LOW	6.0/0.6	9.0/0.8	8.0/0.7	3.0	0.3
COLLECTOR	HIGH	8.0/0.7	12.0/1.1	10.0/0.9	4.0	0.4
	MEDIUM	6.0/0.6	9.0/0.8	8.0/0.7	4.0	0.4
	LOW	4.0/0.4	6.0/0.6	5.0/0.5	4.0	0.4
LOCAL	HIGH	6.0/0.6	9.0/0.8	8.0/0.7	6.0	0.4
	MEDIUM	5.0/0.5	7.0/0.7	6.0/0.6	6.0	0.4
	LOW	3.0/0.3	4.0/0.4	4.0/0.4	6.0	0.4

Table Notes:

* Pedestrian Activity Classifications are defined in **Section 11.3.1.**

E_{avg}: Maintained average illuminance.

E_{avg}: Minimum illuminance

$L_{v,max}$: Maximum veiling luminance

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Regional Illumination Photometrics

EVARI

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Regional Illumination Photometrics
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EVARI
51

51


Automating Decisions
52
How to make truly “SMART”?
ON. OFF. ON. OFF.
EVARI
52

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Modeling Exterior Lighting

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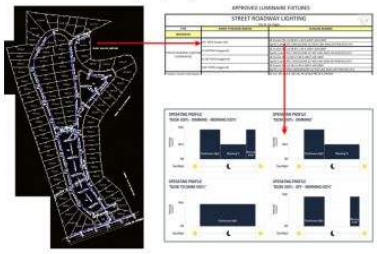
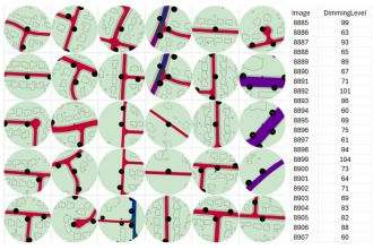
Geospatial + AI = Better Lighting

Better Lighting = Safety, Security, Economic, and Environmental Benefits

Today: A designer sets one dimming schedule for thousands of lights, regardless of conditions.



With Photometrics AI: The same designer's choices instantly optimized and uniquely applied to every light, under every condition.



AI doesn't replace lighting professionals. It expands their influence.
You set the priorities; AI executes with design-level precision.
Lighting matched to real-world needs: rain, events, safety, energy savings.

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Photometrics.ai
Where Light Meets Intelligence

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Modeling Exterior Lighting

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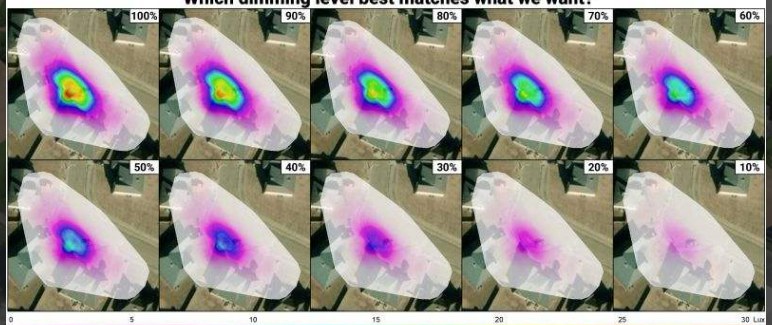
What we want

Which dimming level best matches what we want?



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Where Light Meets Intelligence

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Traffic Safety + NLCs
55
EVARI
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Crime + NLCs
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THREAT DETECTED!
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Events (Planned + Unplanned) + NLCs
57
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Light Trespass + NLCs
58
EVARI
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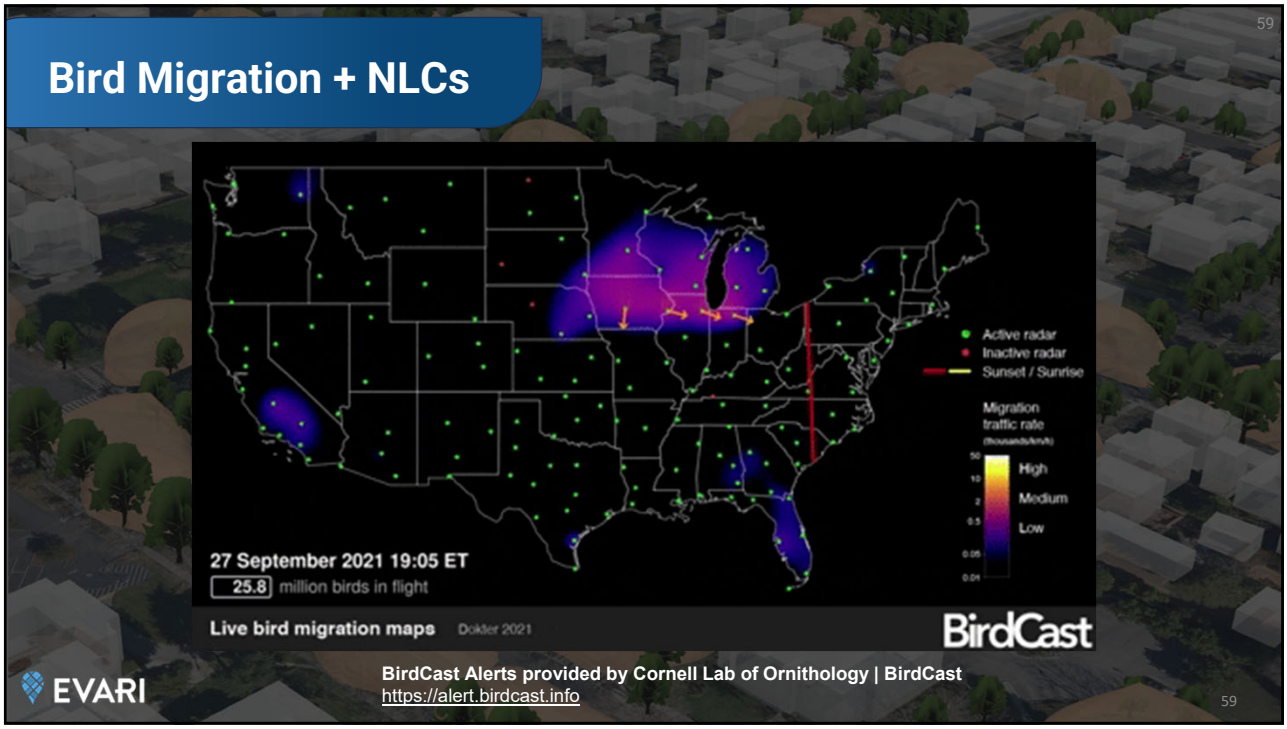
Bird Migration + NLCs
59
Active radar
Inactive radar
Sunset / Sunrise
Migration traffic rate
High
Medium
Low
27 September 2021 19:05 ET
25.8 million birds in flight
Live bird migration maps
Dokter 2021
BirdCast
EVARI
BirdCast Alerts provided by Cornell Lab of Ornithology | BirdCast
https://alert.birdcast.info
59

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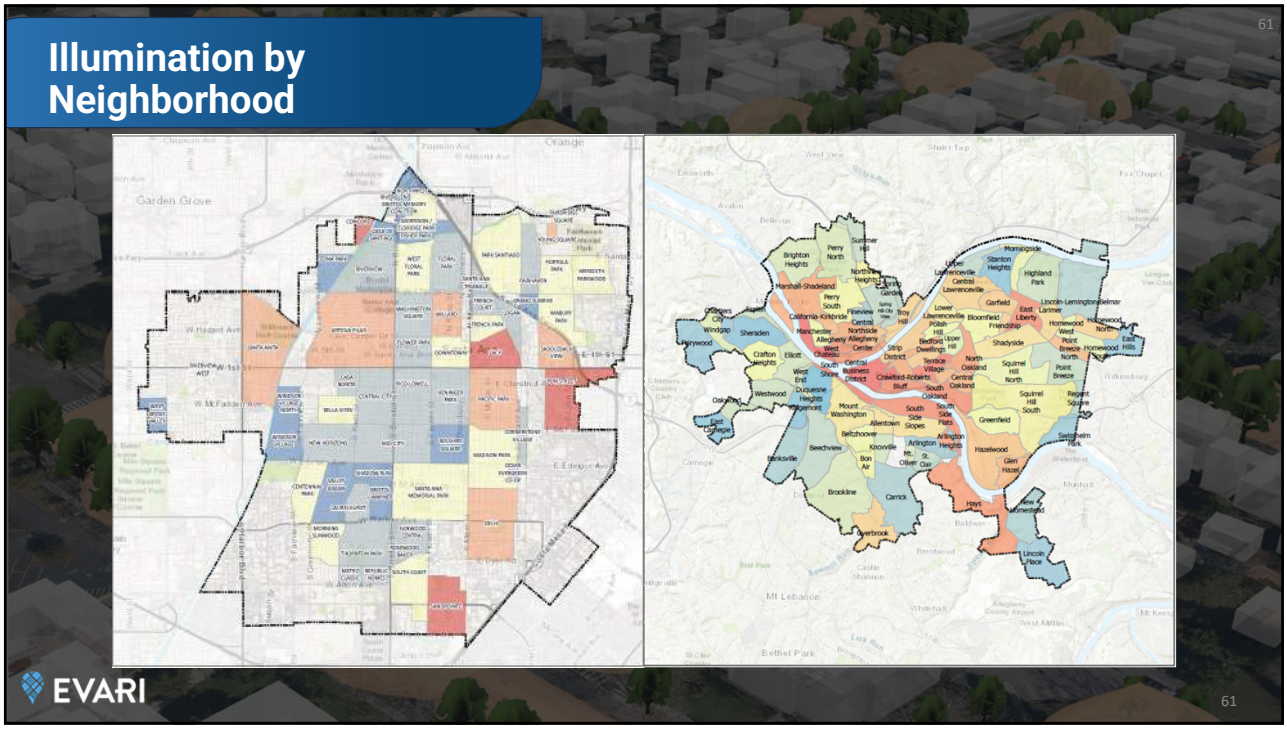
In Practice...
60
AverageLux
> 50
8.1 - 50
5.1 - 8.0
2.1 - 5.0
0.1 - 2.0
0.0
W Santa Ana Blvd
Angels Community Park
EVARI
60

60


Illumination by Neighborhood
61
EVARI
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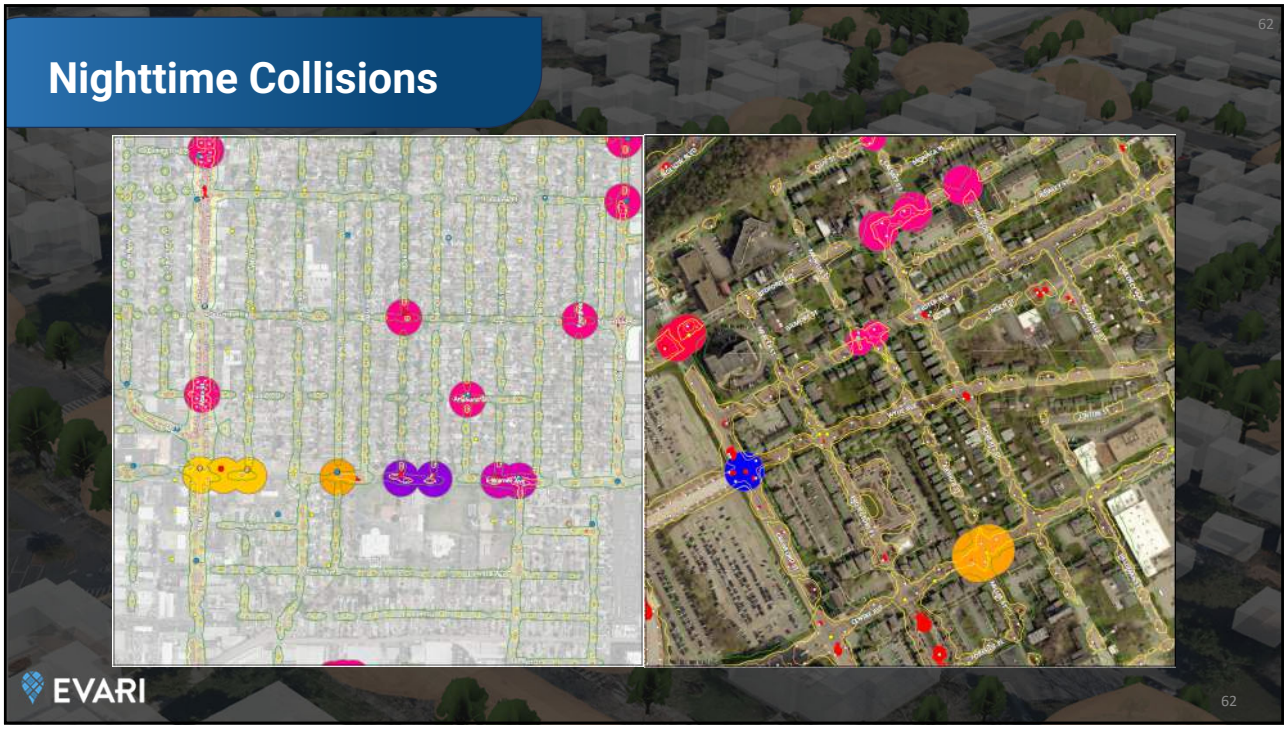
Nighttime Collisions
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EVARI
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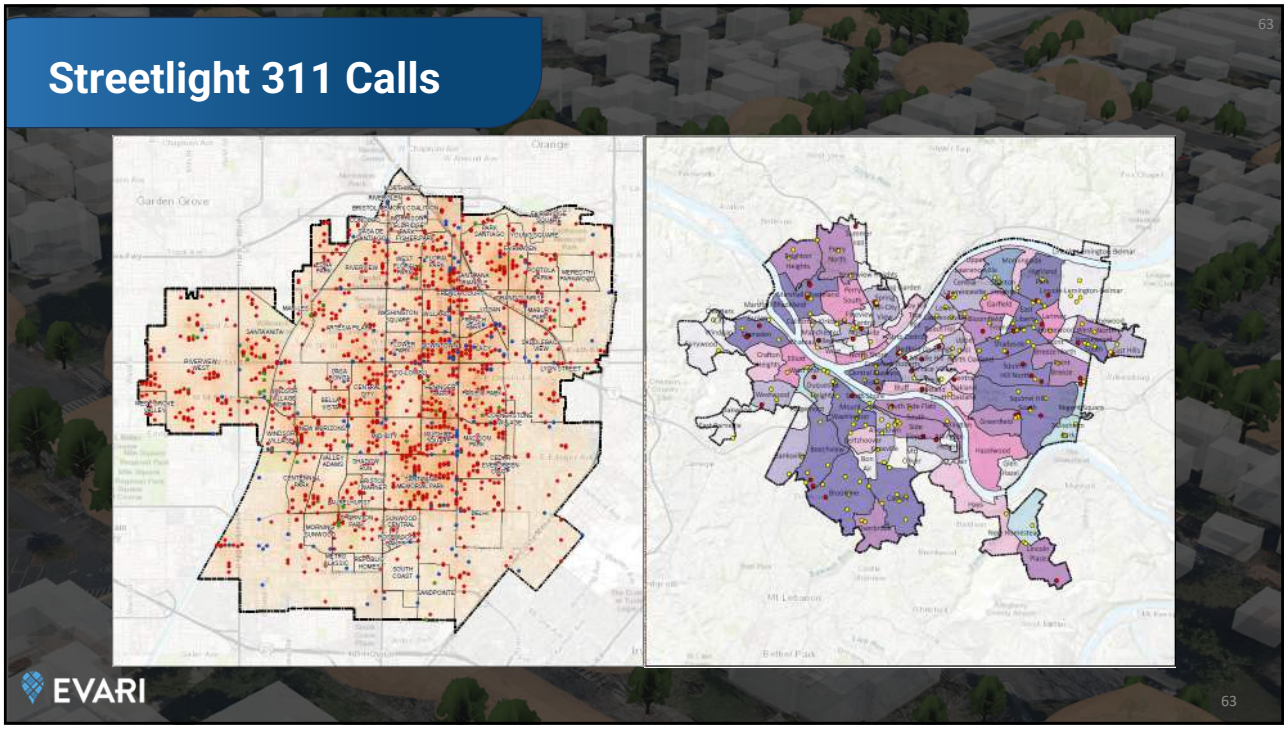
Streetlight 311 Calls
63
EVARI
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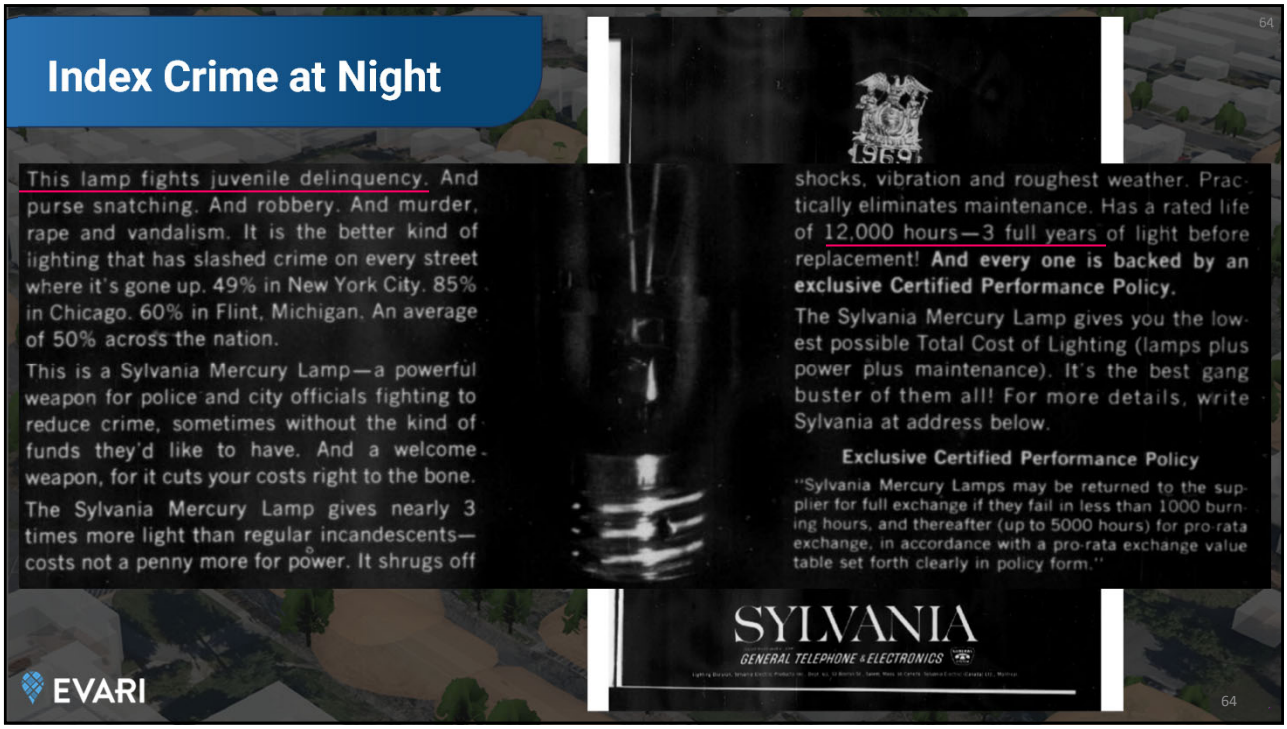
Index Crime at Night
64
This lamp fights juvenile delinquency. And purse snatching. And robbery. And murder, rape and vandalism. It is the better kind of lighting that has slashed crime on every street where it's gone up. 49% in New York City. 85% in Chicago. 60% in Flint, Michigan. An average of 50% across the nation.
This is a Sylvania Mercury Lamp—a powerful weapon for police and city officials fighting to reduce crime, sometimes without the kind of funds they'd like to have. And a welcome weapon, for it cuts your costs right to the bone.
The Sylvania Mercury Lamp gives nearly 3 times more light than regular incandescents—costs not a penny more for power. It shrugs off
1969
shocks, vibration and roughest weather. Practically eliminates maintenance. Has a rated life of 12,000 hours—3 full years of light before replacement! And every one is backed by an exclusive Certified Performance Policy.
The Sylvania Mercury Lamp gives you the lowest possible Total Cost of Lighting (lamps plus power plus maintenance). It's the best gang buster of them all! For more details, write Sylvania at address below.
Exclusive Certified Performance Policy
"Sylvania Mercury Lamps may be returned to the supplier for full exchange if they fail in less than 1000 burning hours, and thereafter (up to 5000 hours) for pro-rata exchange, in accordance with a pro-rata exchange value table set forth clearly in policy form."
SYLVANIA
GENERAL TELEPHONE & ELECTRONICS
EVARI
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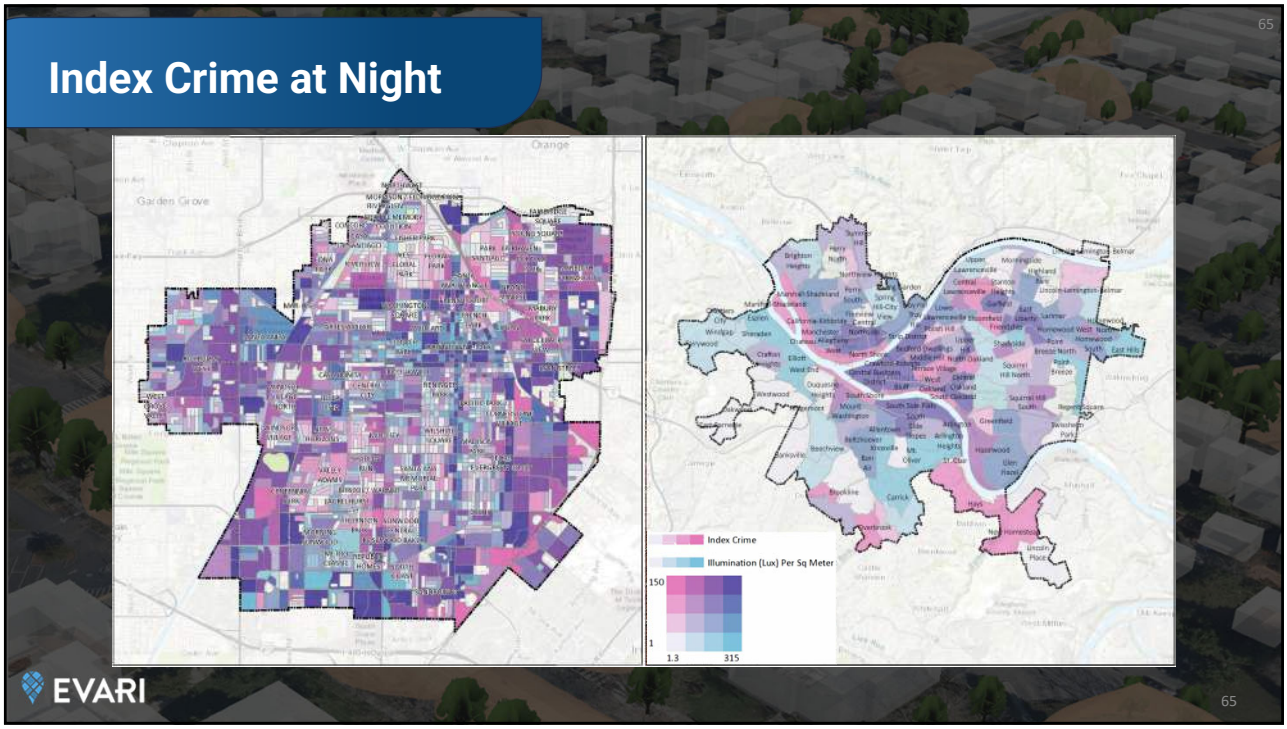
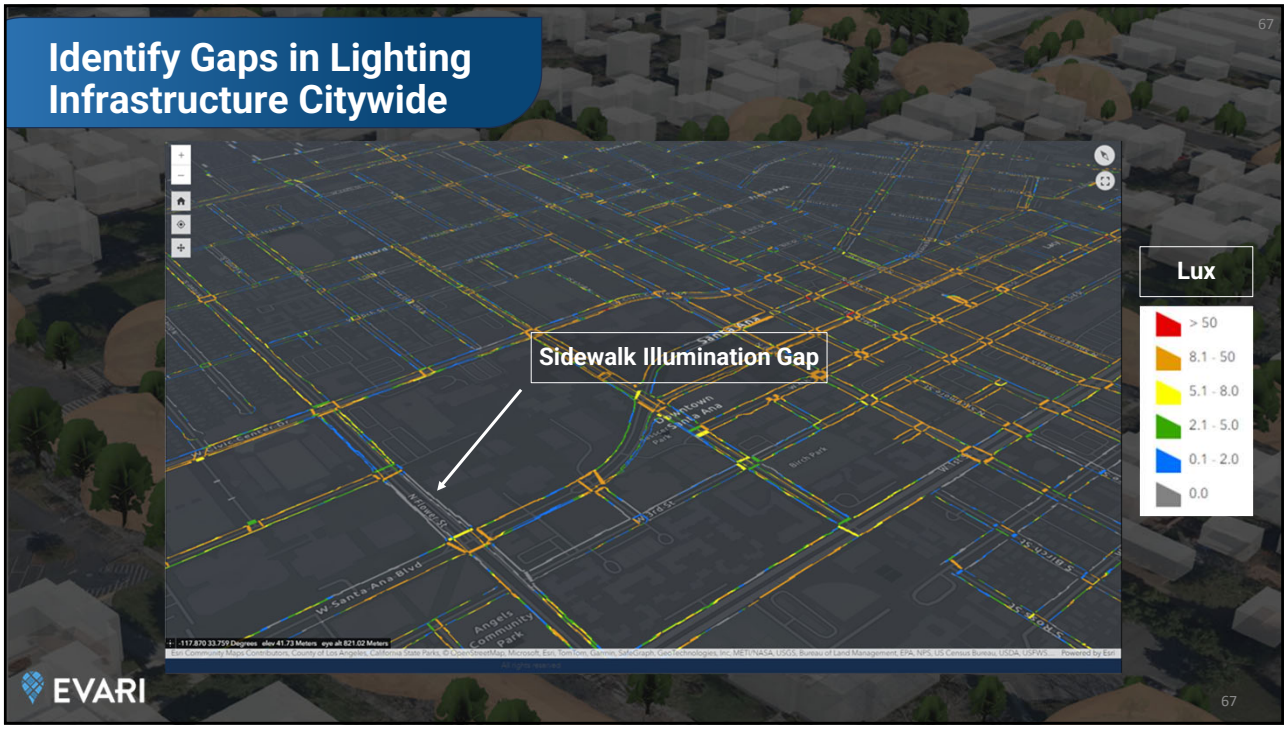

Index Crime at Night
65
Index Crime
Illumination (Lux) Per Sq Meter
150
1
1.3
315
EVARI
65

65


Index Crime at Night
66
Average Illumination at Murder Locations
No. of Murder Occurrences
Illumination (LUX)
Mean : 7
Median : 7
Normal Dist.
Percentage of Lights that are Ped-Scale in Relation to Crime and Illumination
No. of Index Crime Occurrences
Illumination (LUX)
Pedestrian-Scale Lighting Decreasing
Percentage of Ped-Scale Lights in Relation to Index Crime Illumination
No. of Index Crime Occurrences
Illumination (LUX)
EVARI
66

66


Identify Gaps in Lighting Infrastructure Citywide
Sidewalk Illumination Gap
Lux
> 50
8.1 - 50
5.1 - 8.0
2.1 - 5.0
0.1 - 2.0
0.0
W Santa Ana Blvd
EVARI
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Corridor Studies
EVARI
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Thanks!
Any questions?
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Q&A
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