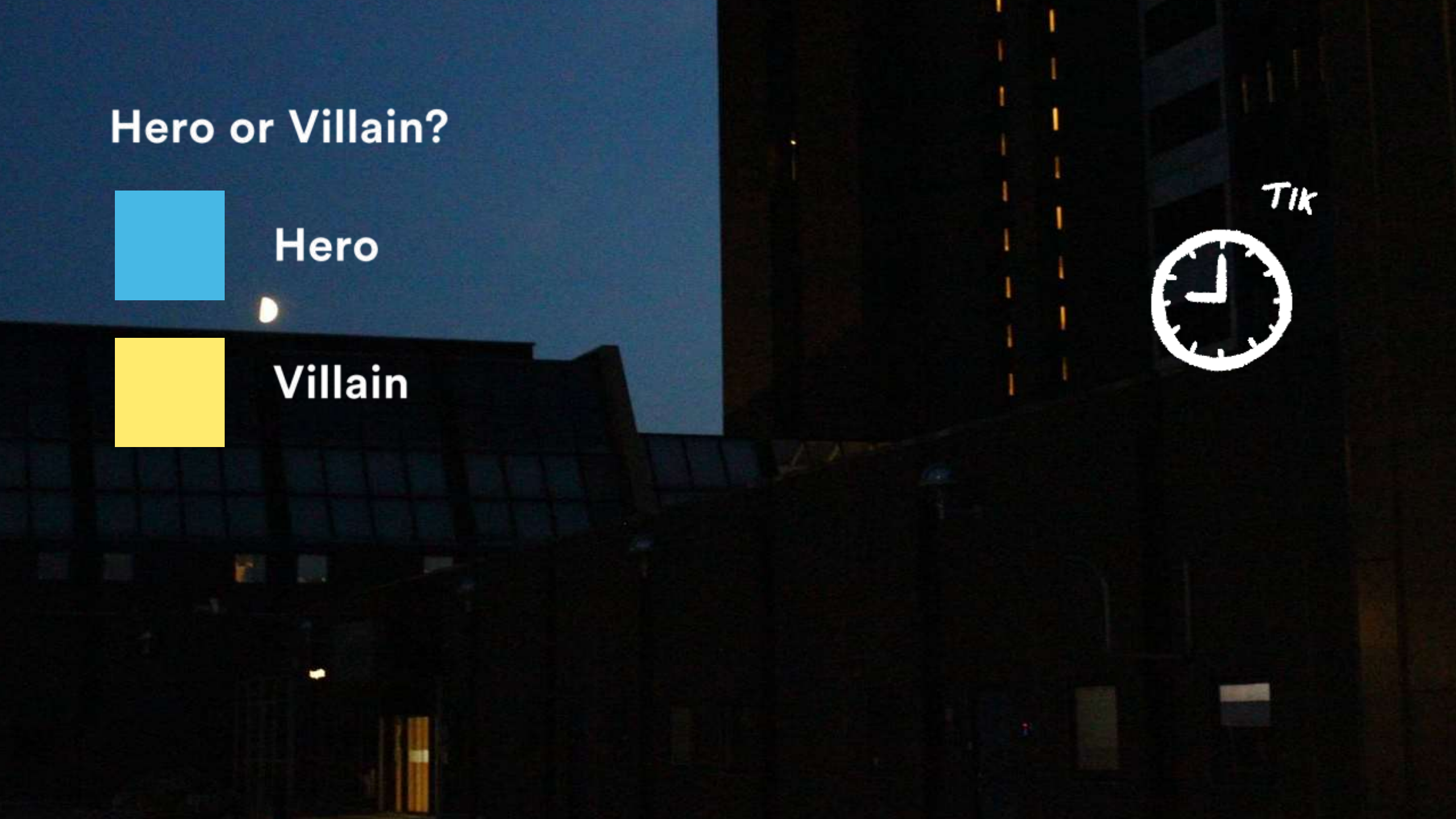
The Light We Love
The Damage We Ignore

A Call for Conservation in Lighting Design

noctua

Chiara Carucci
IALD associate Lighting Designer


Hero or Villain?
Hero
Villain
Tik


Hero or Villain?
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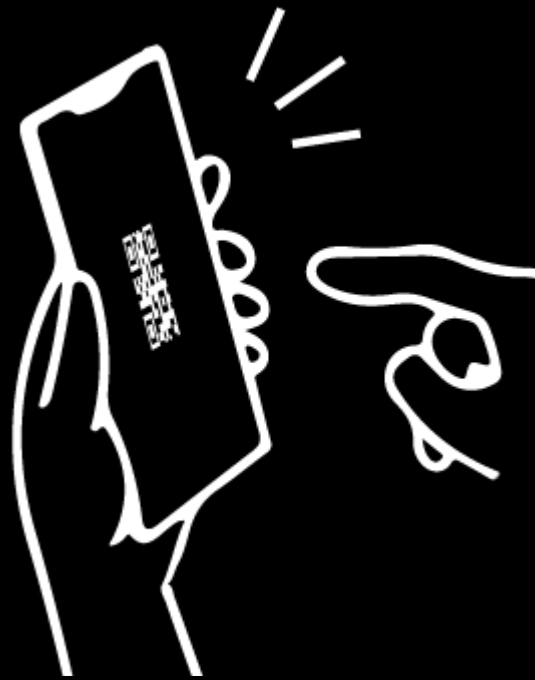
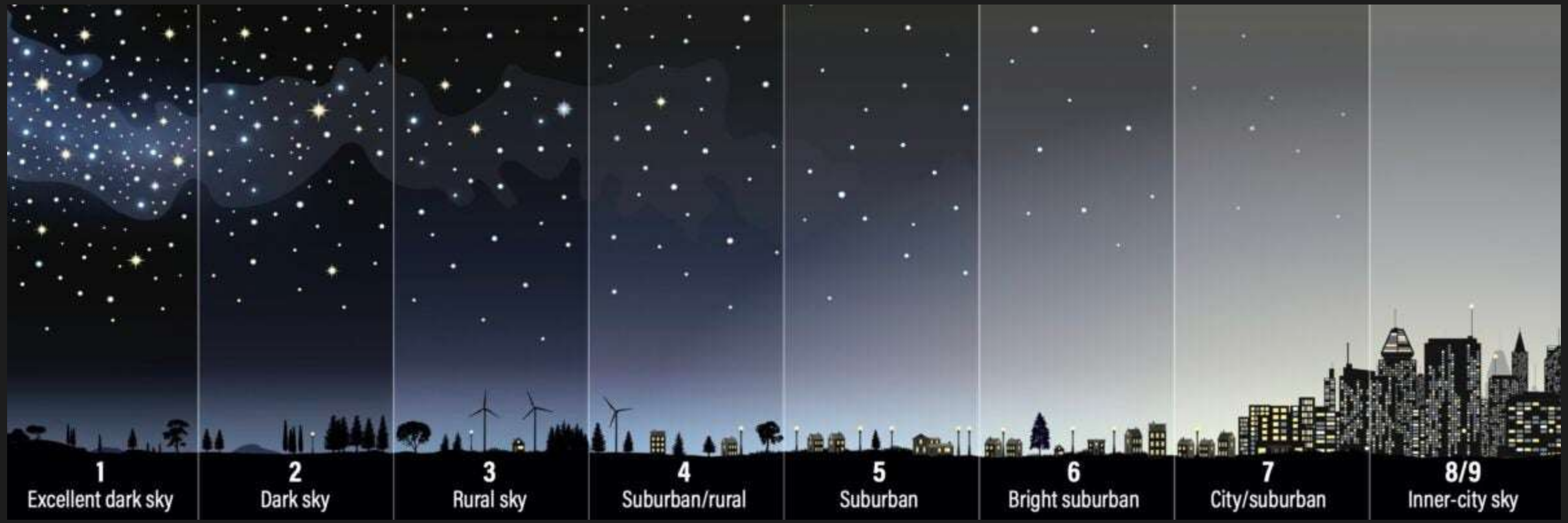
The Light We Love

The Damage We Ignore

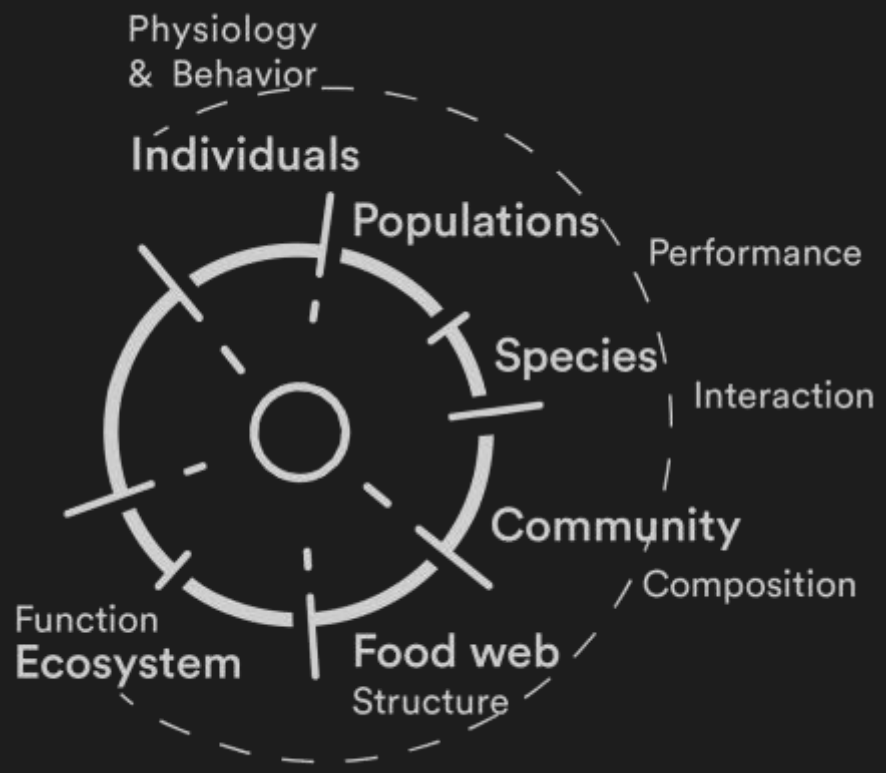
Chiara Carucci, Noctua



Astronomical Light Pollution



Ecological Light Pollution

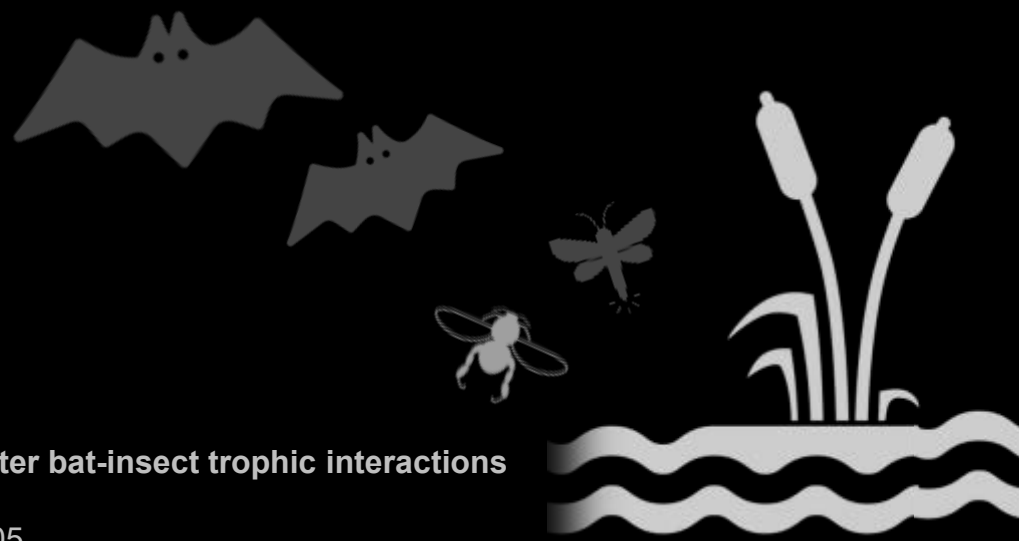


SLL Magazine: The Night Watch

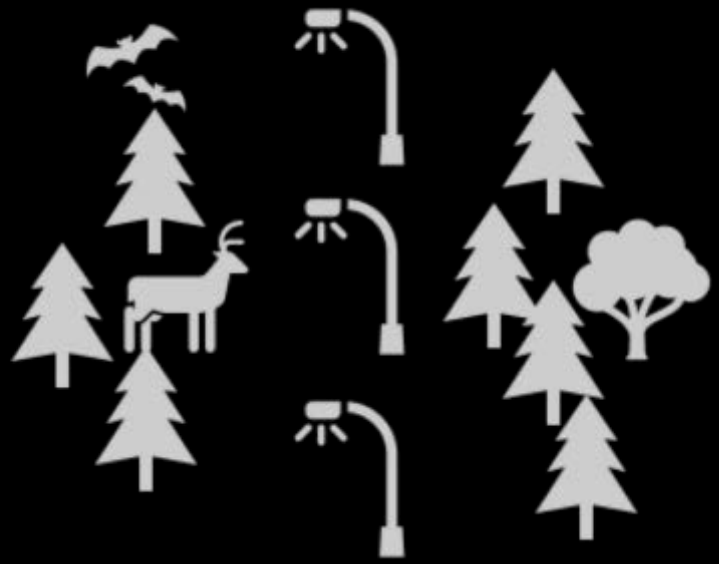
Population and community levels: Predator-prey Dynamics

Bat Activity Shifts in Response to Intense Lighting
Gili, F.; Fassone, C.; Rolando, A.; Bertolino, S
https://doi.org/10.3390/su16062337

Artificial illumination near rivers may alter bat-insect trophic interactions
Danilo Russo, Leonardo Ancillotto et al.
https://doi.org/10.1016/j.envpol.2019.06.105

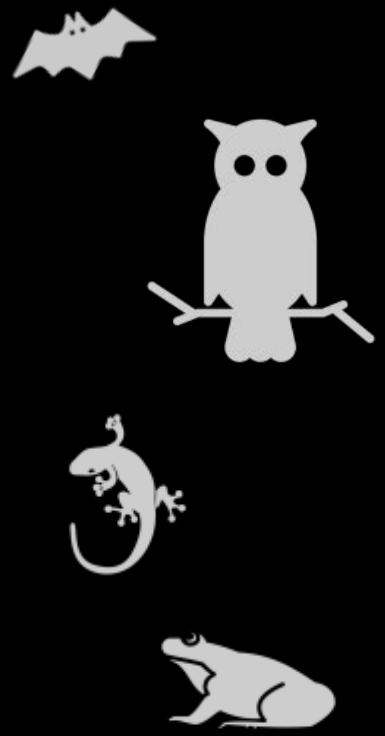


Landscape level: Loss of Connectivity



Ungulates in the city: light pollution and open habitats predict the probability of roe deer occurring in an urban environment
Michał Ciach & Arkadiusz Fröhlich
doi 10.1007/s11252-019-00840-2

Cascade Effects at Ecosystem Level



Nocturnal or crepuscular species

Decrease areas and time of activity

Vulnerable habitats

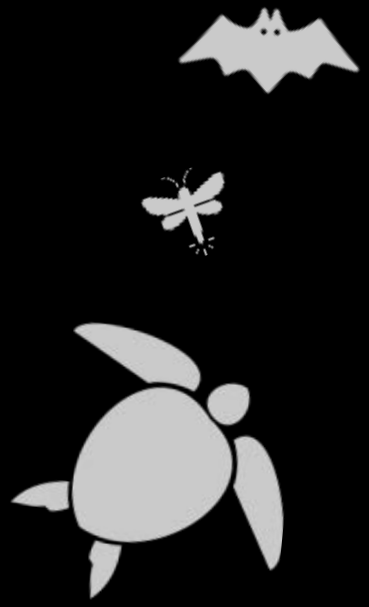
General highest impact

Migrational or seasonal movement

Several negative impacts

Positive or negative phototaxis

Ecological traps



Endangered species

Ex. Decrease safe areas for negative phototaxis


Wildlife Friendly?
Think Again!

Shift in Predator-prey Dynamics

Ecological Traps, e.g.:

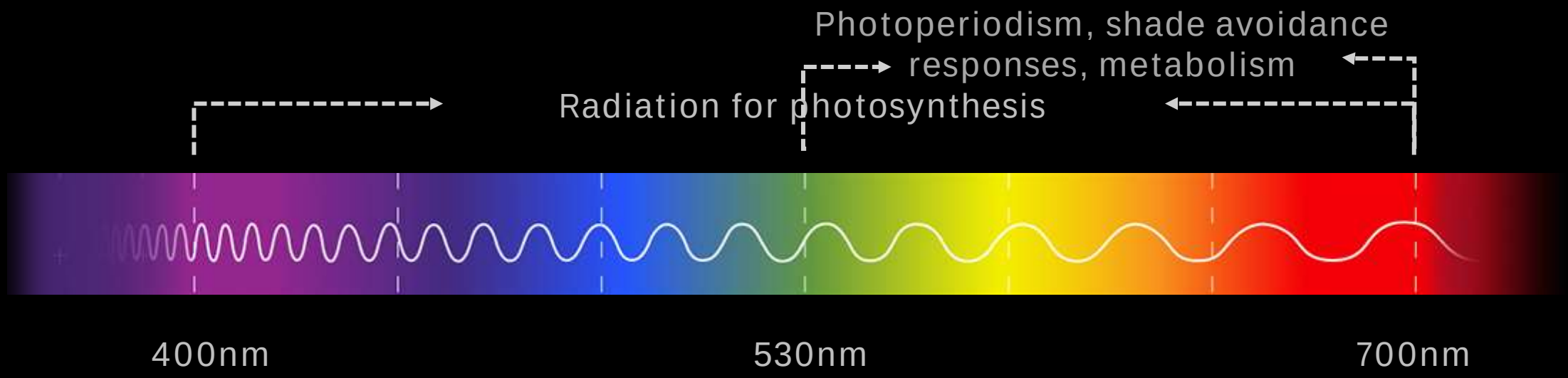
Red light to mitigate light pollution: Is it possible to balance functionality and ecological impact?
Durmus D, Jägerbrand A, Tengelin M.
https://doi.org/10.1177/14771535231225362

Peak sensitivity ≠ No perception

A compendium of photopigment peak sensitivities and (…)
Longcore T.
https://doi.org/10.1016/j.baae.2023.09.002

Light-dependent magnetoreception: behaviour of migratory birds under dim red light
Wiltschko R, Munro U, Ford H, Stapput K, Wiltschko W.
https://doi.org/10.1242/jeb.020313

Non-visual Photoreceptors



Plasticity of photosynthetic processes and the accumulation of secondary metabolites in plants
Landi, Zivcak, Sytar, Brestic, Allakhverdiev,
https://doi.org/10.1016/j.bbabio.2019.148131

https://doi.org/10.1071/WR15138
Robertson K, Booth DT, Limpus CJ (2016)
An assessment of ‘turtle-friendly’ lights on the sea-finding behaviour of loggerhead turtle hatchlings (Caretta caretta)

There is no “silver bullet” spectrum that will provide nighttime visual safety for humans while avoiding impacts on other species

Spectral tuning **may** provide **some** aid in impacted area, **if** calculated relative to a standard such as the **full moon**

Full moon radiance represents the maximum natural light regime that mammals are regularly exposed to.

Five Lighting Principles for Responsible Outdoor Lighting

DarkSky

Illuminating Engineering Society

Responsible outdoor lighting is

1 Useful

Use light only if it is needed

All light should have a clear purpose. Consider how the use of light will impact the area, including wildlife and their habitats.

2 Targeted

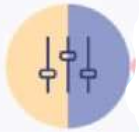
Direct light so it falls only where it is needed

Use shielding and careful aiming to target the direction of the light beam so that it points downward and does not spill beyond where it is needed.

3 Low Level

Light should be no brighter than necessary

Use the lowest light level required. Be mindful of surface conditions, as some surfaces may reflect more light into the night sky than intended.



4 Controlled

Use light only when it is needed

Use controls such as timers or motion detectors to ensure that light is available when it is needed, dimmed when possible, and turned off when not needed.

5 Warm-colored

Use warmer color lights where possible

Limit the amount of shorter wavelength (blue-violet) light to the least amount needed.

https://doi.org/10.1016/j.cois.2024.101276

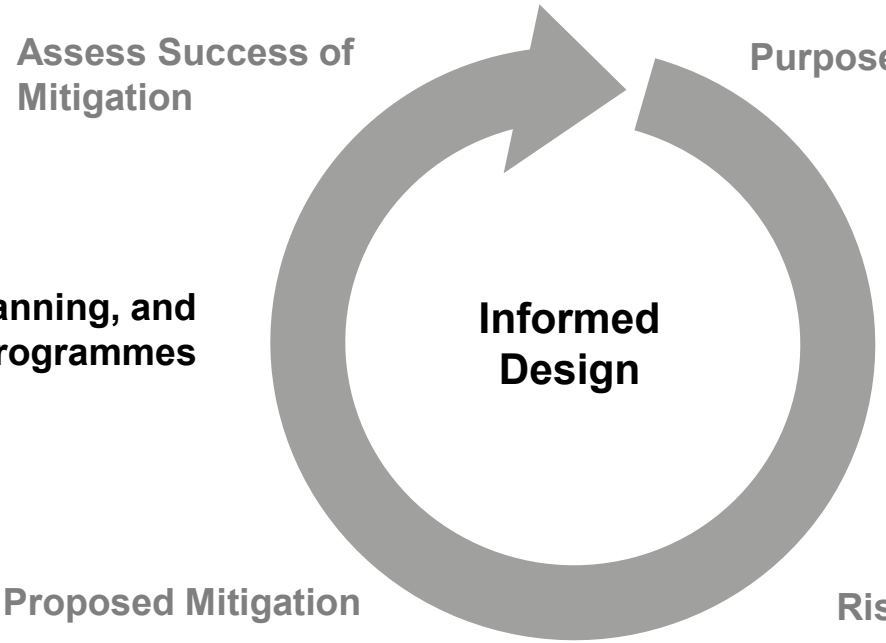
Avalon CS Owens, Michael JO Pocock and Brett M Seymoure

Current evidence in support of insect-friendly lighting practices


Wildlife Friendly?
What Do You
Think Now?


Illustration by K. Holoski, based on A. Jägerbrand and K. Spoelstra. Science, 2023 DOI: 10.1126/science.adg317
Challenge Confirmation Bias
PLAN
DO
EVALUATE & LEARN
ADJUST

Challenge Specialization Bias

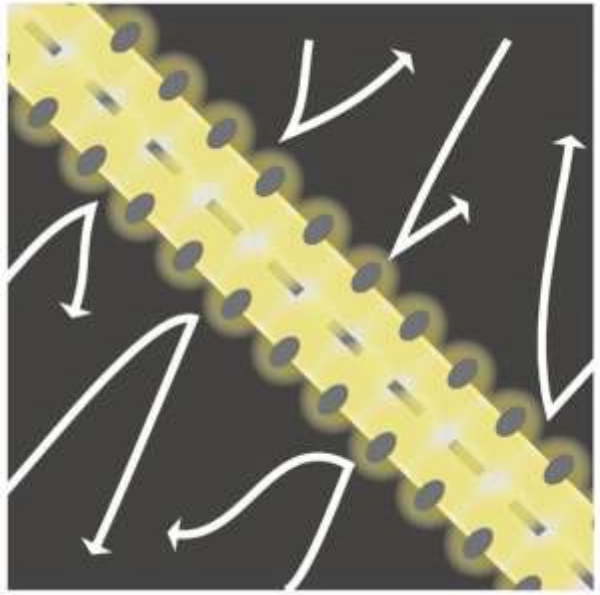


https://doi.org/10.17863/CAM.14060

Collaboration between designers and scientists

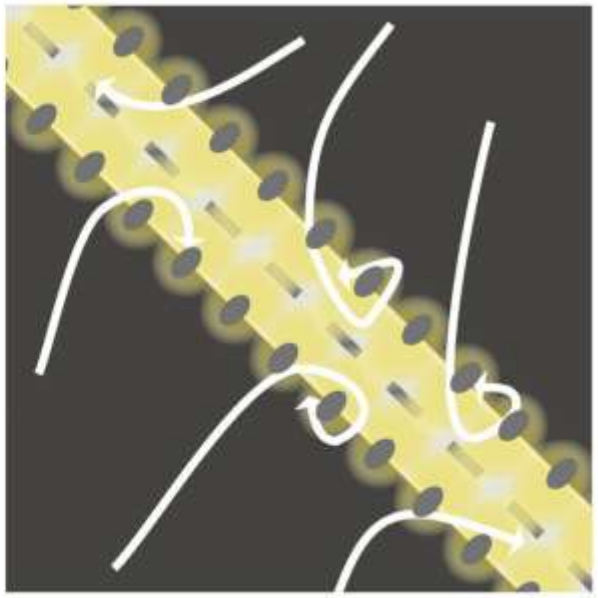
Strategies for Conservation
Dark Corridors

Avoiding Barrier Effect



Terrestrial mammals (e.g. Bliss-Ketchum et al., 2016), Bats (e.g. Bhardwaj et al., 2020), Amphibians (e.g. Van Grunsven et al., 2017)

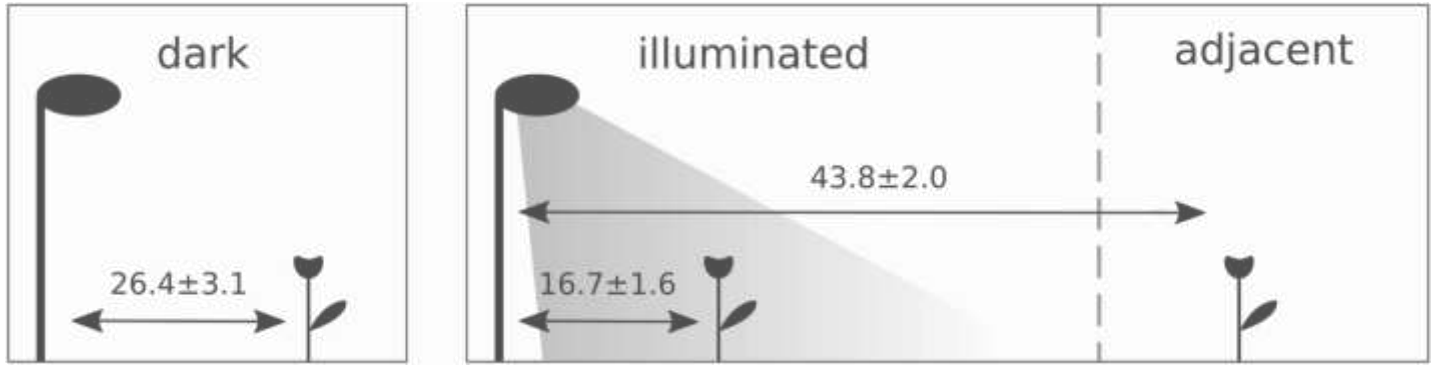
Sink / Crash Barrier Effect



Birds (e.g. Longcore *et al*., 2013) Insects (e.g. Degen *et al*., 2016; theorized by Eisenbeis, 2006),

Strategies for Conservation

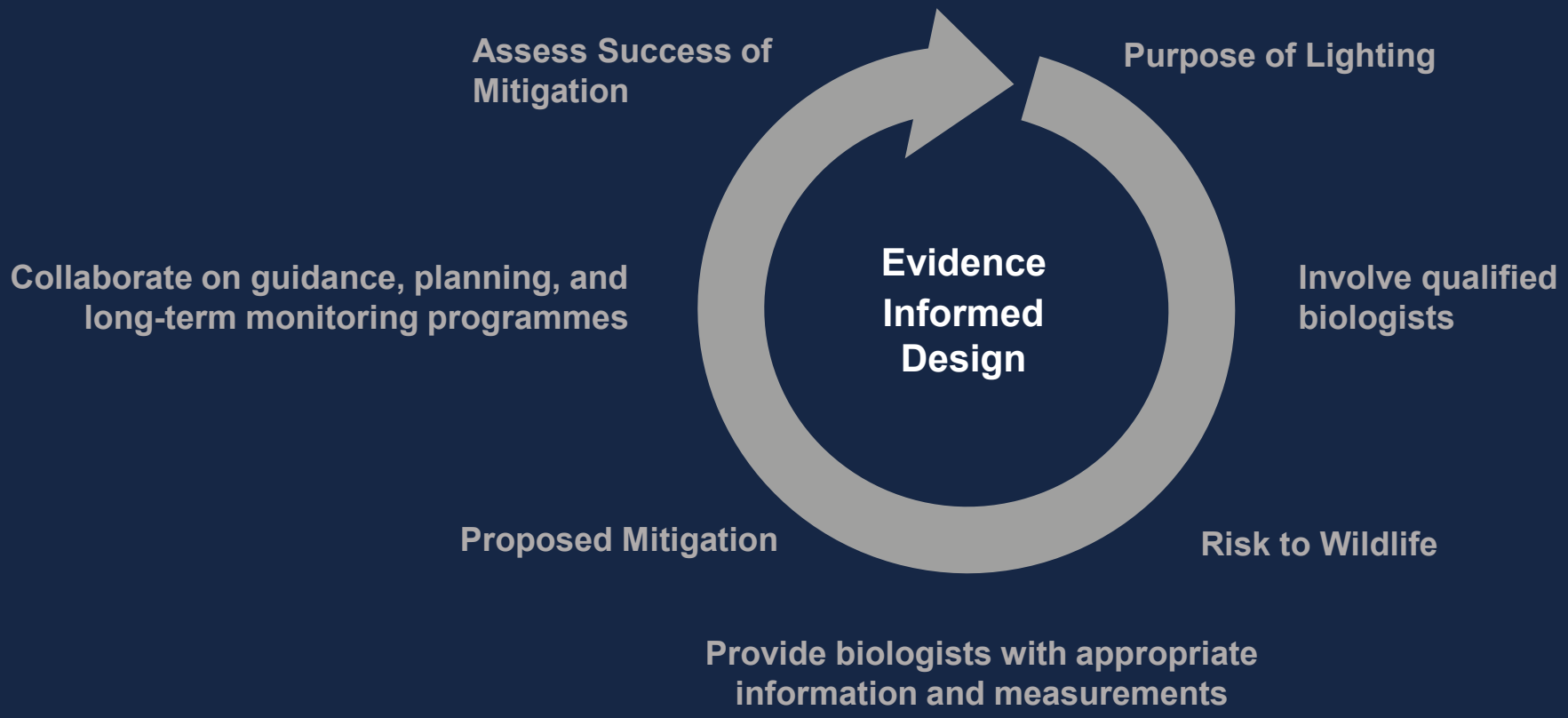
Dark Corridors



Schematic drawing of the field experiment set up and light treatments.
Dark: plants exposed on dark control sites;
Illuminated: plants exposed on illuminated sites;
Adjacent: plants exposed to a dark site but adjacent to the illuminated site.

https://doi.org/10.1038/s41598-020-68667-y
Simone Giavi, Sina Blösch, Guido Schuster, Eva Knop
Artificial light at night can modify ecosystem functioning beyond the lit area

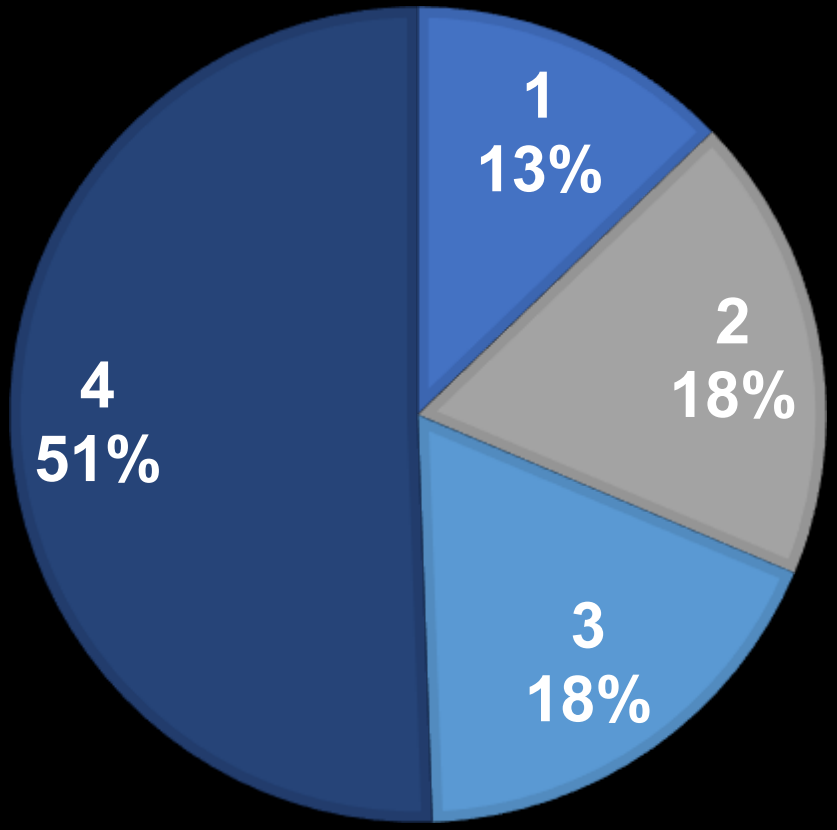
Challenge Expert Bias



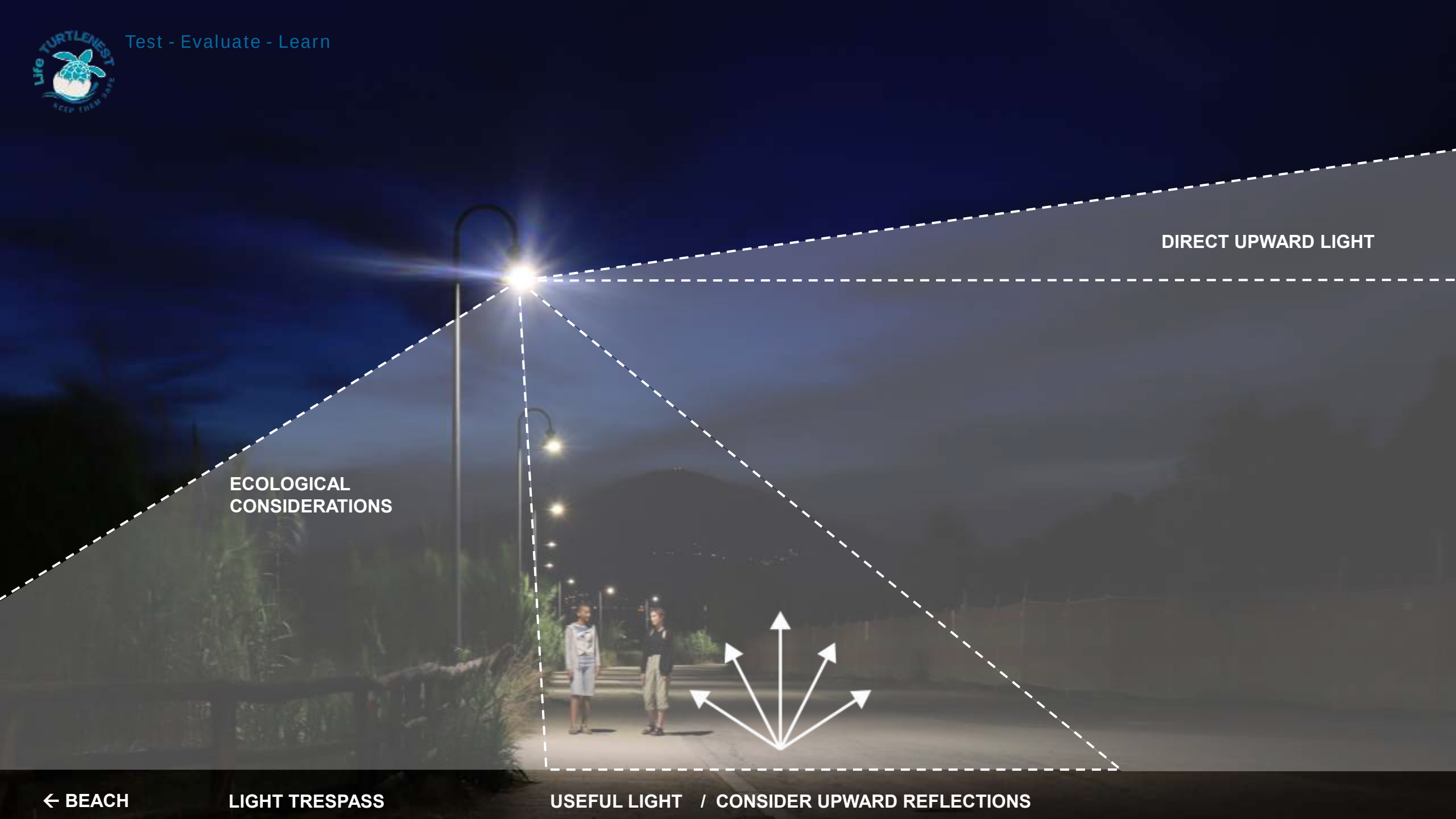
COLLEPARDO BIODIVERSITY CAVE
Frosinone, Italy – *Chiara Carucci, Noctua*
PH: Jansin & Hammarling

Test - Evaluate - Learn
Mock-up for survey

Opinions



LIFE21 Turtlenest Pilot Project
Ascea, Italy – *Chiara Carucci, Noctua*
Client: Stazione Zoologica Anton Dohrn


DIRECT UPWARD LIGHT
ECOLOGICAL CONSIDERATIONS
← BEACH
LIGHT TRESPASS
USEFUL LIGHT / CONSIDER UPWARD REFLECTIONS

First, do no harm!

- Embrace Interdisciplinary Collaboration
- Conduct Environmental Assessments
- Implement Adaptive Management Strategies
- Think Integrally, Not in Isolation
- Innovate Within Constraints

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Thank you!