

Informed Design

Progettazione della luce e tutela dell'ambiente



Chiara Carucci

IALD associate Lighting Designer



European Light Pollution Manifesto

Per favore considerate di firmare questo manifesto, redatto e promosso dal progetto europeo Plan-B e DarkSky. Ogni firma puo' contribuire a raggiungere l'obiettivo!

<https://darksky.org/get-involved/the-european-light-pollution-manifesto>



Caretta in Vista - Volontariato

Per favore condividete il link per diventari volontari per e la tutela delle tartarughe marine in Campania. Non ci sono pre-requisiti ne' limiti di eta' ma si richiede disponibilita' di almeno una settimana.

<https://linktr.ee/carettainvista>



Informed Design

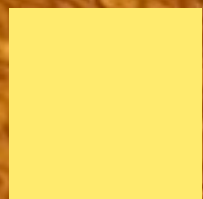
Chiara Carucci, Noctua

Nel progettare spazi all'aperto, soprattutto in contesti ecologicamente sensibili, l'illuminazione può avere un ruolo chiave nella tutela della biodiversità e delle specie a rischio, progettando la luce giusta, al momento giusto. Questo intervento esplora diversi casi studio, presentando risultati concreti, sfide affrontate e nuove opportunità di collaborazione. Verranno inoltre messi in discussione alcuni pregiudizi sulle misure di mitigazione, con l'obiettivo di promuovere un approccio più consapevole e sostenibile alla progettazione della luce.

Hero or Villain?



Hero



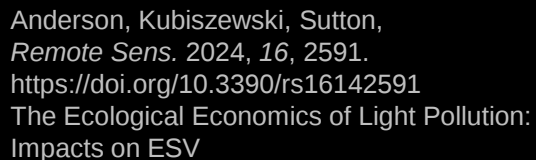
Villain





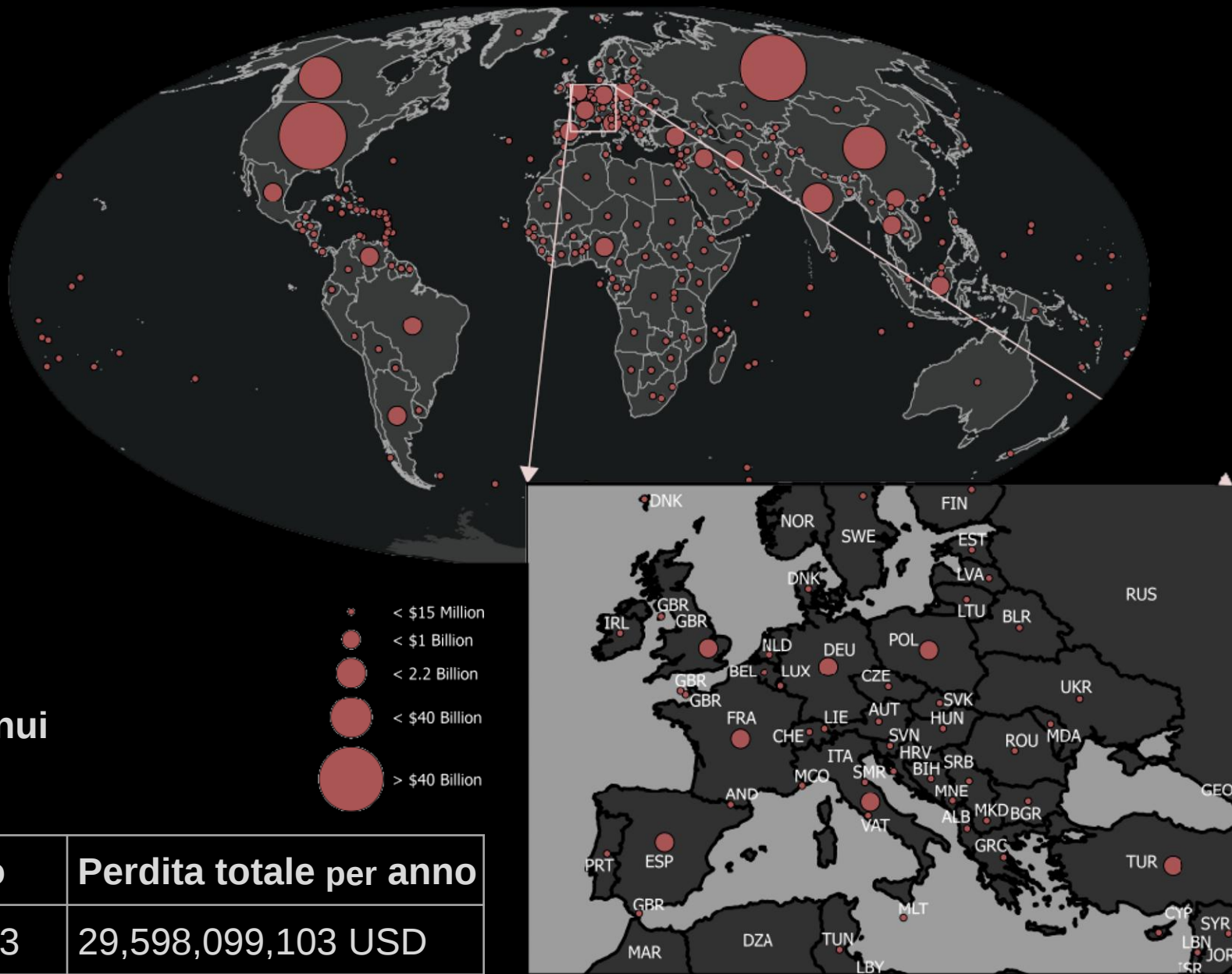
<https://doi.org/10.1002/aqc.4011>

Colleen R. Miller, Aaron N. Rice. Aquatic Conservation: Marine and Freshwater Ecosystems 2023
A synthesis of the risks of marine light pollution across organismal and ecological scales



ESV: Valore dei Servizi Ecosistemici

ESV di base	ESV degradato	Perdita totale per anno
139,285,932,706	109,687,833,603	29,598,099,103 USD



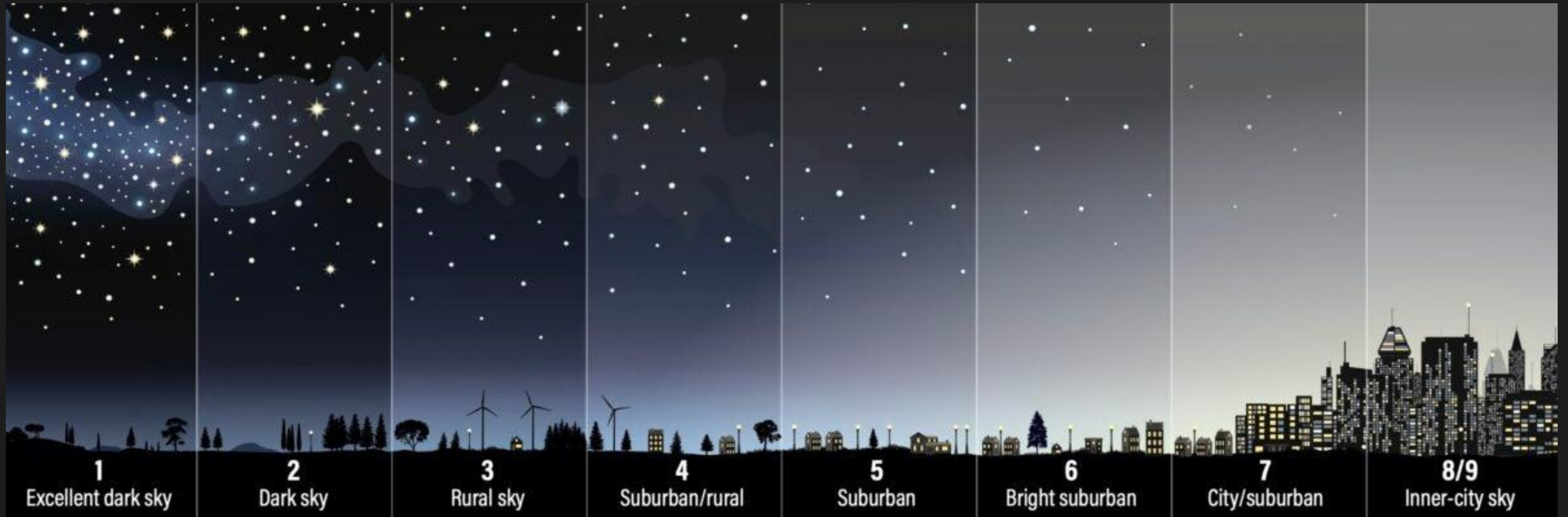


Images by Leigha Del Busso

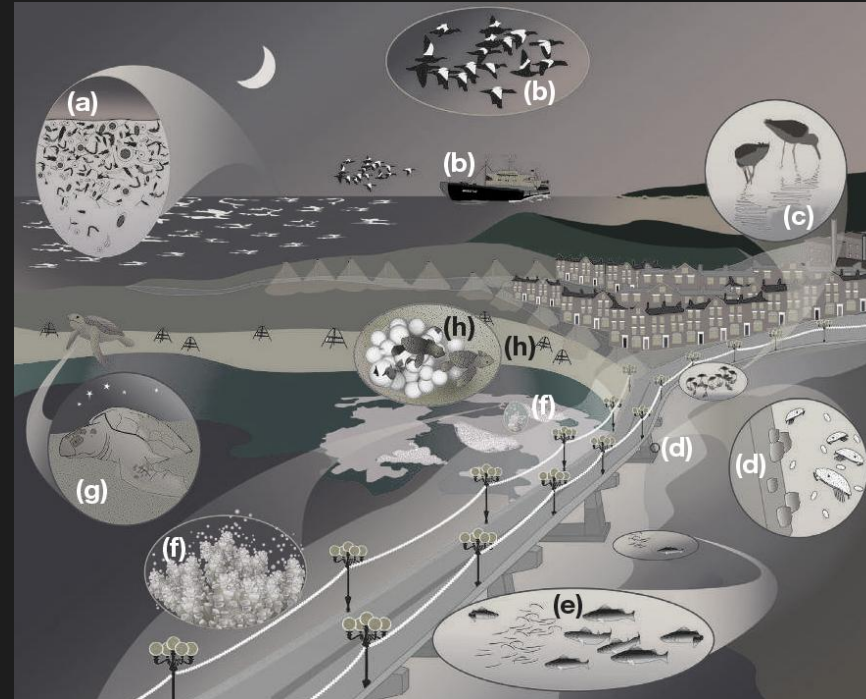


L'illuminazione dopo il tramonto, ALAN, è molto più di una questione visiva o estetica: è un fattore di stress ambientale estremamente pervasivo. Tutti gli ecosistemi sono definiti dalla complessa interazione tra contesto e specie diverse – tutte dipendono da un delicato equilibrio tra luce e buio.

Astronomical Light Pollution



Ecological Light Pollution



dovremmo distinguere tra “inquinamento luminoso astronomico”, che oscura la visione del cielo notturno, e “inquinamento luminoso ecologico”, che altera i regimi naturali di luce e buio negli ecosistemi terrestri e acquatici.

Ecological Light Pollution



Wrong scent
Female cabbage moths



Crop failure
Soybeans



Fatal attraction
Birds killed at communication towers



Going hungry
Santa Rosa beach mouse



Compass jammed
Nocturnal dung beetles



Delayed departure
Sockeye salmon fry



Speed dating
Tungara frogs



Communication error
Male eastern firefly



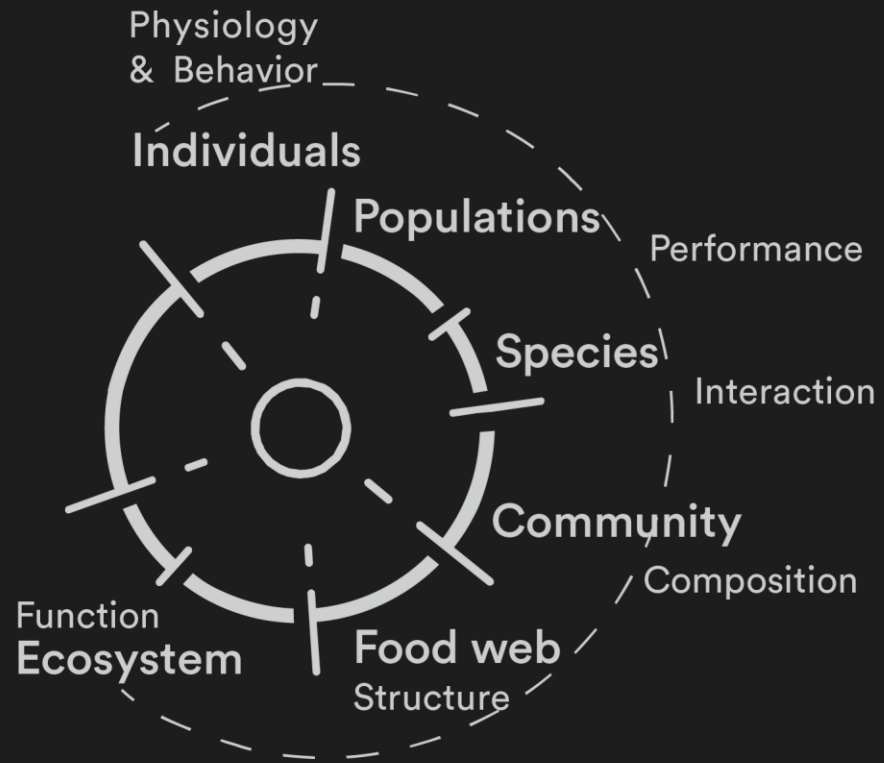
Loosing sleep
Great tits



Missing microbes
Freshwater sediments

There goes the night <https://spatial.usc.edu/there-goes-the-night/>

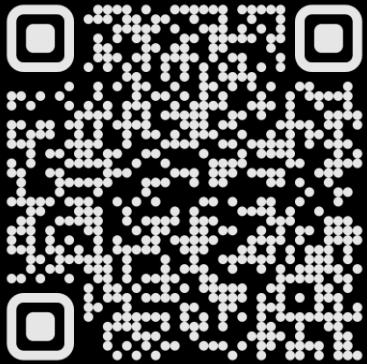
Ecological Light Pollution



SLL Magazine: The Night Watch

https://issuu.com/slllightlines/docs/light_lines_sept_24/5

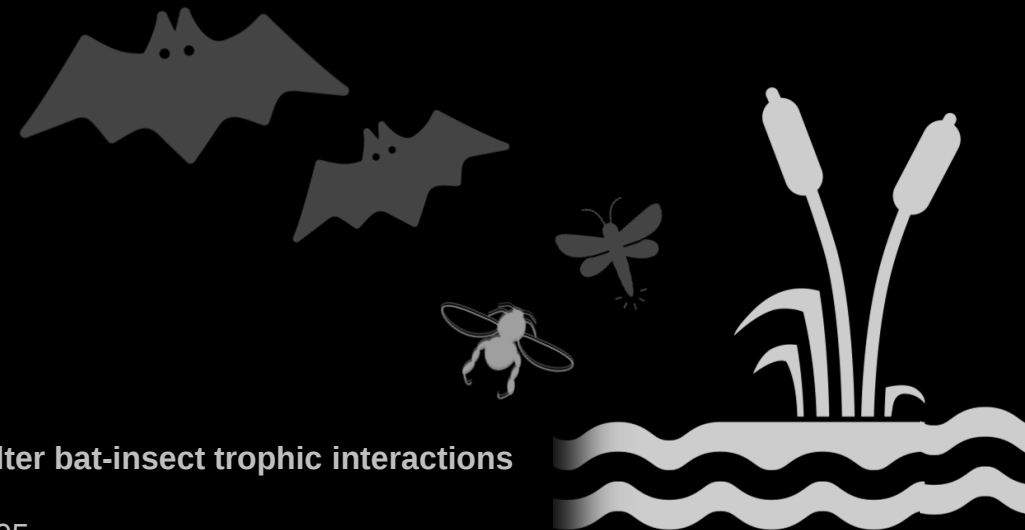
Population and community levels: Predator-prey Dynamics



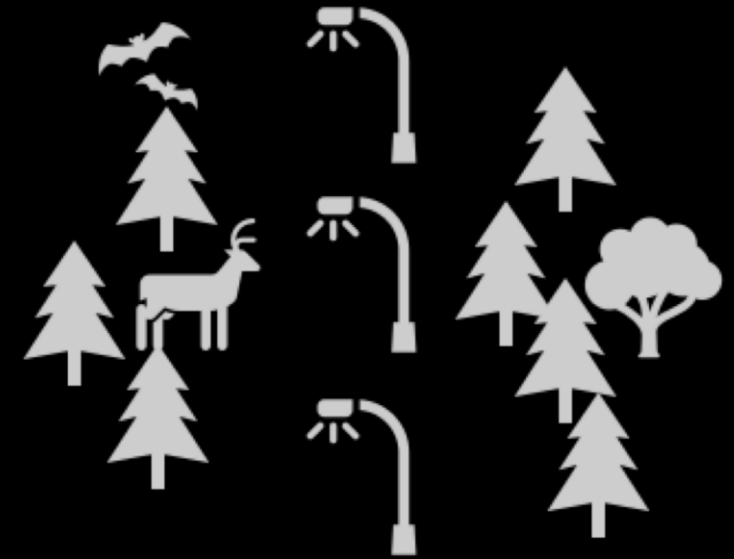
Bat Activity Shifts in Response to Intense Lighting
Gili, F.; Fassone, C.; Rolando, A.; Bertolino, S
<https://doi.org/10.3390/su16062337>



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



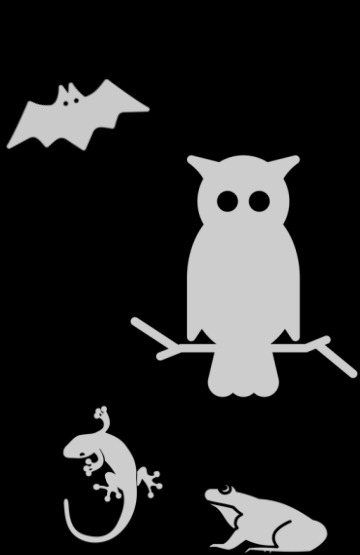
Ungulates in the city: light pollution and open habitats predict the probability of roe deer occurring in an urban environment

Michał Ciach & Arkadiusz Fröhlich

doi 10.1007/s11252-019-00840-2

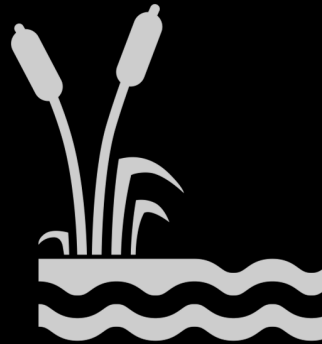
Cascade Effects at Ecosystem Level

*In ogni progetto dovremmo valutare **localmente** come la luce influenzi l'intero ecosistema, come effetto a cascata, invece di concentrarci solo sulla mitigazione del danno per una singola specie, come spesso accade con l'uso dei prodotti etichettati come '...friendly' o anche 'a misura di fauna'*



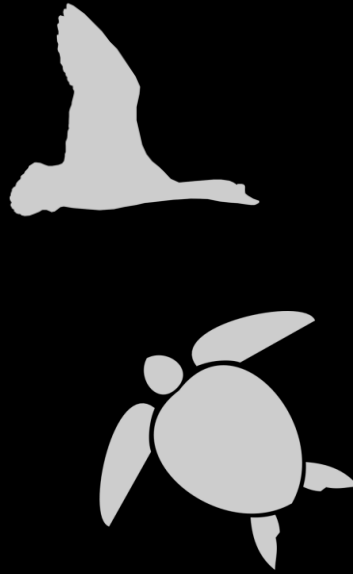
Nocturnal or crepuscular species

Decrease areas and time of activity



Vulnerable habitats

General highest impact



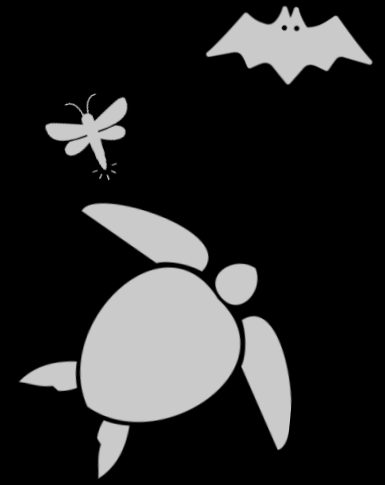
Migrational or seasonal movement

Several negative impacts



Positive or negative phototaxis

Ecological traps



Endangered species

Ex. Decrease safe areas for negative phototaxis



Wildlife Friendly?



Think Again!



Fototattismo (o eliotattismo): proprietà di alcuni organismi vegetali e animali di reagire a uno stimolo luminoso modificando la propria posizione rispetto a esso.

Positive Phototactic



Pipistrellus pygmaeus



Pipistrellus nathusii

Fototattismo (o eliotattismo): proprietà di alcuni organismi vegetali e animali di reagire a uno stimolo luminoso modificando la propria posizione rispetto a esso.

Avoidance Behaviour



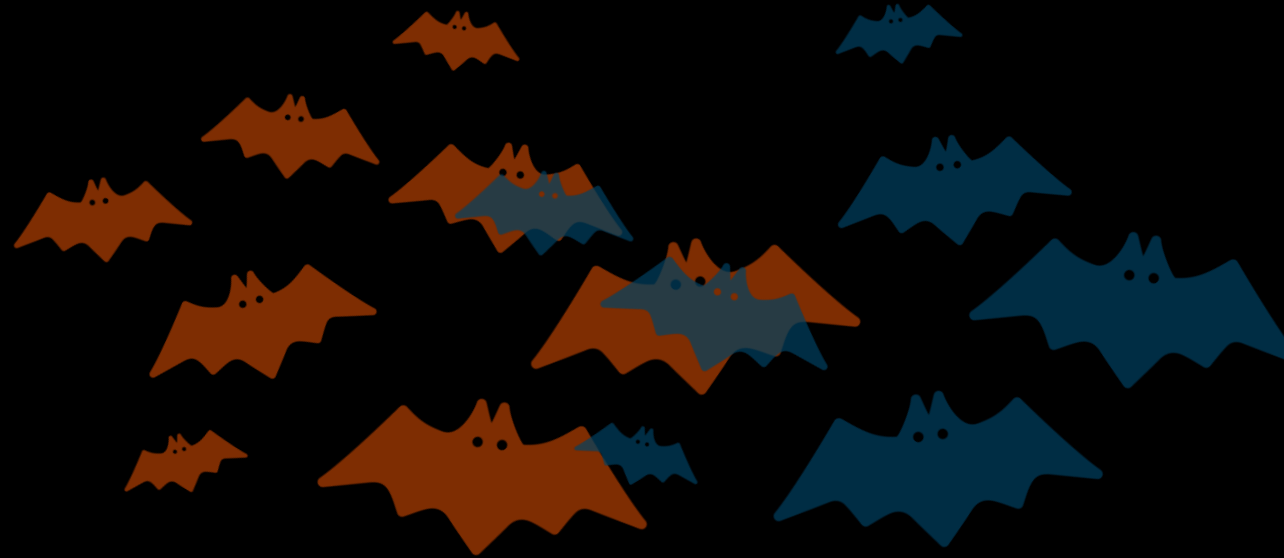
Myotis nattereri



Rhinolophus hipposideros



Plecotus austriacus



Red light to mitigate light pollution: Is it possible to balance functionality and ecological impact?

Durmus D, Jägerbrand A, Tengelin M.

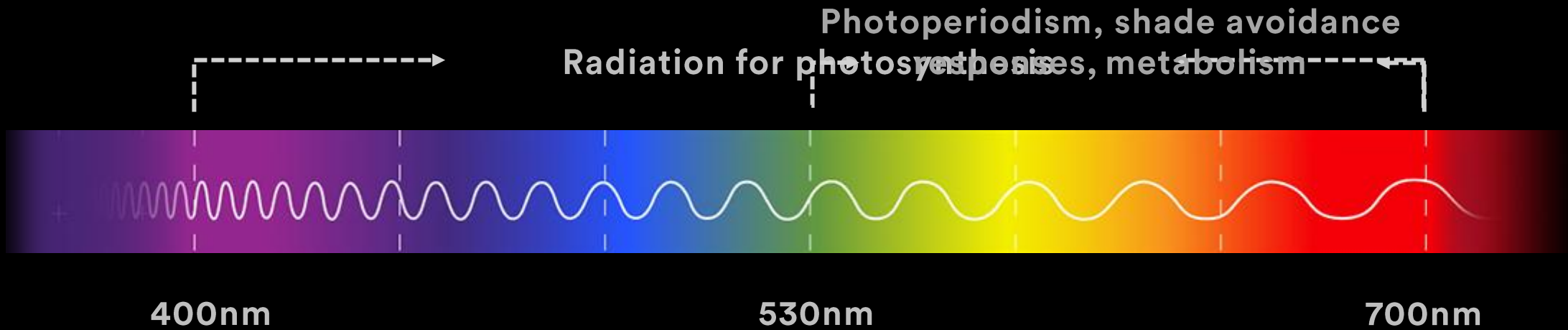
<https://doi.org/10.1177/14771535231225362>

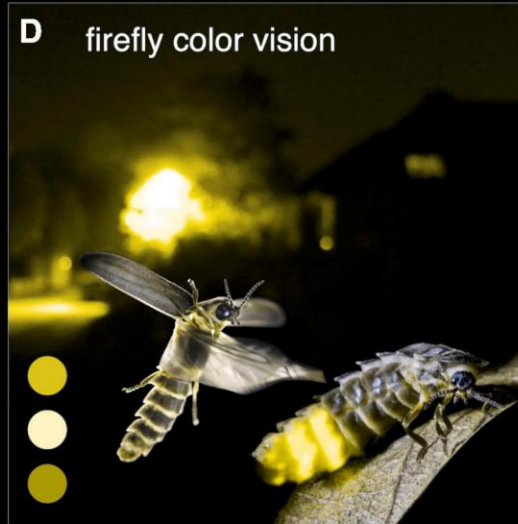
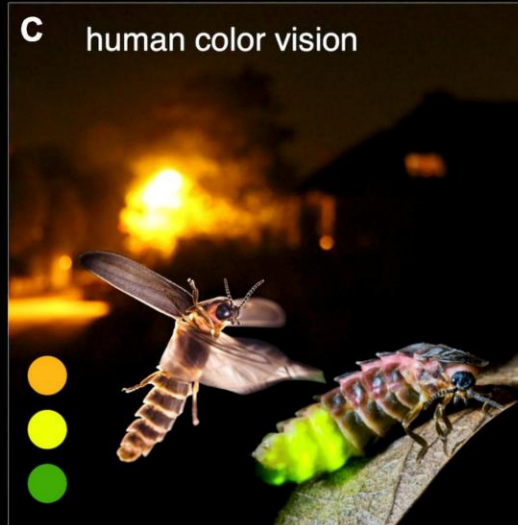
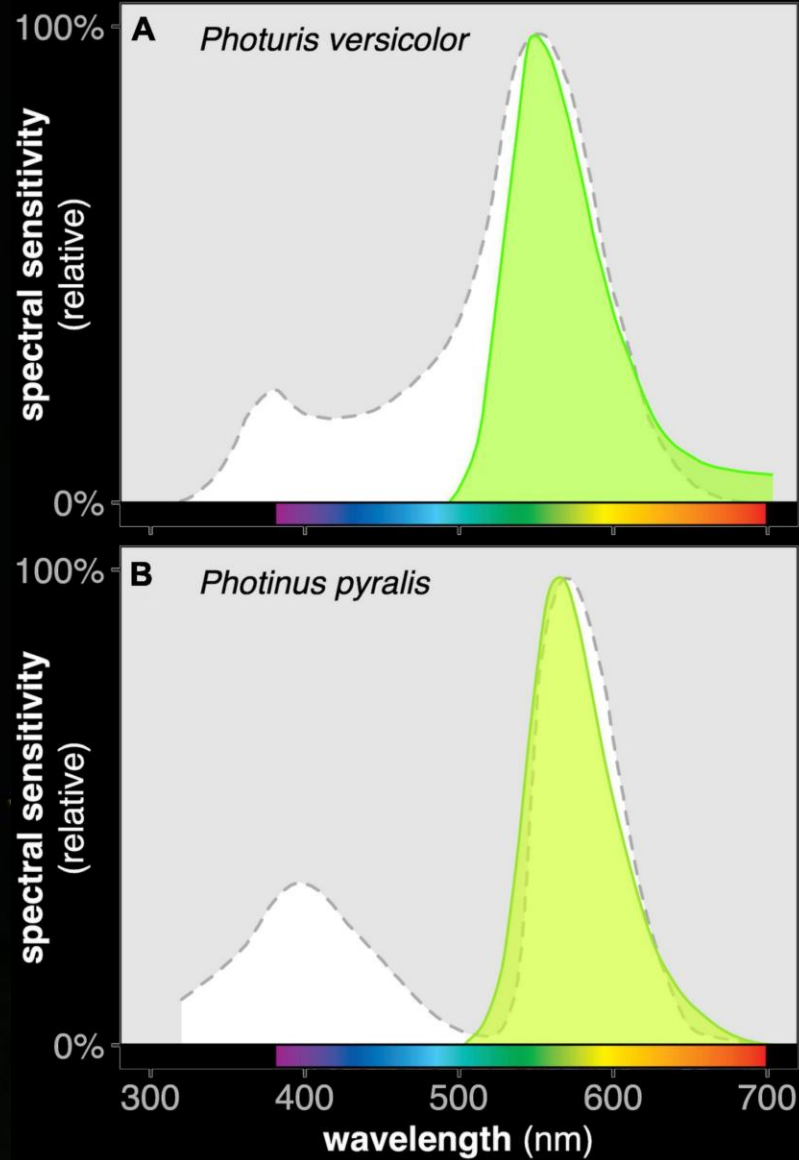


Red light to mitigate light pollution: Is it possible to balance functionality and ecological impact?

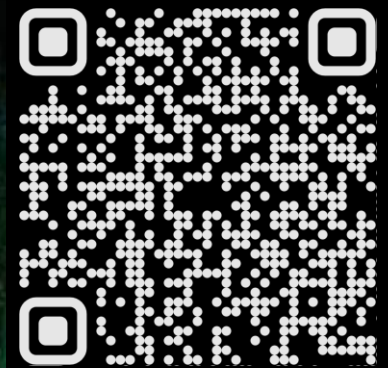
Durmus D, Jägerbrand A, Tengelin M.

<https://doi.org/10.1177/14771535231225362>



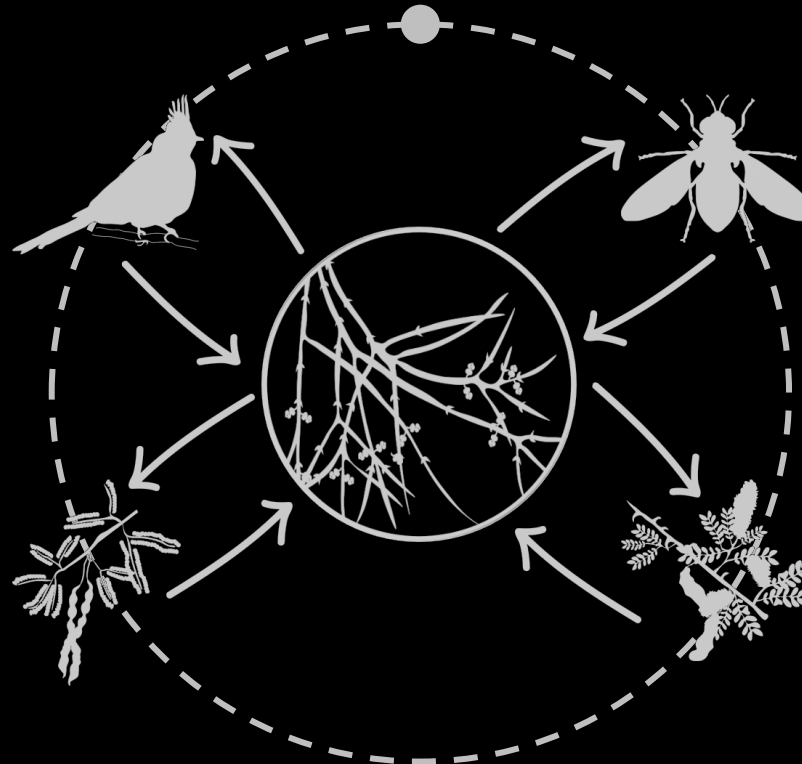


<https://doi.org/10.1111/icad.12487>
Avalon C.S. Owens, Sara M. Lewis
Narrow-spectrum artificial light silences female fireflies (Coleoptera: Lampyridae)



“Phosphor Converted (PC) amber LED lighting - often suggested to be less harmful to nocturnal insects - is disruptive, with unpredictable consequences for insect visual ecology”

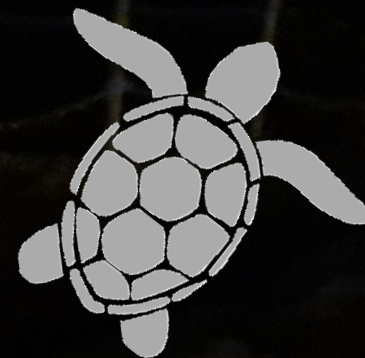
Specialized Spectra



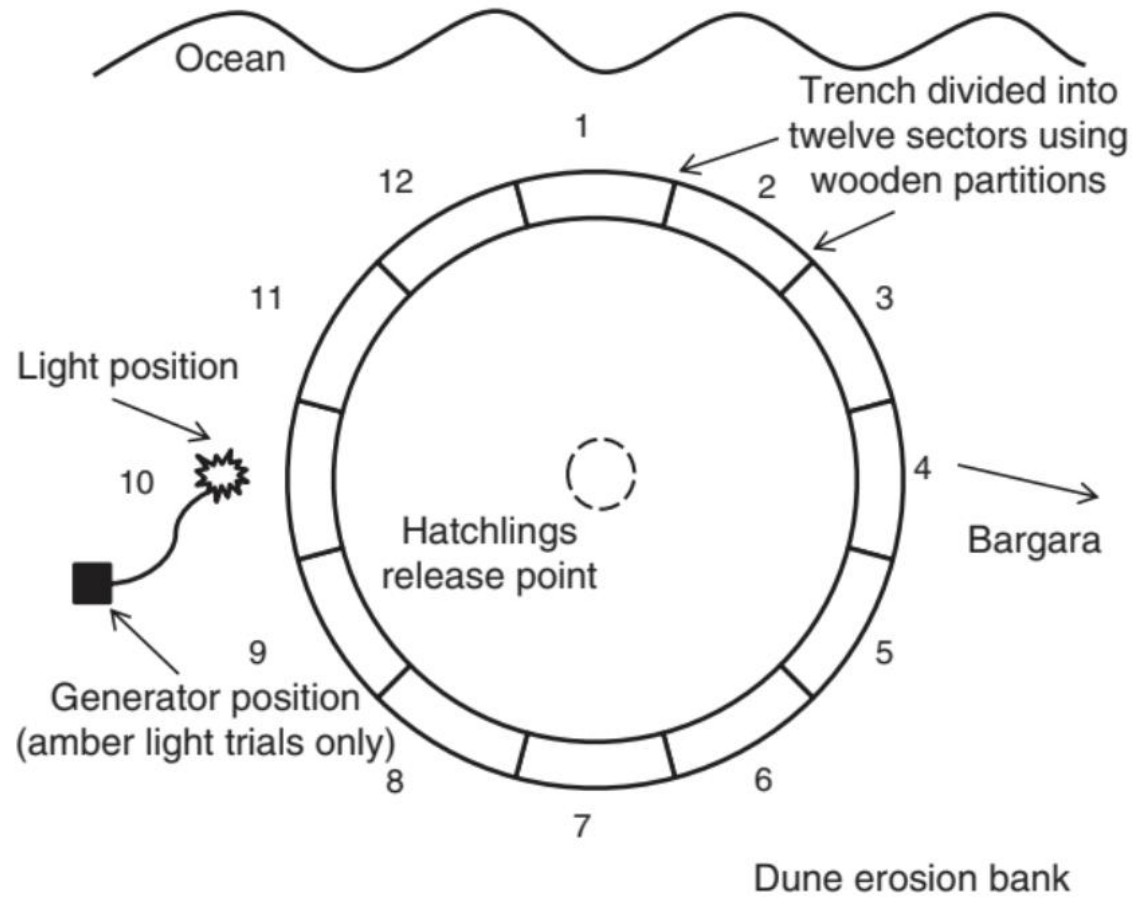
<https://doi.org/10.1038/s41467-021-24394-0>

Emmanuelle S. Briolat, Kevin J. Gaston, Jonathan Bennie, Emma J. Rosenfeld & Jolyon Troscianko (2021)
Artificial nighttime lighting impacts visual ecology links between flowers, pollinators and predators





Troviamo luoghi comuni simili anche nel caso delle tartarughe marine. Se utilizziamo questa luce monocromatica mentre tuteliamo i loro nidi, non è perché il rosso sia 'ecologico', ma semplicemente perché non intacca particolarmente i fotopigmenti su cui si basa la nostra visione notturna.



<https://doi.org/10.1071/WR15138>

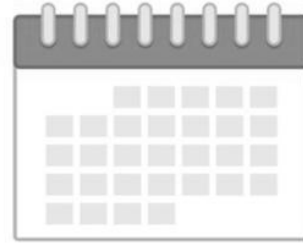
Robertson K, Booth DT, Limpus CJ (2016)

An assessment of 'turtle-friendly' lights on the sea-finding behaviour of loggerhead turtle hatchlings (*Caretta caretta*)

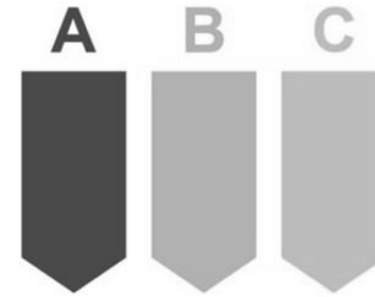
How to interpret a study



1. Who published the study?



2. When was the study published?



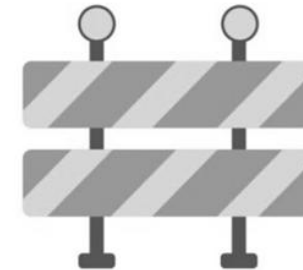
3. What type of study is it?



4. Are you comparing apples to apples?



5. What is the p-value and how was the data collected?



6. What are the limitations of the study?



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.



Wildlife Friendly...



**What Do You
Think Now?**

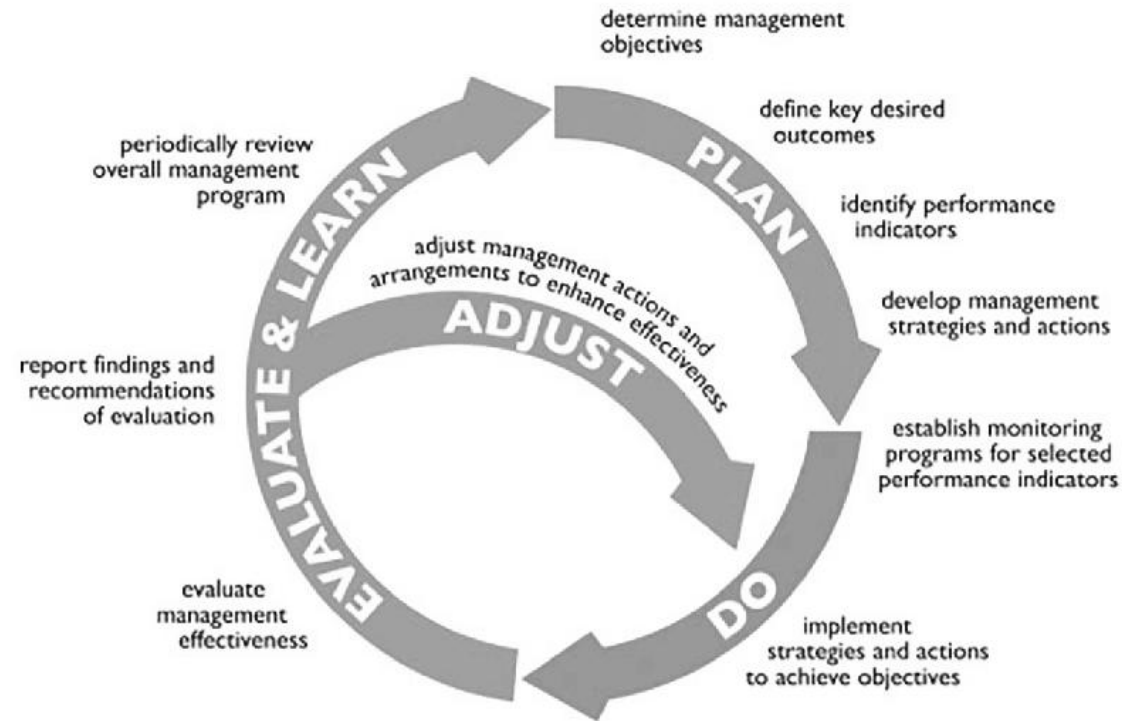




Can Policy and Practice **Keep up with Research?**

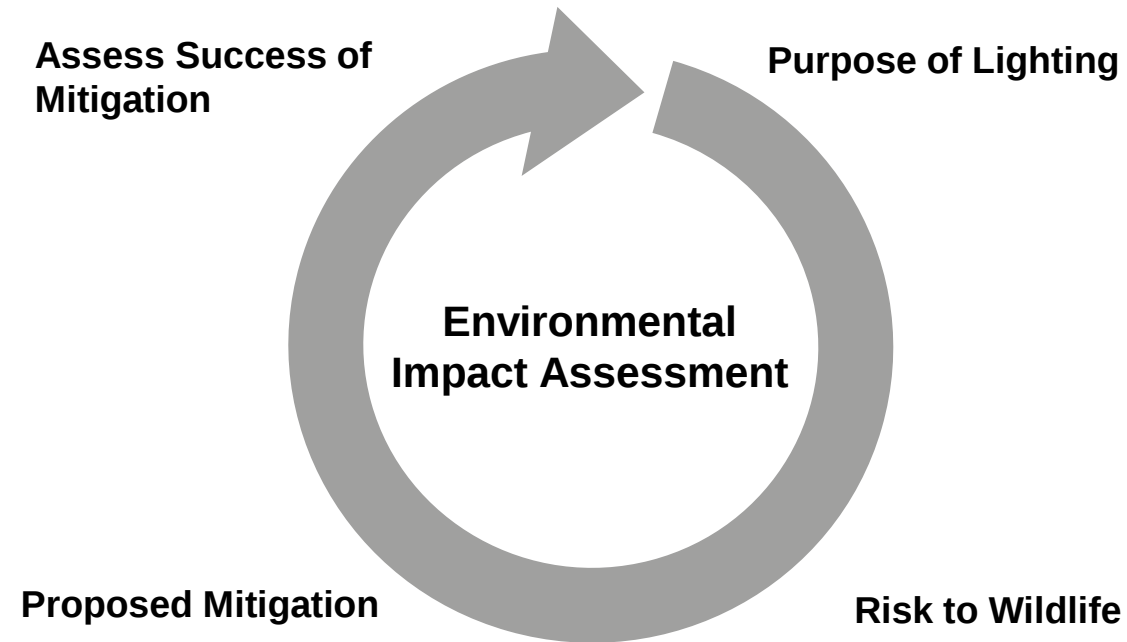


Challenge Confirmation Bias



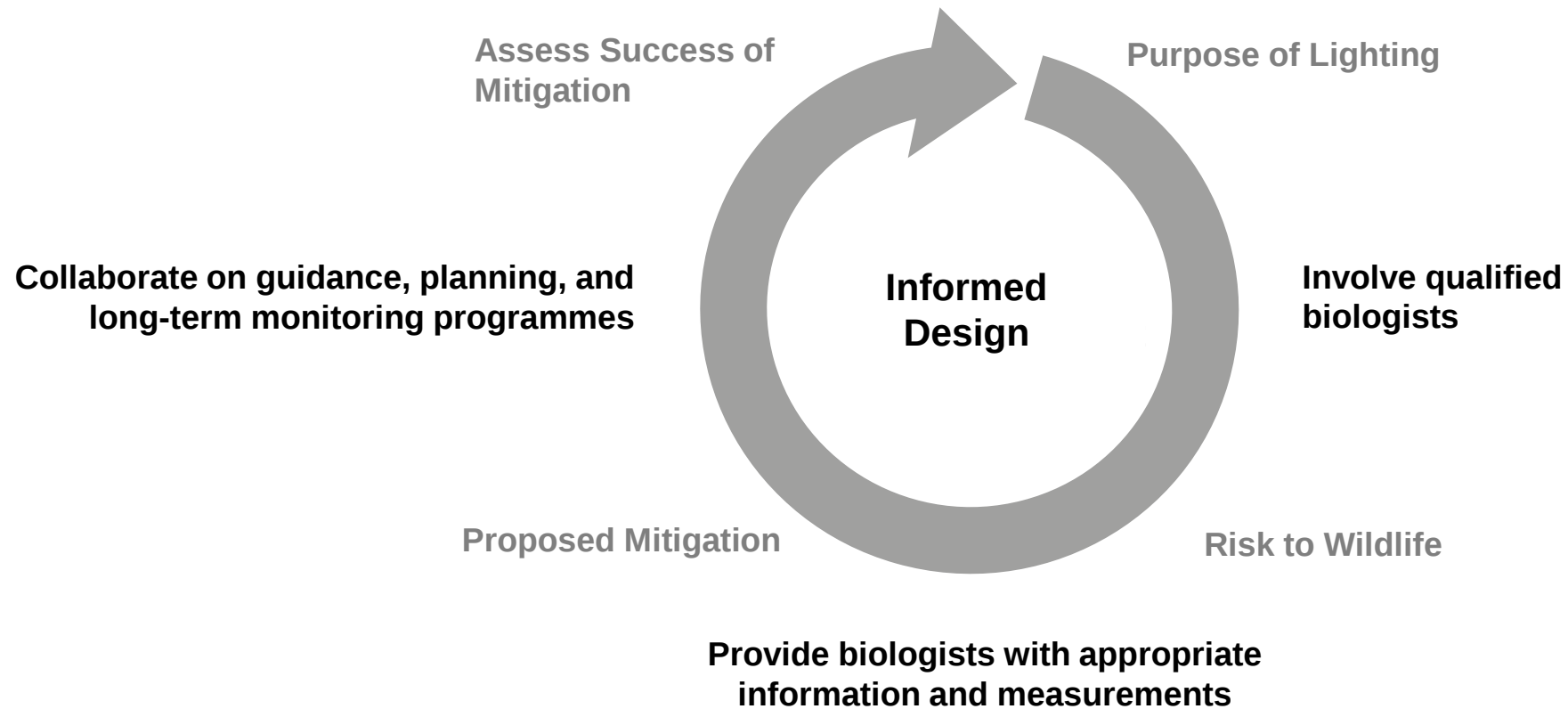
Challenge Specialization Bias

Valutazione di Impatto Ambientale

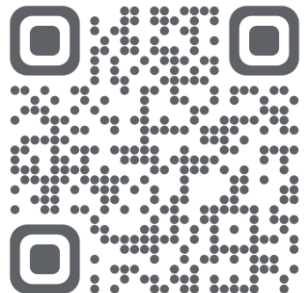


Challenge Specialization Bias

Collaboration



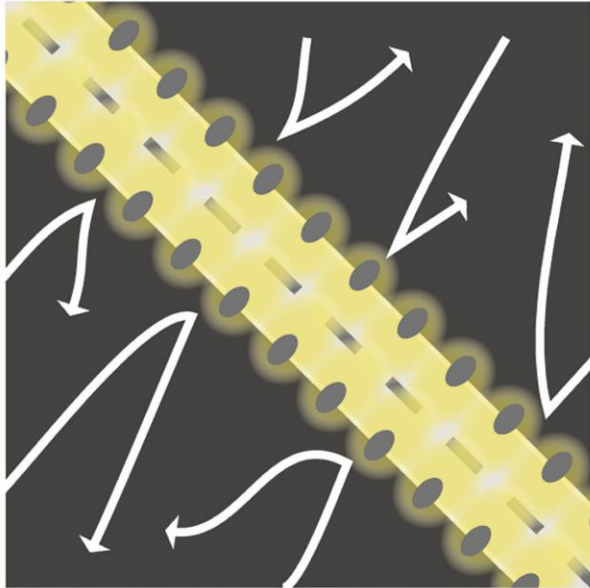
<https://doi.org/10.17863/CAM.14060>
Collaboration between designers and scientists



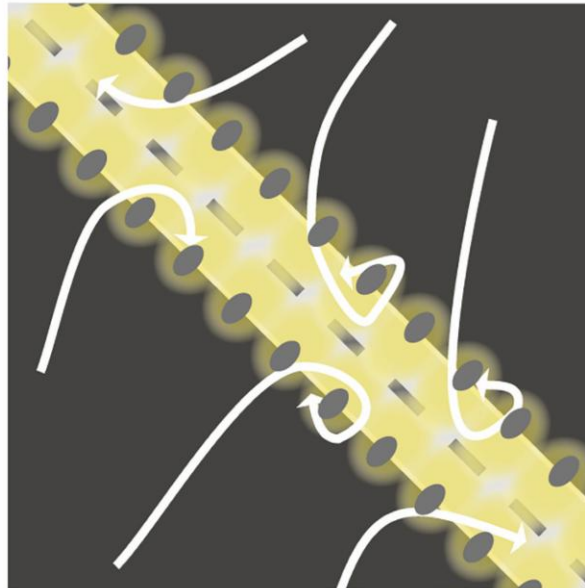
Strategies for Conservation

Dark Corridors

Avoiding Barrier Effect



Sink / Crash 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)

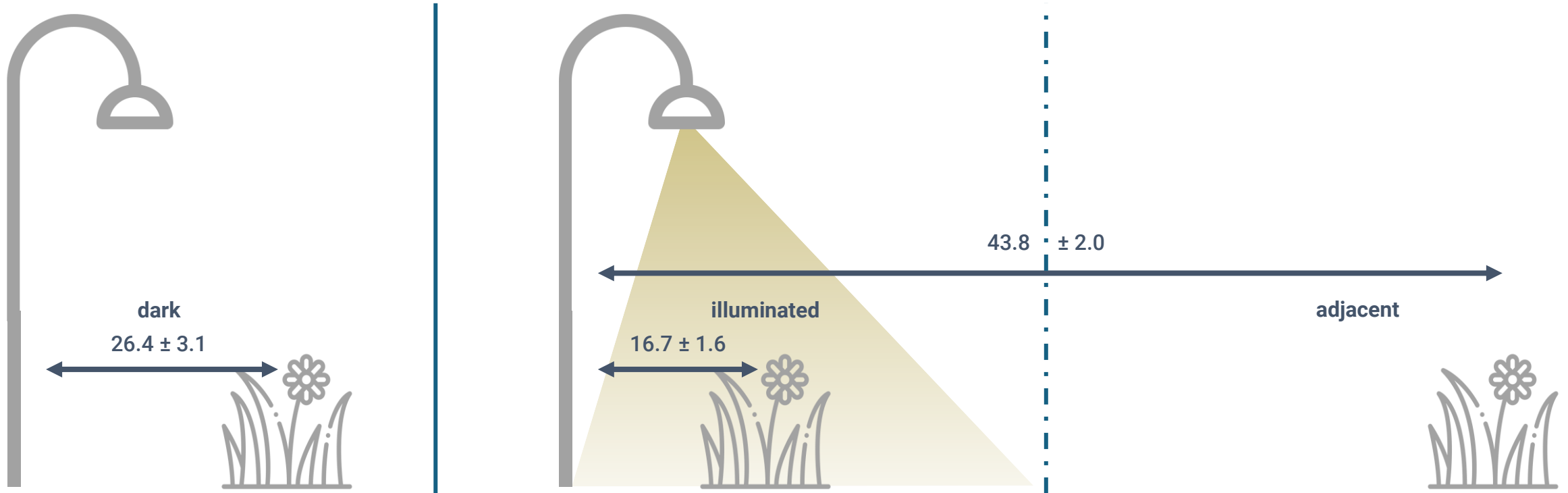


Birds (e.g. Longcore et al., 2013) Insects (e.g. Degen et al., 2016; theorized by Eisenbeis, 2006),



Strategies for Conservation

Dark Corridors?



dark: plants exposed on dark control sites;

illuminated: plants exposed on illuminated sites - **adjacent:** plants in a dark site adjacent to the illuminated site.

Schematic drawing of the field experiment set up and light treatments.

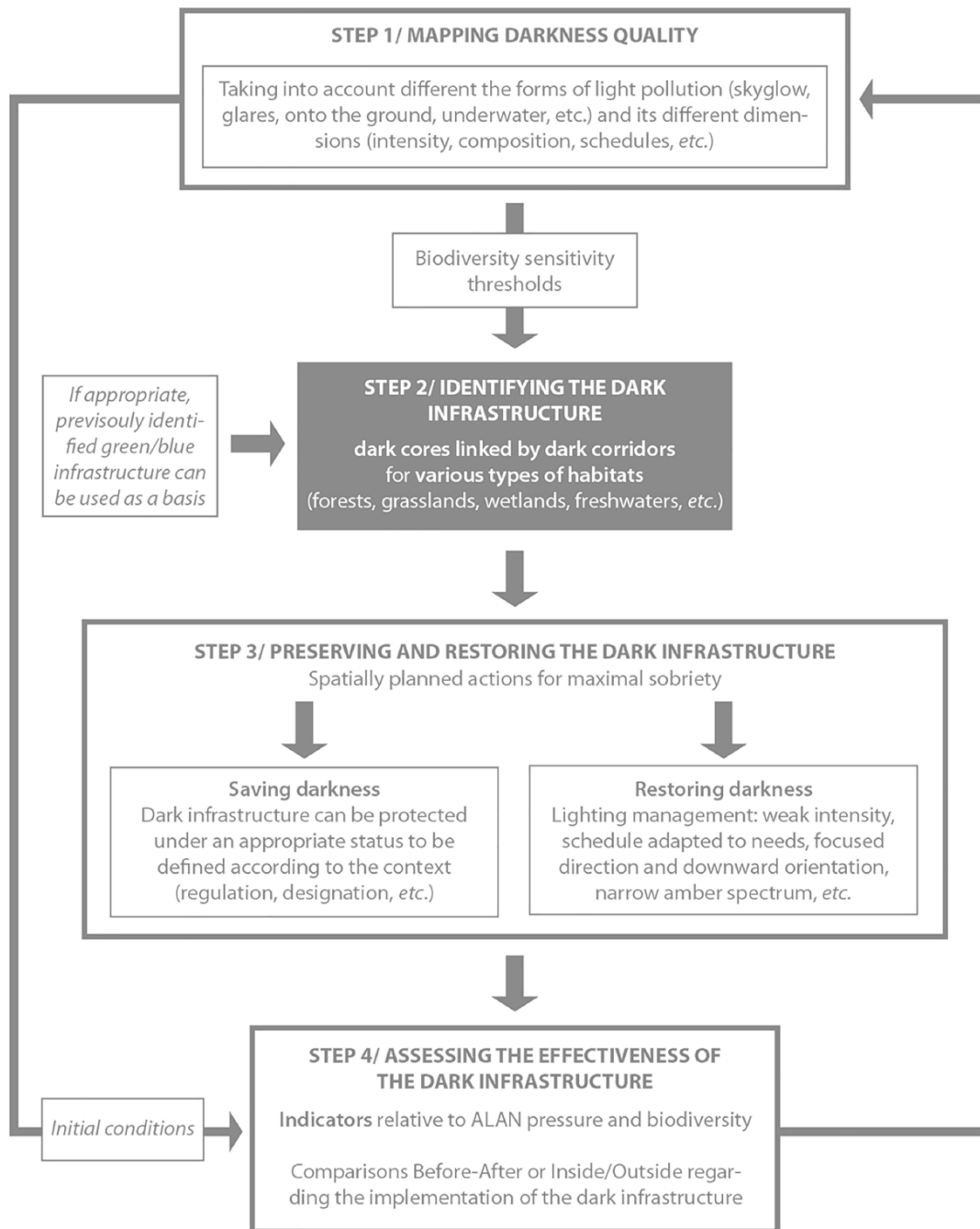
<https://doi.org/10.1038/s41598-020-68667-y>

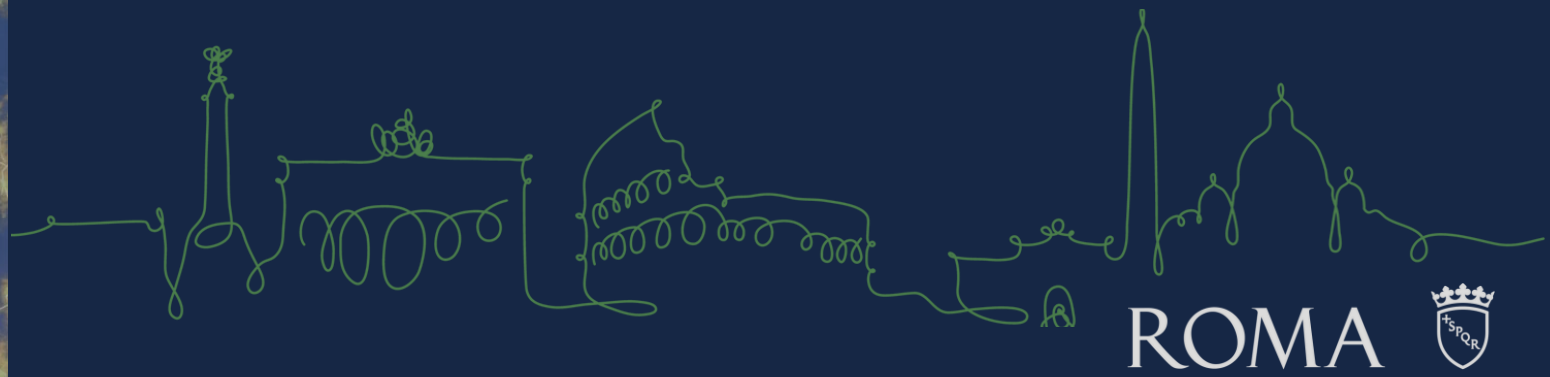
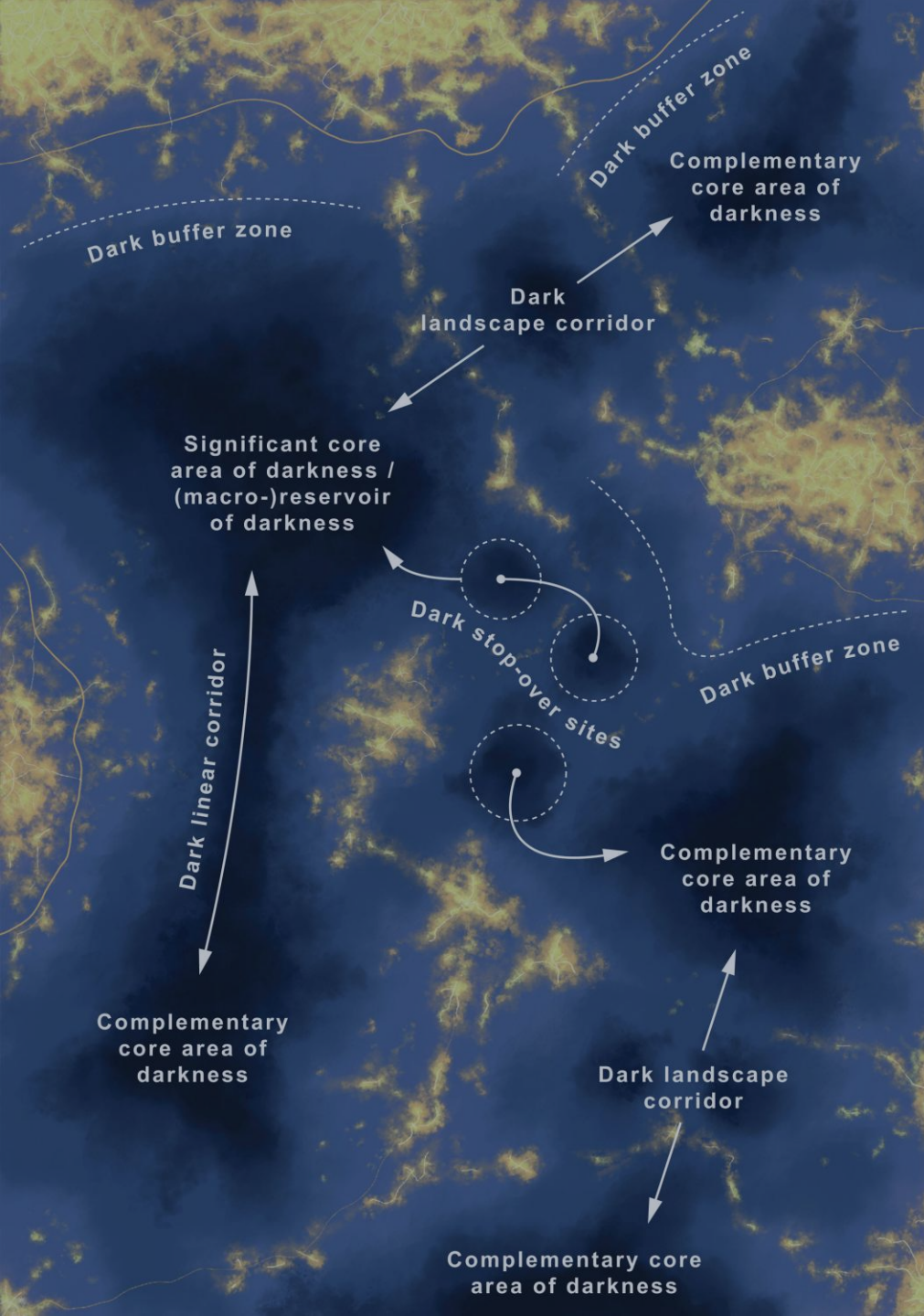
Simone Giavi, Sina Blösch, Guido Schuster, Eva Knop

Artificial light at night can modify ecosystem functioning beyond the lit area



Strategies for Conservation Dark Infrastructure



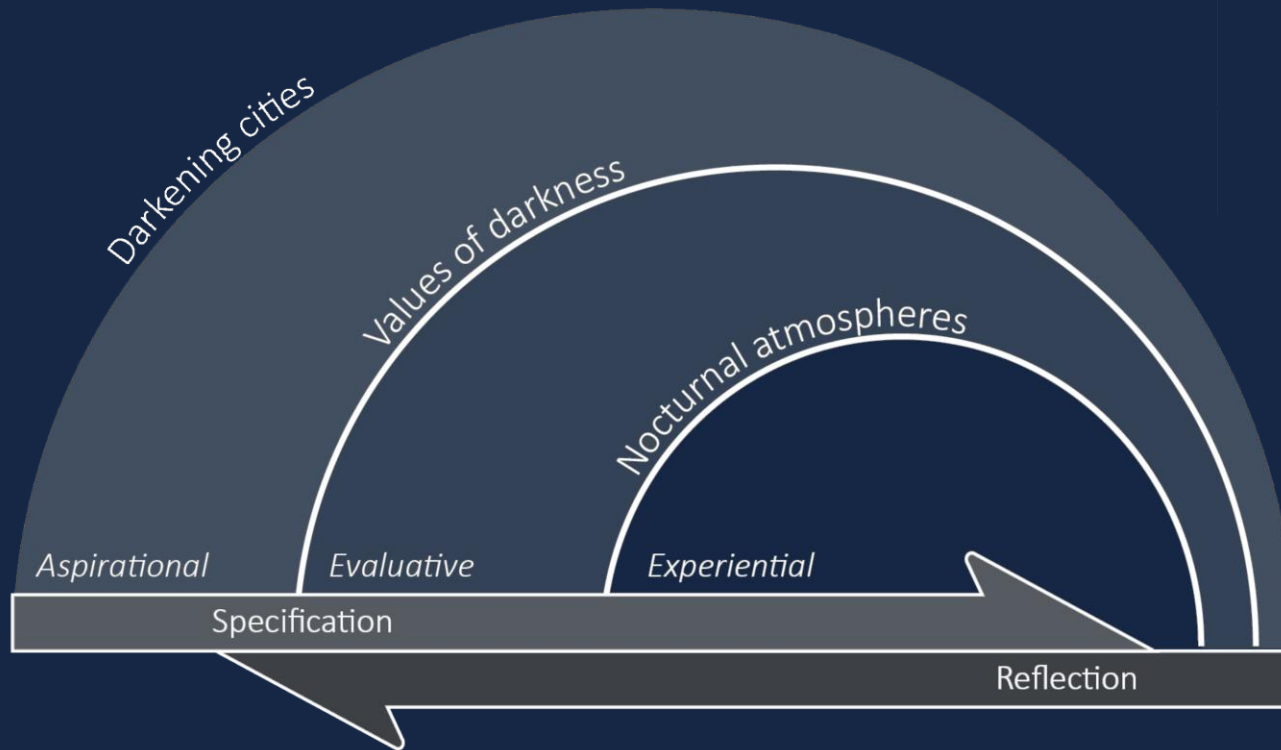


Sondaggio tra i responsabili e architetti del paesaggio



Designing Darkness

Theoretical Foundations



ISBN: 9781782797487
Nick Dunn, Lancaster University – Ed. Zero Books 2016
Dark Matters: A Manifesto for the Nocturnal City



Reframing Darkness

Re-frame potentially conflicting goals



Act of Repair
Act of Care

<https://doi.org/10.7551/mitpress/11771.001.0001>
Christopher R. Henke, Benjamin Sims. The MIT Press. 2020
Repairing Infrastructures: The Maintenance of Materiality and Power



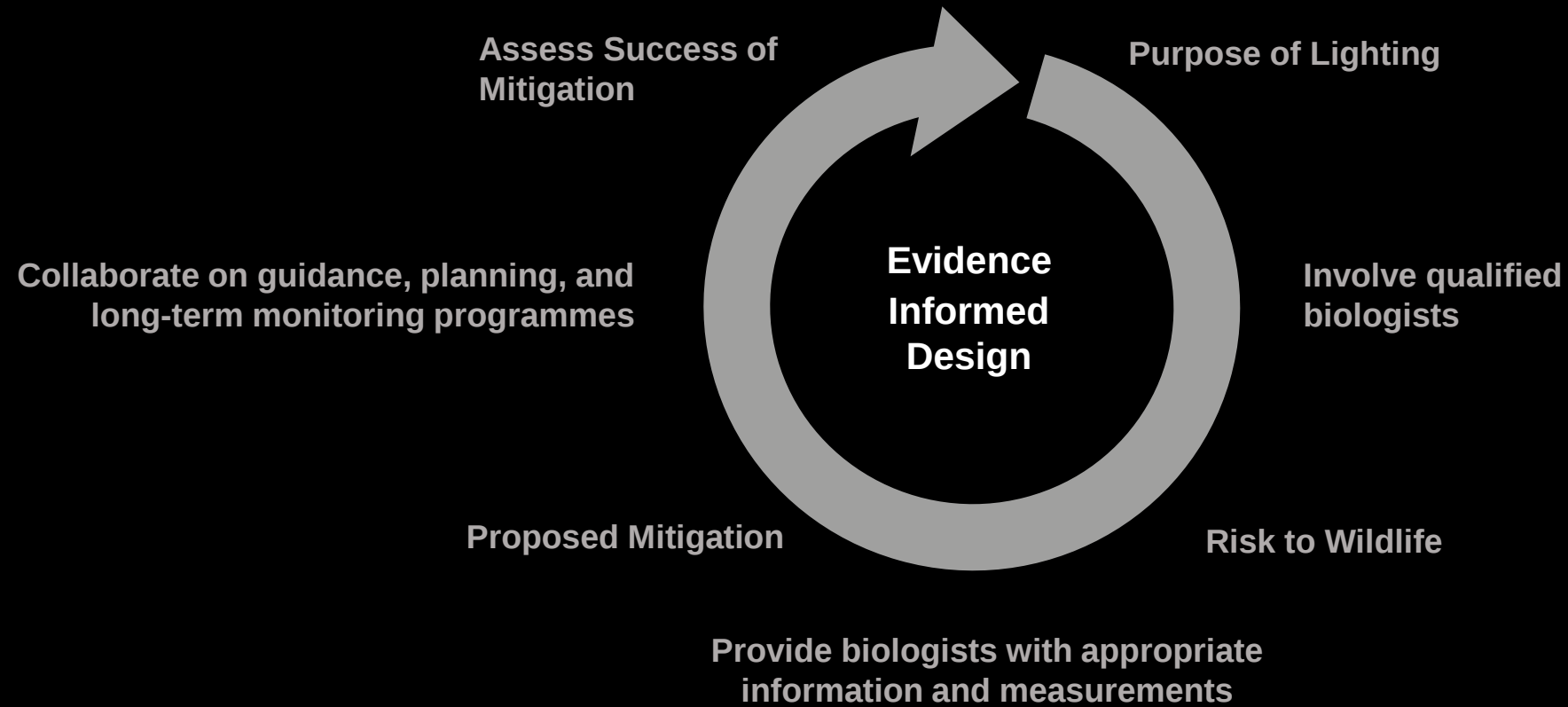
Designing Darkness: Strategies

Public awareness



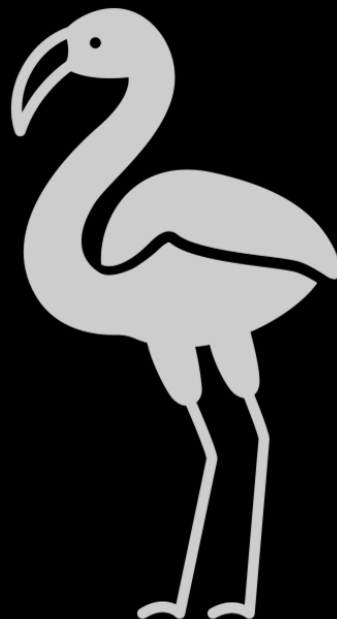
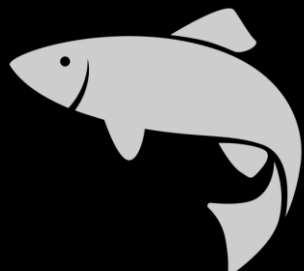
Challenge Expert Bias

*Con tutte queste complessità, come possiamo andare avanti?
Secondo me, la risposta è una sola: collaborazione*



Challenge Expert Bias

Ogni volta che ricevo una telefonata riguardo una specie diversa mi torna alla mente che il 'design' informato» non riguarda solo ciò che possiamo studiare, ma la nostra curiosità, la capacità di mettere in discussione le abitudini e di imparare dagli altri.



Challenge Curse of Knowledge

Possiamo pensare che qualcuno paghi per questi 'ulteriori' servizi?



HOW THE CLIENT EXPLAINED IT



HOW THE SALES PERSON UNDERSTOOD IT



HOW THE PROJECT MGR. UNDERSTOOD IT



HOW THE DESIGNER DESIGNED IT



HOW THE DEVELOPER CODED IT



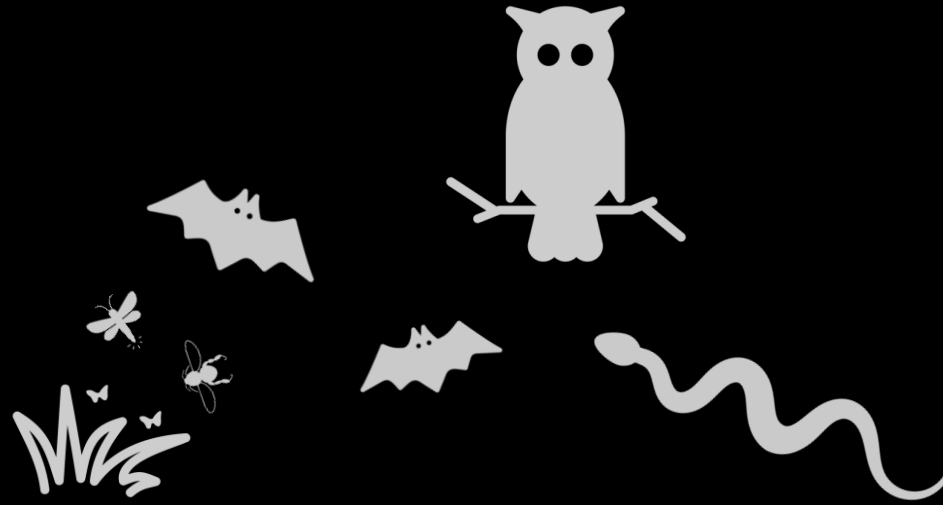
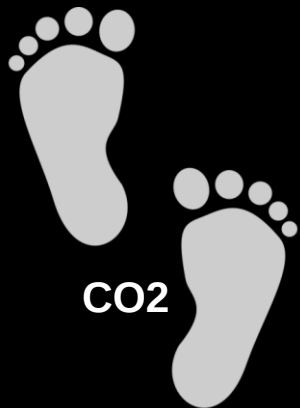
WHAT THE CLIENT REALLY NEEDED

Environmental Sustainability

Molti non sono consapevoli dei danni ambientali che i nostri pregiudizi, le nostre azioni e i nostri progetti possono creare, specie quando l'illuminazione e' adattata (copy paste) ad un posto, senza collaborare con esperti in loco

How much does it cost?

- **Cost of energy + carbon footprints**
- **Cost of bad lighting**
- **Consequences of misinformation**



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Economic Sustainability

La collaborazione multidisciplinare porta a risultati concreti. E' un approccio efficace e conveniente, come dimostrato da diversi casi studio realizzati negli ultimi anni.

Advantages of collaboration:

- **Save on energy with tailored projects**
- **Good lighting focused on research and quality**
- **Avoid damages to the ecosystem**
- **Save time on decision making**
- **Save time in the approval's process**

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Limitazioni:

- Tutti i casi studio presentati sono disponibili sul sito: <https://noctua.life/> e in svariate pubblicazioni online. Resto a disposizione per qualsiasi ulteriore informazione via email: chiara@noctua.life
- I poster realizzati nell'ambito del progetto europeo Life21 Turtlenest sono disponibili solo per le istituzioni e i partner. Per richieste di collaborazione con il progetto: chiara@noctua.life
- Le linee guida di Legambiente per la tutela delle tartarughe marine non sono ancora state pubblicate ufficialmente, sara' mia cura farvi avere il link per il download con il comunicato stampa.
- Sebbene sia fuori dall'ambito di questa presentazione, potete trovare un'analisi delle percezioni di "wilderness" da una prospettiva europea in questo articolo <https://doi.org/10.3197/096327114X13947900181590>
- Questa presentazione ha avuto un ambito esplicitamente limitato, concentrandosi sulle regioni sviluppate, dove l'impatto ecologico e sociale dell'eccesso di illuminazione notturna è diventato una preoccupazione. Non sono state trattate le problematiche legate alle aree del mondo con accesso limitato o nullo all'elettricità, ma potete leggerne a questo link <https://doi.org/10.1093/envhis/emw102>

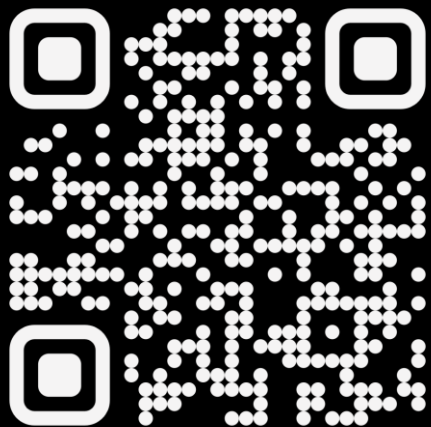
First, do no harm!

Lavorando nel settore dell'illuminazione, integrare un approccio transdisciplinare nel processo progettuale può sembrare una sfida... ma è una sfida che porta con sé enormi benefici. Ecco alcune considerazioni pratiche:

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

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chiara@noctua.life](https://noctua.life/chiara@noctua.life)



noctua
Cultural & Natural Heritage

