Spatially Predicting Impacts of Anthropogenic Nightlight and Noise on Wildlife Habitat Integrity

Project Team:

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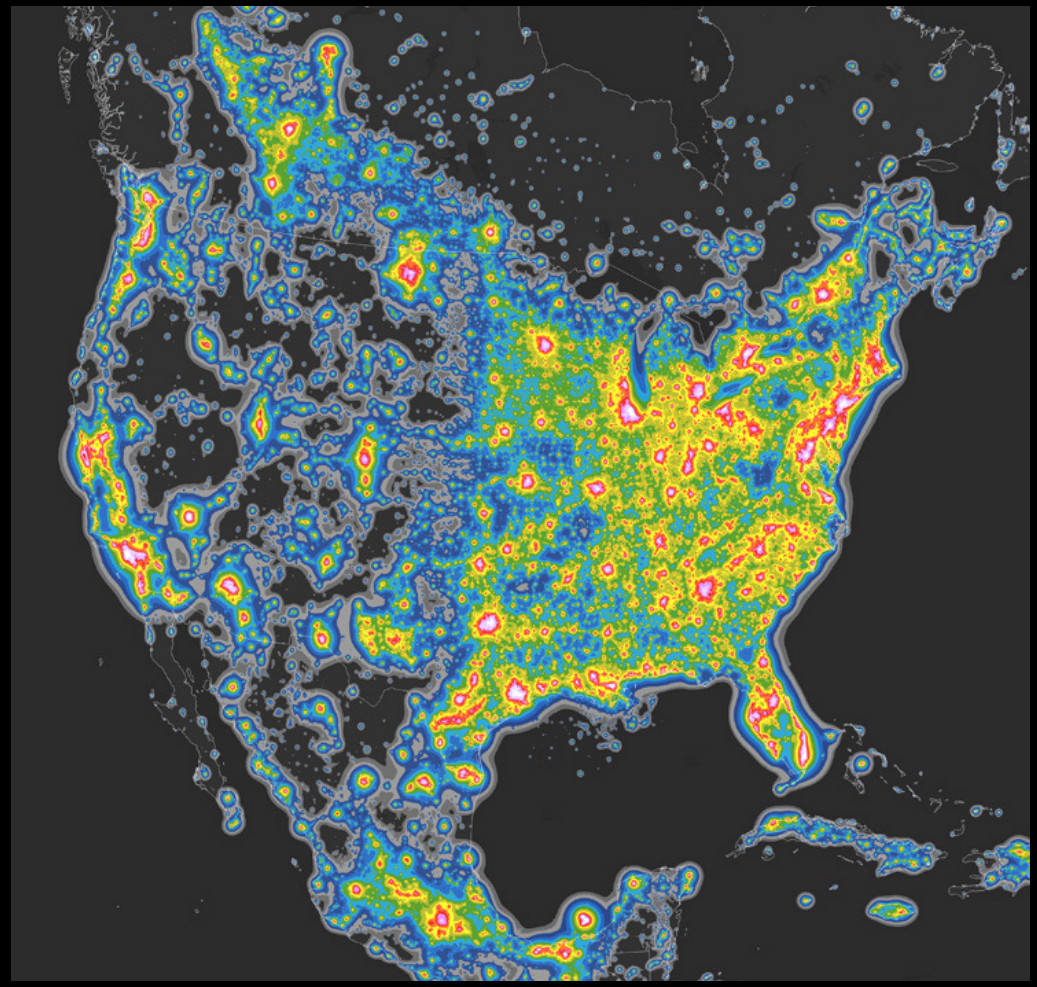
Project Goal

- Decision-support tool for the NPS to identify and mitigate effects of anthropogenic sensory stimuli on wildlife habitats across the Park system.

- End-User = NPS
  - Policy and legislative mandates to conserve acoustic and night sky environments
  - NPS Natural Sounds and Night Skies Division



Falchi et al. 2016

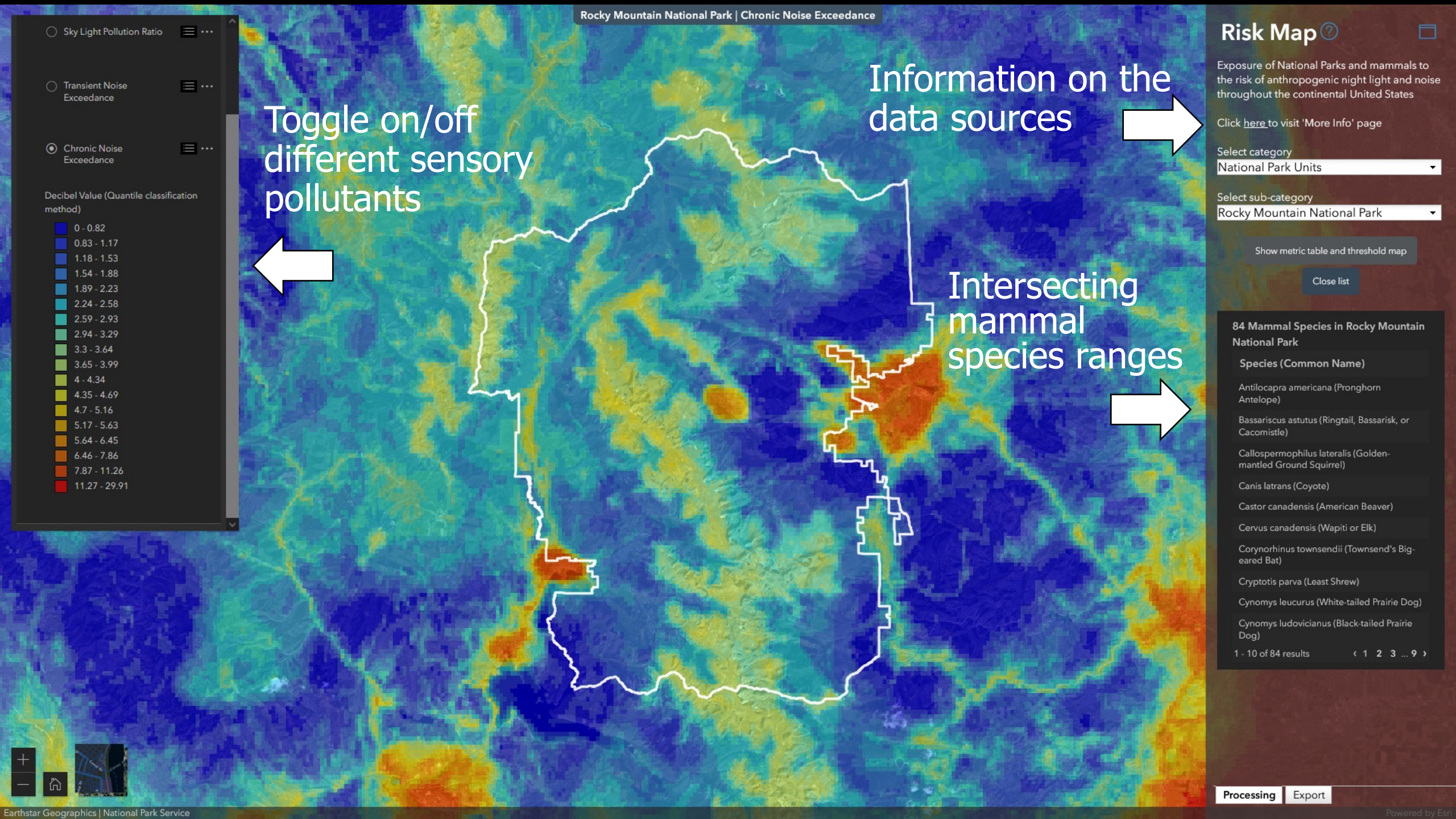
Decision-Support Application

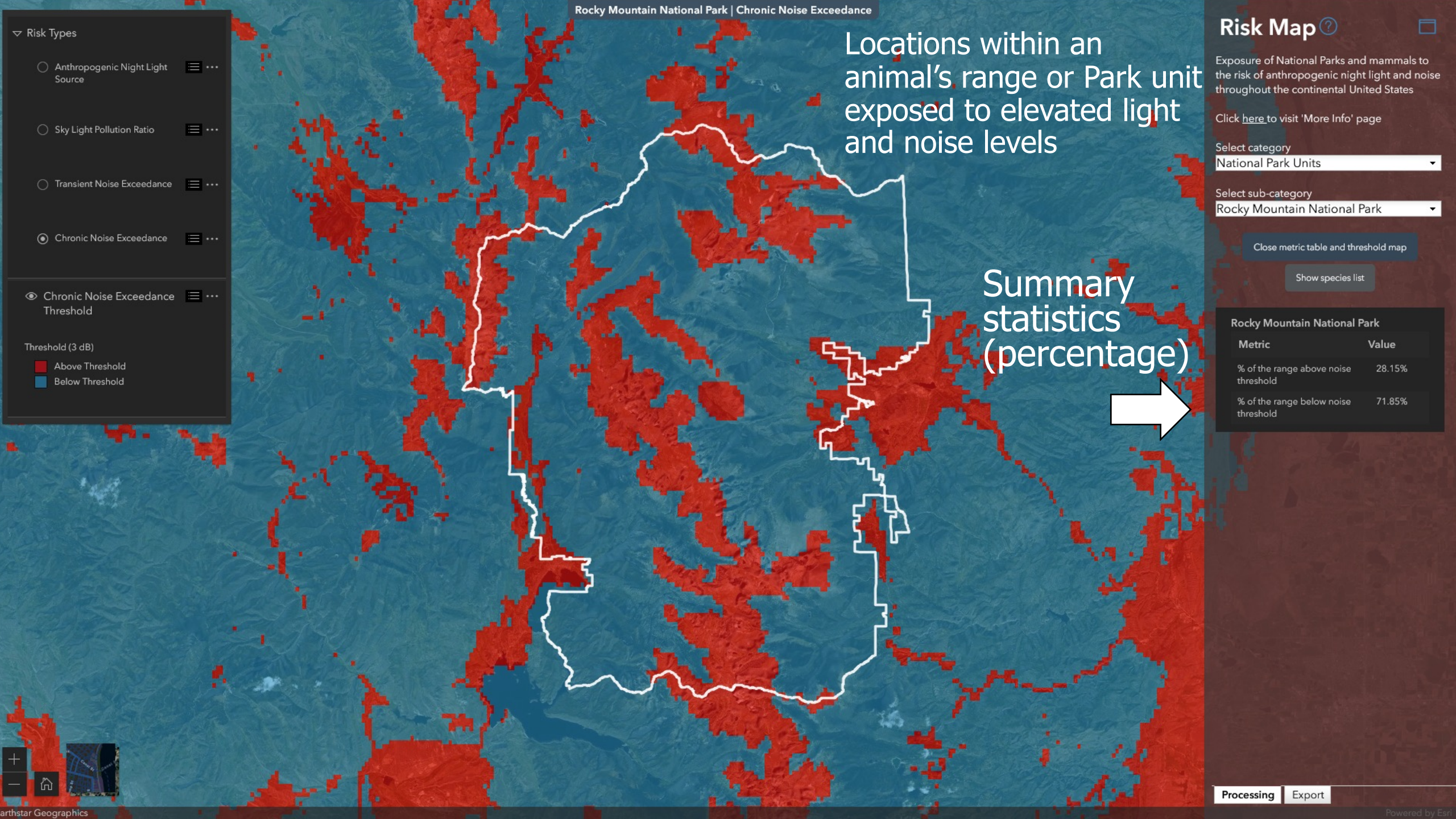
- Market research
  - Surveys
    - Qualtrics survey of NPS staff
    - Preferred functions & utilities
    - 30 respondents
  - Consultative meetings & workshops

- Geospatial framework
  - Compiles various pollutant spatial data
  - Available to wide range of users, from volunteers to researchers to superintendents
  - Easy to use and navigate
  - Forecasts locations where benefits of mitigation would be greatest

Decision-Support Application

- Web tool!
  - https://vms.seas.umich.edu/
- Main Data
  - Spatial boundaries of >350 mammal ranges
  - All National Park units in continental US
  - NASA's VIIRS Blackmarble (monthly 2012-2017)
  - Sky light pollution ratio (NPS)
  - Chronic & transient noise pollution (NPS)
- Webinars
  - Two large webinars (2020, 2021) engaging over 200 NPS staff on using the tool


Rocky Mountain National Park | Chronic Noise Exceedance
Sky Light Pollution Ratio
Transient Noise Exceedance
Chronic Noise Exceedance
Decibel Value (Quantile classification method)
0 - 0.82
0.83 - 1.17
1.18 - 1.53
1.54 - 1.88
1.89 - 2.23
2.24 - 2.58
2.59 - 2.93
2.94 - 3.29
3.3 - 3.64
3.65 - 3.99
4 - 4.34
4.35 - 4.69
4.7 - 5.16
5.17 - 5.63
5.64 - 6.45
6.46 - 7.86
7.87 - 11.26
11.27 - 29.91
Toggle on/off different sensory pollutants
Information on the data sources
Intersecting mammal species ranges
Risk Map
Exposure of National Parks and mammals to the risk of anthropogenic night light and noise throughout the continental United States
Click here to visit 'More Info' page
Select category
National Park Units
Select sub-category
Rocky Mountain National Park
Show metric table and threshold map
Close list
84 Mammal Species in Rocky Mountain National Park
Species (Common Name)
Antilocapra americana (Pronghorn Antelope)
Bassariscus astutus (Ringtail, Bassarisk, or Cacomistle)
Callospermophilus lateralis (Golden-mantled Ground Squirrel)
Canis latrans (Coyote)
Castor canadensis (American Beaver)
Cervus canadensis (Wapiti or Elk)
Corynorhinus townsendii (Townsend's Big-eared Bat)
Cryptotis parva (Least Shrew)
Cynomys leucurus (White-tailed Prairie Dog)
Cynomys ludovicianus (Black-tailed Prairie Dog)
1 - 10 of 84 results
‹ 1 2 3 ... 9 ›
Processing
Export
Earthstar Geographics | National Park Service
Powered by Esri


Rocky Mountain National Park | Chronic Noise Exceedance
Risk Types
Anthropogenic Night Light Source
Sky Light Pollution Ratio
Transient Noise Exceedance
Chronic Noise Exceedance
Chronic Noise Exceedance Threshold
Threshold (3 dB)
Above Threshold
Below Threshold
Locations within an animal's range or Park unit exposed to elevated light and noise levels
Summary statistics (percentage)
Risk Map
Exposure of National Parks and mammals to the risk of anthropogenic night light and noise throughout the continental United States
Click here to visit 'More Info' page
Select category
National Park Units
Select sub-category
Rocky Mountain National Park
Close metric table and threshold map
Show species list
Rocky Mountain National Park
Metric
Value
% of the range above noise threshold
28.15%
% of the range below noise threshold
71.85%
Processing
Export
arthstar Geographics
Powered by Esri

Rocky Mountain National Park | Anthropogenic Night Light Source

Risk Types

Anthropogenic Night Light Source

Log Radiance (nWatts.cm-2.sr-1)
(Quantile classification method)

- -3.01 - -1.27
- -1.26 - -1.12
- -1.11 - -1.01
- -1 - -0.95
- -0.94 - -0.88
- -0.87 - -0.84
- -0.83 - -0.8
- -0.79 - -0.76
- -0.75 - -0.69
- -0.68 - -0.63
- -0.62 - -0.54
- -0.53 - -0.46
- -0.45 - -0.35
- -0.34 - -0.22
- -0.21 - -0.07
- -0.06 - 0.16
- 0.17 - 0.67
- 0.68 - 2.42

Sky Light Pollution Ratio

Transient Noise Exceedance

Monthly trend lines

Risk Map

Exposure of National Parks and mammals to the risk of anthropogenic night light and noise throughout the continental United States

Click here to visit 'More Info' page

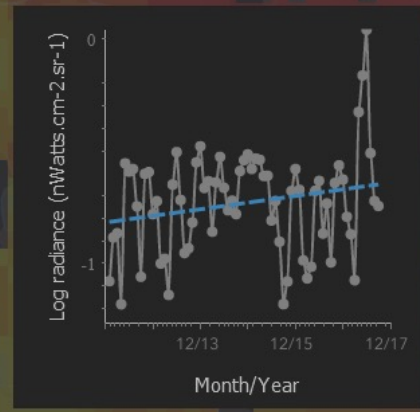
Select category
National Park Units

Select sub-category
Rocky Mountain National Park

Show metric table and threshold map

Close chart

Show species list



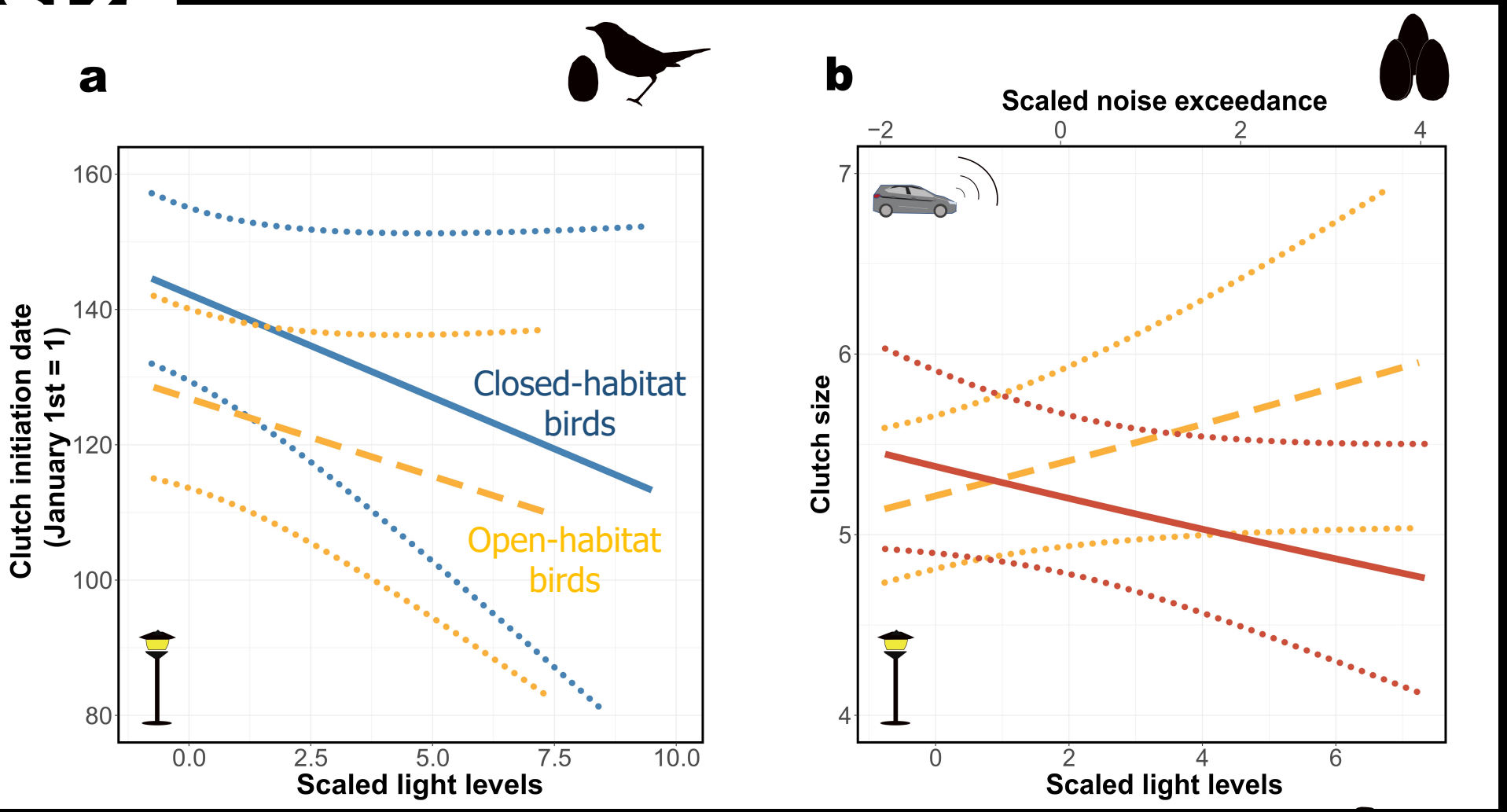
Processing | Export

Help fill knowledge gaps

- Spatially predict the quantitative impacts of ANLN on wildlife habitat quality and connectivity using nation-wide databases of wildlife occurrence and reproductive success.

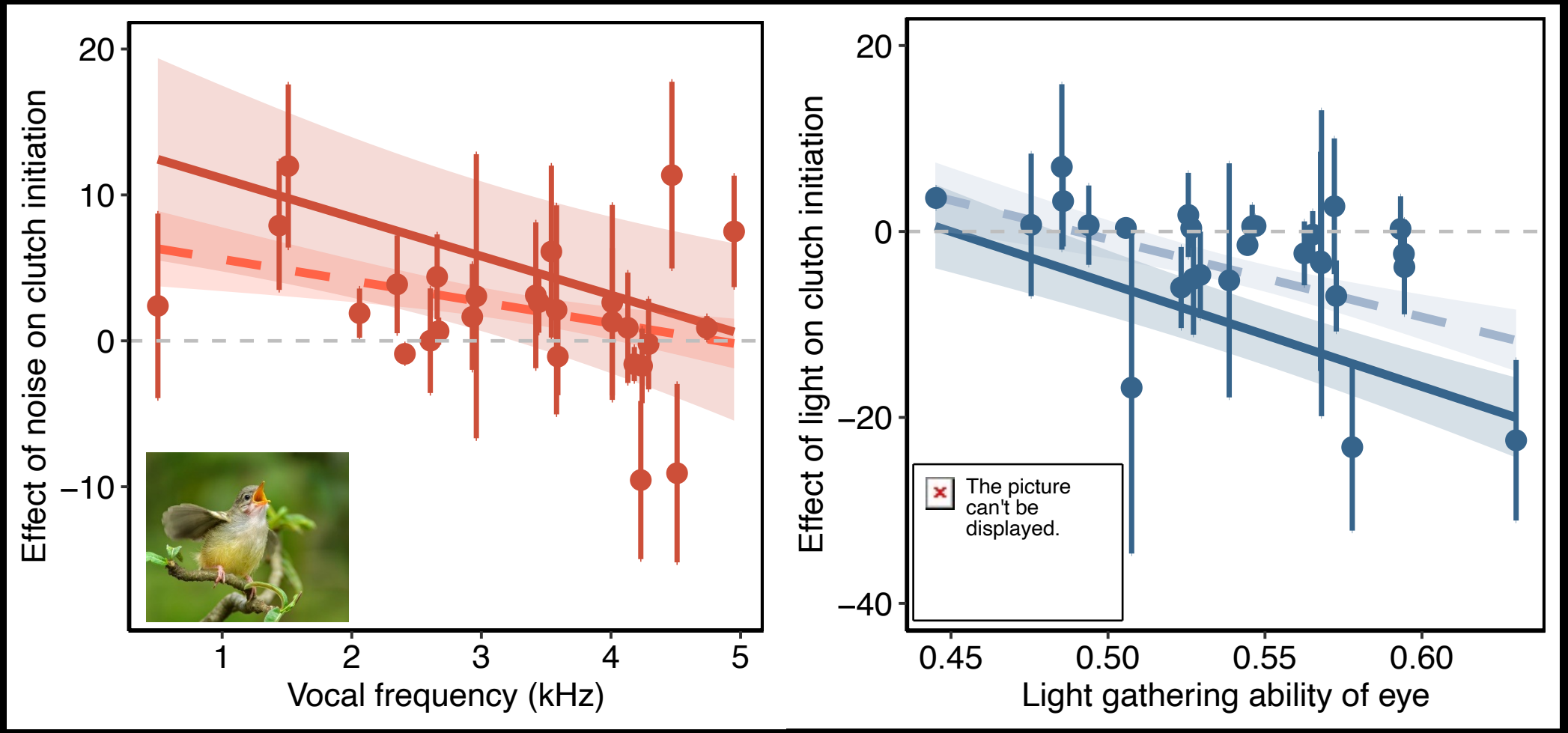
- 9 peer-reviewed publications
  - *Nature, Nature Ecology and Evolution, Global Change Biology, Ecography, Environmental Research Letters, Proceedings of the Royal Society of London, journal of Animal Ecology, Biological Conservation, and Integrative & Comparative Biology*

Light & noise affect clutch initiation & size



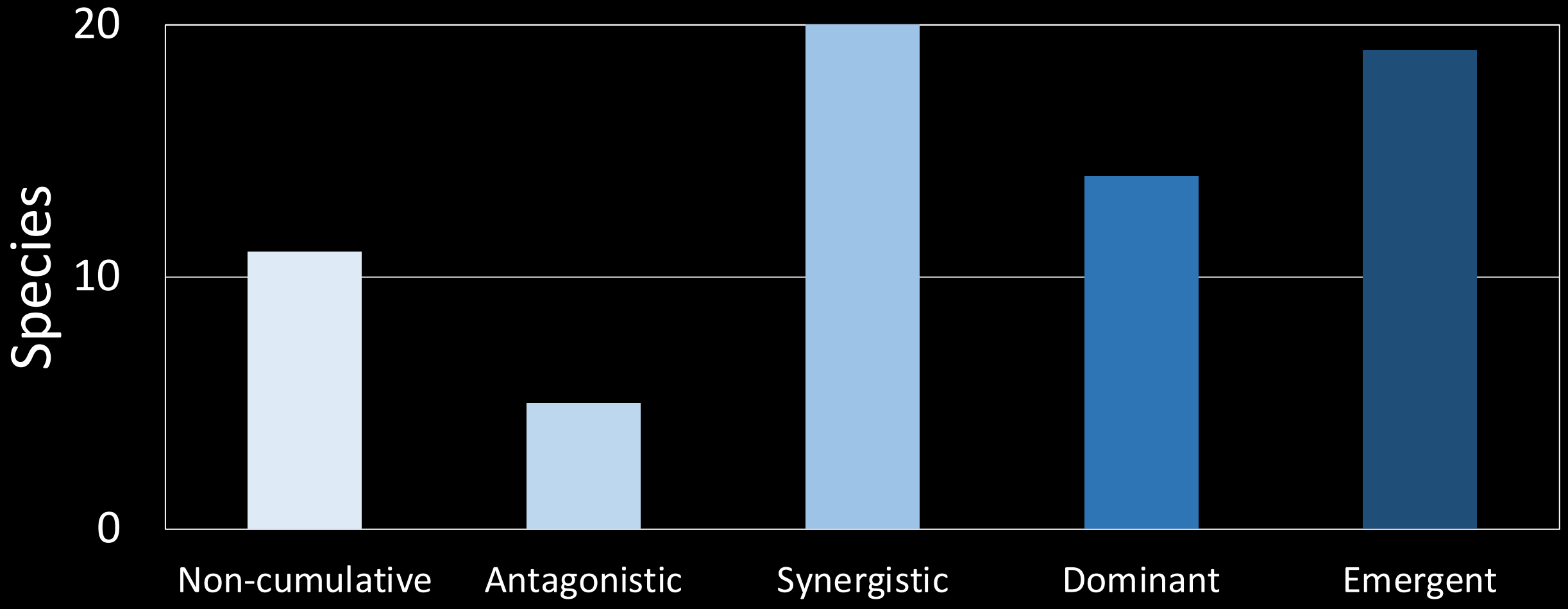
Senzaki et al. (2020) *Nature*

Phenological responses linked to traits



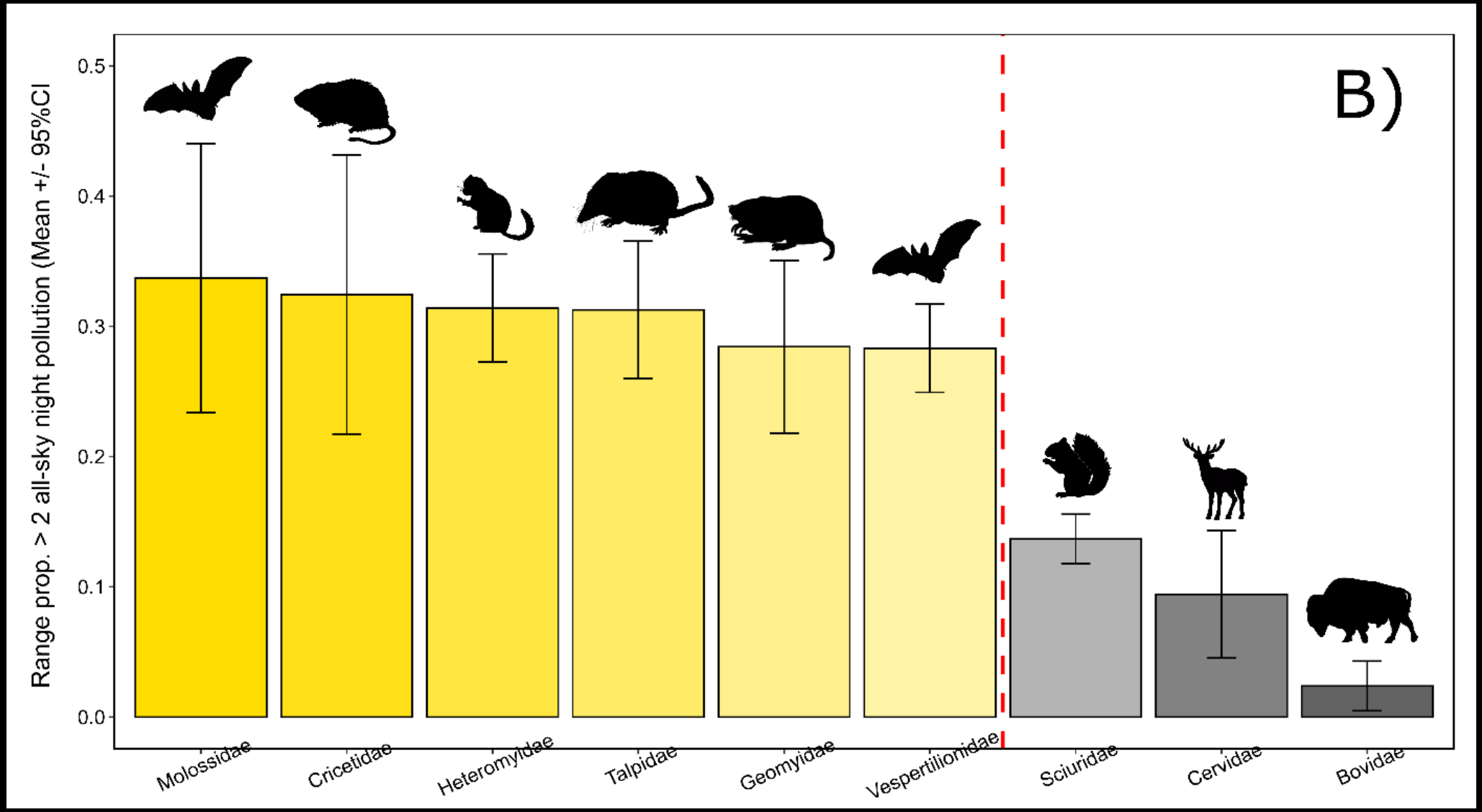
Senzaki et al. (2020) *Nature*

Light x Noise: Cumulative & non-cumulative responses



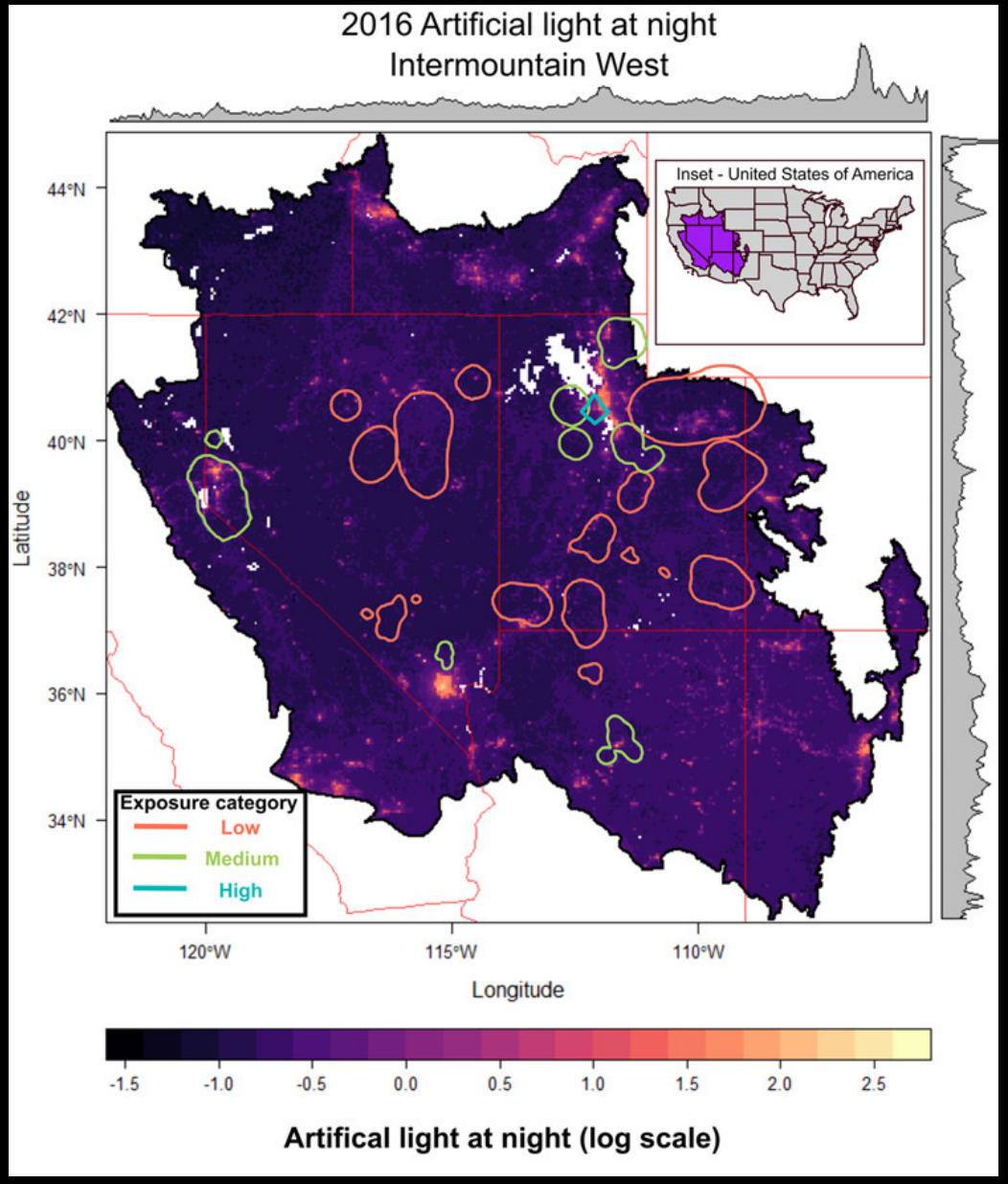
Wilson et al. (2021) *Global Change Biology*

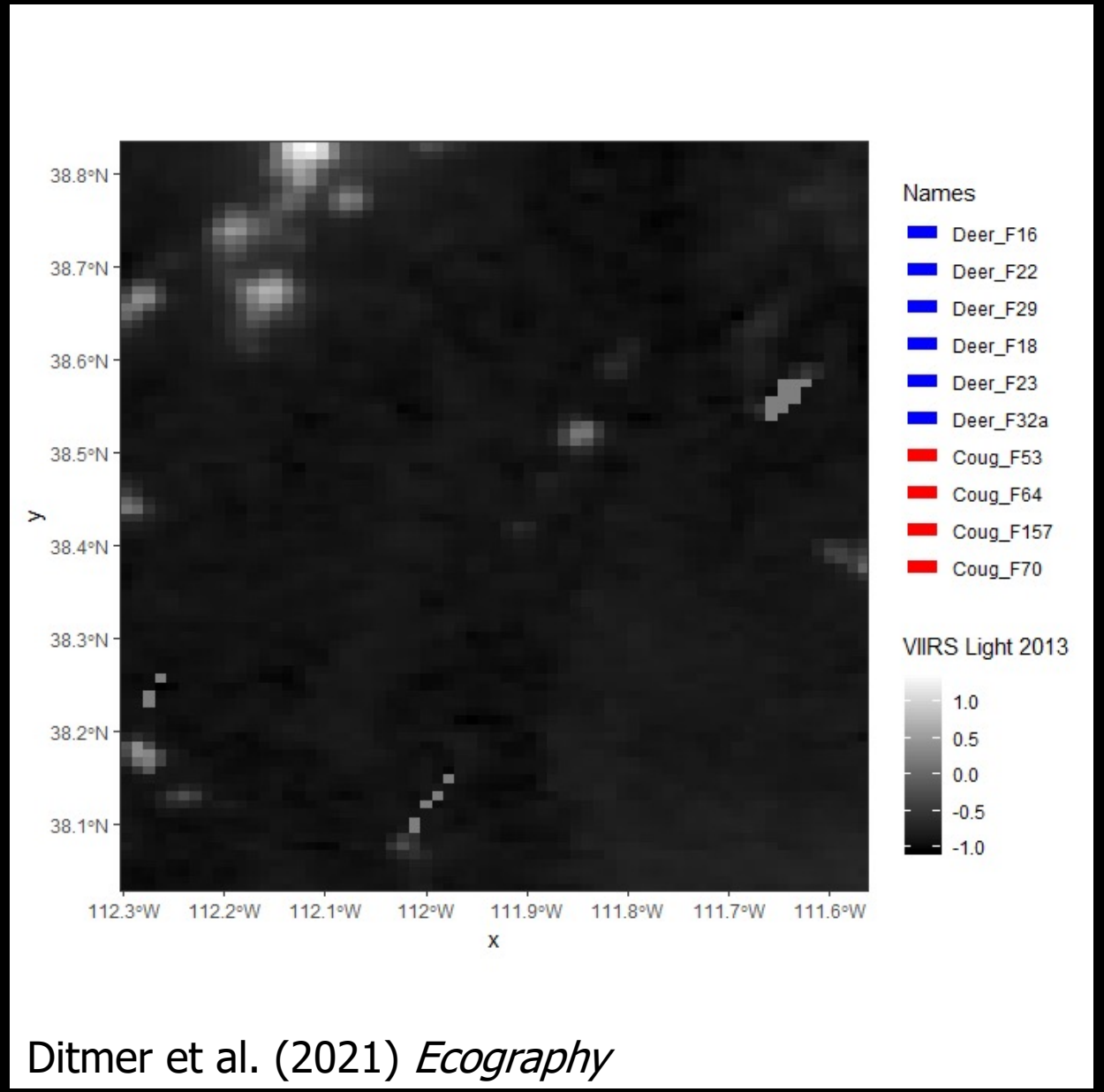
Dark environments and fragmentation



Ditmer et al. (2020) *Biological Conservation*

Nightlight influence on predator-prey dynamics

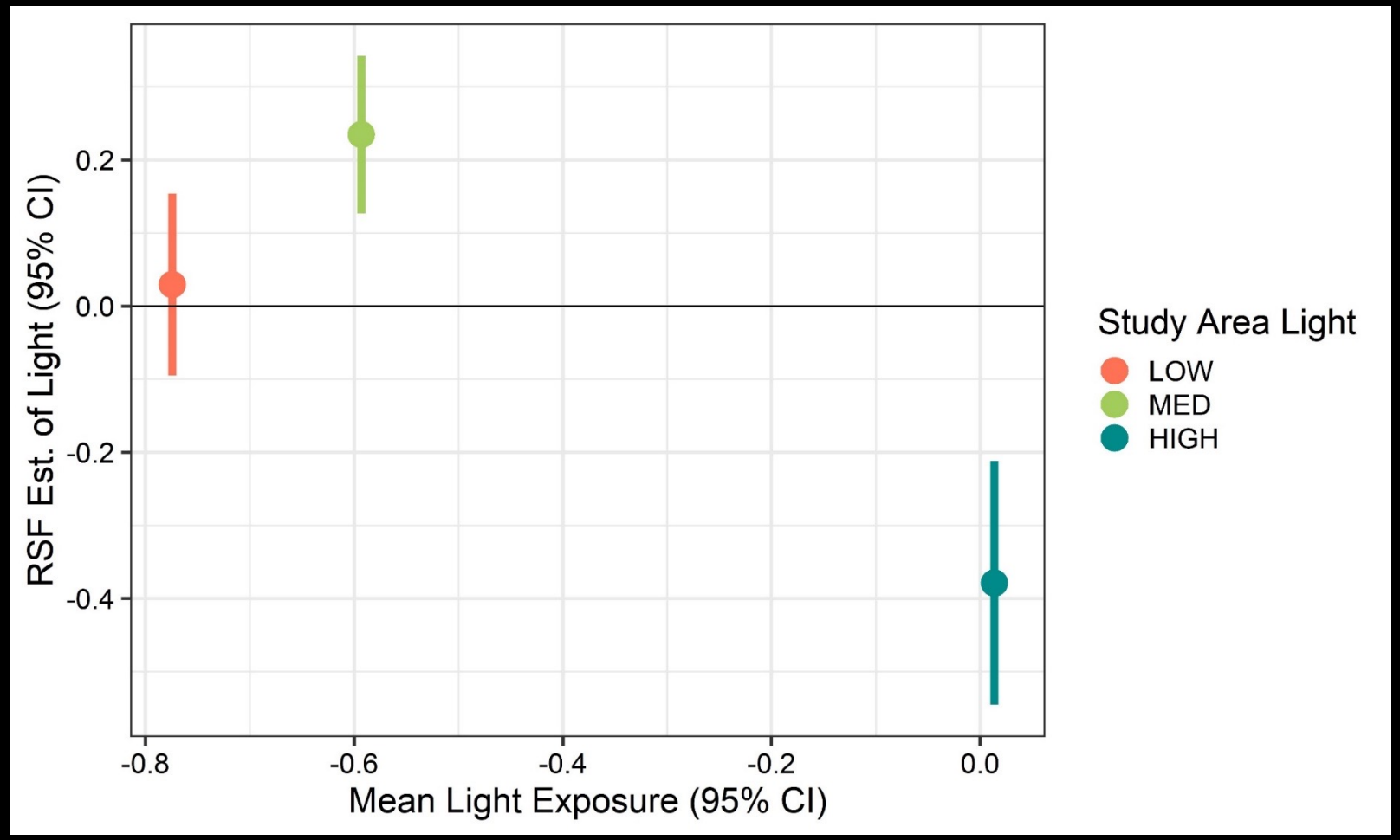




Ditmer et al. (2021) *Ecography*

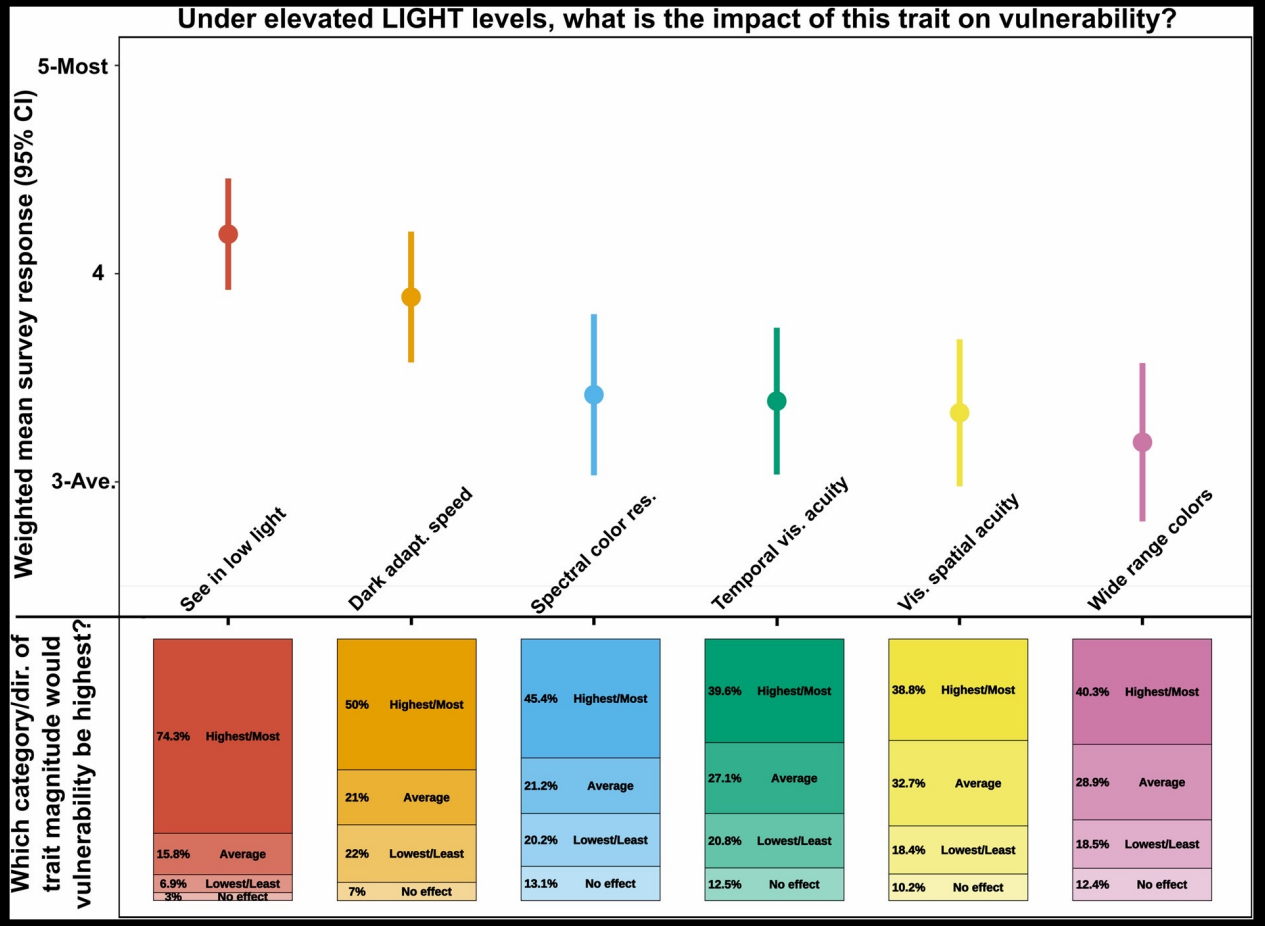
Nightlight influence on predation risk

Artificial Nightlight

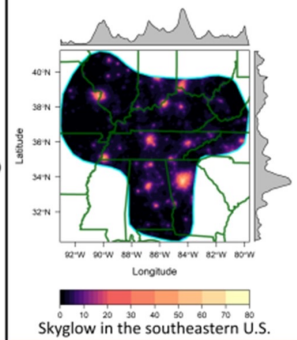
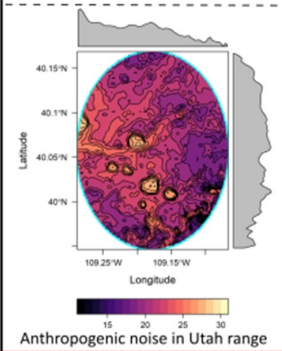


Ditmer et al. (2021) *Ecography*

Animal Vulnerability to Nightlight & Noise



Ditmer et al. (2021) *Integrative and Comparative Biology*

	Myotis grisescens (gray bat)	*Mustela nigripes* (black-footed ferret)
Species		
Sensory pollutant of concern	**Light**	**Noise**
Vulnerability to night light and noise — **Sensitivity** (based on expert survey)	Nocturnal activity pattern Habitat specialist High ability to see in low light	Auditory specialist Habitat specialist Dietary specialist
Adaptive capacity (down is more adaptive/ less vulnerable)	Aerial Specific structures required for roosting	Very limited: human barriers & specific habitat needs
Exposure (based on publically avail. data)	 Skyglow in the southeastern U.S.	 Anthropogenic noise in Utah range
	Federally (U.S.) listed as Endangered & considered "Vulnerable" by the IUCN (*recent conservation efforts have increased the population) Reduce sources of art. light near hibernaculum and roosts Reduce luminance near roadways (billboards) or other sources of mortality (wind farms)	Federally (U.S.) listed as Endangered & considered "Endangered" by the IUCN Sensitive to noise for communication & predator avoidance Determine if and where expanding energy development and associated traffic noise overlap remaining range

Thanks!

Data Contribution:

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NPS Natural Sounds and Night Skies Division

https://www.nps.gov/subjects/sound/index.htm

https://www.nps.gov/subjects/nightskies/index.htm

NASA Ecological Forecasting
Grant #: NNX17AG36G