TRIEU KARIE, M2 IDIL ECOLOGY, 2023

PROTECTING BATS, A KEYSTONE SPECIES
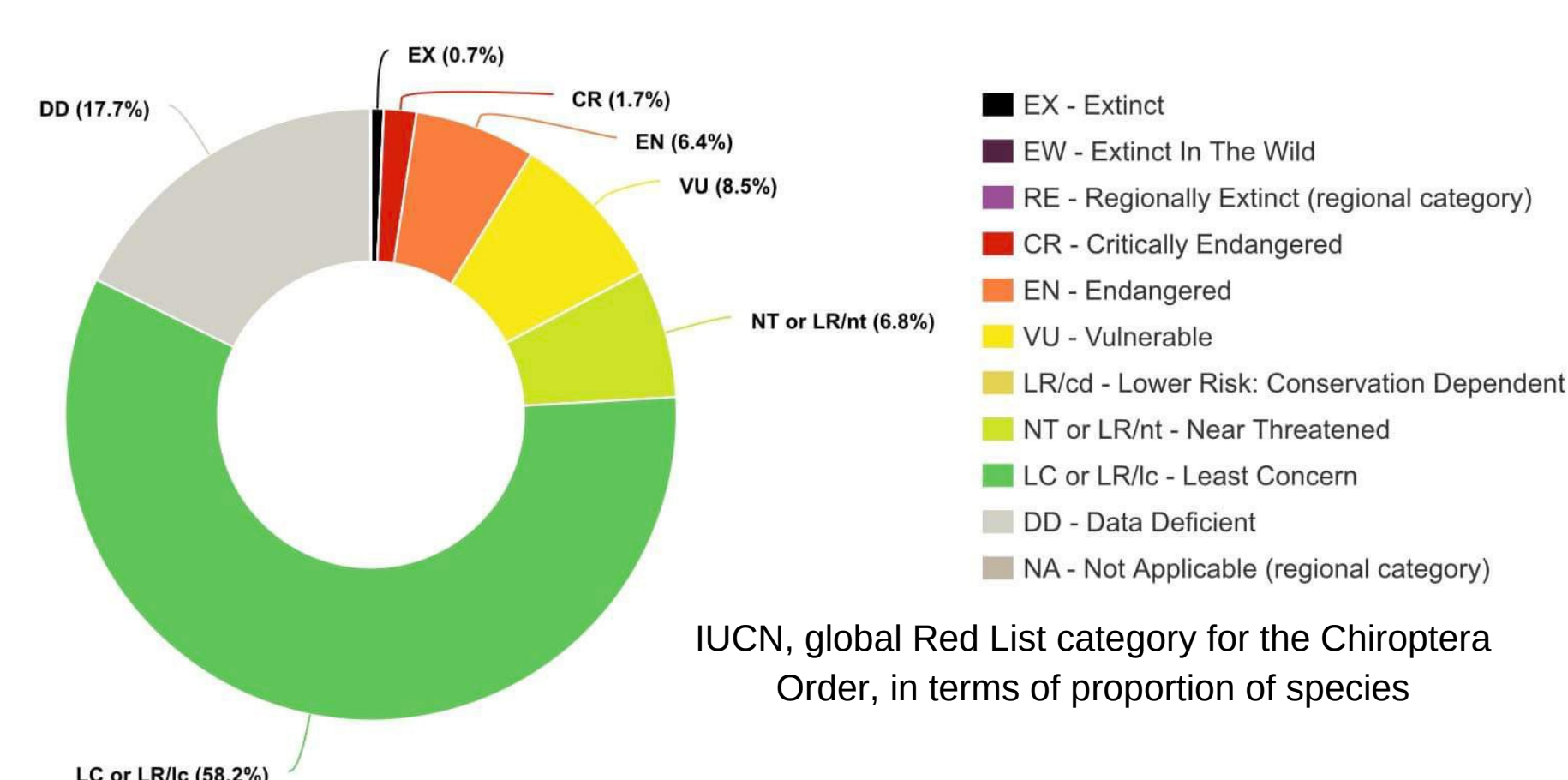
PROBLEMATIC

How can we optimize the monitoring of the bats' population to enhance conservation efforts and guide sustainable building practices?

INTRODUCTION

> Bats, constituting a fifth of global mammalian diversity, play vital roles as seed dispersers, pollinators, and insect predators.[1]
> However, bats face threats like habitat loss (hibernation, maternity, transitional roosts, swarming, and foraging sites), bushmeat hunting, persecution, and wind turbine farms, while changes in climate impact the timing and availability of food resources along migratory routes.[2] **Thus, good quality data is indispensable to understand bats' population ecology, behaviour, and migration for effective conservation.**
  —> How can we optimize the monitoring the bats' population to enhance conservation efforts and guide sustainable building practices?

EX (0.7%)
CR (1.7%)
DD (17.7%)
EN (6.4%)
VU (8.5%)
NT or LR/nt (6.8%)
LC or LR/lc (58.2%)

- EX - Extinct
- EW - Extinct In The Wild
- RE - Regionally Extinct (regional category)
- CR - Critically Endangered
- EN - Endangered
- VU - Vulnerable
- LR/cd - Lower Risk: Conservation Dependent
- NT or LR/nt - Near Threatened
- LC or LR/lc - Least Concern
- DD - Data Deficient
- NA - Not Applicable (regional category)

IUCN, global Red List category for the Chiroptera Order, in terms of proportion of species
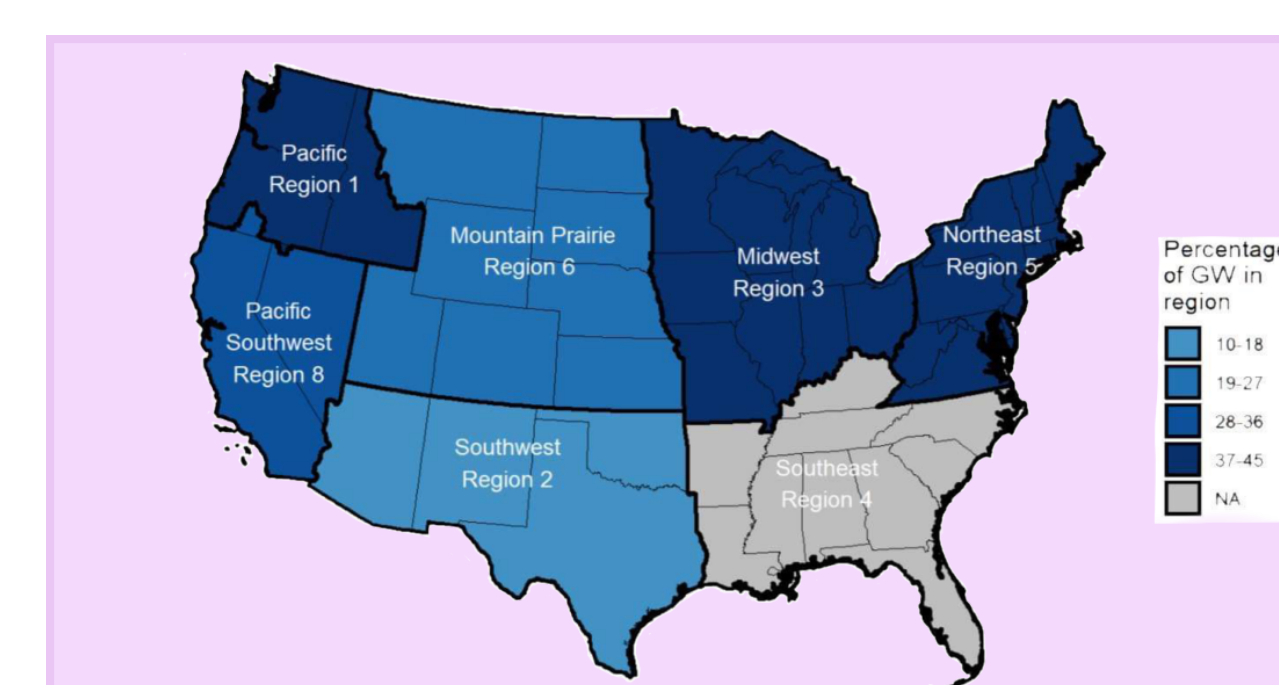
TRADITIONAL METHODS

- mist nest
- harp traps

Challenges coming from traditional methods:

- limited nocturnal visibility : bats are nocturnal in nature
- difficult species identification: due to human bias, bats' elusive behaviour, and inaccessibility to roosts
- lack of data regarding bat behaviour according to weather changes
- invasive techniques : can cause stress and biais the results
- limited coverage
- intensive in resources (ie. time, effort, people)

- POTENTIAL OF ELECTRONIC AND PHOTONICS TECHNOLOGIES

- **Species identification**
  ultrasonic bat detectors[3]
- **Foraging and roosting behaviour**
- **Migration movement**[4]
  radio telemetry [5]
  satellite telemetry [6]
- **Detection and recognition of bats in flight**
  thermal imaging [7]
  motion-sensitive infrared camera [8]

Pacific Region 1
Pacific Southwest Region 8
Mountain Prairie Region 6
Southwest Region 2
Midwest Region 3
Northeast Region 5
Percentage of GW in region

Percent of total installed wind capacity (gigawatts – GW) represented by post-construction fatality monitoring data contained in this report by USFWS Regions.

Research topic

WIND TURBINES : A NEW ENEMY FOR BAT CONSERVATION

> Facing the imperative to reduce carbon emissions, we observe an increase in wind farms to facilitate the transition to cleaner energy resources (in 2021, the US installed 13GW of new wind capacity).[9]
> Unfortunately, wind turbines pose a new threat to bats.[10] Still, there is little understanding regarding the factors influencing whether bats interact with those structures or not.

Aim: Reduce the decline of bats, due to collisions with wind turbines

SO1. Understanding and monitor flight behaviour

when and how collision occur, which species are concerned (insights in spatial migratory behaviour, roost behaviour, ...) -> attraction to turbines[11]?

SO2. Quantify the loss of bat activity in wind turbine surrounding (short, mean, long distances)

which species are concerned (insights in spatial migratory behaviour, roost behaviour, ...) -> avoidance behaviour[12]?

SO3. Test effect of mitigation strategies during autumn migration on nights with low wind speeds

A : by curtailing wind turbine movements, during time of higher risk[13]

OR
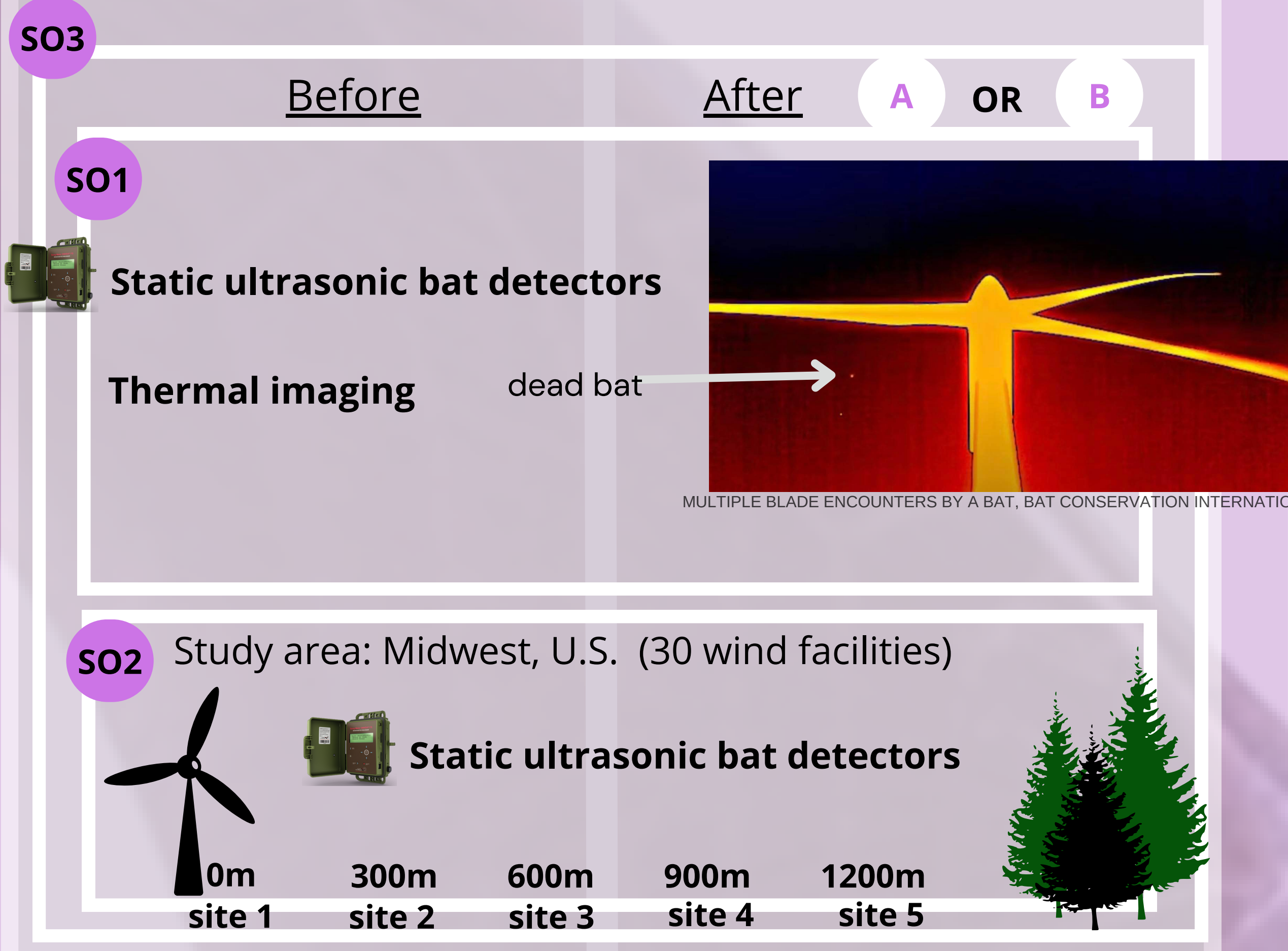
B : by using ultrasound **accoustic** deterrents[14]

A DEAD EASTERN RED BAT FOUND AT A WIND TURBINE FACILITY IN PENNSYLVANIA
MICHAEL SCHIRMACHER

Methodology

Study area: Midwest, U.S. (68 wind facilities, 34 will be studied under mitigation strategy A, 34 under mitigation strategy B)

Duration: 23 nights during migration period, over two years

SO3

| Before | After | A OR B |

SO1

Static ultrasonic bat detectors

Thermal imaging — dead bat

MULTIPLE BLADE ENCOUNTERS BY A BAT, BAT CONSERVATION INTERNATIONAL

SO2 Study area: Midwest, U.S. (30 wind facilities)

Static ultrasonic bat detectors

| 0m | 300m | 600m | 900m | 1200m |
| site 1 | site 2 | site 3 | site 4 | site 5 |

EXPECTED RESULTS

SO1 +SO2 Identify species attracted to and avoiding wind turbines : ecological and environmental comparison within and between those two groups

SO3 Compare the efficiency of each mitigation strategy to the control scenario (before) and between both strategies

SUMMARY

The integration of electronic and photonics technologies can significantly contribute to monitor and understand bats' populations, to facilitate the implementation of long-term and large-scale surveys, thus helping in their preservation and the conservation of ecosystem services.

PERSPECTIVES

The development of machine learning and AI will allow us:[15,16]
- to handle large datasets efficiently
- to automate species recognition for classification; and reduce human bias

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