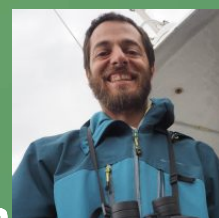
WIND FARM IMPACTS ON BIRDS AND BATS. Planning, baseline studies, mitigation and monitoring overview

BIODIVERSITY NODE

Rodrigo Fernández-Mellado



Eladio L. García de la Morena

www.biodiversitynode.com

1. About us…

III International scientific and practical conference
KAZAKHSTAN ALMATY 2023
Eagles of Palearctic: study and conservation

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Biodiversity

We understand Biodiversity conservation as a fundamental action for human well-being, protection and improvement to the variety for living species on Earth.

Natural Capital

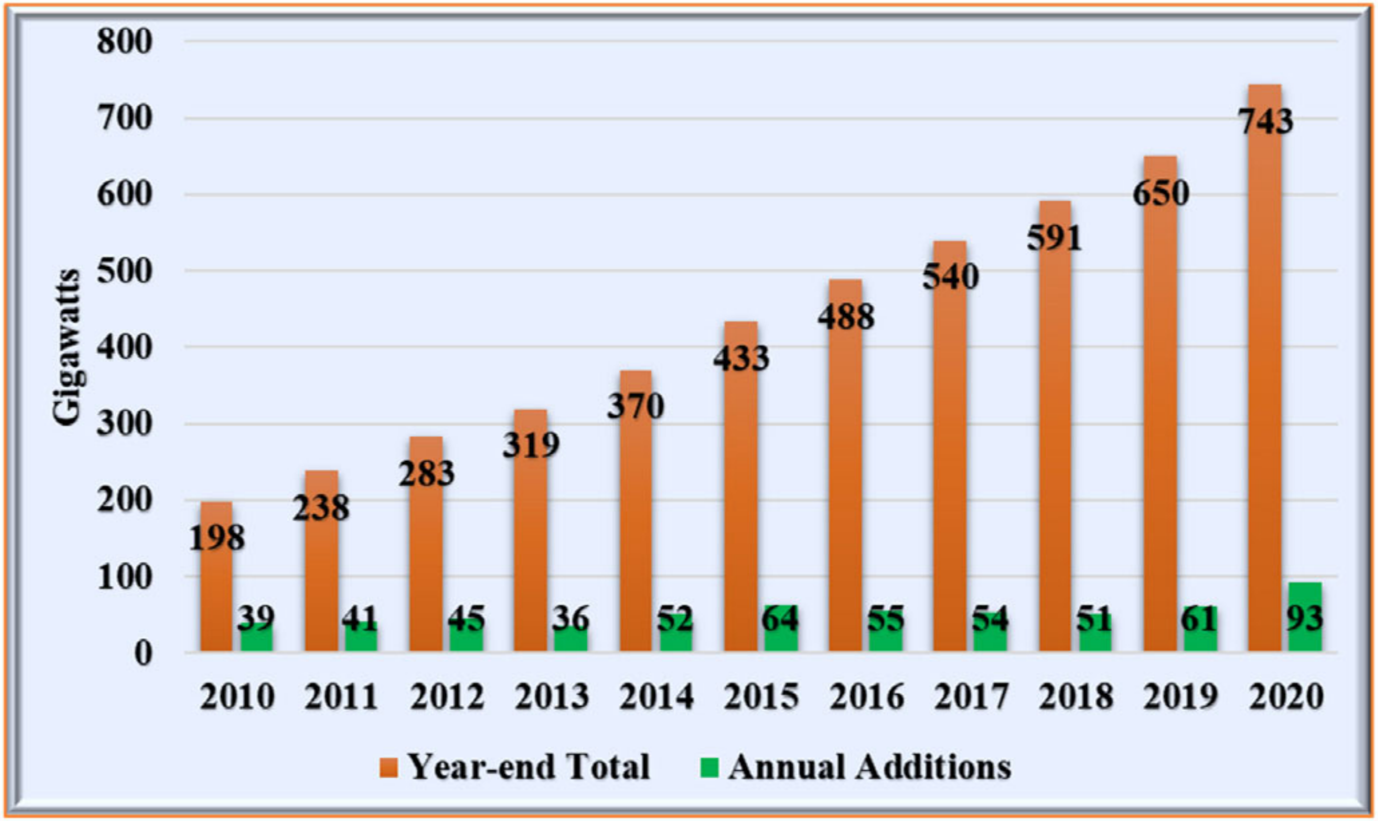
We carry out initiatives utilising Natural Capital approaches to better integrate the value of nature in accounting and decision-making. Creating an asset from which numerous benefits flow in the form of ecosystem services.

Renewable Energy

We work with companies that are committed to Renewable Energy, as the engine of economic and social change. Fully focus on the mitigation of greenhouse gas emissions and the reduction of global warming.

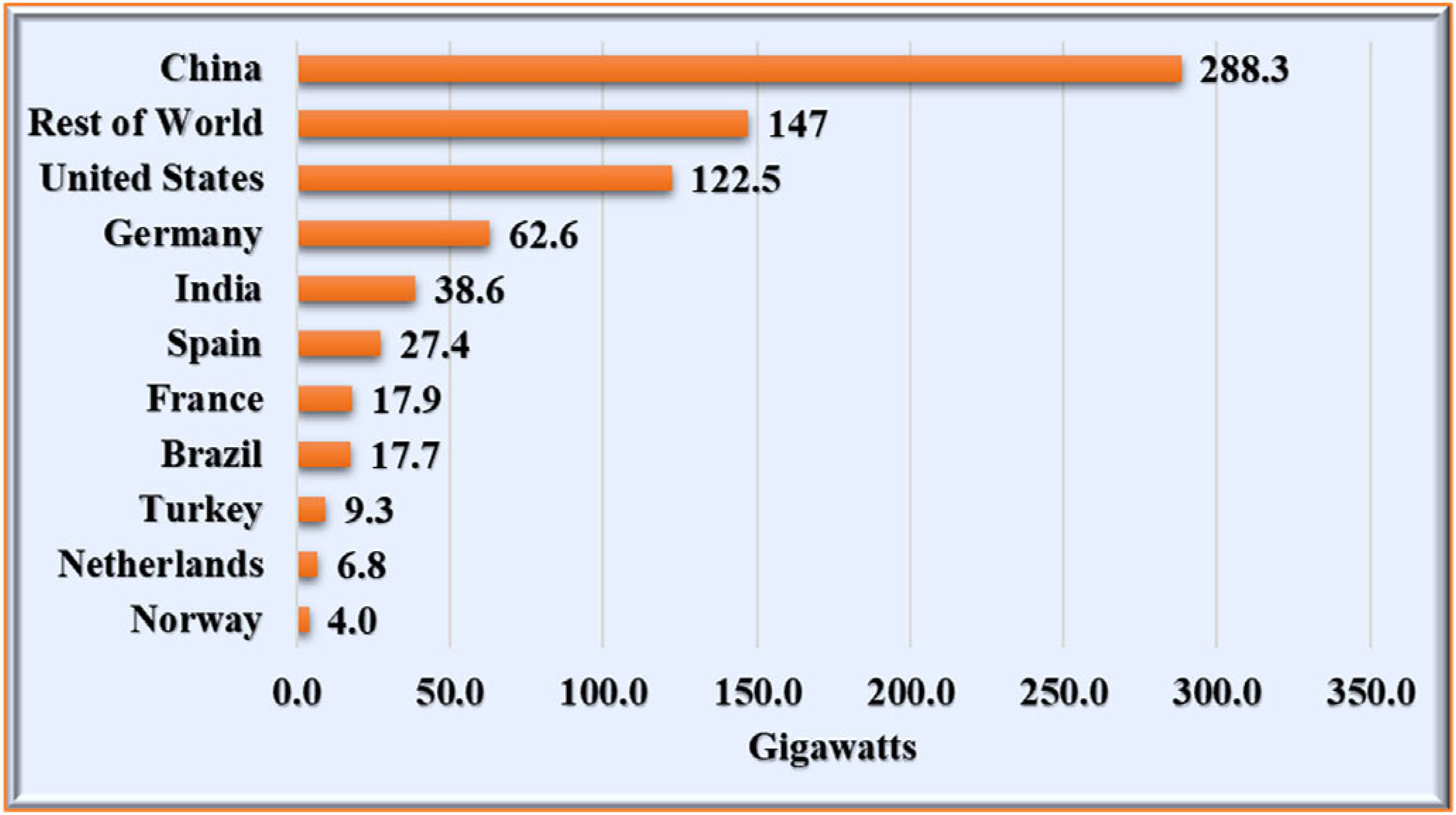
02. Wind power energy trends

Wind Power Energy development trends



Wind power global capacity and annual additions (REN21, 2021, in Msigwa *et al*. 2022)

Wind power development trends



Wind power capacity of top 10 countries in 2020 (REN21, 2021, in Msigwa *et al*. 2022)

03. Effects of wind energy on birds and bats

Wind farms impacts on birds and bats

There are 3 main impacts globally detected and recognised when wind Energy is developed:

- Direct collision mortality
- Habitat degradation or loss
- Barrier effects to movement

Wind farms impacts on birds and bats

1.- Mortality due to direct

Area affected	Mortality rate	Years observed	Species killed	Source
South Africa	4.6 ± 2.9 birds/turbine/year	2014–2018	130 (30 %)	(Perold et al., 2020)
Quebec, Canada	1.29–1.84 bats/MW/year	2016	8	(MacGregor and Lemaître, 2020)
Romania	14.2 bats/MW/year	2013–2016	10	(Măntoiu et al., 2020)
Isthmus of Tehuantepec, Mexico	9.06–12.85 birds/MW/year 20.47–43.79 bats/MW/year	June-Nov 2015	30 birds 20 bats	(Cabrera-Cruz et al., 2020)
Spain	0.5 bats/MW/year	2005–2016	13	(Sánchez-Navarro et al., 2020)
USA	5.26 ± 8.52 birds/MW/year	2019	–	(Diffendorfer et al., 2021)
India	0.478 birds/turbine/year	2011–2014	11	(Kumar et al., 2019)
Texas, USA	16 bats/MW/year	March 2017–March 2018	8	(Weaver et al., 2020b)

Birds and bats mortality observed in different wind farms around the world (Msigwa *et al*. 2022)

Wind farms impacts on birds and bats

<u>Mortality</u>

Most affected groups:

•Birds (362 species):
- Diurnal raptors (Accipitriformes)
- Seabirds and Waterbirds (Ciconiformes and Charadriiformes)
- Passerines
- Terrestrial birds (Bucerotiformes)
- Swifts
- Pigeons

•Bats (31 species): (Molossidae and Hipposideridae)
- Migratory species
- High heigh feeders

(Thaxter *et al*. 2017)

Wind farms impacts on birds and bats

54% of the wind farms threaten species are *Accipitiformes* species (attending IUCN category). Of these, 84%, were predicted to be in the top 90% percentile of risk predictions (Thaxter *et al*. 2017)

Family	Scientific name	Common name	Percentile	Status	Population
Accipitidae	*Gyps coprotheres*	Cape Vulture	**99.97**	EN	↓
	Aquila nipalensis	Steppe Eagle	**99.96**	EN	↓
	Aquila chrysaetos	Golden Eagle	**99.93**	LC	-
	Clanga pomarina	Lesser Spotted Eagle	**99.90**	LC	-
	Milvus milvus	Red Kite	**99.87**	NT	↓
	Gypaetus barbatus	Bearded Vulture	**99.85**	NT	↓
	Gyps fulvus	Griffon Vulture	**99.78**	LC	↑
	Hieraaetus pennatus	Booted Eagle	**99.68**	LC	?
	Pernis ptilorhynchus	Oriental Honey-buzzard	**99.38**	LC	-
	Neophron percnopterus	Egyptian Vulture	**99.35**	EN	↓
	Circaetus gallicus	Short-toed Snake-eagle	**99.25**	LC	-
	Haliaeetus albicilla	White-tailed Sea-eagle	**99.24**	LC	↑
	Buteo rufinus	Long-legged Buzzard	**99.23**	LC	-
	Milvus migrans	Black Kite	**98.91**	LC	?
	Pernis apivorus	European Honey-buzzard	**98.85**	LC	↓
	Haliaeetus pelagicus	Steller's Sea-eagle	**97.16**	VU	↓
	Circus aeruginosus	Western Marsh-harrier	**95.33**	LC	↑
	Buteo buteo	Eurasian Buzzard	**94.17**	LC	-
	Accipiter nisus	Eurasian Sparrowhawk	**90.58**	LC	-
	Accipiter gentilis	Northern Goshawk	**90.42**	LC	?
	Aquila adalberti	Spanish Imperial Eagle	89.26	VU	↑
	Accipiter brevipes	Levant Sparrowhawk	85.58	LC	-
	Circus pygargus	Montagu's Harrier	80.15	LC	↓
	Circus maillardi	Reunion Marsh-harrier	76.17	EN	↓
Pandionidae	*Pandion haliaetus*	Osprey	76.64	LC	↑
Falconidae	*Falco peregrinus*	Peregrine Falcon	**98.51**	LC	-
	Falco tinnunculus	Common Kestrel	**97.71**	LC	↓
	Falco biarmicus	Lanner Falcon	**97.65**	LC	↑
	Falco subbuteo	Eurasian Hobby	**97.34**	LC	↓
	Falco columbarius	Merlin	**96.80**	LC	-
	Falco eleonorae	Eleonora's Falcon	**94.58**	LC	↑
Strigidae	*Asio flammeus*	Short-eared Owl	**96.26**	LC	↓
	Otus angelinae	Javan Scops-owl	na	VU	↓

Wind farms impacts on birds and bats

Mortality traits (general) - (Thaxter *et al*. 2017)

•Birds:

- Habitat association (farmland, urban and grassland)
- Diet and foraging (invertebrates and scavenge)
- Migrant species (intermediate dispersal distances 25-100 km)

•Bats:

- Migrant species
- tree-roosting species

High risk at aggregation sites, such as migratory bottlenecks
or near breeding colonies.

Wind Energy could therefore **reduce populations**, particularly of long-lived, slow-reproducing species and wide-ranging or migratory species.

Wind farms impacts on birds and bats

Mortality: Local conditions

Also very important when determining high risk species and mortality rates:

- Nesting places and core areas in bird territories
- Juvenile dispersion areas
- Roosting spots and local migration routes
- Attraction spots (landfills, waste water treatment plants, wetlands, cattle carcass disposal spots…)

BASE LINE AND WIND FARM PLANNING MUST CONSIDER ALL THE ABOVE INFORMATION

Wind farms impacts on birds and bats

2.- Habitat degradation or loss

•**Indirect effects** (avoidance by tall structures, noise, lights…) → landscape scale

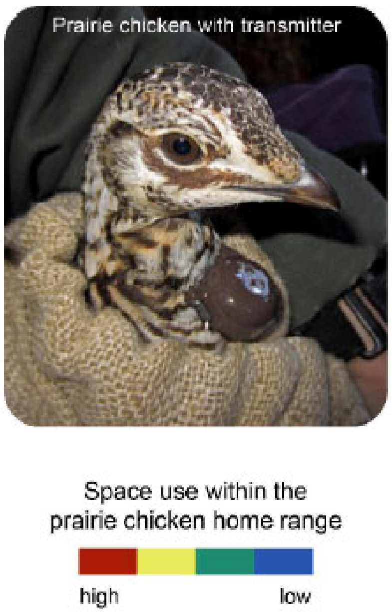
•**Direct loss** (wind turbines, platforms, roads, transmission poles → local scale

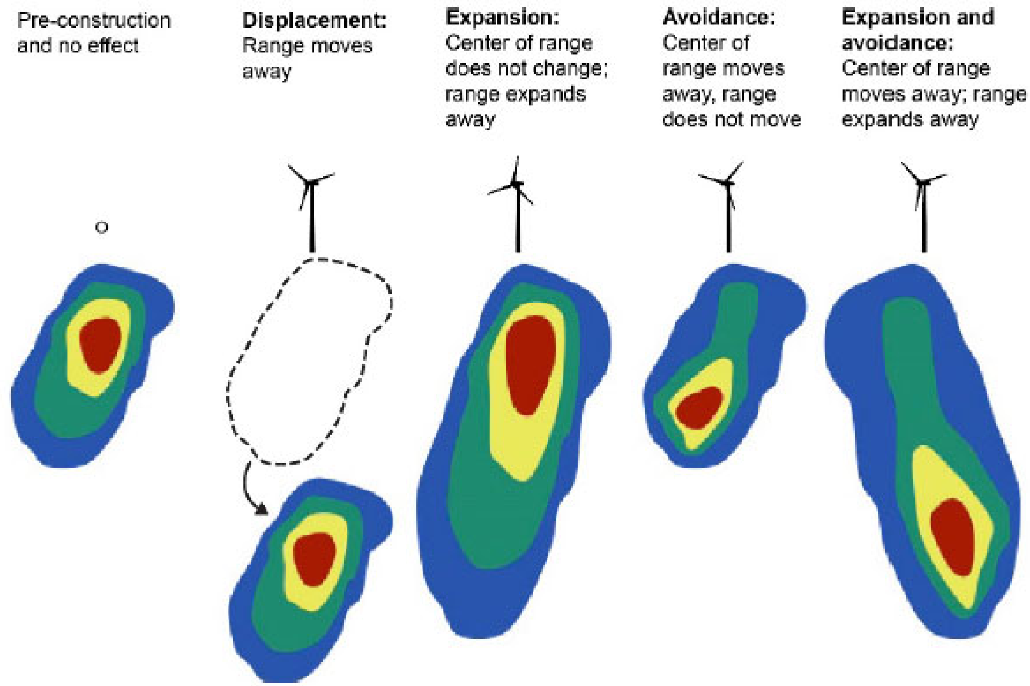
Demonstrated effects examples:

A. Displacement from feeding or nesting areas
B. Behavioral changes
C. Predation rate changes

Wind farms impacts on birds and bats

A.- Displacement from feeding or nesting areas





(Taber *et al*. 2019)

Some species could show different patterns of displacement. Taber et al found that prairie chicken and sage grouse, both ground dwelling species, showed different responses, from total displacement to an expansion of their movements.

Wind farms impacts on birds and bats

A.- Displacement from feeding or nesting areas

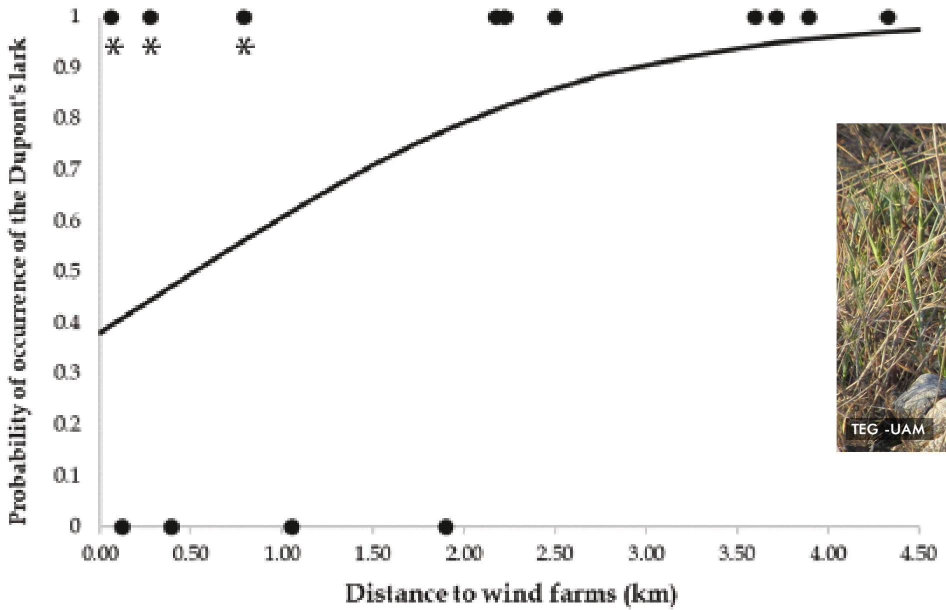


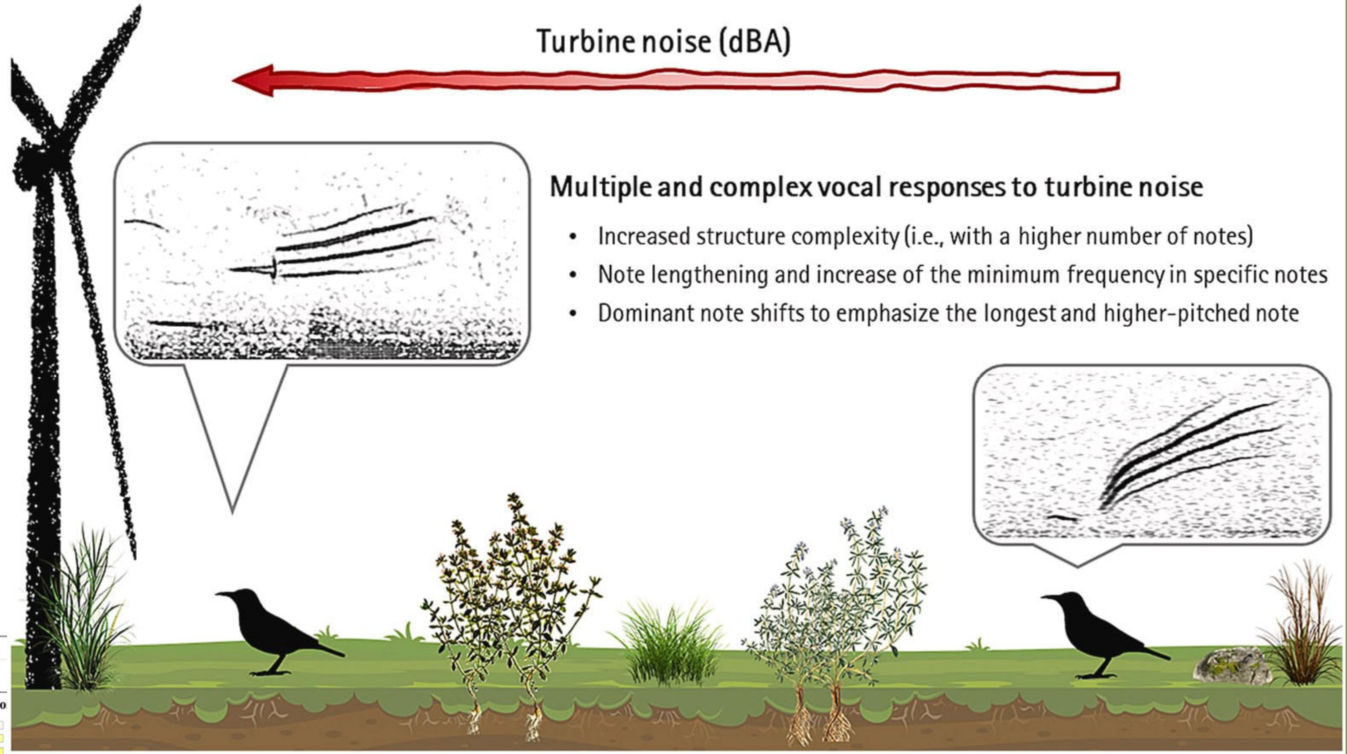
Figure 5.3. Effect of the distance to wind farms on the probability of occurrence of Dupont's lark in 2016. Observed values for the 14 populations (black dots) and predicted values by the model (black line) are shown. The three remaining populations in the presence of wind farms are marked with asterisk (*): "Esteras de Medinaceli," "Sierra Ministra" and "Miño-Medinaceli" (see Table 5.1 for population changes in 2008–2016).

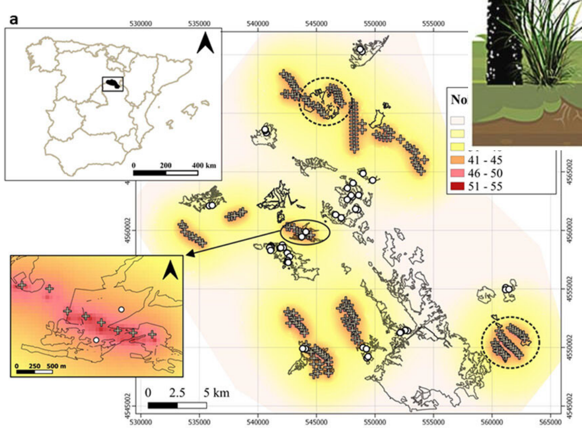
(Gómez-Catasus *et al*. 2018)

Wind farms impacts on birds and bats

B.- Behavioral changes

Wind farm noise shifts vocalizations of a threatened shrub-steppe passerine (Gómez-Catasus *et al*. 2022)

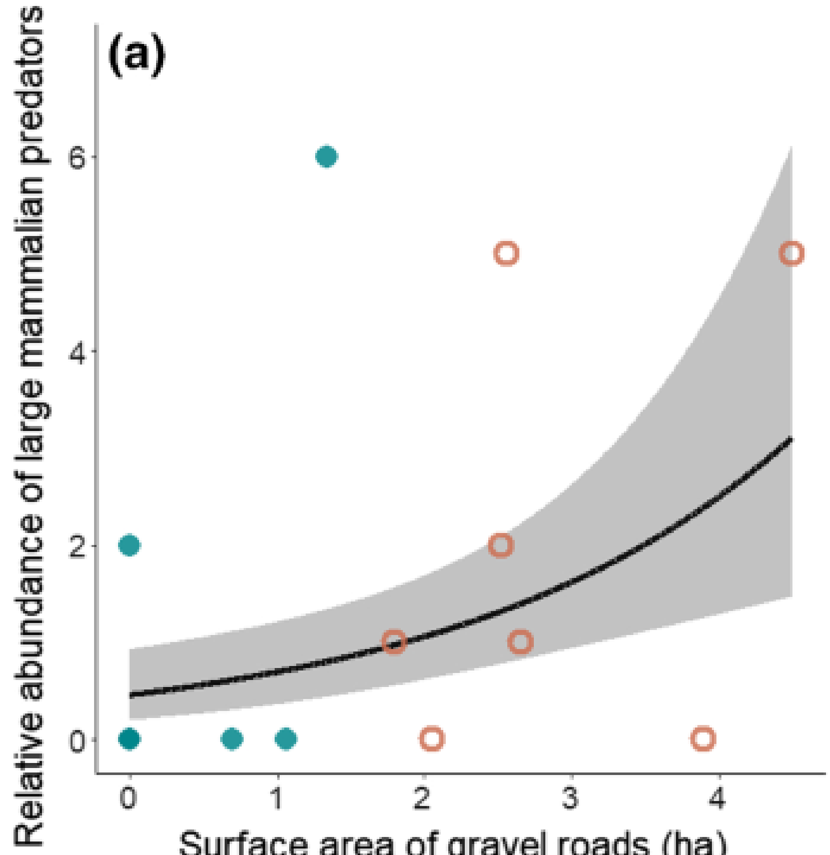




Wind farms impacts on birds and bats

C.- Predation rates changes

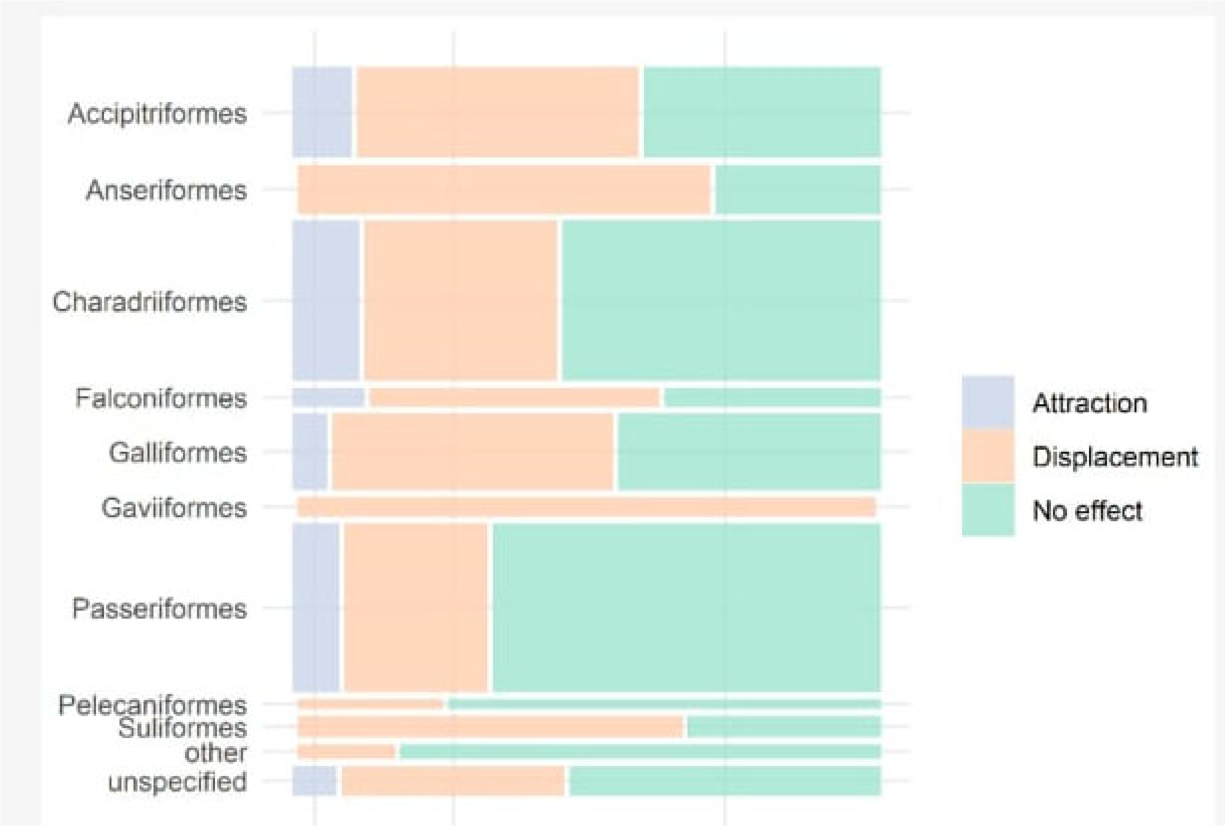
Landscape features associated to wind farms increase mammalian predator abundance and ground- nest predation (Gómez-Catasus *et al*. 2022)



Wind farms impacts on birds and bats

3.- Barrier effect to movement: routes displacement

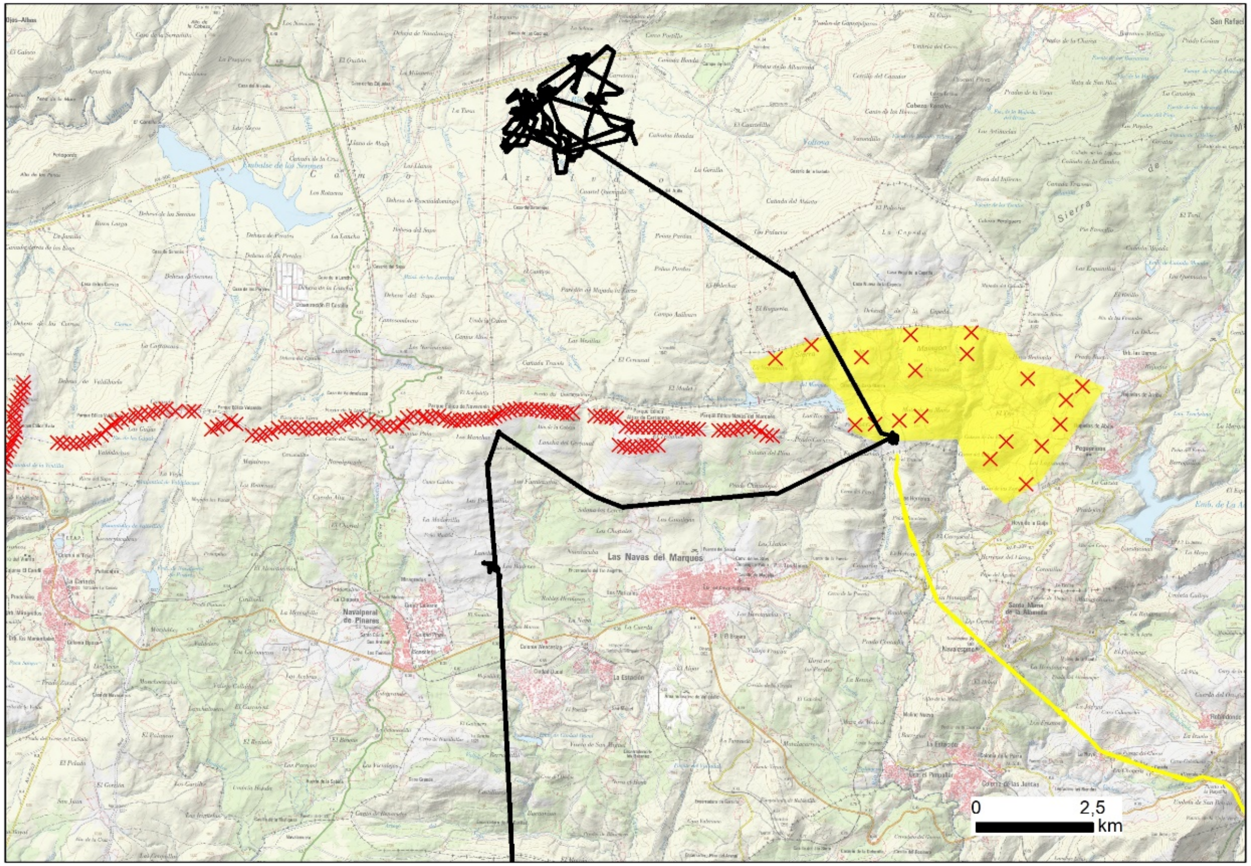
Bird displacement by Wind Turbines: Assessing Current Knowledge and Recommendations for future studies (Marques et al, 2021)



Relative frequency of trials (n=286) reporting attraction, displacement or no effects of wind turbines on bird space use or abundance, per birds´ group. The bar witdth represents the number of experimental trials performed per each birds´groups.

Wind farms impacts on birds and bats

3.- Barrier effect to movement: routes displacement



Little bustard *(Tetrax tetrax)* tagged with GPS migrating from south Spain to summering grounds in central Spain showed a clear displacement on its route when confronting an existing wind farm (unpublished data)

04. Mitigation

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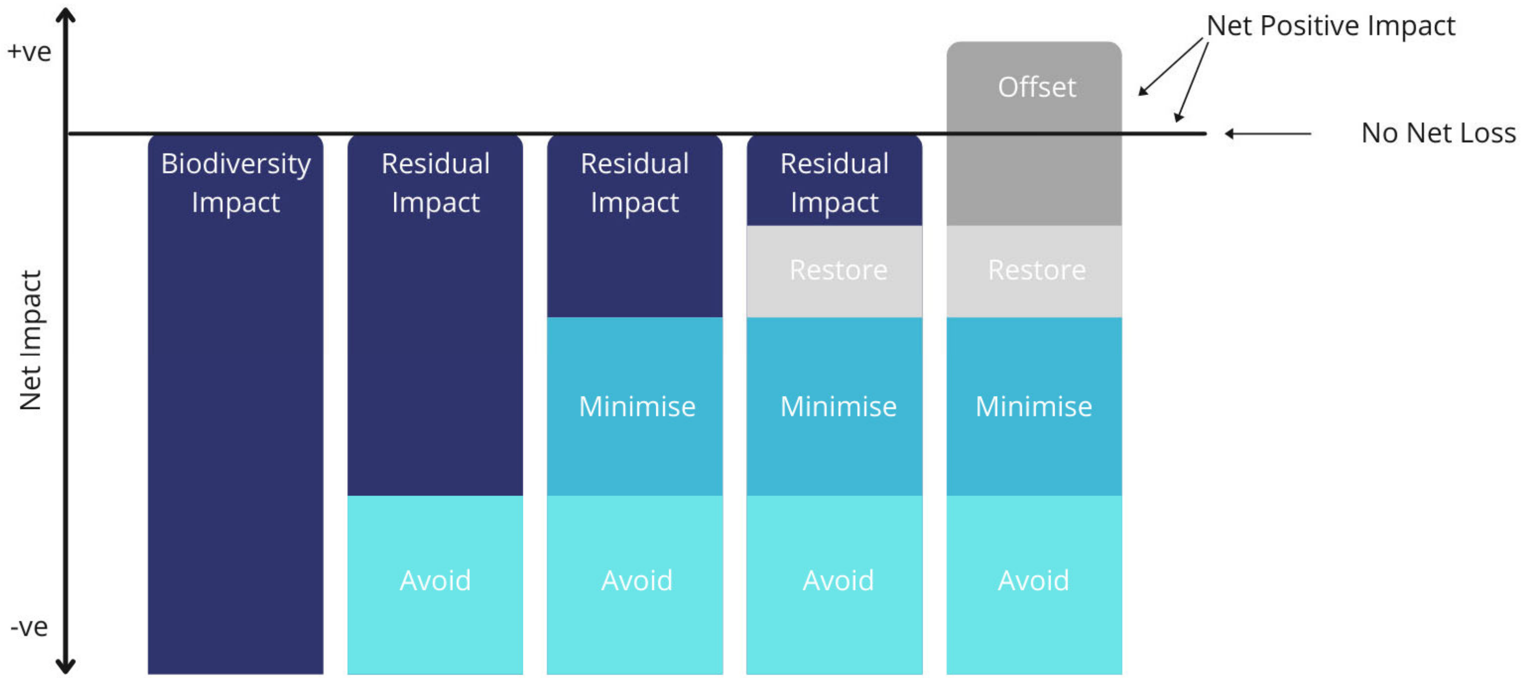
Net positive and the mitigation hierarchy



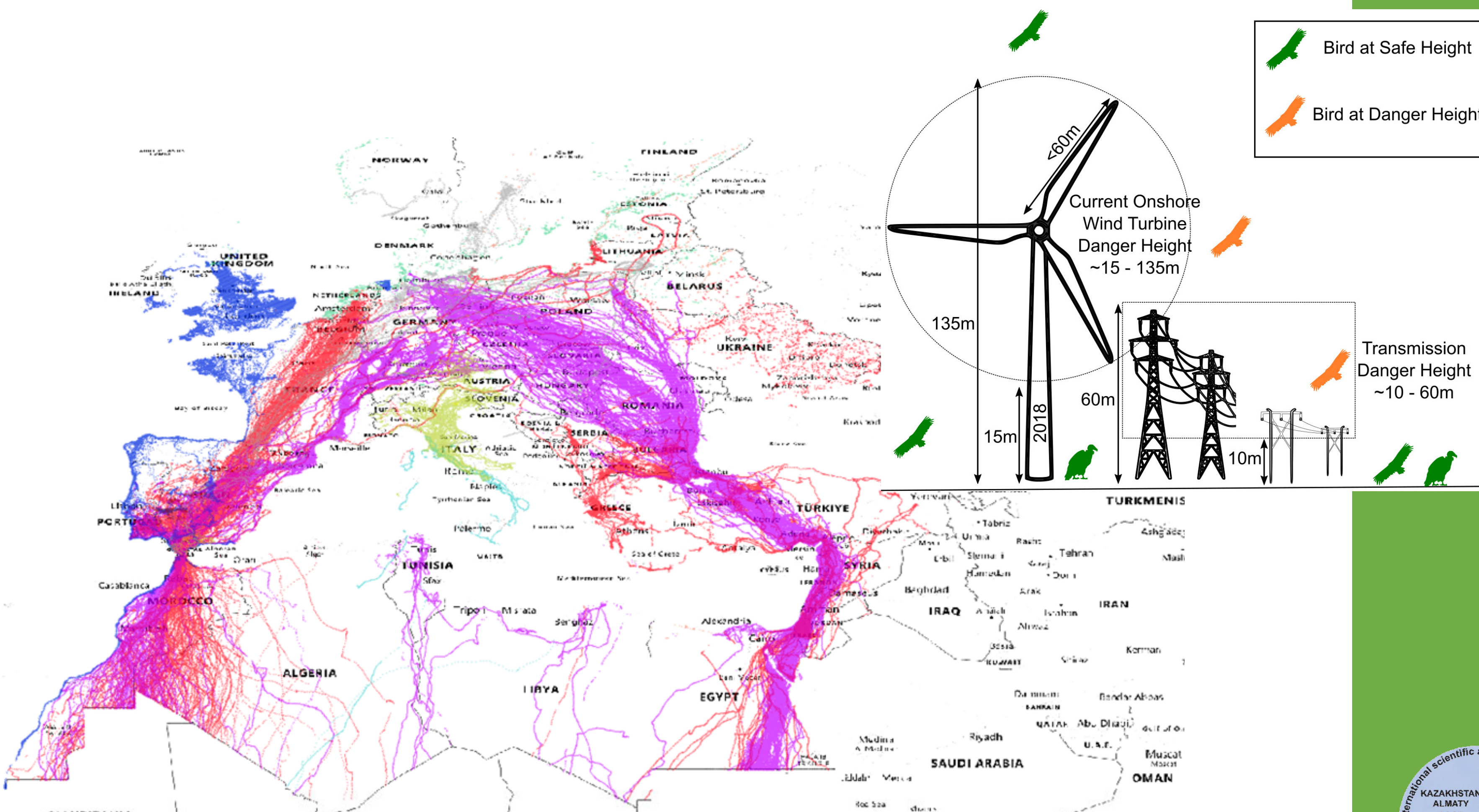
05. Avoidance

Initial planning

- Prefeasibility Analysis (key species, migration routes, habitats, protected areas, ...).
- Realistic proposal of Alternatives.
- Best moment for Baseline studies definition.

Initial planning: migration routes

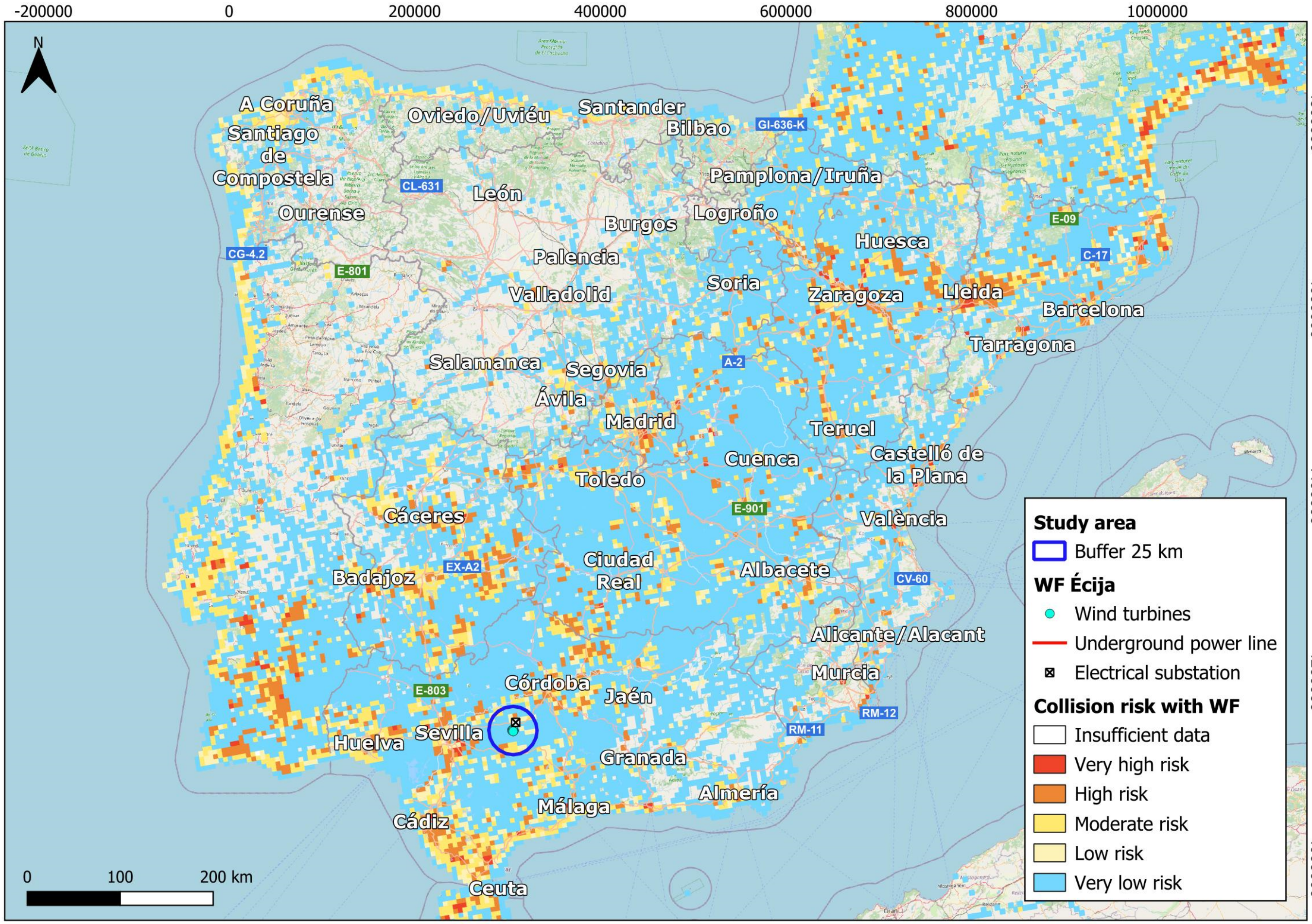
Collision risk (european scale)



Gauld, Jethro G., João P. Silva, Philip W. Atkinson, Paul Record, Marta Acácio, Volen Arkumarev, Julio Blas, et al. «Hotspots in the Grid: Avian Sensitivity and Vulnerability to Collision Risk from Energy Infrastructure Interactions in Europe and North Africa». *Journal of Applied Ecology* 59, n.º 6 (2022): 1496-1512. https://doi.org/10.1111/1365-2664.14160.

Initial planning: migration routes

Collision risk (country scale)

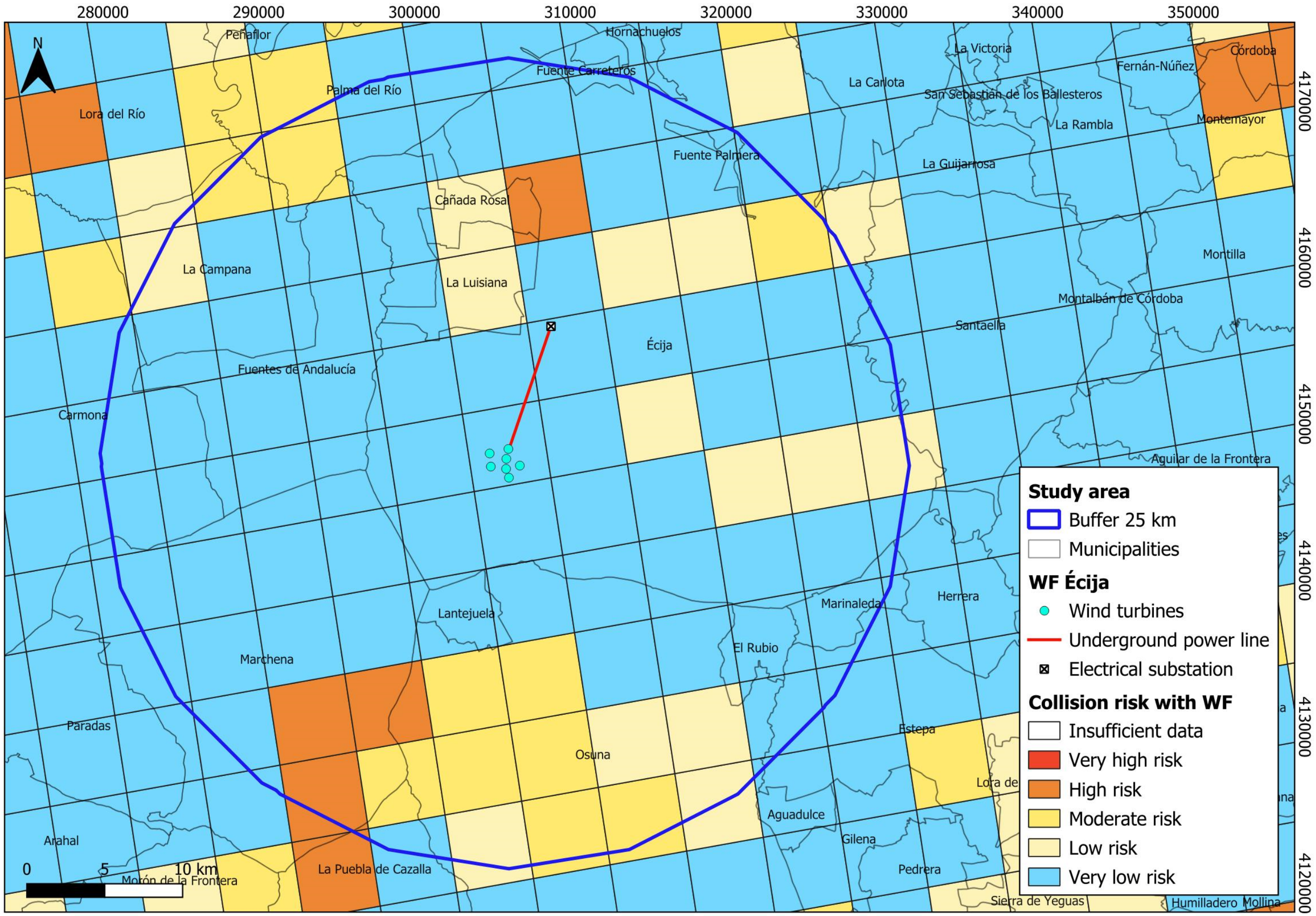


ETRS 89/Zone 30

Risk zones of bird collision with power lines and wind turbines at the scale of the Iberian Peninsula, North Africa, and Southern Europe. The blue line delineates the 25 km analysis area around the project (Source: Gauld et al., 2022).

Initial planning: migration routes

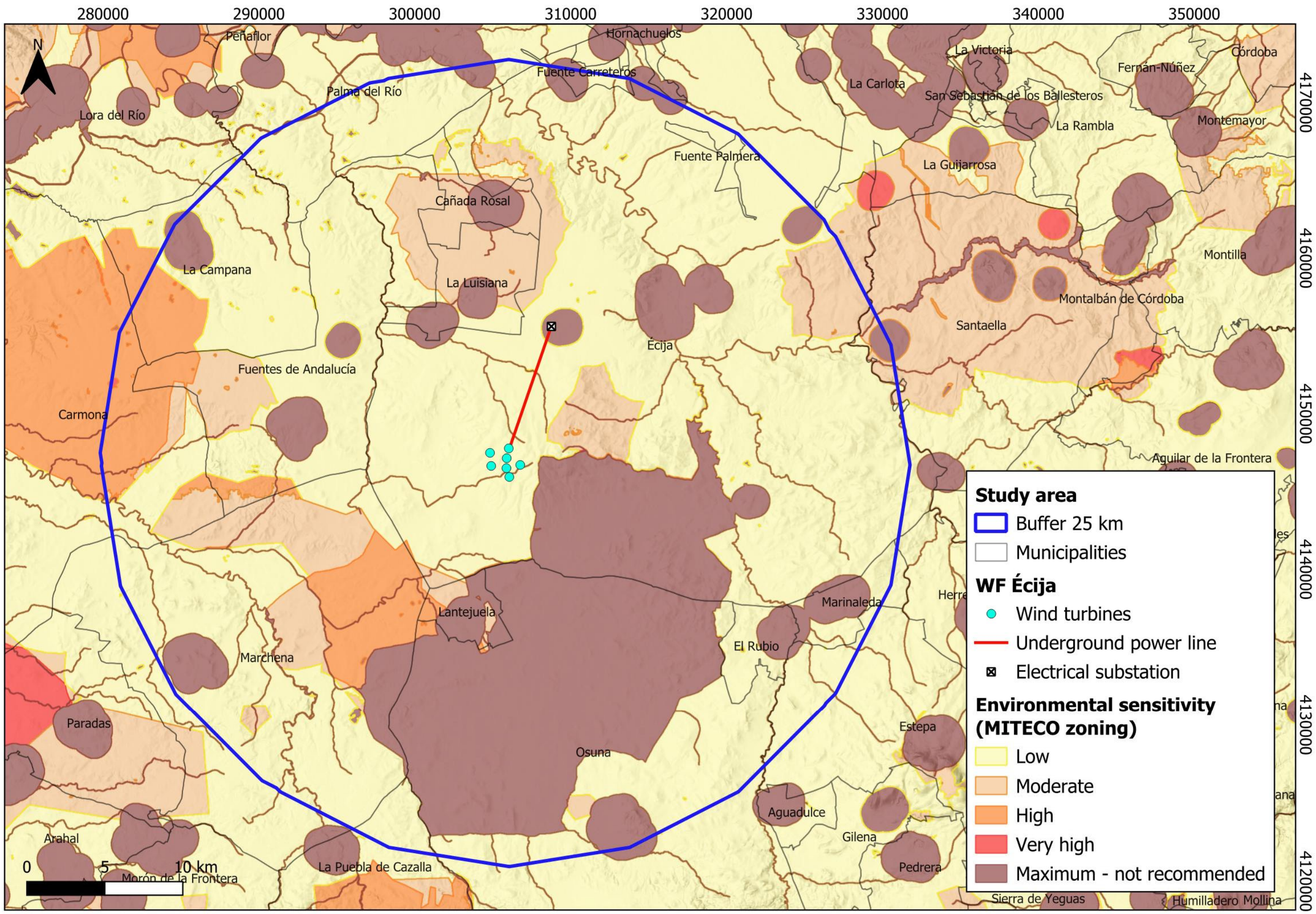
Collision risk (regional scale – 5x5km square grid)



ETRS 89/Zone 30

Detail of the bird collision risk zones with power lines and wind turbines within the study area. The blue line delineates the 25 km analysis area around the project (Source: Gauld et al., 2022).

Initial planning: State cartography



ETRS 89/Zone 30

Environmental sensitivity - Wind (Spanish Minister for Ecological Transition). Source: Biodiversity Node, 2023

Environmental sensitivity index of the study area. The blue line delineates the 25 km analysis boundary around the project.

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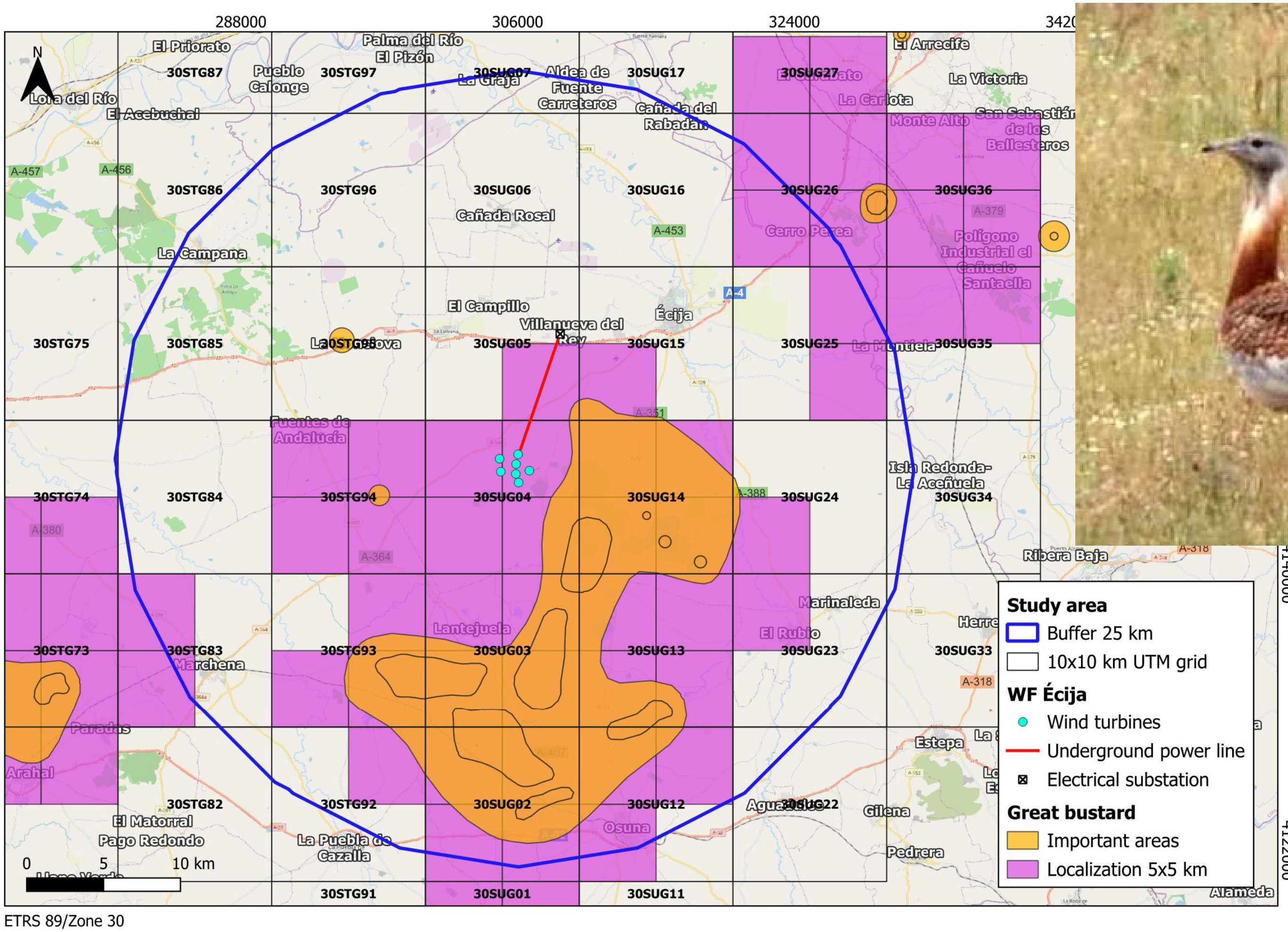
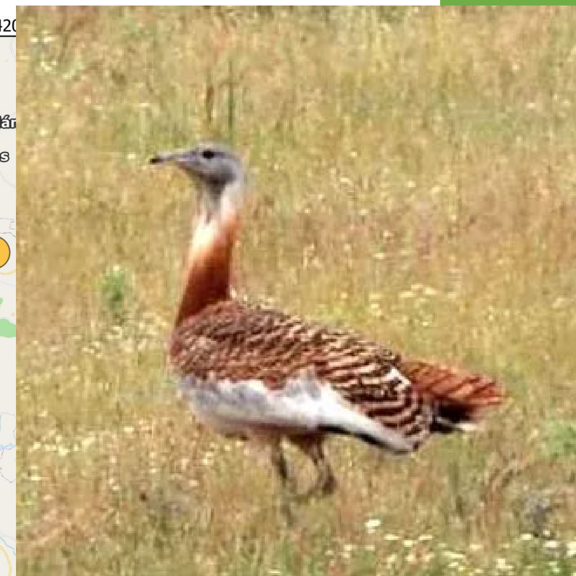
Initial planning: specific data





Important areas and localization of great bustard (Otis tarda) sightings within the study area through 5x5 km UTM grids. Source: Own elaboration based on data from the Environmental Information Network of Andalusia (REDIAM). (Source: Biodiversity Node, 2023)

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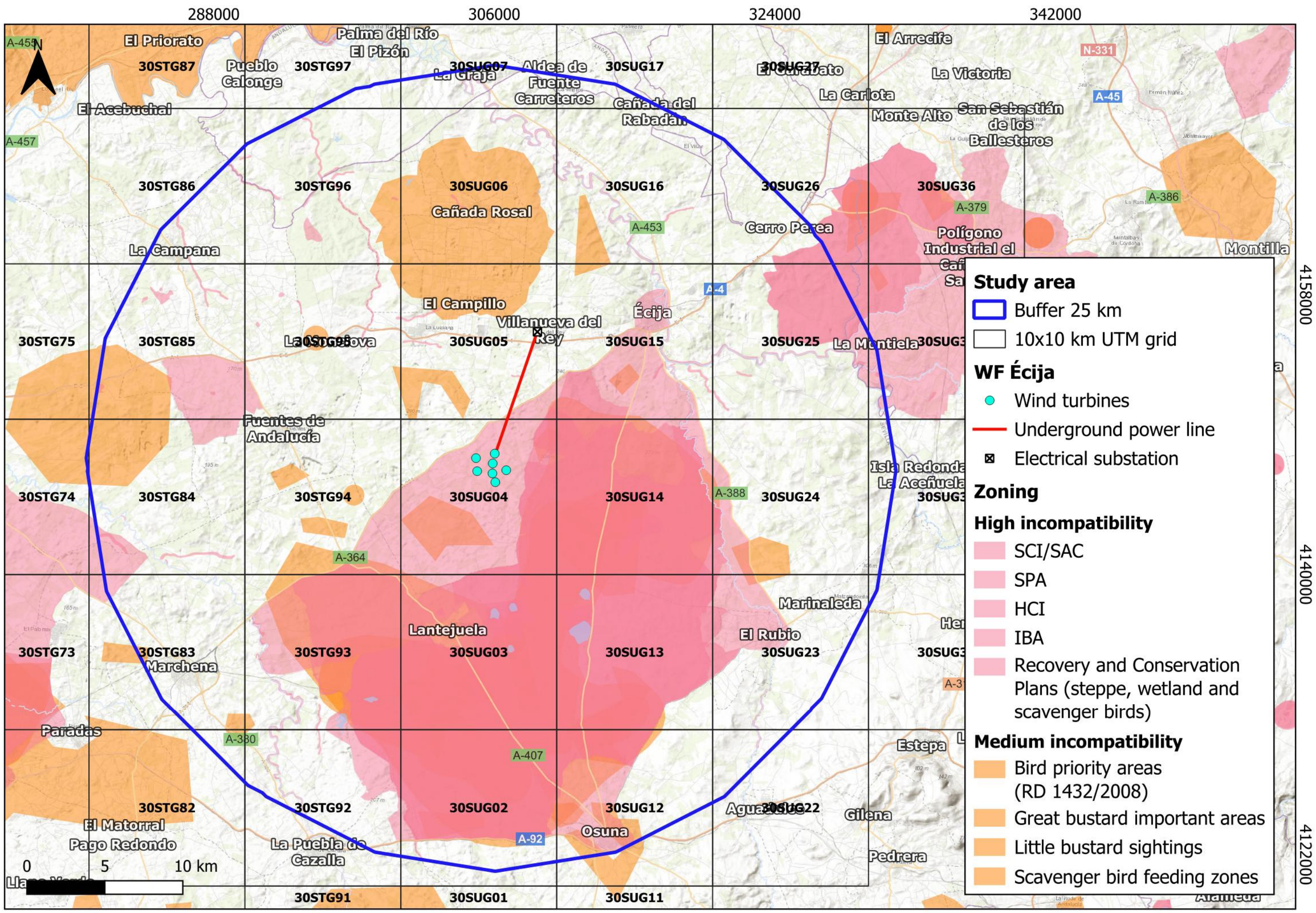
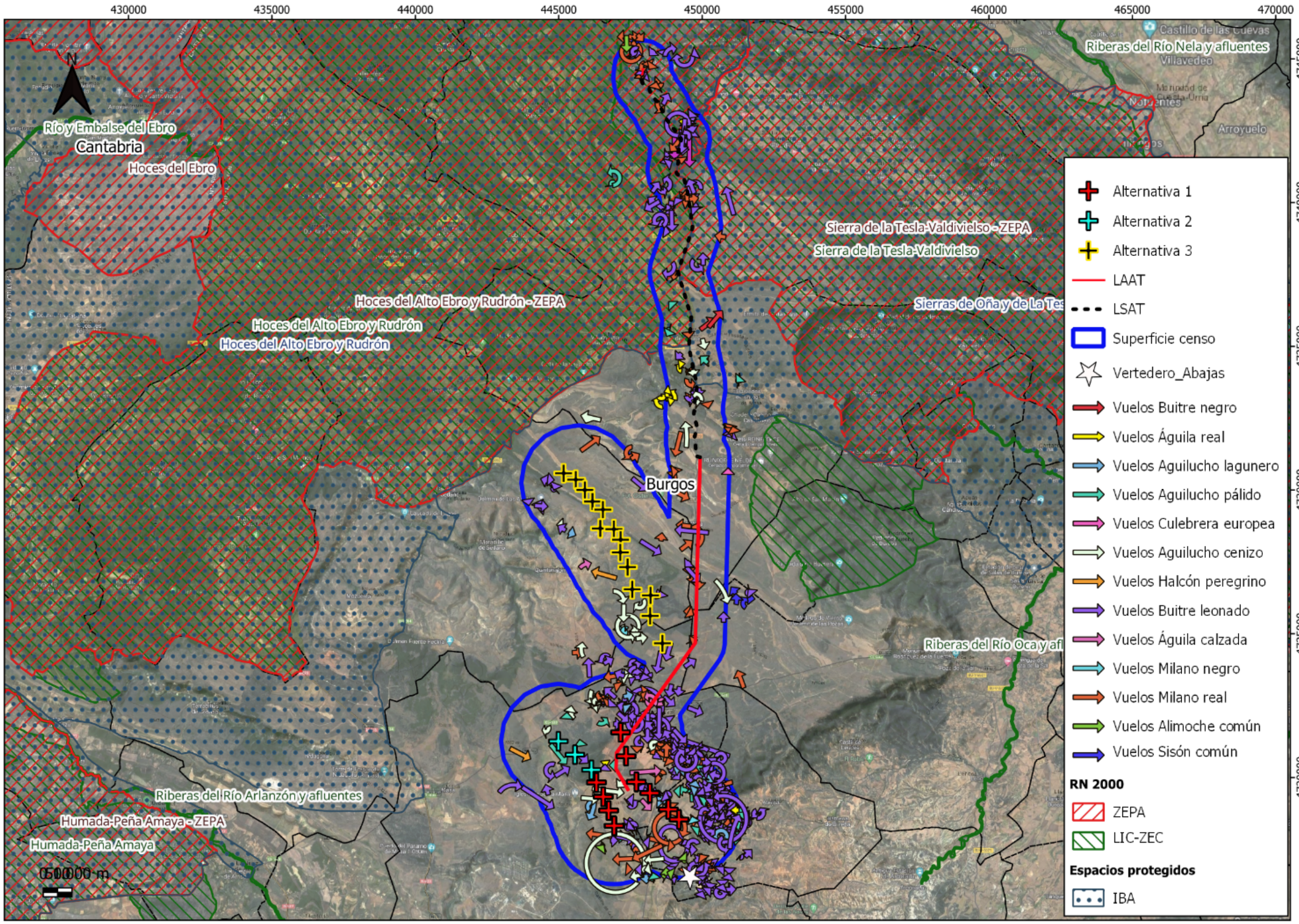
Initial planning: added information



ETRS 89/Zone 30

Zoning by environmental compatibility adding all collected information (Source: Biodiversity Node, 2023).

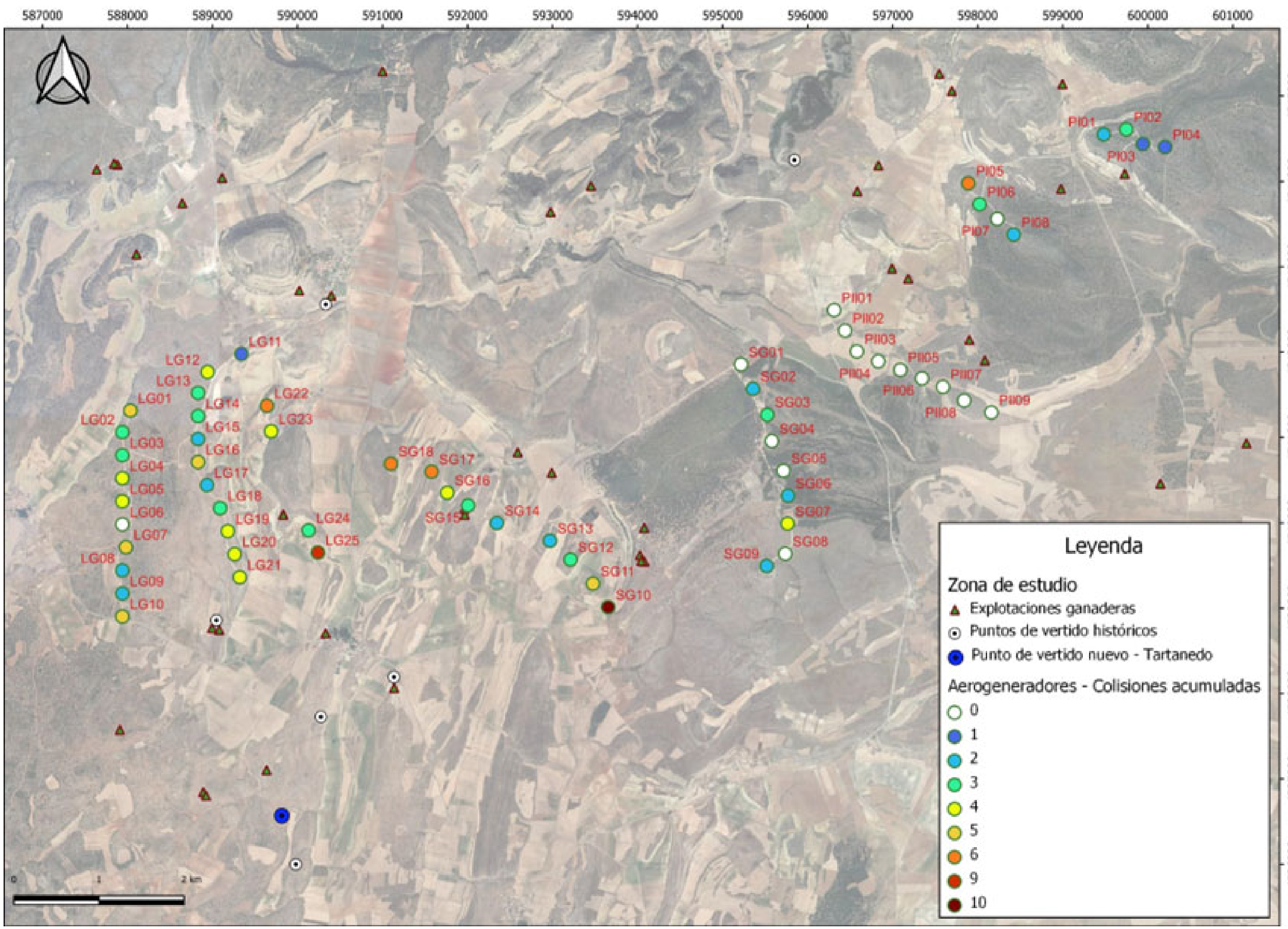
Realistic proposal of alternatives and Baseline studies



Total register of bird flights during an 8 months survey.

06. Minimization

Posconstruction monitoring



Griffon vulture collisions per wind turbine in 3 wind farms located in Guadalajara, Central Spain.

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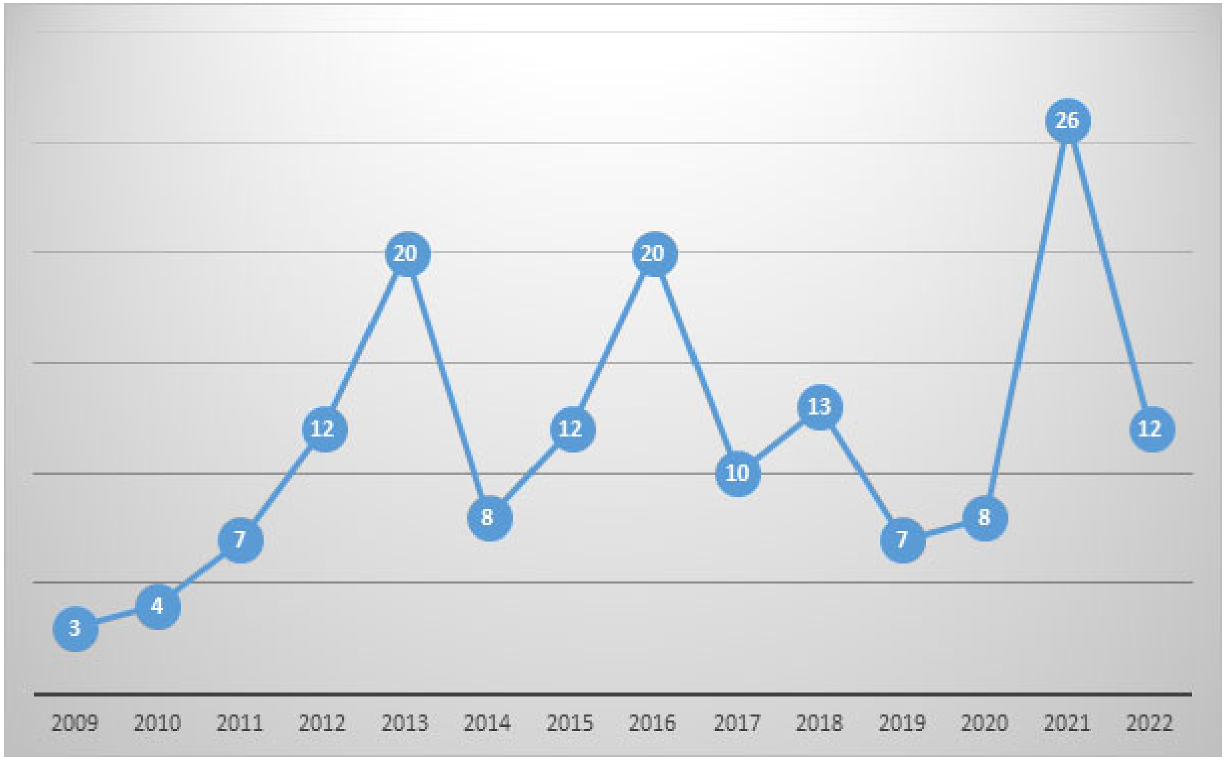
Posconstruction monitoring



Griffon vulture collisions at 3 wind farms from 2009 to December 2022

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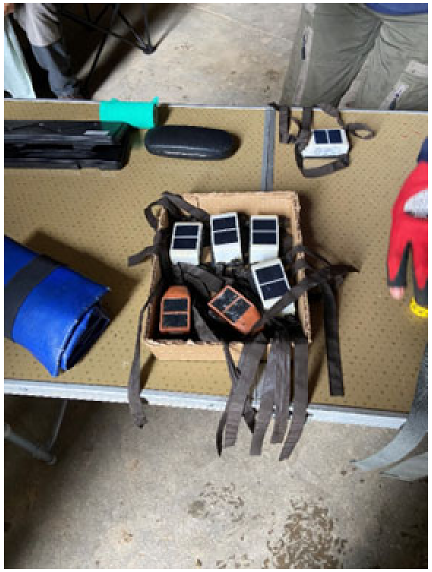
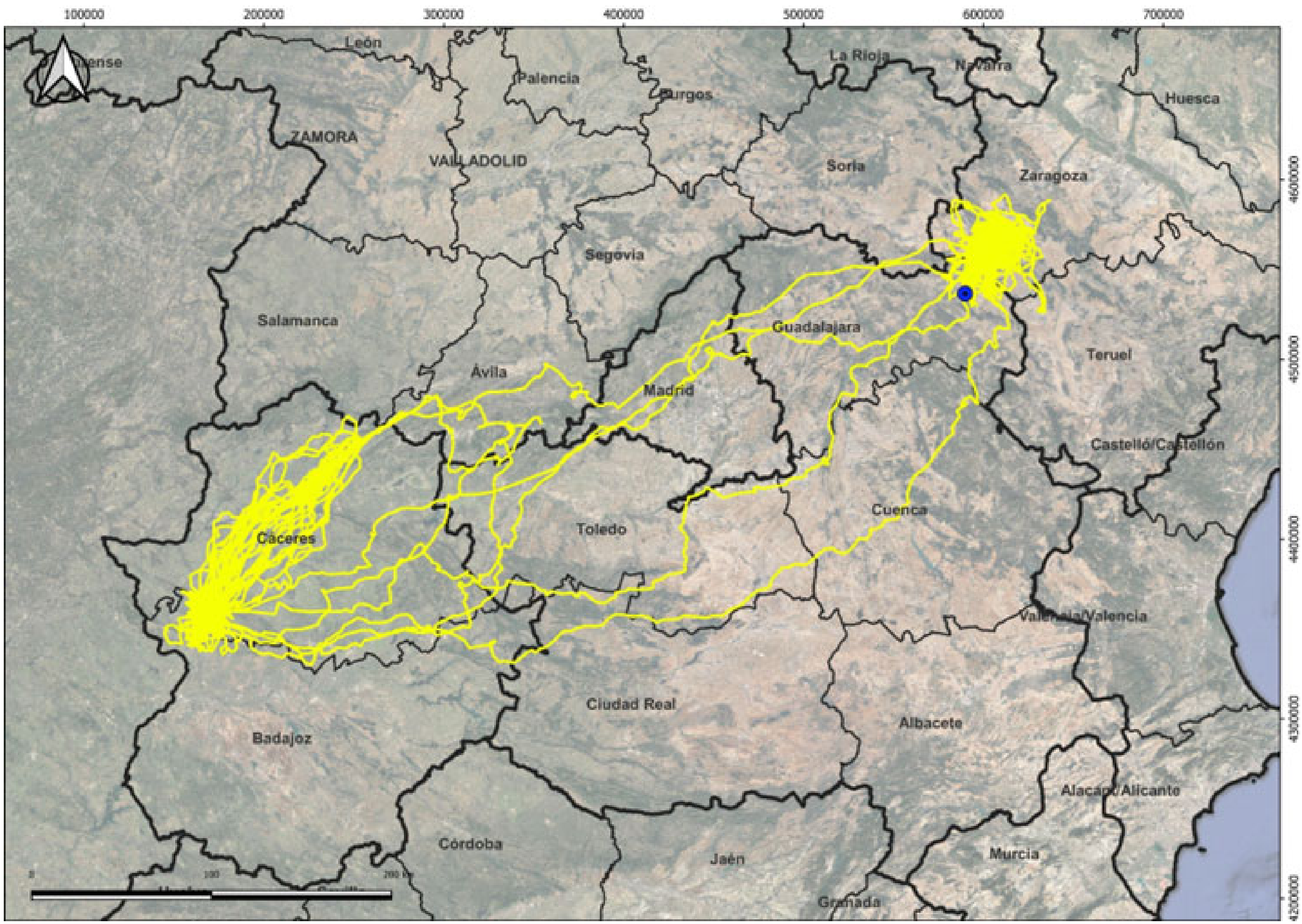
Posconstruction monitoring



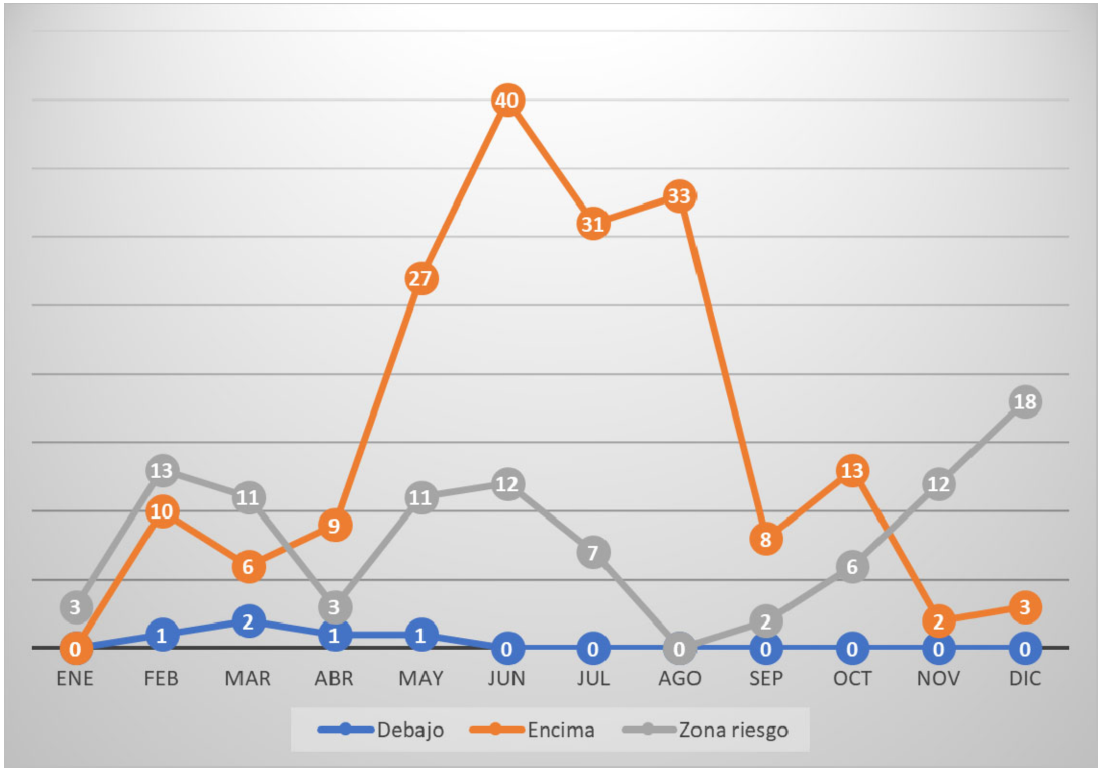
Vulture capturie for ring and GPS tagging

Posconstruction monitoring



Movimientos registrados por el buitre leonado marcado con el GPS 200313b. Datos Abril 2021 – Noviembre 2022. Se indica con un punto azul el lugar de anillamiento.

Posconstruction monitoring

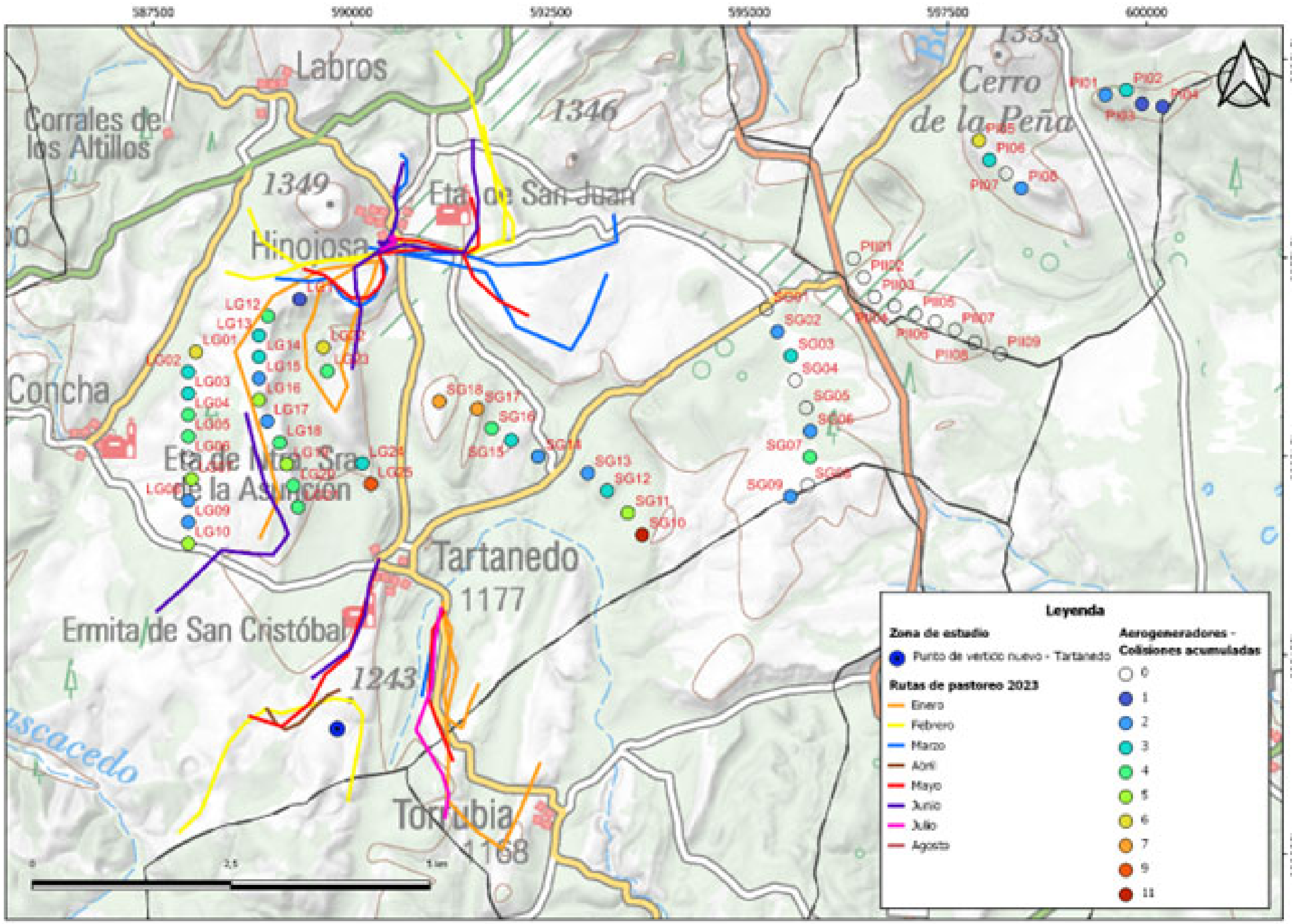


Flight heights recorded since the start of the study. The numbers indicate the number of flights detected per month for each of the categories.

	Ene	Feb	Mar	Abr	May	Jun	Jul	Ago	Sep	Oct	Nov	Dic	TOTAL
TOTAL	12	15	21	12	18	7	5	7	15	20	20	10	162

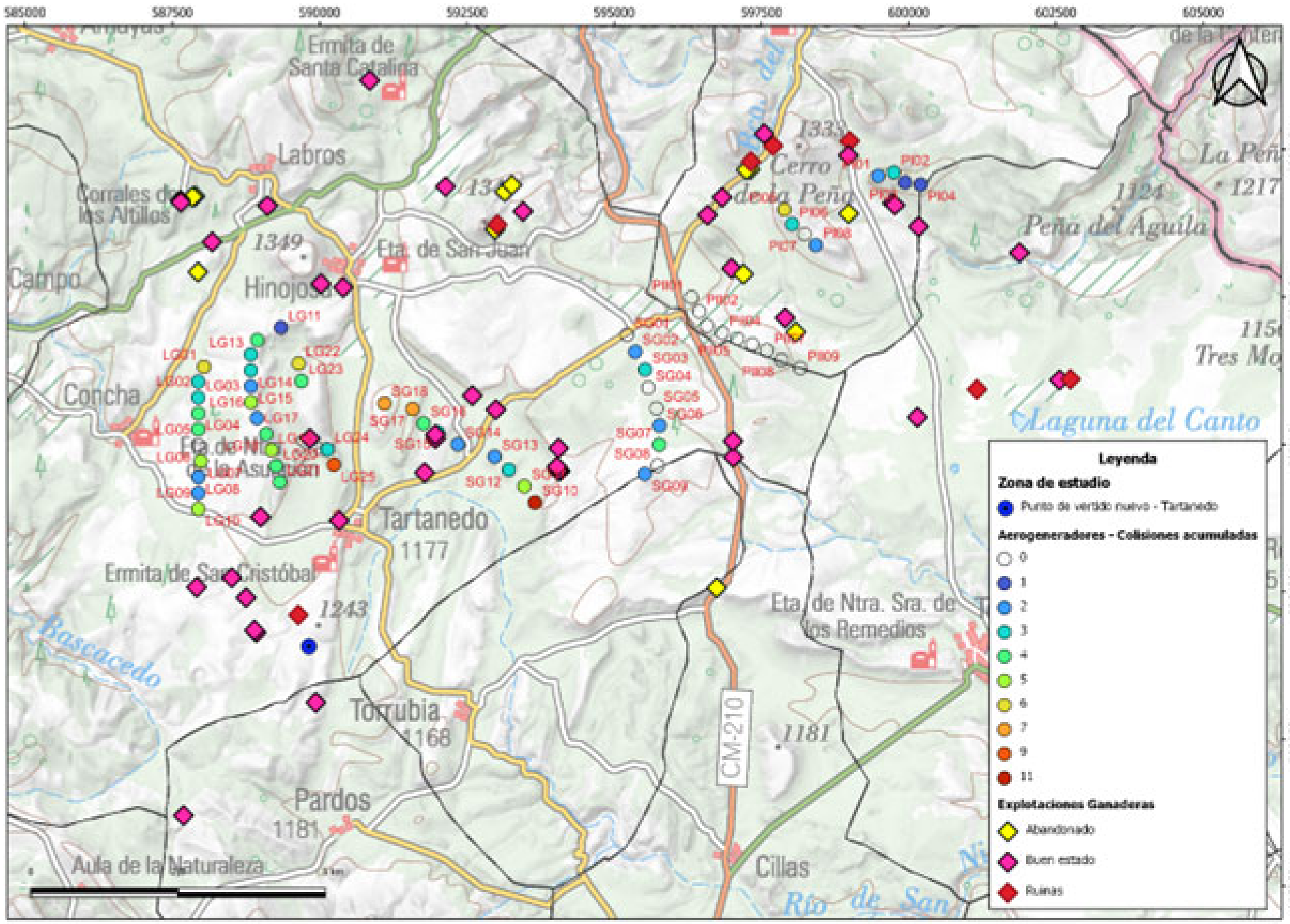
Griffon vulture collisions accumulated for the entire period of monitoring (2009-2022)

Posconstruction monitoring



Herd movements in the vicinity of the wind farm collected in the period January - August 2023. The number of collisions accumulated by each wind turbine since 2009 is indicated in colour code.

Posconstruction monitoring



Livestock farms surveyed during the study period January - August 2023. The condition of the farms is represented with a colour code: yellow for abandoned structures, pink in good condition and red for ruined structures.

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Posconstruction monitoring

CONCLUSIONS FROM THIS PROJECT ARE:

- With all these information, better planning of the wind farm could be done in order to achieve the minimum possible rate of collision: higher control of carcasses disposal, temporal shutdown of specific wind turbines in specific periods of the year…

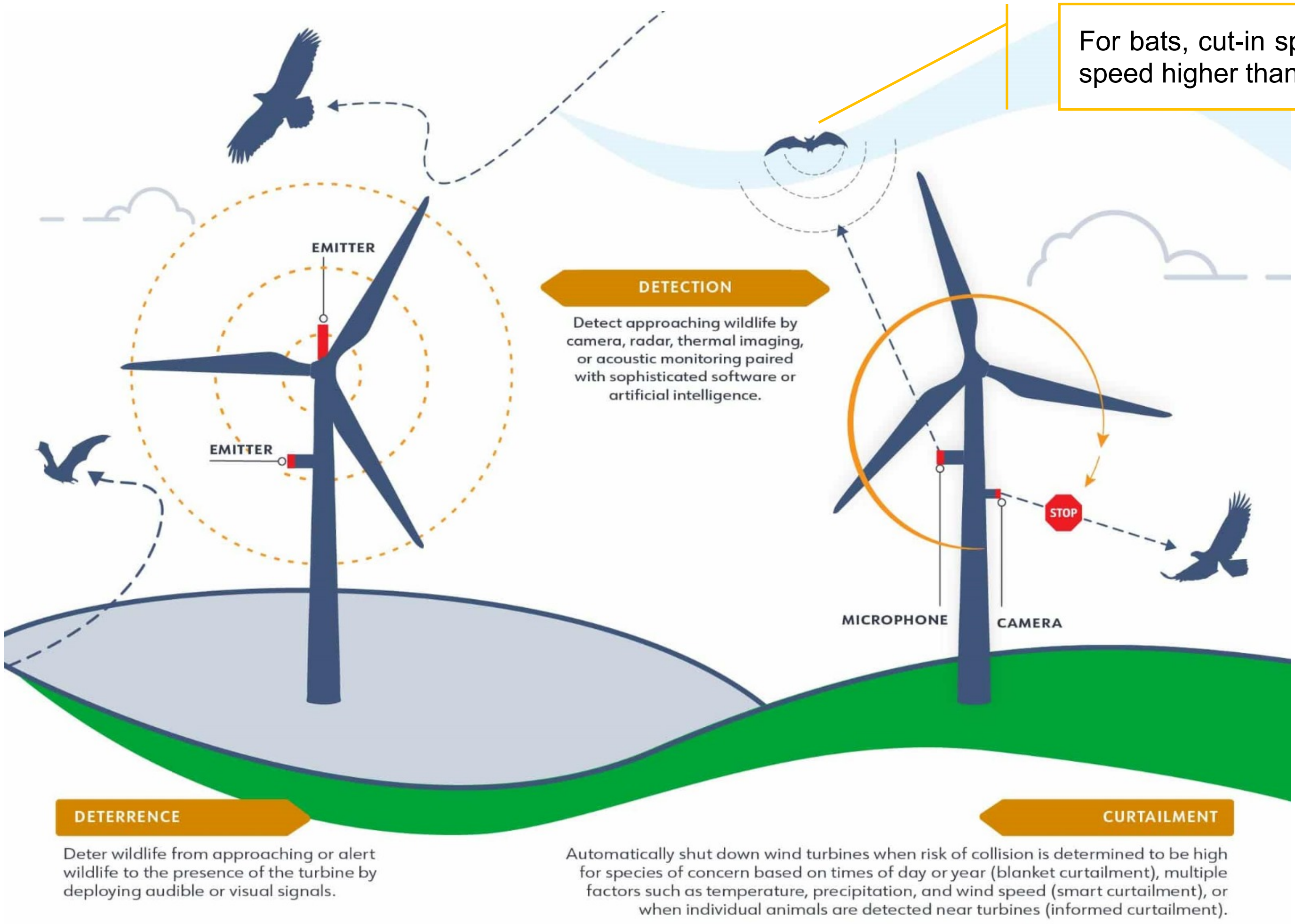
- Also, economical fines per collision seems to be an important driver for energy companies to minimize their impacts.

- However, it is important to remember that none of this would be necessary if the windfarm location should have been properly analysed during the design phase.

- Spanish government is learning from this process and is now setting new conditions to energy companies, imposing temporal shut down when endangered species suffer collisions, and a system of ecological repair process must be stablished too.

Summary of minimization measures

For bats, cut-in speed of wind turbine with wind speed higher than 6 m/s!!! (+60% reduction)



Source: www.REWI.org – Guide to Wind Energy and Wildlife. 2023

07. Offsetting

Some examples of compensation

- *RAPTORS:*
  - *Non natural mortality reduction:*
    - *Electrocution and collision with power lines*
    - *Drowning in irrigation ponds*
    - *Poisoning*
    - *Illegal shooting / poaching*
  - *Trophic resources and nesting opportunities improvement (far away from the wind farm)*

- *AGROECOSISTEMS AND STEPPE BIRDS*
  - *Agro-environmental programs*

РАҚМЕТ СІЗГЕ! - СПАСИБО! - THANKS!

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