Mapping the risk of collision of Little Bustard's with power lines: implications for the planning of new power lines and identification of existing power lines at hazardous sites

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Foto: Luís Venâncio

Background

- The little bustard is a leking grassland bird
- Males establish territories in a aggregated manner and attract females
- Parental care is provided singly by the female
- Are gregarious during the rest of the year

- During the yearly cycle this species performs movements towards areas with greater food availability, depending on different areas along the yearly cycle

Interactions with power lines

- Considered to be one of the most susceptible species to collision with overhead distribution power lines
- A rough estimate shows that impacts caused by overhead power lines are lightly to be significant:
    - Estimates that overhead power lines cause mortality to at least 1.5% of the population yearly

- Highly susceptible to suffer accidents because:
    - Gregarious
    - Migrate during night
    - Habitat with a high density of power lines
    - Vision not optimized to look ahead

Usefulness of mapping collision risk

- Mitigation measures used to prevent collision of birds are mostly related to the marking of the conductors and earth cable
- However these measures have shown not to be very effective, usually with an efficiency estimated under 60%
- It is acknowledged that the most efficient action to prevent collisions with power lines is through planning

<u>Need for collision risk maps, mainly for structuring power lines</u>

Mapping collision risk - Methods

2 types of collision risk maps:

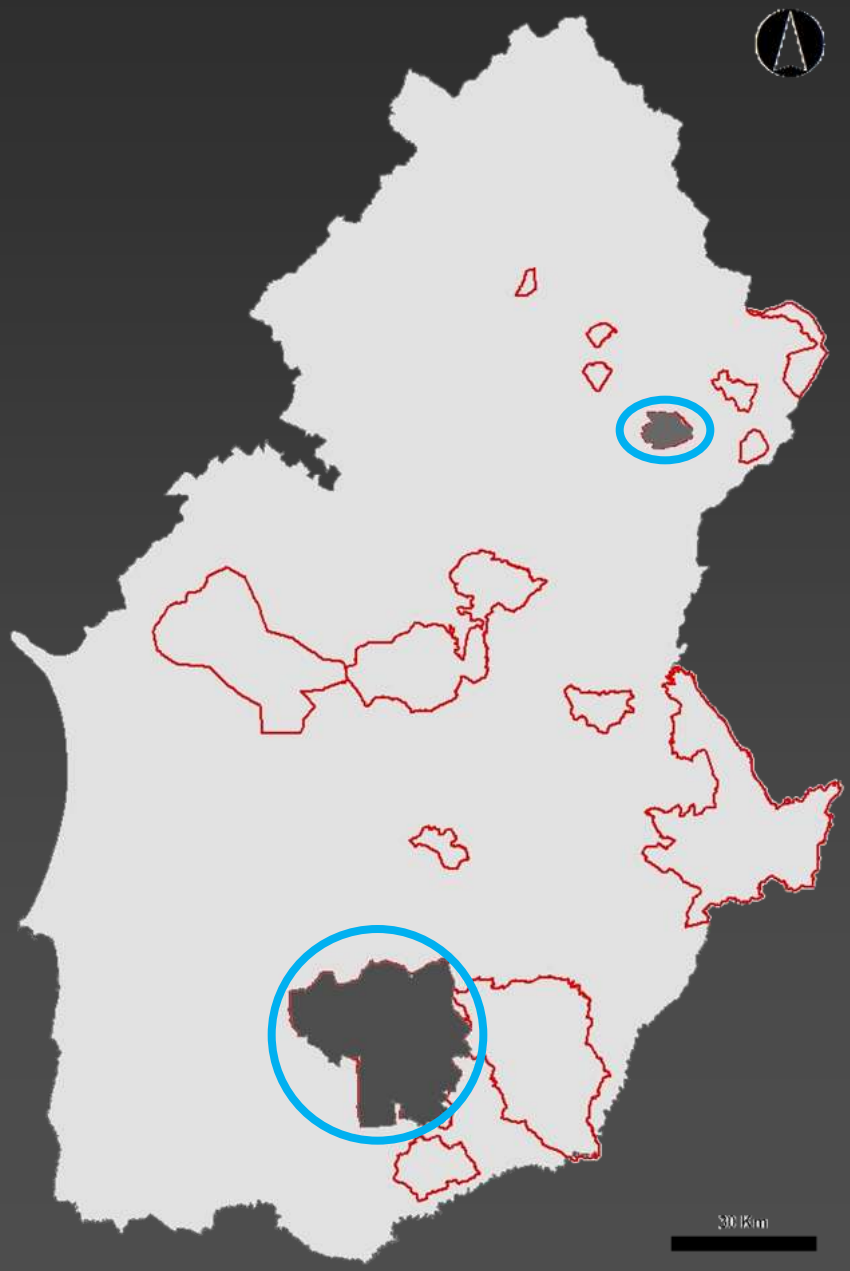
- Collision risk maps within each season (breeding, post-breeding and winter):
  - Daily movements at 2 hour-intervals measured from satellite telemetry
  - Focal observations used to:
    - Calibrate the estimates of 2 hour interval movements derived from satellite telemetry
    - Describe the frequency of different types of flights that were recorded at different heights

- Collision risk map for the migratory movements, usually between seasons
  - Using data from the satellite tracking

Mapping collision risk - Methods

Satellite telemetry – study area

- Captures conducted at 2 priority conservation sites:
  - Castro Verde – more than half of the breeding population within SPAs and approximately 20% of the national population
  - Vila Fernando – priority site for breeding with high density of breeding males



Mapping collision risk - Methods

Satellite telemetry

Satellite tracking

- Took place between April 2009 and August 2011
- For most birds that died we were able recover the PTT

Captures

- Prevent capture miopathy - need to manipulate the birds in less than 30 min
- Previous training of the team

Mapping collision risk - Methods

Satellite telemetry

- Study of the movements of the Little Bustard using satellite telemetry:
  - Microwave solar PTT/GPS 30 gr
  - Programmed to obtain a fix every 2 hours (maximum number of fixes possible)
  - During winter and part of autumn and spring the number of night fixes was reduced to manage the battery

Mapping collision risk - Methods

Focal observations

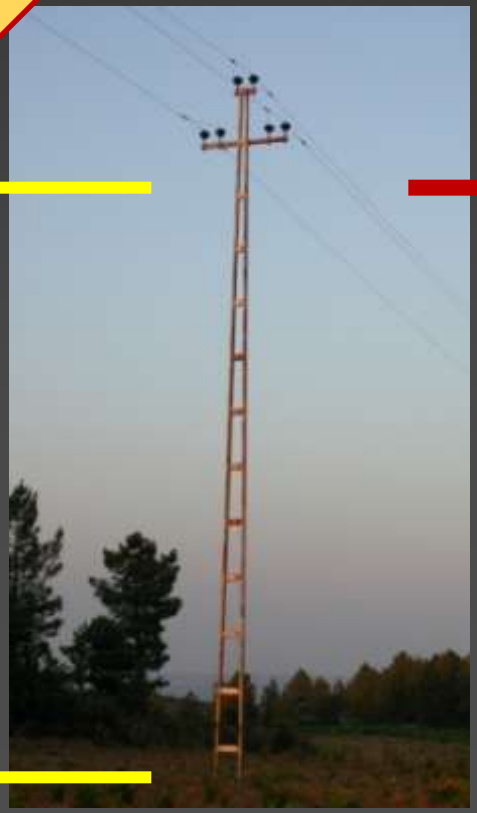
- Field work took place at the sites were the birds were tracked – Alentejo, Extremadura and Castilla y Leon
- Conducted for a maximum of 2 hour periods
  - How far it flew
  - Time in flight
  - Mean flight height, in one the following categories:

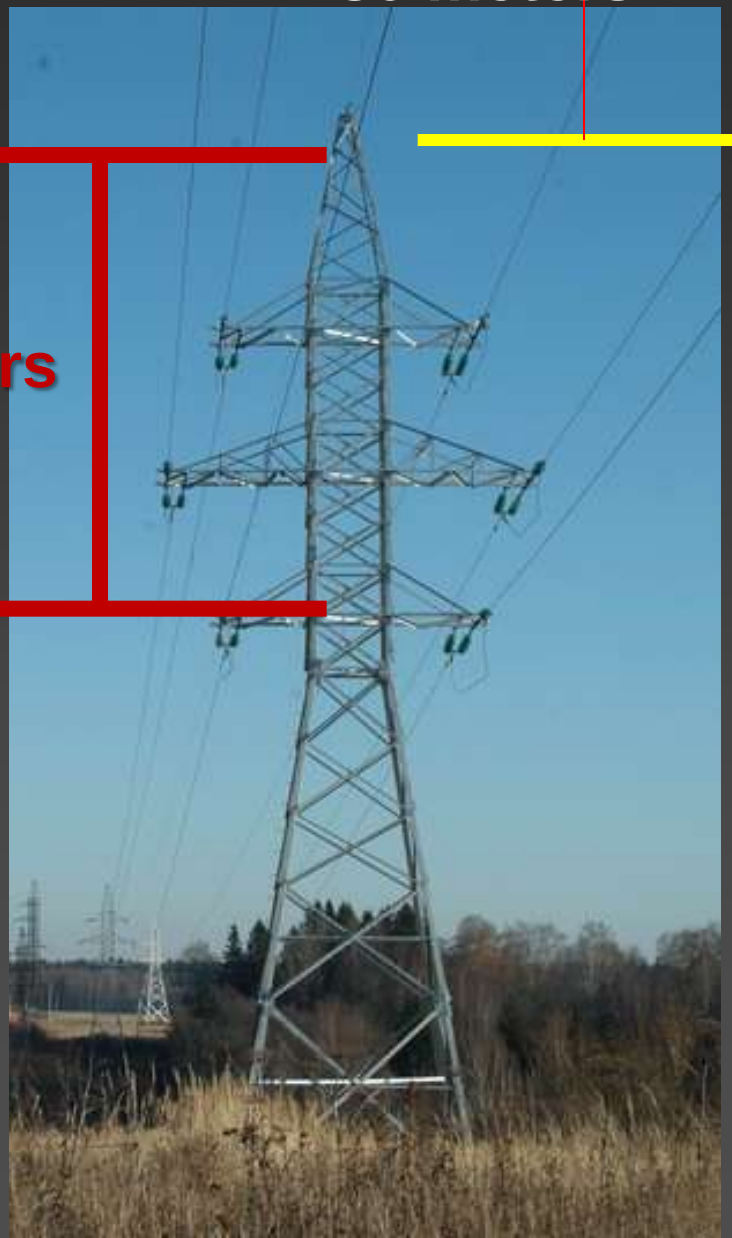
Focal observations

> 30 meters

15 – 30 meters

1 – 15 meters





Mapping collision risk - Methods

Map building process

1

Collision risk during **daily** movements ~ $\int$ (Population density + Distance travelled in flight + % flights at risk height)

total daily flight distance at risk height within 1 Km²

2

Collision risk during **migration** movements

density of migratory flights within a 2,5 x 2,5 Km grid

Mapping collision risk - Methods

Collision risk daily movements

Collision risk during daily movements ~ $\int$ (**Population density** + Distance travelled in flight + % flights at risk height)

- Population density (based on the data collected in a previous Life project – Life Sisão)
  - Modelling little bustard's presences using Maxent, using the following variables
    - Regional autocorrelation
    - LandCoverCorine 2006
    - Soil productivity
  - Adapted probabilities into a approximate population density map

Mapping collision risk - Methods

Collision risk daily movements

$$\text{Collision risk during daily movements} \sim \int \left(\text{Population density} + \textbf{Distance travelled in flight} + \text{\% flights at risk height} \right)$$

- Distance travelled in flight
  - All migratory movements removed from the data set
  - Distance between locations given every 2 hours with GPS precision (error aprox. 18m)

Mapping collision risk - Methods

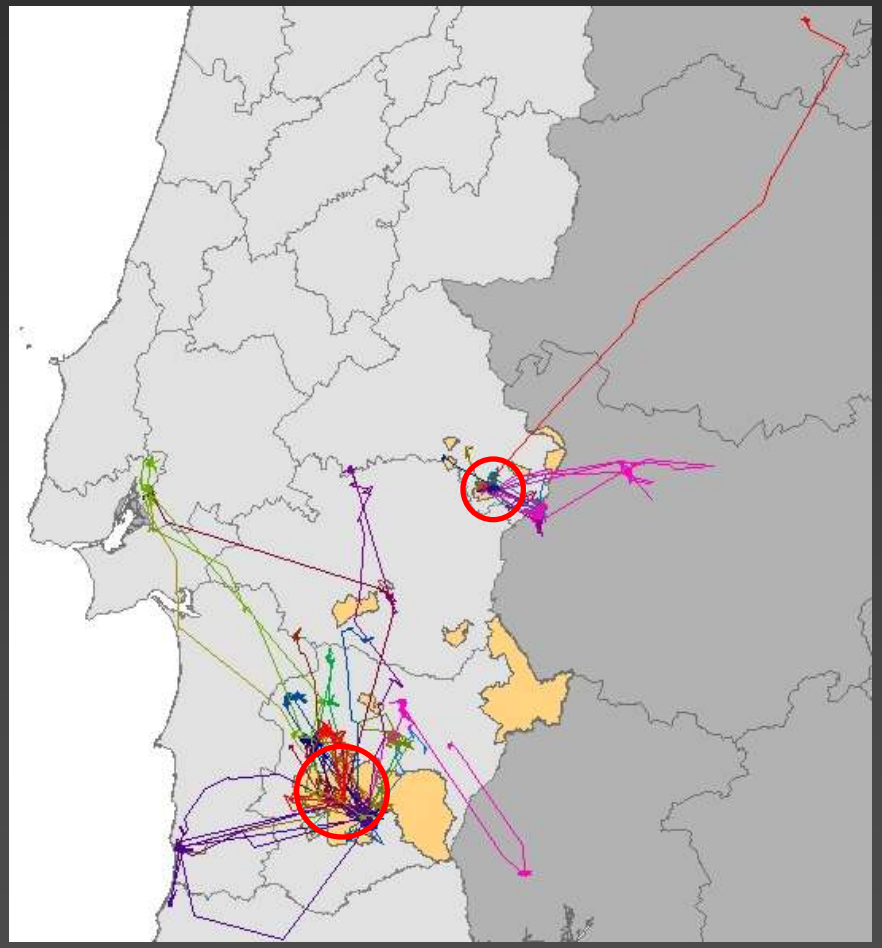
Collision risk daily movements

$$\text{Collision risk during daily movements} \sim \int \left(\text{Population density} + \text{Distance travelled in flight} + \textbf{\% flights at risk height} \right)$$

- % of flights at risk height
  - Calculated as an average of the flights heights

Mapping collision risk - Results

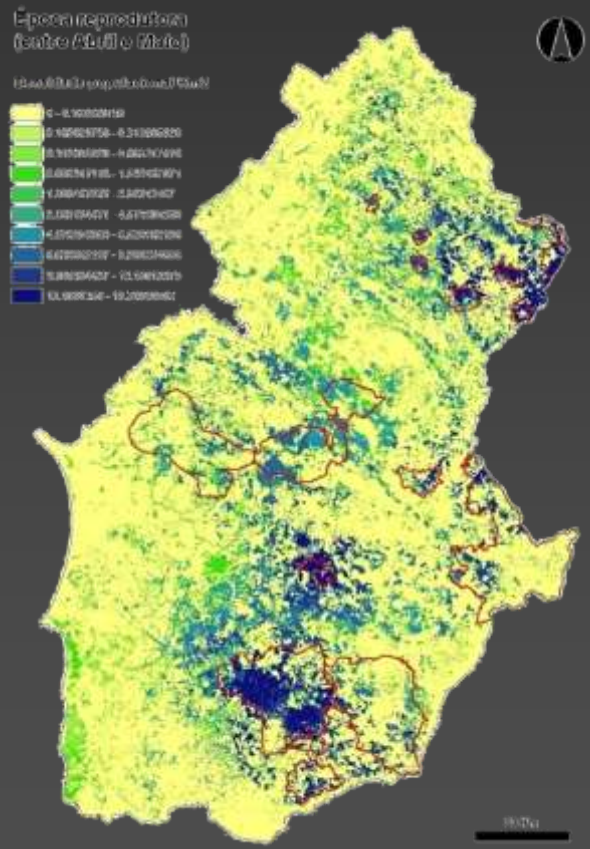
- Overall 31 birds were captured and fitted a PTT
  - 8 in Vila Fernando
  - 23 in Castro Verde
- 27 of which transmitted between one month and 2 and half years
- Over 75.000 location were collected, summing approximately 21.500 Km of movements as given by the satellite tracking



Mapping collision risk - Results

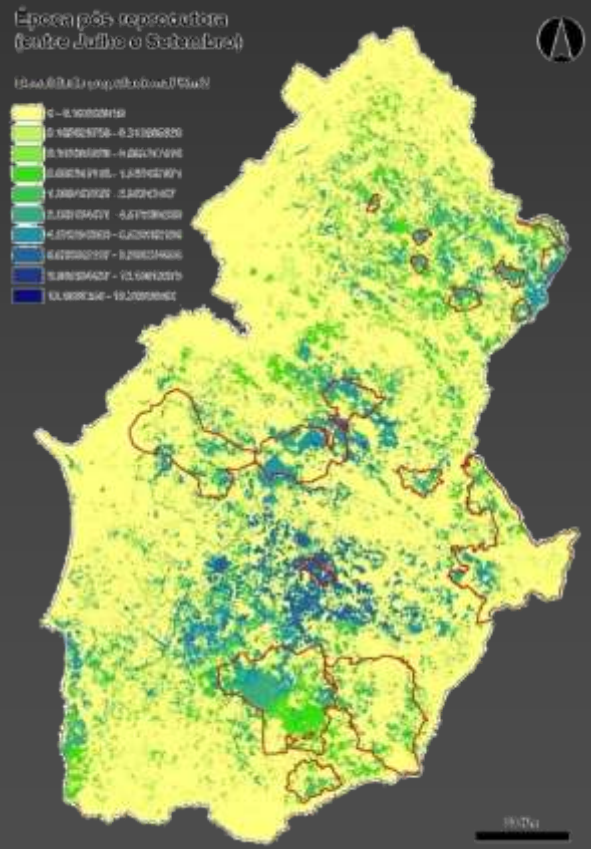
Collision risk during daily movements ~ $\int$ (**Population density** + Distance travelled in flight + % flights at risk height)

Breeding



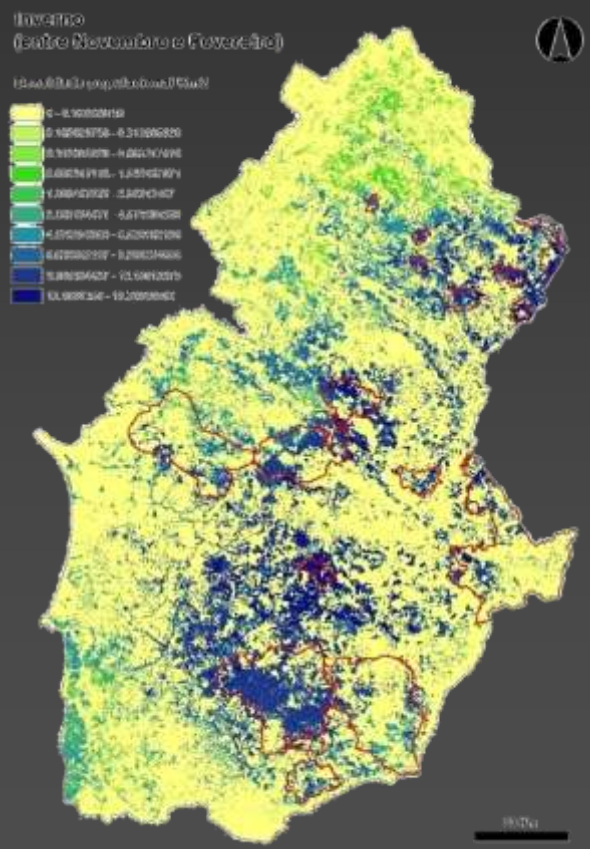
Max. – 19.4 birds/Km^2

Post-breeding



Max. – 8.6 birds/Km^2

Winter

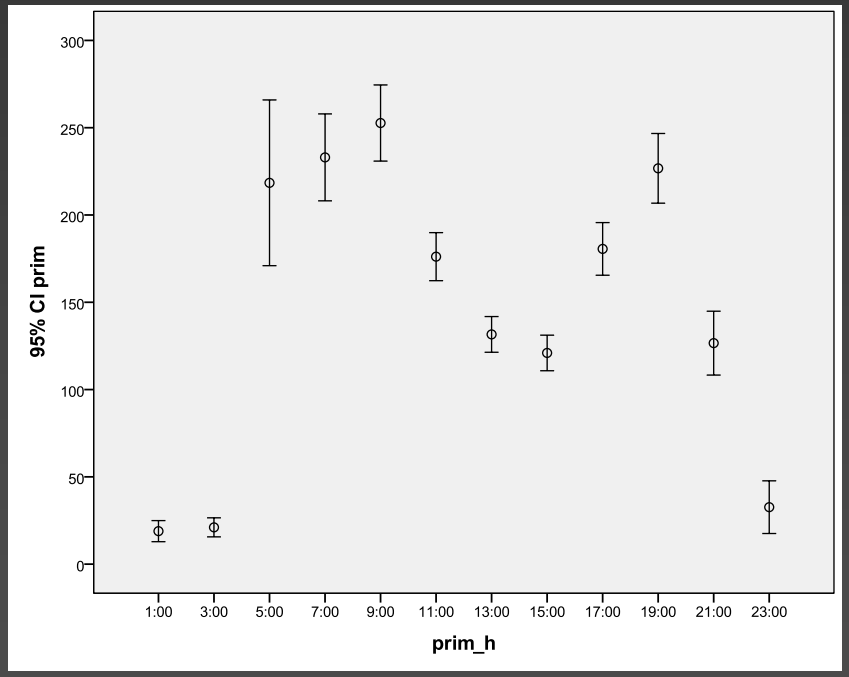


Max. – 14.4 birds/Km^2

Mapping collision risk - Results

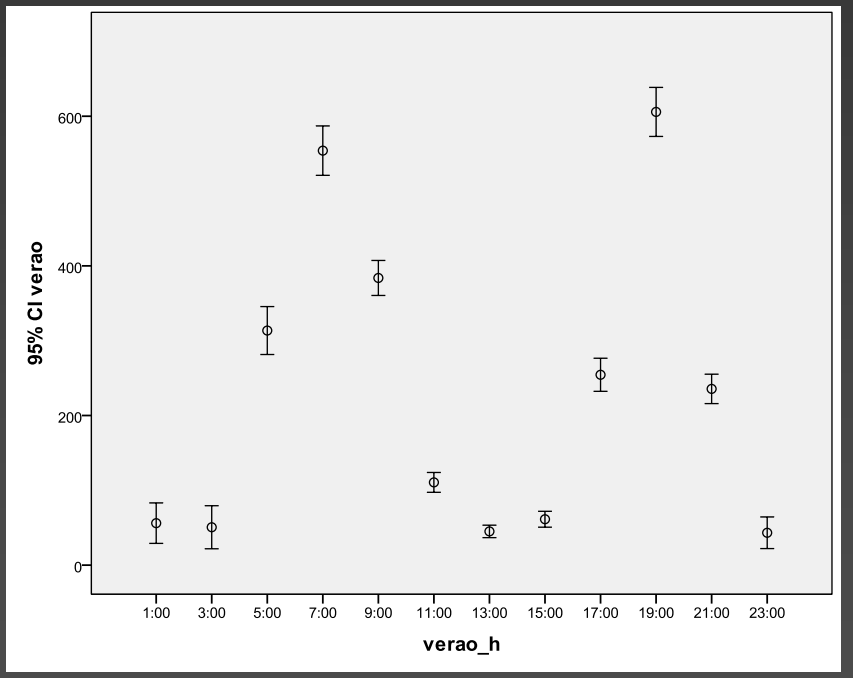
Collision risk during daily movements ~ $\int$ (Population density + **Distance travelled in flight** + % flights at risk height)

Breeding



Daily distance travelled: 3028m

Post-breeding

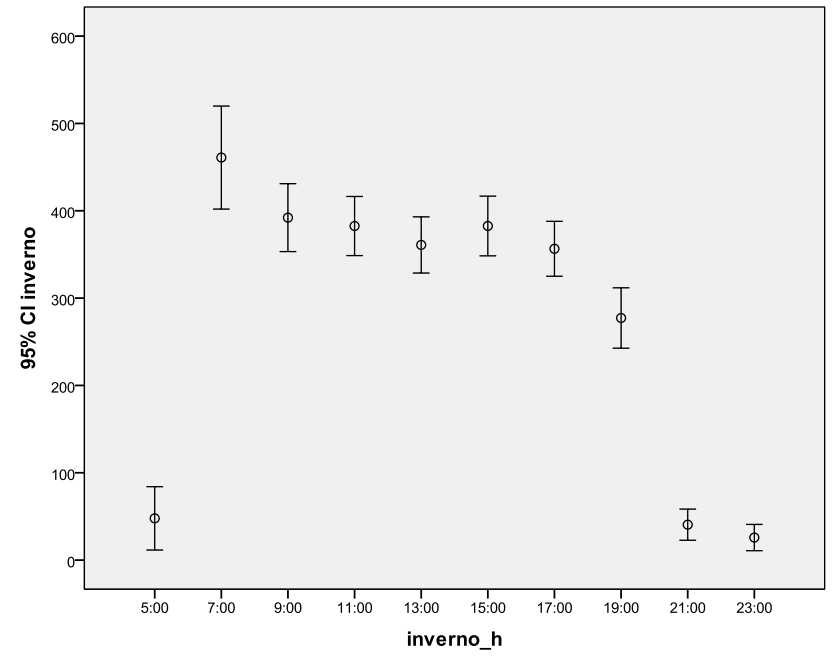


Daily distance travelled: 9311m

Mapping collision risk - Results

Collision risk during daily movements ~ $\int$ (Population density + **Distance travelled in flight** + % flights at risk height)

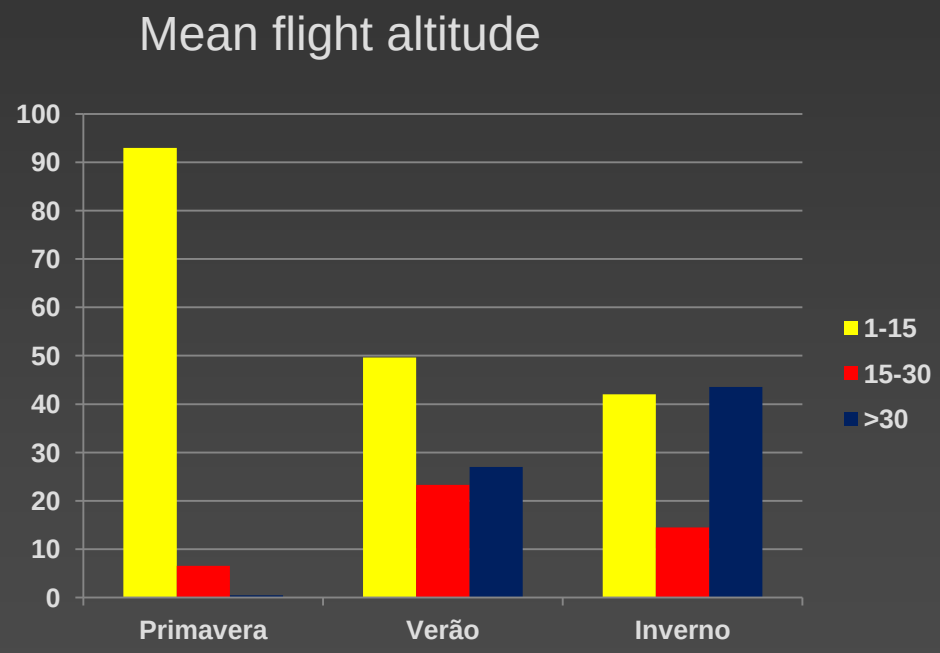
Winter



Daily distance travelled: 10.873m

Mapping collision risk - Results

Collision risk during daily movements ~ $\int$ (Population density + Distance travelled in flight + **% flights at risk height**)

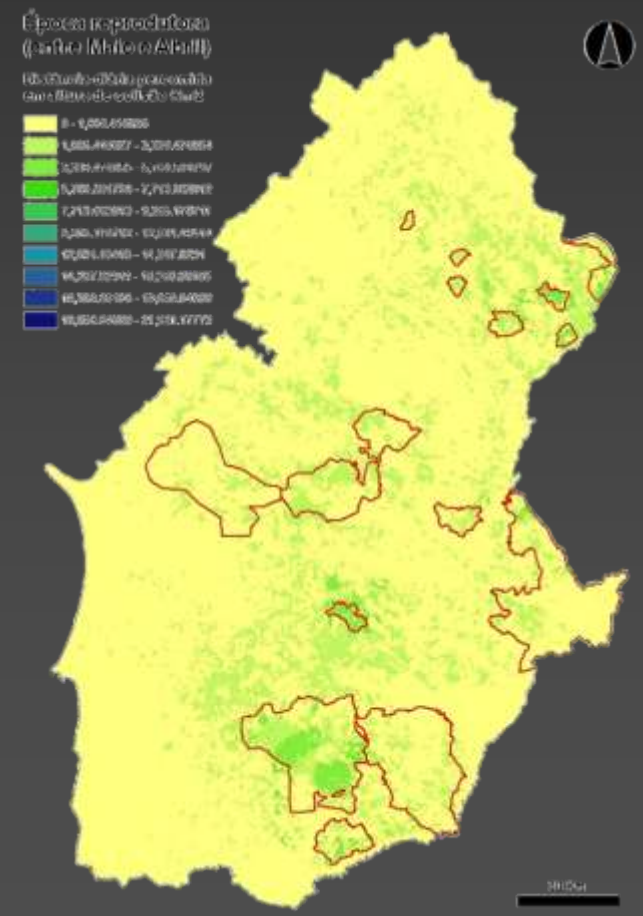


Mean frequency of flight height per season (%)			
	Breeding	Post-breeding	Winter
15-30	7	23	14

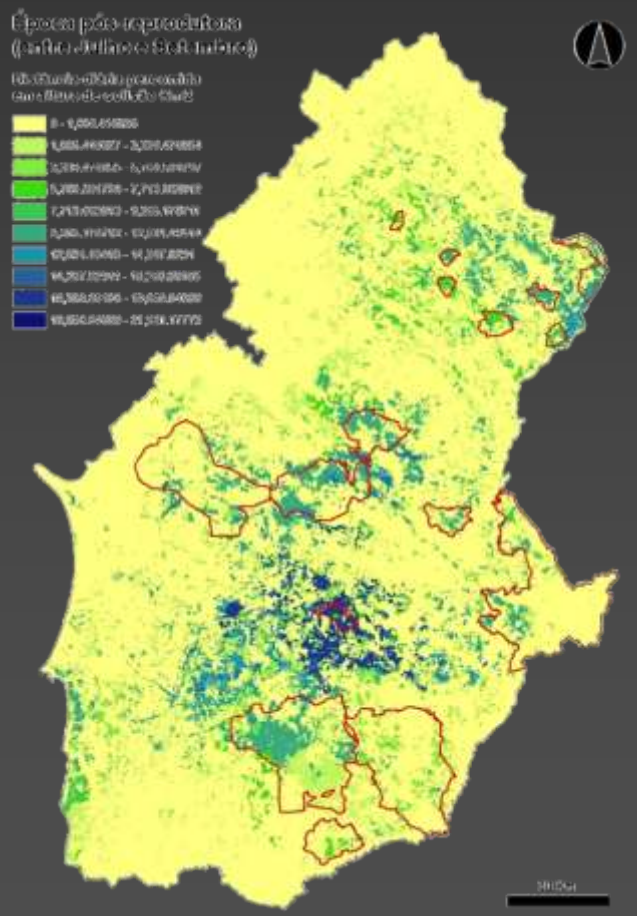
Mapping collision risk - Results

Collision risk during daily movements ~ $\int$ (**Population density** + **Distance travelled in flight** + **% flights at height risk**)

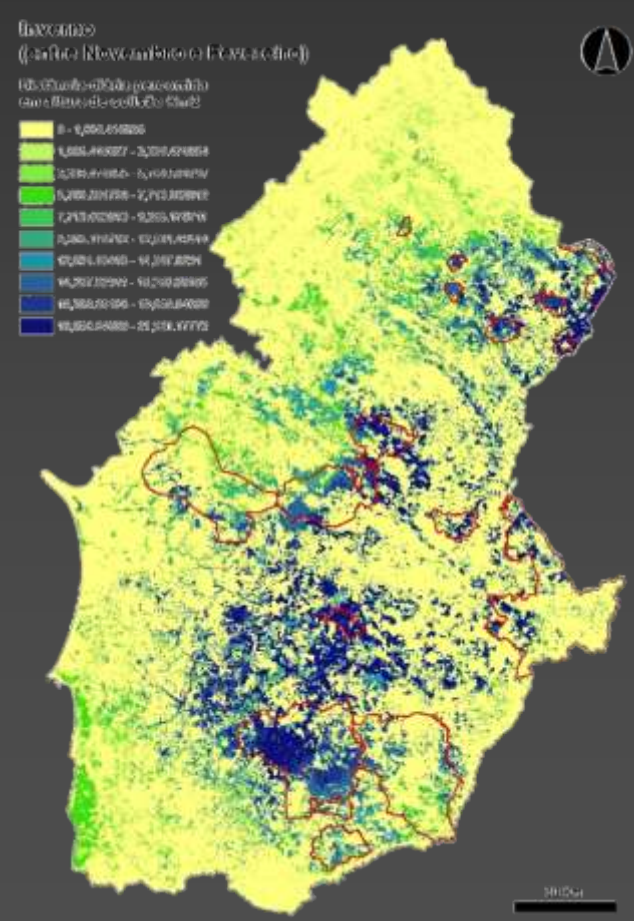
Breeding



Post-breeding



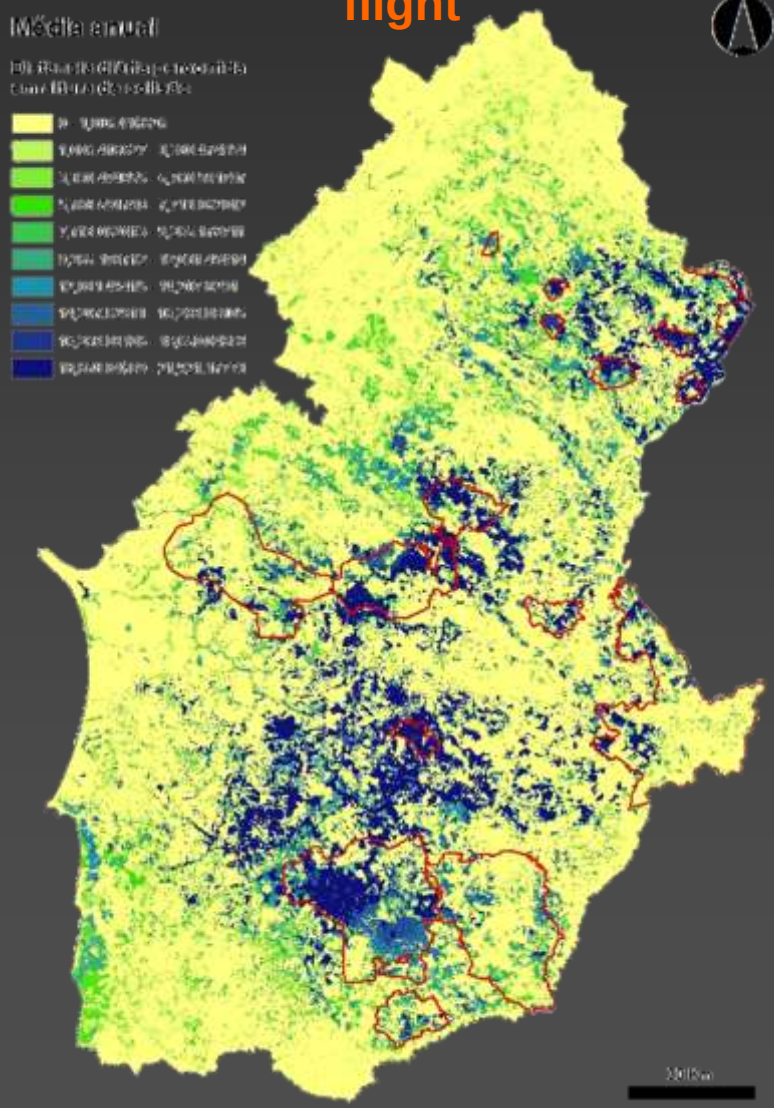
Winter



Mapping collision risk - Results

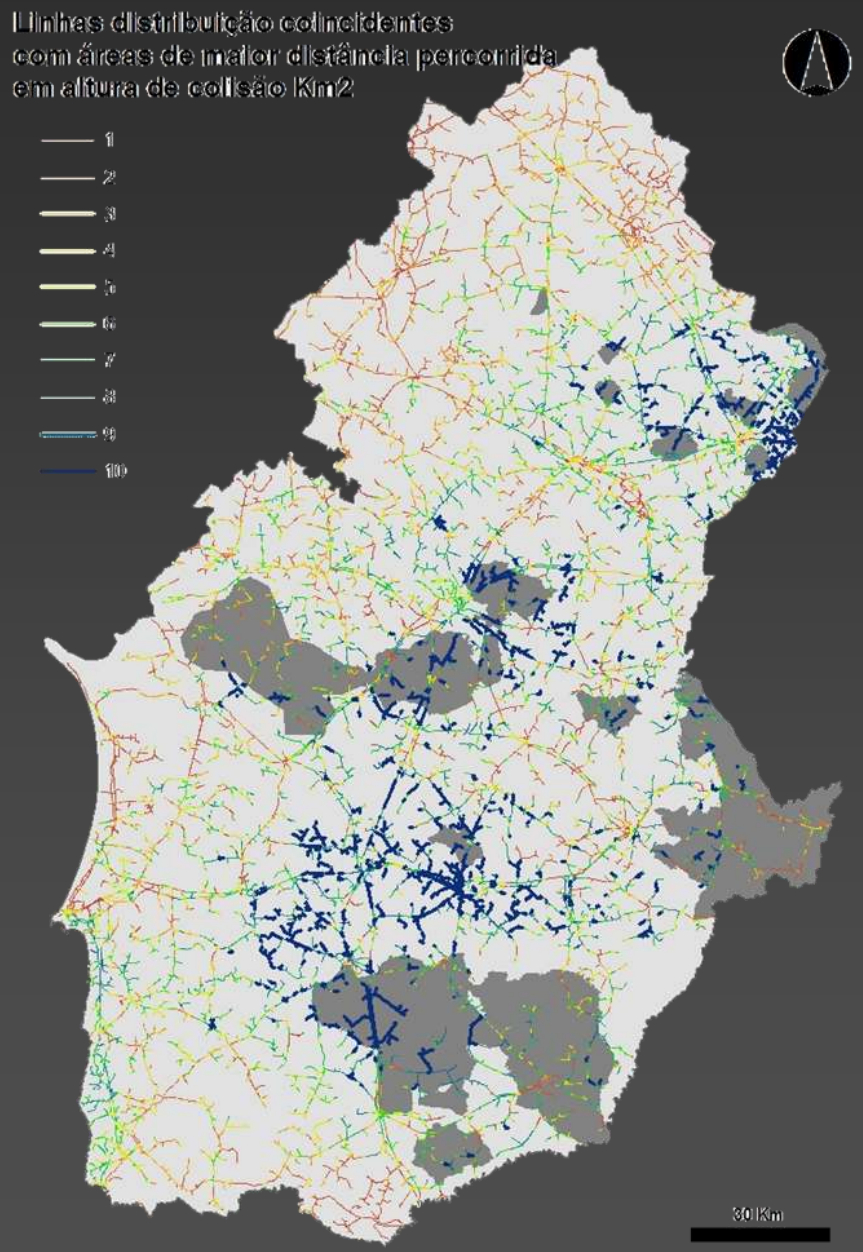
Collision risk during daily movements ~ $\int$ (**Population density** + **Distance travelled in flight** + **% flights at height risk**)

Annual collision risk based on daily movements



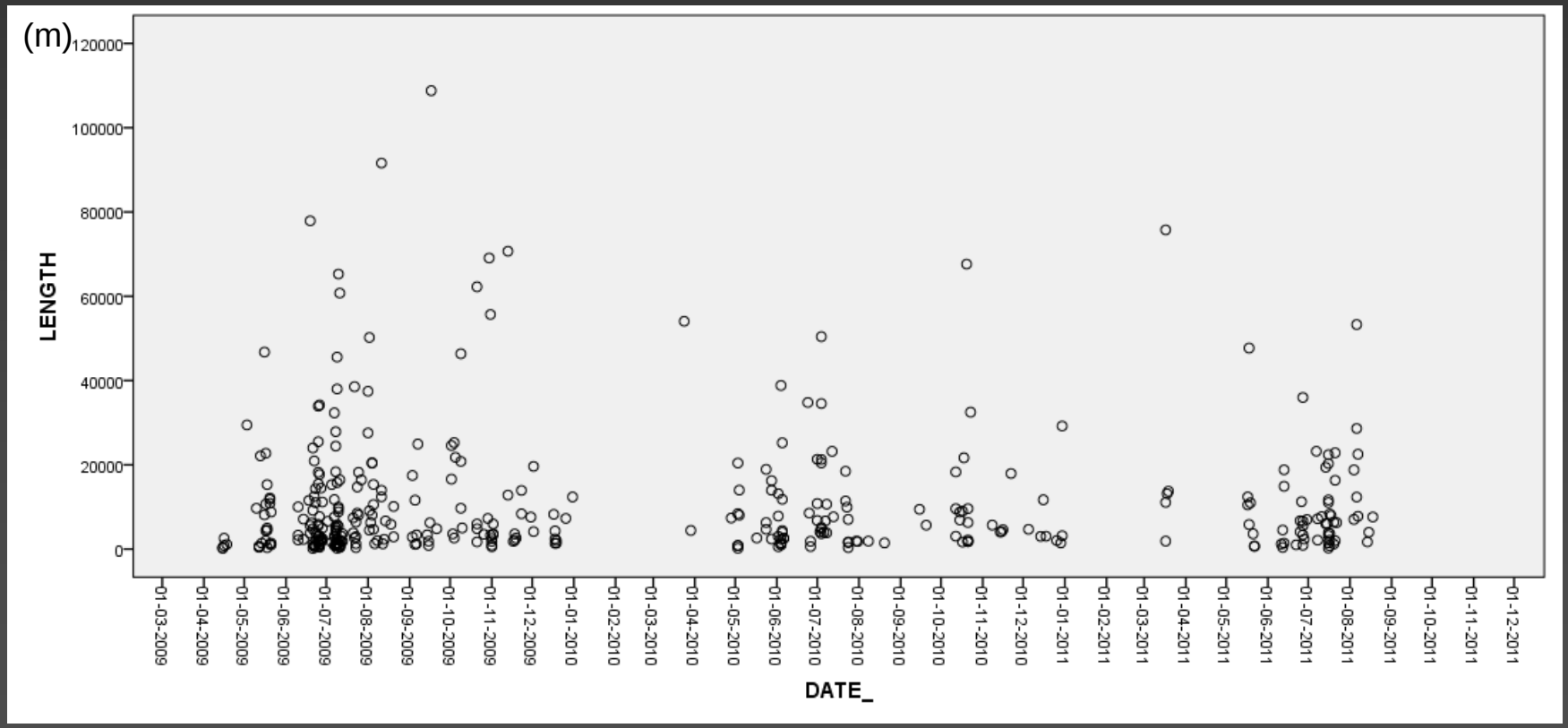
Mapping collision risk - Results

Distribution of medium and high tension power lines crossing areas of greater collision risk



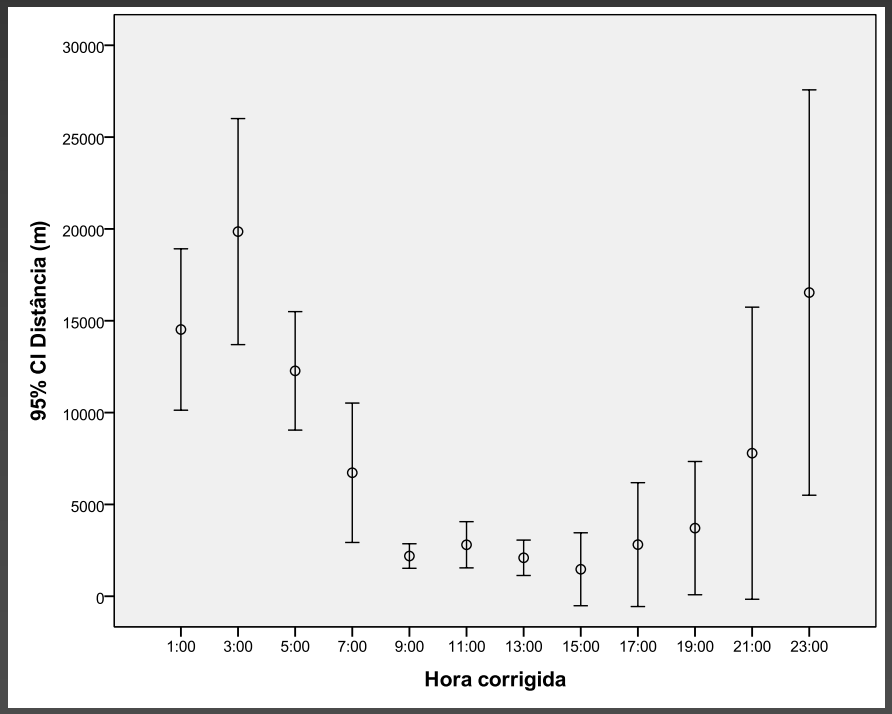
Mapping collision risk - Results

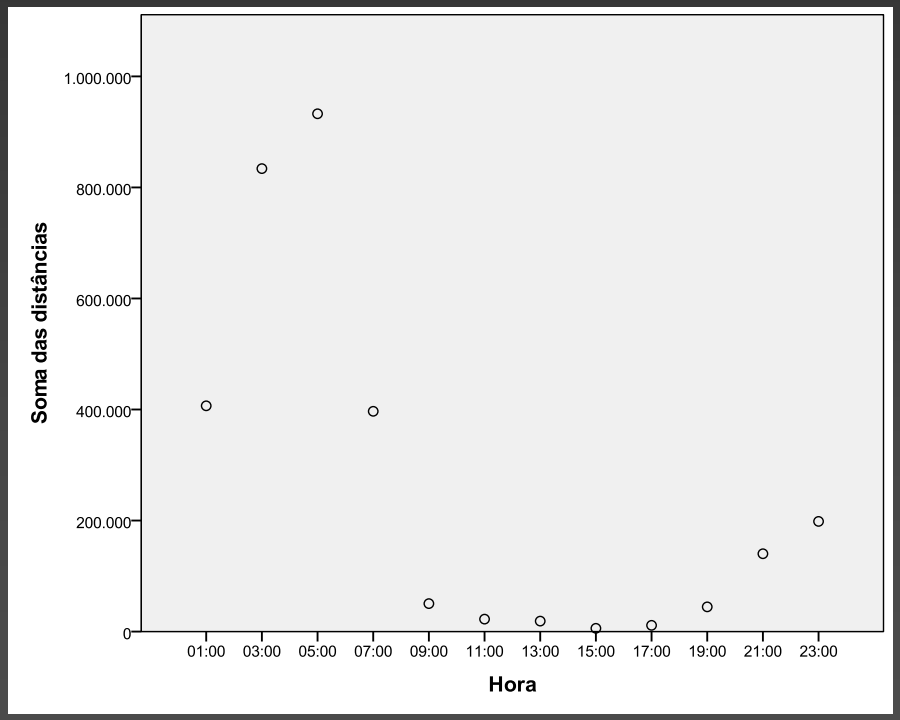
Collision risk during migration movements



Mapping collision risk - Results

Collision risk during migration movements





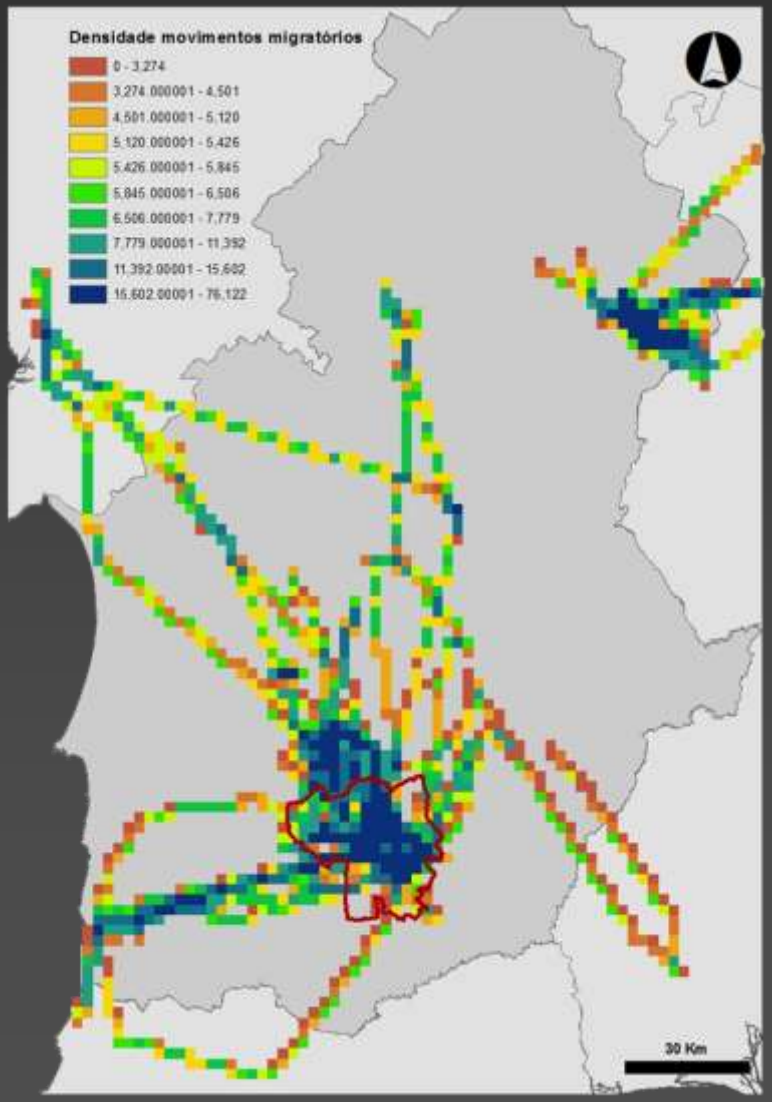
Mapping collision risk - Results

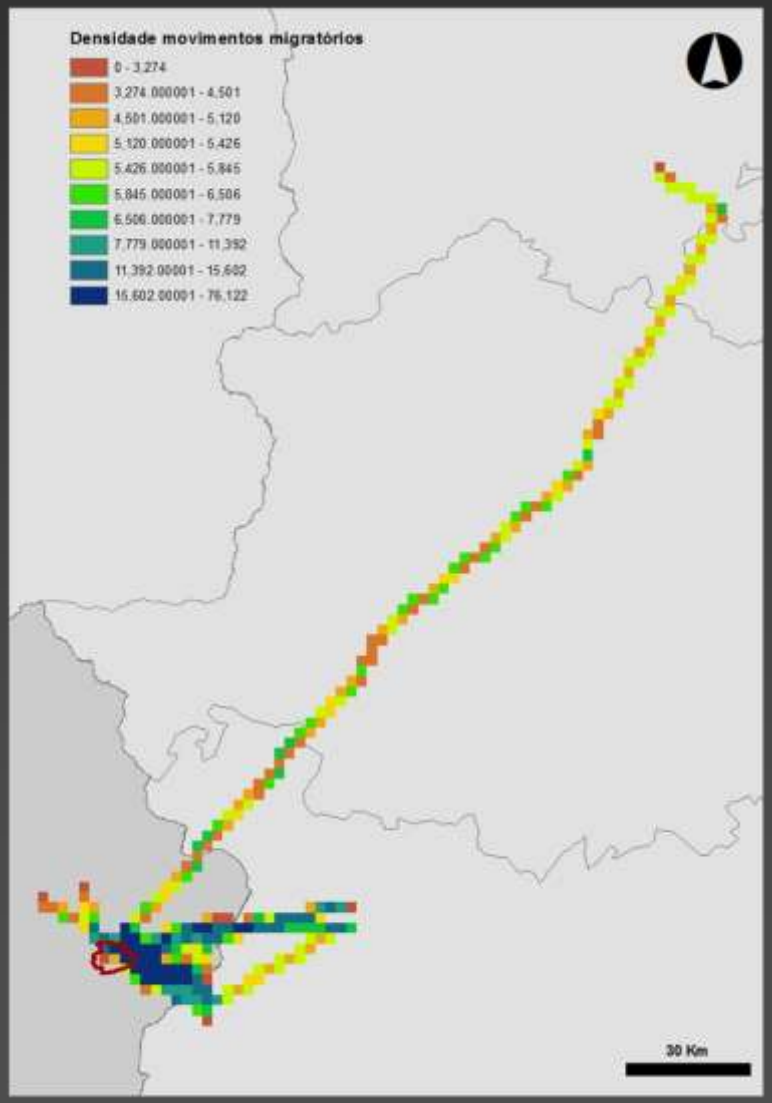
Collision risk during migration movements

Mapping collision risk - Results

Collision risk during migration movements

Castr Verde





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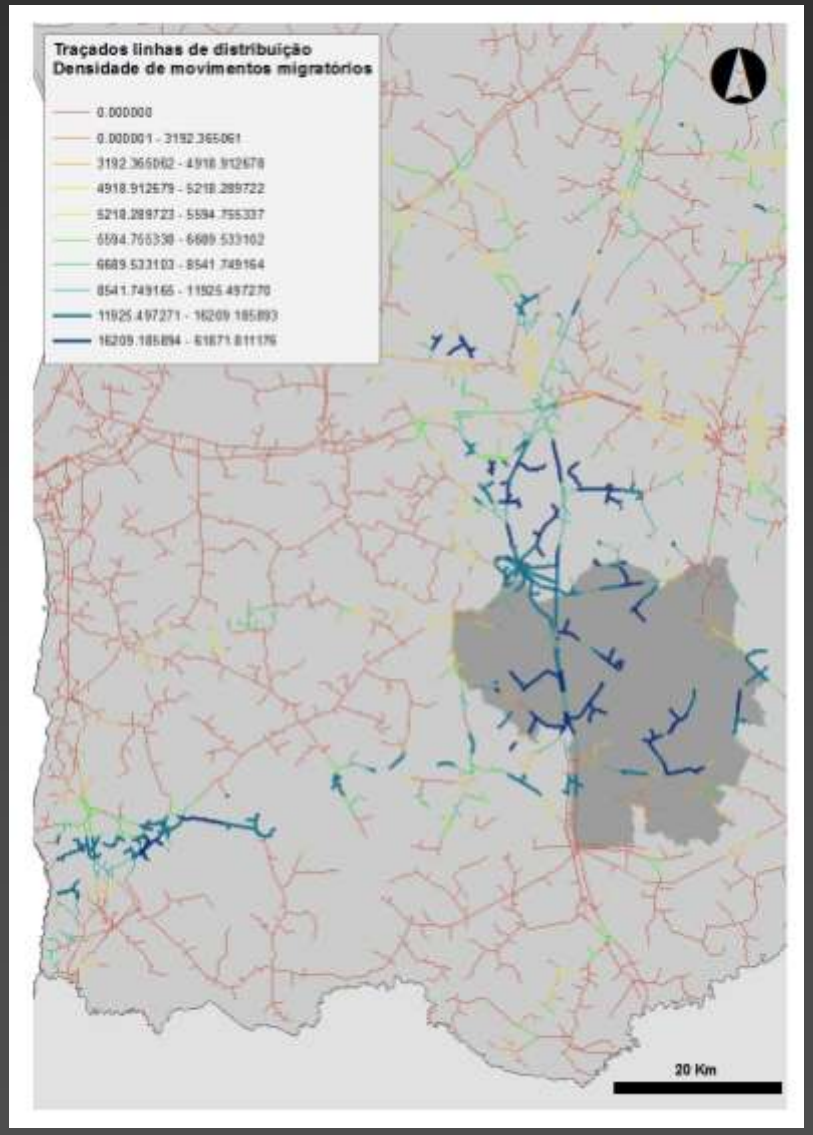
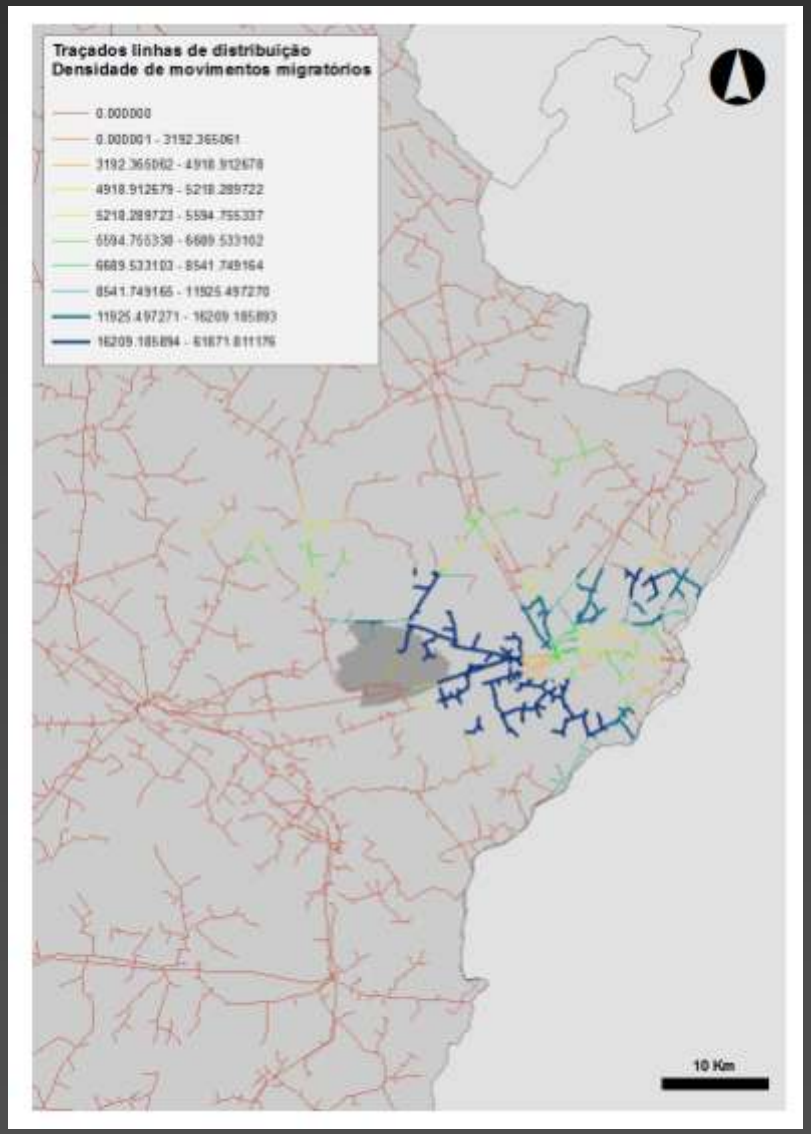
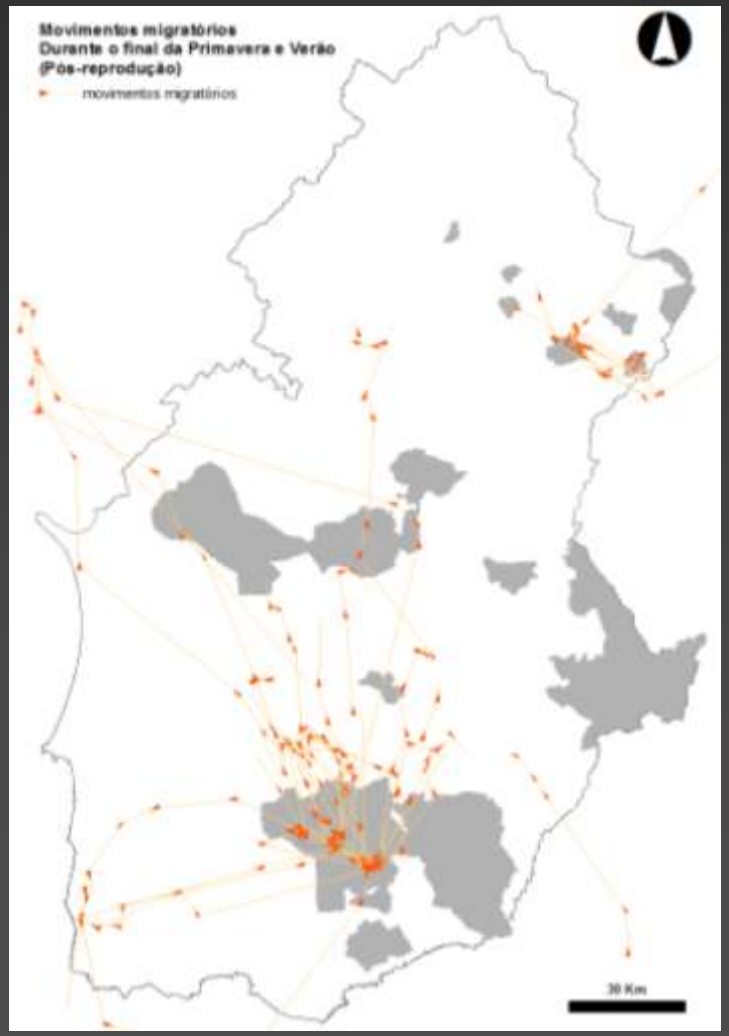
Collision risk during migration movements

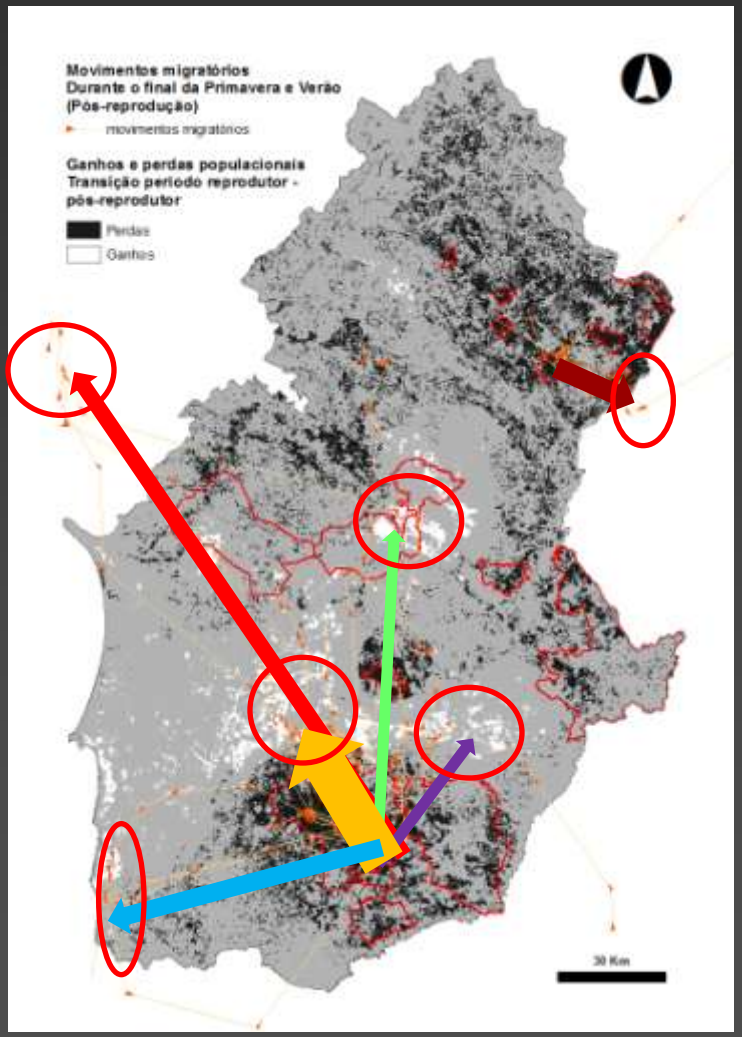




Mapping collision risk - Results

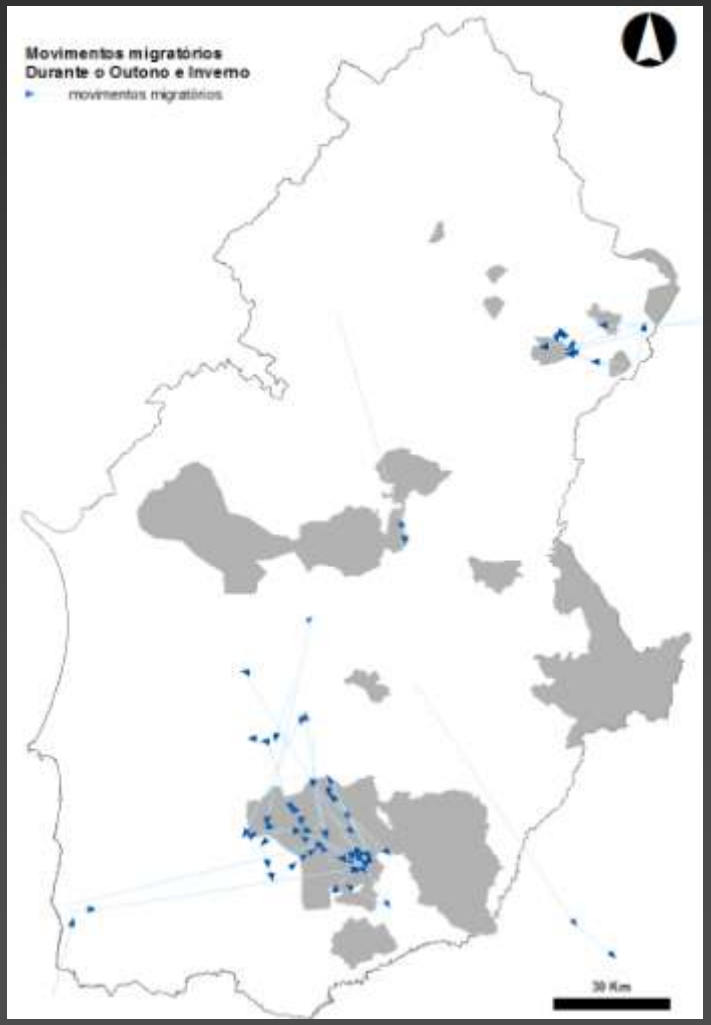
Collision risk during migration movements

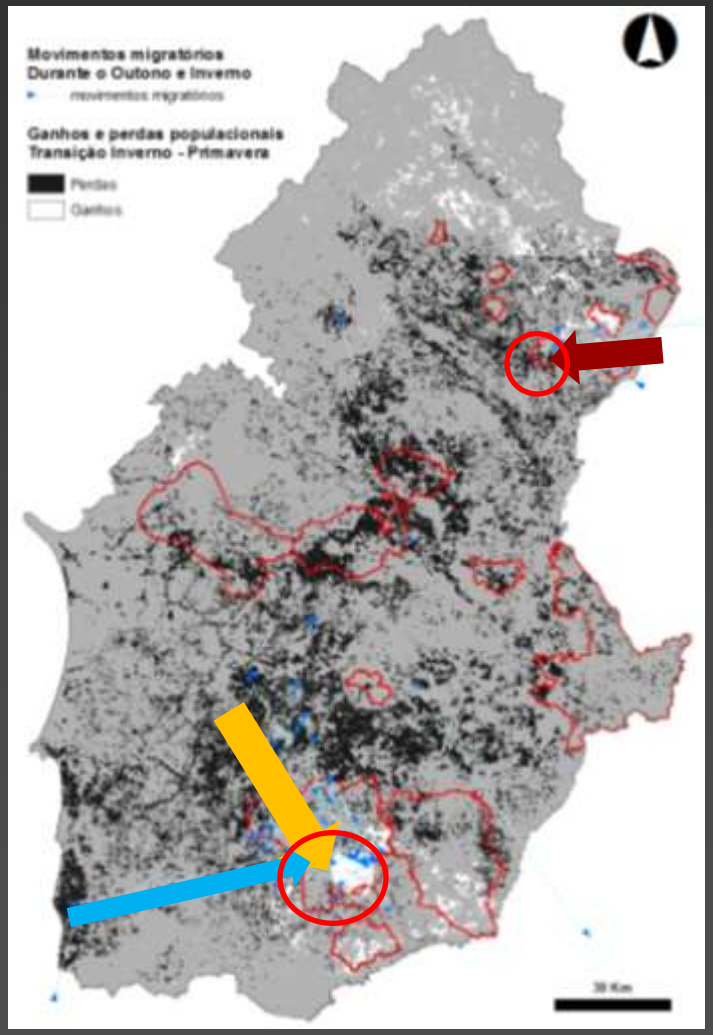




Mapping collision risk - Results

Collision risk during migration movements





Mapping collision risk - conclusions

- Collision risk maps for daily movements and migration movements are now available and can now be used in the planning of new power lines and mitigation measures for existing ones
- During the breeding season the collision risk is low due to low frequency of flights at height risk and short flight distances
- The winter season has the highest collision risk, because of the co-occurrence of larger areas with higher population density and longer distances flown during that season
- No particular migration corridors were used, however regions with higher density of migratory movements in the studied populations were identified

Acknowledgements