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**MODELLING GREAT AND LITTLE BUSTARD
MORTALITY IN VERY HIGH-TENSION POWER
LINES IN PORTUGAL**

Ana Teresa Marques



BACKGROUND



✓ **Great bustard and little bustard** are highly vulnerable to collision with power lines:

- Collision-prone species
- High mortality rate
- Collision is a major source of anthropogenic mortality
- Population-level effects expected
- Species of conservation concern

*3.4-3.8% Iberian population
of Little bustard collides
annually with power lines*



*Changes in
migratory pattern
of Great bustard*

OBJECTIVES



Gather all the information on bustards' collision with transmission power lines in Portugal, to:

- ✓ Describe the spatial patterns
 - ✓ Describe the temporal patterns
 - ✓ Determine the relative importance of the main drivers of collision:
 - Habitat
 - Power line technical features
 - Wire marking
- ... of both species and contrast patterns across species

Suggest improvements to mitigation measures targeting bustards' species





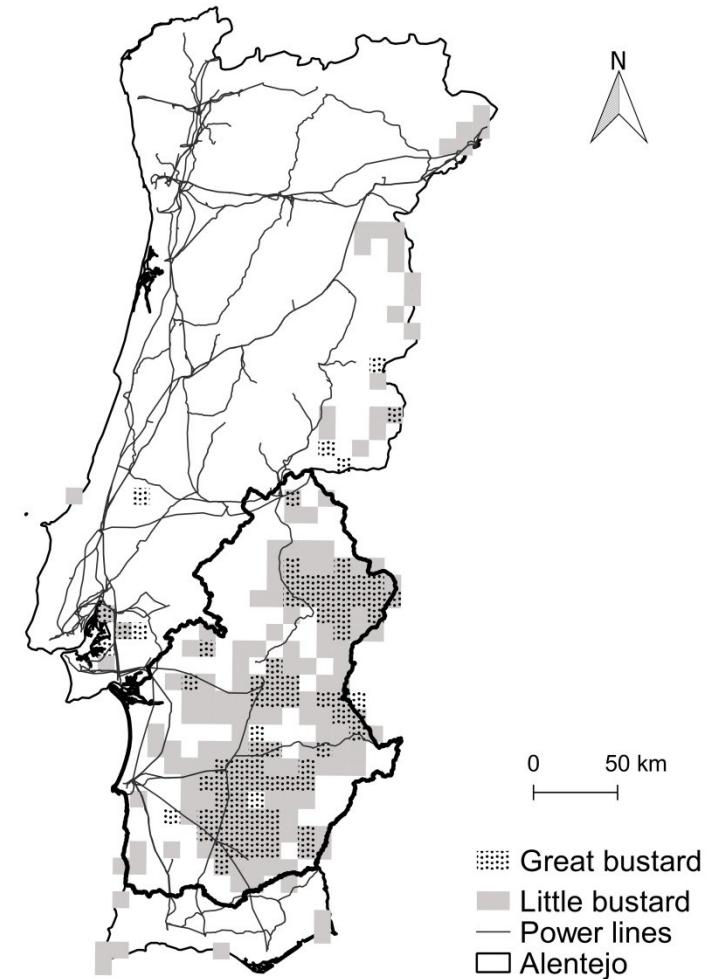
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METHODS

METHODS

✓ **Study area:** Alentejo

- 1239 km transmission lines
- 150 kV & 400 kV



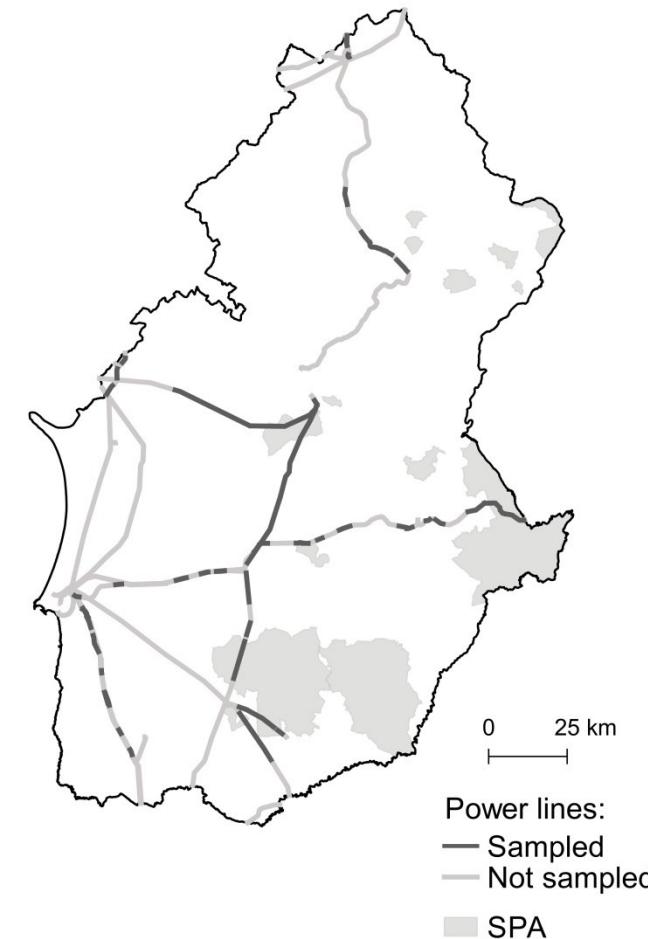
METHODS

✓ **Study area:** Alentejo

- 1239 km transmission lines
- 150 kV & 400 kV

✓ **Data compilation**

- 9 studies on bird collision
(national assessment, studies focusing on wire-marking effectiveness & monitoring programs - Environmental Impact Assessment processes)
- Survey: 280 km (ca. 23%)
- 2003 to 2015



METHODS

✓ Data characteristics

- Sampling effort uneven across studies (duration and survey frequency)
- Data with differing spatial and temporal details

*Power lines were divided in 144 sections
of ca. 2-km each*

*Presence/ absence of mortality per 2-km
section*





METHODS

✓ Data analysis

- Collision patterns per species:
 - Seasonal pattern
 - Spatial pattern
(simulation envelope of Ripley's K-function to test for Complete Spatial Randomness)

METHODS

✓ Data analysis

- Collision risk modelling using Boosted Regression Trees
 - Habitat

% open farmland
dominant habitat



METHODS

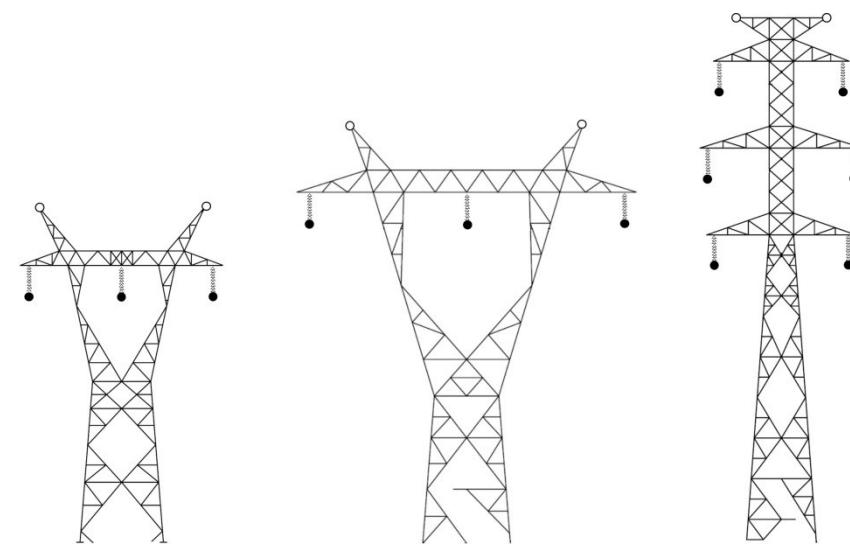
✓ Data analysis

- Collision risk modelling using Boosted Regression Trees
 - Habitat
 - Power line type

HL – horizontal configuration (single circuit), at 150 kV

HH – horizontal configuration (single circuit), at 400 kV

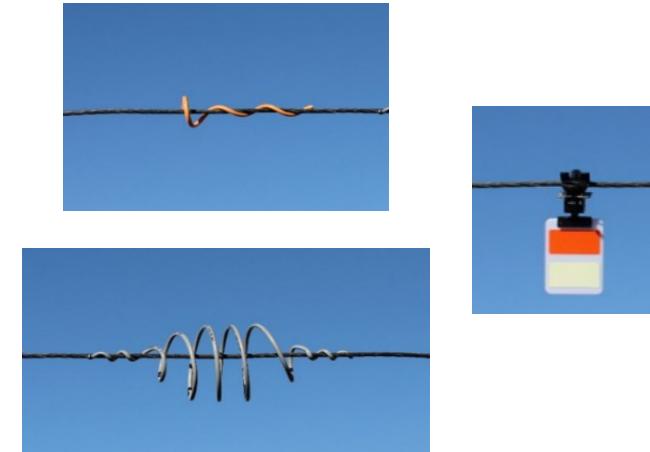
V – vertical configuration, (double circuit), at 150 or 400 kV



METHODS

✓ Data analysis

- Collision risk modelling using Boosted Regression Trees
 - Habitat
 - Power line type
 - Wire marking
 - Survey effort

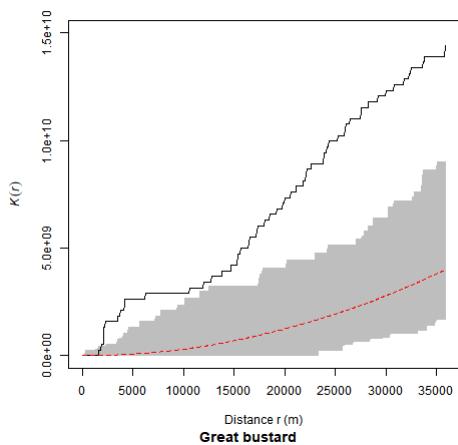




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RESULTS

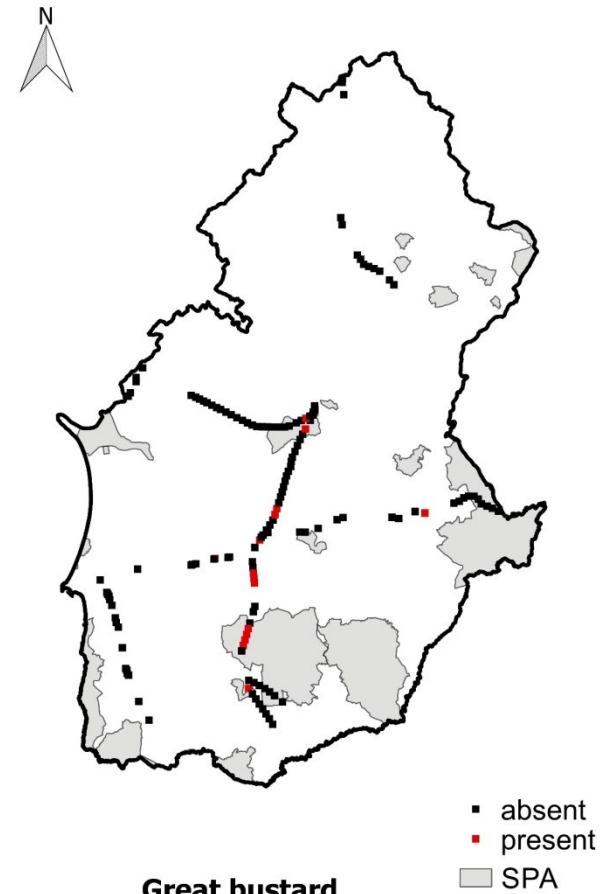
COLLISION PATTERNS



✓ 156 fatality events were recorded:

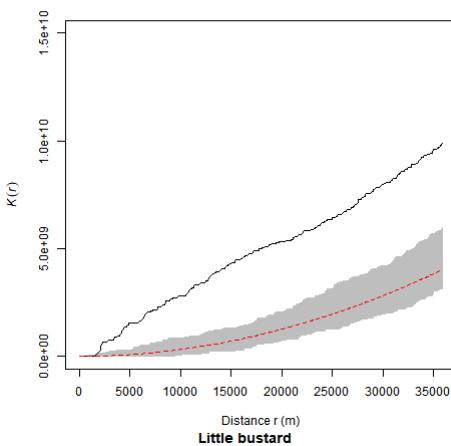
✓ Great bustard:

- 59 records
- 15 power lines sections
- 73% inside SPA
- Clustered spatial pattern
- In-side SPA: fall & spring
- Out-side SPA: late summer & fall



Great bustard

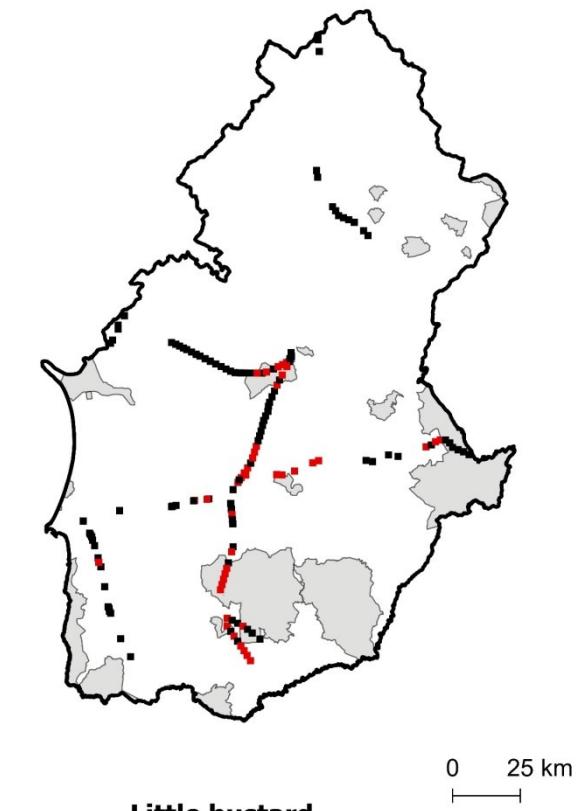
COLLISION PATTERNS



✓ 156 fatality events were recorded:

✓ Little bustard:

- 97 records
- 42 power lines sections
- 55% outside SPA
- Clustered spatial pattern
- In-side SPA: breeding & post-breading
- Out-side SPA: summer



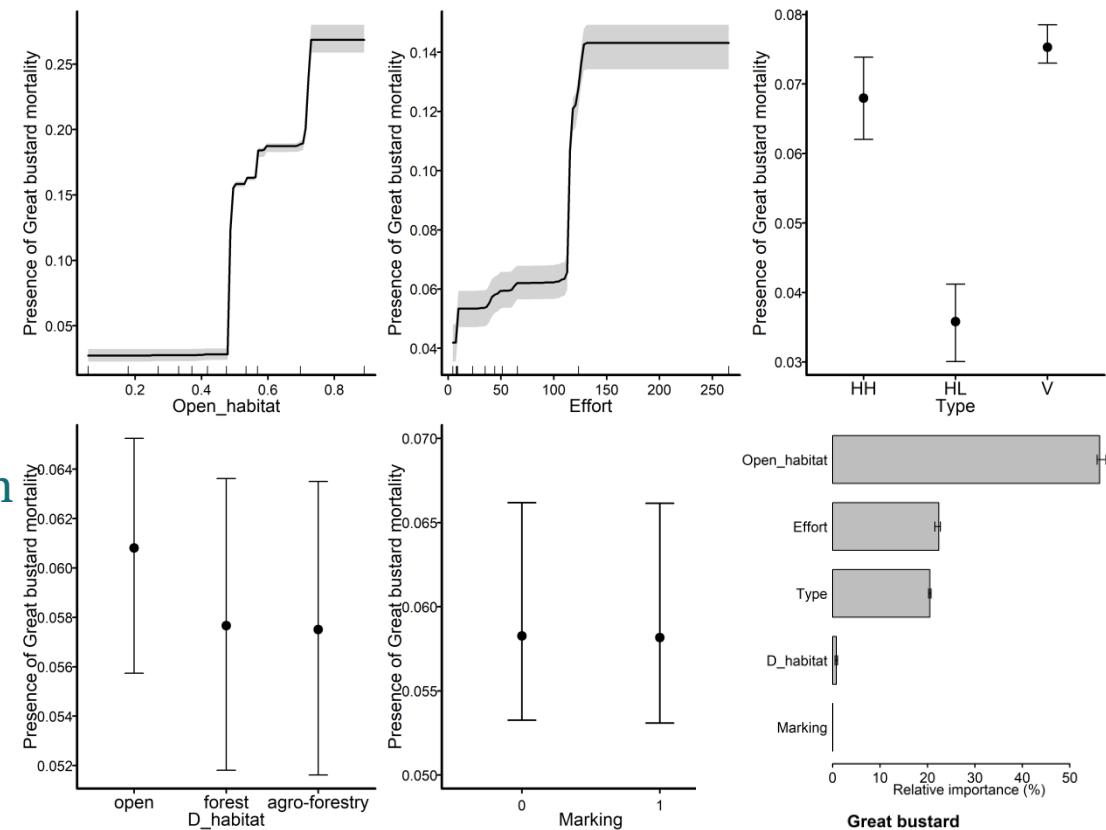
COLLISION RISK MODELLING



Higher collision risk:

- ✓ >50% open farmland habitat
- ✓ Pole configuration:
 - not conclusive
- ✓ Wire marking:
 - data insufficient to evaluate an effect in the Great bustard
- ✓ Survey effort

Great bustard



COLLISION RISK MODELLING



Higher collision risk:

- ✓ 20% open farmland habitat

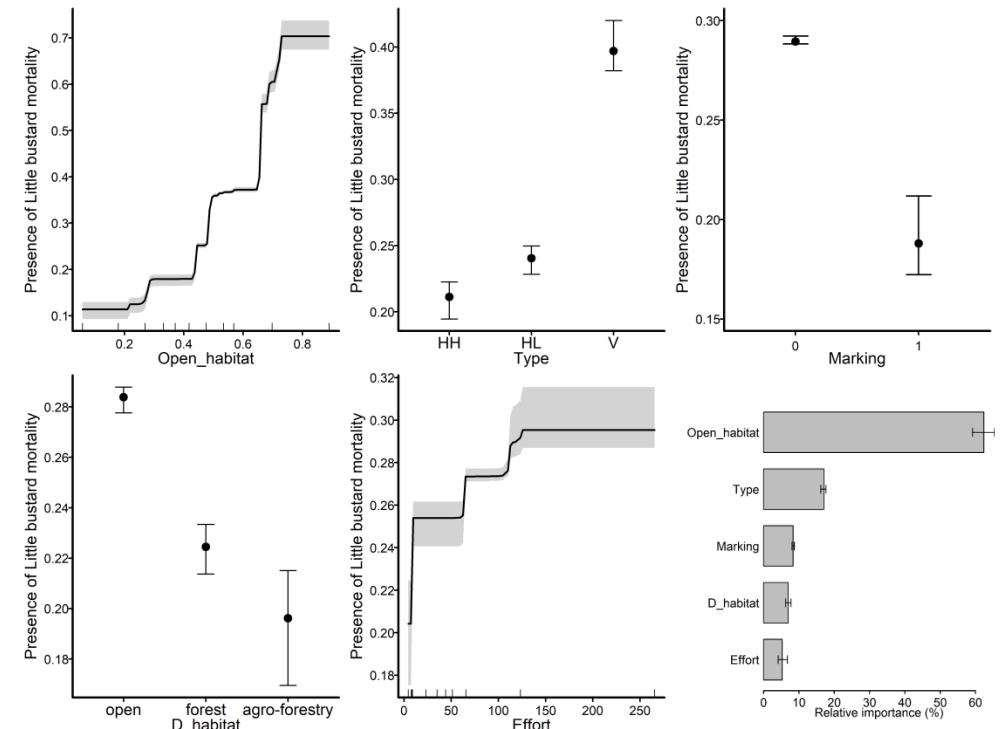
- ✓ Pole configuration:

- taller pylons
- higher no. of vertical wires

- ✓ Wire marking:

- significant but minor effect in reducing Little bustard mortality

Little bustard





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RECOMENDATIONS

RECOMENDATIONS

- ✓ Transmission power lines should avoid crossing large areas of open farmland habitat, **even outside SPAs**
- ✓ Whenever this is not possible, power lines in open farmland habitat should have small pylons, a reduced number of collision plans (with less cables displaced vertically) and small distances between top and bottom wires
- ✓ Lines crossing >20% of open habitats should have marking devices
- ✓ Experimental BACI designs should be used to test new marking devices for bustards' species



THANK YOU!

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