HUMANS SHIELD GOLDEN JACKALS FROM WOLVES IN THEIR EXPANSION ACROSS EUROPE:

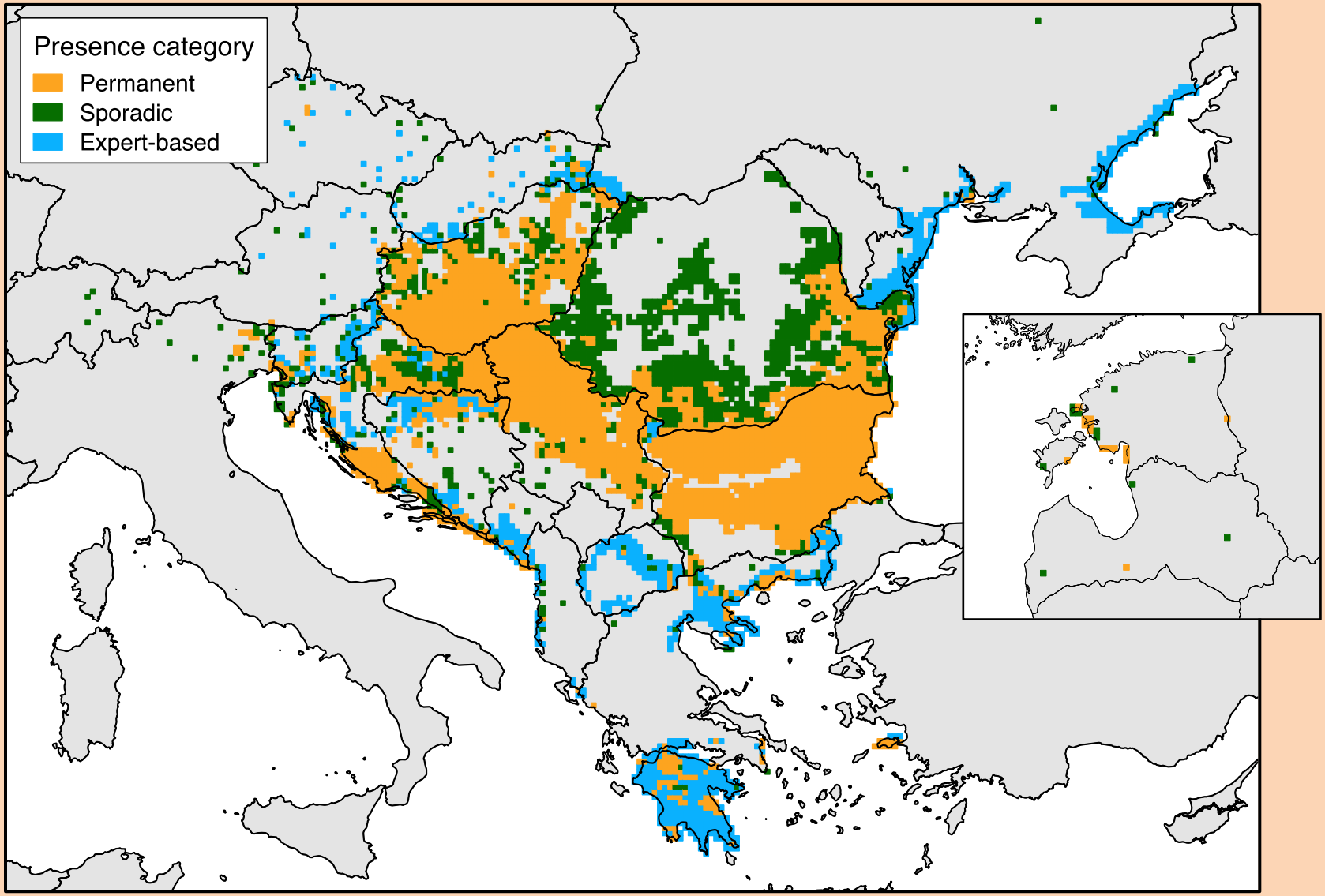
Nathan Ranc and Miha Krofel

C.C. Wilmers, D. Warton, L. Maiorano, F. Cagnacci, I. Acosta-Pankov, F. Álvares, O. Banea, T. Berce, J. Červinka, D. Ćirović, N. Ćosić, L. Gál, G. Giannatos, N. Guimarães, J. Hatlauf, M. Heltai, G. Ivanov, J. Lanszki, L. Lapini, P. Männil, D. Melovski, D. Migli, J. Mladenovic, M. Pavanello, A. Penezić, A. Petrova, M. Šálek, A. Sallay, I. Selanec, A. Selimovic, T. Sforna, A. Stojanov, L. Szabó, I. Trbojević, T. Trbojević and P. Urban

INRAE

UC SANTA CRUZ

Current Distribution

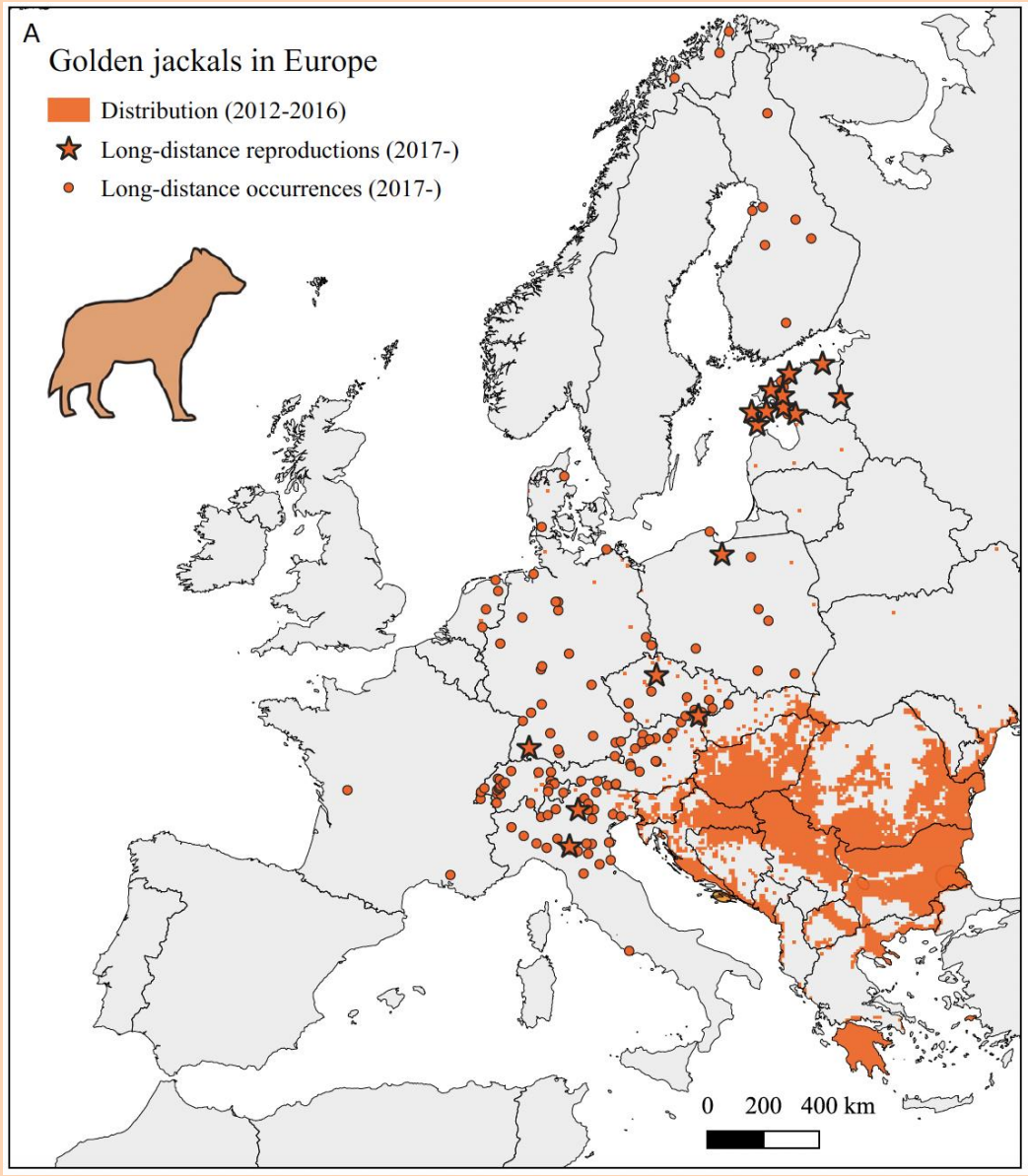


Ranc et al. 2022

Habitat Plasticity

land-use examples

Ongoing Expansion



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Reason for Expansion?

Study Objectives

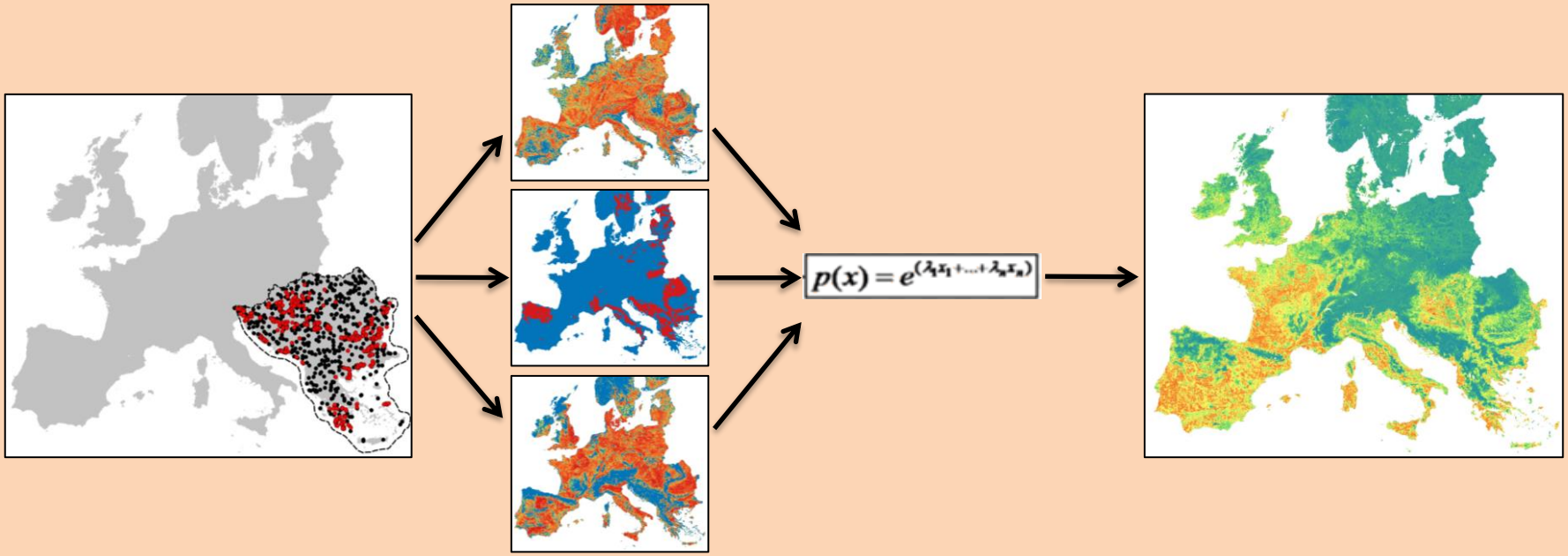
(1) Identify ecological drivers of species distribution – especially the role of wolves

(2) Predict "suitability" beyond current range

(3) Explore potential drivers of recent jackal expansion

METHODS

Species Distribution Modelling



Point locality data
- Detection
- Non-detection

+

Environmental covariates

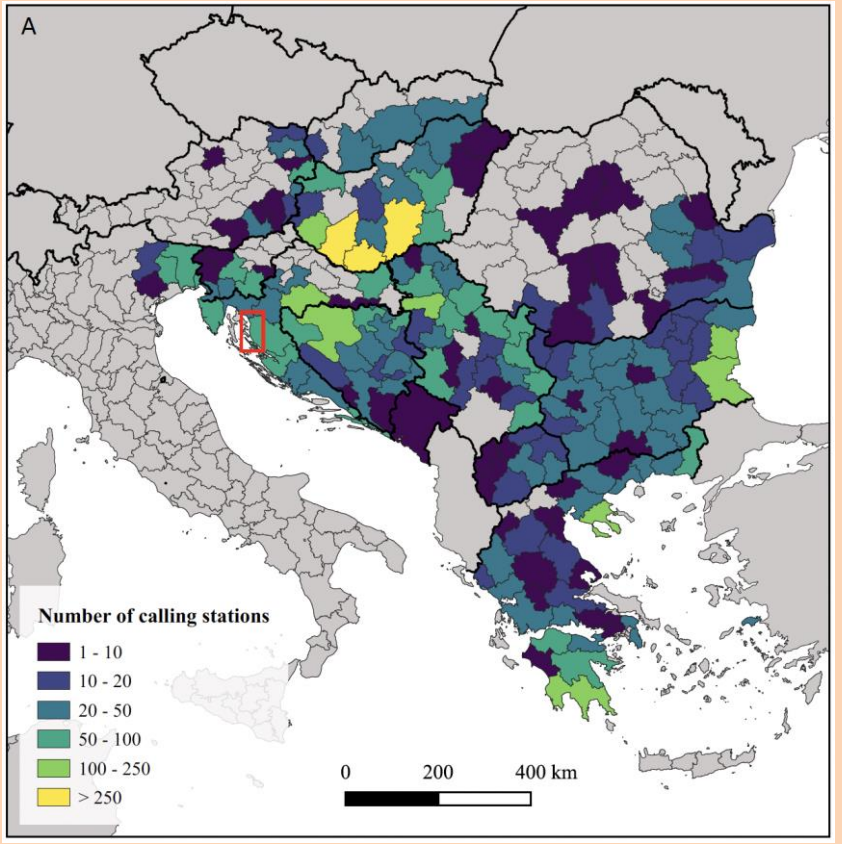
Detectability covariates

Complementary log-log GLM

Model output
(common level of detection)

General Framework

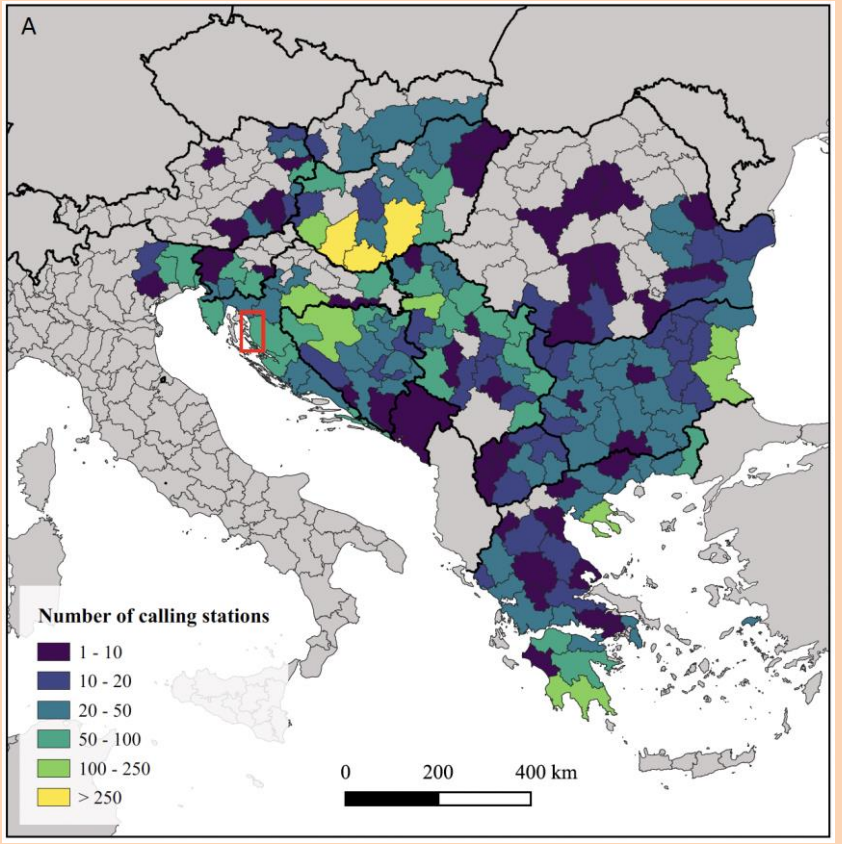
- **Detection/non-detection data from howling survey transects**



General Framework

- Detection/non-detection data from howling survey transects

- **Diverse environmental covariates (+ detectability covariates)**
  - abiotic
  - land cover
  - biotic interaction
  - **species expansion process!**



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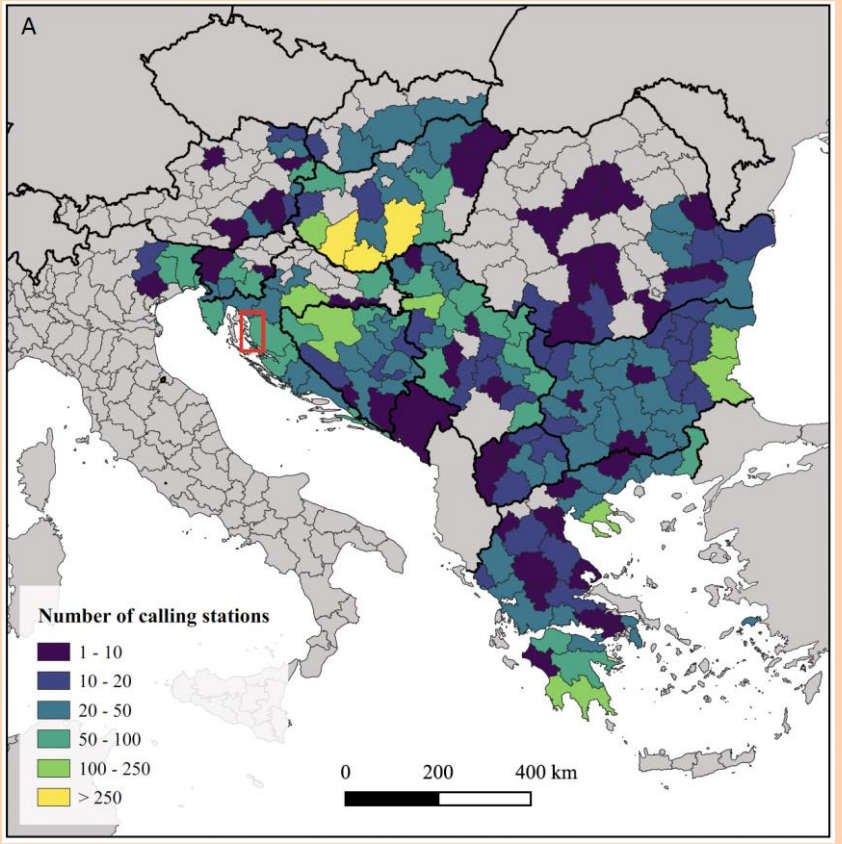
- **Validation (intra + hunting bags)**



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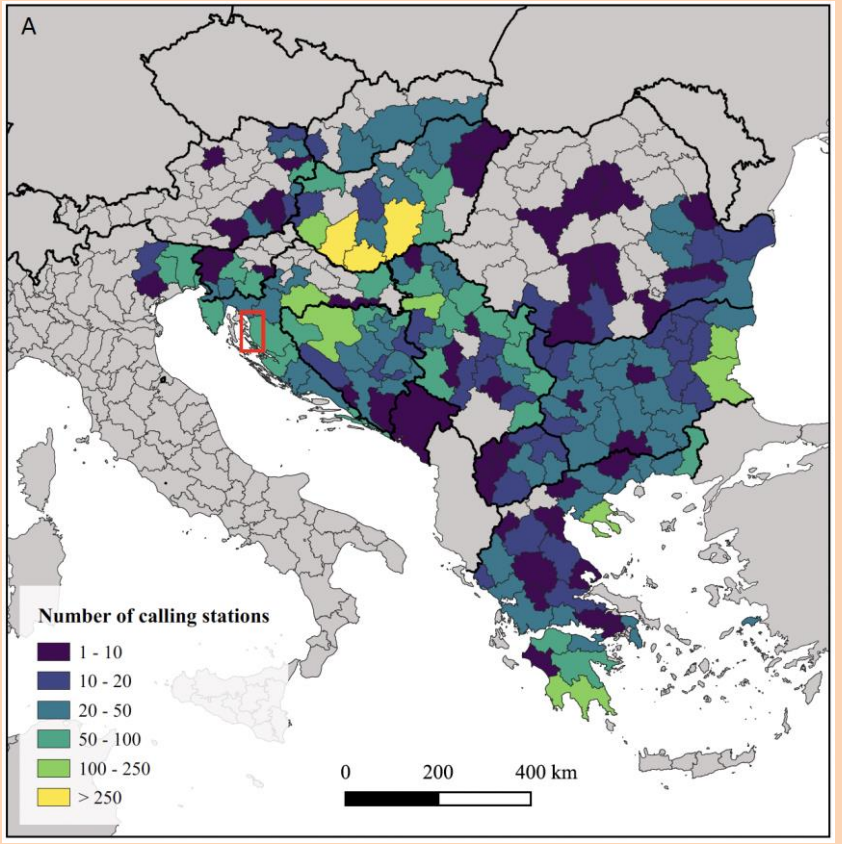
- Validation (intra + hunting bags)
- **Projection across Europe**



Land Cover Covariates

- FoesCorine Land Cover – **forest cover**
  - Temporal coverage: 2000, 2006, and 2012
  - Resolution: 250 m
- Copernicus Imperviousness – **distance to human development**
  - Temporal coverage: 2006, 2009, 2012 & 2015
  - Resolution: 100 m
- Copernicus Water & Wetness dataset – **distance to water**
  - Temporal coverage: 2015
  - Resolution: 100 m

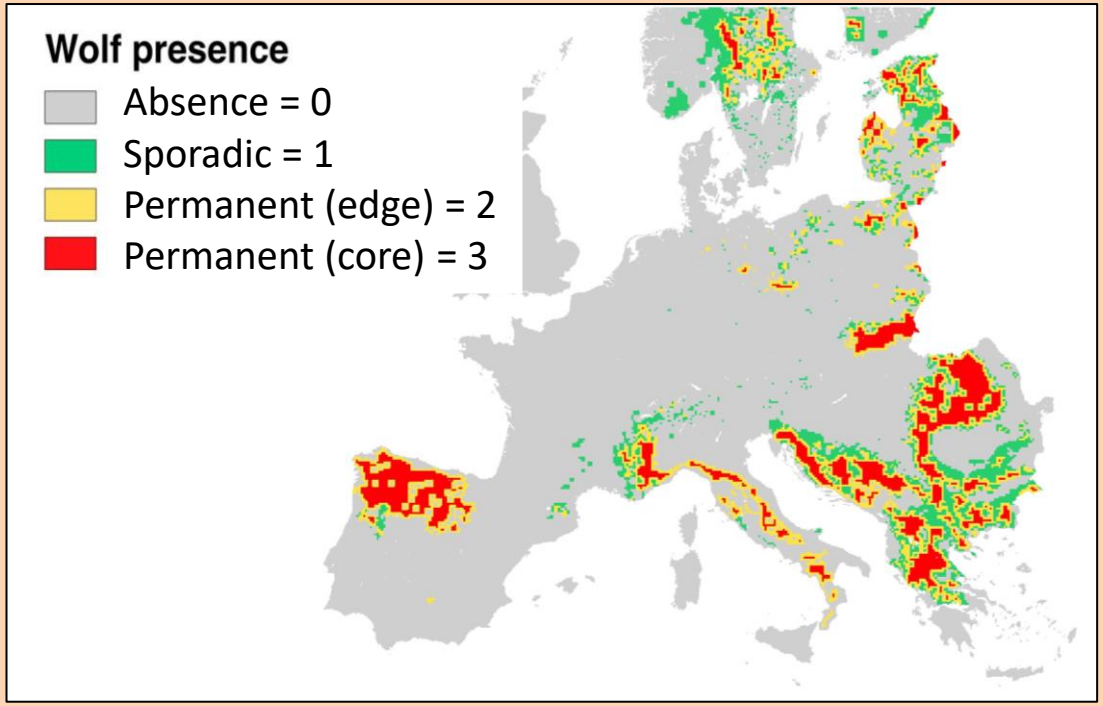
Abiotic Covariate

- MODIS **Snow cover duration**
  - Temporal coverage: average since year 2000
  - Resolution: 500 m

Biotic Interaction

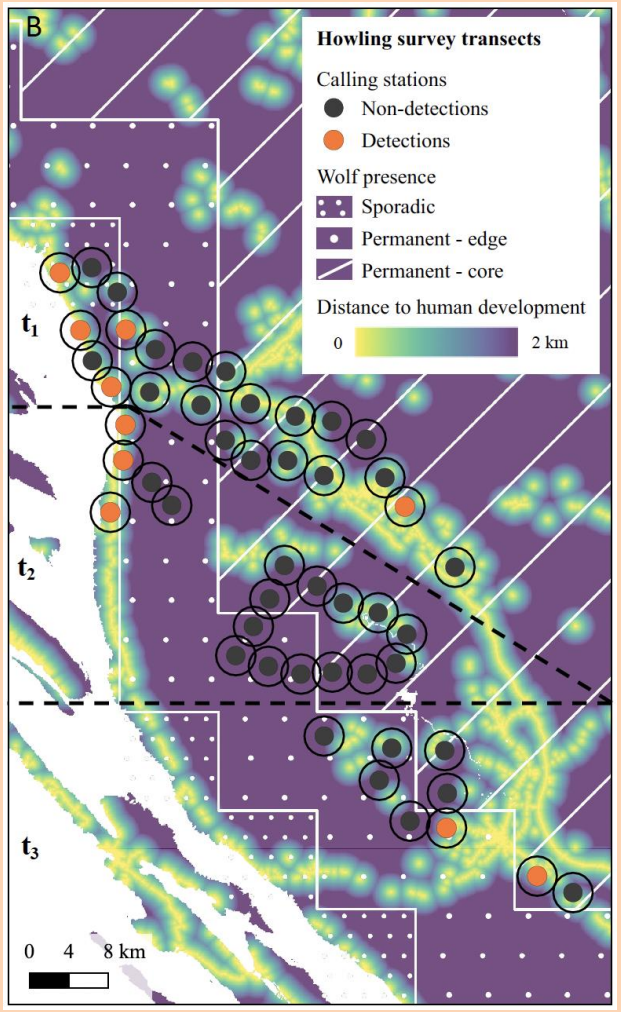
- **Grey wolf *(Canis lupus)* presence**
  - Dataset: LCIE, 2007-2011 and 2012-2016
  - Resolution: 10 km
  - Ordinal

- **Shield effect wolf:distance from humans**



Additional Presence Covariates

- **Transect** as random effect **+ autocovariate**



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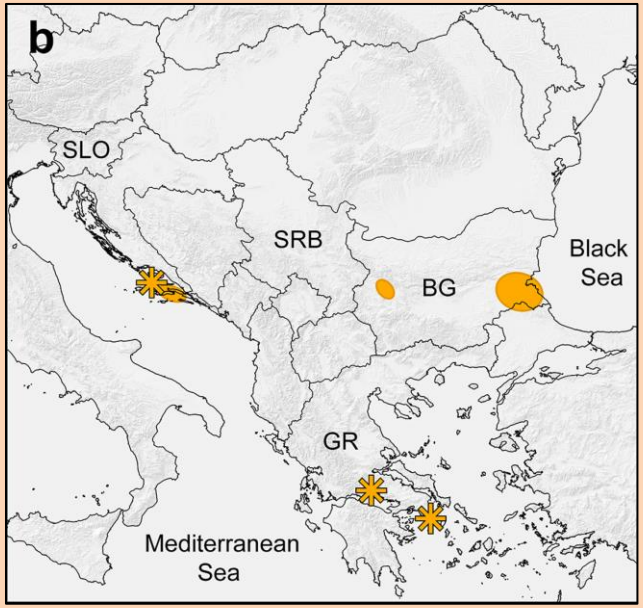
- **Distance from pre-1500 distribution** (log-transformed) => equilibrium assumption



Krofel et al., 2017

Detectability Covariates

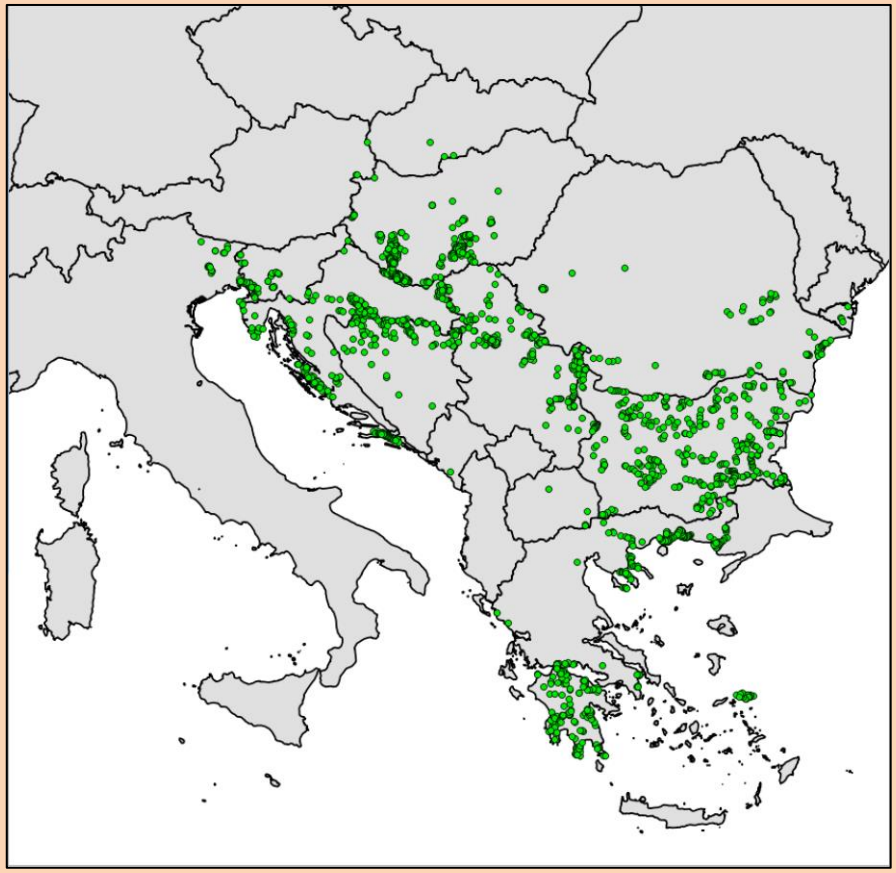
- Julian date
- Hour
- Number of broadcast repeats
- Listening time duration between repeats

RESULTS

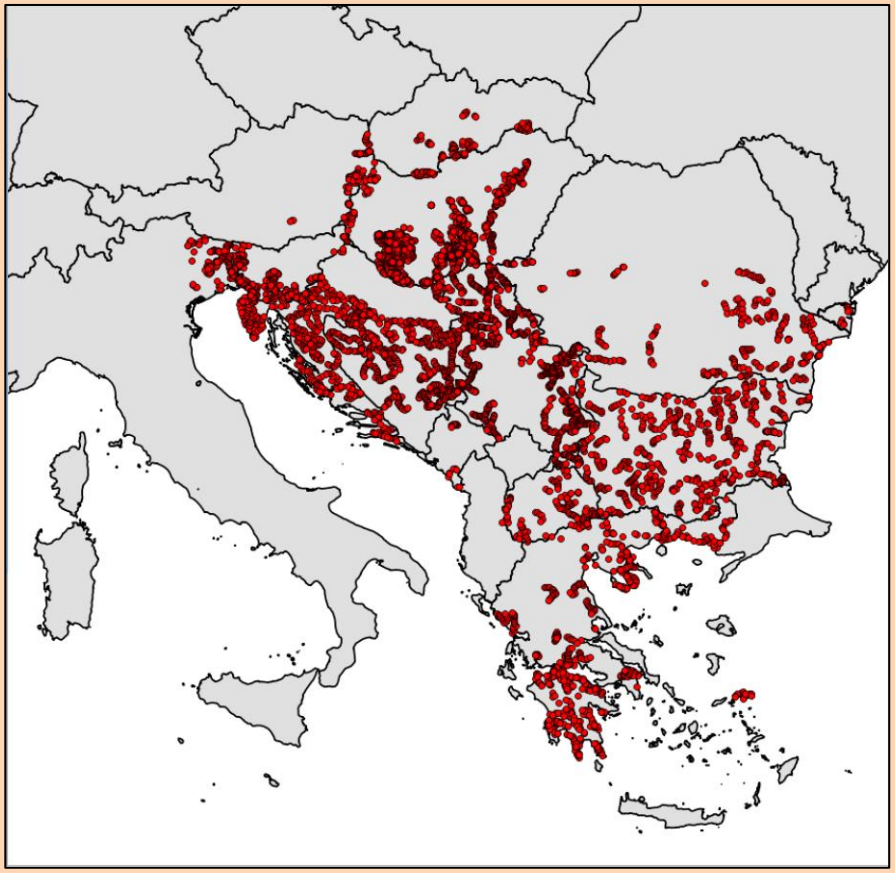
Howling survey stations

n total = 8991

Positive: n = 1537



Negative: n = 7454



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Model Selection and Fit

- **Best Supported Model:**

Covariates	**BIC score**
Distance origin	186.9
Autocovatiate	80.2
Wolf	47.2
Snow	39.6
Distance humans	29.3
Forest^2	24.0
Distance water	13.6
Shield effect wolf:human	7.2

Covariates	***BIC score***
Forest	*NA*
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Survey year	*NA*
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- **R-squared: 0.30**

- **Good validation (AUC = 0.7; ρ = 0.76 for hunting bags)**

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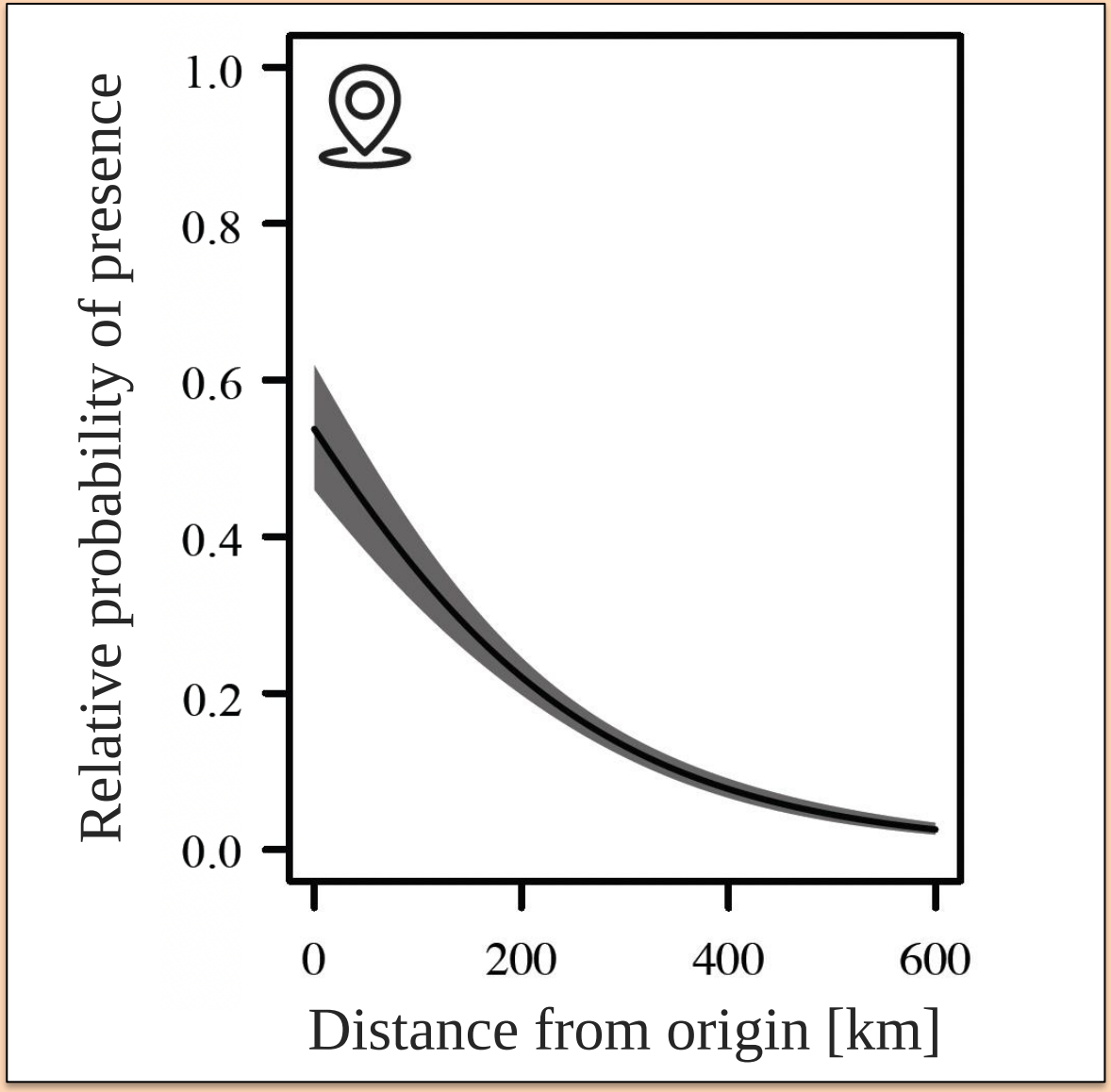
Distance from origin



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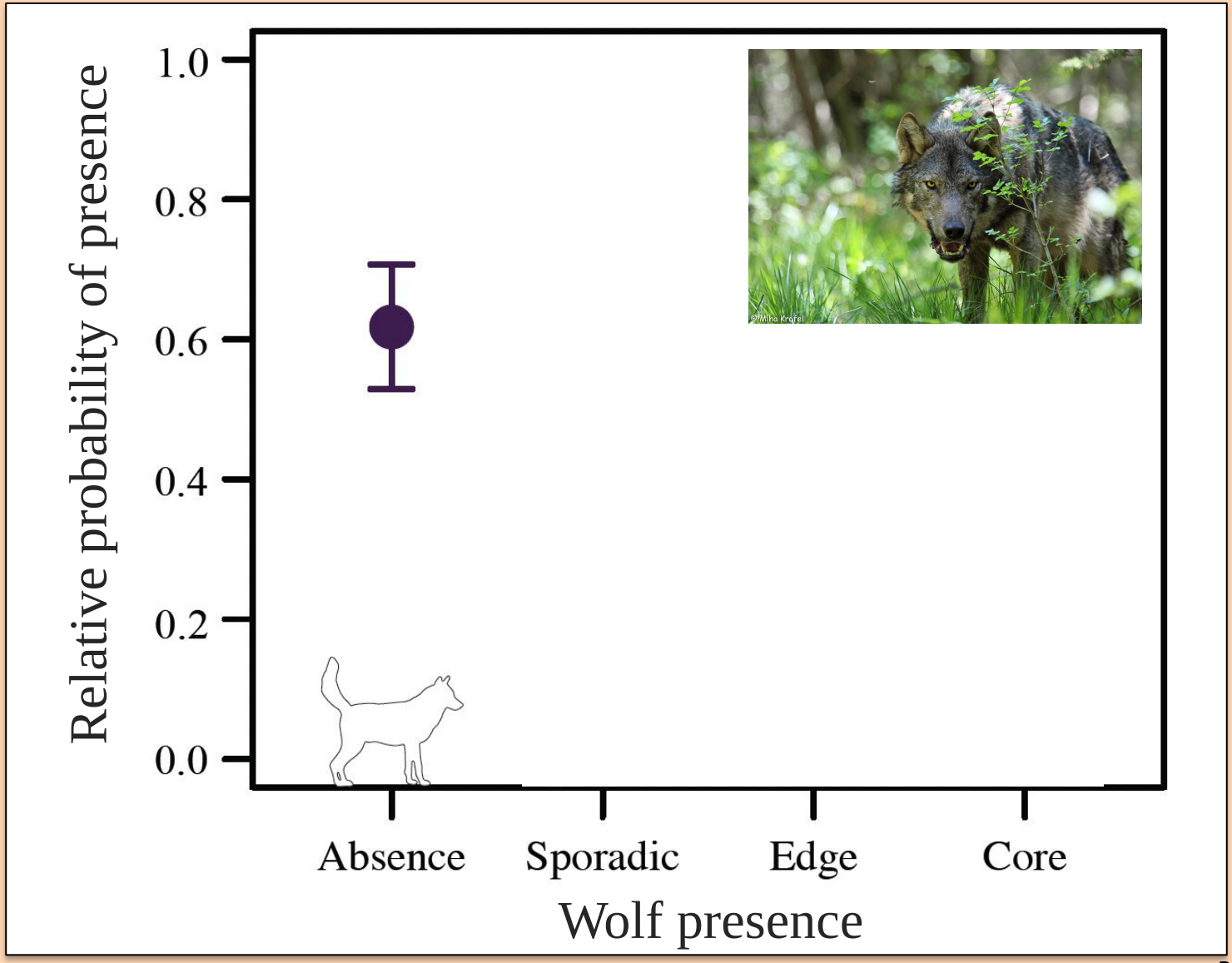
Wolf presence



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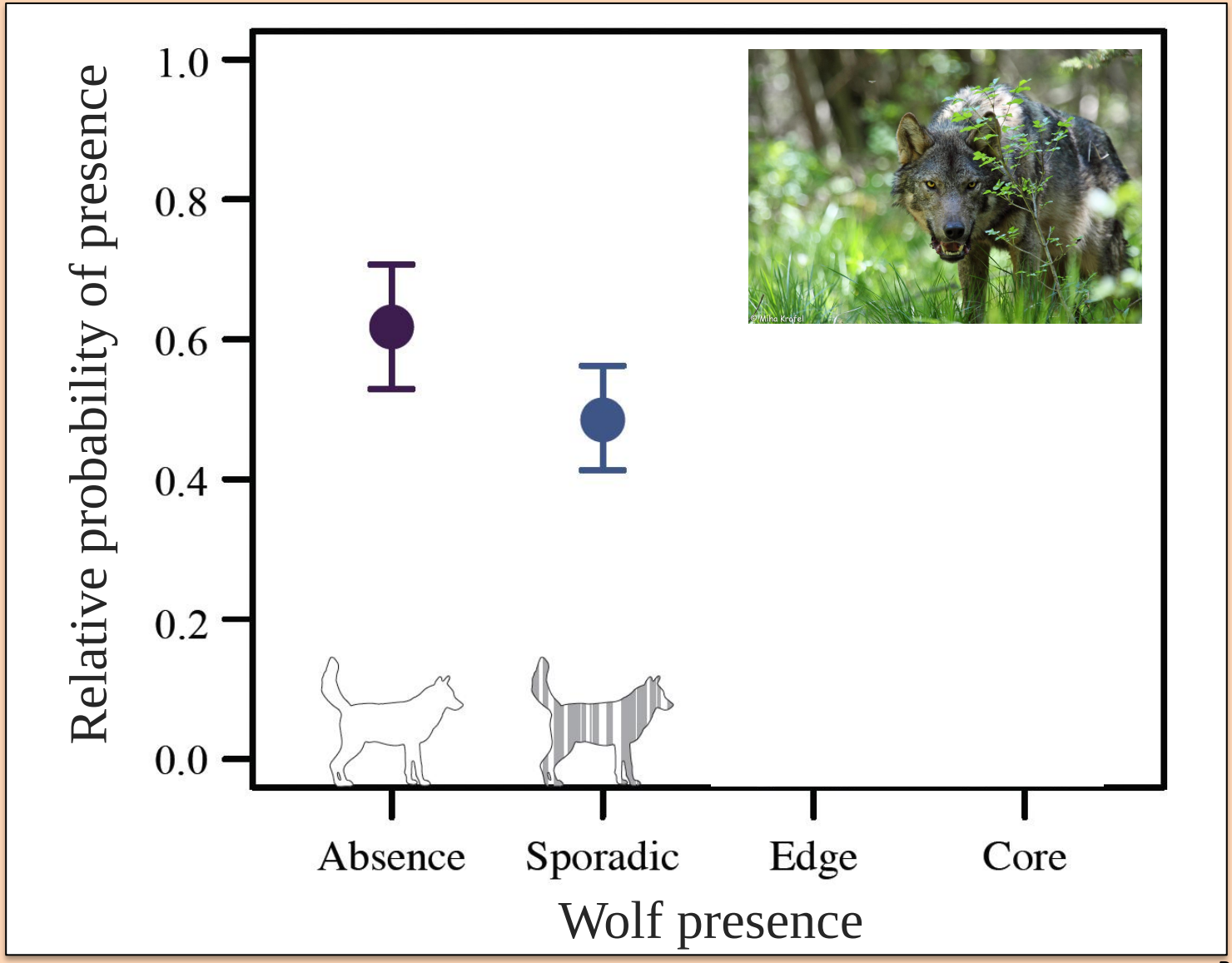

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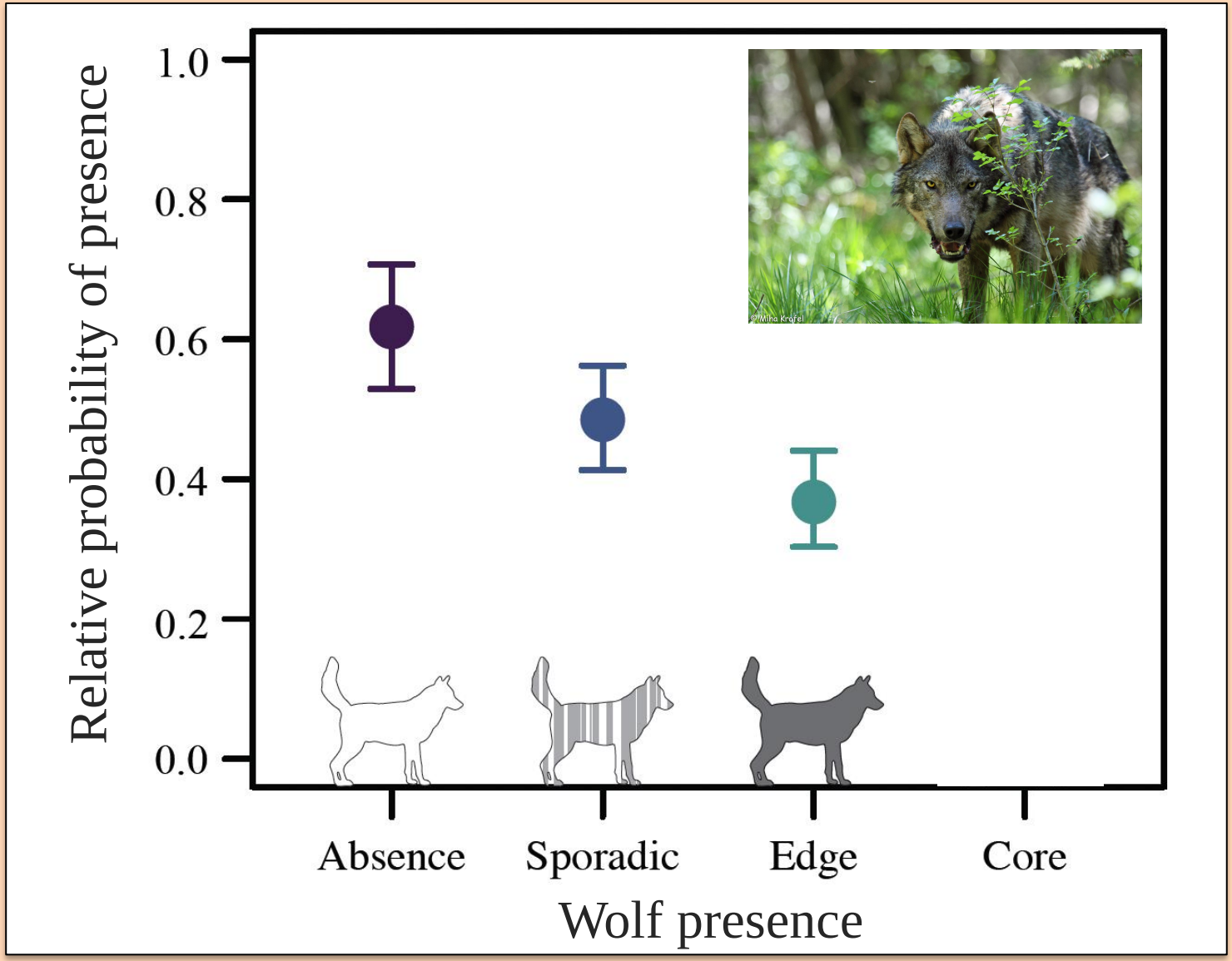

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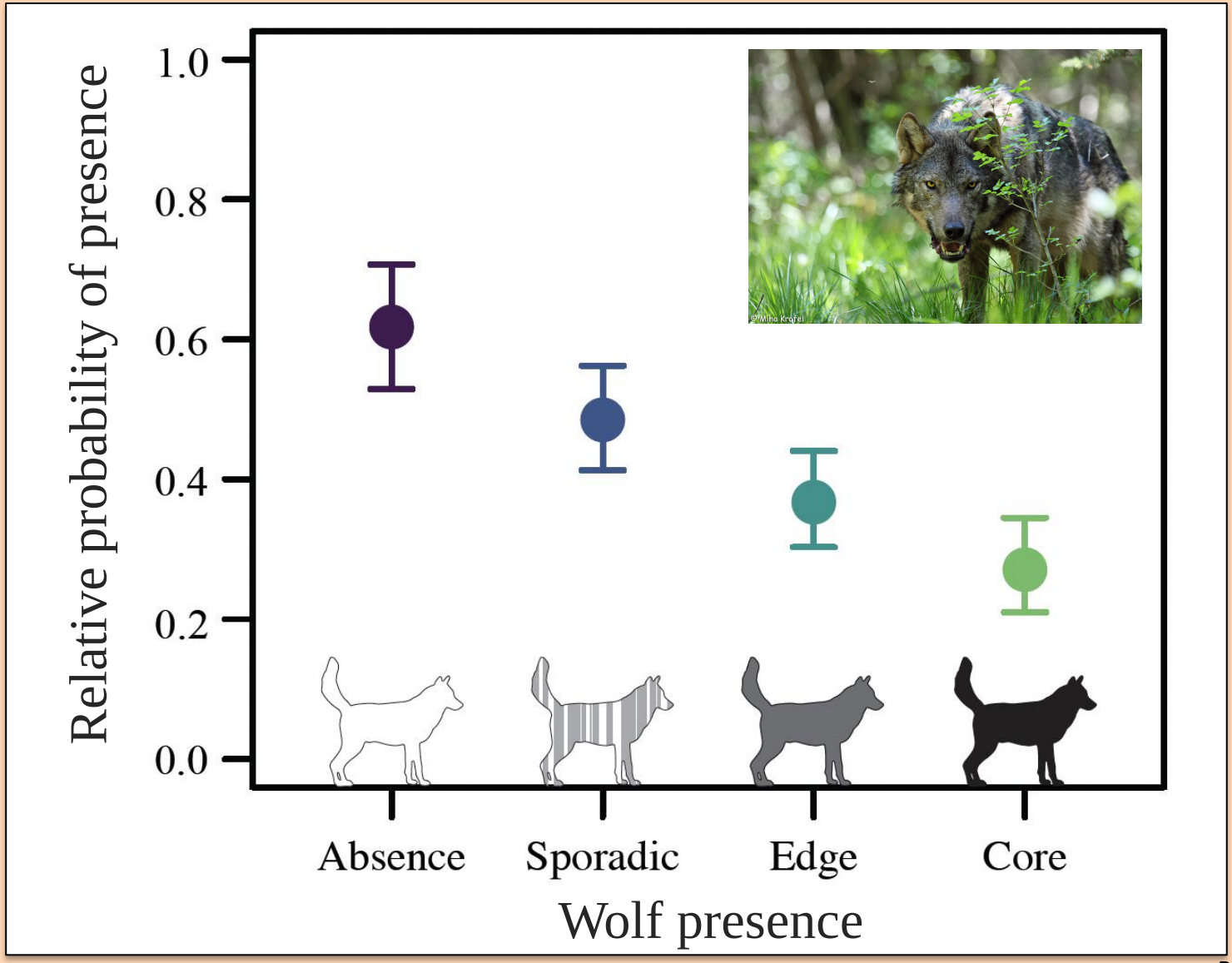

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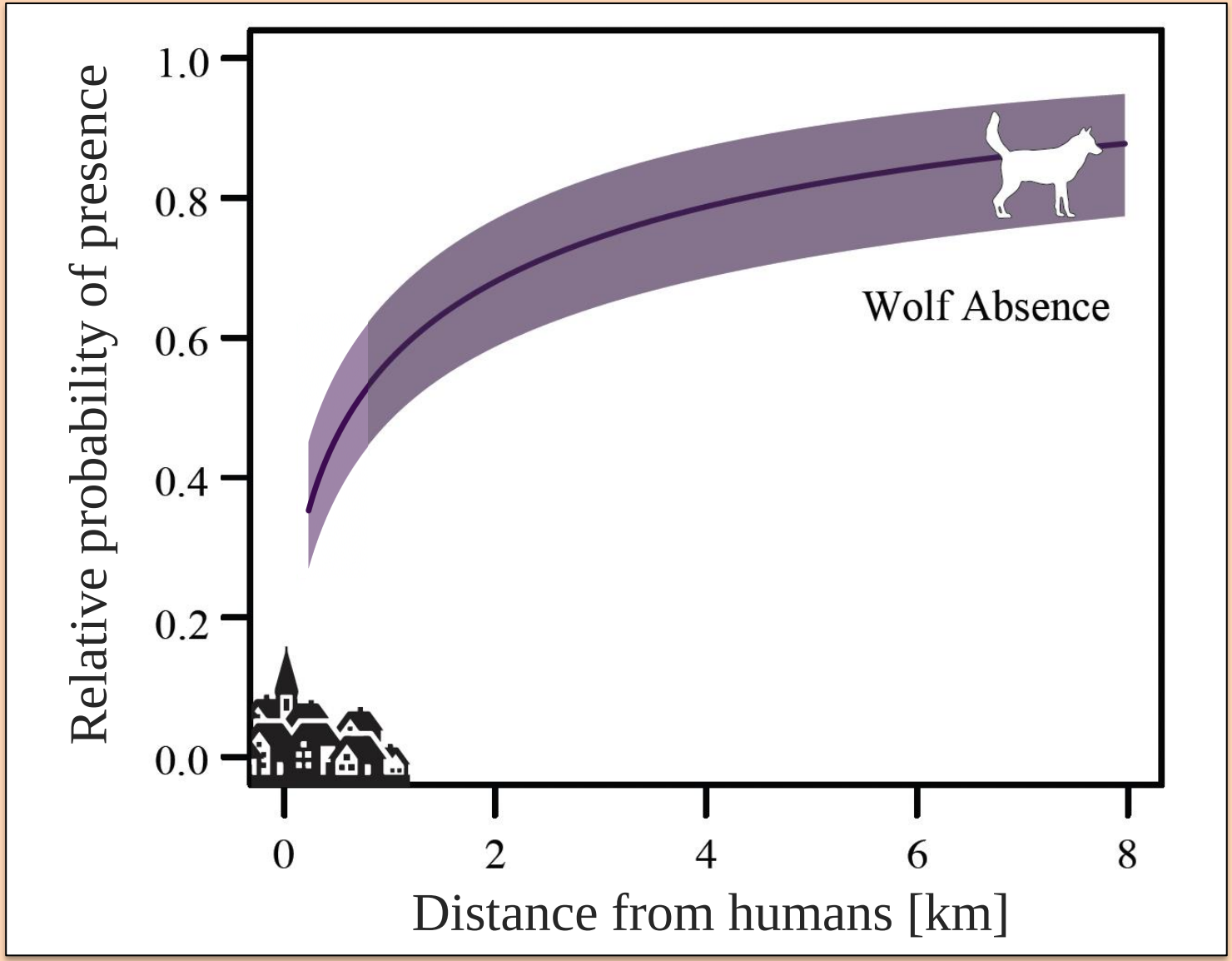
Human shield



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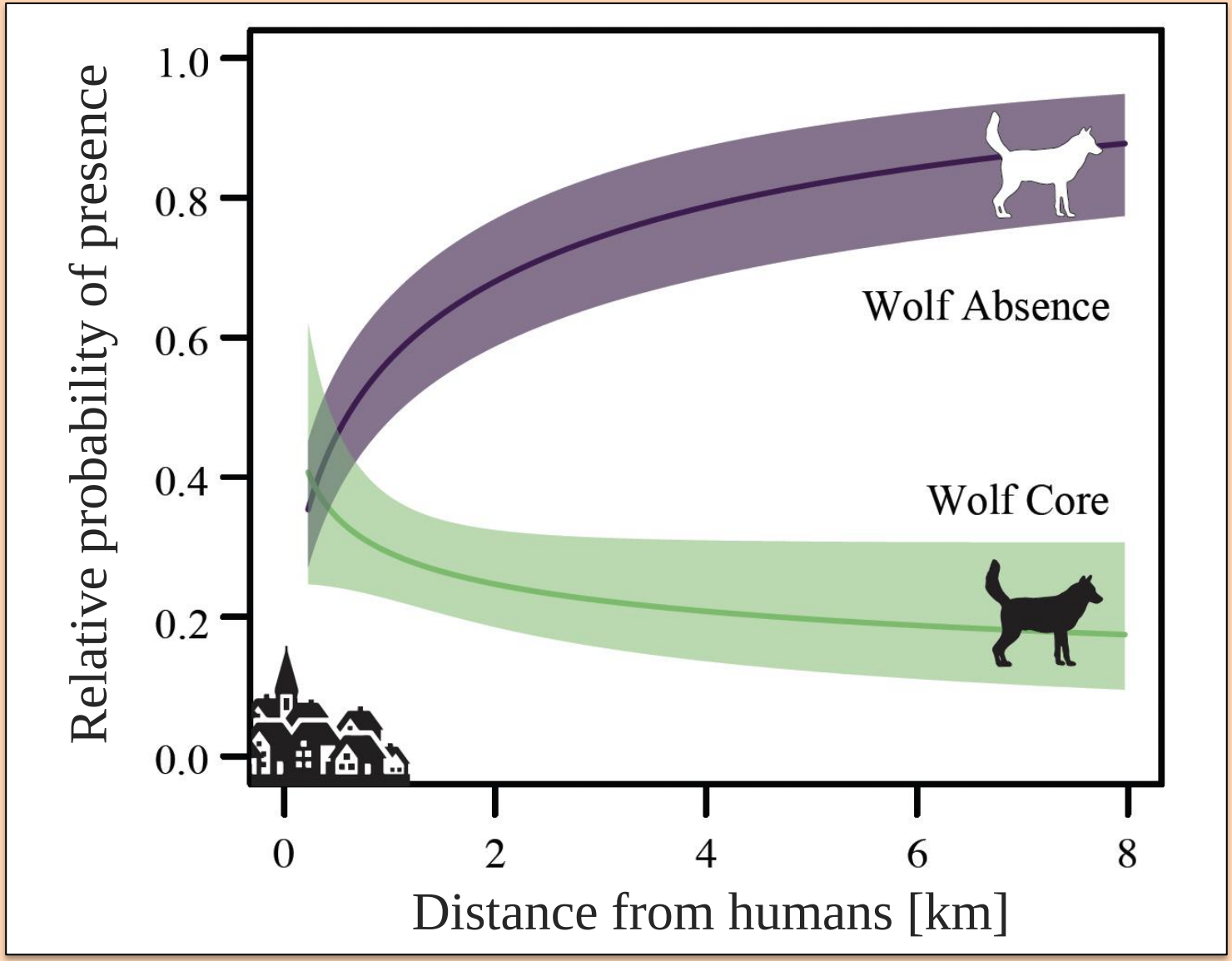

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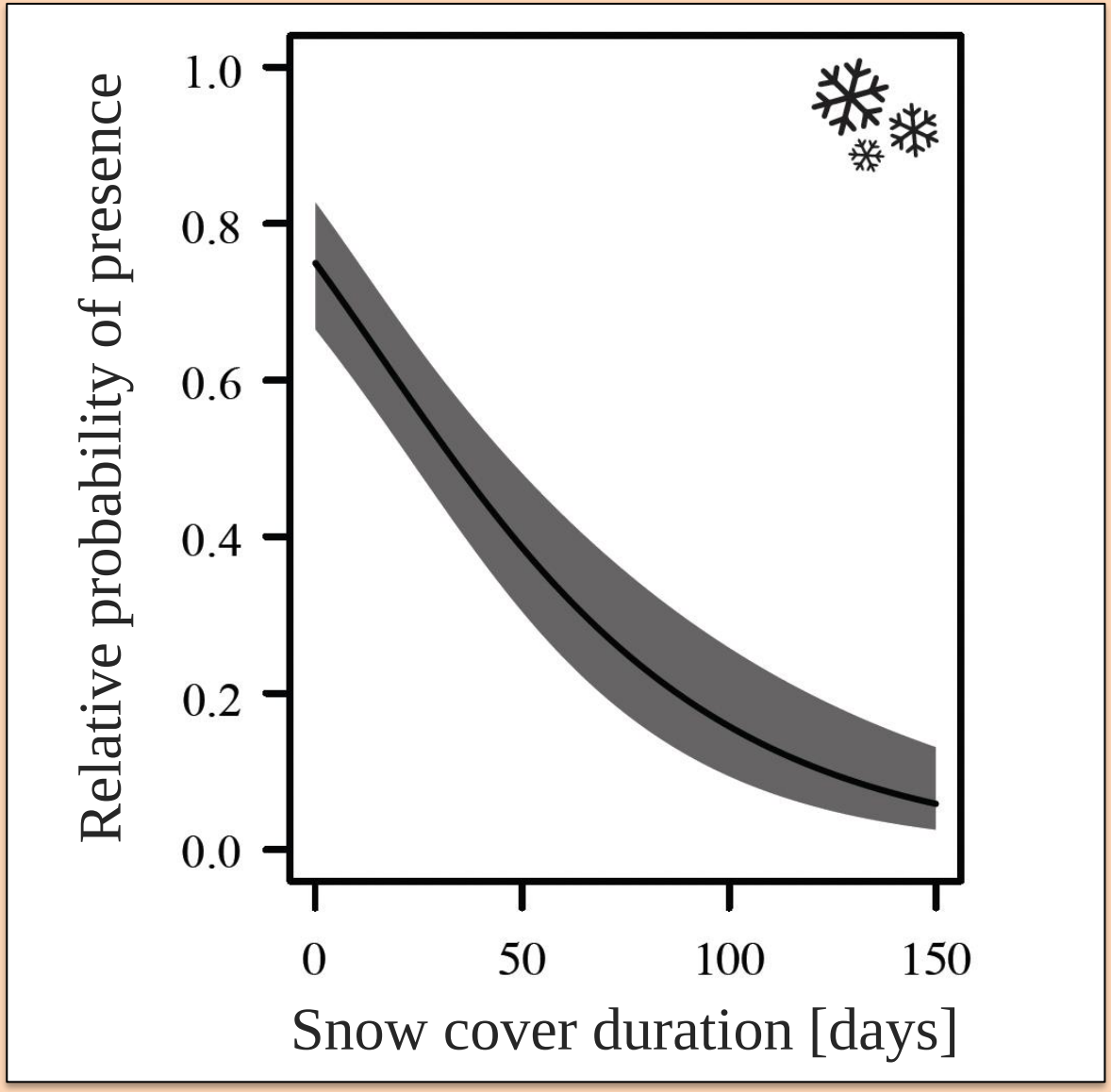
Snow cover duration



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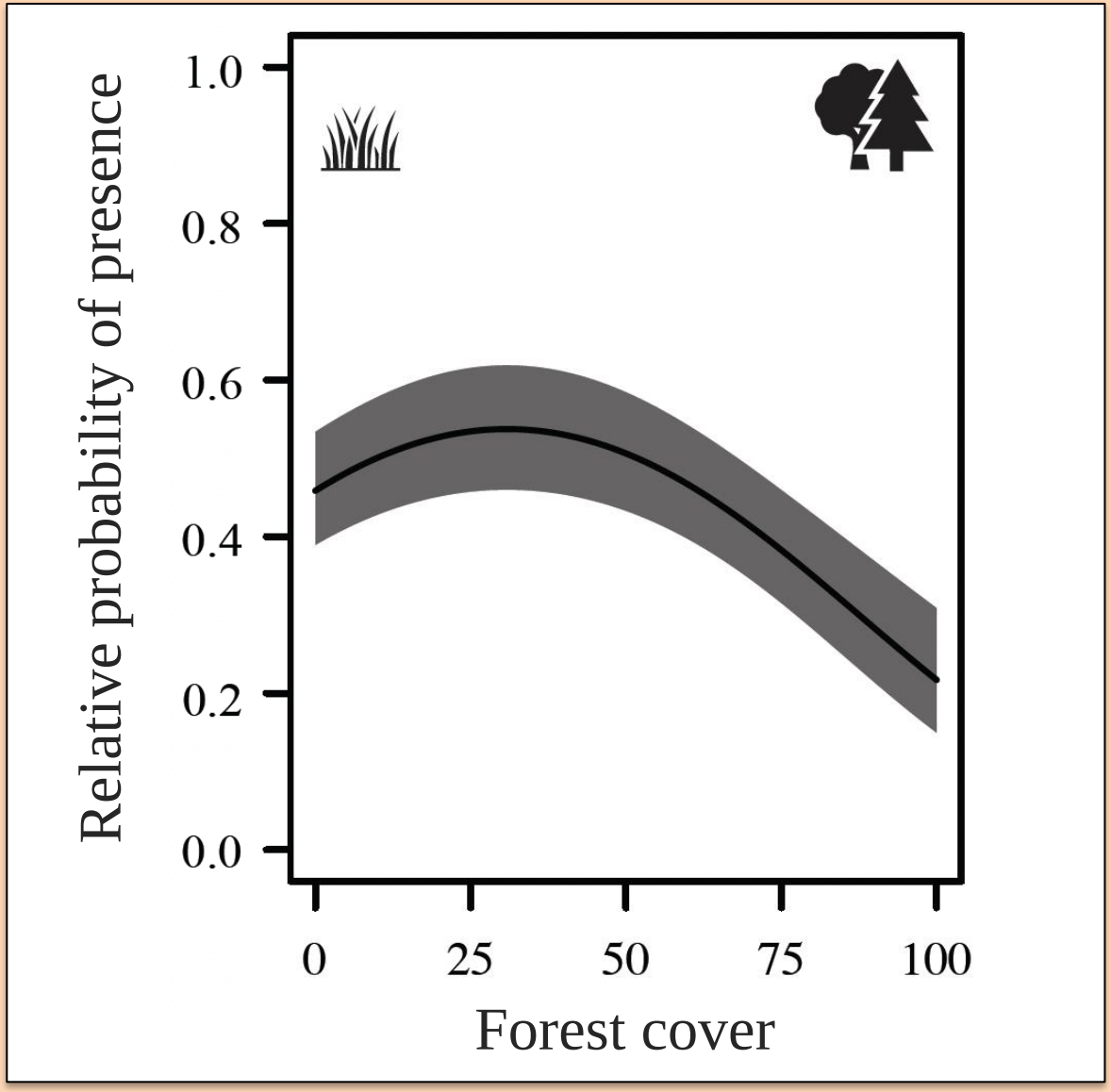
Forest cover



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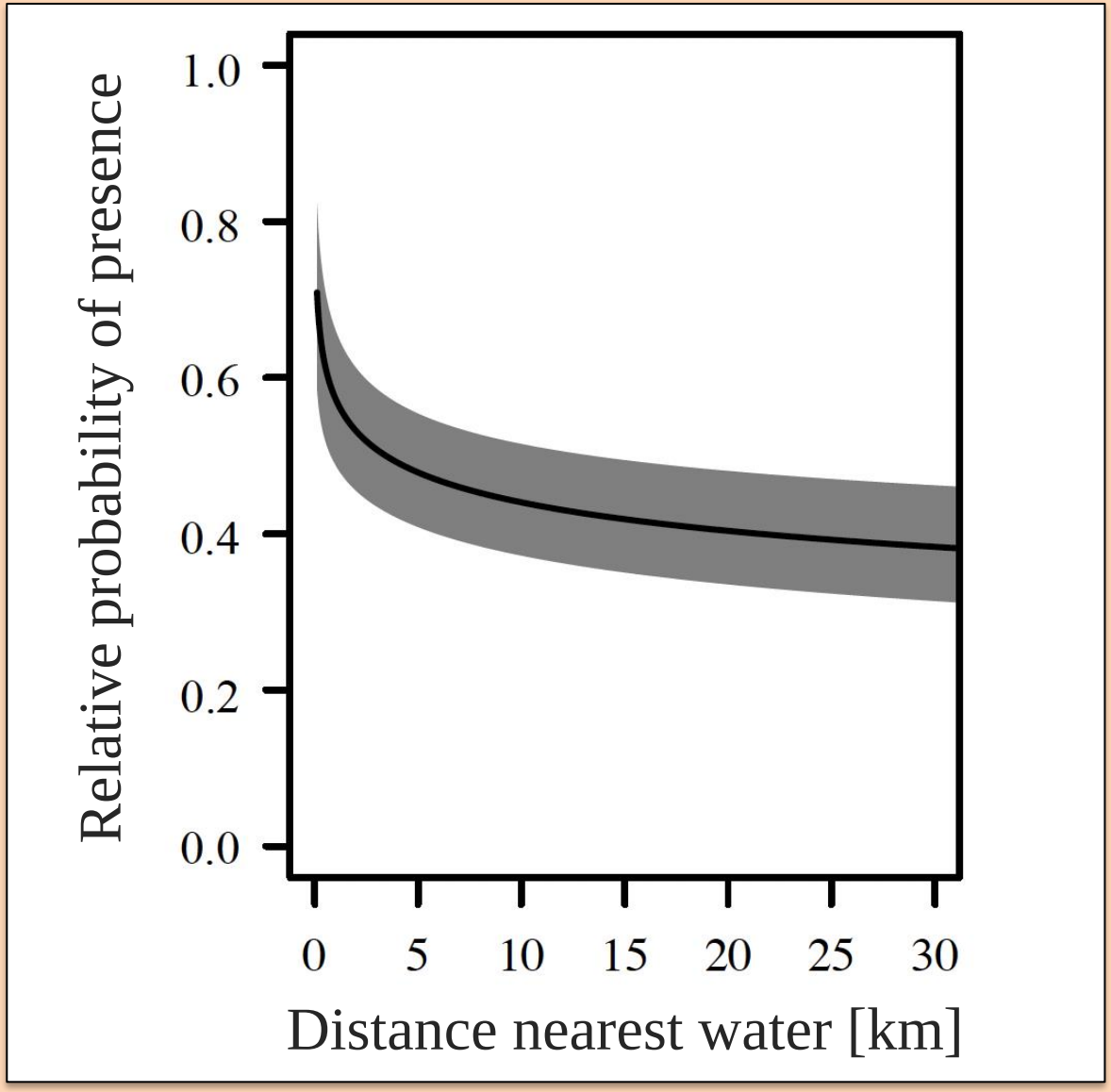
Distance nearest water



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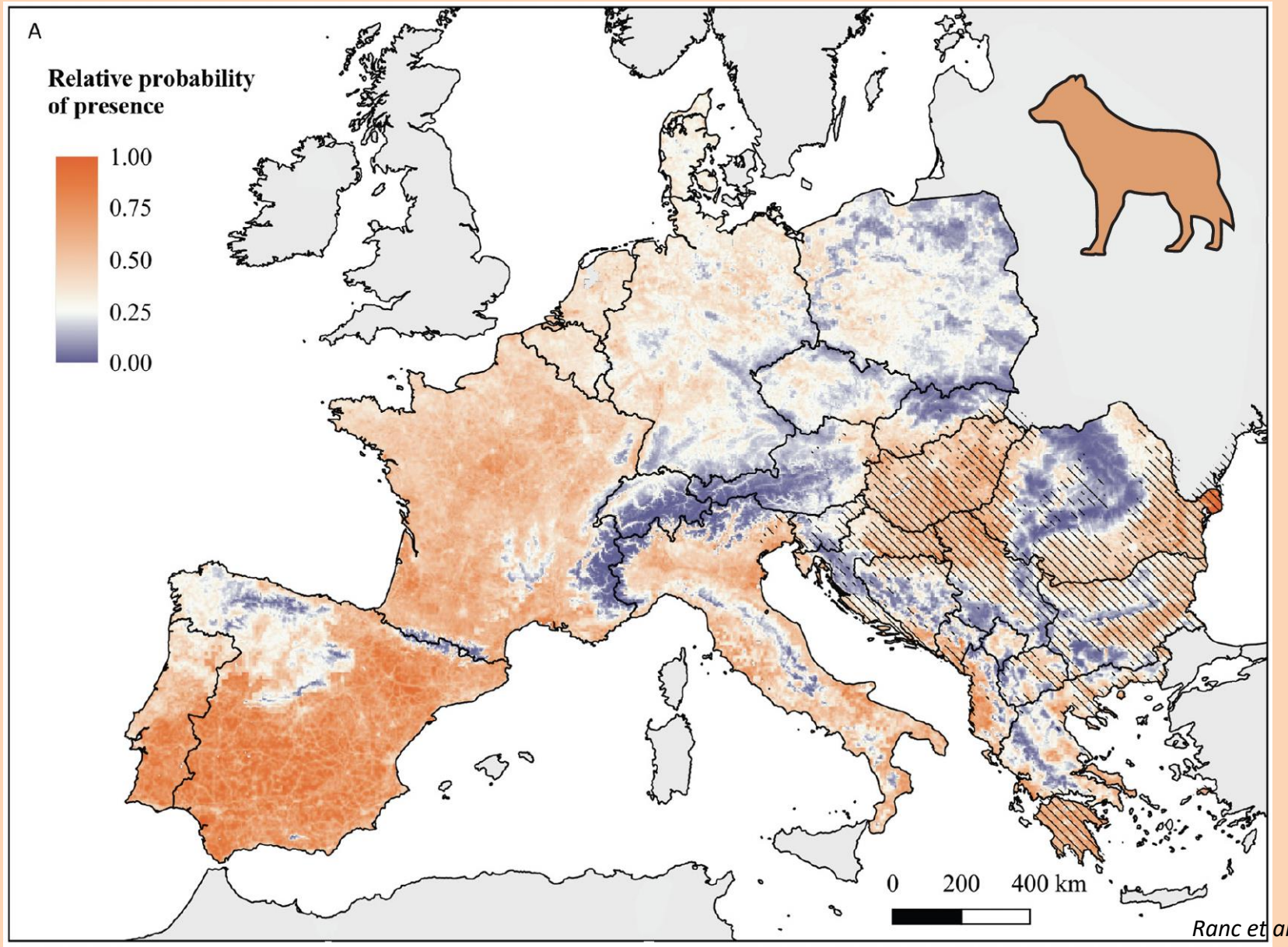
Predictions

spatial pattern



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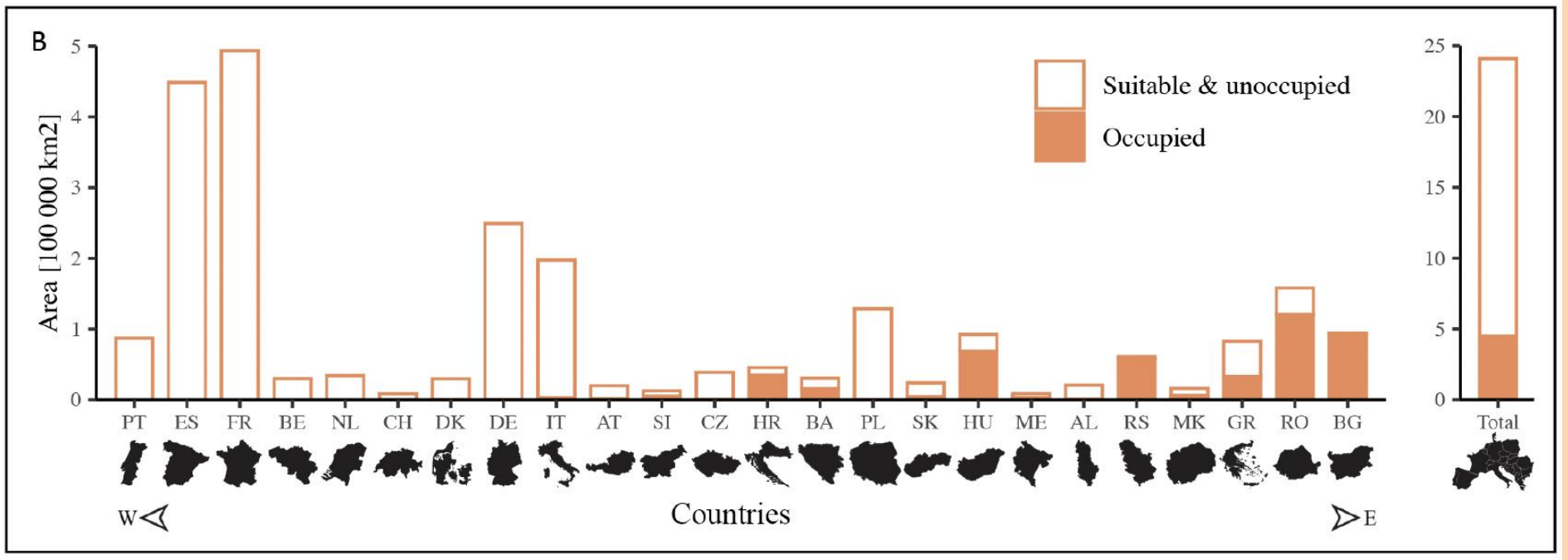
Predictions

amount of suitable habitat



- 72% of Europe is suitable to golden jackals!

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Large-scale influence of wolves

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- -55,000 km^2 suitable to golden jackals due to the **recovery of wolves** (+23%) between 2007 and 2016.
- If sporadic **wolf presence consolidates** into permanent presence, we can expect -170,000 km^2 to be suitable.

The Role of Anthropogenic Resources

- Jackals largely use <u>waste dumps</u> and <u>remains</u> of game and livestock.
- Availability of anthropogenic food affects both distribution and density.
- Difficulty to quantify and map this resource (often illegal).

SUMMARY

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- Jackals can inhabit areas of wolf presence by using a human shield.
- A lot of Europe is suitable to jackals, especially in the West.
- Ongoing wolf recovery is limiting jackal expansion potential.

ACKOWLEDGMENTS

Colleagues, researchers and data contributors

C.C. Wilmers, D. Warton, L. Maiorano, F. Cagnacci, I. Acosta-Pankov, F. Álvares, O. Banea, T. Berce, J. Červinka, D. Ćirović, N. Ćosić, L. Gál, G. Giannatos, N. Guimarães, J. Hatlauf, M. Heltai, G. Ivanov, J. Lanszki, L. Lapini, P. Männil, D. Melovski, D. Migli, J. Mladenovic, M. Pavanello, A. Penezić, A. Petrova, M. Šálek, A. Sallay, I. Selanec, A. Selimovic, T. Sforna, A. Stojanov, L. Szabó, I. Trbojević, T. Trbojević and P. Urban.

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QUESTIONS?

For Further Information:

- Nathan Ranc: **nathan.ranc@gmail.com**