

Different approaches to model the distribution of wild ungulates density in Europe

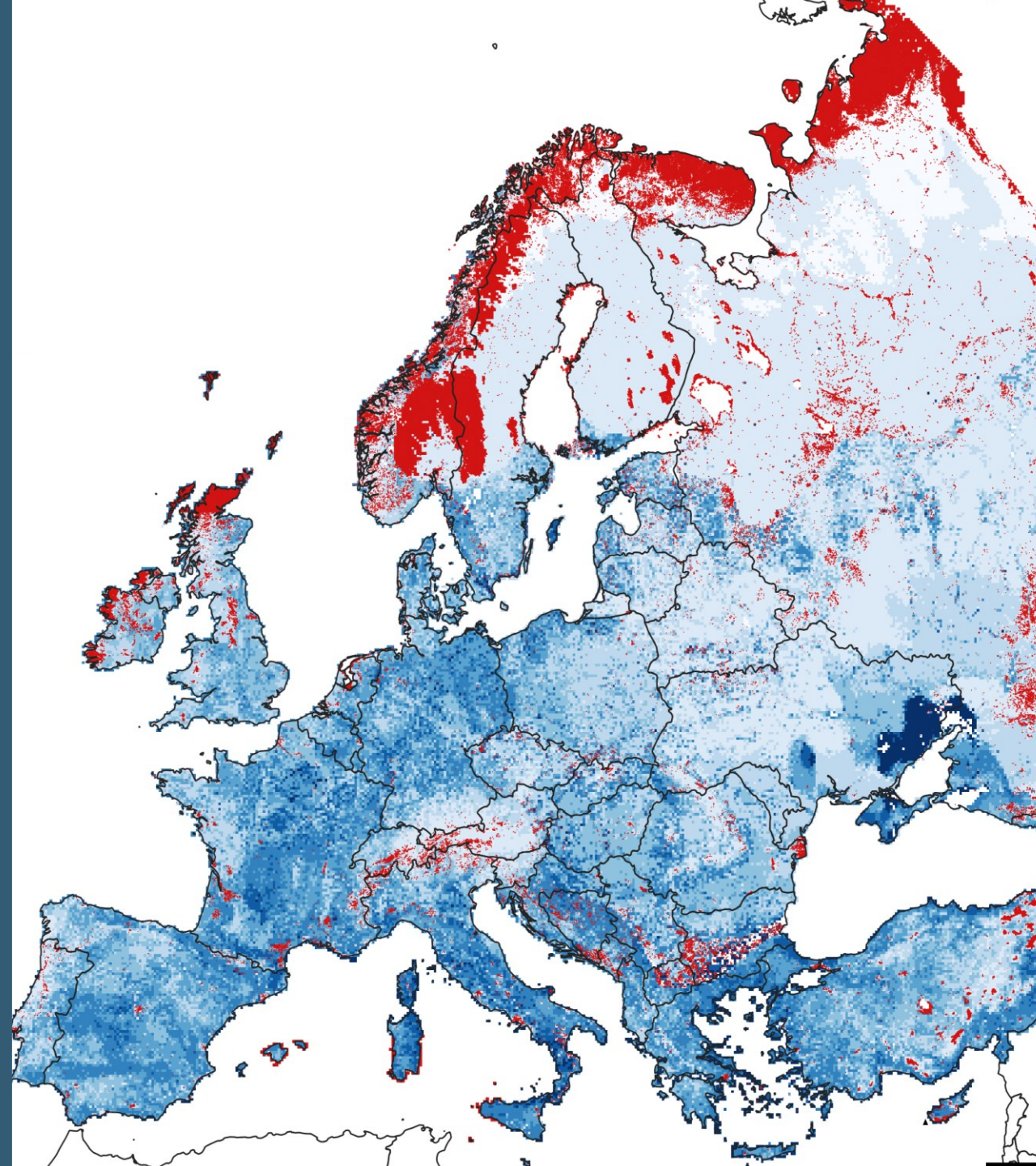
Illanas, S.^a, Fernández-López, J.^{a,b}, Blanco-Aguilar, J. A.^a, Carmen Ruiz^a, Acevedo, P.^a, Vicente, J.^a, and ENETWILD Consortium

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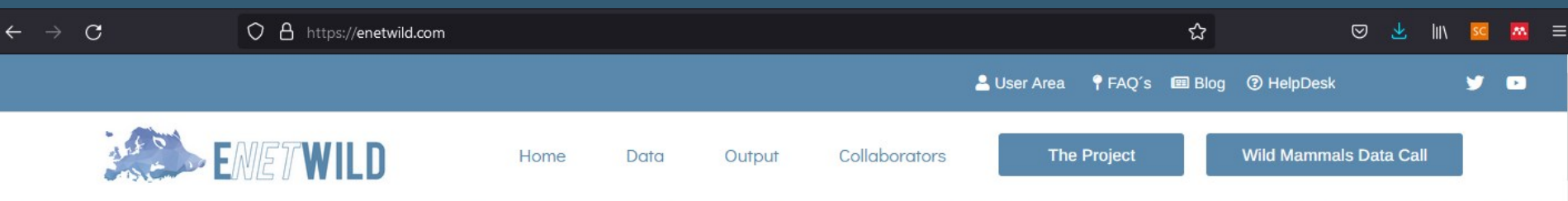
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ENETWILD project

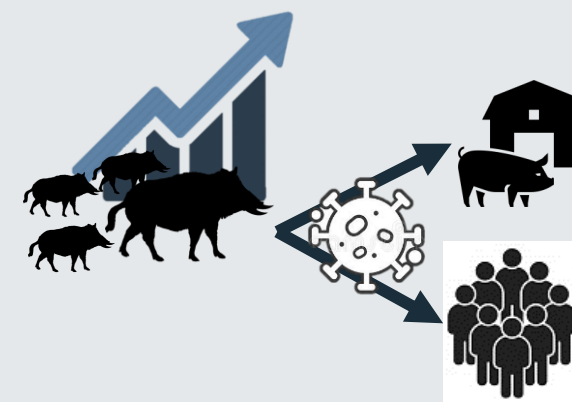


A european network of wildlife professionals capable of providing reliable data on species distribution and abundance of selected host species and their pathogens.

START ▾

Main goals:

- 1) Guidance of estimating population.
- 2) Harmonization of collected data.
- 3) Estimating distribution, abundance and density of wild species across Europe.
- 4) Wildlife-livestock interface



Collaborators, data collected and distribution modeling

ENETWILD consortium, 2019

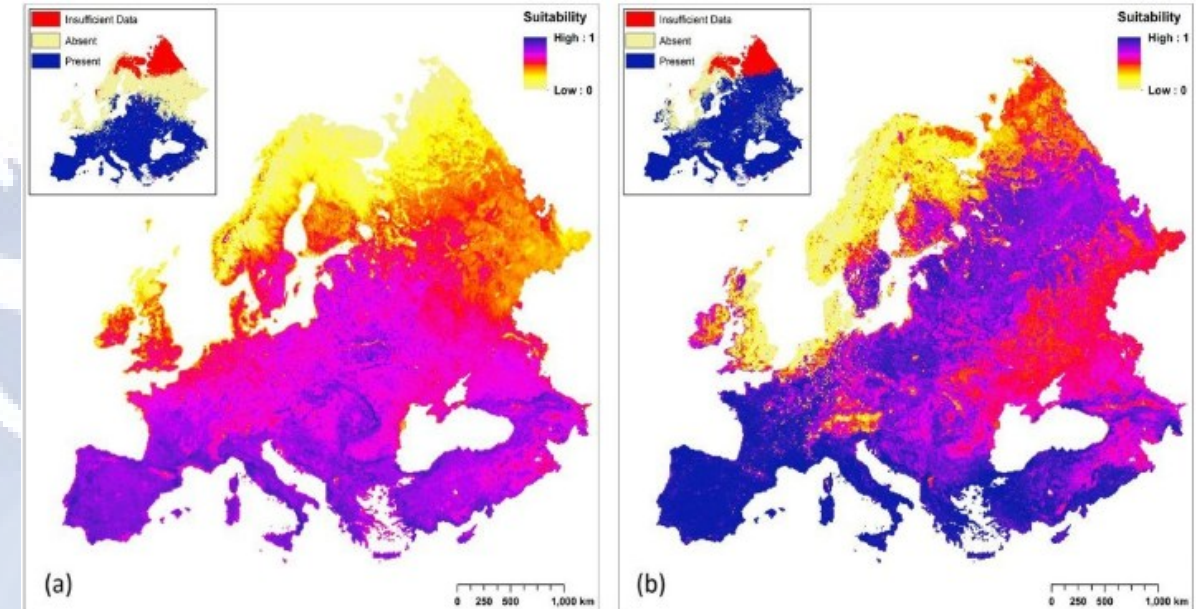
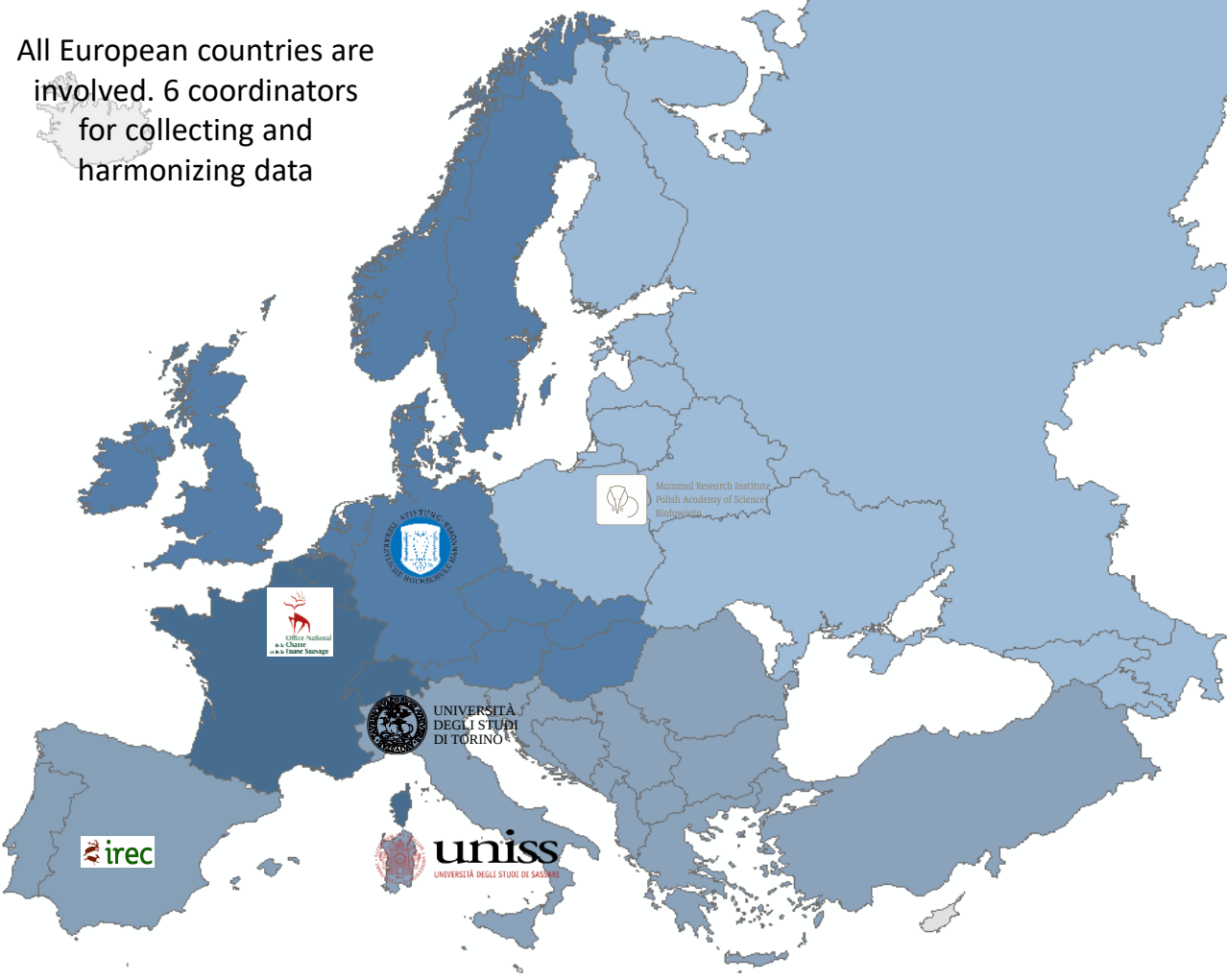


Figure 5: Maps showing predicted environmental suitability (relative likelihood of presence) for wild boar using Maxent models (a) and random forest models (b).

Predicted presence/absence highlighting areas where model transferability may be limited

Wild boar presence data was insufficient at Eastern Europe.
Lack of absence data.

Abundance modeling

Main source of comparable information: Hunting statistics (Hunting yields = HY)



Wild boar model based on hunting data (ENTETWILD consortium, 2019)

Downscaling wild boar abundance (ENTETWILD consortium, 2020a)

Update hunting yield-based data models: new approach to handle bioregion effect. (ENTETWILD consortium, 2020b)

Improving models: new insights for predictions at fine spatial resolution (ENTETWILD consortium, 2020c)

Update of model for wild boar abundance (ENTETWILD consortium, 2021)

Abundance modeling

Main source of comparable information: Hunting statistics (Hunting yields = HY)



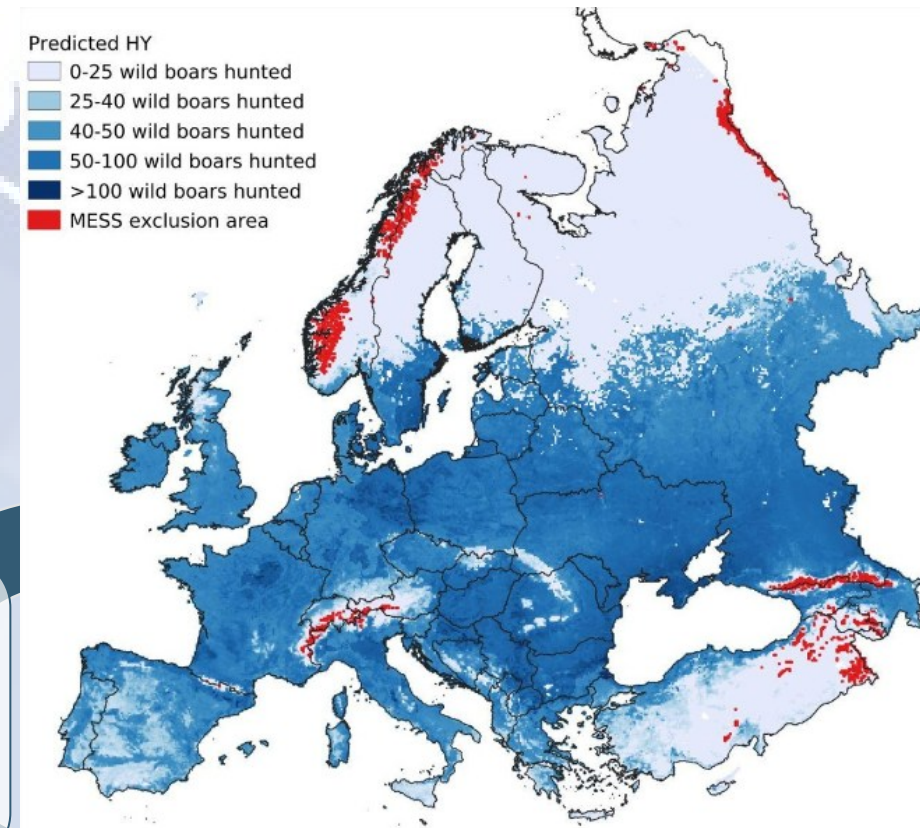
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Challenges for modelling:

1. Different resolution scales of data (NUTS2, NUTS3 or hunting ground).
2. Bioregion effect.
3. Downscaling to finer spatial resolution. → Overprediction



Abundance modeling

Main source of comparable information: Hunting statistics (Hunting yields = HY)



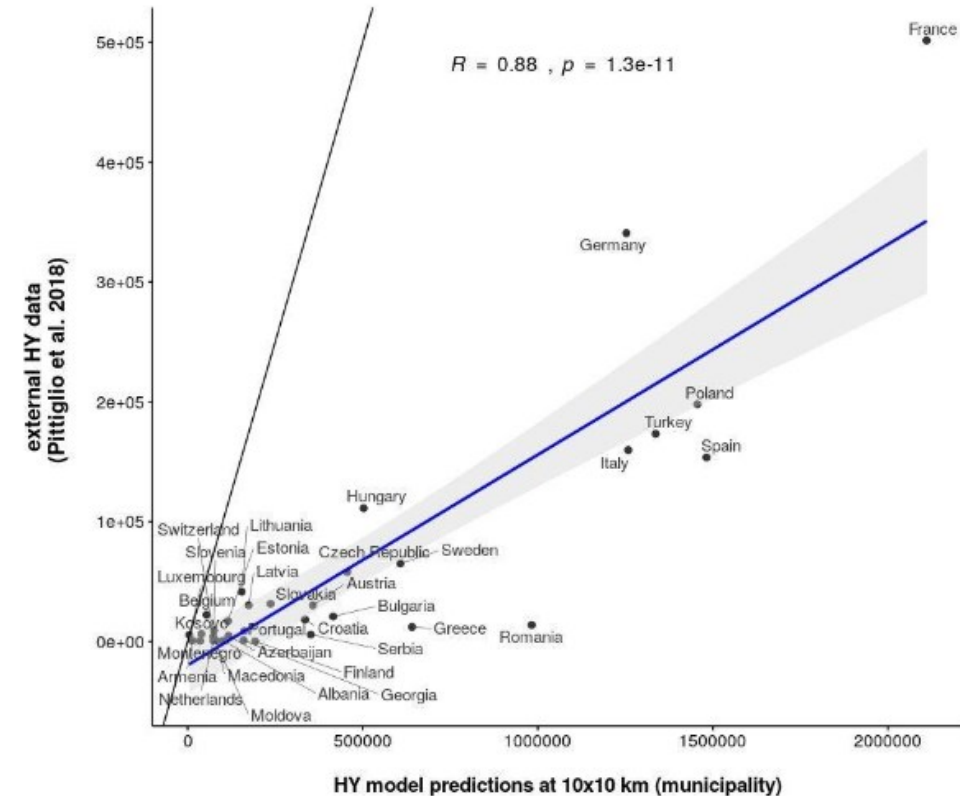
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Challenges for modelling:

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Overprediction was solved 1) using density as response variable, and 2) including spatial autocorrelation.

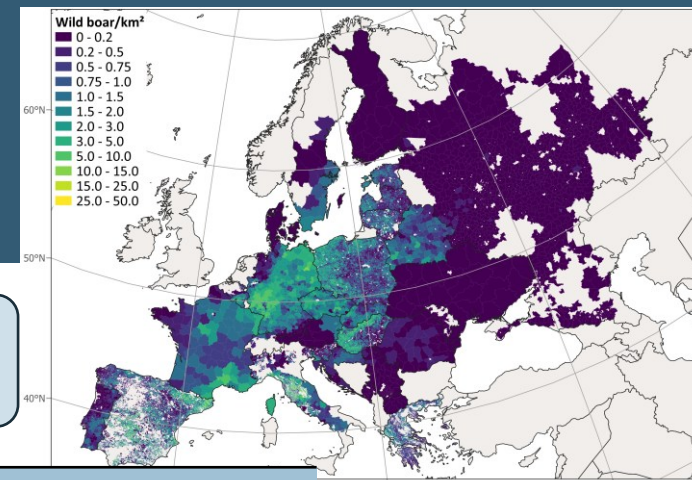
Methodology:

Biological data and Environmental Variables

Density model

ENETWILD consortium, 2021

HY data serie from 2012-2019 hunting season.
HY data = Maximum quantity of HY registered in the hunting season



Response
variable

HY_12/13	HY_13/14	HY_14/15	HY_15/16	HY_16/17	HY_17/18	HY_18/19	HY_max	Dens_max
0	724	778	819	947	1085	992	1085	0.1625940
0	507	535	616	762	945	997	9997	0.1871945
0	802	856	864	822	863	1170	1170	0.3156317
0	0	0	782	811	1168	1262	1262	5.7331477

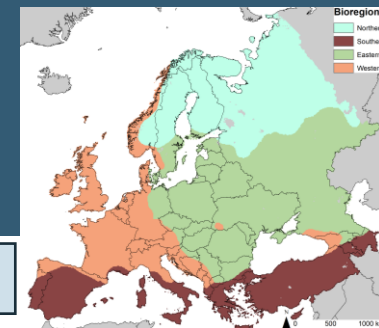
Environmental
variables

- 19 **climatic variables** (Wordclim 2).
- Mean **altitude** (USGS Space Shuttle Radar Topography Mission, SRTM).
- **Snow cover** (MODIS/Terra Snow Cover project: Monthly L3 Global 0.05Deg CMG, Version 6),
- 29 **Land use** variables (ESA/CCI_LC Project).
- **Percentage of Eucalyptus spp.** (European Forest Institute)
- **Human footprint index** (The Last of the Wild Project version 2)
- **Vegetation growing period** (Agro-Ecological Zones project, FAO)
- **Area** (square kilometers of sampling unit).

Multicollinearity
analysis

Variables used as
predictors for GLM:
VIF < 2.

Methodology: Density modeling procedure



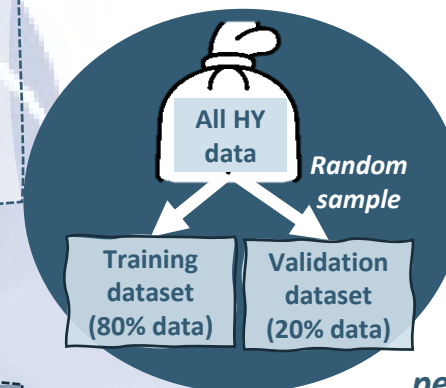
4 models were developed according to each bioclimatic regionalization in order to allow more flexibility to the models.

1

Response Variable ~ GLM Environmental variables

Negative Binomial Distribution and Logarithmic link function.

Final models obtained using forwards-backwards stepwise procedure based on AIC.



2

*Assess the
predictive
performance*

3

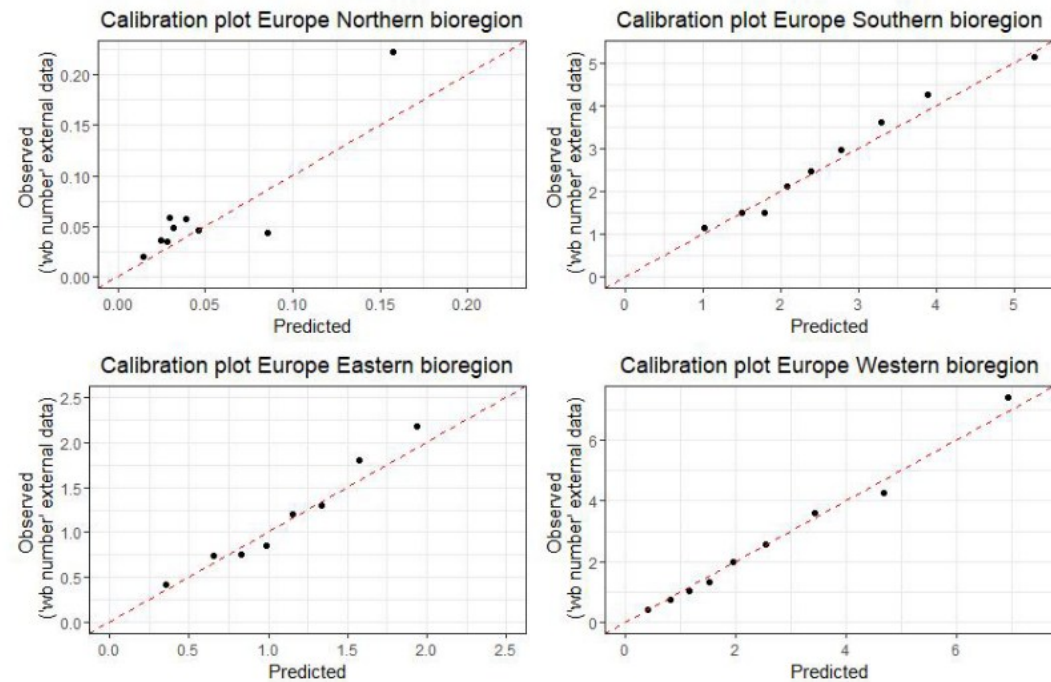
Multivariate Environmental Similarity Surface (MESS) analyses was carried out to assess if training dataset is represented at 2x2km and 10x10km resolution to downscale model predictions

4

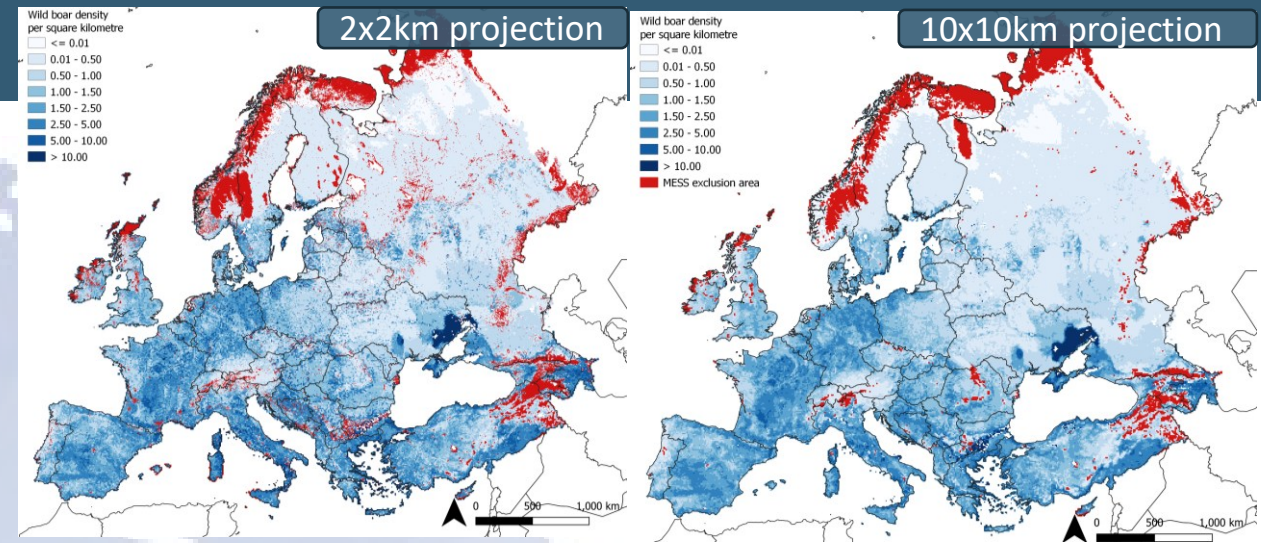
Model predictions were evaluated against external data Pittiglio et al. 2018

Results

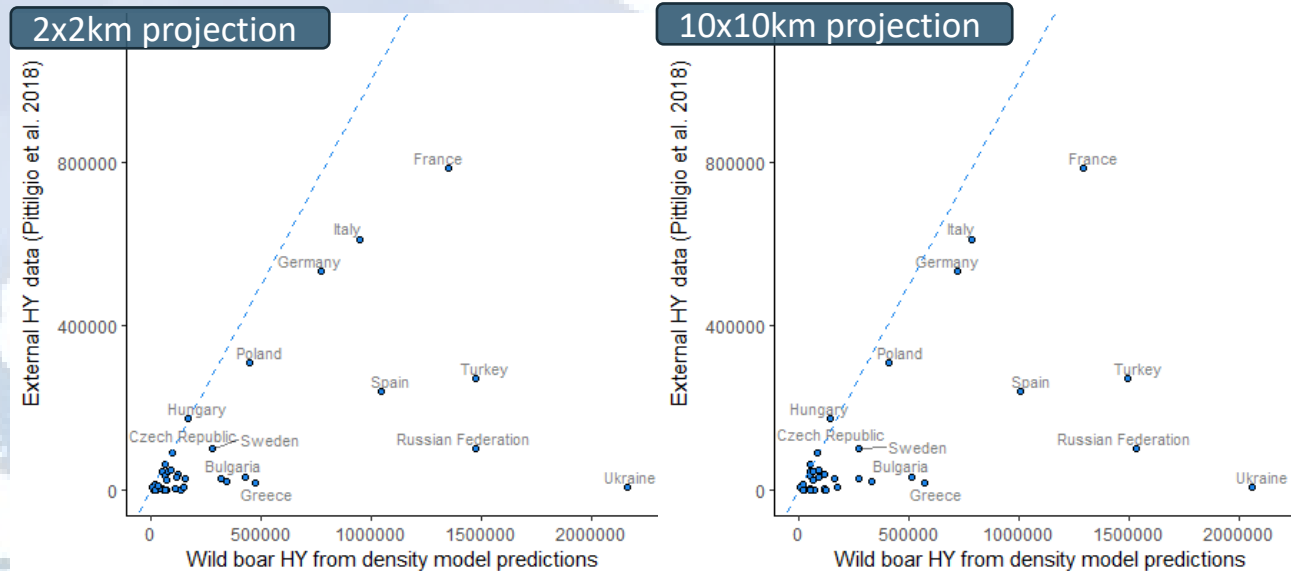
✓ Predictive performance



✓ Geographical pattern



○ External validation



Conclusions

- Density model shows **consistency** in the **geographical pattern** with previous abundance models.
- Density model predictions **reduced the overprediction**, but there is remaining some overprediction with external validation.

Next steps

- Spatial autocorrelation in density model must be used to try to reduce the remaining overprediction, as simulations with regional data showed improvements in model performance when accounting for spatial autocorrelation.
- Framework tested could be used for modeling other wild species (Ruminant abundance models for Europe).

References

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Thanks for your attention



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ENETWILD



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