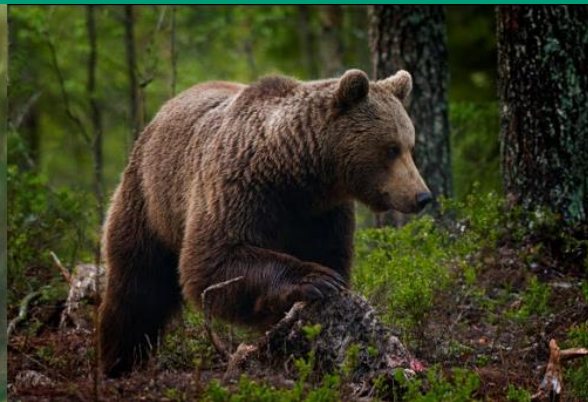# Species distribution modelling of large terrestrial carnivores in Europe with Maxent

Canis lupus lupus
Eurasian Grey Wolf

Lynx lynx
Eurasian Lynx

Ursus arctos arctos
Eurasian Brown Bear

Species Distribution Modelling (SDM)

SDM

MaxEnt

Hypothesis

Methods

Results

Conclusion

Species Distribution Models: Ecological Explanation and Prediction Across Space and Time

Jane Elith[1] and John R. Leathwick[2]

[1] School of Botany, The University of Melbourne, Victoria 3010, Australia; email: j.elith@unimelb.edu.au
[2] National Institute of Water and Atmospheric Research, Hamilton, New Zealand; email: j.leathwick@niwa.co.nz

Improving Species Distribution Modelling of freshwater invasive species for management applications

Marta Rodríguez-Rey *, Sofia Consuegra, Luca Börger, Carlos Garcia de Leaniz

Department of Biosciences, Swansea University, Swansea, United Kingdom

Modelling the spatial distribution of Paleontological sites in the Makuyuni region, Tanzania

Märker, M.[1], Bachofer, F.[2], Quénéhervé, G.[1], Hertler, C.[1], Saanane, C.[3], Giemsch, L.[4], Thiemeyer, H.[5]

Species distribution modelling to support forest management. A literature review

Matteo Pecchi [a], Maurizio Marchi [b] ☒, Vanessa Burton [c], Francesca Giannetti [a], Marco Moriondo [d], Iacopo Bernetti [a], Marco Bindi [a], Gherardo Chirici [a]

MaxEnt 2017 (Maximum Entropy)

- Machine learning process to assign an initial probability/a-prior-probability to incomplete datasets

- Correlative approach based on occurrence data combined with environmental variables

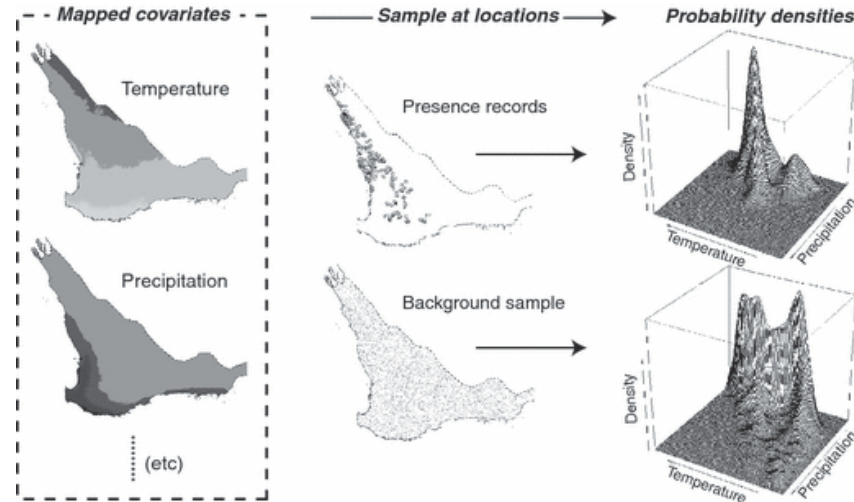- Randomly sampled background data are compared against occurrence locations

- Amount of occurrences in a grid cell defines its relative probability density of containing a species

- Model sensitive to background points

SDM

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Hypothesis

- The realized niche of Lynx lynx/Canis lupus lupus/Ursus arctos in Europe is currently limited by human impact.
- The niche will become smaller and shift northwards with climate change

Methods – Eurasian Lynx

- Occurrence data from gbif filtered by
  - Coordinate availability
  - Area
  - Subspecies (Lynx lynx (Linnaeus, 1758))
  - Type of record
  - Years of record

→ **1471 records**

Filtered present points of the Eurasian Lynx

WorldClim

- Training data – bioclimatic variables
  - Historical climate data from 1970 – 2000
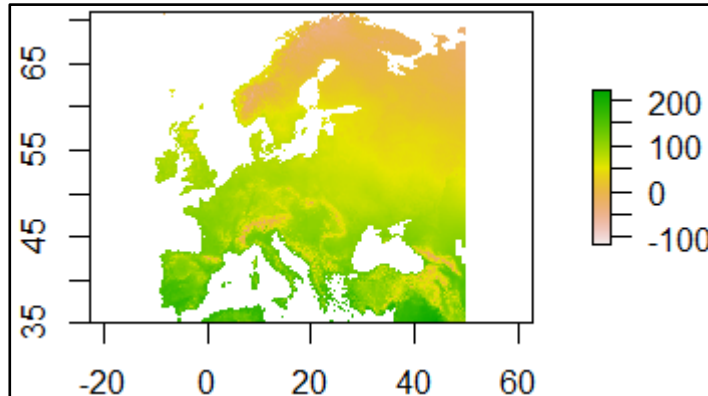 - Resolution 2.5 minutes
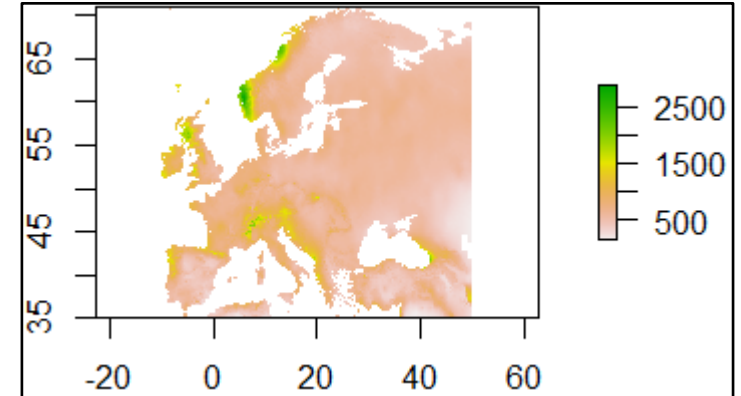 - Raster file with 19 layers

Mean annual temperature

Mean annual precipitation

SDM

MaxEnt

Hypothesis

Methods

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Conclusion

WorldClim

- Future climate data – bioclimatic variables
  - CMIP5 for the year 2050
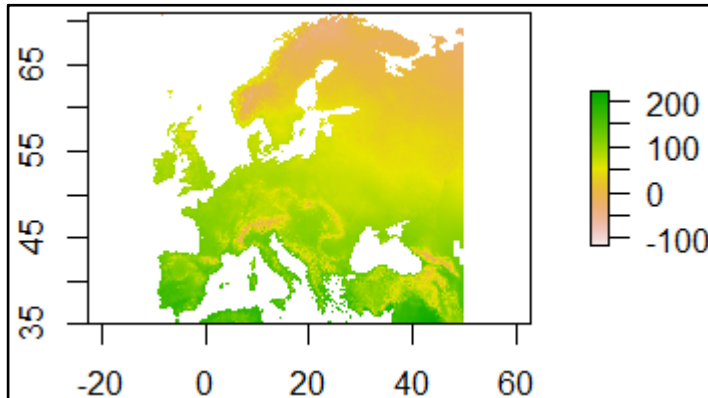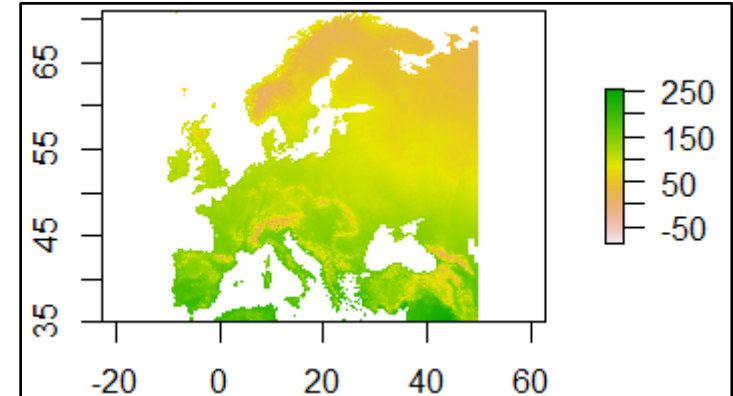 - Model: BC-CCSM1-1
  - Scenario: rcp85

Mean annual temperature 1970-200
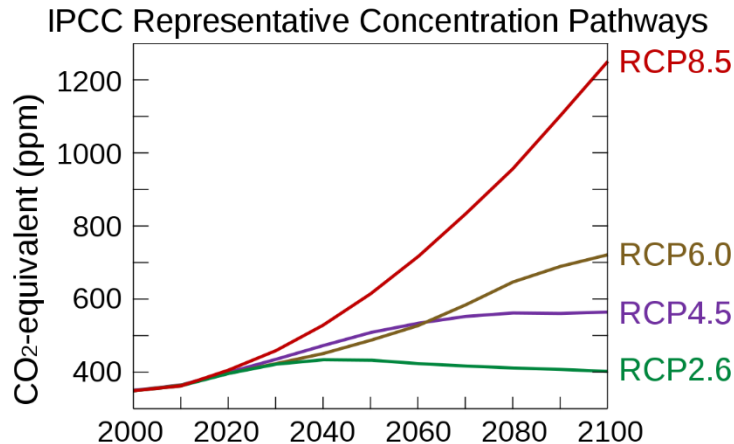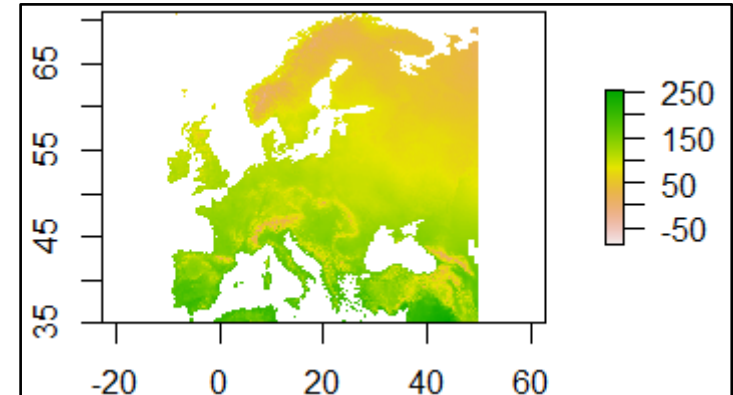

Mean annual temperature 2050

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WorldClim

SDM

MaxEnt

Hypothesis

Methods

Results

Conclusion

- Future climate data – bioclimatic variables
  - CMIP5 for the year 2050
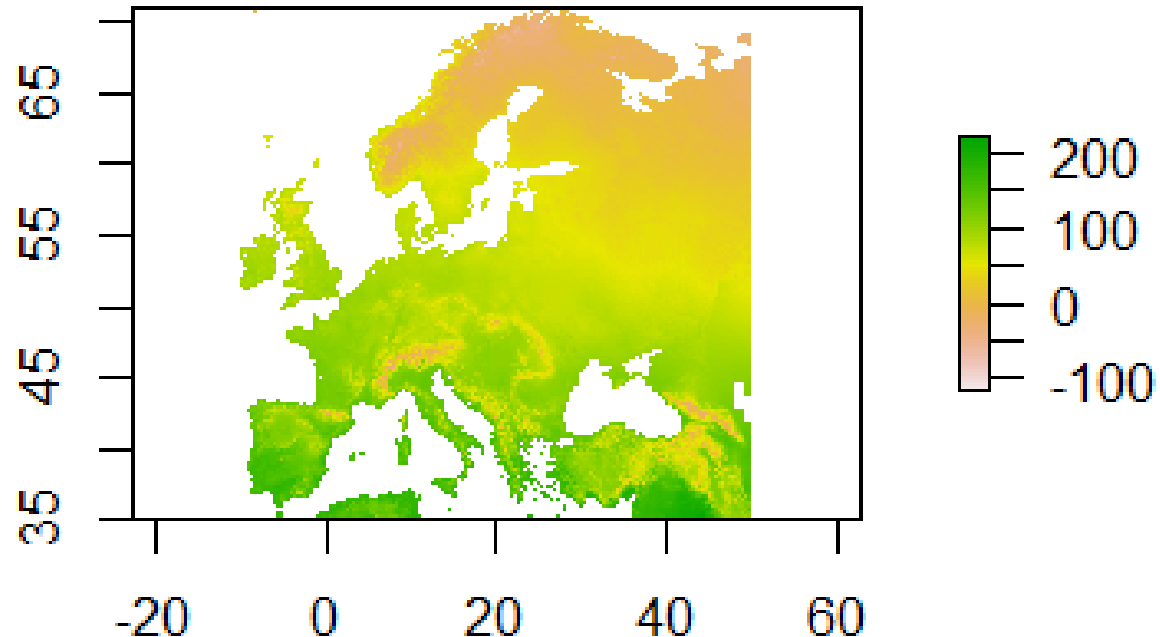 - Model: BC-CCSM1-1
  - Scenario: rcp85

IPCC Representative Concentration Pathways

RCP8.5
RCP6.0
RCP4.5
RCP2.6

Mean annual temperature 2050

- **Background points**
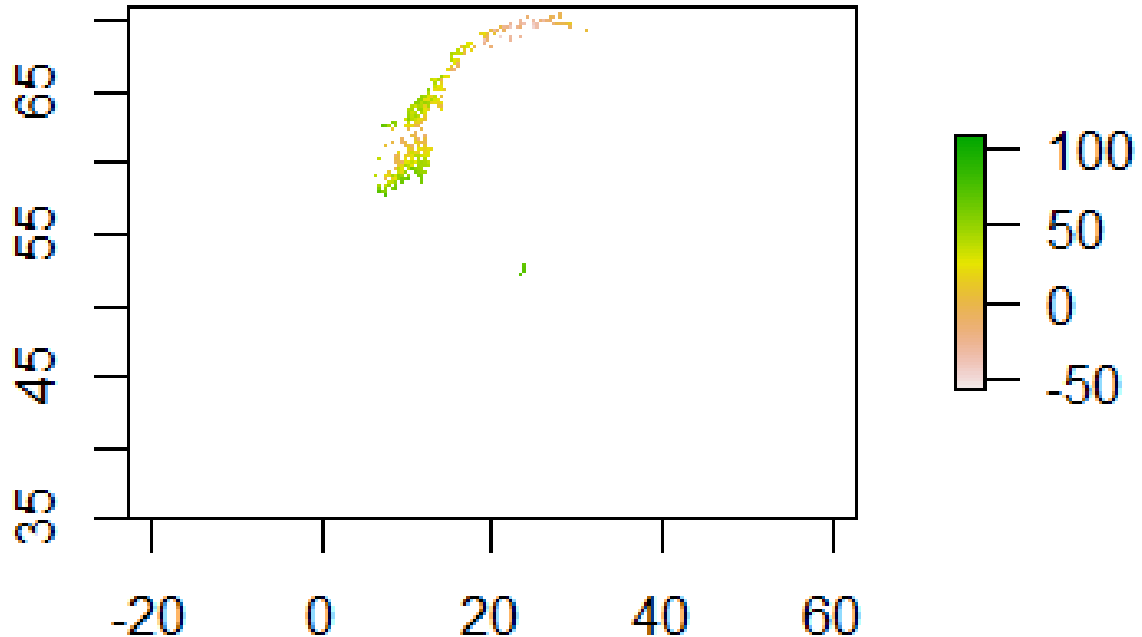 - 10 000 points within a defined area surrounding the occurrence points

SDM

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- Background points
  - 10 000 points within a defined area surrounding the occurrence points
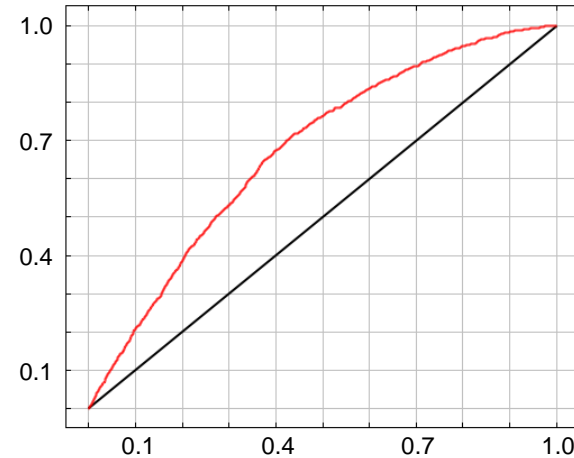
SDM

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Results

- Reduced model
- Trained with 1177 occurrences

AUC-plot

- AUC = 0.673

Mean annual temperature
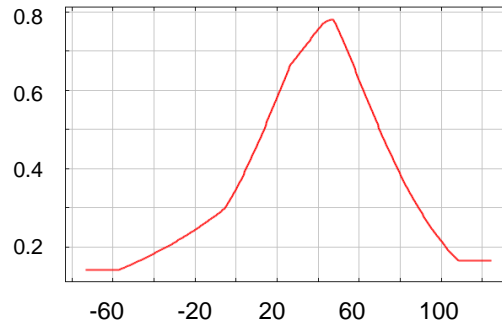
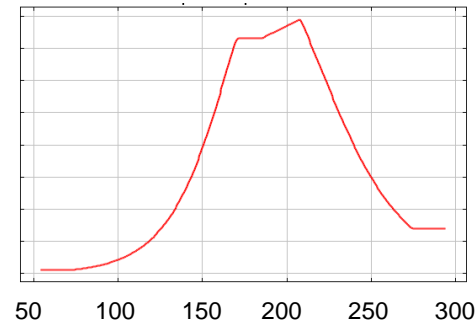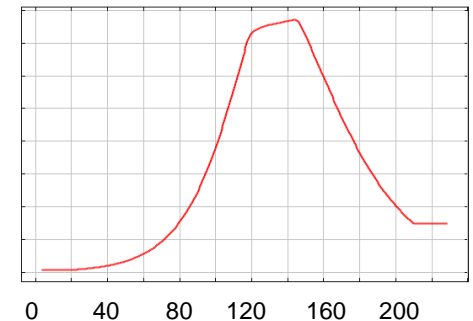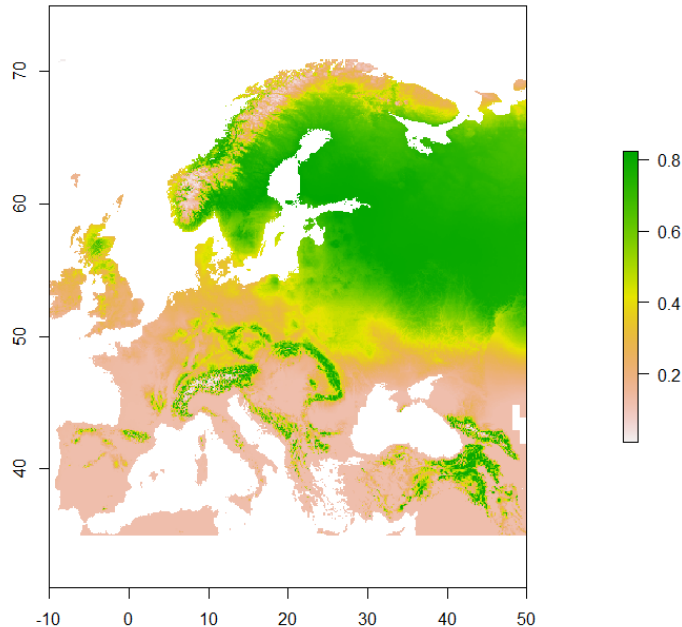Max. temp. of the warmest month

Mean temp. of the warmest quarter

Predictions

- Based on climate data from 1970 - 2000

SDM

MaxEnt

Hypothesis

Methods

Results

Conclusion

- Presence probability of lynxes

- Natural barriers are not considered

- Model sensitive to temperature

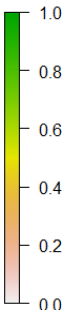- Threshold to simplify the output

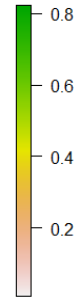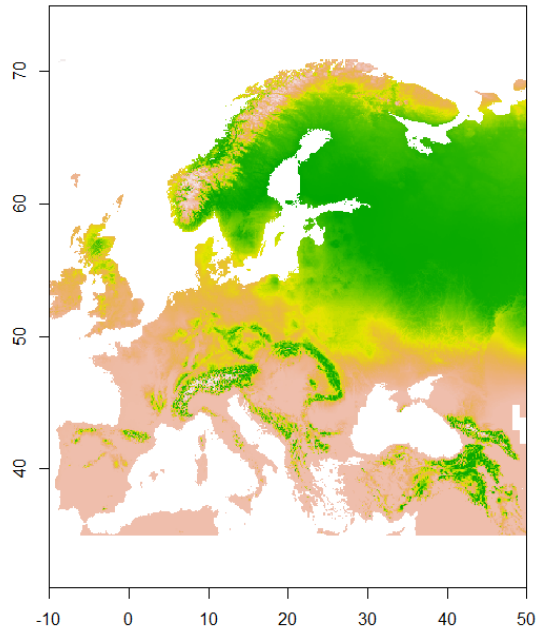# Predictions

- Based on climate data from 1970 - 2000

SDM
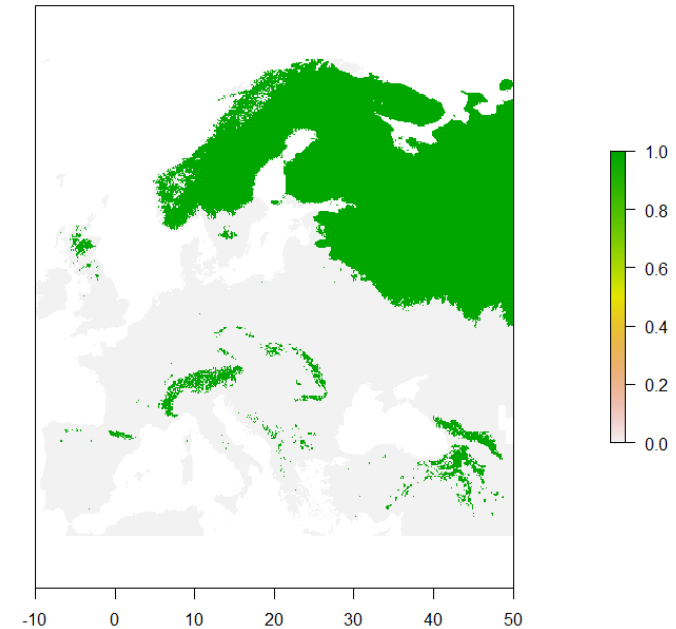
MaxEnt

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Predictions

- Based on modelled climate data for 2050

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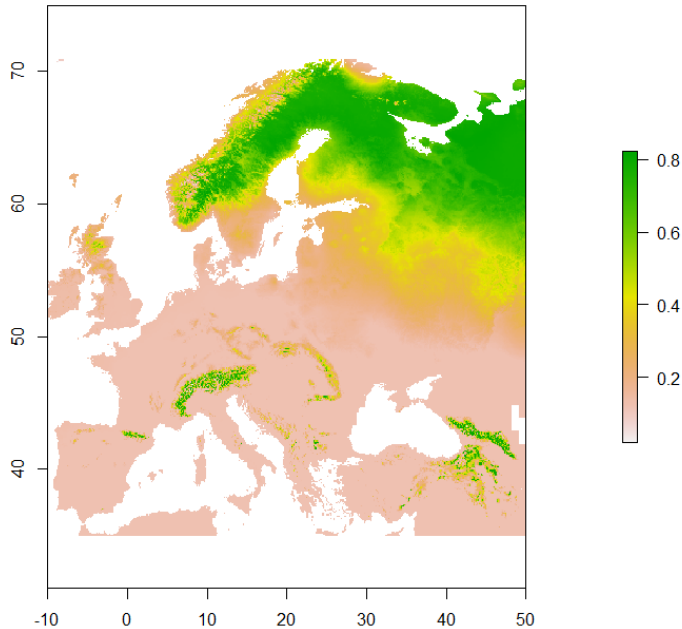
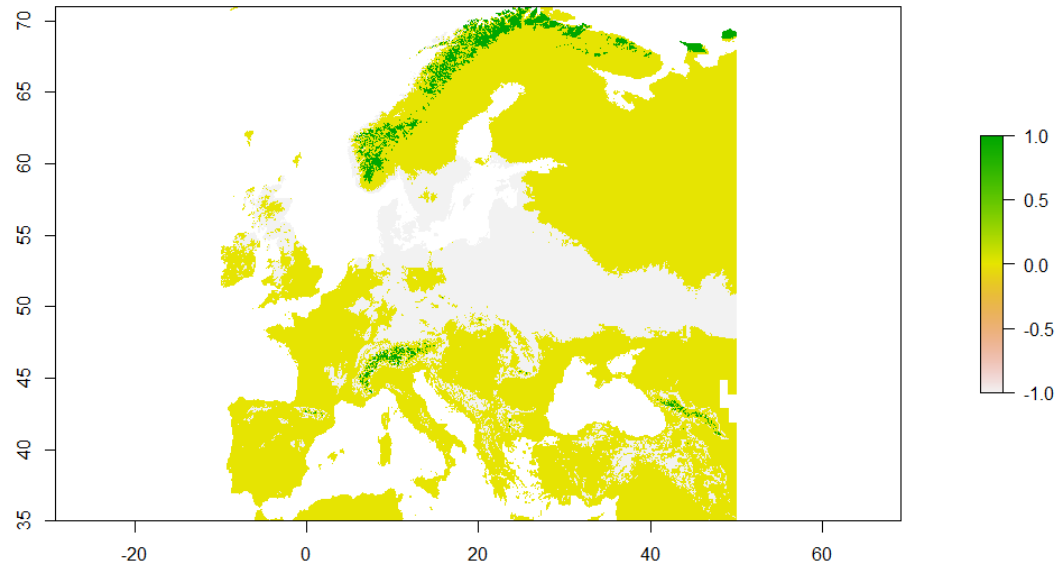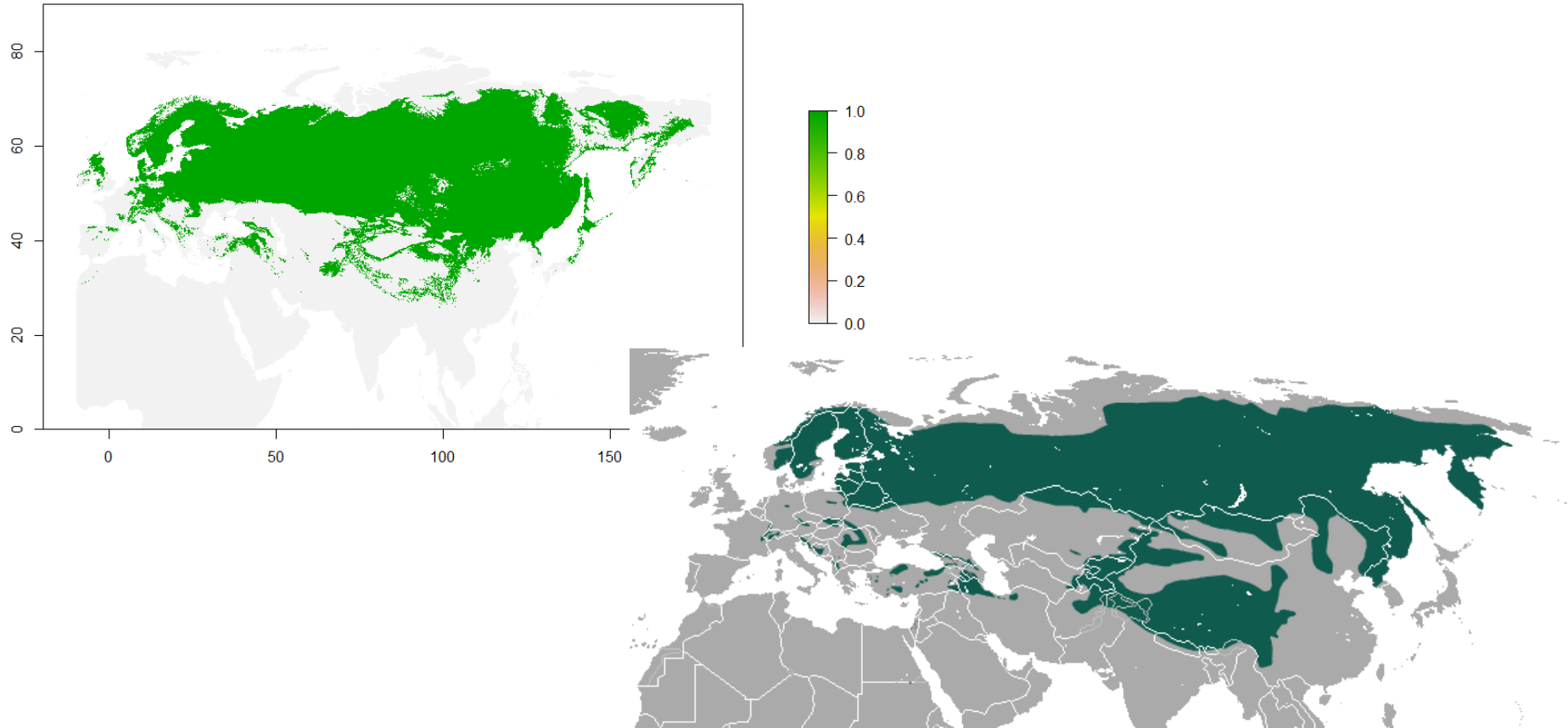# Conclusion

SDM

MaxEnt

Hypothesis

Methods

Results

Conclusion

- The predicted future scenario supports the hypothesis of a shrinking and shifting habitat for the Eurasian lynx

Thank you for your attention!

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References

- Elith, J., et al. (2011). "A statistical explanation of MaxEnt for ecologists." Diversity and Distributions **17**(1): 43-57.

- gbif.org

- worldclim.org

- Von IUCN Red List of Threatened Species, species assessors and the authors of the spatial data., CC BY-SA 3.0, https://commons.wikimedia.org/w/index.php?curid=12279155