Bioclimatic modelling of the distribution area of the European Roller: preliminary results

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Roller photos:
Bence Máté, Béla Tokody

conservation of the
EUROPEAN ROLLER
www.rollerproject.eu

Birds and climatic processes

- Current climatic processes →
- Advancement of phenology
- Changes in metrics of population dynamics
- Shifting of distribution areas
- →
- Population declines
- Isolation
- Local extinction

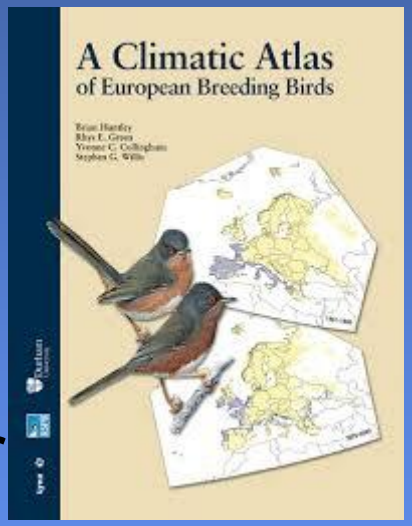
Moller et al. 2010, Pearce-Higgins & Green 2014

Rollers and climate

- Extensive distribution: Eu+Asia Minor
- ***A Climatic Atlas of European Breeding Birds*** →
- Northward shift
- Range contract in South-Europe

↔

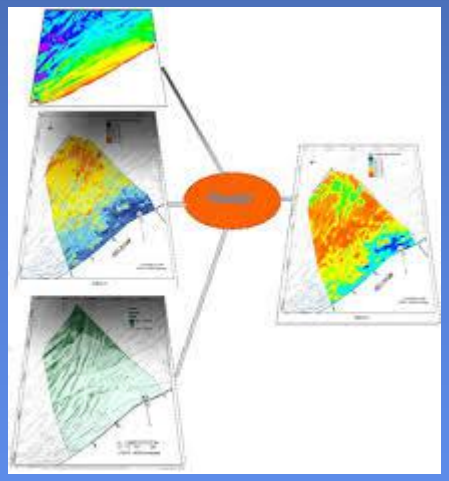
- Importance of winter parameters not clear
- Outdated versions of climatic scenarios
- Predicted to benefit from current climatic trends:
  - Northward shift of distributio
  - Increasing population

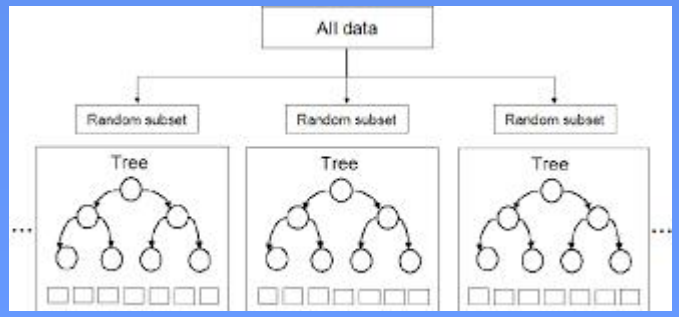


Huntley et al. 2007

Species Distribution Modelling (SDM)

- Relationships: occurrence points ~
  - environmental predictors
  - spatial structure
- predicting climatic suitability
- Biogeography, conservation, ecology
- Regression problems: General Linear Models
- Random Forest approach
- MaxEnt



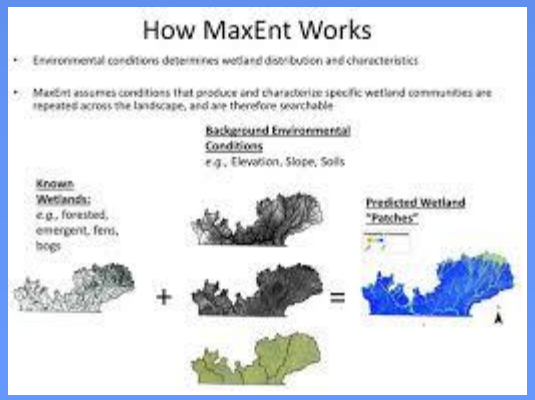


Syfert et al. 2013, Bean et al. 2014

MaxEnt

- Occurrence data
- Capable of handling presence-only data
- Competitive ~ highest performing methods
- Climate data: WorldClim.org
  - Present
  - Past: mid-Holocene (6kY)
    - LGM (25kY)
  - Future: 2050, 2070

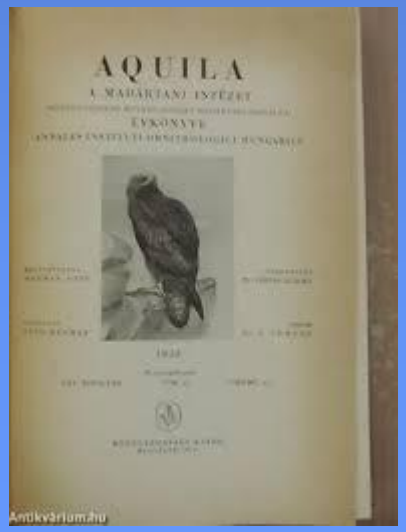
- Various emission scenarios
- 19 bioclimatic variables → preselection
- Machine-learning algorithm
- Area Under Curve (AUC): (0.0;1.0)



Philips et al. 2006; Elith et al 2011

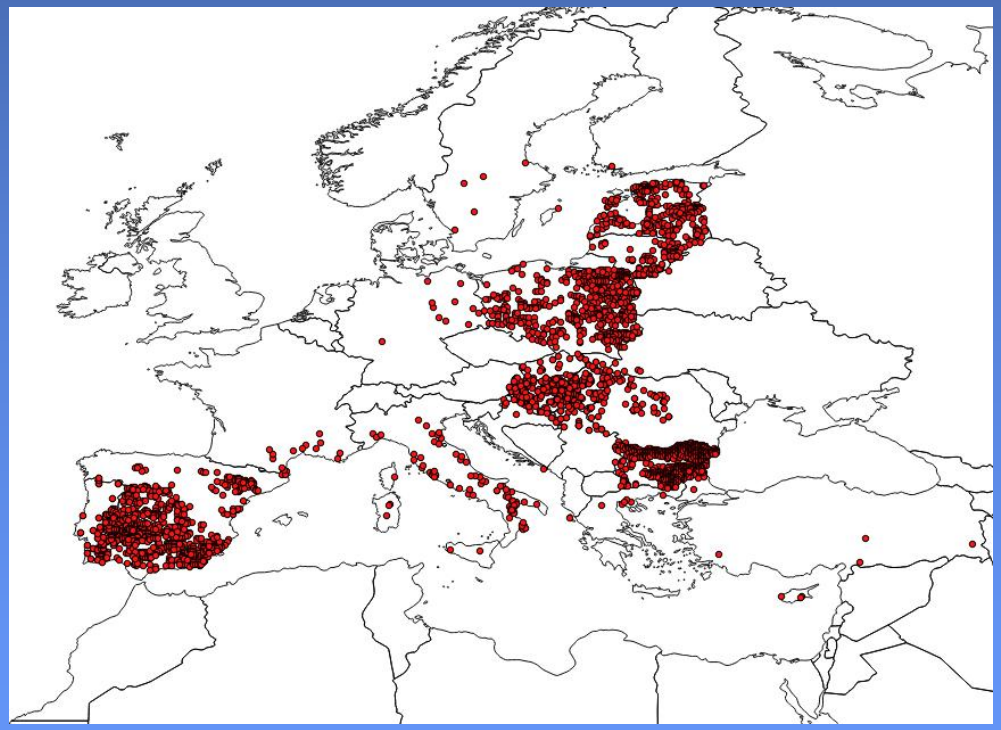
Data collection

- Primary papers: georeferenced map points
- Specific studies: shape files of georeferenced breeding locations
- Historical data from the Carpathian Basin: district centroids (1898-1985)



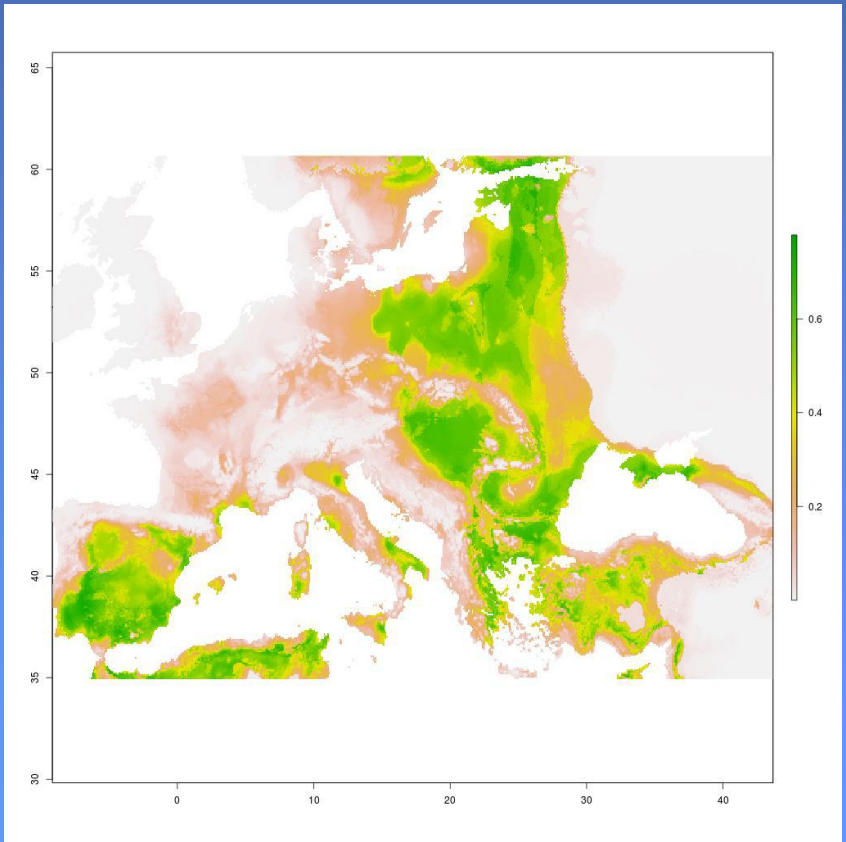
Occurrence points

- Countries included:
- All European breeding countries excluding
  - Ukraine
  - Russia
  - Belarus
- 3173 data points



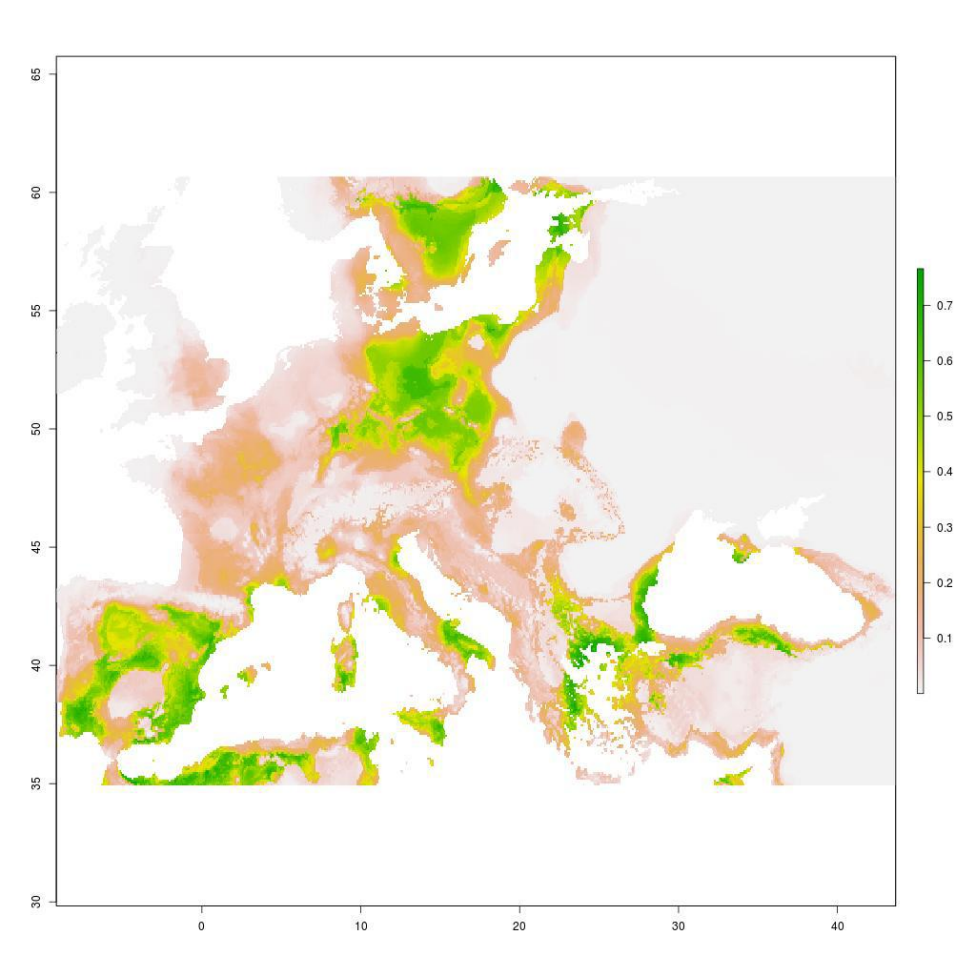
Predicted distribution area: present

- AUC = 0.885
- Unexpected coverage:
  - North-Africa
  - South-Sweden
  - Black Sea coast found
- Most important variables:
  - Temperature seasonality
  - Temperature annual range
  - Less important: annual precipitation



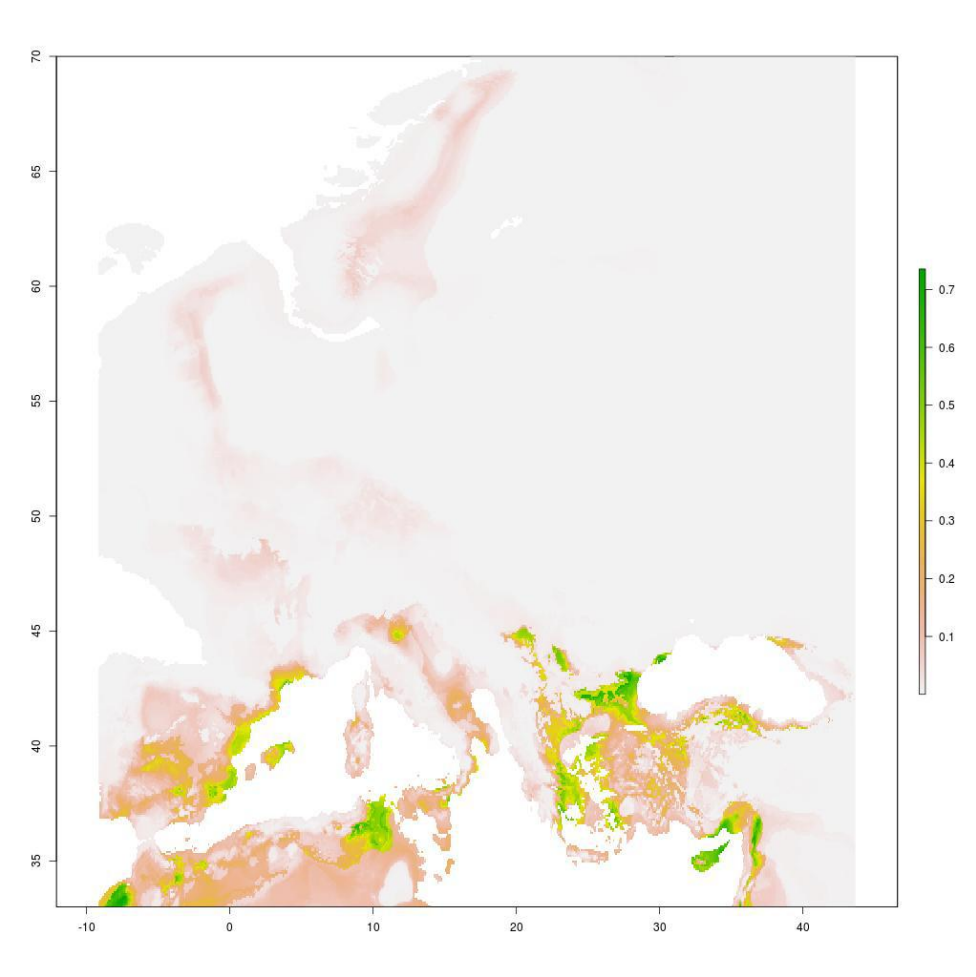
Predicted distribution area: mid-Holocene

- 6000 years BP
- AUC = 0.559
- Less supported
- Additional analyses needed
- N-Africa
- S-Skandinavia



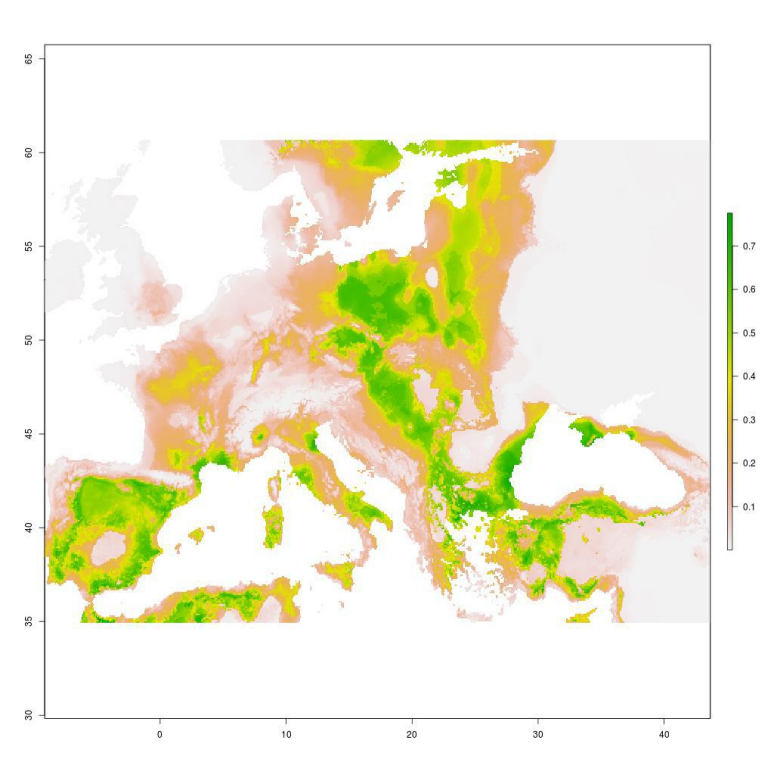
Predicted distribution area: Last Glacial Maximum (LGM)

- 25000 years BP
- AUC = 0.566
- Less supported
- Additional analyses needed
- Mediterranean Basin



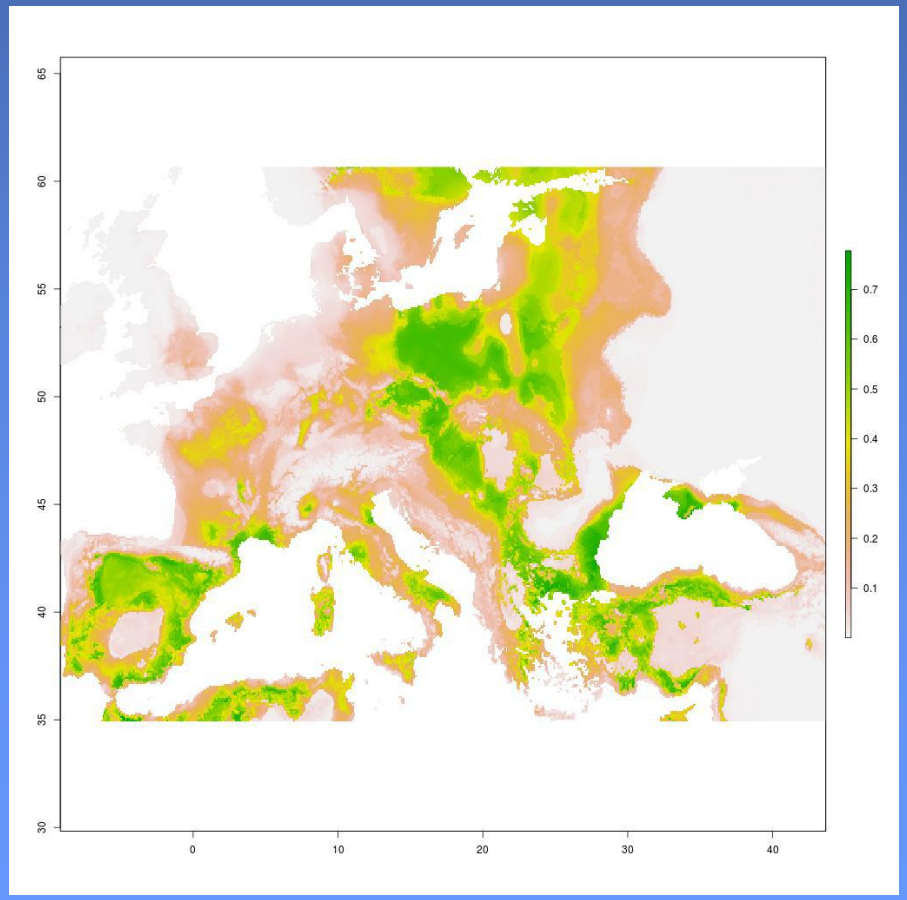
Predicted distribution area: 2050

- AUC = 0.7799
- 20% area contraction
- well supported
- Less decline in Mediterranean
- Larger decline in C-Europe



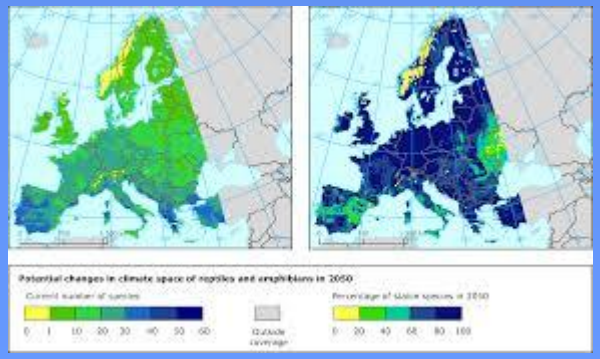
Predicted distribution area: 2070

- AUC = 0.7404
- well supported
- Similar to 2050



Conclusions

- As compared to the Climatic Atlas:
  - Similar spatial patterns:
    - Northward shift
  - Contrasting patterns:
    - Less decline in Mediterranean
- Range decrease by 20 % for 2050
- Colonization speed not controlled for
- Effects of land use not considered
- Further analyses needed for past projections



Management implications

- Adaptation of management plans
- Adaptation of species action plan
- Informing spatial strategies in assisted colonisation:
    - Acceleration of crossing barriers
    - Increasing colonisation speed
    - Designing translocation

Acknowledgements

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Thank you