Evaluating the impact of European forest management on forest-related species using *iSDM*s

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ForestNavigator

Introduction

European forests play a crucial role for achieving the EU climate neutrality goal by absorbing greenhouse gas emissions. *ForestNavigator* assesses forest-based climate change mitigation pathways, while simultaneously considering socio-economic and biodiversity aspects. Here, we present a framework using integrated species distribution models (*iSDM*s)[1] to quantify impacts of climate change scenarios and forest management on diverse forest-related species.

Methods

Projected covariates describe environmental conditions as well as forest characteristics and are based on climate change scenarios along with simulated forest management strategies (*G4M-X*)[2]. Modelled species are based on the EU Directives and European Red Lists of species to reflect conservation and community interests. Integrating several data sources and models, projected habitat suitability maps are used to derive multiple biodiversity indicators.
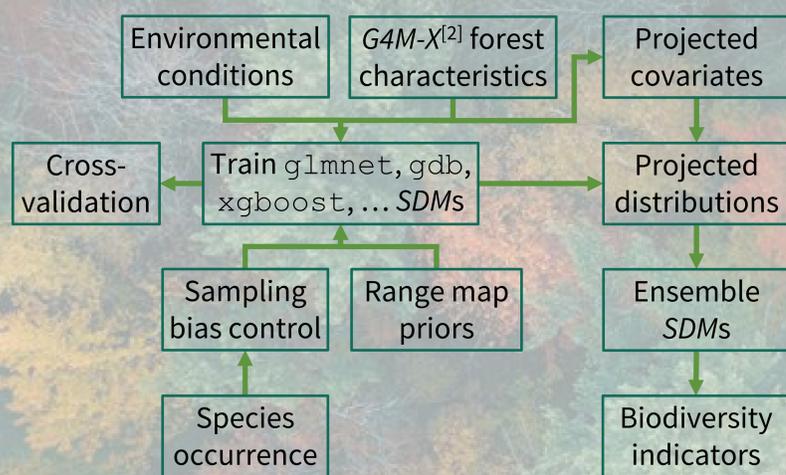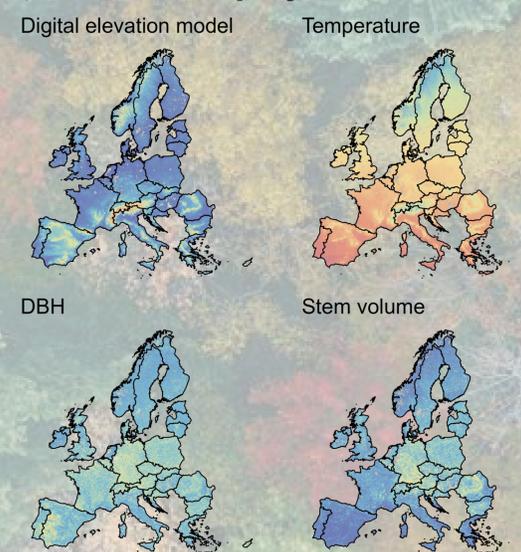

Figure 1: Conceptual model framework

I) Current and projected covariates

Digital elevation model — Temperature — DBH — Stem volume

II) Species occurrence data

e.g., *Salamandra salamandra*

III) Modelled habitat suitability

ibis.iSDM [3]

IV) Derived biodiversity indicators

(Conceptualized)

LANDSCAPE METRICS [4]

Pathway a) Pathway b) Pathway c)

Figure 2: Exemplary *iSDM* workflow

Table 1: Example of covariates included in the framework

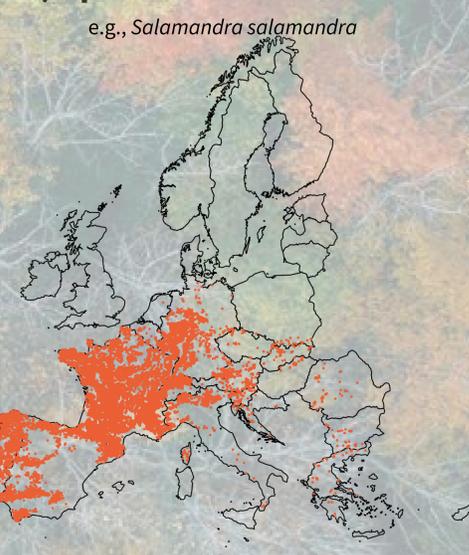| Environmental conditions	*G4M-X*[2] forest characteristics
Elevation	Species composition
Slope	Tree age
Aspect	Tree density
Precipitation	DBH
Temperature	Stem volume
Available water capacity	Harvested volume
Soil organic carbon	Biomass dead trees
Soil nitrogen	Deadwood carbon
Soil pH	Leaf area index
…	…

Table 2: Forest-related species included in the framework

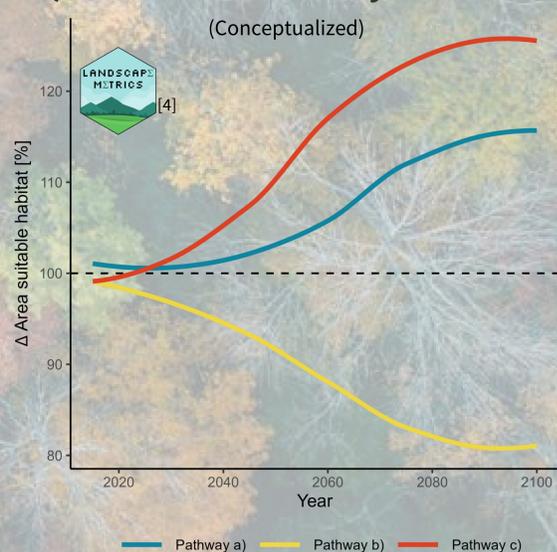| Species group	EU Directives	EU Red List of Species
Amphibian, Reptiles	63	44
Bees	-	40
Beetles	25	195
Birds	179	56
Butterflies	16	50
Ferns	6	27
Mammals	108	35
Mollusca	10	100
Non-vascular Plants	16	5
Vascular Plants	72	197
Other Insects	5	103

Outlook

We will provide biodiversity assessments based on climate change scenarios and forest management strategies. The integrated modelling framework allows to identify robust climate change mitigation pathways and support policy making that also considers biodiversity conservation aspects on a European scale.

References

[1] Fletcher, R.J., *et al.*, 2019. A practical guide for combining data to model species distributions. Ecology 100, e02710.

[2] Gusti, M., Kindermann, G., 2011. An approach to modeling landuse change and forest management on a global scale. Proceedings of 1st International Conference on Simulation and Modeling Methodologies, Technologies and Applications, pp. 180–185.

[3] Jung, M., 2023. An integrated species distribution modelling framework for heterogeneous biodiversity data. Ecological Informatics, p.102127.

[4] Hesselbarth, M.H.K., *et al.*, 2019. landscapemetrics: an open-source R tool to calculate landscape metrics. Ecography, 42(10), pp.1648-1657.

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