François Leroy

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Keywords: Machine Learning, Deep Learning, Statistical Modelling, Spatio-temporal analyses

Experience

2024-2026 **Postdoctoral researcher - Using Artifical Inteligence to understand spatio-temporal changes of biodiversity**, *Ohio State University, dept. of Evolution, Ecology and Organismal Biology*, Columbus, Ohio.

- Creating Hierarchical Neural Networks from a Bayesian framework
- Tailoring loss functions to infer distribution parameters
- Creating simulated data to test the model
- Hired for the project ABC Global Center, collaborating with computer scientists from MIT, McGill University, Mila institute (Montreal, Canada)

2020-2024 **PhD. in Macroecology - Spatial scaling and decomposition of macroecological changes**, *Faculty of Environmental Sciences, CZU, dept. of Spatial sciences*, Prague.

- Using big data to model biodiversity changes across spatial scales
- Using model optimisation and selection on various machine learning algorithms (Random Forest, BRT, XGBoost, linear models...)
- Available here

2021-2024 **Teaching**.

- Statistical ecology and macroecology
- Seminar on reproducible science using Git and Github
- GIS and spatial analysis

Education

2020-2024 **PhD. in Macroecology - Spatial scaling and decomposition of macroecological changes**, Prague.

2018-2020 **Marine Sciences MSc**, *Sorbonne University*, Paris.
Numerical Ecology, modelling, geostatistics, GIS, oceanography, marine ecology, biogeochemistry, database management

2015-2018 **3rd year of Bachelor of Science**, *South Brittany University*, Vannes (France).
Specialized in Coastal Ecosystems and Management, GIS

Modelling skills

Deep Learning Multilayer Perceptron, Convolutional/Recurrent/Hierarchical Neural Networks, Transformers, Variational Autoencoders, Generative Adversarial Networks, Deep Reinforcement Learning, Meta-learning

Machine Learning Classification and Regression Tree based algorithms (RF, BRT, GBM, XGBoost), Support Vector Machines, K-Nearest Neighbors, Naive Bayes, Linear Models (GLM, Mixed Models, polynomial regressions...), Hierarchical modelling

Others Generalized Additive Models, Bayesian inference with MCMC algorithms, Bayesian Networks, Hidden Markov Models, Feature engineering, Spatially explicit models, Time series analysis, Multivariate analysis, Multiscale analysis, Clustering, Ordination, Model: optimisation (e.g. regularization), prediction, scalability

Coding skills

Advanced Python, R, Git, QGIS, ArcGIS, LaTeX

Intermediate Shell, MySQL

Basic Julia, MATLAB, HTML5, CSS

Other experiences

2024 (1 semester) **Deep Learning**, *Faculty of Mathematics and Physics*, Charles University, Prague.

- Going through all Deep Learning algorithms

2023 (1 week) **TheoMoDiv workshop**, *CESAB*, Montpellier.

- Training in theory-based approaches to model ecological data (time series, macroecology, interaction, trophic network)

2022 (1 months) **Visiting Ohio State University**, *Jarzyna lab*, Colombus, Ohio.
- Collaborating with Dr. Marta Jarzyna on the spatial scaling of abundance-based biodiversity trends

2022 (1 week) **HMSC course**, *Jyväskylä summer school*, Jyväskylä , Finland.
- Summer school on Hirearchical Modeling of Species Community

2021 (1 semester) **Machine Learning with R**, *Faculty of Mathematics and Physics*, Charles University, Prague.
- Going through all Machine Learning algorithms, from Support Vector Machines to Neural Networks

Talks and conferences

Conference 2024-06-14 **Acceleration and demographic rates of bird abundance decline in North America**, *GfO macro*, Marburg, Germany, Slides.

Invited speaker 2024-02-16 **Introduction to Reproducible Science: Version Control using Git and Github**, *Ecoinformatics IAVS*, Online, Slides.

Conference 2024-01-07 **Acceleration and demographic rates of bird decline in North America**, *International Biogeography Society*, Prague, Poster.

Conference 2023-08-10 **Decomposing abundance change to recruitment and loss: analysis of the North-American avifauna**, *Ecological Society of America*, Portland, OR, Slides.

Conference 2022-06-05 **Untangling biodiversity changes across a continuum of spatial scales**, *International Biogeography Society conference*, Vancouver, BC, Slides.

Conference 2021-10-23 **Modeling biodiversity changes across a continuum of spatial scales**, *International Biogeography Society conference (Early career)*, Online, Slides.

Conference 2021-09-01 **Spatio-temporal scaling of biodiversity trends**, *GfÖ Virtual Annual Meeting*, Online, Slides.

Seminar 2020-07-01 **Introduction to Reproducible Science: Version Control using Git**, *CZU*, Prague, Slides.

Publications

Petr Keil, Adam T. Clark, Vojtěch Barták, and François Leroy. Should regional species loss be faster, or slower, than local loss? it depends on density-dependent rate of death. URL: http://biorxiv.org/lookup/doi/10.1101/2024.04.05.588218, doi:10.1101/2024.04.05.588218.

Francois Leroy. *Spatial scaling and decomposition of macroecological changes [online]*. Doctoral theses, dissertations, Czech University of Life Sciences Prague, Faculty of Environmental SciencesPraha, 2024 [cit. 2024-11-13]. SUPERVISOR: Mgr. Petr Keil, Ph.D. URL: https://theses.cz/id/aigse5/.

François Leroy, Marta Jarzyna, and Petr Keil. Acceleration and demographic rates behind bird decline in north america. URL: https://ecoevorxiv.org/repository/view/6921/, doi:10.32942/X21032.

François Leroy, Jiři Reif, David Storch, and Petr Keil. How has bird biodiversity changed over time? a review across spatio-temporal scales. 69:26–38. URL: https://www.sciencedirect.com/science/article/pii/S1439179123000117, doi:10.1016/j.baae.2023.03.004.

François Leroy, Jiří Reif, Zdeněk Vermouzek, Karel Šťastný, Eva Trávníčková, Vladimír Bejček, Ivan Mikuláš, and Petr Keil. Decomposing biodiversity change to processes of extinction, colonization, and recurrence across scales. page e06995. URL: https://onlinelibrary.wiley.com/doi/10.1111/ecog.06995, doi:10.1111/ecog.06995.

Vítězslav Moudrý, Kateřina Gdulová, Lukáš Gábor, Eliška Šárovcová, Vojtěch Barták, Francois Leroy, Olga Špatenková, Duccio Rocchini, and Jiří Prošek. Effects of environmental conditions on ICESat-2 terrain and canopy heights retrievals in central european mountains. 279:113112. URL: https://www.sciencedirect.com/science/article/pii/S0034425722002267, doi:10.1016/j.rse.2022.113112.

Vítězslav Moudrý, Petr Keil, Anna F Cord, Lukáš Gábor, Vincent Lecours, Alejandra Zarzo-Arias, Vojtěch Barták, Marco Malavasi, Duccio Rocchini, Michele Torresani, Kateřina Gdulová, Florencia Grattarola, François Leroy, Elisa Marchetto, Elisa Thouverai, Jiří Prošek, Jan Wild, and Petra Šímová. Scale mismatches between predictor and response variables in species distribution modelling: A review of practices for appropriate grain selection. page 03091333231156362. Publisher: SAGE Publications Ltd. doi:10.1177/03091333231156362.

Dominika Prajzlerová, Vojtěch Barták, Petr Keil, Vítězslav Moudrý, Markéta Zikmundová, Petr Balej, François Leroy, Duccio Rocchini, Michela Perrone, Marco Malavasi, and Petra Šímová. The relationship between remotely-sensed spectral heterogeneity and bird diversity is modulated by landscape type. 128:103763. URL: https://linkinghub.elsevier.com/retrieve/pii/S1569843224001171, doi:10.1016/j.jag.2024.103763.

Scientific Referees

Dr. **Marta Jarzyna**, Ohio State University, ☎+1 (978) 587-5938, jarzyna.1@osu.edu

Dr. **Petr Keil**, Czech University of Life Sicences, ☎+420 224382659, keil@fzp.czu.cz

Dr. **Martin Marzloff**, Ifremer, ☎+332 98224327, Martin.Marzloff@ifremer.fr

Dr. **Vítězslav Moudrý**, Czech University of Life Sicences, ☎+420 224382653, moudry@fzp.czu.cz