# Curriculum vitæ

## Personal informations

Schmitt Sylvain
4th of August 1993, Rennes, France
UMR AMAP, 2196 Bd de la Lironde,
34980, Montferrier-sur-Lez, France

Website
Google scholar profile
ORCID: 0000-0001-7759-7106
sylvain.m.schmitt@gmail.com

## Research activities

**Overview.** Since starting my career as an Msc in 2016, the primary objective of my research has been to understand and model the biodiversity of tropical forests, from the ecosystem to the individual, in order to improve our ability to manage these ecosystems and predict how they will respond to global changes and anthropic disturbances. I have used several complementary and mutually informative approaches - functional & community ecology with population & quantitative genetics - based on advanced modelling of tropical biodiversity through nested biodiversity levels.

**Research ethic.** I believe in the importance of open science for more sustainable research and, as such, I have always tried to promote open science, from data to publication. My first contribution was the development of free and open source software. Since then, I have made it a habit to share data in open databases and analysis code freely in open repositories with version tracking following the FAIR principle for improved reproducibility and transparency. To further improve my approach, I am now experimenting with open peer review and diamond publication. Similarly, I'm eager to share the methods and tools that I discover and develop and I get involved as often as possible (supervision of student thesis and projects, workshops) in the training of my peers and students. Finally, I value collaborative work for interdisciplinarity and sharing my approaches while learning new views.

**Functional, community and ecosystem ecology.** I studied tropical biodiversity with an ecological perspective at multiple levels: from ecosystems, by studying the distribution of species; through communities, by exploring their assemblage; to individuals, by exploring their local distribution and functioning along the topography. Doing so, I embraced the importance of trait-based ecology to better understand and predict tropical biodiversity across different spatio-temporal levels.

**Population & quantitative genetics.** My PhD provided me with an understanding of the importance of evolutionary biology in shaping tropical biodiversity. I studied and quantified the role of micro-adaptation to local environmental variation in the demography and coexistence of closely related tree species.

**Modelling biodiversity across levels.** Throughout my early career, I focus on developing advanced and effective modelling approaches for biodiversity at all levels, from the ecosystem with the distribution of invasive species worldwide to the genome with the detection of somatic mutations. I advocate for the importance of a better quantitative and predictive framework in both ecology and evolution, especially for the management of tropical forests in the face of increasing anthropogenic disturbances. Therefore, I have developed advanced knowledge in programming, Bayesian statistics for quantitative ecology and genetics, and individual-based modelling of tropical forest dynamics.

## Experience

2023-2023 *6 months*
**Postdoctoral researcher: Tropical forest modelling with joint effect of climate change and anthropic disturbances**
Laboratory Botany and Modeling of Plant and Vegetation Architecture (AMAP, France). Supervisor: Dr. Isabelle Maréchaux (INRAE)
*Individual-based modelling of tropical forest dynamics (TROLL), Bayesian statistics, Forest dynamics, Biodiversity Ecosystem Functioning.*

2021-2023 *26 months*
**Postdoctoral researcher: Mutation in the tropical tree canopy**
Laboratory Ecology of Guiana Forests (ECOFOG, French Guiana)
Supervisor: Drs. Niklas Tysklind & Myriam Heuertz (INRAE)
*Field planning, Team supervision, Tree-climbing sample collection, Genomic data analysis, Mutation detection, Tropical forest evolution.*

2017-2020 *39 months*
**PhD thesis: Ecological genomics of niche exploitation and individual performance in tropical forest trees**
Laboratories Biodiversity Genes and Communities (BIOGECO, France) and Ecology of Guiana Forests (ECOFOG, French Guiana), with a 6-month mobility to the laboratory Forest and Environment (FOREN, Ivory Coast)
Supervisor: Drs. Myriam Heuertz (INRAE) & Bruno Hérault (CIRAD)
*Planning and field sampling in remote tropical forests, Measurement of functional traits, DNA extraction and gene capture experiments, Quantitative and ecological genomics, Functional and community ecology, Forest demography and dynamics.*

2017 *6 months*
**MSc research project: Biodiversity and resilience of tropical forest ecosystem after disturbance**
Laboratory Ecology of Guiana Forests (ECOFOG, French Guiana)
Supervisor: Drs. Bruno Hérault (CIRAD) & Stéphane Traissac (APT)
*Individual-based modelling of tropical forest dynamics (TROLL), Bayesian statistics, Forest dynamics, Biodiversity Ecosystem Functioning.*

2016 *6 months*
**Research internship: Wood and leaf strategy in a low elevation rainforest of Western Ghats (India)**
French Institute of Pondicherry (FIP, India)
Supervisor: Drs. François Munoz (U. Grenoble) & Maxime Réjou-Méchain (IRD)
*Field sampling in remote tropical forests, Measurement of functional traits, Statistics, Community and functional ecology.*

2015-2016 *6 months*
**Research internship: Species distribution modelling (SSDM)**
New Caledonian Agronomic Institute (IAC, New Caledonia)
Supervisor: Drs. Phillipe Birnbaum (CIRAD) & Robin Pouteau (IRD)
*R package development, Species distribution modelling, Statistics and machine learning, Ecology, Botany, Field sampling.*

2015 *3 months*
**Research internship in soil ecology**
Helmholtz Zentrum München (HZM, Germany). Supervisor: Drs. René Kerner & Karin Pritsch (HZM). *Statistics, Functional ecology, Scientific writing.*

## Education

2017-2020 **PhD in Ecology and Evolution**, University of Bordeaux
*Thesis written in English.*
*Dissertation committee: Pr. Xavier Vekemans, Dr. Tamara Münkemüller, Dr. Olivier Hardy, Dr. Céline Teplitsky, Dr. Caroline Scotti-Saintagne, Dr. Marta Benito-Garzón.*

2015-2016 **M. Sc. in Ecology, Biodiversity and Evolution**, University of Montpellier
*Grade rank: 1st out of 10.*

2013-2016 **Engineer degree in natural land management**, AgroParisTech Nancy
*One of France's leading schools in environmental sciences and engineering, to which entrance is based on a national competitive exam. An engineer degree is equivalent to an MSc.*

2011-2013 **Undergraduate studies, majors in Biology, Chemistry, Earth Sciences and Mathematics**, Lycée François René de Chateaubriand
*2-year intensive undergraduate study (Classes préparatoires), in preparation of the highly competitive entry exams to France's leading schools of science and engineering (Grandes Écoles) equivalent to years 1 and 2 of a BSc.*

## Publications

*number of citations according to Google Scholar*

**Published in peer-reviewed international journals:**

12. **S Schmitt**, B Hérault, G Derroire. High intraspecific growth variability despite strong evolutionary heritage in a neotropical forest. *Peer Community in Ecology* [*recommended*].

11. **S Schmitt**, M Boisseaux. Robust assessment reveals high intraspecific variability in water and carbon related leaf traits in ten neotropical tree species. *Annals of Botany* https://doi.org/10.1093/aob/mcad042. Citations: 0.

10. **S Schmitt**, T Leroy, M Heuertz, N Tysklind. Somatic mutation detection in plants: a critical evaluation through simulations and reanalyses. *Peer Community Journal* https://doi.org/10.1101/2021.10.11.462798. Citations: 1.

9. **S Schmitt**, S Trueba, S Coste, É Ducouret, N Tysklind, M Heuertz, D Bonal, B Burban, B Hérault, G Derroire (2022). Seasonal variation of leaf thickness: An overlooked component of functional trait variability. *Plant Biology* 24:458-463. https://doi.org/10.1111/plb.13395. Citations: 3.

8. **S Schmitt**, N Tysklind, M Heuertz, B Hérault (2022). Selection in space and time: Individual tree growth is adapted to tropical forest gap dynamics. From the Cover, *Molecular Ecology*, [in press]. https://doi.org/10.1111/mec.16392. Citations: 3.

7. **S Schmitt**, N Tysklind, B Hérault, M Heuertz (2021). Topography drives microgeographic adaptations of closely related species in two tropical tree species complexes. *Molecular Ecology* 30:5080-5093. https://doi.org/10.1111/mec.16116. Citations: 11.

6. **S Schmitt**, V Raevel, M Réjou‐Méchain, N Ayyappan, N Balachandran, N Barathan, G Rajashekar, F Munoz (2021). Canopy and understorey tree guilds respond differently to the environment in an Indian rain forest. *Journal of Vegetation Science* 32:e13075. https://doi.org/10.1111/jvs.13075. Citations: 2.

5. **S Schmitt**, N Tysklind, G Derroire, M Heuertz, B Hérault (2021). Topography shapes the local coexistence of tree species within species complexes of Neotropical forests. *Oecologia* 196:389-398. https://doi.org/10.1007/s00442-021-04939-2. Citations: 9.

4. **S Schmitt**, B Hérault, É Ducouret, A Baranger, N Tysklind, M Heuertz, É Marcon, SO Cazal, G Derroire (2020). Topography consistently drives intra‐and inter‐specific leaf trait variation within tree species complexes in a Neotropical forest. *Oikos* 196:1521-1530. https://doi.org/10.1111/oik.07488. Citations: 32.

3. **S Schmitt**, I Maréchaux, J Chave, F Jörg Fischer, C Piponiot, S Traissac, B Hérault (2020). Functional diversity improves tropical forest resilience: Insights from a long‐term virtual experiment. *Journal of Ecology* 108:831-843. https://doi.org/10.1111/1365-2745.13320. Citations: 36.

2. J Kattge, G Bönisch, …, **S Schmitt**, *et al.* (2020). TRY plant trait database–enhanced coverage and open access. *Global Change Biology* 26:119-188. https://doi.org/10.1111/gcb.14904. Citations: 864.

1. **S Schmitt**, R Pouteau, D Justeau, F De Boissieu, P Birnbaum (2017). SSDM: An R package to predict distribution of species richness and composition based on stacked species distribution models. *Methods in Ecology and Evolution* 8:1795-1803. https://doi.org/10.1111/2041-210X.12841. Citations: 122.

**Under review or in preparation:**

5. V Badouard, **S Schmitt**, G Salzet, T Gaquiere, O Brunaux, C Bedeau, M Rojat, G Derroire. LoggingLab: an R package for simulating reduced impact logging in tropical forests using forest inventory data. *Ecological Modelling* [*major review*]

4. **S Schmitt**, G Salzet, I Maréchaux, F Jörg Fischer, J Chave. rcontroll: an R interface for the individual-based forest dynamics simulator TROLL. *Methods in Ecology and Evolution* [*minor review*].

3. **S Schmitt**, P Heuret, V Troispoux, M Beraud, J Cazal, E Chancerel, C Cravero, E Guichoux, O Lepais, J Loureiro, W Marande, O Martin, G Vincent, J Chave, C Plomion, T Leroy, M Heuertz, N Tysklind. Low-frequency somatic mutations are heritable in plants. *PNAS* [*in preparation*].

3. J Kass, .., **S Schmitt**, …, A Smith. Harnessing the growing diversity of species distribution modeling software: what is out there? *Ecology Letters* [*in preparation*].

1. G Salzet, M Aubry-Kientz, T Gaquiere, M Boisseaux, S Traissac, É Marcon, **S Schmitt**. Hydro-edaphic gradient shapes local community assembly of trees in a neotropical forest. *Oikos* [*in preparation*].

## Grants

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| 2020 | **Outgoing mobility grant.** 6-months mobility to Ivory Coast funded by the Laboratory of Excellence on Continental To Coastal Ecosystems: evolution, adaptability and governance (COTE). |
| 2019 | **International mobility support.** To participate in a conference and field work in Ecuador funded by the Univ. Bordeaux "Sciences and environments" doctoral school. |
| 2019 | **Congress Grants for Doctoral Students.** To participate in the 56th Annual meeting of the Association for Tropical Biology and Conservation funded by the Department of Environmental Sciences of the University of Bordeaux. |

2017-2020 **PhD grand (three-year salary).** Funded by the French ministry of higher education and research.

## Major communications *including only international conferences*

3. **S Schmitt**, R Pouteau, D Justeau, F De Boissieu, P Birnbaum (2017). SSDM: An A package to predict distribution of species richness and composition based on stacked species distribution models. *Poster at the international biogeography society 2019 Humboldt Meeting*.

2. **S Schmitt**, B Hérault, É Ducouret, A Baranger, N Tysklind, M Heuertz, É Marcon, SO Cazal, G Derroire (2019). Ontogeny and abiotic environment drive intraspecific trait variation in Neotropical tree species. *Talk at the Annual meeting of the Association for Tropical Biology and Conservation*.

1. **S Schmitt**, N Tysklind, B Hérault, M Heuertz (2018). Ecological genomics of niche exploitation and individual performance in tropical forest trees. *Poster at the European Conference of Tropical Ecology*.

## Teaching, student supervision, and scientific reviewing

**Student supervision:**

**2022.** B Lagrange, F Kratz (4 months). Simulation of logging damage in TROLL. *AgroParisTech MSc project*.

**2022.** S Cassin, S Hoppe (4 months). Regeneration of seedlings in Paracou. *AgroParisTech MSc project*.

**2022.** M Lebrun, G Pouthé, Y Saliou, L Valade (2 weeks). Forest regeneration in a tropical environment. *AgroParisTech MSc project*.

**2021.** L Alvergnat, M Bentkowski, P Desvéronnières, O Girard Reydet (2 weeks). Functional traits of tropical trees : Inter- and intra-specific variability at the Paracou site. *AgroParisTech MSc project*.

**2019.** A Baranger (3 months). Modelling intraspecific variability among two species complexes from French Guiana. *AgroParisTech voluntary internship*.

**2019.** A Adam, A Benfredj Zaleski, N Faucherre, D Zipper (2 weeks). Variability of functional and morphological traits within the *Parvifolia* species complex. *AgroParisTech MSc project*.

**2018.** N Page (6 months, co-supervisor). Simulation of harvested forests with the TROLL model. *Msc thesis at the University of the French West Indies*.

**2018.** É Ducouret (6 months). Modelling intraspecific variability among two species complexes from French Guiana. *Msc thesis at the University of the French West Indies*.

**Teaching and workshops:**

**2022**. rcontroll: an R interface for the individual-based forest simulator TROLL (2h). *Peer workshop*.

**2022**. Reproducible analyses with Snakemake & Singularity (4h). *Peer workshop*.

**2021-2022.** Modelling diversity (4x1h). *MSc tropical rainforest module*.

**2020**. Reproducible analyses with Rmarkdown and Bookdown (2x1h). *Peer workshop.*

**2019-2020**. 3 peer workshops on Bayesian modelling (3x1h): *Animal model*, *Dirichlet Multinomial*, *& Neighbourhood models and Segmentation*

**2018.** Introduction to Bayesian modelling with stan (4h). *Peer workshop*.

**2018-2019.** Introduction to Bayesian modelling with winbugs (2x6h). *MSc Tropical Forest Ecology*.

**Scientific reviewing:**

(2) Biological Conservation, (2) Molecular Ecology, (2) Tree Physiology, (1) Ecological Informatics, (1) Functional Ecology. View my Publons profile.

## Technical skills

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| Languages | French (mother tongue), English (fluent; TOEIC: 960/990), German (basic) |
| Field | Tree climbing, Tree sampling from the ground (Big Shot), Functional trait measurements, Permanent sample plots, Organising field missions in remote stations |
| Laboratory | DNA extraction, Genomic library preparation, Gene capture experiment |
| Statistics | Bayesian hierarchical modelling, Machine learning, Advanced statistical analyses |
| Informatic | Programming (R, C++, Bash, Python, Perl), R package development, Bioinformatics pipeline development (Snakemake, Singularity), High performance computing, Versioning (Git, GitHub), Reproducibility (R Markdown, Quarto, renv, Docker) |