

Elsa ABS

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- **Education**

2015 - 2019 **PhD, Eco-Evo Mathematics**, University of Paris Sorbonne, France. Supervisor: Pr. Regis Ferriere and Pr. Scott R. Saleska.

2013 - 2015 **Msc, Applied Mathematics to Biology**, Ecole Normale Supérieure of Ulm, Paris, France.

2010 - 2013 **Bsc, Agricultural and Environmental Engineering**, AgroParisTech, Paris, France.

- **Current positions**

Oct 2025 – now **CNRS Researcher CR**, Laboratory of Environmental and Climate Sciences (LSCE), Paris, France.

Feb 2025 – now **ERC Research Fellow**, Laboratory of Environmental and Climate Sciences (LSCE), Paris, France. Funded by HORIZON-ERC-2024-STG-101164645 grant.

- **Previous positions**

2024 – Feb 2025 **Research Fellow**, Laboratory of Environmental and Climate Sciences (LSCE), Paris, France. Funded by the CALIPSO project through the Schmidt Futures program.

2023 - 2024 **Marie Curie Individual Fellow**, Laboratory of Environmental and Climate Sciences (LSCE), Paris, France. Funded by H2020-MSCA-IF-891576 grant.

2021 - 2023 **Marie Curie Individual Fellow**, Department of Ecology and Evolutionary Biology, University of California, Irvine, USA. Funded by H2020-MSCA-IF-891576 grant.

2019 - 2021 **Postdoctoral Scholar**, Department of Ecology and Evolutionary Biology, University of California, Irvine, USA.

Summary of previous activities

"Trained as an ecologist and evolutionary biologist, I have aimed since the start of my PhD to foster a dialogue between ecology, evolution, and geosciences. I believe that integrating ecological and evolutionary insights into Earth sciences is essential for advancing our understanding of global biogeochemical cycles. This conviction has driven me to pursue resolutely interdisciplinary research, as reflected in the key highlights listed below."

One major outcome of my doctoral research was the **integration of microbial evolution into models of soil organic matter decomposition**. I developed stochastic and hybrid stochastic-deterministic models that are non-spatial at the micrometer scale, with variables representing microbial biomass, enzyme mass, and organic carbon pools to describe soil carbon fluxes. I also created a spatially explicit numerical model incorporating stochastic microbial evolution at the micrometer scale in C++. I demonstrated that microbes adapt their enzyme production strategies under low soil diffusivity, a condition likely to become more frequent with climate change. This adaptation accelerated soil carbon turnover, increased soil CO₂ emissions, and reduced carbon stocks (Abs et al., 2020).

During my postdoctoral research at the University of California, Irvine, I explored microbial dispersal's role in soil carbon cycling using the DEMENT model, a spatially explicit numerical model at the micrometer scale simulating microbial community-mediated decomposition with variables for 12 litter compounds, 100 microbial taxa, and 50 enzyme types. By modeling microbial dispersal as a stochastic process, I demonstrated that dispersal could rescue specific microbial functions like nitrogen cycling (Abs et al., 2024).

Later, as an MSCA Fellow, I compared microbial adaptation through mutation and dispersal by extending the DEMENT model to include stochastic microbial mutation. I found that mutation provided up to 12% faster adaptation than short-range dispersal, challenging assumptions about selection equivalence across adaptive mechanisms (Abs et al., 2024). This work will inspire new avenues in modeling microbial contributions to soil carbon feedbacks.

In my most recent research, I contributed to global land surface modeling by integrating microbial evolution into ORCHIDEE-MIMICS, demonstrating its significant influence on global soil carbon loss under warming

scenarios. Using metagenomic data and enzyme assays, I identified key gaps in data for model validation, laying the groundwork for future integration of microbial diversity into ecosystem models (Abs et al., in review). These advances, alongside my leadership in international collaborations and efforts to bridge theoretical ecology with practical applications, have shaped my interdisciplinary research portfolio.

Synthesis of scientific publications in peer-reviewed journals

Table 1 - List of indexed journals in which I have published, their impact factor (h-index), and their ranking (quartile) within their associated discipline(s) (source: Journal Citation Report 2024). The table provides: the number (Nb) of publications per journal, those for which I am listed as the 1st or 2nd author, and whether my PhD supervisors are absent. Q1 = 1st quartile (green), Q2 = 2nd quartile (yellow).

Indexed journals	Impact factor and quartile	Nb of publications	Nb of publications as 1 st author	Nb of publications as 2 nd author	PhD supervisors	Year(s)
<i>Nature</i>	50.5	1 (cited: 5)	0	0	Absent	2024
<i>Nature communications</i>	14.7	1 (cited: 27)	0	1	Absent	2024
<i>Global Change Biology</i>	10.8	2 (cited: 10)	2	/	Absent (1/2)	2024, 2025
<i>New Phytologist</i>	8.3	1 (cited: 10)	0	1	Absent	2021
<i>Ecology Letters</i>	7.6	1 (cited: 2)	1	/	Absent	2024
<i>Communications Biology</i>	5.2	1 (cited: 23)	1	/		2020
<i>Elementa: Science of the Anthropocene</i>	4.7	2	2	/	Absent (2/2)	2023, 2024
<i>Environmental Microbiology</i>	4.3	1 (cited: 16)	1	/	Absent	2022
<i>Ecosphere</i>	2.7	1 (cited: 2)	1	/	Absent	2024
<i>Aquatic Microbial Ecology</i>	1.6	1 (cited: 132)	0	1	Absent	2015
<i>Nature Research Square</i>		1 (cited: 11)	1	/		2022
Total number of publications		12	8	3	Absent: 10	

Choice and strategy in publishing

My publication strategy is rooted in the principles of open science and thoughtful journal selection, aimed at maximizing the impact and reach of my research. For instance, I published my most recent ecological work in *Ecology Letters* and my latest geoscience perspective in *Global Change Biology* to engage an **interdisciplinary audience** of ecologists, geoscientists, evolutionary biologists, and interested non-experts.

I strive to openly share my research findings, data, and methods to promote transparency and reproducibility in science. With the support of the Marie Curie grant, I have adhered to the **FAIR data principles**: ensuring that data are findable, accessible, interoperable, and reusable. All my publications are open access and also available on the HAL repository.

Scientific autonomy

- **Funding received**

2024	ERC Starting Grant, €1,499,775
2021 – 2024	MSCA Individual Global Postdoctoral Fellowship, €257, 620
2019	Center of Interdisciplinary Research Travel Grant, €1,000
2018 – 2019	Paris Sorbonne University Labex Memolife Fellowship, €8,000
2015 – 2018	Frontiers in Life Sciences PhD Fellowship, €70,000
2022	MCAA Micro Grant, €1,000
2023	MCAA Micro Grant, €1,000
Total	€1,838,395

- **Supervising and mentoring experience**

Laboratory of Environmental and Climate Science: I’m currently supervising one PhD student (Elisa Richard) and two postdocs (Mathilde Bourreau and Thomas Cortier). I supervised Elisa Richard during her Master’s (M2) internship from February to July 2025, for which she received a final grade of 19.5.

University of California Irvine: Dr. Wally Xie, PhD student, now data scientist at Kite Pharma; Dr. Bahareh Sorouri, PhD student, now NSF postdoctoral research fellow at University of Alaska Fairbanks; Jose Murua Royo, PhD student.

Ecole Normale Supérieure of Ulm: Willem Bonnaffe, master's student, now postdoctoral scholar at the University of Oxford; Dr. Antonin Affholder, master's student, now postdoctoral scholar at the University of Arizona.

- **Contributions to research community**

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| 2024 | Chair and co-convenor of two oral sessions and one poster session at the AGU Annual Meeting: “Advancing Soil Carbon Predictions: From Micro-to Global Scale” . |
| 2021 – 2023 | Chair and co-convenor of an Inspire session at the ESA Annual Meeting for three consecutive years: “Connecting Evolutionary and Ecological Perspectives to Find What Matters in Microbial Responses to Change” at ESA 2021, “Microbial adaptation is gonna change our understanding of soil carbon-climate feedback” at ESA 2022, and “Linking Microbial Evolution to Ecosystem Processes for All Ecologists” at ESA 2023. |
| 2020 | Co-convenor of a two-day virtual live event, “Ecology Underground” , at the ESA Annual Meeting. |
| 2018 | Co-convenor of the workshop ‘BIOCOSMOS – Our sense of place, our sense of life in the universe’ held in Feb 2018 at Biosphere 2 gathering international speakers in evolutionary biology and anthropology around the question of habitability, Tucson, USA. |
| 2016 | Co-convenor of the ‘Paris Fitness Workshop’ held in June 2016 at Paris Science Lettres gathering international speakers in empirical and theoretical evolutionary biology around the concept of fitness in biology, Paris, France. |

- **Reviewing activities**

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| 2019 - present | <u>Guest Editor</u> : Elementa: Science of the Anthropocene, University of California Press. <u>Journal reviewer</u> : Nature Communication Biology, The ISME Journal, Soil Biology and Biochemistry, Environmental Microbiology, Elementa: Science of the Anthropocene, Federation of European Microbiological Societies (FEMS) Microbiology Ecology. |
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- **Scientific societies**

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| 2022 – present | European Geophysical Union (EGU) |
| 2021 – present | American Geophysical Union (AGU) |
| 2021 – present | French Society of Ecology and Evolution (SFE ²) |
| 2019 – present | Ecological Society of America (ESA) |

- **Other contributions to the research community**

I am currently an [Early Career Scientist \(ECS\) representative](#) for the Biogeosciences (BG) section of the EGU, where I communicate funding opportunities and events to BG early career scientists, organize social activities, and contribute blog posts (e.g., [“How to Go to EGU by Train”](#)). I also co-created and currently lead the early-career branch of the [Ethics Reflection Group](#) at the Institute Pierre Simon Laplace (IPSL). Together, we have been organizing a seminar series titled [“How to Engage for Climate as Researchers Outside Our Research: Risks and Efficiencies”](#).

In the past, I volunteered with the Marie Curie Alumni Association [North America Chapter](#) for three years (2020–2023), including in 2020 when the chapter was awarded Best Non-European Chapter. I served as a board member and the USA West Coast Coordinator, organizing numerous events for fellows on topics such as climate change, anti-racism, and inclusiveness in academia. At the University of California, Irvine, I served for three years (2020–2023) as an elected member of the Anti-Racism, Diversity, Equity, and Inclusion ([ARDEI](#)) council in the Department of Ecology and Evolutionary Biology (EEB). My contributions included helping to establish and socialize the council by drafting bylaws approved by departmental vote, as well as organizing the first inclusive EEB seminar series.

- **Other involvement in collective activities**

2023 - present [CALIPSO](#) WP4 Integration team leader, LSCE, France (16 months)
 2023 - present [BIOGEO](#) organizing team member, LSCE, France (18 months)
 2017 - 2018 Invited and hosted external speakers for the biweekly institute colloquia series, IBENS, France (1 year)
 2016 - 2017 Led the journal club of the Eco-Evolutionary Mathematics team, IBENS, France (1 year)
 2015 - 2016 Doctoral Student Representative, Learning Planet Institute, France (1 year)

Teaching and dissemination activities

- **Teaching activities**

2015 – 2019 Lecturer of course E480/580, Discrete and Continuous Models in Ecology and Evolutionary Biology, University of Arizona, US.
 2015 Directed lab work (computational simulations) for Pr. Regis Ferriere’s course on Adaptive Dynamics, Ecole Normale Supérieure of Ulm, France.

- **Research dissemination**

I am committed to conducting transparent, reproducible, and high-quality research. This involves posting preprints prior to publication, publishing open access, pre-registering studies, and making collected data accessible to others. Additionally, I actively engage in communicating my findings to non-scientific audiences. For instance, I have been interviewed twice about the responsibility of climate scientists to speak out on climate change in the political sphere. I also regularly use BlueSky and LinkedIn for research dissemination. In June 2023, I was invited as a panel speaker for the “[ClimActions](#)” seminar held at LSCE.

- **Career breaks, diverse career paths and major life events**

I began my career in environmental engineering before transitioning to research in 2014. In 2020, I was awarded a Marie Curie Postdoctoral Fellowship, but its start was delayed until 2021 due to limited visa availability during the Trump administration and the COVID-19 pandemic. In 2022, I transitioned to a non-binary gender identity.

Invited talks and seminars

I presented my work **20 times in the most relevant international conferences in the field**, such as an invited talk at the Annual Meeting of the American Geophysical Union (AGU) in Fall 2019 and an invited “inspire talk” at the Annual Meeting of the Ecological Society of America (ESA) in Summer 2022. I have also been invited to give departmental seminars, including at Stockholm University in the Department of Physical Geography in February 2024, Lawrence Berkeley National Lab in February 2023, the University of Texas at Austin in the Department of Integrative Biology in November 2022, Duke University in the Department of Biology in October 2022, and the Institute of Evolutionary Science of Montpellier (ISEM) in September 2021.

- **Invited international presentations**

2024 Integrating the effect of microbial legacy and adaptation on soil biogeochemistry in the Microbial-Mineral Carbon Stabilization (MIMICS) model, AGU, Washington DC, US
 2023 Global adaptation of soil microbes under environmental change AGU, San Francisco, US
 2021 Connecting ecology and evolution in mathematical models of soil microbial decomposition, ESA, virtual, US
 2020 Effect of invasions on microbiome functional response to environmental change: a modelling approach with DEMENT, ESA, virtual, US
 2019 Implications of microbial adaptation for soil C-climate feedbacks, AGU, San Francisco, US

- **Selected invited seminars**

2024 Using adaptive dynamics to predict microbial eco-evolution, Stockholm University, Sweden
 2023 Microbial eco-evolutionary feedbacks to carbon cycling and climate change, Lawrence

- Berkeley National Lab, Berkeley, US
- 2022 How do microbes adapt to global warming: a theoretical perspective, University of Texas, Austin, US
- 2022 Microbial adaptation could amplify the global carbon loss in response to warming, Duke University, Durham, US
- 2022 On the use of metagenomics to validate predictions of microbial evolution, University of California, Irvine, US
- 2022 Microbial impact of the global carbon cycle, South Methodist University, Dallas, US