Rayanne Vitali

Postdoctoral Research Fellow • Vegetation & Earth system modeller • Interest in Earth system feedbacks

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EDUCATION

2018 – 2023 **PhD in Physical Geography,** University of Exeter. (Rewarded October 2023)

Funded by a royal society studentship, (Supervised by Prof. Andrew Watson & Prof. Claire Belcher)

2014 – 2018 **MMath Mathematics** (First Class honours), University of Exeter

Modules studied include the mathematics of climate change, the climate system, advanced statistical modelling, modelling the weather and climate, and fluid dynamics of atmospheres and oceans.

RESEARCH EXPERIENCE

2023 - present **Postdoctoral Research Fellow,** Aarhus University

As part of the GreenFeedBack project: Greenhouse gas fluxes and Earth system Feedbacks. Role involves collaborating with partners across Europe to implement changes into the coupled Earth system model EC-Earth, performing global-scale sensitivity and future simulations to investigate how high-latitude ecosystem responses feedback onto the global carbon cycle and modulate projected climate changes, with a focus on terrestrial processes and feedbacks.

2023 **Research Technician,** University of Exeter WildFIRE lab

As part of the IDEAL UK FIRE: Toward Informed Decisions on Ecologically Adaptive Land management for mitigating UK FIRE project. Role involves planning, preparing, and assisting with prescribed burns and vegetation measurements, communicating, and working with land managers, and data analysis.

2018 – 2023 **PhD researcher in Earth system science,** University of Exeter

Title: **The history of atmospheric oxygen: Regulation by fire.** Developed a Dynamic Global Vegetation Model (LPJ) to run over varying oxygen concentrations to test potential negative feedbacks on atmospheric oxygen over long timescales, focusing on fire and photorespiration effects on global vegetation. This allowed assessment of untested long-standing assumptions, resulting in a first author publication in a high impact journal. Updates to several biogeochemical models were then made to give an improved understanding of atmospheric oxygen regulation and hence the Earth system through deep time.

2022 **Research Technician,** University of Exeter WildFIRE lab

Assisted in research as part of the UKFDRS: Toward a UK Fire Danger Rating System. Conducted cone calorimeter burns measuring fuel flammability, set up of equipment for and assisted in prescribed burns, undertook measurements of fire severity & fuel load, created blog posts, and represented the project in two prime-time TV appearances on major nationwide TV channels.

Sep. 2019	**Advanced Earth System Modelling Capacity Summer School,** Bad Aibling, Germany combination of lectures on Earth system components, theoretical aspects, numerical modelling, data assimilation and hands-on exercises. Included a session on the coupling of different Earth system components.
2017-2018	**MMath Thesis,** University of Exeter
	Title: Including the nitrogen cycle in the Joint UK land Environment Simulator (JULES): towards an improved representation of vegetation dynamics. Project involved developing the model to include feedback effects from belowground fertilisation in permafrost peatlands, evaluating the ability to reproduce observations and running future simulations with the aim to investigate how belowground nitrogen fertilisation affects the carbon cycle.
2017	**10-week EPSRC vacation Internship,** University of Exeter & the Met Office
	Title: The effect of nitrogen on vegetation under future warming. Independently planned summer project in collaboration with the Met Office in which the newly implemented Nitrogen cycle in the JULES land surface model was evaluated.

PUBLICATIONS

Little, K., Vitali, R., Belcher, C.M., Kettridge, N., Doerr, S. et al. (In review) Do changing fire regimes need new wildfire science research agendas? (Submitted February 2024 to *Philosophical Transactions Of The Royal Society B*)

Vitali, R., Belcher, C.M., Mills, B.J.W. and Watson, A.J., (In revisions). Combined effects of photorespiration and fire plays a key role in regulating atmospheric oxygen. (Submitted December 2023 to *Science Advances*)

Vitali, R., Belcher, C.M., Kaplan, J.O. and Watson, A.J., 2022. Increased fire activity under high atmospheric oxygen concentrations is compatible with the presence of forests. *Nature Communications*, *13*(1), p.7285.

Vitali, R., Chadburn, S.E., Keuper, F., Harper, A.B. and Burke, E.J., 2022. Simulating Increased Permafrost Peatland Plant Productivity in Response to Belowground Fertilisation Using the JULES Land Surface Model. *Nitrogen*, *3*(2), pp.260-283.

Belcher, C.M., Mills, B.J., Vitali, R., Baker, S.J., Lenton, T.M. and Watson, A.J., 2021. The rise of angiosperms strengthened fire feedbacks and improved the regulation of atmospheric oxygen. *Nature Communications*, *12*(1), p.503.

IN PREP:

Vitali, R., Belcher, C.M., Mills, B.J.W., and Watson, A.J., 2023. Improvement of terrestrial feedbacks results in tighter regulation of atmospheric oxygen in biogeochemical models.

PRESENTATIONS

Mar. 2024	EC-Earth General Assembly, Utrecht, Netherlands (poster)
Jul. 2023	Life and Planet 2023, London, UK (Highlight talk)
Jul. 2023	Goldschmidt 2023, Lyon, France (oral presentation)
Jun. 2022	11th European Palaeobotany and Palynology Conference, Stockholm, Sweden (oral presentation)
May 2022	Paleo@Leeds seminar, University of Leeds (invited talk)
Oct. 2021	ClesCon postgraduate research conference, University of Exeter (oral presentation)
Sep. 2019	ESM Advanced Earth System Modelling Capacity Summer School (poster)
Jul. 2019	Lovelock Centenary: The Future of Global Systems Thinking Meeting, University of Exeter (poster)
Dec. 2018	Earth System Science Seminar series, University of Exeter (oral presentation)
Feb. 2018	Employability development for HE mathematics and statistics conference, Sheffield Hallam University (oral presentation)

TEACHING EXPERIENCE

Spring 2021   Assisted in the supervision of a Master students dissertation project involving cone calorimeter burns.

2019-2021   **Postgraduate teaching assistant** – Fire ecology and fire management module. Assisted with preparations and co-running of computer practical's running fire behaviour models.

2018-2019   **Postgraduate teaching assistant** – Research Methods for Geographers module. Computer practical demonstrating (Introductory statistics workshop using SPSS).

Apr. 2019   **Exeter Scholars Tutor**. Organised and conducted activity sessions for 16–18-year-olds as part of Exeter Scholars (a widening participation programme)

2018   Certification for Stage 1 Learning and Teaching in Higher Education (LTHE-1).

2016-2018   **Refresh your Maths Mentor**. Created lessons, developed resources, and led workshops aimed to help last year students familiarize with GCSE level mathematics for future employment for the programmes pilot and second year. The success saw a case study of the programme published in the sigma Network Employability: Employability development for HE mathematics and statistics booklet and led to an invite to talk at their related workshop.

RESEARCH SKILLS & EXPERIENCE

Model experience: EC-Earth Earth System Model, LPJ Dynamic Global Vegetation Model, SPITFIRE fire regime model, JULES land surface model, BehavePlus fire behaviour model and COPSE, SCION & GEOCARBSULFOR biogeochemical models. Experience running models on HPCs.

Programming Languages: C++, Fortran, Python, shell script

Software: R statistical software, Matlab, SPSS, LaTeX, PAST, experience with Git version control & Microsoft Office

Equipment: FTT iCone calorimeter for flammability measurements, transmitted light microscopy of charcoal, experience preparing charcoal samples embedded in polished resin.

OUTREACH & OTHER

2023-present   Sustainability workgroup team member for the Department of Environmental science. Collaborating with an interdisciplinary team to improve sustainability plans and practices for the department, including Assisting in building an emissions inventory.

2020-2022   Global Systems Institute communications team member. Created social media and newsletter content and produced a series of short videos displaying research produced by GSI members.

Aug. 2022   Interviewed for and appeared on BBC One Countryfile: Heatwave Special. A flagship programme regularly seeing above 5 million viewers.

Aug. 2021   Interviewed for and appeared on Channel 4 documentary: Summer of Wild Weather: Is Worse to Come?

May. 2021   Lead organiser of Pint of Science Exeter 2021. Led the planet earth theme team and broadcasted an online event aimed at non-academics.

Nov. 2020   Guest on the Soundart radio podcast – Futures on air: Our Shared Planet. Involved discussing issues of wildfires and climate change with a mix of children as part of the FUTURES2020 festival.