Emma Southall

Curriculum Vitae

Personal Statement

○ I am motivated to apply mathematics towards studying complex systems, especially in the fields of public health and the environment (applied probability, stochastic processes, dynamical systems and time series analysis).

○ My research has culminated in publications across several international scientific journals and includes work commissioned by the *Joint Biosecurity Centre* to advise the *Department of Education* on the community spread of COVID-19 from school attendance.

○ I have had the opportunity to present and discuss my research with the *Food and Agricultural Organisation of the United Nations*, the *Cabinet Office* and the *Department of Education*, giving me experience working directly with external partners.

○ Speaking at various conferences and events has enabled me to form new relationships and collaborate with other researchers in my field, including leading a joint publication between the *University of Warwick* and the *University of Georgia*.

Education

2018–Present   **PhD Mathematics for Real-World-Systems**, *Complexity Department, University of Warwick*.
Expected end date 31/12/2021. EPSRC and MRC funded.
PhD Thesis – "Early-warning signals of disease transitions."
Supervisors: Dr Louise Dyson, Dr Michael Tildesley

2017-2018   **MSc Mathematics for Real-World-Systems (Distinction)**, *University of Warwick*.
MSc Thesis – "The Nipah Virus: leading indicators of zoonotic disease elimination".
Supervisors: Dr Louise Dyson, Dr Michael Tildesley.

MSc Group Project – "Foot-and-Mouth Disease: A Comparative Study of Multiple Intervention Strategies".
Supervisors: Dr Michael Tildesley, Dr Nicholas Lyons (Food and Agricultural Organisation, UN).

2014-2017   **BSc Mathematics (First Class)**, *University of Warwick*.

Experience

May 2020 – Present   **Warwick COVID-19 School Group**, *University of Warwick*.
Work alongside my PhD, examining school attendance and census data. Analysing the data since the partial reopening of schools at the start of June 2020, addressing the spatial and school variability in attendance and absences due to confirmed COVID-19 during the pandemic. This work was regularly reported to the Scientific Pandemic Influenza Group on Modelling (SPI-M), leading to communications with the Scottish Government, Cabinet Office, Joint Biosecurity Centre and Department for Education to guide policy.

Feb - April 2020   **IBM Research UK Internship**, *Hartree Centre, Warrington*.
3 month internship in the Enabling Technologies Data Group, under the supervision of Dr Anne Jones. Project involved developing scalable tools for forecasting malaria incidence in sub-Saharan Africa by integrating large datasets on climate drivers (utilising forecast products from the Weather Company) with simulation models. I learnt a variety of data science techniques for handling spatiotemporal data, including leveraging high-performance computing (HPC) and Big Data technology.

May 2019   **AI in Health & Care Study Group**, *University of Cardiff*.
Problem solving week with academics from a variety of universities in the UK. Problem presented by isardSAT, using machine learning techniques with earth observation data to predict precipitation and infer the risk of mosquito habitation. Funded by UK Research Institute (UKRI).

Nov 2018 - Feb 2019   **Mobile App Developer**, *University of Warwick*.
App developer for the Green Research Group, designing an app to track and reduce lameness in sheep flocks. Role involved ensuring the app's functionality and providing technical support for users (Java, HTML, CSS).

Oct 2018   **Epirecipes**, *Alan Turing Institute, London*.
Participated in a 3-day hackathon to develop a cookbook of epidemiological models in as many computer languages as possible. Funded by Dept. of Veterinary Medicine, Cambridge University.

July 2017 - Sept 2017	**Quantitative Biomedical Research Summer Project**, *University of Warwick*. Evaluating the Saccharomyces cerevisiae (budding yeast) potential as a model for fungal pathogenic traits. Funded by MRC. Supervisor: Dr Irene Stefanini.

Advisory Experience

2020 - 2021	**MMath Project**, *2nd Advisor*, Andrew Nugent, University of Warwick, "Investigating the Potential of Early Warning Signals in Disease Elimination".

Technical skills https://github.com/ersouthall

Proficient	Scientific computing in Python (NumPy, Networkx, scikit-learn, Keras, TensorFlow), MATLAB.
Intermediate	Julia, RStudio and Javascript (Observable notebooks).
Other	Technical report writing in LaTeX, version control using Git, Linux operating systems, high-performance computing.

Other academic activities

2017–Present	**Student and Staff Liaison Committee**, *University of Warwick*. Student representative for the Complexity Department.
2017–Present	**Ada Lovelace Conference**, *University of Warwick*. Panel member at the Ada Lovelace Day, celebrating the achievements of women in mathematics.
2019	**Women in Maths Outreach Day**, *University of Manchester*. Presented a workshop to groups of year 10 & 12 school students, showcasing research possibilities in mathematics.
2018/19	**Equality & Diversity Committee**, *University of Warwick*. Postgraduate representative for the Mathematics Department.

Teaching Experience

2021	**Teaching Assistant**, *Virtually, 4th year undergraduate*, Epidemiology by Example (MATLAB).
2018–2021	**Teaching Assistant**, *3rd year undergraduate*, Bifurcations, Catastrophes and Symmetries.
2019, 2021	**Teaching Assistant**, *1st year undergraduate*, Maths by Computer (MATLAB, Python).
2020	**Senior Teaching Assistant**, *Virtually, 1st year undergraduate*, Analysis I.
2019–2020	**Instructor**, *MSc*, Introduction to Computing (Python, Julia, bash and HPC).
2018–2020	**Teaching Assistant**, *MSc*, Networks and Random Processes.
2017–2019	**Supervisor**, *1st year undergraduate*, Supervisor to first year Maths-Stats Students.
2014–2019	**STEP Exams**, *Advanced Mathematics Support Programme (AMSP)*. Preparing school students for STEP examinations, required by many universities to study maths.

References

Dr Louise Dyson, *PhD supervisor*, Mathematical Sciences Building, 5.09, University of Warwick, CV4 7AL, L.Dyson@warwick.ac.uk.

Dr Michael Tildesley, *PhD supervisor*, Mathematical Sciences Building, 5.03, University of Warwick, CV4 7AL, M.J.Tildesley@warwick.ac.uk.

Dr Anne Jones, *IBM advisor*, IBM Research Laboratory, The Hartree Centre, Warrington, WA4 4AD, Anne.Jones@ibm.com.

Publications

2021	**E. Southall**, T. Brett, M. Tildesley, and L. Dyson. "Early warning signals of infectious disease transitions: a review". *In prep., review article proposal accepted at Journal of the Royal Society Interface.*
2021	**E. Southall***, A. Holmes*, E. Hill, B. Atkins, T. Leng, R. Thompson, L. Dyson, M. Keeling, and M. Tildesley. "An analysis of school absences in England during the Covid-19 pandemic", 15 pages. *Under review at BMC Medicine, available on medRxiv.*

2020 M. Keeling, M. Tildesley, B. Atkins, B. Penman, **E. Southall**, G. Guyver-Fletcher, A. Holmes, H. McKimm, E. Gorsich, E. Hill, and L. Dyson. "The impact of school reopening on the spread of COVID-19 in England", 14 pages. *Philosophical Transactions B, in press.*

2020 **E. Southall**, M. Tildesley, and L. Dyson. "Prospects for detecting early warning signals in discrete event sequence data: application to epidemiological incidence data", 18 pages. *PLOS Computational Biology*.

2019 A. Gama Dessavre*, **E. Southall***, M. Tildesley, and L. Dyson. "The problem of detrending when analysing potential indicators of disease elimination", 10 pages. *Journal of Theoretical Biology*.

* = authors contributed equally to the work.

Conferences and Talks

Apr 2021 **British Applied Mathematics Colloquium**, *Virtually*, Contributed Talk: "Evaluation of lead-time prediction methods for detecting critical transitions using timeseries data".

Mar 2021 **Neglected Tropical Diseases Modelling Consortium (NTDMC) Technical Meeting**, *Virtually*, Invited Talk: "Traits of critical slowing down on the path to disease elimination".

Mar 2021 **LMS Women in Mathematics Day**, *Virtually*, Poster: "Validating time-of-detection methods for alerting an upcoming critical transition".

Aug 2020 **Society of Mathematical Biology Annual Meeting (eSMB)**, *Virtually*, Contributed Talk: "Identifying indicators of critical transitions in epidemiological data".

Nov 2019 **Coalition for Operational Research on NTDs (COR-NTD)**, *National Harbor, Maryland, USA*, Attendee.

Nov 2019 **Centre of Infectious Disease Modelling Seminar**, *National Institute for Public Health and the Environment, Netherlands*, Invited Talk: "Early-warning signals of disease elimination: an equation-free method for monitoring the control of infectious disease".

Oct 2019 **Experimental Ecology & Conservation Seminar**, *University of Bristol*, Invited Talk: "Detecting signals of disease elimination in epidemiological data".

Sep 2019 **Infectious Disease Dynamics Conference (IDD)**, *University of Cumbria*, Contributed Talk: "Detecting signals of disease elimination in epidemiological data".

Apr 2019 **British Applied Mathematics Colloquium**, *University of Bath*, Contributed Talk: "Anticipating Disease Elimination", Funded by LMS.

Dec 2018 **Warwick-Imperial Autumn Meeting**, *University of Warwick*, Contributed Talk: "Foreseeing critical transitions in stochastic infectious disease models".

Jun 2018 **Foot-and-Mouth Disease Meeting**, *Food and Agricultural Organisation of the United Nations, Rome*, Invited Talk (group presentation): "Use of Transect Study Data to Inform Mathematical Models of FMD in Endemic Settings".