SPHERE-PPL: Applying AI Forecasting to Species Distribution Modelling Using the NBN Atlas

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Outline

What is SPHERE-PPL

Forecasting Contests

NBN Contest

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What is SPHERE-PPL?

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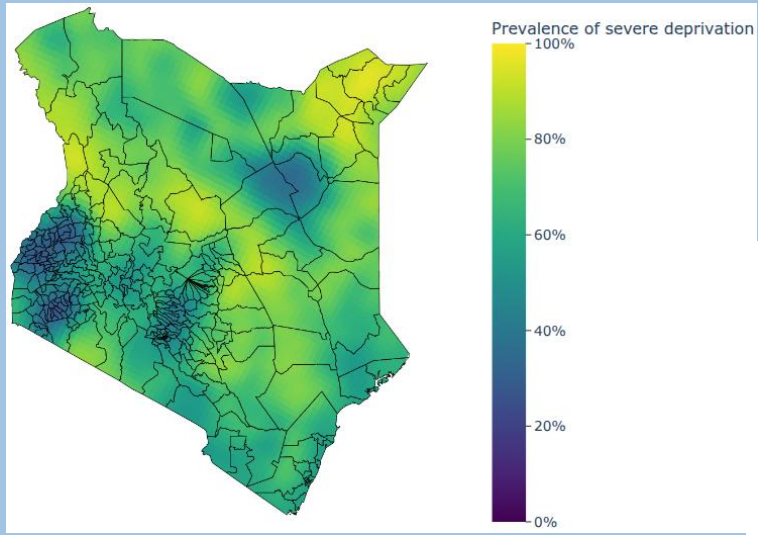
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- Aim: to advance the application of probabilistic programming languages across policy and research
- How: connect organisations (e.g. charities, government departments) with analytical expertise
  - Forecasting contests, training and resources, networking events
- Core domains:
  - Health
  - Climate and Environment
  - Spatial Analyses

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What we've done so far







Symposium for Bayesian Modelling Jan 22 2024

StanCon 2024
Conference on Stan programming and Bayesian Modeling
Oxford University, UK. September 2024



Biodiversity modelling
…with stan!

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Forecasting Contests

What is a Forecasting Contest?

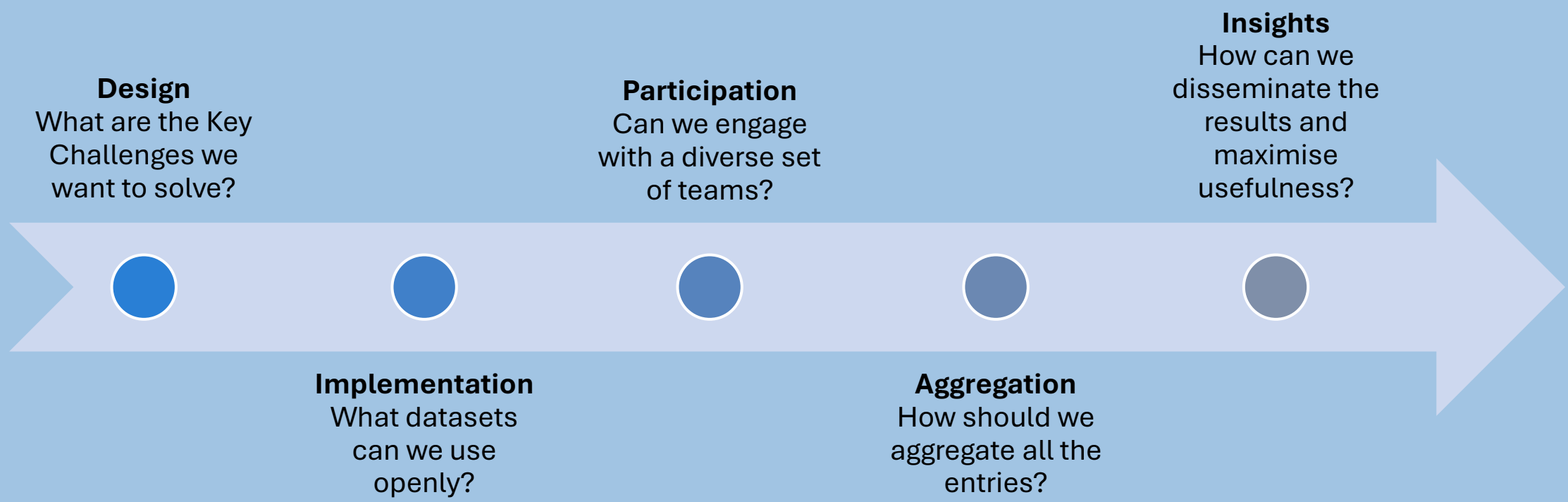
- An open-source competition to find innovative and accurate ways of predicting something
  - Connecting stakeholders with analytical capability
  - Designed around an operational challenge/dataset



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Journey of a Contest



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Previous Contests

Previous contest: Forecasting Severe System Pressure in the NHS



- Hospitals, EDs, and ambulances face unpredictable surges that risk patient care
- Predicting severe system pressure enables proactive staffing, resource allocation, and patient flow management
- Goal: develop an AI forecasting pipeline to predict severe system pressure at 1-10 day horizons

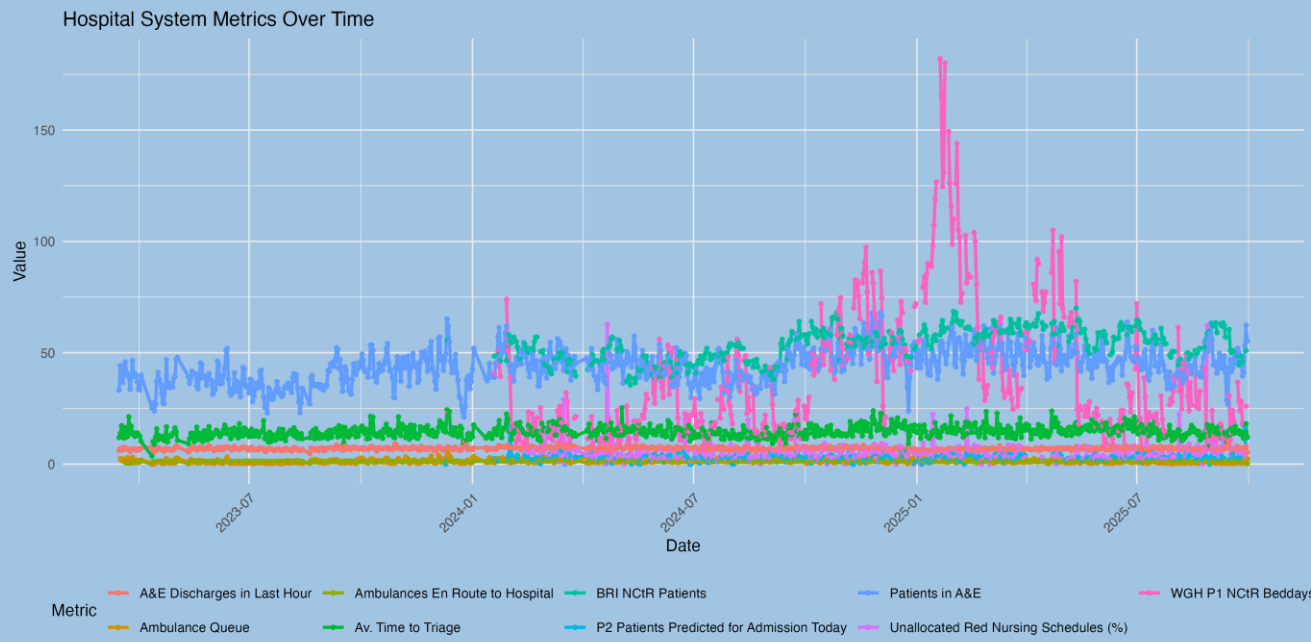


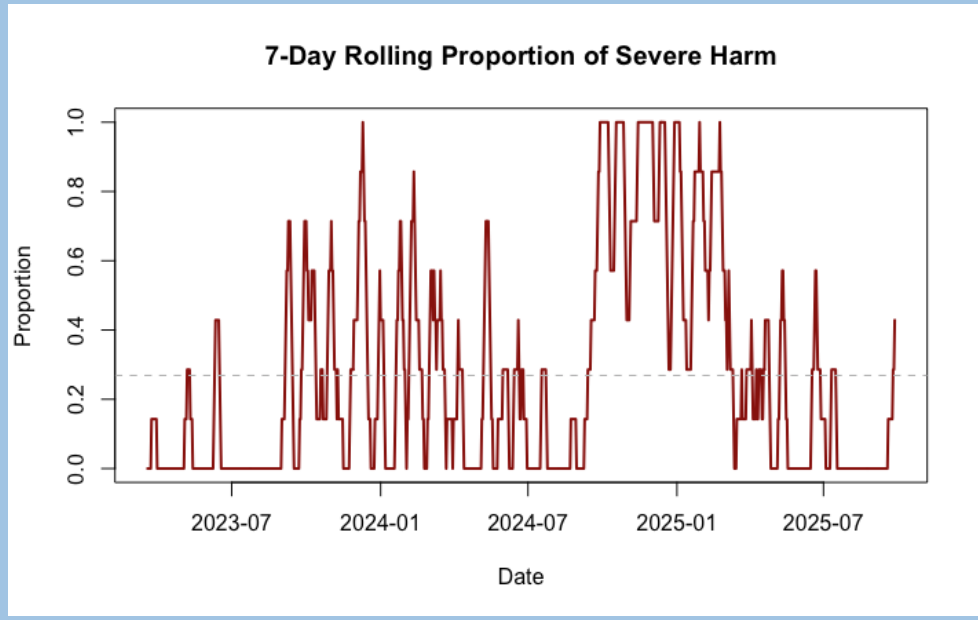
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Data

- Predictors:
  - 157 variables
  - Hospital, ambulance, ED, primary care
- Outcome variable: Severe System Pressure
- 2.5 years of data (Mar 2023 – Sep 2025)





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Previous contest: Forecasting Wheat Crop Diseases across the UK

- Zymoseptoria tritici and yellow rust reduce green leaf area, limiting photosynthesis and lowering yield
- Estimated to cost the agricultural industry up to £250million annually
- Goal: develop a model capable of forecasting the incidence and severity of wheat crop diseases across UK regions





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Data

- Outcome variable:
  - Zymoseptoria tritici Yellow rust severity and crop incidence
  - Wheat leaves 1 and 2
  - UK regions
  - 50 years of data (1971 - 2025)



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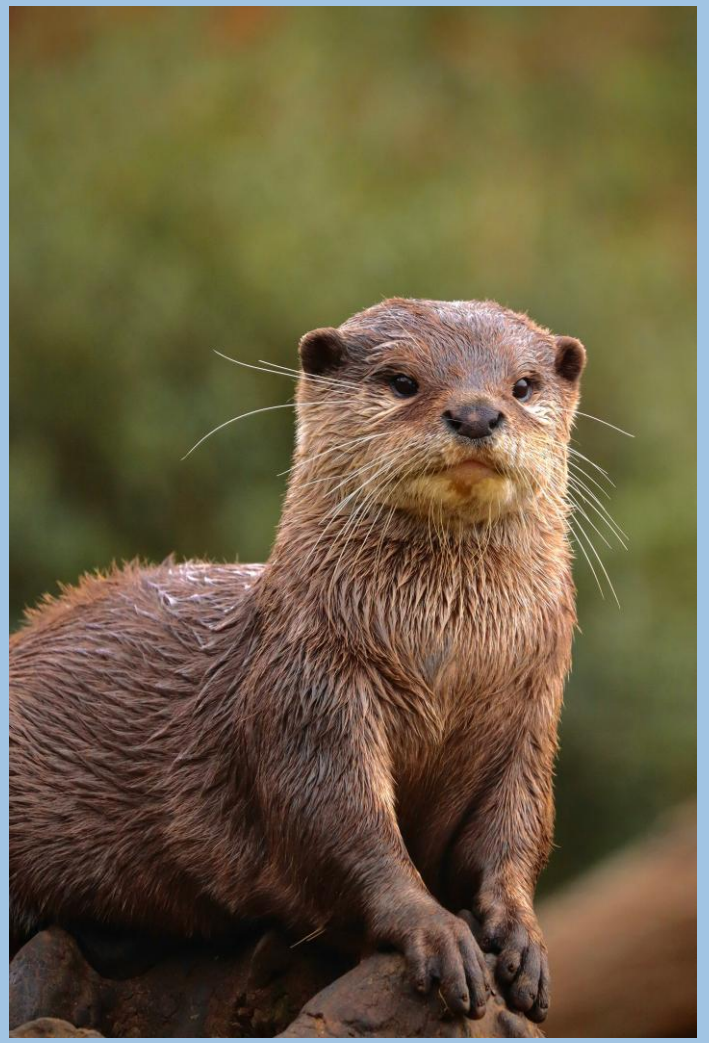
NBN Atlas: Forecasting Species Distributions

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Introduction

- Accurate species distribution modelling can support
  - Environmental monitoring
  - Conservation practices
  - Identification of invasive species trends
- NBN Atlas provides a powerful source of UK biodiversity data
  - > 387 million species occurrence records
- Goal: develop a model capable of forecasting species occurrence within a target UK region in 2026

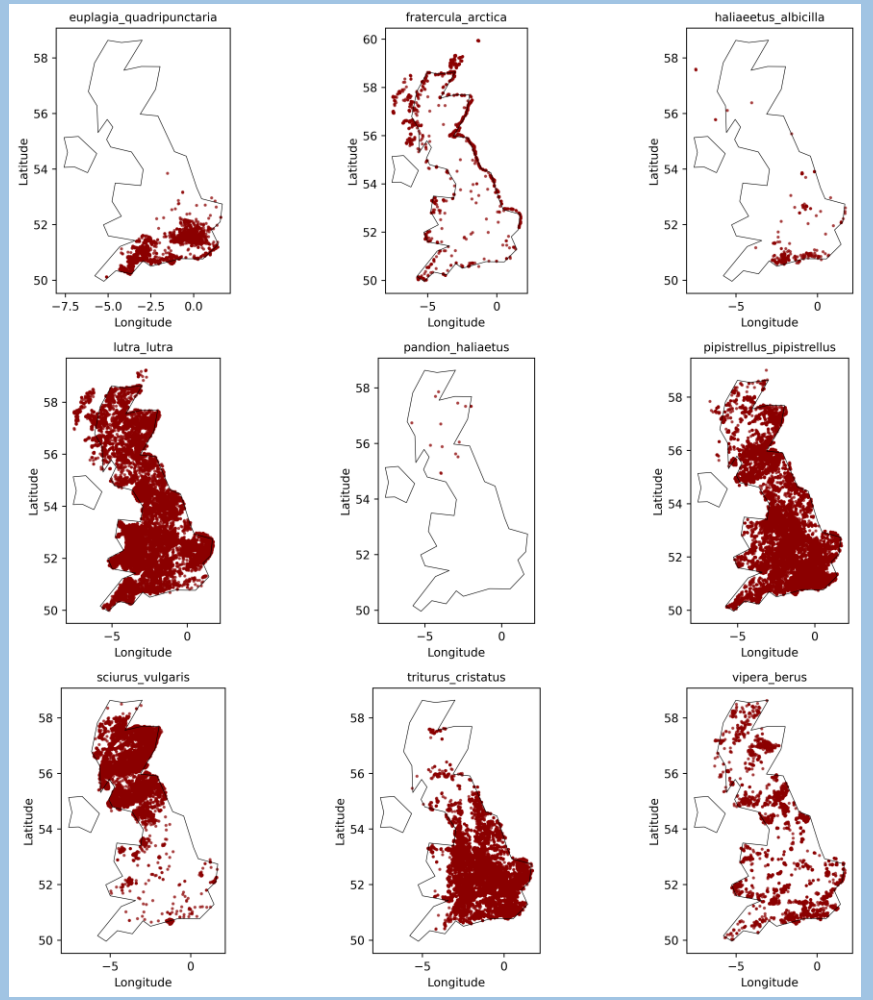


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Data

- Occurrence data for 9 UK species
- Participants encouraged to incorporate external predictor datasets
  - Bioclimate, LUH2 land use, Elevation, Soil
- Spatial resolution: 5km grid



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Contest Rules

- Any coding languages are allowed but all analyses must be reproducible by the panel
- All entries must be loaded into a public Github repo
- All entries must follow the submission formats outlined in the repo
- All entries must include a max 1000 word report





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Contest Winners

- 2 prizes will be given for the best and second best model at forecasting probability of species occurrence in a given target region for 2026
  - Evaluation metric: mean binomial deviance across all nine species
- The winners will be selected by the SPHERE-PPL Team and will be invited to present their forecasts at the next Annual Meeting, with travel covered by the project

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Contest Timeline

1st October 2026	• Competition launch, including the release of the development dataset.
14th December 2026	• Deadline for competitors to submit their final algorithms
mid 2027	• The assessment dataset is released, winners announced

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Thank-You!

Please scan below for contest repo:

For more information, please visit www.sphere-ppl.org or email the team at info@sphere-ppl.org.

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