ASIA AND THE PACIFIC
FOOD SECURITY FORUM 2024
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ADB

Projecting livestock health in the face of climate change

And the AI-powered database 'CliZod'

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MASSEY UNIVERSITY
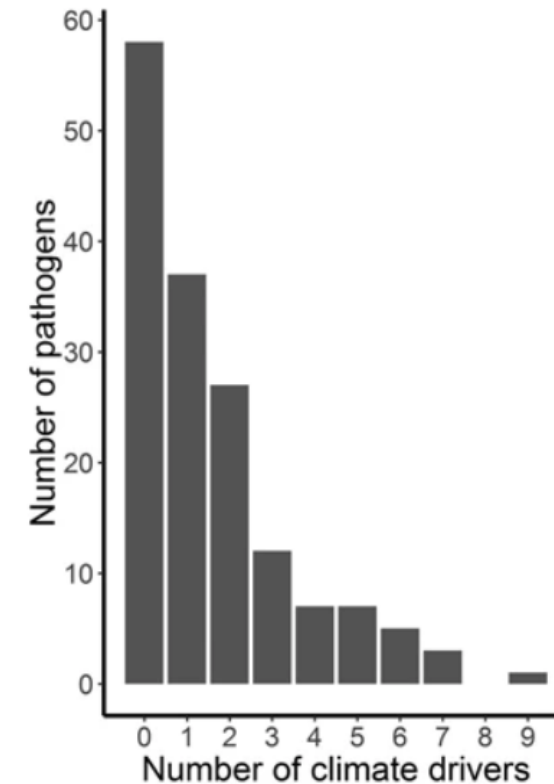TE KUNENGA KI PŪREHUROA

UNIVERSITY OF NEW ZEALAND

Image generated by DALL.E2

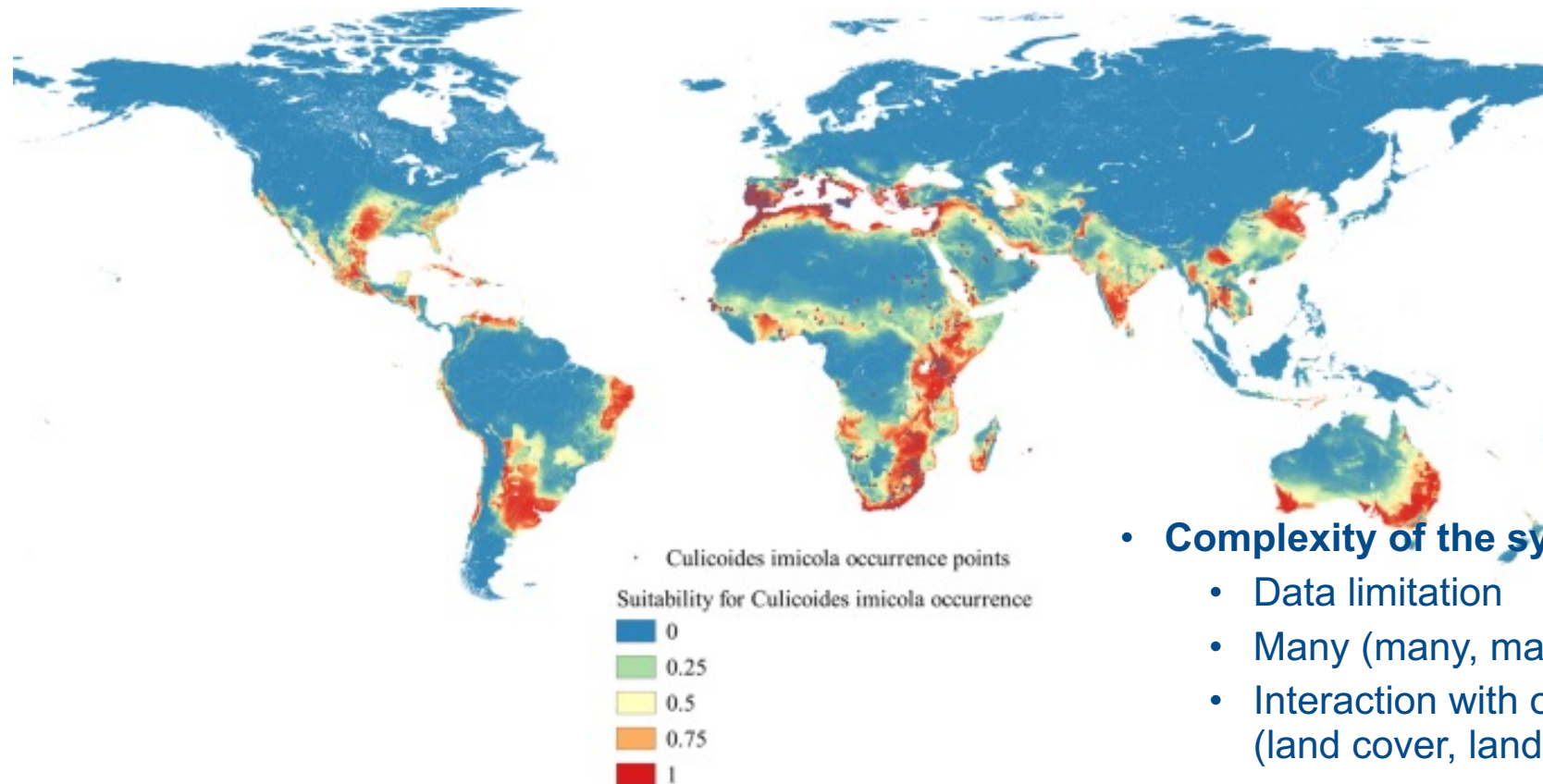# Climate change as a threat to livestock health, food security & safety

- Climate change will exacerbate livestock diseases

*McIntyre et al. 2017. Systematic Assessment of the Climate Sensitivity of Important Human and Domestic Animals Pathogens in Europe. Scientific Reports 7:7134

We need new tools

- To prepare and mitigate climate change impacts on livestock health
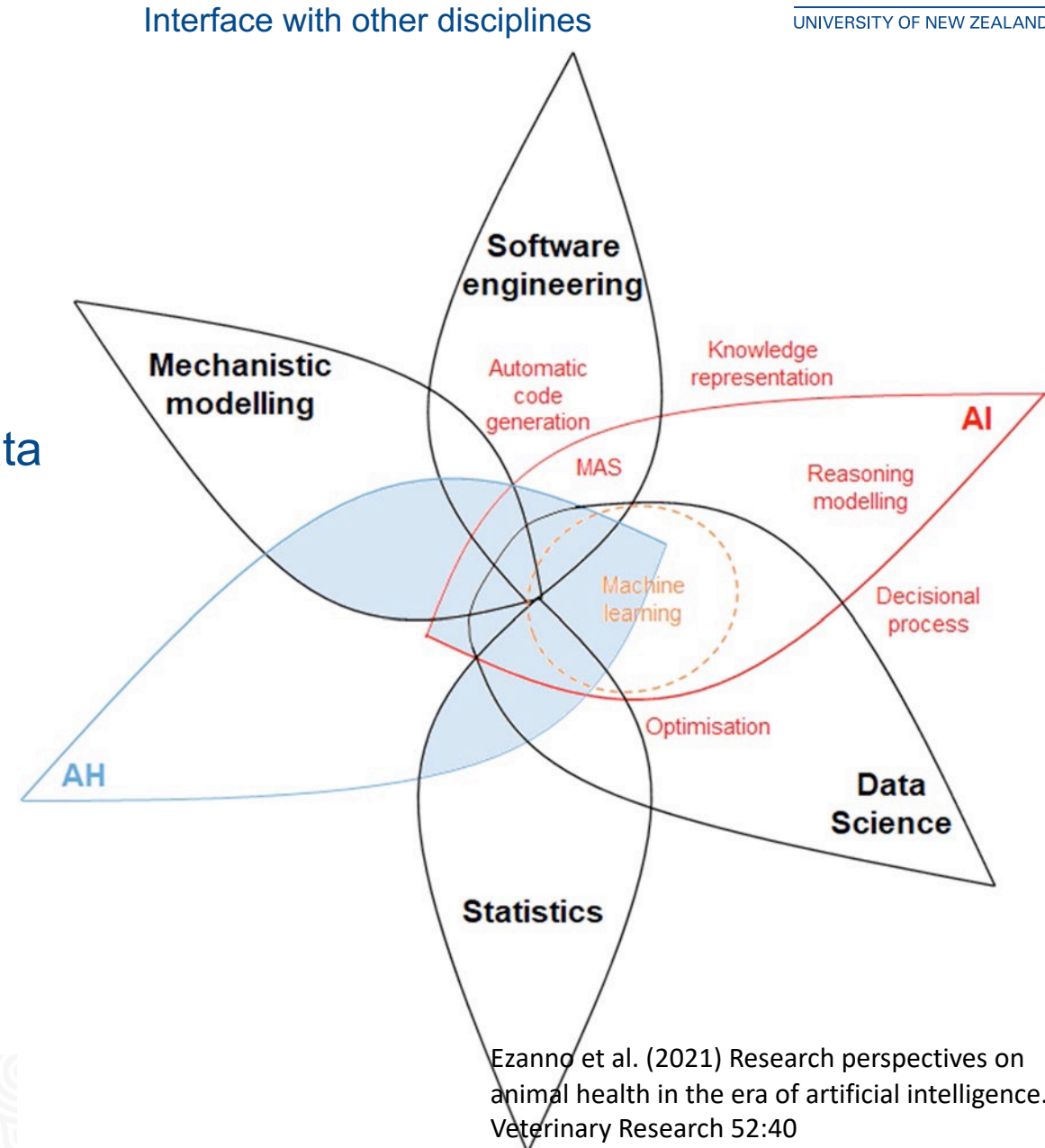
  e.g. risk prediction maps for mosquitoes

Culicoides imicola occurrence points

Suitability for Culicoides imicola occurrence

- 0
- 0.25
- 0.5
- 0.75
- 1

- **Complexity of the systems**
  - Data limitation
  - Many (many, many…) climate variables
  - Interaction with other environmental variables (land cover, land use, host distribution…)
 - Interaction with other socio-economic variables (livestock density)

Can AI be used?

- For tasks that normally require a "human brain"
  - Task autopilot
  - Collection, analysis, and interpretation of existing data

- Various algorithms, depending on the type of data
  - Machine learning
  - Natural Language Processing
  - Neural networks

- Case studies
  1) EARS – prediction model
  2) CliZod – parameter database

Ezanno et al. (2021) Research perspectives on animal health in the era of artificial intelligence. Veterinary Research 52:40
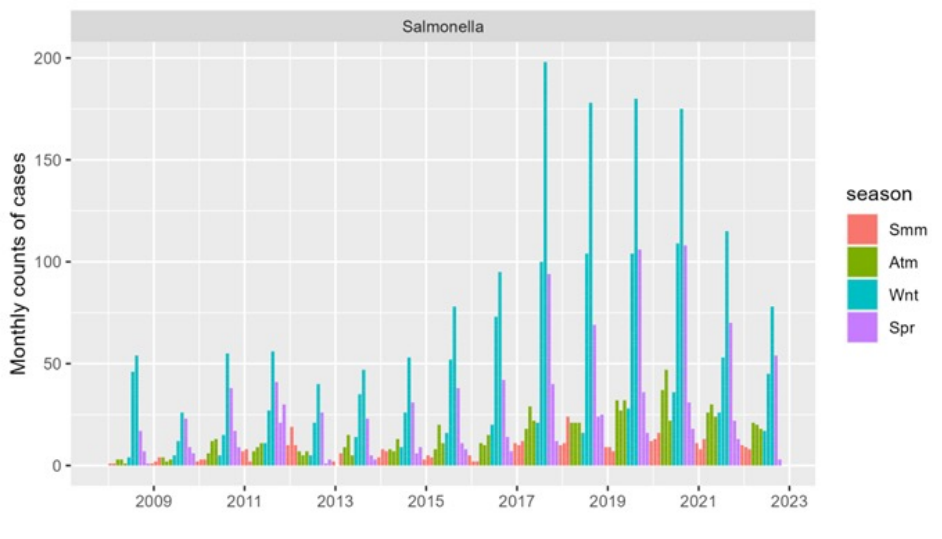
Case study 1: EARS

- 'Early Aberration Reporting System'
  - Monitoring, early warning and prediction of disease outbreaks in livestock

- Developed by Massey University and NZ Ministry for Primary Industries (MPI)

- Enhancement by adding climate data for climate-sensitive disease outbreaks
  - Salmonellosis, Theileriosis, facial eczema, leptospirosis, etc
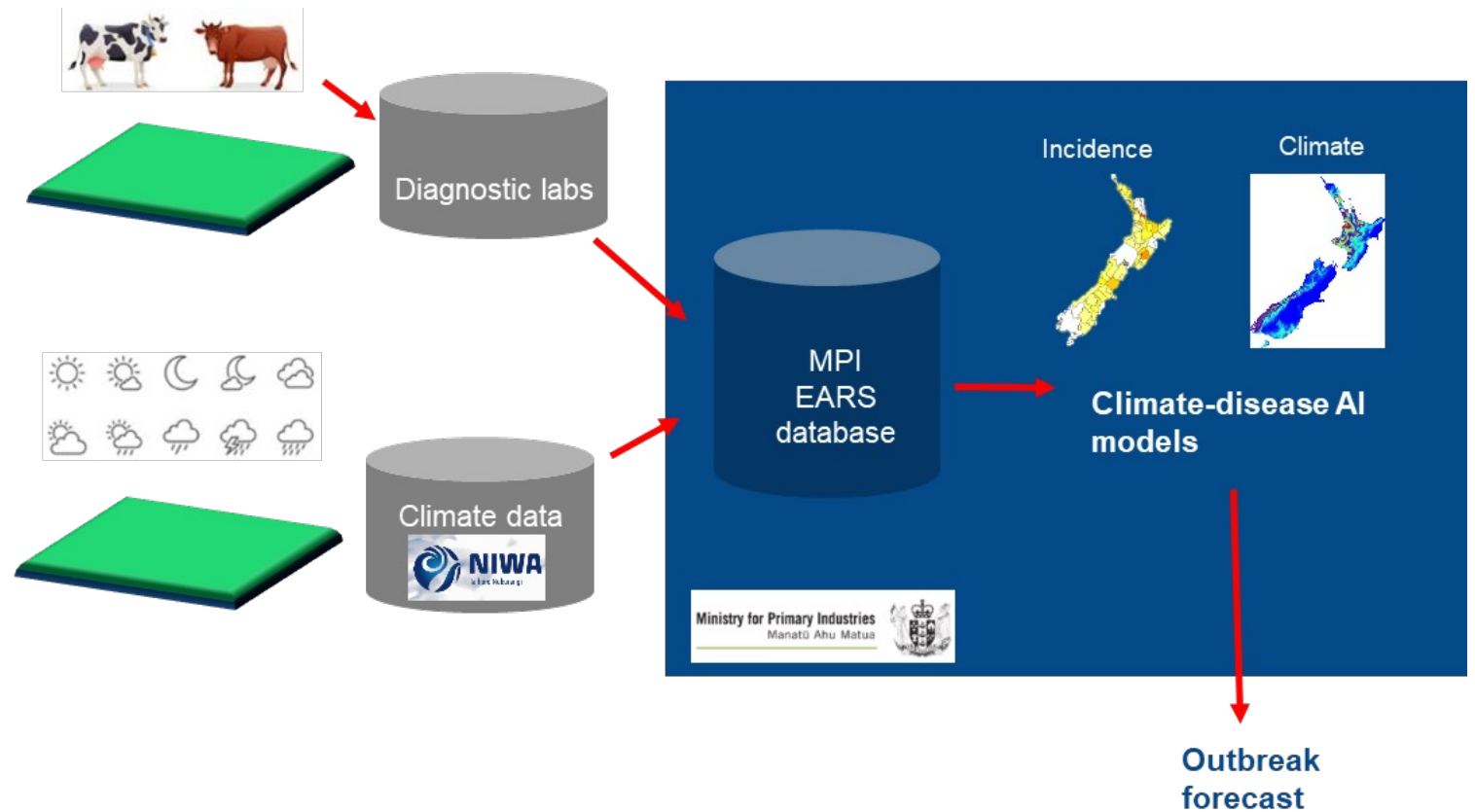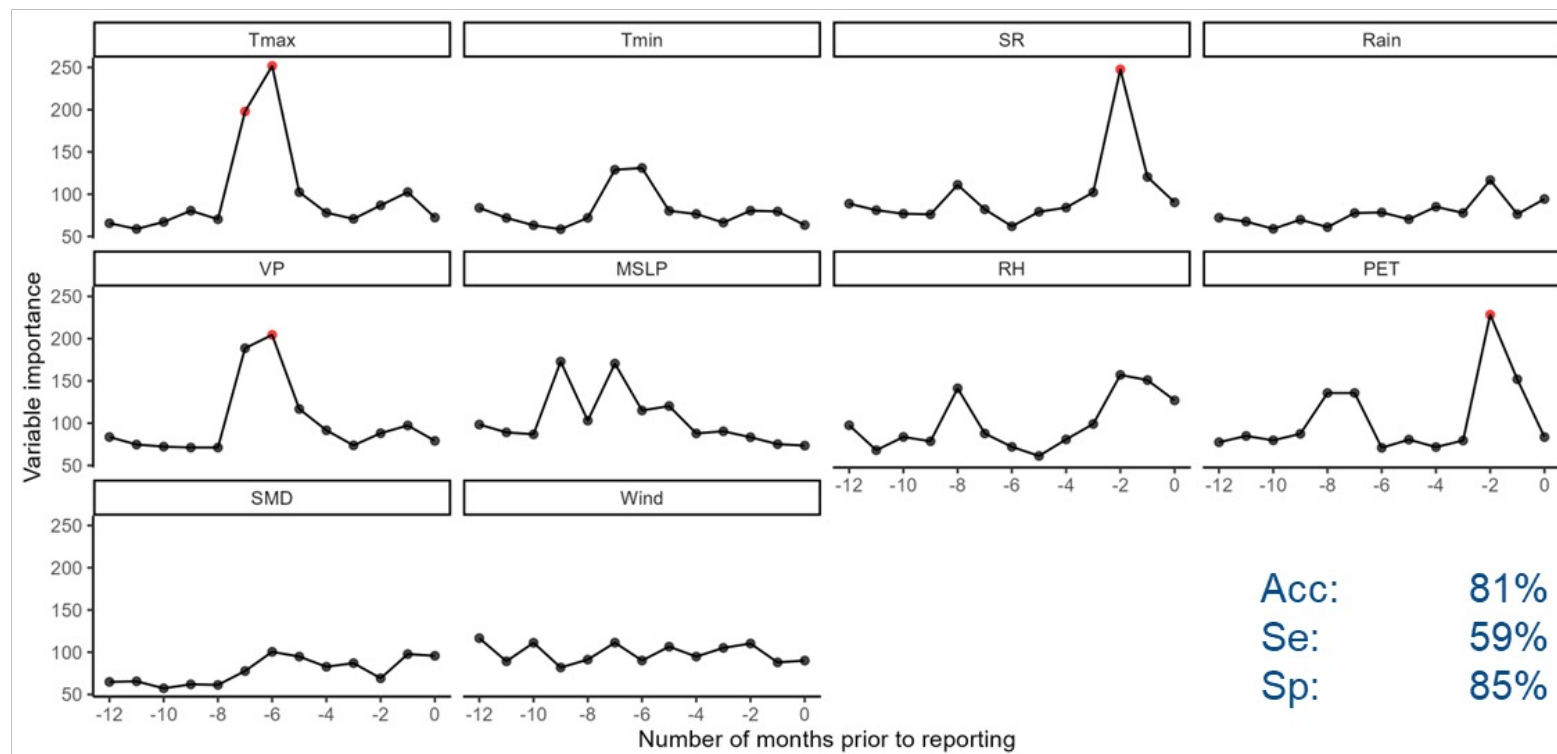
Case study 1: EARS – cont'd

- Example: cattle salmonellosis x climate model

Timeseries incidence

Records of 4689 cases (2008-2022)
+ climate observation data

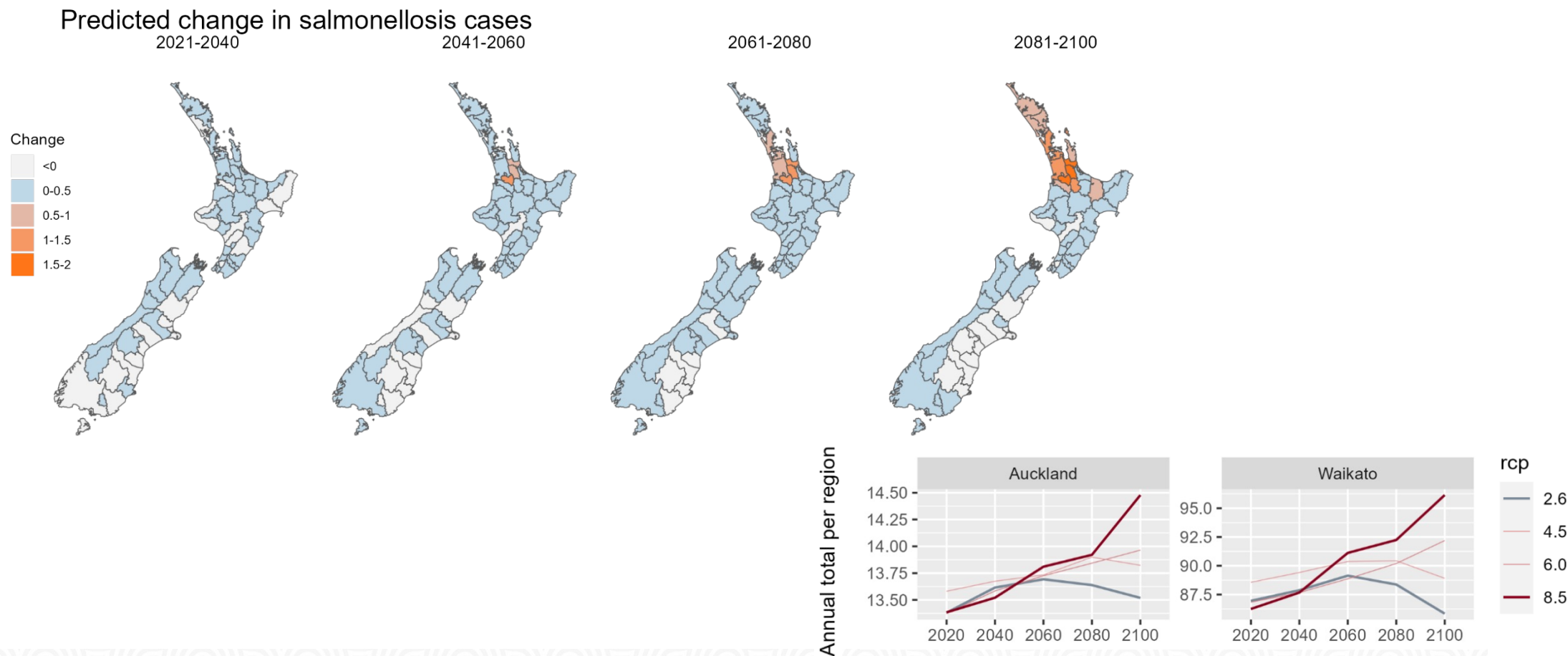### Importance of climate variables

Acc: 81%
Se: 59%
Sp: 85%

District: 903.1; Dairy: 631.2; Beef: 212.1; Season: 16.6; R2 = 27.8%

Case study 1: EARS – cont'd

- Forecasting the future incidence of cattle salmonellosis

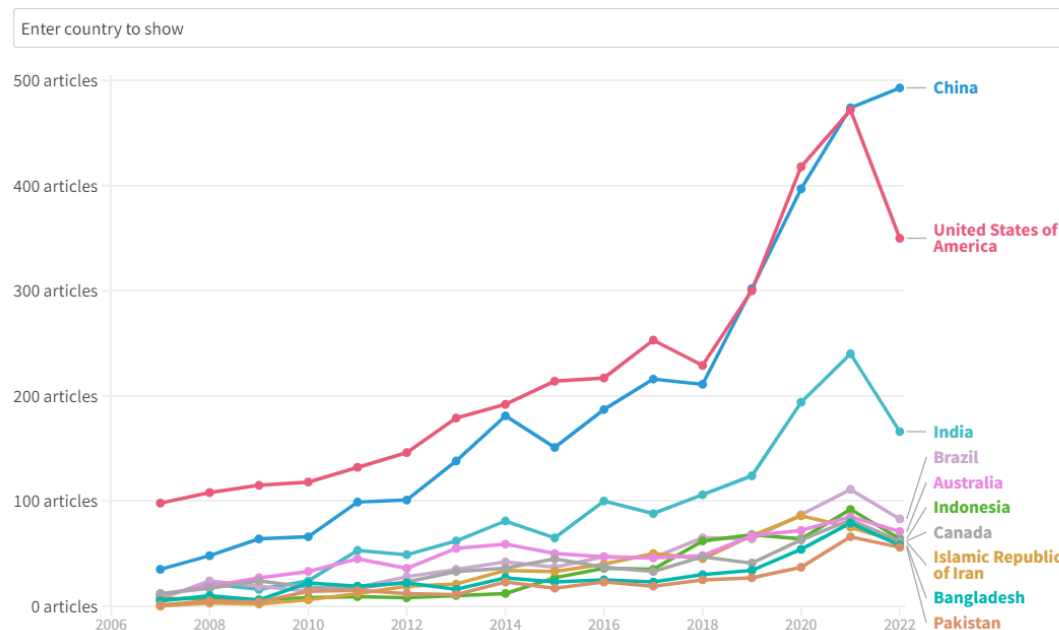# *What if we don't have enough data?*

Case study 2: CliZod

- Climate and Zoonotic Disease Database
  - AI-powered database to review & compile data from literature
- To serve as knowledge base for the evidence of links between climate factors and zoonotic diseases
  - Scientists, policy-makers, clinicians, and the global public alike
- Funded by Wellcome Trust
  - Digital Technology Development Award in Climate Sensitive Infectious Disease Modelling (2022-27)
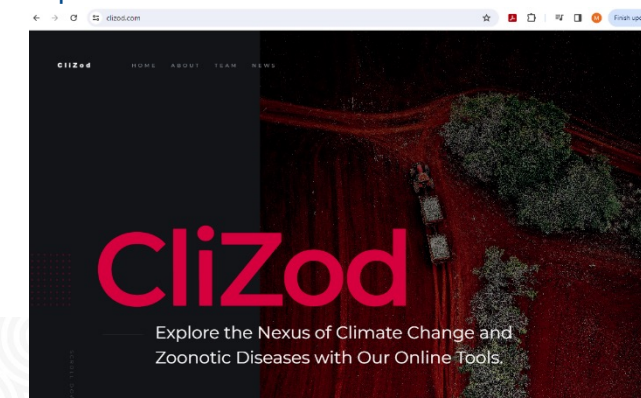

Scientific Journal Articles Covering Health and Climate Change
Number of scientific journal articles covering health and climate change, by country of the lead author, 2007-2022

China, United States of America, India, Brazil, Australia, Indonesia, Canada, Islamic Republic of Iran, Bangladesh, Pakistan

https://www.clizod.com/

CliZod
Explore the Nexus of Climate Change and Zoonotic Diseases with Our Online Tools.
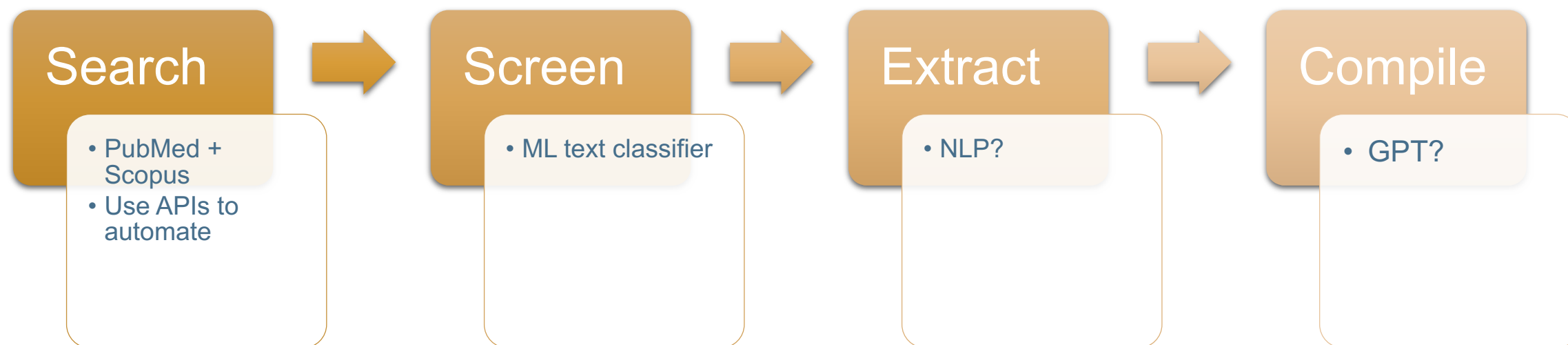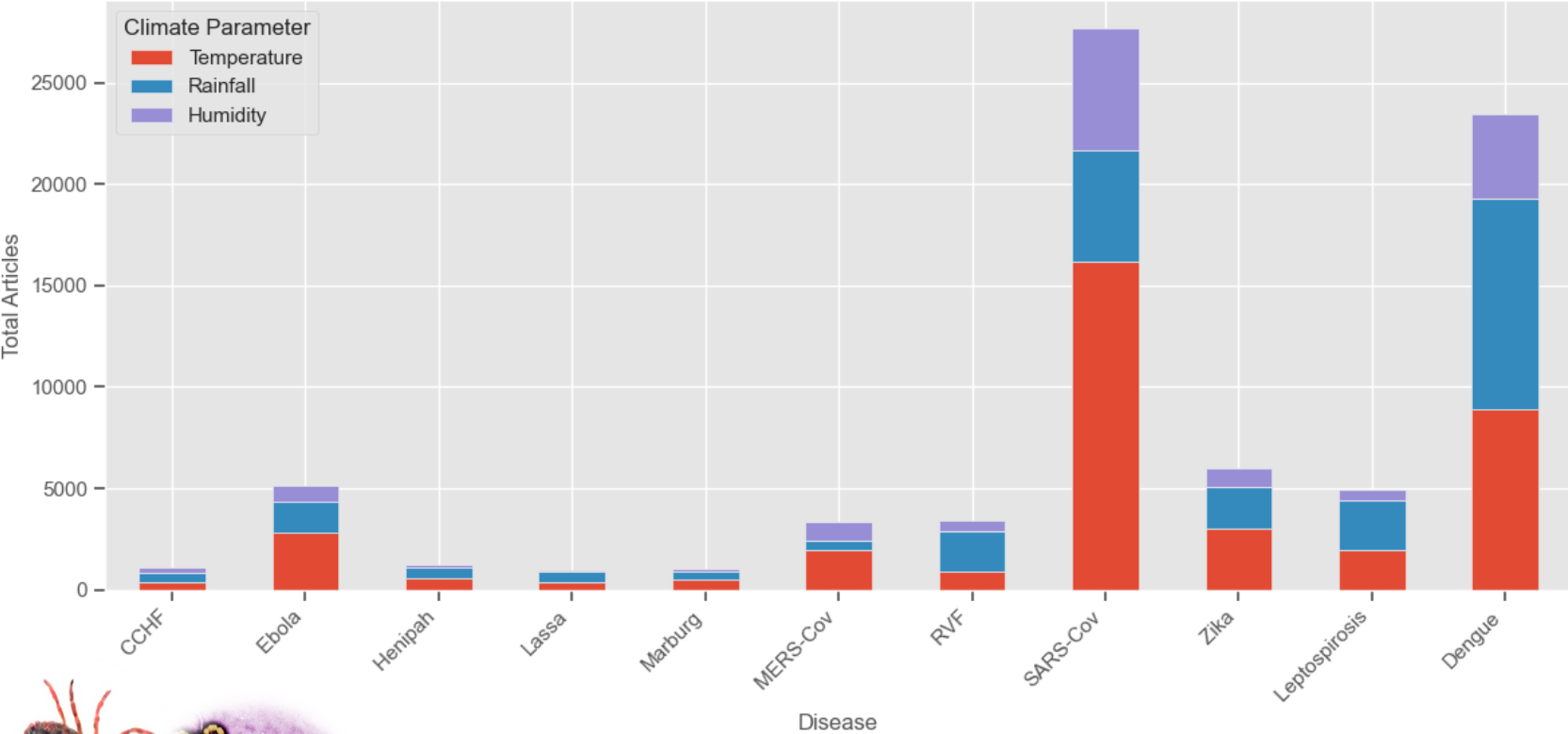
Case study 2: CliZod – cont'd

- Explore the use of AI to automate the process of systematic literature review
    - Screening (ML)
    - Extraction and compilation of evidence linking climate and disease (NLP/GPT)

Search
- PubMed + Scopus
- Use APIs to automate

Screen
- ML text classifier

Extract
- NLP?

Compile
- GPT?

Case study 2: CliZod – cont'd

Total Articles Collected by Disease and Climate Parameter

CCHF

Ebola

Result for preliminary data
Manual screening: 3 - 13% relevance
A classification model: 0 – 44% sensitivity

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Conclusions and challenges

- To mitigate the impacts of climate change on animal-based food systems, we need tools to inform resource allocation and prioritisation

- AI is an ideal approach for solving complex issues or labor-intensive tasks

- Rapidly evolving field: promising, but little/unexplored, a lot of preparation work to do

- Our research may serve as a foundation step towards establishing an AI-based system

Thank you!

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