# Logistic Regression forecasts risks

# of FMD Outbreak and FMD

# Hotpots from Climate and Abattoir

ndicators.

### The Beef Value Chain Transformation: Data Platform for Standardizing and Identifying Trends in Zoonotic **Diseases and Beef Production**

#### INTRO

- Our project addresses the siloed knowledge on zoonotic threats in the Beef Value Chain in South Africa.
- Currently, there is no clear visibility of FMD outbreak triggers which makes it difficult to plan for, and manage risks.
- There's a need for a uniform,

#### RESULTS

Metric	Model A (Pre-2020)	Model B (2020-Onward)
Balanced Accuracy	88.3%	99.4%
ROC AUC	93.2%	99.4%
Test Set Accuracy	75.0%	100.0%
Test Set Recall (Class 1 – Outbreak)	64.3%	100.0%
Test Set F1-Score	72.0%	100.0%
Test Set Support (Class 1)	14	34

Table 1: Summary of the key results from the

#### evaluation of the models.

Rank	Feature	Importance
	Humidity	0.2706
2	Temperature	0.2385
3	Disease – Foot-and-Mouth Disease (FMD)	0.1363
l I	Disease – FMD Virus SAT 3	0.1211
5	Number of Abattoirs	0.1147

Table 2: Summary of key features by rank and

### Visualizations

1.0

0.8

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Figure 1: Heat map displaying FMD Outbreak Cases, Deaths and Culling with varying weather conditions i.e. Humidity, Temperature and Rainfall.

FMD Risk Forecast by Month

spatially aware platform that provides outbreak-risk insights.

### **METHODS**

- 1. N = 262,
- 2. Collected several datasets to form 1 coherent dataset.
- Established a common key (Date, 3. Province, District, Species).
- Modelling & evaluation: 4.
  - Logistic Regression & Random Ο Forest Classifier
  - 5-fold K-fold validation  $\bigcirc$
  - Balanced-Accuracy & ROC-AUC. Ο
- **Omphemetse Tlakula, Mihle Sinene**

importance.

### DISCUSSION

• Random Forest surfaces the top drivers of FMD outbreaks (humidity, temperature, SAT 3 viral serotype, abattoir density), and a Logistic Regression converts these into districtlevel risk scores validated with 5-fold CV (balanced-accuracy  $\geq$  0.88, ROC-AUC  $\geq$  0.93); together they lay the groundwork for a spatial risk management dashboard once new outbreak data are integrated.



Figure 2: Bar graph displaying FMD Outbreak Probability by Month given Climate, Population and number of Abattoirs as user input.

Risk Forecast for Buffalo City - 2024 - Jun Predicted Outbreak Probability 4.38%

Figure 3: District-Level FMD Outbreak Probability Percentage given Cimate, Population and number of Abattoirs as user input.





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