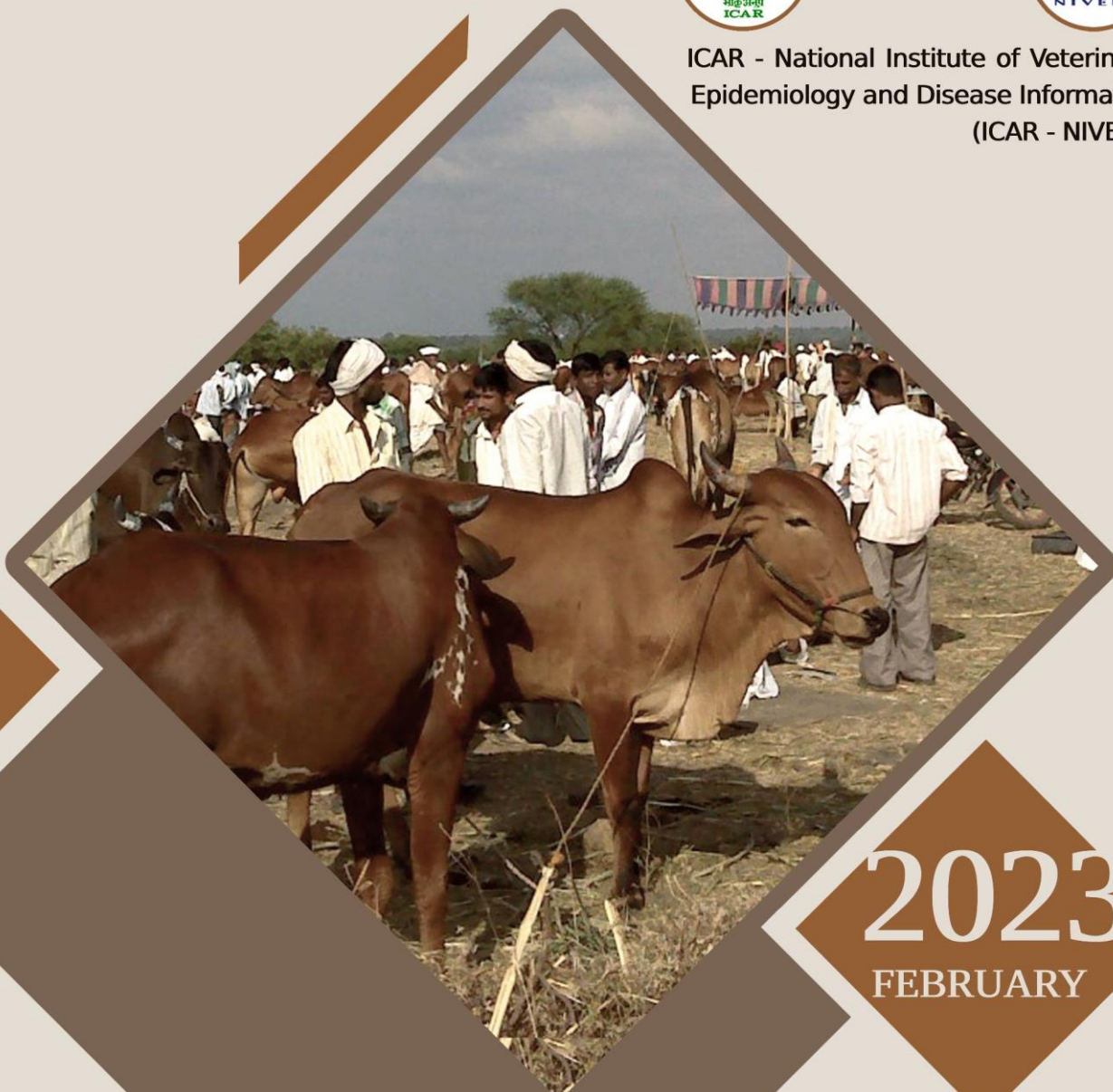DECEMBER, 2022, Volume 10, Issue 12

ICAR - National Institute of Veterinary
Epidemiology and Disease Informatics
(ICAR - NIVEDI)

2023
FEBRUARY

LIVESTOCK DISEASE RISK
FOREWARNING BULLETIN

Powered by Artificial Intelligence

NOW LINKED WITH
FARMER REGISTRATION AND UNIFIED
BENEFICIARY INFORMATION SYSTEM
(FRUITS)

Prepared By: Dr. K. P. Suresh
Dr. D. Hemadri
Dr. S. S. Patil
Dr. P. Krishnamoorthy
Dr. S. J. Siju

Front Page Design by: Ms. Apoorva Hemadri

Disclaimer

The forewarnings are based on the retrospective disease data available in the NADRES database. Hence, for those states wherein data is limited/less, the forewarning may not be realistic. Further the forewarning will not take into consideration the control measures that are *in situ.*

Acknowledgement

Director
ICAR- NIVEDI

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1. ABOUT THE BULLETIN…

Livestock sector plays a crucial role in the rural economy of India as around 20.5 million people depend upon livestock for their livelihood. Even though the investment in the livestock sector is meagre, tremendous achievements have been observed in the sector during the last decade. As it is an important component in poverty alleviation programmes, continuous emphasis is being laid on this sector for enhancing the quality of the primary and secondary products in the international market, which in turn demands improved animal health. Therefore, livestock development programmes cannot succeed unless a well-organized animal health service is built up and in place for safeguarding the livestock against economically important diseases.

India has made a noteworthy success in the eradication of Rinderpest (RP), CBPP, AHS and Dourine. However, there are several other infectious and non-infectious diseases prevailing in the country causing huge annual economic loss. Prevention, control and eradication of the animal diseases need a thorough understanding of the epidemiology as well their economic impact.

National Institute of Veterinary Epidemiology and Disease Informatics (NIVEDI) has the mandate to carry out research activities in the area of veterinary epidemiology and disease informatics. With the eradication of RP successfully, India has not only proved its ability to face the challenges but also to succeed, despite various limitations. Similar efforts are needed to control and eradicate diseases like FMD, PPR, Brucellosis, CSF, HS etc., which cause huge economic loss annually to the livestock industry. To this end, ICAR-NIVEDI has identified 13 priority livestock diseases, based on the past incidence patterns and has built a strong database of these diseases. The database, which is the backbone of the National Animal Disease Referral Expert System (NADRESv2), is used for providing monthly livestock disease forewarning, which is compiled in this monthly bulletin to alert the animal husbandry departments, both at the National/state level, to take appropriate control measures. We hope users/stakeholders find this bulletin useful in their quest to control livestock diseases. This forewarning bulletin will assist the field Veterinarians in adopting appropriate preventive and control measures, thereby reducing the occurrence of livestock disease outbreaks.

2. SUMMARY OF THE FOREWARNING BULLETIN….

The association between infectious diseases and the climate was known from ancient times. Hippocrates observed in the 5th century that epidemics were associated with natural phenomena rather than divinities or demons. In modern times, our increasing capabilities to detect and predict climate variations joined with growing evidence for global climate change, have powered interest in understanding the impacts of climate on animal health, particularly the emergence and transmission of infectious disease agents. Simple reasoning suggests that climate can affect infectious disease patterns because the pathogens (viruses, bacteria, and parasites) and their vectors are sensitive to temperature, moisture, and other ambient environmental conditions.

India being an agriculture-based country, the livestock sector plays a vital role in contributing to the economy. A robust reporting and forewarning system enable the concerned authorities in disease preparedness and awareness of the risk associated with livestock diseases. Therefore, the economic loss due to morbidity and mortality of the animals is reduced thereby helps to increase the productivity in terms of egg, meat, and dairy products. National Animal Disease Referral Expert System database is a weather-based forewarning system enabled with an artificial intelligence system developed by ICAR-National Institute of Veterinary Epidemiology & Disease Informatics Bengaluru, Karnataka state, India that forecast potential threats from pathogens two months in advance to provide the stakeholders with sufficient timeline for awareness and preparedness to act. Artificial Intelligence (AI) and Machine Learning (ML) models use the programmed algorithms that receive and analyse input data to predict output (Infectious risk prediction) values within an acceptable range. As new data fed into these algorithms, they learn and optimize their operations to improve performance, developing intelligence over time.

The livestock disease forewarning for February 2023 revealed Jharkhand, Karnataka, Assam and Kerala as the top states with high predicted livestock disease outbreaks.

Among the predicted diseases, control programmes are in full swing for FMD and PPR in the country and due attention is demanded by the predicted disease outbreaks of these diseases. Among the expected disease outbreaks, the predicted number of FMD outbreaks is more in Jharkhand and Kerala where as predicted PPR outbreaks is high in Jharkhand. Further, the co-occurrence of FMD and HS can be expected in Goa, Gujarat, Jharkhand, Karnataka, Kerala, Madhya Pradesh, Odisha, Rajasthan and West Bengal. Among the different diseases in livestock, the predicted outbreaks are expected to be high for FMD (72) and PPR (52).

The major challenges for the effective disease control programme being the lack of thorough understanding about the complexity of disease dynamics, wide host range of pathogens, widening of niche of pathogens due to climate change etc. The effective control programme for major livestock diseases in the country can be efficiently addressed by planning and execution of available control measures in the high risk areas and routine surveillance and monitoring of diseases.

Table S1. Summary of Statewise Livestock Disease forewarning for February- 2023

Sl. No	State Name	Anthrax	Babesiosis	BQ	BT	ET	Fasciolosis	FMD	HS	PPR	S&G Pox	SF	Theileriosis	Trypanosomosis	Total number of districts predicted for risk of disease
1	Andaman & Nicobar Islands	0	0	0	0	0	3	0	0	0	0	0	0	0	**3**
2	Andhra Pradesh	1	0	2	0	1	0	0	2	2	1	0	0	0	**9**
3	Arunachal Pradesh	0	0	0	0	0	4	0	0	1	0	3	0	0	**8**
4	Assam	3	5	14	0	4	7	0	7	6	2	10	2	0	**60**
5	Bihar	0	0	0	0	0	0	1	0	0	0	1	0	3	**5**
6	Goa	0	0	0	0	0	0	1	0	0	0	0	0	0	**1**
7	Daman and Diu	0	1	0	0	0	0	0	0	1	0	1	1	0	**4**
8	Goa	0	0	0	0	1	0	2	1	1	0	0	0	0	**5**
9	Gujarat	0	0	0	0	2	0	2	1	3	1	0	0	0	**9**
10	Haryana	0	0	0	0	1	0	1	0	0	1	0	0	0	**3**
11	Himachal Pradesh	0	0	0	0	0	0	1	0	0	0	0	0	0	**1**
12	Jammu & Kashmir	0	0	0	0	0	0	0	0	0	8	0	0	0	**8**
13	Jharkhand	0	23	3	0	3	23	12	3	12	2	7	23	24	**135**
14	Karnataka	7	0	11	10	6	0	14	6	4	9	1	0	0	**68**
15	Kerala	2	3	1	0	0	0	12	4	7	1	1	13	0	**44**
16	Madhya Pradesh	0	0	0	0	0	0	1	3	1	0	0	0	0	**5**
17	Maharashtra	0	0	2	0	0	0	0	2	5	1	0	0	0	**10**
18	Manipur	0	0	0	0	0	2	0	0	0	0	3	0	0	**5**
19	Meghalaya	0	0	3	0	0	0	4	0	0	0	3	0	0	**10**
20	Mizoram	0	0	1	0	0	0	0	0	0	0	1	0	0	**2**
21	Nagaland	0	0	0	0	0	0	2	0	0	0	1	0	0	**3**
22	Odisha	2	0	2	0	0	0	7	4	2	0	0	1	1	**19**
23	Puducherry	0	2	0	0	0	1	0	0	0	2	0	0	0	**5**
24	Punjab	0	0	0	0	0	0	0	0	0	0	2	0	0	**2**
25	Rajasthan	0	0	0	0	1	0	5	5	1	1	0	0	0	**13**
26	Sikkim	0	1	0	0	0	0	0	0	0	0	1	0	0	**2**
27	Tamil Nadu	2	0	2	0	0	0	1	0	0	0	0	0	0	**5**
28	Tripura	0	2	0	0	0	4	1	0	0	3	2	0	0	**12**
29	Uttar Pradesh	0	3	0	0	0	3	0	1	0	1	0	0	7	**15**
30	Uttarakhand	0	0	0	0	0	0	1	0	1	0	0	0	0	**2**
31	West Bengal	0	1	6	0	0	0	5	1	5	3	0	2	1	**24**
	Total number of districts likely for risk of disease	**17**	**41**	**47**	**10**	**19**	**47**	**72**	**40**	**52**	**36**	**37**	**42**	**36**	**496**

3.INTRODUCTION TO NADRES v2

The geographic and seasonal distribution of many infectious diseases are associated with climate and therefore the possibility of using seasonal climate forecasts as predictive indicators in disease early warning system (EWS) became imminent. In this context, ICAR-NIVEDI, in its quest for achieving better livestock health, had developed an interactive web portal named "National Animal Disease Referral Expert System (NADRES)" during early part of the first decade of the millennium. The web portal, which was developed from the financial support of National Agricultural Technology Project, was launched in the year 2005. The portal which is interactive, allows the user/stakeholder to access livestock disease forewarning (n=13) at the district level for entire country two months in advance. The portal which was initially built on oracle platform was later changed to MySQL platform to store the administrator provided disease information and other relevant meteorological and risk factor information. However, with the availability of remote sensed satellite images and the advancement in information technology and statistical algorithms, the upgradation of NADRES became inevitable. To this end, a newer version of NADRES (NADRES *V2*) has been developed.

How it is different from previous version?

In brief, it can be said that NADRES $_{V2}$ underwent a sea change not only in its internal structure but also in its physical design. As a result, now the central menu bar consists of Home, about us, Risk factors, Analysis, Livestock disease, post prediction validation and contact details. Risk factors menu comprises of details on resolution, time interval, units and source of 11 meteorological and 5 remote sensing parameters. Analytics menu has various analysis options. The newly created livestock disease menu has the details regarding species affected, clinical signs and preventive measures to be adopted for the 13 economically important diseases. Post prediction validation menu contains the outbreak reports vs prediction. The menu bar on the RHS tabs include online GIS, state wise Livestock disease forecast, district wise Livestock disease forecast, Epi-calculator, download links for mobile app, etc. The website now hosts disease maps in the form of choropleth maps for 13 diseases in two time periods (1990-2000 and 2000-2018). Similarly, disease trends plots exhibit periodic regression plots providing future trend for the disease. On the LHS, Login menu is provided for authorized persons to login and enter disease details and other related parameters. Disease maps provide choropleth maps for 13 diseases in two time periods (1990-2000 and 2000-2018) is presented. Disease trends- Periodic regression plots are exhibited for prediction of the diseases. Auto-messaging option has been created to send the reminders in the form of text messages to concerned PI's and Co-PI's of NADEN centers for submission of outbreak reports. This message is sent weekly to all the concerned officials. Additionally, a message is sent to the concerned veterinary officers in Karnataka for initiation of preventive measures for the forewarned diseases at the block level. Plans are in place to incorporate farmers' and local vets' mobile numbers in to the list so that they may be asked to initiate preventive measures for the forewarned diseases.
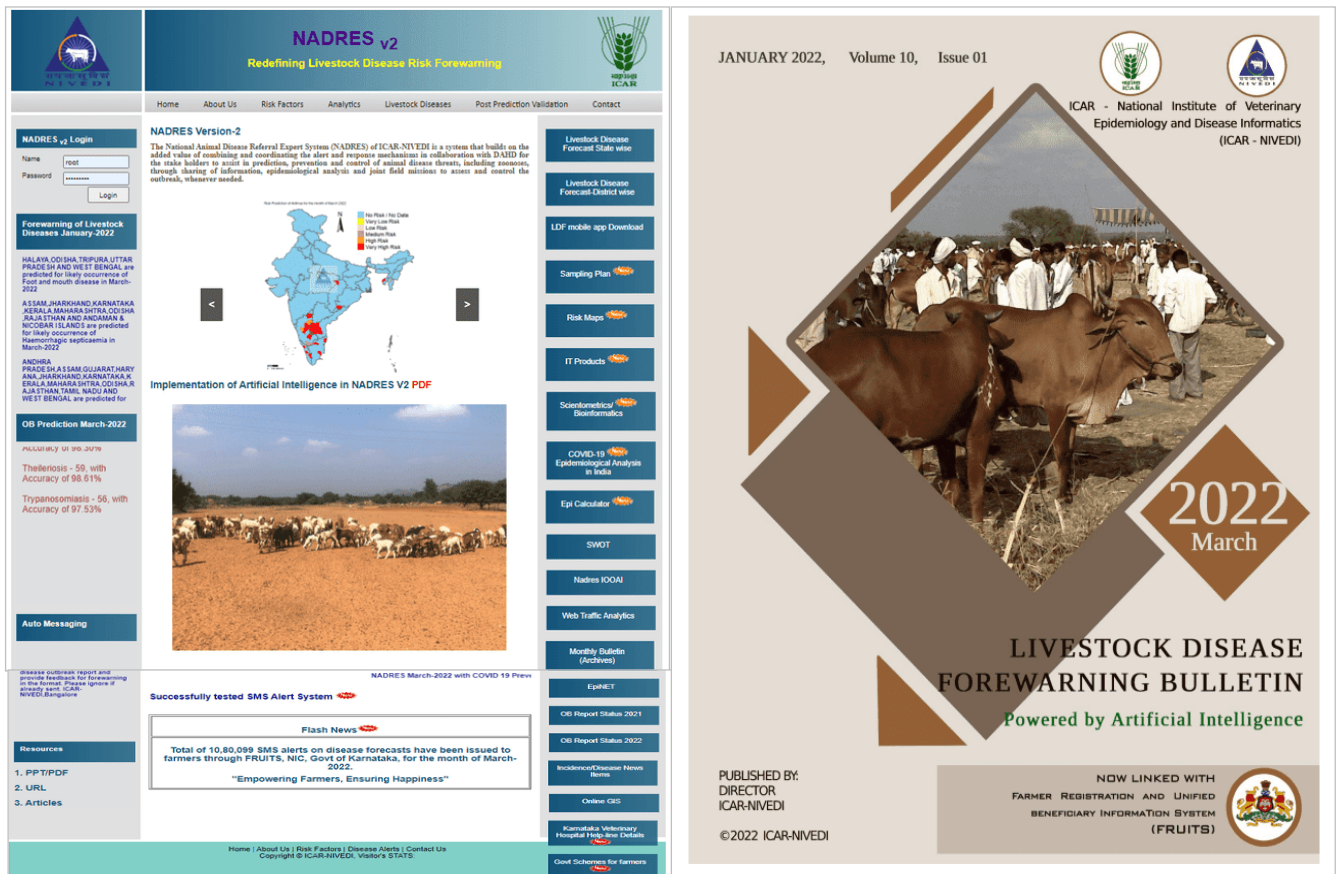
Fig 3.1.NADRES V$_2$ Home page

 The forewarning methodology used is unique and has not been used earlier for livestock disease forewarning in India.Following few paragraphs describe about the forewarning methodology used. It is a well-known fact that weather plays an important role in the precipitation of many diseases and therefore, the climatic parameters such as land surface temperature (LST), precipitation, wind velocity, humidity etc are considered as risk parameters. These parameters along with other non-climatic parameters such as livestock population, density, Normalized Differential Vegetation Index (NDVI), soil moisture constitute the overall risk parameters. A total of 24 such parameters are collected/generated at village level and then aggregated to district level before these are used for analysis.

 In addition to the output provided at interactive web portal, the NADRES output are also published in the form of monthly livestock disease forewarning bulletins. The prediction results come with a disclaimer that forewarnings do not take into account of the control measures that already in situ and also may not be realistic for those regions where the data is either unavailable or limited. This bulletin provides the likely occurrence of the 13 shortlisted diseases two months in advance at the district level, disease forewarning maps, prediction accuracy, details on diseases, species affected, clinical signs and its preventive measures.

 In summary, it can be said that NADRES $_{v2}$ has underwent substantial changes not only in its internal structure but also in its physical design and can be a useful tool for visitors of the website, farmers, vets, policy makers etc.

4. Forewarning Methodology

Preamble

NADRES v2 is an early warning system powered by Artificial Intelligence with set of capacities needed to generate and disseminate timely and meaningful warning information that enables at-risk livestock population, farmers and organizations to prepare and act appropriately and in sufficient time to reduce the livestock disease incidence.

Objectives

- Development of forecasting model for the major livestock diseases and predicting the risk of livestock diseases in advance of two months.
- Development of state of art of communication models to communicate risk of livestock diseases to the stake holders.

I. Materials and data aquisition

Livestock disease data

Previous 10 years' livestock disease outbreak data retrieved from the NADRES database linked with Risk factors data.

Livestock population data

The population data at village level for five major livestock species viz., cattle, buffalo, sheep, goat and pigs were obtained from 20th Livestock census (2019) from Department of statistics, DAHD, GOI.

Species-wise & Category-wise Livestock Population (in thousands)					
Sl No	Species	Category	Population in 2012	Population in 2019	% Change
1	Cattle	Exotic	39732	51356	29.3
		Indigenous	151172	142106	-6
		Total	190904	193462	1.3
2	Buffalo	Total	108702	109852	1.1
3	Sheep	Exotic	3781	4088	8.1
		Indigenous	61288	70172	14.5
		Total	65069	74260	14.1
4	Goat	Total	135173	148885	10.1
5	Pig	Exotic	2456	1897	-22.8
		Indigenous	7837	7159	-8.7
		Total	10293	9056	-12
6	Yaks	Total	77	58	-24.7
7	Mithuns	Total	298	386	29.5
8	Horses & Ponies	Total	625	342	-45.3
9	Mules	Total	196	84	-57.1
10	Donkeys	Total	319	124	-61.1
11	Camels	Total	400	252	-37
Total Livestock			**512056**	**536761**	**4.8**

Meteorological and Remotely Sensed Data:

The parameters such as air temperature (^{0}C), perceptible water (mm), pressure (millibar), relative humidity (%) and sea level pressure (millibar) were extracted from National Centre for environmental prediction (NCEP). The parameters such as potential evapotranspiration (PET), Enhanced Vegetation Index (EVI), Leaf Area Index (LAI), Land Surface Temperature (LST), Normalised Difference Vegetation Index (NDVI) were extracted from remote sensed images from MODIS website (https://modis.gsfc.nasa.gov/). In brief, the MODIS products from NASA-TERRA satellite was downloaded for the Indian locations by specifying the tiles (H24V5, H25V6, H24V6, H24V7, H25V7, H25V8, H26V7, H26V6) from 2001 to till date.

The details are given below;

PRODUCT	Science Data Sets (HDF Layers)
MOD15A2H	Lai_500m (Leaf area index) 8 days average
MOD16A2	PET_500m (Total Potential Evapotranspiration) 8 days average
MOD11A2	LST_Day_1km (Daytime Land Surface Temperature) 8 days average
MOD13A1	i. 500m 16 days NDVI (Normalized Difference Vegetation Index) ii. Enhanced Vegetation Index (EVI) 16 days average

The downloaded HDF files (Datasets, which are multidimensional arrays (layers) of a homogeneous type) were converted to GeoTIFF files (single layer data) using R packages, which were later used to extract the parameters by linking it with the sinusoidal values of the Indian villages. The scale factors were multiplied for the extracted values as specified by the MODIS data products to get the values of the parameters. As shown above, the atmospherically corrected NDVI was collected on 16-day interval at 250-meter resolution using MODIS product MOD13A1 and LST was collected on 8-day interval using MOD11A2 at 1 KM resolution.

The parameters such as rainfall, soil moisture and wind speed were obtained from Global Land DataAssimilation System of NASA (https://disc.gsfc.nasa.gov). The remaining parameters were downloaded from climatic research unit (CRU) of University of East Anglia website. It is worth mentioning that the entire process of extraction, assimilation, processing and aligning have been done using R programming language and R environment. After aligning the climatic and non-climatic data with the disease and the livestock population data (aggregated at the district level), the statistical analysis was performed in the R environment.

Initially, two regression models and six machine learning models were applied to test their suitability to fit the data and in all, three models; one regression model (Generalized Linear Model (GLM) and two machine learning models, *viz.,* Gradient Boosting Machine Learning Algorithm (GBM) and Random Forest (RF), which fitted to data well were incorporated for the purpose of disease prediction. The models were trained using the case and control data available at ICAR-NIVEDI. Validation of the models were done by dividing the total observations for a particular disease into marker samples and validation samples and accuracy was tested in terms of discrimination power, which was done using Receiving Operating Characteristics (ROC), Cohen Kappa (Heildke Skill Score) and True Skill statistics (TSS). Once the models produce the probability value, it was used for categorizing the risk. Briefly, when all the models produce the p value of more than 0.5, then the highest p value is used for determining the high-risk category. If all the models or any one model produces the p value of less than 0.5, then the lowest p value was used for categorizing lower risk. This was done to minimize the false alert. Thus, the risk predictions based on the probability values ranging from 0-1 are made as follows; Very High Risk (p=0.81-1.0), High Risk (p=0.61-0.80), Moderate Risk (p=0.41-0.60), Low Risk (p=0.21-0.40), Very Low Risk (p=0.0-0.20) and No Risk (p=0.0) for the occurrence of a said disease. It is believed that categorizing districts in to various risk categories will help the stake holders to effectively utilize the available resources (money and manpower).

II.NADRES v2 Data Flow and Data Processing Diagram

A) Data Flow Diagram:
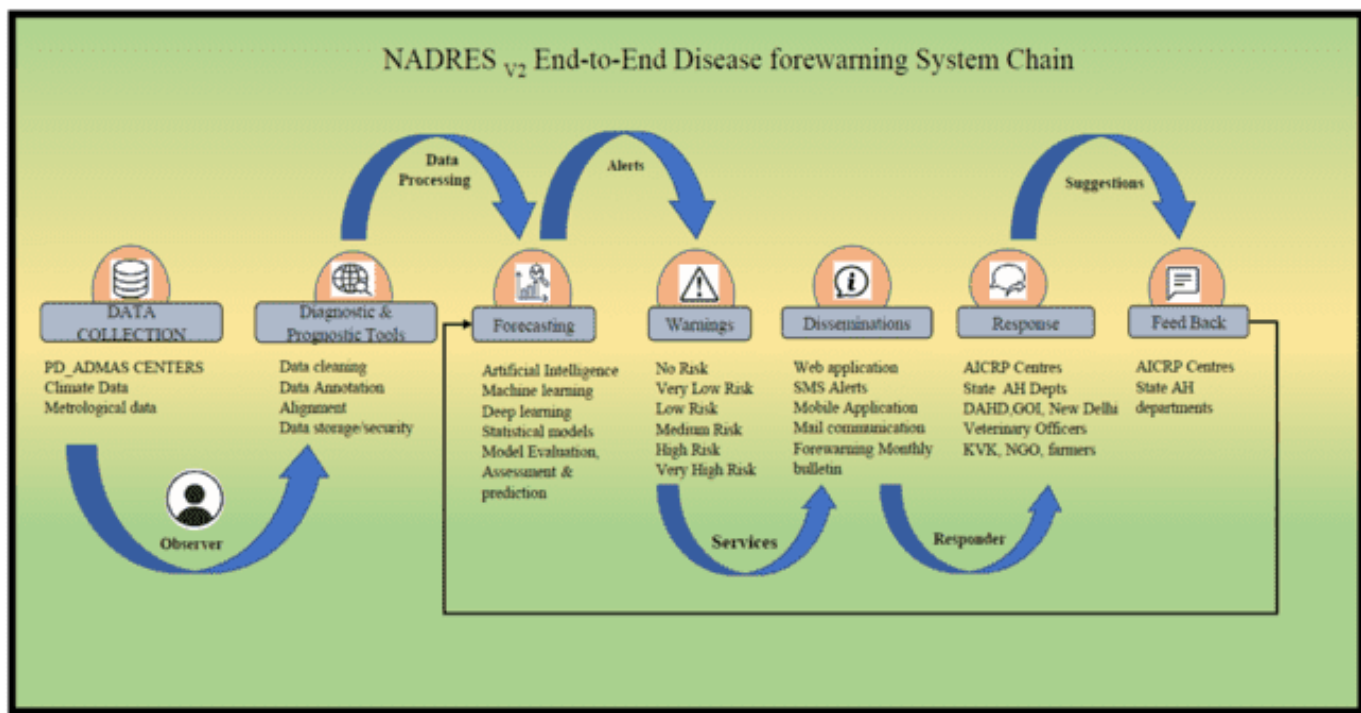
Fig 4.1. NADRES v2 Data Flow Diagram.

B) Artificial Intelligence enabled Data Capturing and Forewarning System:
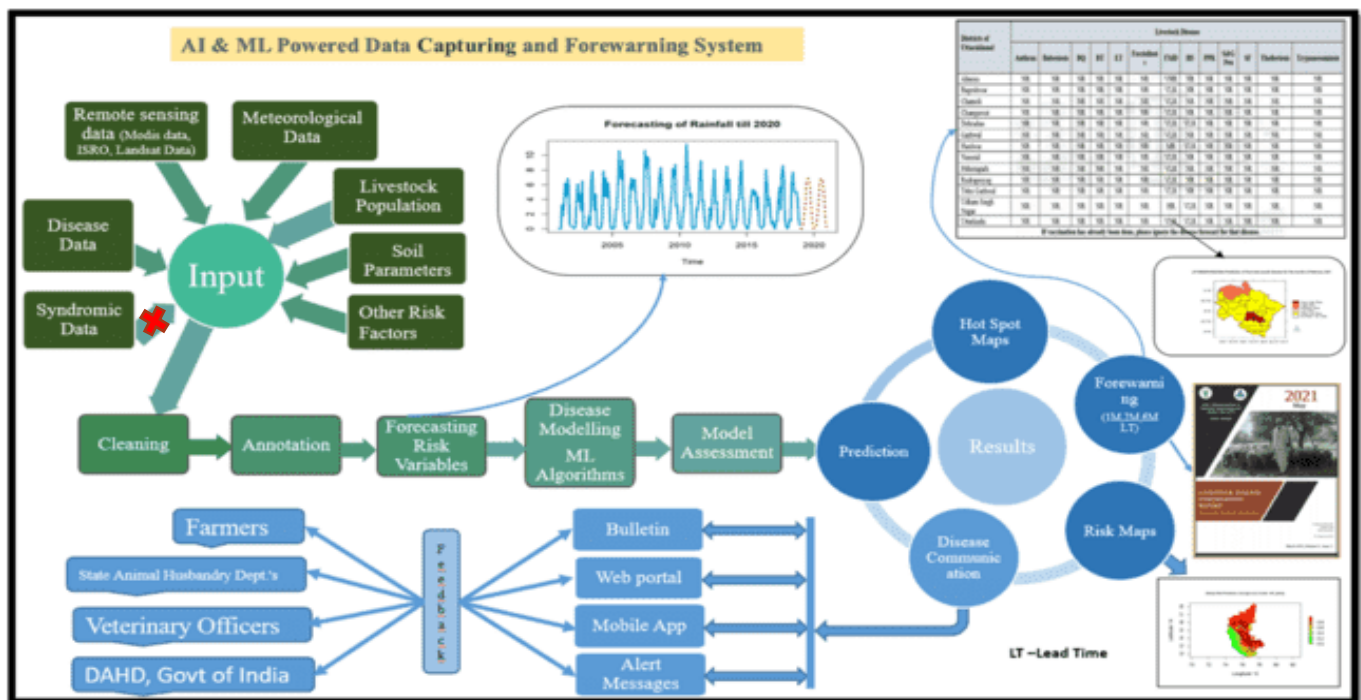
Fig 4.2. Data Capturing and Forewarning system

III. <u>Weighted Outbreak Score</u>

The outbreak data for the month of forecasting is extracted from NADRES database for the period of 10 years from current year. Outbreak data of 13 important livestock diseases are considered. The data is aggregated at district level and the weighted score is defined based on the number of outbreaks for each district in each month considering last 10 years. The weightage score was assigned as 0 for less than three number of outbreaks in the last 10 years for selected month, score 1 for 3–6 number of outbreaks and 2 for more than 6 outbreaks. This weightage score for each district is labelled as risk variable in building the models and risk maps.
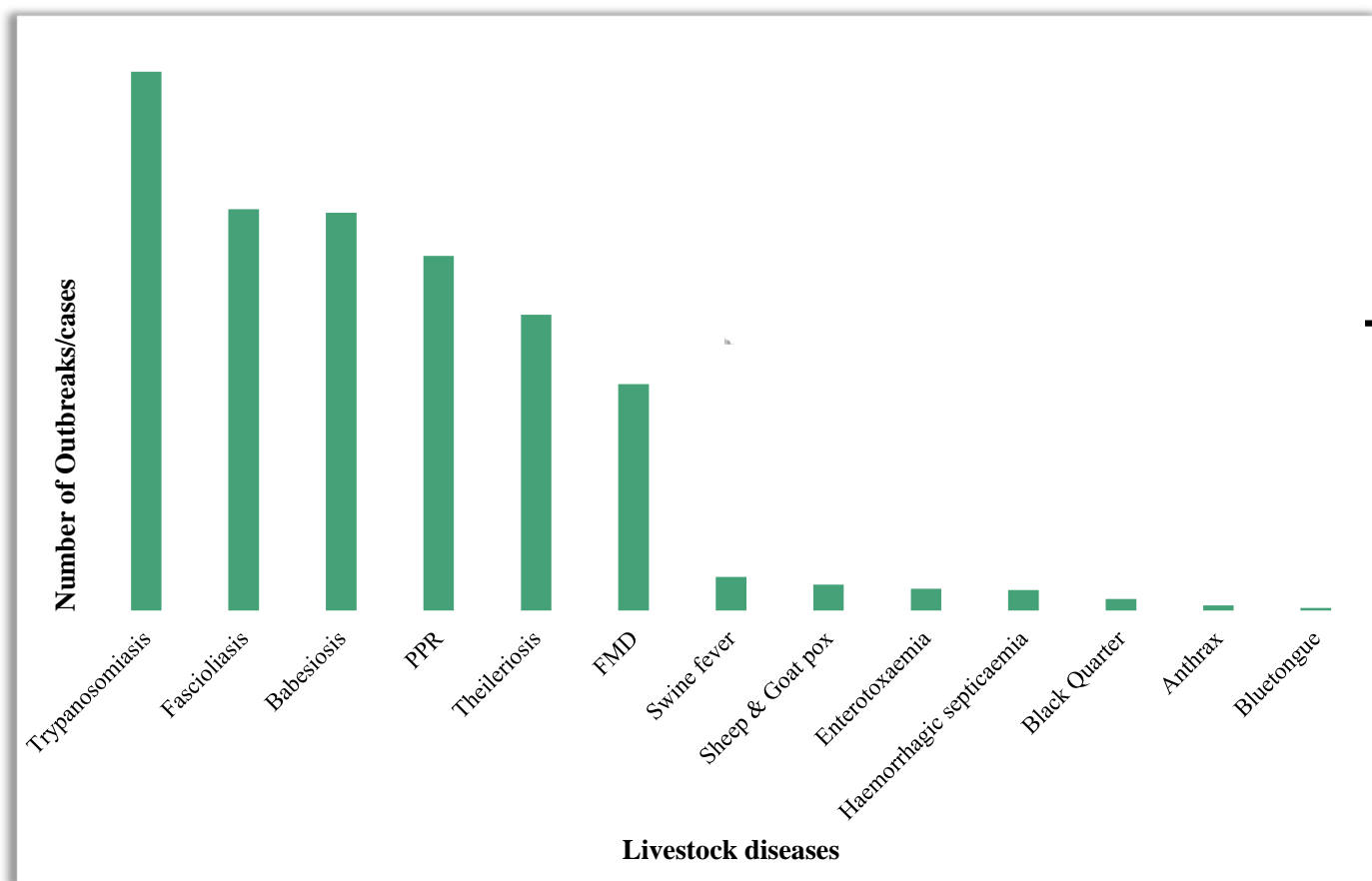
Fig 4.3. Top ten livestock diseases (2021)

IV. <u>Forecasting of Weather Parameters</u>

Weather forecasting has been one of the most challenging problems around the world because of both its practical value in meteorology and the popular sphere for scientific research. Weather forecast systems are among the most complex equation systems that computer has to solve. A great quantity of data, coming from satellites, ground stations and sensors located around our planet send daily information that must be used to foresee the weather situationin next hours and days all around. Weather forecasts provide critical information about future weather. There are various techniques involved in weather forecasting, from relatively simple observation of the sky to highly complex computerized mathematical models. Further, forecast products by Indian Metrological department were used for validationof our forecasts (https://mausam.imd.gov.in/imd_latest/contents/extendedrangeforecast.php).

Following are the basic steps of forecasting process:

1. Determine the forecast's purpose
2. Establish a time horizon
3. Select a forecasting technique
4. Gather and analyse data
5. Perform the forecast
6. Monitor the forecast and use it in prediction of disease

Statistical Models used for forecasting of weather and remotely sensed variables

ARIMA stands for Autoregressive Integrated Moving Average. ARIMA is also known as Box-Jenkins approach. Box and Jenkins claimed that non-stationary data can be made stationary by differencing the series, Y_t. The general model for Y_t is written as,

$$Y_t = \phi_1 Y_{t-1} + \phi_2 Y_{t-2} \ldots \phi_p Y_{t-p} + \epsilon_t + \theta_1 \epsilon_{t-1} + \theta_2 \epsilon_{t-2} + \ldots \theta_q \epsilon_{t-q}$$

Where, Y_t is the differenced time series value, ϕ and θ are unknown parameters and ϵ are independent identically distributed error terms with zero mean. Here, Y_t is expressed in terms of its past values and the current and past values of error terms.

The ARIMA Model combines three basic Methods:

- Auto Regression (AR) – In auto-regression the values of a given time series data are regressed on their own lagged values, which is indicated by the "p" value in the model.
- Differencing (I-for Integrated) – This involves differencing the time series data to remove the trend and convert a non-stationary time series to a stationary one. This is indicated by the "d" value in the model. If d = 1, it looks at the difference between two-time series entries, if d = 2 it looks at the differences of the differences obtained at d =1, and so forth.

- Moving Average (MA) – The moving average nature of the model is represented by the "q" value which is the number of lagged values of the error term.

This model is called Autoregressive Integrated Moving Average or ARIMA (p, d,q) of Y_t. We will follow the steps enumerated below to build our model. ARIMA models were run in 18 combinations of p, d, q. Based on the minimum AIC value, the order of ARIMA model was selected. This order was used for the prediction of all the weather parameters used in developing disease forewarning models.

V. Implementation of Principal Component Analysis

Large datasets are gradually common and are often difficult to interpret. Principal Component Analysis (PCA) is a technique for reducing the dimensionality of such datasets, increasing the interpretability but at the same time, minimizing the information loss. The PCA is employed in NADRES v2 by creating new uncorrelated variables that successively maximize the variance. This means that ` preserving as much variability as possible` translates into finding new variables that are linear functions of those in the original dataset, that successively maximize variance and that are uncorrelated with each other. Determining such new variables, the principal components (PCs) reduce to solve an eigenvalue/eigenvector problem. PCA can be based on either covariance matrix or the correlation matrix and the main use of PCA are descriptive. In the present study, all the meteorological and remote sensing variables are considering for PCA, with correlation matrix, the final output of principal components which are independent of each were considered for further ML modelling and risk estimation.

VI. Machine Learning Models

Disease outbreak data were aligned with generated risk variables to the respective latitude and longitude, which were subjected to climate-disease modelling. A number of models were fit to aligned data and tested for accuracy in terms of discrimination power. Two regression models, Generalized Linear Models (GLM) and Generalized Additive Models (GAM) and six machine learning algorithms, i.e. Random Forest (RF), Boosted Regression Tree (BRT), Artificial Neural Network (ANN), Multiple Adaptive Regression Spline (MARS), Flexible Discriminant Analysis (FDA) and Classification Tree Analysis (CTA) were employed for disease modelling. Different modelling methods return different types of 'model object' and all these model objects could be used for the predict function to make predictions for any combinations of values of independent variables. Response plots were created to explore and understand model predictions.

The fitted models were assessed for their discriminating power using Receiving Operating Characteristic (ROC) curve, Cohen's Kappa (Heildke Skill Score) and True Skill Statistics (TSS). These measures were used to evaluate the quality of predictions based on presence-absence data. Raster Stack was used to combine the results of individual predictions by different model methods. All the models were assessed for overfitting.

The outcome of best fitted models was in probability of disease occurrence and was categorised into 6 risk levels as No risk (NR), Very low risk (VLR), Low risk (LR), Moderate risk (MR), High risk (HR) and Very high risk (VHR) for enabling the stakeholders to take appropriate control measures by suitably allocating available resources.

5. ACCURACY OF PREDICTION

Serial No.	Diseases	Accuracy (%)
1.	**Anthrax**	**99.69**
2.	**Babesiosis**	**97.84**
3.	**Black quarter**	**97.06**
4.	**Bluetongue**	**99.07**
5.	Enterotoxaemia	99.85
6.	Fasciolosis	99.22
7.	**Foot and mouth disease**	**96.29**
8.	**Haemorrhagic septicaemia**	**94.90**
9.	**Peste des petits ruminants**	**95.83**
10.	**Sheep & Goat pox**	**99.53**
11.	**Classical Swine fever**	**98.14**
12.	**Theileriosis**	**98.30**
13.	**Trypanosomosis**	**99.84**

Aggregation and prediction of livestock diseases at district level leading to higher accuracy.

- **Formula Used:** The **Accuracy** of disease prediction was calculated using the following formula.

$$\frac{TP + TN}{Total} * 100$$

TP-True Positive Observations, TN-True Negative Observations, Total- Total observations.

- Internal Accuracy was performed using 10 years of data. Accuracy obtained was >90% for all the diseases predicted.
- Despite the power of climate and disease risk models, considerable uncertainties remain, identifying these uncertainties, highlighting importance of improved data may improve the model accuracy, realism, confidence, together with translating uncertainties in model inputs into uncertainties in model outputs, are important benefits of modelling.

6. MORAN'S I FOR CLUSTERING OF LIVESTOCK DISEASES

Moran's I is a tool that measures spatial autocorrelation (feature similarity) based on both feature locations and feature values simultaneously. Given a set of features and an associated attribute, it evaluates whether the pattern expressed is clustered, dispersed, or random. The tool calculates the Moran's I Index value and both a Z score and p-value evaluating the significance of that index. In general, a Moran's Index value near +1.0 indicates clustering while an index value near -1.0 indicates dispersion.

Autocorrelation tool, the null hypothesis states that"there is no spatial clustering of the values associated with the geographic features in the study area". When the p-value is small and the absolute value of the Z score is large enough that it falls outside of the desired confidence level, the null hypothesis can be rejected. If the index value is greater than 0, the set of features exhibits a clustered pattern. If the value is less than 0, the set of features exhibits a dispersed pattern.

7. R SOFTWARE

R is a programming language and software environment for statistical analysis, graphics representation and reporting. R is a simple and effective programming language, which includes conditionals, loops, user defined recursive functions and input and output facilities. R statistical software version 3.1.3 (version 3.4.3, R Foundation for Statistical Computing, Vienna, Austria. https://www.R-project.org/) was used as an integrated suite for data mining, calculation and graphical display. Several R packages like *openxlx, raster, RMySQL, rgdal, RColorBrewer, sqldf, sp, spdep, xlsx, plyr, randomFores, dismo, SDMTool, dplyr, tmap*and *data table*were used for data extraction, data alignment, annotation, analysis, modelling and risk mapping.

8. FOREWARNING OF LIVESTOCK DISEASE FOR THE MONTH OF FEBRUARY, 2023

i). District wise Livestock Disease forewarning:

District wise Livestock Disease Risk Forewarning for February, 2023: Andaman and Nicobar

Districts of Andaman and Nicobar	Livestock Diseases												
	Anthrax	Babesiosis	BQ	BT	ET	Fasciolosis	FMD	HS	PPR	S&G Pox	CSF	Theileriosis	Trypanosomosis
Nicobars	NR	NR	VLR	VLR	NR	*VHR*	VLR	NR	NR	NR	VLR	MR	NR
North & Middle Andaman	NR	NR	NR	NR	NR	*VHR*	NR	NR	NR	NR	NR	NR	NR
South Andaman	NR	NR	NR	NR	NR	*VHR*	VLR	NR	NR	NR	NR	NR	NR

If vaccinated, please ignore the disease forecast.

*Negligible risk (NR), Very low risk (VLR), Low risk (LR), Moderate risk (MR), High risk (HR),Very high risk (VHR)

District wise Livestock Disease Risk Forewarning for February, 2023: Andhra Pradesh

Districts of Andhra Pradesh	Livestock Diseases												
	Anthrax	Babesiosis	BQ	BT	ET	Fasciolosis	FMD	HS	PPR	S&G Pox	CSF	Theileriosis	Trypanosomosis
Anantapur	NR	NR	NR	MR	NR	MR	NR	NR	NR	NR	NR	NR	NR
Chittoor	NR	NR	NR	MR	NR	MR	NR	NR	NR	NR	NR	NR	NR
East Godavari	NR	*VHR*	NR	MR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Guntur	NR	*HR*	NR	MR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Krishna	NR	NR	MR	NR	MR	NR	MR	NR	MR	MR	MR	MR	NR
Kurnool	NR	NR	MR	NR	MR	NR	MR	*VHR*	*HR*	MR	MR	MR	NR
Prakasam	MR	MR	NR	MR	NR	MR	NR	MR	MR	*VHR*	NR	NR	MR
Sri PottiSriramulu Nellore	MR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Srikakulam	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Visakhapatnam	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Vizianagaram	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
West Godavari	NR	NR	MR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Y.S.R.	*VHR*	NR	NR	NR	NR	NR	NR	*VHR*	*VHR*	NR	NR	NR	NR

If vaccinated, please ignore the disease forecast.

*Negligible risk (NR), Very low risk (VLR), Low risk (LR), Moderate risk (MR), High risk (HR),Very high risk (VHR)

District wise Livestock Disease Risk Forewarning for February, 2023: Arunachal Pradesh

Districts of Arunachal Pradesh	Livestock Diseases												
	Anthrax	Babesiosis	BQ	BT	ET	Fasciolosis	FMD	HS	PPR	S&G Pox	CSF	Theileriosis	Trypanosomosis
Anjaw	NR	NR	NR	NR	NR	NR	VLR	NR	NR	NR	VLR	NR	NR
Changlang	NR	NR	NR	NR	NR	VLR	NR	VLR	NR	NR	VLR	NR	NR
Dibang Valley	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
East Kameng	NR	VLR	NR	NR	NR	VLR	NR	VLR	NR	NR	VLR	VLR	NR
East Siang	NR	NR	NR	NR	NR	VLR	NR	VLR	NR	NR	*VHR*	NR	NR
KurungKumey	NR	VLR	NR	NR	NR	VLR	NR	NR	NR	NR	NR	VLR	NR
Lohit	NR	NR	VLR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Lower Dibang Valley	NR	NR	NR	NR	NR	VLR	NR	VLR	NR	NR	VLR	NR	NR
Lower Subansiri	NR	NR	NR	NR	NR	*VHR*	NR	VLR	VLR	NR	VLR	NR	NR
Papum Pare	NR	NR	NR	NR	NR	*HR*	NR	VLR	*VHR*	NR	NR	NR	NR
Tawang	NR	NR	VLR	NR	NR	NR	NR	NR	NR	NR	VLR	NR	NR
Tirap	NR	NR	NR	NR	NR	NR	VLR	VLR	NR	NR	NR	NR	NR
Upper Siang	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Upper Subansiri	NR	NR	NR	NR	NR	*VHR*	NR	VLR	NR	NR	*VHR*	VLR	NR
West Kameng	NR	NR	NR	NR	NR	NR	NR	VLR	NR	NR	VLR	NR	NR
West Siang	NR	NR	NR	NR	NR	*VHR*	NR	NR	NR	NR	*VHR*	VLR	NR

If vaccinated, please ignore the disease forecast.

*Negligible risk (NR), Very low risk (VLR), Low risk (LR), Moderate risk (MR), High risk (HR),Very high risk (VHR)

District wise Livestock Disease Risk Forewarning for February, 2023: Assam

Districts of Assam	Livestock Diseases												
	Anthrax	Babesiosis	BQ	BT	ET	Fasciolosis	FMD	HS	PPR	S&G Pox	CSF	Theileriosis	Trypanosomosis
Baksa	NR	NR	*VHR*	NR	NR	VLR	NR	VLR	*VHR*	NR	*VHR*	NR	NR
Barpeta	NR	*VHR*	*HR*	NR	NR	NR	NR	*HR*	*VHR*	NR	VLR	NR	NR
Bongaigaon	NR	*VHR*	*VHR*	NR	NR	*HR*	NR	VLR	VLR	NR	*VHR*	NR	NR
Cachar	NR	NR	*VHR*	NR	NR	NR	NR	VLR	NR	NR	VLR	NR	NR
Chirang	*VHR*	VLR	*VHR*	NR	NR	VLR	NR	VLR	VLR	NR	VLR	NR	NR
Darrang	NR	NR	*VHR*	NR	NR	VLR	NR	VLR	VLR	NR	NR	NR	NR
Dhemaji	NR	NR	*VHR*	NR	NR	*VHR*	NR	VLR	NR	NR	*VHR*	VLR	NR
Dhubri	NR	NR	VLR	NR	NR	MR	NR	VLR	VLR	NR	VLR	NR	NR
Dibrugarh	NR	NR	NR	NR	NR	NR	NR	VLR	NR	NR	VLR	VLR	NR
Dima Hasao	NR	NR	NR	NR	NR	NR	VLR	VLR	NR	NR	VLR	NR	NR
Goalpara	NR	NR	VLR	NR	NR	NR	VLR	VLR	VLR	NR	*VHR*	NR	NR
Golaghat	NR	VLR	*VHR*	NR	*VHR*	MR	NR	VLR	NR	NR	LR	NR	NR
Hailakandi	NR	VLR	NR	NR	NR	NR	VLR	VLR	NR	NR	NR	NR	NR
Jorhat	NR	NR	*HR*	NR	NR	NR	NR	VLR	NR	NR	VLR	NR	NR
Kamrup	*VHR*	NR	VLR	NR	NR	MR	NR	VLR	VLR	NR	*VHR*	NR	NR
Kamrup Metropolitan	*HR*	VLR	VLR	NR	NR	*VHR*	NR	*VHR*	*VHR*	NR	MR	NR	NR
KarbiAnglong	NR	NR	VLR	NR	NR	NR	VLR	*HR*	NR	NR	*VHR*	NR	NR
Karimganj	NR	*VHR*	VLR	NR	NR	VLR	VLR	VLR	VLR	NR	NR	NR	NR
Kokrajhar	NR	NR	NR	NR	NR	VLR	NR	VLR	VLR	NR	VLR	NR	NR
Lakhimpur	NR	VLR	*VHR*	NR	NR	*VHR*	NR	VLR	NR	*VHR*	*VHR*	NR	NR
Morigaon	NR	NR	VLR	NR	NR	VLR	NR	*VHR*	VLR	NR	NR	NR	NR

Continued

Districts of Assam	Livestock Diseases												
	Anthrax	**Babesiosis**	**BQ**	**BT**	**ET**	**Fasciolosis**	**FMD**	**HS**	**PPR**	**S&G Pox**	**CSF**	**Theileriosis**	**Trypanosomosis**
Nagaon	NR	NR	VLR	NR	NR	VLR	NR	*HR*	VLR	NR	*HR*	NR	NR
Nalbari	NR	*VHR*	*VHR*	NR	NR	*VHR*	NR	*HR*	*VHR*	*VHR*	VLR	NR	NR
Sivasagar	NR	NR	*HR*	NR	*VHR*	*VHR*	NR	VLR	NR	NR	*HR*	NR	NR
Sonitpur	NR	NR	*VHR*	NR	*VHR*	*VHR*	NR	*VHR*	*VHR*	NR	*VHR*	*VHR*	NR
Tinsukia	NR	*HR*	NR	NR	*VHR*	VLR	NR	VLR	*VHR*	NR	VLR	*HR*	NR
Udalguri	NR	VLR	*VHR*	VLR	NR	VLR	NR	VLR	VLR	NR	VLR	VLR	NR

If vaccinated, please ignore the disease forecast.

*Negligible risk (NR), Very low risk (VLR), Low risk (LR), Moderate risk (MR), High risk (HR),Very high risk (VHR)

District wise Livestock Disease Risk Forewarning for February, 2023: Bihar

Districts of Bihar	Livestock Diseases												
	Anthrax	Babesiosis	BQ	BT	ET	Fasciolosis	FMD	HS	PPR	S&G Pox	CSF	Theileriosis	Trypanosomosis
Araria	NR	NR	NR	VLR	NR	NR	NR	NR	VLR	NR	NR	NR	NR
Arwal	NR	VLR	NR	NR	NR	VLR	NR	NR	NR	NR	NR	VLR	NR
Aurangabad	NR	VLR	NR	NR	NR	NR	NR	NR	VLR	NR	NR	VLR	NR
Banka	NR	VLR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Begusarai	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Bhagalpur	NR	VLR	NR	NR	NR	NR	VLR	NR	NR	NR	NR	NR	NR
Bhojpur	NR	VLR	NR	NR	NR	MR	NR	NR	NR	NR	NR	VLR	*VHR*
Buxar	NR	VLR	NR	NR	NR	NR	NR	NR	NR	NR	NR	VLR	NR
Darbhanga	NR	NR	NR	NR	NR	NR	VLR	NR	NR	NR	NR	VLR	NR
Gaya	NR	VLR	NR	NR	NR	NR	NR	NR	NR	NR	NR	VLR	NR
Gopalganj	NR	VLR	NR	NR	NR	NR	NR	NR	NR	NR	NR	VLR	NR
Jamui	NR	VLR	NR	NR	NR	NR	NR	VLR	NR	NR	VLR	VLR	NR
Jehanabad	NR	VLR	NR	NR	NR	VLR	NR	NR	NR	NR	NR	VLR	NR
Kaimur (Bhabua)	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	VLR	NR
Katihar	NR	VLR	NR	NR	NR	NR	NR	NR	NR	NR	VLR	NR	NR
Khagaria	NR	VLR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	*VHR*
Kishanganj	NR	NR	NR	NR	NR	VLR	NR	NR	VLR	NR	VLR	NR	NR
Lakhisarai	NR	NR	NR	NR	NR	NR	VLR	NR	NR	NR	NR	VLR	NR
Madhepura	NR	VLR	NR	NR	NR	VLR	NR	NR	NR	NR	NR	NR	NR
Madhubani	NR	NR	NR	NR	NR	NR	NR	NR	VLR	NR	NR	NR	NR
Munger	NR	VLR	NR	NR	NR	NR	VLR	NR	NR	NR	NR	NR	NR
Muzaffarpur	NR	NR	NR	NR	NR	NR	NR	NR	VLR	NR	NR	NR	NR

Continued

Districts of Bihar	Livestock Diseases												
	Anthrax	Babesiosis	BQ	BT	ET	Fasciolosis	FMD	HS	PPR	S&G Pox	CSF	Theileriosis	Trypanosomosis
Nalanda	NR	VLR	NR	NR	NR	NR	NR	NR	NR	NR	NR	VLR	NR
Nawada	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	VLR	NR
PashchimChamparan	NR	VLR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Patna	NR	VLR	NR	VLR	NR	NR	VLR	NR	NR	NR	*VHR*	NR	NR
PurbaChamparan	NR	VLR	NR	NR	NR	NR	NR	NR	NR	NR	NR	VLR	NR
Purnia	NR	VLR	NR	NR	NR	VLR	VLR	NR	VLR	NR	NR	NR	NR
Rohtas	NR	VLR	NR	NR	NR	NR	NR	NR	NR	NR	NR	VLR	NR
Saharsa	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Samastipur	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	VLR	NR
Saran	NR	NR	NR	NR	NR	NR	VLR	NR	NR	NR	NR	VLR	NR
Sheikhpura	NR	NR	NR	NR	NR	NR	MR	NR	VLR	NR	NR	MR	*VHR*
Sheohar	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Sitamarhi	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Siwan	NR	NR	NR	NR	NR	NR	NR	NR	VLR	NR	NR	VLR	NR
Supaul	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Vaishali	NR	NR	NR	NR	NR	NR	*VHR*	NR	NR	NR	NR	VLR	NR

If vaccinated, please ignore the disease forecast.

*Negligible risk (NR), Very low risk (VLR), Low risk (LR), Moderate risk (MR), High risk (HR),Very high risk (VHR)

District wise Livestock Disease Risk Forewarning for February, 2023: Chandigarh

Districts of Chandigarh	Livestock Diseases												
	Anthrax	Babesiosis	BQ	BT	ET	Fasciolosis	FMD	HS	PPR	S&G Pox	CSF	Theileriosis	Trypanosomosis
Chandigarh	NR	NR	NR	VLR	NR	NR	MR	NR	NR	NR	NR	NR	NR

If vaccinated, please ignore the disease forecast.

*Negligible risk (NR), Very low risk (VLR), Low risk (LR), Moderate risk (MR), High risk (**HR**),Very high risk (VHR)

District wise Livestock Disease Risk Forewarning for February, 2023: Chhattisgarh

Districts of Chhattisgarh	Livestock Diseases												
	Anthrax	Babesiosis	BQ	BT	ET	Fasciolosis	FMD	HS	PPR	S&G Pox	CSF	Theileriosis	Trypanosomosis
Bastar	NR	NR	VLR	NR	NR	NR	VLR	NR	NR	NR	VLR	NR	NR
Bijapur	NR	NR	NR	NR	NR	NR	VLR	NR	NR	NR	NR	NR	NR
Bilaspur	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
DakshinBastar Dantewada	NR	NR	NR	NR	NR	NR	VLR	NR	NR	NR	NR	NR	NR
Dhamtari	NR	NR	NR	NR	NR	NR	NR	NR	VLR	NR	NR	VLR	NR
Durg	NR	NR	NR	NR	NR	NR	NR	NR	VLR	NR	NR	VLR	NR
Janjgir-champa	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Jashpur	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	VLR	NR	NR
Kabeerdham	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Korba	NR	NR	NR	VLR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Koriya	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	VLR	NR	NR
Mahasamund	NR	NR	NR	VLR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Narayanpur	NR	NR	NR	NR	NR	NR	NR	NR	VLR	NR	NR	NR	NR
Raigarhh	NR	VLR	NR	VLR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Raipur	NR	NR	NR	NR	NR	NR	NR	NR	VLR	NR	NR	NR	NR
Rajnandgaon	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Surguja	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Uttar BastarKanker	NR	NR	NR	NR	NR	NR	VLR	NR	NR	NR	NR	NR	NR

If vaccinated, please ignore the disease forecast.

*Negligible risk (NR), Very low risk (VLR), Low risk (LR), Moderate risk (MR), High risk (HR),Very high risk (VHR)

District wise Livestock Disease Risk Forewarning for February, 2023: Dadra and Nagar Haveli

Districts of Dadra and Nagar Haveli	Livestock Diseases												
	Anthrax	Babesiosis	BQ	BT	ET	Fasciolosis	FMD	HS	PPR	S&G Pox	CSF	Theileriosis	Trypanosomosis
Dadra and Nagar Haveli	NR	VLR	NR	NR	NR	NR	NR	VLR	NR	NR	NR	NR	NR

If vaccinated, please ignore the disease forecast.

*Negligible risk (NR), Very low risk (VLR), Low risk (LR), Moderate risk (MR), High risk (HR),Very high risk (VHR)

District wise Livestock Disease Risk Forewarning for February, 2023: Daman and Diu

Districts of Daman and Diu	Livestock Diseases												
	Anthrax	Babesiosis	BQ	BT	ET	Fasciolosis	FMD	HS	PPR	S&G Pox	CSF	Theileriosis	Trypanosomosis
Daman	NR	NR	NR	VLR	NR	NR	*HR*	NR	NR	NR	NR	NR	NR
Diu	NR	NR	NR	VLR	NR	NR	NR	NR	NR	NR	NR	VLR	NR

If vaccinated, please ignore the disease forecast.

*Negligible risk (NR), Very low risk (VLR), Low risk (LR), Moderate risk (MR), High risk (HR),Very high risk (VHR)

District wise Livestock Disease Risk Forewarning for February, 2023: Goa

Districts of Goa	Livestock Diseases												
	Anthrax	**Babesiosis**	**BQ**	**BT**	**ET**	**Fasciolosis**	**FMD**	**HS**	**PPR**	**S&G Pox**	**CSF**	**Theileriosis**	**Trypanosomosis**
North Goa	NR	NR	VLR	NR	NR	NR	MR	NR	*HR*	NR	*VHR*	VLR	NR
South Goa	NR	*HR*	NR	VLR	NR	NR	VLR	VLR	NR	NR	VLR	*HR*	NR

If vaccinated, please ignore the disease forecast.

*Negligible risk (NR), Very low risk (VLR), Low risk (LR), Moderate risk (MR), High risk (HR),Very high risk (VHR)

District wise Livestock Disease Risk Forewarning for February, 2023: Gujarat

Districts of Gujarat	Livestock Diseases												
	Anthrax	Babesiosis	BQ	BT	ET	Fasciolosis	FMD	HS	PPR	S&G Pox	CSF	Theileriosis	Trypanosomosis
Ahmadabad	NR	NR	NR	NR	NR	NR	VLR	NR	VLR	MR	NR	NR	NR
Amreli	NR	NR	NR	VLR	NR	NR	NR	VLR	NR	NR	NR	NR	NR
Anand	NR	NR	NR	NR	NR	NR	VLR	VLR	VLR	NR	NR	VLR	NR
Banas Kantha	NR	NR	NR	NR	NR	NR	NR	VLR	VLR	NR	NR	VLR	NR
Bharuch	NR	NR	NR	NR	NR	NR	VLR	VLR	VLR	NR	NR	NR	NR
Bhavnagar	NR	NR	NR	VLR	*VHR*	NR	NR	VLR	VLR	NR	NR	NR	NR
Dohad	NR	NR	NR	NR	NR	NR	VLR	VLR	VLR	NR	NR	VLR	NR
Gandhinagar	NR	NR	NR	NR	NR	NR	VLR	VLR	*HR*	NR	NR	VLR	NR
Jamnagar	NR	NR	NR	NR	NR	NR	NR	VLR	NR	NR	NR	NR	NR
Junagadh	NR	NR	NR	NR	NR	NR	NR	VLR	NR	NR	NR	NR	NR
Kachchh	NR	NR	NR	VLR	NR	NR	NR	VLR	VLR	NR	NR	NR	NR
Kheda	NR	NR	NR	NR	NR	NR	*HR*	NR	VLR	NR	NR	NR	NR
Mahesana	NR	NR	NR	NR	NR	NR	NR	*HR*	VLR	NR	NR	NR	NR
Narmada	NR	NR	NR	NR	NR	NR	NR	NR	VLR	NR	NR	NR	NR
Navsari	NR	NR	NR	NR	NR	NR	NR	VLR	NR	NR	NR	NR	NR
PanchMahals	NR	NR	NR	NR	NR	NR	VLR	VLR	VLR	NR	NR	NR	NR
Patan	NR	NR	NR	NR	NR	NR	VLR	VLR	VLR	NR	NR	VLR	NR
Porbandar	NR	NR	NR	NR	NR	NR	VLR	VLR	NR	NR	NR	NR	NR
Rajkot	NR	NR	NR	NR	NR	NR	*VHR*	VLR	NR	NR	NR	NR	NR
SabarKantha	NR	NR	NR	NR	NR	NR	NR	VLR	VLR	NR	NR	NR	NR
Surat	NR	NR	NR	NR	NR	NR	NR	VLR	VLR	NR	NR	NR	NR
Surendranagar	NR	NR	NR	VLR	NR	NR	NR	VLR	VLR	NR	NR	NR	NR
Tapi	NR	NR	NR	NR	NR	NR	NR	VLR	NR	NR	NR	NR	NR
The Dangs	NR	NR	NR	NR	NR	NR	VLR	VLR	NR	NR	NR	NR	NR
Vadodara	NR	NR	NR	NR	NR	NR	NR	VLR	VLR	NR	NR	VLR	NR
Valsad	NR	NR	NR	NR	NR	NR	VLR	VLR	NR	NR	NR	NR	NR

If vaccinated, please ignore the disease forecast.

*Negligible risk (NR), Very low risk (VLR), Low risk (LR), Moderate risk (MR), High risk (HR),Very high risk (VHR)

District wise Livestock Disease Risk Forewarning for February, 2023: Haryana

Districts of Haryana	Livestock Diseases												
	Anthrax	Babesiosis	BQ	BT	ET	Fasciolosis	FMD	HS	PPR	S&G Pox	CSF	Theileriosis	Trypanosomosis
Ambala	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Bhiwani	NR	NR	NR	NR	*VHR*	NR	NR	VLR	*VHR*	NR	NR	NR	NR
Faridabad	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Fatehabad	NR	NR	NR	NR	*HR*	NR	*VHR*	*VHR*	*VHR*	NR	NR	NR	NR
Gurgaon	NR	NR	NR	NR	NR	NR	NR	VLR	VLR	NR	NR	NR	NR
Hisar	NR	NR	NR	NR	NR	NR	*HR*	NR	*VHR*	*VHR*	NR	NR	NR
Jhajjar	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Jind	NR	NR	NR	NR	NR	NR	NR	VLR	NR	NR	NR	VLR	NR
Kaithal	NR	NR	NR	VLR	NR	NR	NR	VLR	NR	NR	NR	VLR	NR
Karnal	NR	NR	NR	NR	NR	VLR	NR	VLR	NR	NR	NR	NR	NR
Kurukshetra	NR	NR	NR	NR	NR	NR	NR	VLR	NR	NR	NR	NR	NR
Mahendragarh	NR	NR	NR	NR	NR	NR	NR	VLR	NR	NR	NR	NR	NR
Mewat	NR	NR	NR	VLR	NR	NR	VLR	VLR	NR	NR	NR	NR	NR
Palwal	NR	NR	NR	NR	NR	NR	NR	VLR	NR	NR	NR	NR	NR
Panchkula	NR	NR	NR	NR	NR	NR	NR	VLR	NR	NR	NR	NR	NR
Panipat	NR	NR	NR	NR	NR	NR	NR	VLR	NR	NR	NR	NR	NR
Rewari	NR	NR	VLR	NR	NR	NR	VLR	VLR	NR	NR	NR	NR	NR
Rohtak	NR	NR	NR	NR	NR	NR	NR	VLR	NR	NR	NR	NR	NR
Sirsa	NR	NR	NR	NR	NR	NR	VLR	VLR	NR	NR	NR	NR	NR
Sonipat	NR	NR	NR	NR	NR	NR	NR	VLR	NR	NR	NR	NR	NR
Yamunanagar	NR	NR	NR	NR	NR	NR	VLR	VLR	NR	NR	NR	NR	NR

If vaccinated, please ignore the disease forecast.

*Negligible risk (NR), Very low risk (VLR), Low risk (LR), Moderate risk (MR), High risk (HR),Very high risk (VHR)

District wise Livestock Disease Risk Forewarning for February, 2023: Himachal Pradesh

Districts of Himachal Pradesh	Livestock Diseases												
	Anthrax	Babesiosis	BQ	BT	ET	Fasciolosis	FMD	HS	PPR	S&G Pox	CSF	Theileriosis	Trypanosomosis
Bilaspur	NR	NR	NR	NR	NR	NR	VLR	NR	NR	NR	NR	NR	NR
Chamba	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Hamirpur	NR	NR	NR	NR	NR	NR	VLR	NR	NR	NR	NR	NR	NR
Kangra	NR	NR	NR	NR	NR	NR	VLR	NR	NR	NR	NR	NR	NR
Kinnaur	NR	NR	NR	NR	*VHR*	NR	VLR	VLR	NR	*VHR*	NR	NR	NR
Kullu	NR	NR	NR	NR	NR	NR	VLR	VLR	NR	NR	NR	NR	NR
Lahul&Spiti	NR	NR	NR	NR	NR	NR	VLR	NR	NR	NR	NR	NR	NR
Mandi	NR	NR	NR	VLR	NR	NR	*HR*	NR	NR	NR	NR	NR	NR
Shimla	NR	NR	VLR	VLR	NR	NR	VLR	NR	VLR	NR	NR	NR	NR
Sirmaur	NR	NR	NR	NR	NR	NR	NR	VLR	NR	NR	NR	NR	NR
Solan	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Una	NR	NR	NR	NR	NR	NR	VLR	VLR	NR	NR	NR	NR	NR

If vaccinated, please ignore the disease forecast.

*Negligible risk (NR), Very low risk (VLR), Low risk (LR), Moderate risk (MR), High risk (HR),Very high risk (VHR)

District wise Livestock Disease Risk Forewarning for February, 2023: Jammu and Kashmir

Districts of Jammu and Kashmir	Livestock Diseases												
	Anthrax	Babesiosis	BQ	BT	ET	Fasciolosis	FMD	HS	PPR	S&G Pox	CSF	Theileriosis	Trypanosomosis
Anantnag	NR	NR	NR	NR	NR	NR	NR	VLR	NR	*VHR*	NR	NR	NR
Badgam	NR	NR	NR	NR	NR	NR	NR	NR	NR	*VHR*	NR	NR	NR
Bandipore	NR	NR	NR	NR	NR	NR	NR	NR	VLR	*VHR*	NR	NR	NR
Baramula	NR	NR	NR	VLR	NR	NR	NR	NR	NR	*VHR*	NR	NR	NR
Doda	NR	NR	NR	VLR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Ganderbal	NR	NR	NR	NR	NR	NR	NR	NR	VLR	MR	NR	NR	NR
Jammu	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Kargil	NR	NR	NR	VLR	NR	NR	NR	NR	NR	NR	VLR	NR	NR
Kathua	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Kishtwar	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Kulgam	NR	NR	NR	VLR	NR	NR	NR	NR	VLR	*VHR*	NR	NR	NR
Kupwara	NR	NR	NR	VLR	NR	NR	NR	NR	VLR	NR	NR	NR	NR
Leh(Ladakh)	NR	VLR	NR	VLR	NR	NR	NR	NR	VLR	NR	VLR	NR	NR
Pulwama	NR	NR	NR	NR	NR	NR	NR	NR	NR	*VHR*	NR	NR	NR
Punch	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Rajouri	NR	NR	NR	VLR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Ramban	NR	NR	NR	NR	NR	NR	NR	NR	VLR	NR	NR	NR	NR
Reasi	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Samba	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Shupiyan	NR	NR	NR	NR	NR	NR	NR	NR	NR	*VHR*	NR	NR	NR
Srinagar	NR	NR	NR	NR	NR	NR	NR	NR	NR	*VHR*	NR	NR	NR
Udhampur	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	VLR	NR	NR

If vaccinated, please ignore the disease forecast.

*Negligible risk (NR), Very low risk (VLR), Low risk (LR), Moderate risk (MR), High risk (HR),Very high risk (VHR)

District wise Livestock Disease Risk Forewarning for February, 2023: Jharkhand

Districts of Jharkhand	Livestock Diseases												
	Anthrax	Babesiosis	BQ	BT	ET	Fasciolosis	FMD	HS	PPR	S&G Pox	CSF	Theileriosis	Trypanosomosis
Bokaro	NR	*VHR*	NR	VLR	NR	*VHR*	MR	NR	*VHR*	NR	*VHR*	*VHR*	*VHR*
Chatra	NR	*VHR*	NR	NR	NR	MR	NR	NR	NR	NR	NR	VLR	*VHR*
Deoghar	NR	*VHR*	NR	NR	NR	*VHR*	*VHR*	*VHR*	*VHR*	NR	VLR	*VHR*	*VHR*
Dhanbad	NR	*VHR*	VLR	NR	NR	*VHR*	*VHR*	VLR	*VHR*	NR	VLR	*VHR*	*VHR*
Dumka	NR	*VHR*	NR	NR	NR	*VHR*	*VHR*	VLR	*VHR*	NR	*VHR*	*VHR*	*VHR*
Garhwa	NR	*VHR*	NR	NR	NR	*VHR*	NR	NR	NR	NR	NR	*VHR*	*VHR*
Giridih	NR	*VHR*	VLR	NR	*VHR*	*VHR*	MR	VLR	VLR	NR	NR	*VHR*	*VHR*
Godda	NR	*VHR*	*HR*	VLR	NR	*VHR*	*VHR*	MR	NR	NR	NR	*VHR*	*VHR*
Gumla	NR	*VHR*	NR	VLR	NR	*VHR*	*HR*	NR	*HR*	NR	*VHR*	*VHR*	*VHR*
Hazaribagh	NR	*VHR*	NR	VLR	NR	*VHR*	NR	NR	NR	NR	NR	*VHR*	*VHR*
Jamtara	NR	*VHR*	NR	VLR	NR	*VHR*	NR	VLR	*VHR*	NR	*VHR*	*VHR*	*VHR*
Khunti	NR	*VHR*	NR	VLR	NR	*VHR*	*HR*	*HR*	*VHR*	*VHR*	NR	*VHR*	*VHR*
Koderma	NR	MR	NR	NR	NR	*VHR*	NR	NR	NR	NR	NR	*VHR*	*VHR*
Latehar	NR	*VHR*	NR	NR	NR	*VHR*	NR	NR	NR	NR	NR	*VHR*	*VHR*
Lohardaga	NR	*VHR*	NR	NR	NR	*VHR*	MR	NR	*HR*	NR	*VHR*	*VHR*	*VHR*
Pakur	NR	*VHR*	NR	NR	MR	*VHR*	NR	NR	NR	NR	VLR	*VHR*	*VHR*
Palamu	NR	*VHR*	NR	NR	*VHR*	*VHR*	VLR	VLR	VLR	NR	NR	*VHR*	*VHR*
PashchimiSinghbhum	NR	*VHR*	NR	NR	NR	*VHR*	*VHR*	NR	*HR*	MR	VLR	*VHR*	*VHR*
PurbiSinghbhum	NR	*VHR*	VLR	NR	NR	*VHR*	*VHR*	VLR	*HR*	NR	NR	*VHR*	*VHR*
Ramgarh	NR	*VHR*	NR	VLR	MR	*VHR*	*VHR*	NR	VLR	NR	VLR	*VHR*	*VHR*
Ranchi	NR	*VHR*	NR	VLR	NR	*VHR*	*VHR*	NR	*HR*	NR	NR	*VHR*	*VHR*
Sahibganj	NR	*VHR*	*VHR*	MR	*VHR*	*VHR*	*VHR*	*VHR*	*VHR*	*VHR*	*VHR*	*VHR*	*VHR*
Seraikela - Kharsawan	NR	*VHR*	NR	VLR	NR	*VHR*	NR	NR	NR	NR	NR	*HR*	*VHR*
Simdega	NR	*VHR*	*HR*	VLR	NR	*VHR*	*HR*	NR	VLR	NR	*HR*	*VHR*	*VHR*

If vaccinated, please ignore the disease forecast.

*Negligible risk (NR), Very low risk (VLR), Low risk (LR), Moderate risk (MR), High risk (HR),Very high risk (VHR)

District wise Livestock Disease Risk Forewarning for February, 2023: Karnataka

Districts of Karnataka	Livestock Diseases												
	Anthrax	**Babesiosis**	**BQ**	**BT**	**ET**	**Fasciolosis**	**FMD**	**HS**	**PPR**	**S&G Pox**	**CSF**	**Theileriosis**	**Trypanosomosis**
Bagalkot	NR	NR	NR	LR	NR	NR	VLR	VLR	VLR	*VHR*	NR	NR	NR
Bangalore	NR	NR	*VHR*	VLR	NR	NR	*VHR*	VLR	VLR	NR	NR	NR	NR
Bangalore Rural	NR	VLR	*HR*	VLR	NR	NR	*VHR*	VLR	VLR	NR	NR	VLR	NR
Belgaum	NR	NR	NR	LR	*VHR*	NR	NR	VLR	LR	*VHR*	NR	NR	NR
Bellary	*VHR*	NR	NR	*VHR*	*VHR*	NR	VLR	VLR	*VHR*	*VHR*	NR	NR	NR
Bidar	NR	NR	VLR	VLR	NR	NR	NR	VLR	*HR*	MR	NR	NR	NR
Bijapur	NR	NR	NR	VLR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Chamarajanagar	NR	NR	NR	VLR	NR	NR	*HR*	VLR	VLR	NR	NR	NR	NR
Chikkaballapura	NR	NR	NR	*HR*	*VHR*	NR	*VHR*	VLR	VLR	*VHR*	*HR*	NR	NR
Chikmagalur	NR	NR	*HR*	VLR	NR	NR	*HR*	*HR*	*HR*	NR	NR	NR	NR
Chitradurga	*HR*	NR	*VHR*	*VHR*	*VHR*	NR	VLR	VLR	LR	*VHR*	NR	NR	NR
Dakshina Kannada	NR	NR	NR	VLR	NR	NR	*VHR*	VLR	NR	NR	NR	VLR	NR
Davanagere	*VHR*	NR	MR	*HR*	NR	NR	VLR	*VHR*	NR	MR	NR	NR	NR
Dharwad	NR	NR	NR	VLR	NR	NR	NR	VLR	NR	NR	NR	NR	NR
Gadag	NR	NR	NR	*HR*	NR	NR	MR	*HR*	NR	*VHR*	NR	NR	NR

Continued

Districts of Karnataka	Livestock Diseases												
	Anthrax	**Babesiosis**	**BQ**	**BT**	**ET**	**Fasciolosis**	**FMD**	**HS**	**PPR**	**S&G Pox**	**CSF**	**Theileriosis**	**Trypanosomosis**
Gulbarga	NR	NR	NR	VLR	NR	NR	VLR	NR	NR	NR	NR	NR	NR
Hassan	NR	NR	*HR*	*HR*	NR	NR	MR	LR	VLR	NR	NR	NR	NR
Haveri	*VHR*	NR	*VHR*	VLR	NR	NR	NR	*VHR*	VLR	NR	NR	NR	NR
Kodagu	NR	NR	MR	NR	NR	NR	VLR	VLR	VLR	NR	VLR	NR	NR
Kolar	*VHR*	NR	NR	*HR*	NR	NR	*HR*	VLR	MR	*VHR*	NR	NR	NR
Koppal	*VHR*	NR	VLR	*VHR*	*VHR*	NR	*HR*	LR	MR	*VHR*	NR	NR	NR
Mandya	NR	NR	*VHR*	VLR	NR	NR	*HR*	VLR	NR	NR	NR	NR	NR
Mysore	NR	NR	*VHR*	VLR	NR	NR	*VHR*	*VHR*	MR	NR	NR	NR	NR
Raichur	NR	NR	MR	*HR*	NR	NR	NR	VLR	MR	NR	NR	NR	NR
Ramanagara	NR	NR	VLR	VLR	NR	NR	*VHR*	VLR	MR	MR	NR	NR	NR
Shimoga	NR	NR	*VHR*	VLR	NR	NR	LR	VLR	VLR	NR	NR	NR	NR
Tumkur	*VHR*	NR	*HR*	*HR*	*VHR*	NR	*VHR*	*VHR*	*VHR*	*VHR*	NR	NR	NR
Udupi	NR	NR	VLR	VLR	NR	NR	*VHR*	VLR	MR	NR	VLR	VLR	NR
Uttara Kannada	NR	NR	*VHR*	NR	NR	NR	*VHR*	VLR	VLR	NR	NR	VLR	NR
Yadgir	NR	NR	VLR	VLR	NR	NR	NR	VLR	VLR	NR	NR	VLR	NR

If vaccinated, please ignore the disease forecast.

*Negligible risk (NR), Very low risk (VLR), Low risk (LR), Moderate risk (MR), High risk (HR),Very high risk (VHR)

District wise Livestock Disease Risk Forewarning for February, 2023: Kerala

Districts of Kerala	Livestock Diseases												
	Anthrax	**Babesiosis**	**BQ**	**BT**	**ET**	**Fasciolosis**	**FMD**	**HS**	**PPR**	**S&G Pox**	**CSF**	**Theileriosis**	**Trypanosomosis**
Alappuzha	NR	NR	NR	NR	NR	NR	*VHR*	VLR	VLR	NR	NR	*HR*	NR
Ernakulam	NR	*VHR*	NR	VLR	NR	NR	*VHR*	VLR	VLR	NR	NR	*VHR*	NR
Idukki	NR	NR	NR	NR	NR	NR	*HR*	NR	VLR	NR	NR	*HR*	*HR*
Kannur	NR	VLR	NR	NR	NR	NR	*VHR*	VLR	*VHR*	NR	NR	*VHR*	NR
Kasaragod	NR	NR	NR	NR	NR	NR	MR	VLR	*VHR*	NR	NR	*VHR*	NR
Kollam	NR	*VHR*	NR	VLR	NR	NR	*VHR*	*HR*	LR	NR	NR	*HR*	NR
Kottayam	NR	NR	NR	NR	NR	NR	*VHR*	*HR*	*VHR*	NR	NR	*VHR*	NR
Kozhikode	NR	NR	NR	NR	NR	NR	*VHR*	VLR	*VHR*	NR	VLR	*VHR*	NR
Malappuram	NR	VLR	NR	NR	NR	NR	*VHR*	VLR	*VHR*	NR	NR	*VHR*	NR
Palakkad	NR	NR	NR	VLR	NR	NR	VLR	*HR*	*HR*	NR	NR	*VHR*	NR
Pathanamthitta	NR	NR	NR	NR	NR	NR	*VHR*	VLR	VLR	NR	NR	VLR	NR
Thiruvananthapuram	*VHR*	NR	NR	NR	NR	NR	*VHR*	VLR	*VHR*	NR	VLR	*HR*	NR
Thrissur	NR	NR	NR	NR	NR	NR	*VHR*	*VHR*	VLR	*VHR*	NR	*VHR*	NR
Wayanad	*VHR*	*VHR*	*HR*	NR	NR	NR	*VHR*	NR	VLR	NR	NR	*VHR*	NR

If vaccinated, please ignore the disease forecast.

*Negligible risk (NR), Very low risk (VLR), Low risk (LR), Moderate risk (MR), High risk (HR),Very high risk (VHR)

District wise Livestock Disease Risk Forewarning for February, 2023: Lakshadweep

Districts of Lakshadweep	Livestock Diseases												
	Anthrax	Babesiosis	BQ	BT	ET	Fasciolosis	FMD	HS	PPR	S&G Pox	CSF	Theileriosis	Trypanosomosis
Lakshadweep	NR	NR	NR	VLR	NR	NR	NR	NR	NR	NR	NR	NR	NR

If vaccinated, please ignore the disease forecast.

*Negligible risk (NR), Very low risk (VLR), Low risk (LR), Moderate risk (MR), High risk (HR),Very high risk (VHR)

District wise Livestock Disease Risk Forewarning for February, 2023: Madhya Pradesh

Districts of Madhya Pradesh	Livestock Diseases												
	Anthrax	Babesiosis	BQ	BT	ET	Fasciolosis	FMD	HS	PPR	S&G Pox	CSF	Theileriosis	Trypanosomosis
Alirajpur	NR	NR	NR	VLR	NR	NR	NR	*VHR*	NR	NR	NR	NR	NR
Anuppur	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Ashoknagar	NR	NR	NR	NR	NR	NR	NR	VLR	NR	NR	NR	NR	NR
Balaghat	NR	NR	NR	VLR	NR	NR	NR	NR	VLR	NR	NR	NR	NR
Barwani	NR	NR	NR	NR	NR	NR	VLR	VLR	NR	NR	NR	NR	NR
Betul	NR	NR	MR	NR	NR	NR	NR	*VHR*	NR	NR	NR	NR	NR
Bhind	NR	VLR	NR	NR	NR	NR	VLR	VLR	NR	NR	NR	NR	NR
Bhopal	NR	NR	NR	NR	NR	NR	MR	*VHR*	*VHR*	NR	NR	NR	NR
Burhanpur	NR	NR	NR	VLR	NR	NR	NR	NR	VLR	NR	NR	NR	NR
Chhatarpur	NR	NR	NR	NR	NR	NR	NR	VLR	VLR	NR	NR	NR	NR
Chhindwara	NR	NR	NR	NR	NR	NR	NR	VLR	VLR	NR	NR	NR	NR
Damoh	NR	NR	NR	NR	NR	NR	NR	VLR	NR	NR	NR	NR	NR
Datia	NR	NR	NR	NR	NR	NR	VLR	VLR	VLR	NR	NR	NR	NR
Dewas	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Dhar	NR	NR	NR	NR	NR	NR	NR	VLR	NR	NR	NR	NR	NR
Dindori	NR	NR	NR	NR	NR	NR	VLR	VLR	NR	NR	NR	NR	NR
East Nimar	NR	VLR	NR	VLR	NR	NR	NR	VLR	NR	NR	NR	NR	NR
Guna	NR	NR	NR	NR	NR	NR	VLR	NR	NR	NR	NR	NR	NR
Gwalior	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Harda	NR	NR	NR	VLR	NR	NR	VLR	VLR	VLR	NR	NR	NR	NR
Hoshangabad	NR	NR	NR	NR	NR	NR	VLR	VLR	NR	NR	NR	NR	NR
Indore	NR	NR	NR	NR	NR	NR	NR	VLR	NR	NR	NR	NR	NR
Jabalpur	NR	NR	NR	NR	NR	NR	VLR	VLR	NR	NR	NR	NR	NR
Jhabua	NR	NR	NR	NR	NR	NR	VLR	VLR	VLR	NR	NR	VLR	NR
Katni	NR	NR	NR	NR	NR	NR	NR	VLR	VLR	NR	NR	NR	NR

Continued

Districts of Madhya Pradesh	Livestock Diseases												
	Anthrax	Babesiosis	BQ	BT	ET	Fasciolosis	FMD	HS	PPR	S&G Pox	CSF	Theileriosis	Trypanosomosis
Khargone (West Nimar)	NR	NR	NR	NR	NR	NR	NR	VLR	NR	NR	NR	NR	NR
Mandla	NR	NR	NR	NR	NR	NR	VLR	VLR	NR	NR	VLR	NR	NR
Mandsaur	NR	VLR	NR	NR	NR	NR	NR	VLR	NR	NR	NR	NR	NR
Morena	NR	NR	NR	NR	NR	NR	NR	VLR	VLR	NR	NR	NR	NR
Narsimhapur	NR	NR	VLR	VLR	NR	NR	***HR***	VLR	NR	NR	NR	NR	NR
Neemuch	NR	NR	NR	NR	NR	NR	NR	VLR	NR	NR	NR	NR	NR
Panna	NR	NR	NR	NR	NR	NR	NR	NR	VLR	NR	NR	NR	NR
Raisen	NR	NR	NR	NR	NR	NR	NR	VLR	VLR	NR	NR	NR	NR
Rajgarh	NR	NR	NR	NR	NR	NR	VLR	VLR	NR	NR	NR	NR	NR
Ratlam	NR	NR	NR	NR	NR	NR	VLR	VLR	NR	NR	NR	NR	NR
Rewa	NR	NR	NR	NR	NR	NR	NR	VLR	VLR	NR	NR	NR	NR
Sagar	NR	NR	NR	NR	NR	NR	NR	VLR	VLR	NR	NR	NR	NR
Satna	NR	NR	NR	NR	NR	NR	NR	VLR	VLR	NR	NR	NR	NR
Sehore	NR	NR	NR	NR	NR	NR	NR	VLR	NR	NR	NR	NR	NR
Seoni	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Shahdol	NR	VLR	NR	NR	NR	NR	NR	NR	VLR	NR	NR	NR	NR
Shajapur	NR	NR	NR	NR	NR	NR	VLR	VLR	NR	NR	NR	NR	NR
Sheopur	NR	NR	NR	NR	NR	NR	NR	VLR	VLR	NR	NR	NR	NR
Shivpuri	NR	NR	NR	NR	NR	NR	VLR	MR	VLR	NR	NR	NR	NR
Sidhi	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Singrauli	NR	NR	NR	NR	NR	NR	NR	VLR	VLR	NR	NR	NR	NR
Tikamgarh	NR	VLR	NR	NR	NR	NR	NR	VLR	VLR	NR	NR	NR	NR
Ujjain	NR	VLR	NR	NR	NR	NR	NR	NR	VLR	NR	NR	NR	NR
Umaria	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Vidisha	NR	NR	NR	NR	NR	NR	VLR	VLR	NR	NR	NR	NR	NR

If vaccinated, please ignore the disease forecast.

*Negligible risk (NR), Very low risk (VLR), Low risk (LR), Moderate risk (MR), High risk (HR),Very high risk (VHR)

District wise Livestock Disease Risk Forewarning for February, 2023: Maharashtra

Districts of Maharashtra	Livestock Diseases												
	Anthrax	Babesiosis	BQ	BT	ET	Fasciolosis	FMD	HS	PPR	S&G Pox	CSF	Theileriosis	Trypanosomosis
Ahmadnagar	NR	NR	VLR	VLR	NR	NR	NR	*HR*	*VHR*	*VHR*	NR	NR	NR
Akola	NR	NR	NR	NR	NR	NR	NR	NR	VLR	NR	NR	NR	NR
Amravati	NR	NR	NR	NR	NR	NR	NR	VLR	VLR	NR	NR	NR	NR
Aurangabad	NR	NR	NR	NR	NR	NR	NR	VLR	VLR	NR	NR	NR	NR
Bhandara	NR	VLR	NR	VLR	NR	NR	NR	VLR	VLR	NR	NR	NR	NR
Bid	NR	NR	NR	NR	NR	NR	VLR	VLR	MR	NR	NR	NR	NR
Buldana	NR	NR	NR	NR	NR	NR	NR	VLR	VLR	NR	NR	NR	NR
Chandrapur	NR	NR	VLR	NR	NR	NR	VLR	VLR	VLR	NR	NR	NR	NR
Dhule	NR	NR	NR	NR	NR	NR	NR	VLR	VLR	NR	NR	NR	NR
Gadchiroli	NR	NR	NR	NR	NR	NR	NR	VLR	VLR	NR	NR	NR	NR
Gondiya	NR	VLR	NR	NR	NR	NR	NR	VLR	VLR	NR	NR	NR	NR
Hingoli	NR	NR	NR	VLR	NR	NR	NR	NR	VLR	NR	NR	NR	NR
Jalgaon	NR	NR	NR	NR	NR	NR	VLR	VLR	*VHR*	NR	NR	NR	NR
Jalna	NR	VLR	NR	VLR	NR	NR	NR	VLR	VLR	NR	NR	NR	NR
Kolhapur	NR	VLR	NR	VLR	NR	NR	NR	NR	VLR	NR	NR	NR	NR
Latur	NR	NR	NR	VLR	NR	NR	NR	NR	VLR	NR	NR	NR	NR
Mumbai	NR	NR	NR	VLR	NR	NR	VLR	VLR	VLR	NR	NR	NR	NR
Mumbai Suburban	NR	NR	NR	VLR	NR	NR	VLR	VLR	VLR	NR	NR	NR	NR
Nagpur	NR	VLR	*VHR*	NR	NR	NR	NR	VLR	*VHR*	NR	NR	NR	NR
Nanded	NR	NR	NR	VLR	NR	NR	NR	VLR	VLR	NR	NR	NR	NR
Nandurbar	NR	NR	NR	NR	NR	NR	NR	VLR	VLR	NR	NR	NR	NR
Nashik	NR	NR	NR	NR	NR	NR	NR	*VHR*	*VHR*	NR	NR	NR	NR
Osmanabad	NR	NR	NR	VLR	NR	NR	NR	NR	VLR	NR	NR	NR	NR

Continued

Districts of Maharashtra	Livestock Diseases												
	Anthrax	Babesiosis	BQ	BT	ET	Fasciolosis	FMD	HS	PPR	S&G Pox	CSF	Theileriosis	Trypanosomosis
Parbhani	NR	VLR	VLR	VLR	NR	NR	VLR	NR	VLR	NR	NR	NR	NR
Pune	NR	NR	NR	VLR	NR	NR	VLR	VLR	*VHR*	NR	NR	NR	NR
Raigarh	NR	NR	NR	VLR	NR	NR	NR	VLR	VLR	NR	NR	NR	NR
Ratnagiri	NR	NR	NR	VLR	NR	NR	VLR	NR	NR	NR	NR	NR	NR
Sangli	NR	NR	NR	VLR	NR	NR	NR	VLR	NR	NR	NR	NR	NR
Satara	NR	NR	NR	VLR	NR	NR	NR	VLR	VLR	NR	NR	NR	NR
Sindhudurg	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Solapur	NR	NR	NR	VLR	NR	NR	NR	NR	VLR	NR	NR	NR	NR
Thane	NR	NR	*VHR*	NR	NR	NR	VLR	VLR	MR	NR	NR	NR	NR
Wardha	NR	NR	VLR	NR	NR	NR	VLR	VLR	VLR	NR	NR	NR	NR
Washim	NR	NR	NR	NR	NR	NR	VLR	VLR	VLR	NR	NR	NR	NR
Yavatmal	NR	NR	NR	NR	NR	NR	NR	VLR	VLR	NR	NR	NR	NR

If vaccinated, please ignore the disease forecast.

*Negligible risk (NR), Very low risk (VLR), Low risk (LR), Moderate risk (MR), High risk (HR),Very high risk (VHR)

District wise Livestock Disease Risk Forewarning for February, 2023: Manipur

Districts of Manipur	Livestock Diseases												
	Anthrax	Babesiosis	BQ	BT	ET	Fasciolosis	FMD	HS	PPR	S&G Pox	CSF	Theileriosis	Trypanosomosis
Bishnupur	NR	VLR	VLR	NR	NR	*VHR*	NR	VLR	VLR	NR	NR	NR	NR
Chandel	NR	VLR	NR	NR	NR	NR	NR	VLR	NR	NR	*HR*	NR	NR
Churachandpur	NR	NR	NR	NR	NR	NR	VLR	VLR	NR	NR	VLR	NR	NR
Imphal East	NR	VLR	VLR	NR	NR	LR	NR	VLR	NR	NR	NR	NR	NR
Imphal West	NR	MR	VLR	NR	NR	*VHR*	VLR	NR	NR	NR	*VHR*	NR	NR
Senapati	NR	NR	NR	NR	NR	NR	NR	VLR	NR	NR	VLR	NR	NR
Tamenglong	NR	NR	NR	NR	NR	NR	VLR	VLR	NR	NR	VLR	NR	NR
Thoubal	NR	VLR	VLR	NR	NR	VLR	NR	NR	NR	NR	*HR*	NR	NR
Ukhrul	NR	NR	NR	NR	NR	NR	NR	VLR	NR	NR	VLR	NR	NR

If vaccinated, please ignore the disease forecast.

*Negligible risk (NR), Very low risk (VLR), Low risk (LR), Moderate risk (MR), High risk (HR),Very high risk (VHR)

District wise Livestock Disease Risk Forewarning for February, 2023: Meghalaya

Districts of Meghalaya	Livestock Diseases												
	Anthrax	Babesiosis	BQ	BT	ET	Fasciolosis	FMD	HS	PPR	S&G Pox	CSF	Theileriosis	Trypanosomosis
East Garo Hills	NR	VLR	VLR	NR	NR	NR	VLR	VLR	NR	NR	VLR	NR	NR
East Jaintia Hills	NR	VLR	VLR	VLR	NR	NR	VLR	VLR	NR	NR	VLR	NR	NR
East Khasi Hills	NR	NR	VLR	NR	NR	NR	*VHR*	NR	NR	NR	*VHR*	NR	NR
Jaintia Hills	NR	NR	NR	NR	NR	NR	VLR	NR	NR	NR	VLR	NR	NR
North Garo Hills	NR	NR	NR	NR	NR	NR	NR	VLR	NR	NR	NR	NR	NR
Ribhoi	NR	NR	VLR	NR	NR	NR	*VHR*	NR	NR	NR	NR	NR	NR
South Garo Hills	NR	NR	*VHR*	VLR	NR	NR	*VHR*	VLR	NR	NR	*VHR*	VLR	NR
Southwest Garo Hills	NR	NR	*HR*	NR	NR	NR	VLR	NR	NR	NR	VLR	NR	NR
Southwest Khasi Hills	NR	NR	*HR*	NR	NR	NR	MR	VLR	NR	NR	NR	NR	NR
West Garo Hills	NR	NR	VLR	NR	NR	VLR	VLR	VLR	NR	NR	VLR	NR	NR
West Khasi Hills	NR	NR	VLR	NR	NR	NR	*VHR*	VLR	NR	NR	*VHR*	NR	NR

If vaccinated, please ignore the disease forecast.

*Negligible risk (NR), Very low risk (VLR), Low risk (LR), Moderate risk (MR), High risk (HR),Very high risk (VHR)

District wise Livestock Disease Risk Forewarning for February, 2023: Mizoram

Districts of Mizoram	Livestock Diseases												
	Anthrax	Babesiosis	BQ	BT	ET	Fasciolosis	FMD	HS	PPR	S&G Pox	CSF	Theileriosis	Trypanosomosis
Aizawl	NR	NR	*HR*	NR	NR	NR	VLR	NR	NR	NR	VLR	NR	NR
Champhai	NR	NR	NR	NR	NR	NR	VLR	MR	NR	NR	VLR	NR	NR
Kolasib	NR	NR	NR	NR	NR	NR	VLR	NR	NR	NR	*VHR*	NR	NR
Lawngtlai	NR	VLR	NR	NR	NR	NR	VLR	VLR	VLR	NR	NR	NR	NR
Lunglei	NR	NR	NR	NR	NR	NR	VLR	VLR	VLR	NR	VLR	NR	NR
Mamit	NR	NR	NR	NR	NR	NR	VLR	VLR	NR	NR	VLR	NR	NR
Saiha	NR	NR	NR	NR	NR	NR	VLR	NR	VLR	NR	NR	NR	NR
Serchhip	NR	NR	NR	NR	NR	NR	VLR	VLR	VLR	NR	NR	NR	NR

If vaccinated, please ignore the disease forecast.

*Negligible risk (NR), Very low risk (VLR), Low risk (LR), Moderate risk (MR), High risk (HR),Very high risk (VHR)

District wise Livestock Disease Risk Forewarning for February, 2023: Nagaland

Districts of Nagaland	Livestock Diseases												
	Anthrax	Babesiosis	BQ	BT	ET	Fasciolosis	FMD	HS	PPR	S&G Pox	CSF	Theileriosis	Trypanosomosis
Dimapur	NR	NR	VLR	NR	NR	VLR	NR	VLR	NR	NR	VLR	NR	NR
Kiphire	NR	NR	NR	NR	NR	NR	VLR	VLR	NR	NR	VLR	NR	NR
Kohima	NR	NR	VLR	NR	NR	NR	VLR	VLR	NR	NR	NR	NR	NR
Longleng	NR	NR	NR	NR	NR	NR	NR	VLR	NR	NR	NR	NR	NR
Mokokchung	NR	NR	NR	NR	NR	NR	NR	VLR	NR	NR	NR	NR	NR
Mon	NR	NR	NR	NR	NR	NR	NR	VLR	NR	NR	NR	NR	NR
Peren	NR	NR	NR	NR	NR	NR	*HR*	VLR	NR	NR	MR	NR	NR
Phek	NR	NR	VLR	NR	NR	NR	NR	VLR	NR	NR	VLR	NR	NR
Tuensang	NR	NR	NR	NR	NR	NR	VLR	NR	NR	NR	VLR	NR	NR
Wokha	NR	NR	NR	NR	NR	NR	NR	VLR	NR	NR	VLR	NR	NR
Zunheboto	NR	NR	NR	NR	NR	NR	*HR*	VLR	NR	NR	*HR*	NR	NR

If vaccinated, please ignore the disease forecast.

*Negligible risk (NR), Very low risk (VLR), Low risk (LR), Moderate risk (MR), High risk (HR),Very high risk (VHR)

District wise Livestock Disease Risk Forewarning for February, 2023: NCT of Delhi

Districts of NCT of Delhi	Livestock Diseases												
	Anthrax	Babesiosis	BQ	BT	ET	Fasciolosis	FMD	HS	PPR	S&G Pox	CSF	Theileriosis	Trypanosomosis
Central	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
East	NR	NR	NR	NR	NR	NR	VLR	NR	NR	NR	NR	NR	NR
New Delhi	NR	VLR	NR	VLR	NR	NR	VLR	NR	NR	NR	NR	NR	NR
North	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
North East	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
North West	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
South	NR	VLR	NR	VLR	NR	NR	NR	NR	NR	NR	NR	NR	NR
South West	NR	VLR	NR	VLR	NR	VLR	VLR	NR	VLR	NR	NR	VLR	NR
West	NR	NR	VLR	NR	NR	NR	VLR	NR	NR	NR	NR	NR	NR

If vaccinated, please ignore the disease forecast.

*Negligible risk (NR), Very low risk (VLR), Low risk (LR), Moderate risk (MR), High risk (HR),Very high risk (VHR)

District wise Livestock Disease Risk Forewarning for February, 2023: Odisha

Districts of Odisha	Livestock Diseases												
	Anthrax	**Babesiosis**	**BQ**	**BT**	**ET**	**Fasciolosis**	**FMD**	**HS**	**PPR**	**S&G Pox**	**CSF**	**Theileriosis**	**Trypanosomosis**
Anugul	NR	NR	*VHR*	NR	NR	NR	NR	VLR	NR	NR	NR	NR	NR
Balangir	NR	VLR	VLR	NR	NR	NR	NR	VLR	NR	NR	NR	NR	NR
Baleshwar	NR	NR	NR	VLR	NR	NR	VLR	VLR	VLR	NR	NR	NR	NR
Bargarh	NR	NR	VLR	NR	NR	NR	VLR	*VHR*	VLR	NR	NR	NR	NR
Baudh	NR	NR	NR	NR	NR	NR	NR	VLR	NR	NR	NR	VLR	NR
Bhadrak	NR	NR	NR	NR	NR	NR	*HR*	*VHR*	VLR	NR	NR	NR	NR
Cuttack	NR	NR	VLR	NR	NR	NR	*VHR*	VLR	*VHR*	NR	NR	NR	NR
Debagarh	NR	VLR	NR	NR	NR	NR	NR	NR	NR	NR	VLR	NR	NR
Dhenkanal	NR	NR	VLR	NR	NR	NR	VLR	VLR	NR	NR	NR	NR	NR
Gajapati	NR	NR	NR	NR	NR	NR	VLR	VLR	NR	NR	VLR	VLR	NR
Ganjam	NR	NR	VLR	VLR	NR	NR	VLR	VLR	NR	NR	NR	*HR*	NR
Jagatsinghapur	NR	NR	NR	NR	NR	NR	*VHR*	VLR	NR	NR	NR	NR	*VHR*
Jajapur	NR	NR	NR	NR	NR	NR	*VHR*	VLR	NR	NR	NR	NR	NR
Jharsuguda	NR	NR	VLR	NR	NR	NR	NR	NR	VLR	NR	NR	VLR	NR
Kalahandi	NR	NR	NR	VLR	NR	NR	VLR	NR	NR	NR	NR	NR	NR
Kandhamal	NR	NR	NR	VLR	NR	NR	VLR	VLR	NR	NR	NR	NR	NR
Kendrapara	NR	NR	NR	NR	NR	NR	*VHR*	VLR	*VHR*	NR	NR	NR	NR
Kendujhar	NR	NR	VLR	NR	NR	NR	NR	VLR	NR	NR	NR	VLR	NR
Khordha	NR	NR	VLR	NR	NR	NR	VLR	VLR	NR	NR	NR	NR	NR
Koraput	*VHR*	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Malkangiri	NR	NR	VLR	VLR	NR	NR	VLR	VLR	NR	NR	NR	NR	NR

Continued

Districts of Odisha	Livestock Diseases												
	Anthrax	Babesiosis	BQ	BT	ET	Fasciolosis	FMD	HS	PPR	S&G Pox	CSF	Theileriosis	Trypanosomosis
Mayurbhanj	NR	NR	NR	VLR	NR	NR	NR	NR	NR	NR	NR	VLR	NR
Nabarangapur	NR	NR	*VHR*	VLR	NR	NR	VLR	*VHR*	NR	NR	VLR	VLR	NR
Nayagarh	NR	NR	NR	VLR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Nuapada	NR	VLR	NR	NR	NR	NR	VLR	*HR*	VLR	NR	NR	VLR	NR
Puri	NR	NR	NR	NR	NR	NR	*VHR*	NR	NR	NR	NR	NR	NR
Rayagada	NR	NR	NR	VLR	NR	NR	*HR*	NR	NR	NR	NR	VLR	NR
Sambalpur	*VHR*	NR	NR	NR	NR	NR	VLR	NR	VLR	NR	NR	VLR	NR
Subarnapur	NR	VLR	VLR	VLR	NR	NR	NR	VLR	VLR	NR	NR	VLR	NR
Sundargarh	NR	VLR	VLR	NR	NR	NR	NR	VLR	NR	NR	NR	VLR	NR

If vaccinated, please ignore the disease forecast.

*Negligible risk (NR), Very low risk (VLR), Low risk (LR), Moderate risk (MR), High risk (HR),Very high risk (VHR)

District wise Livestock Disease Risk Forewarning for February, 2023: Puducherry

Districts of Puducherry	Livestock Diseases												
	Anthrax	Babesiosis	BQ	BT	ET	Fasciolosis	FMD	HS	PPR	S&G Pox	CSF	Theileriosis	Trypanosomosis
Karaikal	NR	*VHR*	NR	VLR	NR	NR	NR	NR	NR	*VHR*	NR	VLR	NR
Mahe	NR	NR	VLR	VLR	NR	VLR	VLR	VLR	VLR	NR	VLR	NR	NR
Puducherry	NR	*VHR*	NR	VLR	NR	NR	NR	NR	NR	*VHR*	NR	NR	NR
Yanam	NR	NR	MR	VLR	NR	*VHR*	VLR	VLR	NR	NR	VLR	NR	NR

If vaccinated, please ignore the disease forecast.

*Negligible risk (NR), Very low risk (VLR), Low risk (LR), Moderate risk (MR), High risk (HR),Very high risk (VHR)

District wise Livestock Disease Risk Forewarning for February, 2023: Punjab

Districts of Punjab	Livestock Diseases												
	Anthrax	Babesiosis	BQ	BT	ET	Fasciolosis	FMD	HS	PPR	S&G Pox	CSF	Theileriosis	Trypanosomosis
Amritsar	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	VLR	NR	NR
Barnala	NR	NR	NR	NR	NR	NR	NR	VLR	NR	NR	VLR	VLR	NR
Bathinda	NR	NR	NR	NR	NR	VLR	VLR	VLR	VLR	NR	*VHR*	NR	NR
Faridkot	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	*VHR*	NR	NR
Fatehgarh Sahib	NR	NR	NR	NR	NR	VLR	NR	NR	NR	NR	VLR	VLR	NR
Firozpur	NR	NR	NR	NR	NR	NR	NR	VLR	NR	NR	VLR	NR	NR
Gurdaspur	NR	NR	NR	VLR	NR	NR	NR	NR	NR	NR	VLR	NR	NR
Hoshiarpur	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Jalandhar	NR	NR	NR	NR	NR	NR	NR	VLR	NR	NR	NR	NR	NR
Kapurthala	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Ludhiana	NR	NR	NR	NR	NR	NR	NR	VLR	NR	NR	VLR	NR	NR
Mansa	NR	NR	NR	VLR	NR	NR	NR	VLR	VLR	NR	VLR	NR	NR
Moga	NR	NR	NR	NR	NR	NR	NR	VLR	NR	NR	VLR	NR	NR
Muktsar	NR	NR	NR	NR	NR	NR	NR	VLR	VLR	NR	NR	NR	NR
Patiala	NR	NR	NR	NR	NR	NR	NR	VLR	NR	NR	VLR	NR	NR
Rupnagar	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
SahibzadaAjit Singh Nagar	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Sangrur	NR	NR	NR	NR	NR	NR	NR	VLR	NR	NR	VLR	NR	NR
Shahid Bhagat Singh Nagar	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Tarn Taran	NR	NR	NR	NR	NR	NR	NR	VLR	NR	NR	NR	VLR	NR

If vaccinated, please ignore the disease forecast.

*Negligible risk (NR), Very low risk (VLR), Low risk (LR), Moderate risk (MR), High risk (HR),Very high risk (VHR)

District wise Livestock Disease Risk Forewarning for February, 2023: Rajasthan

Districts of Rajasthan	Livestock Diseases												
	Anthrax	Babesiosis	BQ	BT	ET	Fasciolosis	FMD	HS	PPR	S&G Pox	CSF	Theileriosis	Trypanosomosis
Ajmer	NR	NR	NR	NR	NR	NR	NR	*HR*	VLR	NR	NR	NR	NR
Alwar	NR	VLR	NR	NR	NR	NR	*HR*	VLR	VLR	NR	NR	VLR	NR
Banswara	NR	NR	NR	NR	NR	NR	VLR	VLR	VLR	NR	NR	NR	NR
Baran	NR	NR	NR	NR	NR	NR	NR	VLR	NR	NR	NR	NR	NR
Barmer	NR	NR	NR	VLR	NR	NR	NR	NR	VLR	NR	NR	NR	NR
Bharatpur	NR	NR	NR	NR	NR	NR	VLR	*HR*	NR	NR	NR	VLR	NR
Bhilwara	NR	NR	NR	NR	NR	NR	NR	VLR	VLR	NR	NR	NR	NR
Bikaner	NR	NR	NR	VLR	NR	NR	NR	VLR	NR	NR	NR	NR	NR
Bundi	NR	NR	NR	NR	NR	NR	NR	VLR	NR	NR	NR	NR	NR
Chittaurgarh	NR	NR	NR	NR	NR	NR	NR	VLR	VLR	NR	NR	NR	NR
Churu	NR	NR	NR	VLR	NR	NR	NR	VLR	VLR	NR	NR	NR	NR
Dausa	NR	NR	NR	VLR	NR	NR	VLR	*VHR*	NR	NR	NR	NR	NR
Dhaulpur	NR	NR	NR	VLR	NR	NR	MR	VLR	NR	NR	NR	NR	NR
Dungarpur	NR	NR	NR	NR	NR	NR	VLR	VLR	VLR	NR	NR	VLR	NR
Ganganagar	NR	NR	NR	NR	NR	NR	*HR*	VLR	VLR	NR	NR	NR	NR
Hanumangarh	NR	NR	NR	NR	*VHR*	NR	VLR	VLR	VLR	*VHR*	NR	NR	NR
Jaipur	NR	NR	NR	NR	NR	NR	*VHR*	VLR	VLR	NR	NR	NR	NR
Jaisalmer	NR	NR	NR	VLR	NR	NR	NR	VLR	*VHR*	NR	NR	NR	NR
Jalor	NR	NR	NR	VLR	NR	NR	NR	VLR	VLR	NR	NR	NR	NR
Jhalawar	NR	NR	NR	VLR	NR	NR	VLR	VLR	NR	NR	NR	NR	NR
Jhunjhunun	NR	NR	NR	NR	NR	NR	*HR*	VLR	VLR	NR	NR	NR	NR
Jodhpur	NR	NR	NR	VLR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Karauli	NR	NR	NR	NR	NR	NR	VLR	*VHR*	NR	NR	NR	NR	NR

Continued

Districts of Rajasthan	Livestock Diseases												
	Anthrax	Babesiosis	BQ	BT	ET	Fasciolosis	FMD	HS	PPR	S&G Pox	CSF	Theileriosis	Trypanosomosis
Kota	NR	NR	NR	NR	NR	NR	NR	VLR	NR	NR	NR	NR	NR
Nagaur	NR	NR	NR	VLR	NR	NR	NR	VLR	VLR	NR	NR	NR	NR
Pali	NR	NR	NR	VLR	NR	NR	NR	VLR	VLR	NR	NR	NR	NR
Pratapgarh	NR	NR	NR	NR	NR	NR	NR	VLR	NR	NR	NR	NR	NR
Rajsamand	NR	NR	NR	NR	NR	NR	VLR	VLR	VLR	NR	NR	NR	NR
Sawai Madhopur	NR	NR	NR	NR	NR	NR	NR	*HR*	NR	NR	NR	NR	NR
Sikar	NR	NR	NR	VLR	NR	NR	VLR	VLR	VLR	NR	NR	NR	NR
Sirohi	NR	NR	NR	NR	NR	NR	NR	VLR	VLR	NR	NR	NR	NR
Tonk	NR	NR	NR	NR	NR	NR	NR	VLR	VLR	NR	NR	NR	NR
Udaipur	NR	NR	NR	NR	NR	NR	*VHR*	VLR	VLR	NR	NR	NR	NR

If vaccinated, please ignore the disease forecast.

*Negligible risk (NR), Very low risk (VLR), Low risk (LR), Moderate risk (MR), High risk (HR),Very high risk (VHR)

District wise Livestock Disease Risk Forewarning for February, 2023: Sikkim

Districts of Sikkim	Livestock Diseases												
	Anthrax	Babesiosis	BQ	BT	ET	Fasciolosis	FMD	HS	PPR	S&G Pox	CSF	Theileriosis	Trypanosomosis
East District	NR	*VHR*	NR	NR	NR	NR	NR	VLR	NR	NR	VLR	NR	NR
North District	NR	VLR	NR	NR	NR	NR	NR	VLR	NR	NR	*HR*	NR	NR
South District	NR	NR	NR	NR	NR	NR	NR	VLR	NR	NR	VLR	VLR	NR
West District	NR	VLR	NR	NR	NR	NR	NR	NR	NR	NR	VLR	NR	NR

If vaccinated, please ignore the disease forecast.

*Negligible risk (NR), Very low risk (VLR), Low risk (LR), Moderate risk (MR), High risk (HR),Very high risk (VHR)

District wise Livestock Disease Risk Forewarning for February, 2023: Tamil Nadu

Districts of Tamil Nadu	Livestock Disease												
	Anthrax	Babesiosis	BQ	BT	ET	Fasciolosis	FMD	HS	PPR	S&G Pox	CSF	Theileriosis	Trypanosomosis
Ariyalur	NR	NR	MR	NR	NR	VLR	NR	VLR	NR	NR	NR	NR	NR
Chennai	NR	NR	NR	VLR	NR	NR	NR	NR	NR	NR	VLR	NR	NR
Coimbatore	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Cuddalore	NR	NR	NR	NR	NR	NR	VLR	NR	NR	NR	NR	NR	NR
Dharmapuri	NR	NR	NR	VLR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Dindigul	NR	NR	NR	NR	NR	NR	VLR	VLR	NR	NR	NR	NR	NR
Erode	NR	NR	NR	VLR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Kancheepuram	*VHR*	NR	*HR*	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Kanniyakumari	NR	NR	NR	NR	NR	NR	VLR	VLR	NR	NR	NR	NR	NR
Karur	NR	NR	NR	NR	NR	NR	NR	VLR	VLR	NR	NR	NR	NR
Krishnagiri	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Madurai	NR	NR	NR	NR	NR	NR	VLR	VLR	NR	NR	NR	NR	NR
Nagapattinam	NR	NR	NR	NR	NR	NR	VLR	VLR	VLR	NR	NR	NR	NR
Namakkal	NR	NR	NR	NR	NR	NR	VLR	VLR	VLR	NR	NR	NR	NR
Perambalur	NR	NR	NR	NR	NR	NR	NR	VLR	NR	NR	NR	NR	NR
Pudukkottai	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Ramanathapuram	NR	NR	NR	VLR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Salem	NR	NR	VLR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Sivaganga	NR	NR	NR	VLR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Thanjavur	NR	NR	NR	NR	NR	NR	NR	VLR	VLR	NR	NR	NR	NR
The Nilgiris	NR	NR	NR	VLR	NR	NR	VLR	NR	NR	NR	NR	VLR	NR
Theni	*VHR*	NR	NR	VLR	NR	NR	VLR	VLR	VLR	NR	NR	NR	NR
Thiruvallur	NR	VLR	VLR	VLR	NR	NR	VLR	VLR	NR	NR	NR	NR	NR
Thiruvarur	NR	NR	NR	VLR	NR	NR	VLR	VLR	VLR	NR	NR	NR	NR
Thoothukkudi	NR	NR	NR	VLR	NR	NR	VLR	VLR	NR	NR	NR	NR	NR

Continued

Districts of Tamil Nadu	Livestock Disease												
	Anthrax	Babesiosis	BQ	BT	ET	Fasciolosis	FMD	HS	PPR	S&G Pox	CSF	Theileriosis	Trypanosomosis
Tiruchirappalli	NR	NR	NR	NR	NR	NR	NR	NR	VLR	NR	NR	NR	NR
Tirunelveli	NR	NR	NR	VLR	NR	NR	VLR	VLR	NR	NR	NR	NR	NR
Tiruppur	NR	NR	NR	NR	NR	NR	NR	VLR	VLR	NR	NR	NR	NR
Tiruvannamalai	NR	NR	NR	VLR	NR	NR	*VHR*	NR	NR	NR	NR	NR	NR
Vellore	NR	NR	NR	VLR	NR	NR	VLR	VLR	NR	NR	NR	NR	NR
Viluppuram	NR	NR	*VHR*	VLR	NR	NR	VLR	VLR	NR	NR	NR	NR	NR
Virudhunagar	NR	NR	NR	VLR	NR	NR	VLR	VLR	VLR	NR	NR	NR	NR

If vaccinated, please ignore the disease forecast.

*Negligible risk (NR), Very low risk (VLR), Low risk (LR), Moderate risk (MR), High risk (HR),Very high risk (VHR)

District wise Livestock Disease Risk Forewarning for February, 2023: Telangana

Districts of Telangana	Livestock Diseases												
	Anthrax	Babesiosis	BQ	BT	ET	Fasciolosis	FMD	HS	PPR	S&G Pox	CSF	Theileriosis	Trypanosomosis
Adilabad	NR	NR	NR	MR	NR	MR	NR	NR	NR	NR	NR	NR	NR
Hyderabad	NR	NR	NR	MR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Karimnagar	NR	NR	MR	NR	MR	NR	NR	NR	NR	NR	NR	NR	NR
Khammam	NR	NR	MR	NR	MR	NR	MR	NR	NR	NR	MR	NR	NR
Mahbubnagar	NR	MR	MR	NR	MR	NR	MR	MR	MR	MR	MR	MR	MR
Medak	NR	MR	MR	NR	NR	NR	MR	MR	MR	MR	MR	MR	MR
Nalgonda	NR	MR	NR	MR	NR	NR	MR	MR	MR	MR	MR	MR	MR
Nizamabad	MR	MR	NR	MR	NR	MR	MR	MR	MR	MR	NR	NR	MR
Rangareddy	MR	MR	NR	NR	NR	MR	NR	MR	NR	NR	NR	NR	MR
Warangal	NR	NR	MR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR

If vaccinated, please ignore the disease forecast.

*Negligible risk (NR), Very low risk (VLR), Low risk (LR), Moderate risk (MR), High risk (HR),Very high risk (VHR)

District wise Livestock Disease forewarning for February, 2023: Tripura

Districts of Tripura	Livestock Disease												
	Anthrax	Babesiosis	BQ	BT	ET	Fasciolosis	FMD	HS	PPR	S&G Pox	CSF	Theileriosis	Trypanosomosis
Dhalai	NR	*HR*	NR	NR	NR	*VHR*	NR	VLR	NR	NR	VLR	NR	NR
North Tripura	NR	VLR	VLR	NR	NR	*HR*	VLR	VLR	NR	*VHR*	*VHR*	NR	NR
South Tripura	NR	*VHR*	NR	NR	NR	*HR*	NR	VLR	NR	*VHR*	MR	NR	NR
West Tripura	NR	VLR	MR	NR	NR	*VHR*	*VHR*	VLR	NR	*VHR*	*VHR*	NR	NR

If vaccinated, please ignore the disease forecast.

*Negligible risk (NR), Very low risk (VLR), Low risk (LR), Moderate risk (MR), High risk (HR),Very high risk (VHR)

District wise Livestock Disease forewarning for February, 2023: Uttar Pradesh

Districts of Tripura	Livestock Disease												
	Anthrax	Babesiosis	BQ	BT	ET	Fasciolosis	FMD	HS	PPR	S&G Pox	CSF	Theileriosis	Trypanosomosis
Agra	NR	VLR	NR	NR	NR	NR	NR	VLR	NR	NR	NR	VLR	NR
Aligarh	NR	NR	NR	NR	NR	NR	VLR	VLR	NR	NR	NR	NR	NR
Allahabad	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Ambedkar Nagar	NR	NR	NR	NR	NR	*VHR*	NR	NR	NR	NR	NR	NR	*VHR*
Amethi	NR	VLR	NR	NR	NR	NR	NR	NR	NR	NR	NR	VLR	NR
Auraiya	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Azamgarh	NR	NR	NR	NR	NR	NR	NR	NR	VLR	NR	NR	NR	NR
Baghpat	NR	VLR	NR	NR	NR	NR	NR	VLR	NR	NR	NR	NR	NR
Bahraich	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Ballia	NR	*HR*	NR	NR	NR	*HR*	NR	NR	NR	NR	NR	VLR	*VHR*
Balrampur	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Banda	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Bara Banki	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	VLR	NR
Bareilly	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	VLR	NR
Basti	NR	NR	VLR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Bijnor	NR	VLR	NR	NR	NR	VLR	NR	NR	NR	NR	NR	VLR	*VHR*
Budaun	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	VLR	NR
Bulandshahr	NR	VLR	NR	NR	NR	NR	VLR	NR	NR	NR	NR	NR	NR
Chandauli	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Chitrakoot	NR	VLR	NR	NR	NR	NR	VLR	NR	NR	NR	NR	NR	NR
Deoria	NR	VLR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Etah	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Etawah	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Faizabad	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR

Districts of Uttar Pradesh	Livestock Disease												
	Anthrax	Babesiosis	BQ	BT	ET	Fasciolosis	FMD	HS	PPR	S&G Pox	CSF	Theileriosis	Trypanosomosis
Farrukhabad	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	VLR	NR
Fatehpur	NR	NR	NR	NR	NR	NR	VLR	*VHR*	VLR	MR	NR	VLR	NR
Firozabad	NR	NR	NR	NR	NR	NR	VLR	NR	NR	NR	NR	NR	NR
Gautam Buddha Nagar	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Ghaziabad	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Ghazipur	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Gonda	NR	VLR	NR	NR	NR	NR	VLR	NR	VLR	NR	NR	VLR	NR
Gorakhpur	NR	*HR*	NR	NR	NR	NR	NR	NR	VLR	*HR*	VLR	VLR	NR
Hamirpur	NR	NR	NR	NR	NR	NR	VLR	NR	NR	NR	NR	NR	NR
Hapur	NR	NR	NR	VLR	NR	NR	NR	NR	NR	NR	VLR	NR	NR
Hardoi	NR	VLR	NR	NR	NR	NR	NR	NR	NR	NR	NR	VLR	NR
Jalaun	NR	VLR	NR	NR	NR	NR	NR	VLR	NR	NR	NR	NR	NR
Jaunpur	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Jhansi	NR	NR	NR	NR	NR	NR	VLR	VLR	NR	NR	NR	NR	NR
JyotibaPhule Nagar	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	VLR	NR
Kannauj	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Kanpur Dehat	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Kanpur Nagar	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Kanshiram Nagar	NR	VLR	NR	NR	NR	NR	NR	VLR	NR	NR	NR	VLR	NR
Kaushambi	NR	*HR*	NR	NR	NR	NR	NR	NR	NR	NR	NR	VLR	NR
Kheri	NR	NR	NR	NR	NR	VLR	VLR	NR	VLR	NR	NR	NR	NR
Kushinagar	NR	VLR	NR	NR	NR	NR	NR	NR	NR	NR	NR	VLR	NR
Lalitpur	NR	NR	NR	NR	NR	NR	VLR	VLR	NR	NR	NR	NR	NR
Lucknow	NR	NR	NR	NR	NR	NR	NR	VLR	NR	NR	NR	NR	NR
Mahamaya Nagar	NR	NR	NR	NR	NR	NR	NR	VLR	NR	S&G	NR	NR	*VHR*
Mahoba	NR	NR	NR	NR	NR	NR	NR	VLR	VLR	NR	NR	NR	NR

Districts of Uttar Pradesh	Livestock Disease												
	Anthrax	Babesiosis	BQ	BT	ET	Fasciolosis	FMD	HS	PPR	S&G Pox	CSF	Theileriosis	Trypanosomosis
Mahrajganj	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	VLR	NR	NR
Mainpuri	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Mathura	NR	VLR	NR	NR	NR	NR	NR	VLR	NR	NR	NR	NR	NR
Mau	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Meerut	NR	VLR	NR	NR	NR	*VHR*	NR	NR	NR	NR	NR	NR	*VHR*
Mirzapur	NR	VLR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	*VHR*
Moradabad	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	VLR	NR
Muzaffarnagar	NR	NR	NR	NR	NR	VLR	NR	NR	NR	NR	NR	NR	MR
Pilibhit	NR	VLR	NR	NR	NR	NR	NR	NR	NR	NR	NR	VLR	NR
Pratapgarh	NR	NR	NR	NR	NR	NR	NR	VLR	NR	NR	NR	NR	NR
Rae Bareli	NR	NR	NR	NR	NR	NR	VLR	NR	NR	NR	NR	VLR	NR
Rampur	NR	NR	NR	NR	NR	VLR	NR	NR	NR	NR	NR	NR	NR
Saharanpur	NR	VLR	NR	NR	NR	NR	NR	VLR	NR	NR	NR	VLR	NR
Sambhal	NR	VLR	NR	NR	NR	NR	NR	NR	NR	NR	VLR	VLR	NR
Sant Kabir Nagar	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	VLR	NR	NR
SantRavidas Nagar (Bhadohi)	NR	NR	NR	NR	NR	NR	VLR	NR	VLR	NR	NR	NR	NR
Shahjahanpur	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	VLR	NR
Shamli	NR	VLR	NR	NR	NR	NR	NR	NR	NR	NR	VLR	VLR	NR
Shrawasti	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Siddharthnagar	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	VLR	NR	NR
Sitapur	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Sonbhadra	NR	VLR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	*VHR*
Sultanpur	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Unnao	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Varanasi	NR	VLR	NR	NR	NR	NR	NR	NR	VLR	NR	NR	VLR	MR

If vaccinated, please ignore the disease forecast.

*Negligible risk (NR), Very low risk (VLR), Low risk (LR), Moderate risk (MR), High risk (HR),Very high risk (VHR)

District wise Livestock Disease Risk Forewarning for February, 2023: Uttarakhand

Districts of Uttarakhand	Livestock Disease												
	Anthrax	Babesiosis	BQ	BT	ET	Fasciolosis	FMD	HS	PPR	S&G Pox	CSF	Theileriosis	Trypanosomosis
Almora	NR	NR	NR	NR	NR	NR	*HR*	NR	*HR*	NR	NR	NR	NR
Bageshwar	NR	NR	VLR	NR	NR	NR	VLR	NR	NR	NR	NR	NR	NR
Chamoli	NR	NR	NR	NR	NR	NR	VLR	NR	NR	NR	NR	NR	NR
Champawat	NR	NR	VLR	NR	NR	NR	VLR	NR	NR	NR	NR	NR	NR
Dehradun	NR	NR	NR	NR	NR	NR	VLR	VLR	NR	NR	NR	NR	NR
Garhwal	NR	NR	NR	NR	NR	NR	VLR	VLR	NR	NR	NR	NR	NR
Hardwar	NR	NR	NR	NR	NR	NR	VLR	VLR	NR	NR	NR	NR	NR
Nainital	NR	NR	VLR	NR	NR	NR	VLR	VLR	NR	NR	NR	NR	NR
Pithoragarh	NR	NR	NR	NR	NR	NR	VLR	VLR	NR	NR	NR	NR	NR
Rudraprayag	NR	NR	NR	NR	NR	NR	VLR	NR	NR	NR	NR	NR	NR
Tehri Garhwal	NR	NR	NR	NR	NR	NR	VLR	VLR	NR	NR	NR	NR	NR
Udham Singh Nagar	NR	NR	NR	NR	NR	NR	VLR	VLR	NR	NR	MR	NR	NR
Uttarkashi	NR	NR	NR	NR	NR	NR	VLR	VLR	NR	NR	NR	NR	NR

If vaccinated, please ignore the disease forecast.

*Negligible risk (NR), Very low risk (VLR), Low risk (LR), Moderate risk (MR), High risk (HR),Very high risk (VHR)

District wise Livestock Disease Risk Forewarning for February, 2023: West Bengal

Districts of West Bengal	Livestock Disease												
	Anthrax	Babesiosis	BQ	BT	ET	Fasciolosis	FMD	HS	PPR	S&G Pox	CSF	Theileriosis	Trypanosomosis
Bankura	NR	NR	*VHR*	VLR	NR	NR	*HR*	LR	*VHR*	NR	NR	NR	NR
Barddhaman	NR	VLR	*HR*	VLR	NR	NR	MR	VLR	*VHR*	*VHR*	NR	VLR	NR
Birbhum	NR	NR	VLR	NR	NR	NR	*VHR*	VLR	VLR	NR	NR	MR	*VHR*
Dakshin Dinajpur	NR	NR	MR	NR	NR	NR	VLR	NR	NR	NR	VLR	NR	NR
Darjiling	NR	VLR	NR	NR	NR	NR	NR	VLR	NR	NR	VLR	VLR	NR
Haora	NR	NR	*VHR*	NR	NR	NR	*VHR*	VLR	*VHR*	*VHR*	NR	*HR*	NR
Hugli	NR	NR	VLR	NR	NR	NR	VLR	VLR	*VHR*	NR	NR	*VHR*	NR
Jalpaiguri	NR	NR	LR	NR	NR	NR	NR	VLR	NR	NR	VLR	NR	NR
Koch Bihar	NR	NR	*VHR*	NR	NR	NR	NR	VLR	VLR	NR	NR	NR	NR
Kolkata	NR	VLR	VLR	VLR	NR	NR	NR	NR	VLR	NR	NR	NR	NR
Maldah	NR	VLR	NR	VLR	NR	NR	VLR	VLR	NR	NR	NR	VLR	NR
Murshidabad	NR	NR	VLR	VLR	NR	NR	*VHR*	VLR	VLR	NR	NR	VLR	NR
Nadia	NR	*HR*	VLR	NR	NR	NR	VLR	*VHR*	LR	NR	NR	VLR	NR
North Twenty Four Parganas	NR	VLR	VLR	NR	NR	NR	VLR	VLR	LR	*VHR*	NR	NR	NR
Paschim Medinipur	NR	NR	*HR*	VLR	NR	NR	VLR	LR	VLR	NR	NR	VLR	NR
PurbaMedinipur	NR	NR	VLR	NR	NR	NR	VLR	VLR	LR	NR	NR	NR	NR
Puruliya	NR	VLR	VLR	NR	NR	NR	*HR*	MR	*HR*	NR	VLR	NR	NR
South Twenty Four Parganas	NR	NR	*HR*	VLR	NR	NR	MR	VLR	VLR	NR	NR	VLR	NR
Uttar Dinajpur	NR	NR	NR	NR	NR	NR	NR	NR	VLR	NR	VLR	NR	NR

If vaccinated, please ignore the disease forecast.

*Negligible risk (NR), Very low risk (VLR), Low risk (LR), Moderate risk (MR), High risk (HR),Very high risk (VHR)

II) Glimpse about the risk of predicted diseases:

The Livestock disease risk obtained based on the Machine Learning algorithm were further categorized into risk events using High Risk and Very High Risk.

1. Andaman and Nicobar

Sl. No	Disease prone districts	Number of districts prone for disease	Disease Name
1.	Nicobars, North & Middle Andaman and South Andaman	Three	Fasciolosis

2. Andhra Pradesh

Sl. No	Disease prone districts	Number of districts prone for disease	Disease Name
1.	Y.S.R.	One	Antrax
2.	East Godavari and Guntur	Two	Babesiosis
3.	Kurnool and Y.S.R.	Two	Haemorrhagic Septicaemia
4.	Kurnool and Y.S.R.	Two	Peste des Petits Ruminants
5.	Prakasam	One	Sheep & goat pox

3. Arunachal Pradesh

Sl. No	Disease prone districts	Number of districts prone for disease	Disease Name
1.	Lower Subansiri, Papum Pare, Upper Subansiri and West Siang	Four	Fascioliasis
2.	Papum Pare	One	Peste des Petits Ruminants
3.	Upper Subansiri	One	Sheep & Goat pox
4.	East Siang Upper Subansiri and West Siang	Three	Classical Swine fever

4. Assam

Sl. No	Disease prone districts	Number of districts prone for disease	Disease Name
1.	Chirang, Kamrup and Kamrup Metropolitan	Three	Anthrax
2.	Barpeta, Bongaigaon, Karimganj Nalbari and Tinsukia	Five	Babesiosis
3.	Baksa, Barpeta, Bongaigaon, Cachar, Chirang, Darrang, Dhemaji, Golaghat, Jorhat, Lakhimpur,	Fourteen	Black Quarter

	Nalbari, Sivasagar, Sonitpur and Udalguri		
4.	Golaghat, Sivasagar, Sonitpur and Tinsukia	Four	Enterotoxaemia
5.	Bongaigaon, Dhemaji, Kamrup Metropolitan, Lakhimpur, Nalbari, Sivasagar and Sonitpur	Seven	Fasciolosis
6.	Barpeta, Kamrup Metropolitan, Karbi Anglong, Morigaon, Nagaon, Nalbari and Sonitpur	Seven	Haemorrhagic Septicaemia
7.	Baksa, Barpeta, Kamrup Metropolitan, Nalbari, Sonitpur and Tinsukia	Six	Peste des Petits Ruminants
8.	Lakhimpur and Nalbari	Two	Sheep & Goat pox
9.	Baksa, Bongaigaon, Dhemaji, Goalpara, Kamrup, Karbi Anglong, Lakhimpur, Nagaon, Sivasagar and Sonitpur	Ten	Swine Fever
10.	Sonitpur and Tinsukia	Two	Theileriosis

5. Bihar

Sl. No	Disease prone districts	Number of districts prone for disease	Disease Name
1.	Vaishali	One	Foot and Mouth Disease
2.	Patna	One	Classical Swine fever
3.	Bhojpur, Khagaria and Sheikhpura	Three	Trypanosomiasis

6. Daman and Diu

Sl. No	Disease prone districts	Number of districts prone for disease	Disease Name
1.	Daman	One	Foot and Mouth Disease

7. Goa

Sl. No	Disease prone districts	Number of districts prone for disease	Disease Name
1.	South Goa	One	Babesiosis
2.	North Goa	One	Peste des Petits Ruminants
3.	North Goa	One	Swine Fever
4.	South Goa	One	Theileriosis

8. Gujarat

Sl. No	Disease prone districts	Number of districts prone for disease	Disease Name
1.	Bhavnagar	Two	Enterotoxaemia
2.	Kheda and Rajkot	Five	Foot and Mouth Disease
3.	Mahesana	Three	Haemorrhagic Septicaemia
4.	Gandhinagar	Two	Peste des Petits Ruminants

9. Haryana

Sl. No	Disease prone districts	Number of districts prone for disease	Disease Name
1.	Bhiwani and Fatehabad	Two	Enterotoxaemia
2.	Fatehabad and Hisar	Two	Foot and Mouth Disease
3.	Fatehabad	One	Haemorrhagic Septicaemia
4.	Bhiwani, Fatehabad and Hisar	Three	Peste des Petits Ruminants
5.	Hisar	One	Sheep & Goat pox

10. Himachal Pradesh

Sl. No	Disease prone districts	Number of districts prone for disease	Disease Name
1.	Kinnaur	One	Enterotoxaemia
2.	Mandi	One	Foot and mouth Disease
3.	Kinnaur	One	Sheep & Goat pox

11. Jammu & Kashmir

Sl. No	Disease prone districts	Number of districts prone for disease	Disease Name
1.	Anantnag, Badgam, Bandipore, Baramula, Kulgam, Pulwama, Shupiyan and Srinagar	Eight	Sheep and Goat pox

12. Jharkhand

Sl. No	Disease prone districts	Number of districts prone for disease	Disease Name
1.	All districts except Koderma	Twenty-three	Babesiosis
2.	Godda, Sahibganj and Simdega	Three	Black Quarter
3.	Giridih, Palamu and Sahibganj	Three	Enterotoxaemia
4.	All districts except Chatra	Twenty-three	Fasciolosis
5.	Deoghar, Dhanbad, Dumka, Godda, Gumla, Khunti, Pashchimi Singhbhum, Purbi Singhbhum, Ramgarh, Ranchi, Sahibganj and Simdega	Twelve	Foot and Mouth Disease
6.	Deoghar, Khunti and Sahibganj	Three	Haemorrhagic Septicaemia
7.	Bokaro, Deoghar, Dhanbad, Dumka, Gumla, Jamtara, Khunti, Lohardaga, Pashchimi Singhbhum, Purbi Singhbhum, Ranchi and Sahibganj	Twelve	Peste des Petits Ruminants
8.	Khunti and Sahibganj	Two	Sheep & Goat pox
9.	Bokaro, Dumka, Gumla, Jamtara, Lohardaga, Sahibganj and Simdega	Seven	Swine Fever
10.	All the districts except Chatra	Twenty-three	Theileriosis
11.	All the districts except	Twenty-four	Trypanosomosis

13. Karnataka

Sl. No	Disease prone districts	Number of districts prone for disease	Disease Name
1.	Bellary, Chitradurga, Davanagere, Haveri, Kolar, Koppal and Tumkur	Seven	Anthrax
2.	Bangalore, Bangalore Rural, Chikmagalur, Chitradurga, Hassan, Haveri, Mandya, Mysore, Shimoga, Tumkur and Uttara Kannada	Nine	Black Quarter
3.	Bellary, Chikkaballapura, Chitradurga, Davanagere, Gadag, Hassan, Kolar, Koppal, Raichur and Tumkur	Ten	Blue Tongue
4.	Belgaum, Bellary, Chikkaballapura, Chitradurga, Koppal and Tumkur	Six	Enterotoxaemia
5.	Bangalore, Bangalore Rural, Chamarajanagar, Chikkaballapura,	Fourteen	Foot and Mouth Disease

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	Chikmagalur, Dakshina Kannada, Kolar, Koppal, Mandya, Mysore, Ramanagara, Tumkur, Udupi and Uttara Kannada		
6.	Chikmagalur, Davanagere, Gadag, Haveri, Mysore and Tumkur	Six	Haemorrhagic Septicaemia
7.	Bellary, Bidar, Chikmagalur, Tumkur and Uttara Kannada	Four	PestedesPetits Ruminants
8.	Bagalkot, Belgaum, Bellary, Chikkaballapura, Chitradurga, Gadag, Kolar, Koppal and Tumkur	Ten	Sheep & Goat pox
9.	Chikkaballapura	One	Classical Swine fever

14. Kerala

Sl. No	Disease prone districts	Number of districts prone for disease	Disease Name
1.	Thiruvananthapuram and Wayanad	Two	Anthrax
2.	Ernakulam, Kollam and Wayanad	Three	Babesiosis
3.	Wayanad	One	Black Quarter
4.	All districts except Kasaragod and Palakkad	Twelve	Foot and Mouth Disease
5.	Kollam, Kottayam, Palakkad and Thrissur	Four	Haemorrhagic Septicaemia
6.	Kannur, Kasaragod, Kottayam, Kozhikode, Malappuram, Palakkad and Thiruvananthapuram	Seven	Peste des Petits Ruminants
7.	Thrissur	One	Sheep and Goat pox
8.	Idukki	One	Swine Fever
9.	All districts except Pathanamthitta	Thirteen	Theileriosis

15. Madhya Pradesh

Sl. No	Disease prone districts	Number of districts prone for disease	Disease Name
1.	Narsimhapur	One	Foot and Mouth Disease
2.	Alirajpur, Betul and Bhopal	Three	Haemorrhagic Septicaemia
3.	Bhopal	One	Peste des Petits Ruminants

16. Maharashtra

Sl. No	Disease prone districts	Number of districts prone for disease	Disease Name
1.	Nagpur and Thane	Two	Black Quarter
2.	Ahmadnagar and Nashik	Two	Haemorrhagic Septicaemia
3.	Ahmadnagar, Jalgaon, Nagpur, Nashik and Pune	Five	Peste des Petits Ruminants
4.	Ahmadnagar	One	Sheep & goat pox
5.	Bhandara, Chandrapur, Gadchiroli and Wardha	Four	Classical Swine fever
6.	Akola	One	Theileriosis

17. Manipur

Sl. No	Disease prone districts	Number of districts prone for disease	Disease Name
1.	Bishnupur and Imphal West	Two	Fasciolosis
2.	Chandel, Imphal West and Thoubal	Three	Classical Swine fever

18. Meghalaya

Sl. No	Disease prone districts	Number of districts prone for disease	Disease Name
1.	South Garo Hills, Southwest Garo Hills and Southwest Khasi Hills	Three	Black Quarter
2.	East Khasi Hills, Ribhoi, South Garo Hills and West Khasi Hills	Four	Foot and Mouth Disease
3.	East Khasi Hills, South Garo Hills and West Khasi Hills	Three	Swine Fever

19. Mizoram

Sl. No	Disease prone districts	Number of districts prone for disease	Disease Name
1.	Aizawl	One	Black Quarter
2.	Kolasib	One	Swine Fever

20. Nagaland

Sl. No	Disease prone districts	Number of districts prone for disease	Disease Name
1.	Peren and Zunheboto	Two	Foot and Mouth Disease
2.	Zunheboto	One	Classical Swine fever

21. Odisha

Sl. No	Disease prone districts	Number of districts prone for disease	Disease Name
1.	Koraput and Sambalpur	Two	Anthrax
2.	Anugul and Nabarangapur	Two	Black Quarter
3.	Bhadrak, Jagatsinghapur, Cuttack, Jajapur, Kendrapara, Puri and Rayagada	Seven	Foot and Mouth Disease
4.	Bargarh, Bhadrak, Nabarangapur and Nuapada	Four	Haemorrhagic Septicaemia
5.	Cuttack and Kendrapara	Two	Peste des Petits Ruminants
6.	Ganjam	One	Theileriosis
7.	Jagatsinghapur	One	Trypanosomiasis

22. Puducherry

Sl. No	Disease prone districts	Number of districts prone for disease	Disease Name
1.	Karaikal and Puducherry	Two	Babesiosis
2.	Yanam	One	Fasciolosis
3.	Karaikal and Puducherry	Two	Sheep & Goat pox

23. Punjab

Sl. No	Disease prone districts	Number of districts prone for disease	Disease Name
1.	Bathinda and Faridkot	Two	Classical Swine fever

24. Rajasthan

Sl. No	Disease prone districts	Number of districts prone for disease	Disease Name
1.	Dausa	One	Enterotoxaemia
2.	Alwar, Ganganagar, Jaipur, Jhunjhunun and Udaipur	Five	Foot and Mouth Disease
3.	Ajmer, Bharatpur, Dausa, Karauli and Sawai Madhopur	Five	Haemorrhagic Septicaemia
4.	Jaisalmer	One	Peste des Petits Ruminants
5.	Hanumangarh	One	Sheep and Goat pox

25. Sikkim

Sl. No	Disease prone districts	Number of districts prone for disease	Disease Name
1.	East District	One	Babesiosis
2.	North District	One	Classical Swine fever

26. Tamil Nadu

Sl. No	Disease prone districts	Number of districts prone for disease	Disease Name
1.	Kancheepuram and Theni	Two	Anthrax
2.	Kancheepuram and Viluppuram	Two	Black Quarter
3.	Tiruvannamalai	One	Foot and Mouth Disease

27. Tripura

Sl. No	Disease prone districts	Number of disease prone for districts	Disease Name
1.	Dhalai and South Tripura	Two	Babesiosis
2.	All districts	Four	Fasciolosis
3.	West Tripura	One	Foot and Mouth Disease
4.	North Tripura, South Tripura and West Tripura	Three	Sheep & Goat pox
5.	North Tripura and West Tripura	Two	Classical Swine fever

28. Uttar Pradesh

Sl. No	Disease prone districts	Number of districts prone for disease	Disease Name
1.	Ballia, Gorakhpur and Kaushambi	Three	Babesiosis
2.	Ambedkar Nagar, Ballia and Meerut	Three	Fasciolosis
3.	Fatehpur	One	Haemorrhagic Septicaemia
4.	Gorakhpur	One	Sheep and Goat pox
5.	Amethi, Ballia, Bijnor, Mahamaya Nagar, Meerut, Mirzapur and Sonbhadra	Seven	Trypanosomosis

29. Uttarakhand

Sl. No	Disease prone districts	Number of disease prone for districts	Disease Name
1.	Almora	One	Foot and Mouth disease
2.	Almora	One	Peste des Petits Ruminants

30. West Bengal

Sl. No	Disease prone districts	Number of districts prone for disease	Disease Name
1.	Nadia	One	Babesiosis
2.	Bankura, Barddhaman, Haora, Koch Bihar, Paschim Medinipur and South Twenty Four Parganas	Six	Black quarter
3.	Bankura, Birbhum, Haor, Murshidabad and Puruliya	Five	Foot and Mouth Disease
4.	Nadia	One	Haemorrhagic Septicaemia
5.	Bankura, Barddhaman, Haora, Hugli and Puruliya	Five	Peste des Petits Ruminants
6.	Barddhaman, Haora and North Twenty Four Parganas	Three	Sheep & Goat pox
7.	Haora and Hugli	Two	Theileriosis
8.	Birbhum	One	Trypanosomiasis

iii) Diseases, Species affected, Clinical signs and its preventive measures.

Sl No.	Disease	Species Affected	Clinical Signs	Preventive Measures
1	Anthrax (AX)	Most of the mammals and ruminants are highly susceptible. Pigs and Horses are moderately susceptible. Carnivores are relatively resistant.	Convulsion and sudden death with oozing of blood from natural orifices such as rectum and nose prior to death. Occasionally oedema develops in the throat and shoulder over a period of one week before death.	Ring vaccination and reporting of the disease is advised. Vaccination to be done in consultation with the veterinarians and as decided by state animal husbandry authorities. Strict biosecurity measures may be followed. Carcass may be disposed by deep burying covered with lime powder. Contaminated area may be disinfected with 4% formalin or 10% caustic soda. Grazing area may be restricted.
2	Babesiosis (BA)	Cattle. Cross breeds are more susceptible.	High temperature, jaundice like symptoms, yellowish mucosal membrane of eye, rectum and coffee colour urine.	Periodical application of acaricides in and around the animal shed and on the animals. For therapeutic application, Diaminazine or Imidocarb can be useful.
3.	Black Quarter (BQ)	Common disease of cattle and sheep, but occasionally goats and pigs also suffer from the disease.	High fever and lameness followed by swelling in the neck, shoulder, lumbar, gluteal and sacral regions. Skin over the affected area become dark and crepitate on palpation. Loss of feed intake, colic, lateral recumbency, dyspnoea and death.	Affected animals may be treated with suitable antibiotics. Vaccination to be done in consultation with the veterinarians and as decided by state animal husbandry authorities. Strict biosecurity measures may be followed. Grazing area may be restricted. Carcass may be disposed hygienically.

4.	Bluetongue (BT)	Sheep are more susceptible than goats.	Fever, swelling of face, neck, eyelids respiratory distress, nasal discharge, Salivation, necrotic ulcers on tongue, dental pad, gum, lips hyperaemia of muzzle and may bleed at muco-cutaneous junction. Affected tongue may become swollen, cyanotic and purple blue in colour – 'bluetongue'.	Vector control using insecticides and good water management. Vaccination of susceptible animals preferably in the month of May. Do not shear sheep during winter months. Restriction in animal movement, segregation of affected animals and symptomatic treatment. Strict biosecurity measures.
5.	Enterotoxaemia (ET)	Common disease of sheep and goats especially among the young animals.	Dullness, opisthosomas, convulsions, coma and sudden death. Affected adult sheep, which survive for several days May show diarrhoea and staggering.	Affected animals may be treated with suitable antibiotics. Vaccination to be done in consultation with the veterinarians and as decided by State Animal Husbandry Authorities. Strict biosecurity measures may be followed. Carcass may be disposed hygienically. Grazing area to be restricted, stall fed, vitamins and probiotics may be provided.
6.	Fasciolosis (FA)	Cattle, buffalo, sheep and goats.	Progressive anaemia, pale mucous membrane, sub-mandibular oedema (Bottle jaw), loss of appetite, weakness, isolated from flock while grazing, loss in production.	The animal should not be allowed to graze in water stagnant fields or submerged fodder should not be given directly to the animals. The submerged fodder can be processed through hay/silage preparation in order to destroy the metacercariae. The affected animals can be treatedwith Carbon tetrachloride/ Rafoxanide/Nitroxynil/ Niclofolan/Closantel/Oxyclozanide, under the strict supervision of veterinarian.

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7.	Foot and Mouth Disease (FMD)	Cattle, buffalo, sheep, goats and pigs are often affected domesticated species, but the disease is more severe in cattle and pigs.	Fever, loss of feed intake, drop in milk production, drooling of saliva like ropey string, vesicles develop on the tongue, lips, gums, and palate and eventually rupture. Concurrent to oral lesions, vesicles also appear in inter digital skin and coronary band of the feet. The animal may open and close its mouth with a characteristic smacking sound. Sheep and goats may show lameness. In pigs, lesions may be seen on snout and also on the feet.	Regular vaccination and seromonitoring. Disinfection with sodium carbonate (4%) or 10% washing soda and strict biosecurity measures to be followed and animal movement may be controlled.
8.	Haemorrhagic septicaemia (HS)	Common disease for cattle and buffaloes, but can also occur among other species such as pigs, sheep, goats and many wild animals.	The disease starts with high fever, respiratory distress and haemorrhages maybe seen on the mucous membranes. There is lacrymation, nasal discharge, drop in milk production and anorexia. As the disease progress ear droops and the animals will be prostrated with cyanosis of mucous membranes. There may be oedema along the head, neck, thorax, vulva and anal areas. Sudden death occurs within few hours of clinical signs.	Affected animals may be treated with suitable antibiotics. Vaccination to be done in consultation with the veterinarians and as decided by state animal husbandry authorities. Strict biosecurity measures may be followed. Carcass may be disposed hygienically and stress factors may be reduced by following good animal husbandry practices.

9.	Peste des Petits Ruminants (PPR)	Goats and sheep are most affected domestic animals.	Fever, nasal and ocular discharge, respiratory distress, necrotic lesions in buccal mucosa, gum, dental pad, palate, tongue and diarrhoea. Animals may die because of dehydration and pneumonia.	Vaccination of susceptible animals of above 3 months old age. Restriction on animal movement, strict biosecurity measures and proper disposal of carcass.
10.	Sheep and Goat pox (SGP)	Sheep and Goats	Respiratory distress and pock lesions over the non-hairy parts of body, more common in teat, udder, scortum, head, neck, ear, perineum, inner aspect of thighs and under tail.	Vaccination of susceptible animals of above 3 months old age. Symptomatic treatment of affected animals. Restriction on animal movement, strict biosecurity measures and proper disposal of carcass.
11.	Swine Fever (SF)	Pigs	Fever, Conjunctivitis, purplish discolouration of snout, ears, abdomen, inner side of the legs and staggering gait.	Vaccination of susceptible animals. Restriction on animal movement, strict biosecurity measures and proper disposal of carcass.
12.	Theileriosis (TE)	Large Ruminants. Cross bred cattle are more vulnerable.	High temperature, yellowish eye, sometime eyes may be heavily swollen, icteric mucosal membrane of rectum, dark yellowish urine, sometime may reach to coffee colour. Antibiotic is of no use to check the fever.	Periodical application of acaricides in and around the animal shed and on the animals. Therapeutic treatment with Buparvaquone can be useful in both early and advanced stages of the infection.

13.	Trypanosomosis (TR)	Domestic and wild carnivores and herbivores including cattle, buffalo, horse, donkey, camel, dog and cats. Buffaloes are known as carriers.	Fluctuating high fever which is not responded by antibiotics, swollen lymph gland, chronic emaciation and weakness, loss of appetite, gradual loss of production.	The affected animal should be treated with Diaminazine compounds or chloride and sulphate salts of Quinapyramine. Periodical spray of insecticide in and around animal shed to remove the flies.

iv). Risk Prediction - Livestock Disease Forewarning Maps

Risk Prediction of Anthrax for the month of February 2023
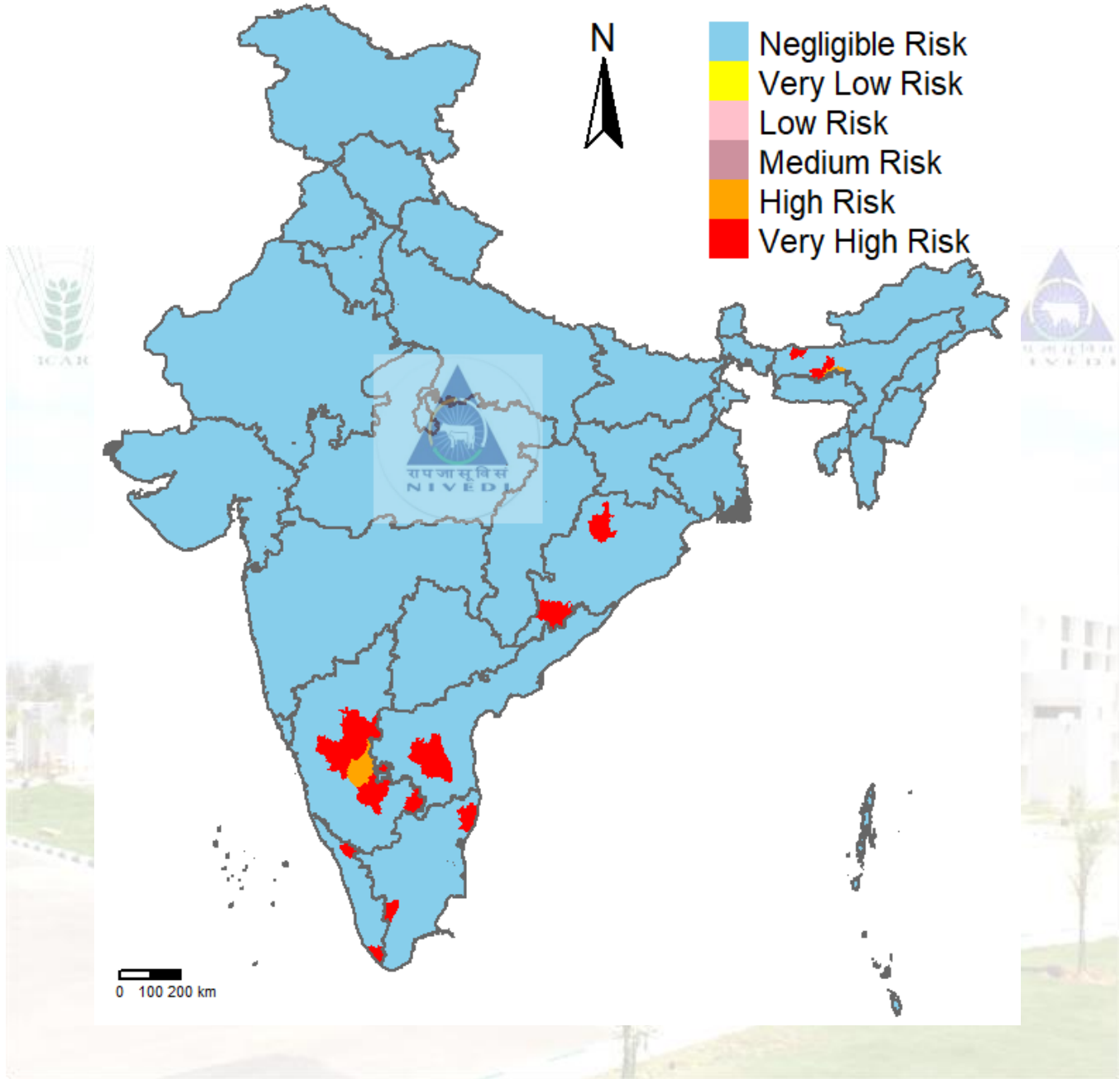
Risk Prediction of Sheep and Goat pox for the month of February 2023
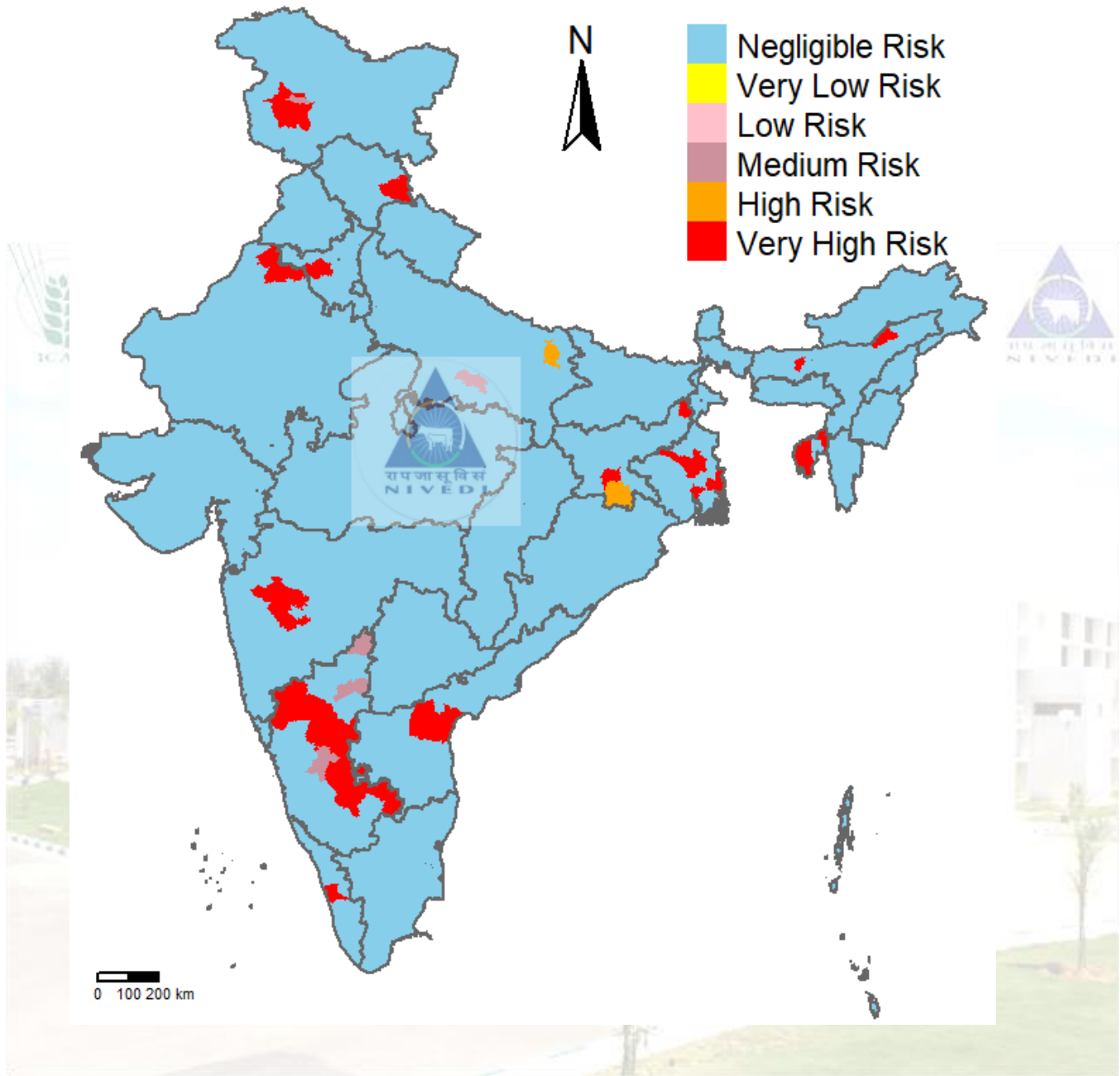
Risk Prediction of Swine fever for the month of February 2023
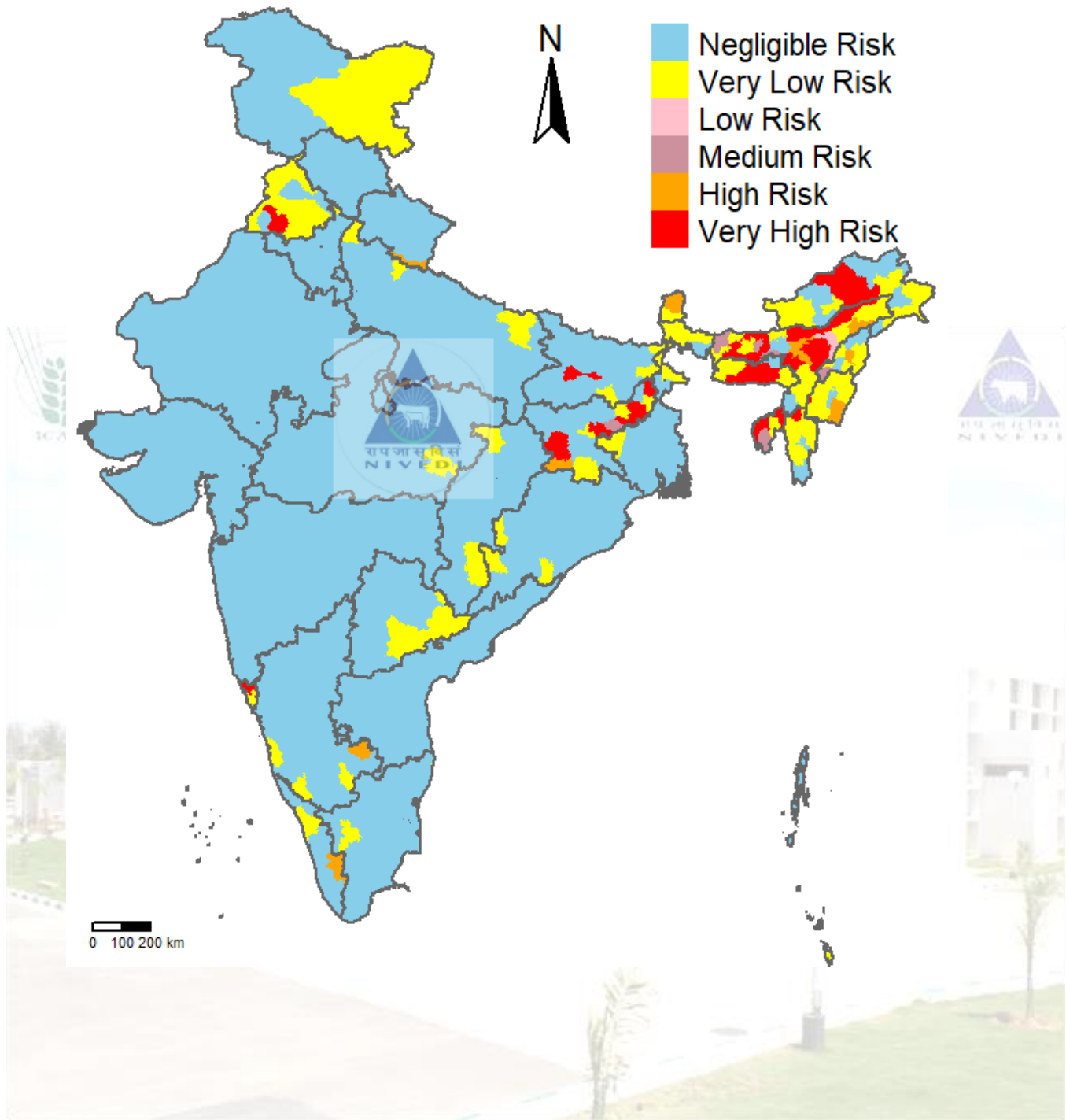
Risk Prediction of Theileriosis for the month of February 2023
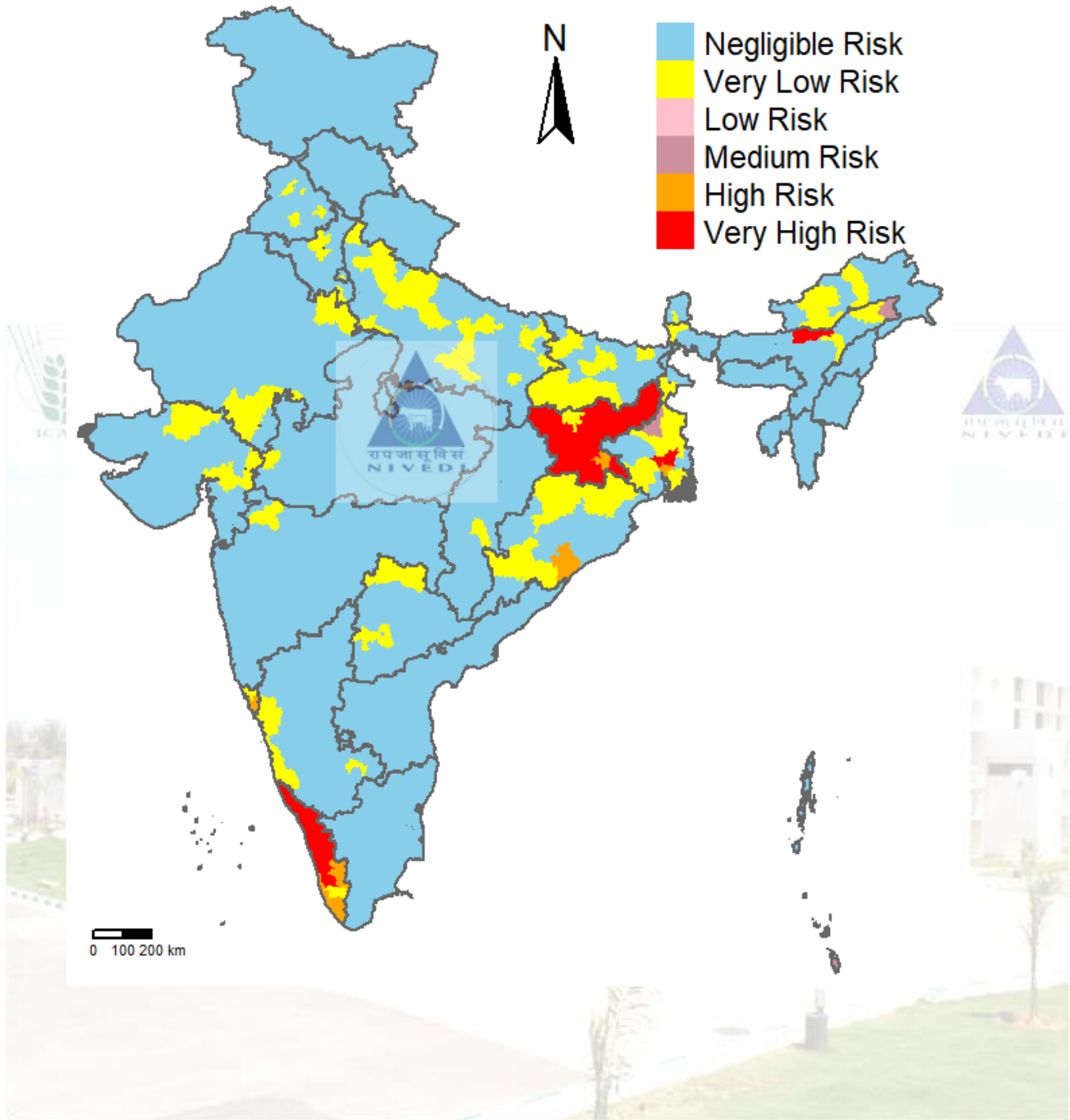
Risk Prediction of Trypanosomiasis for the month of February 2023
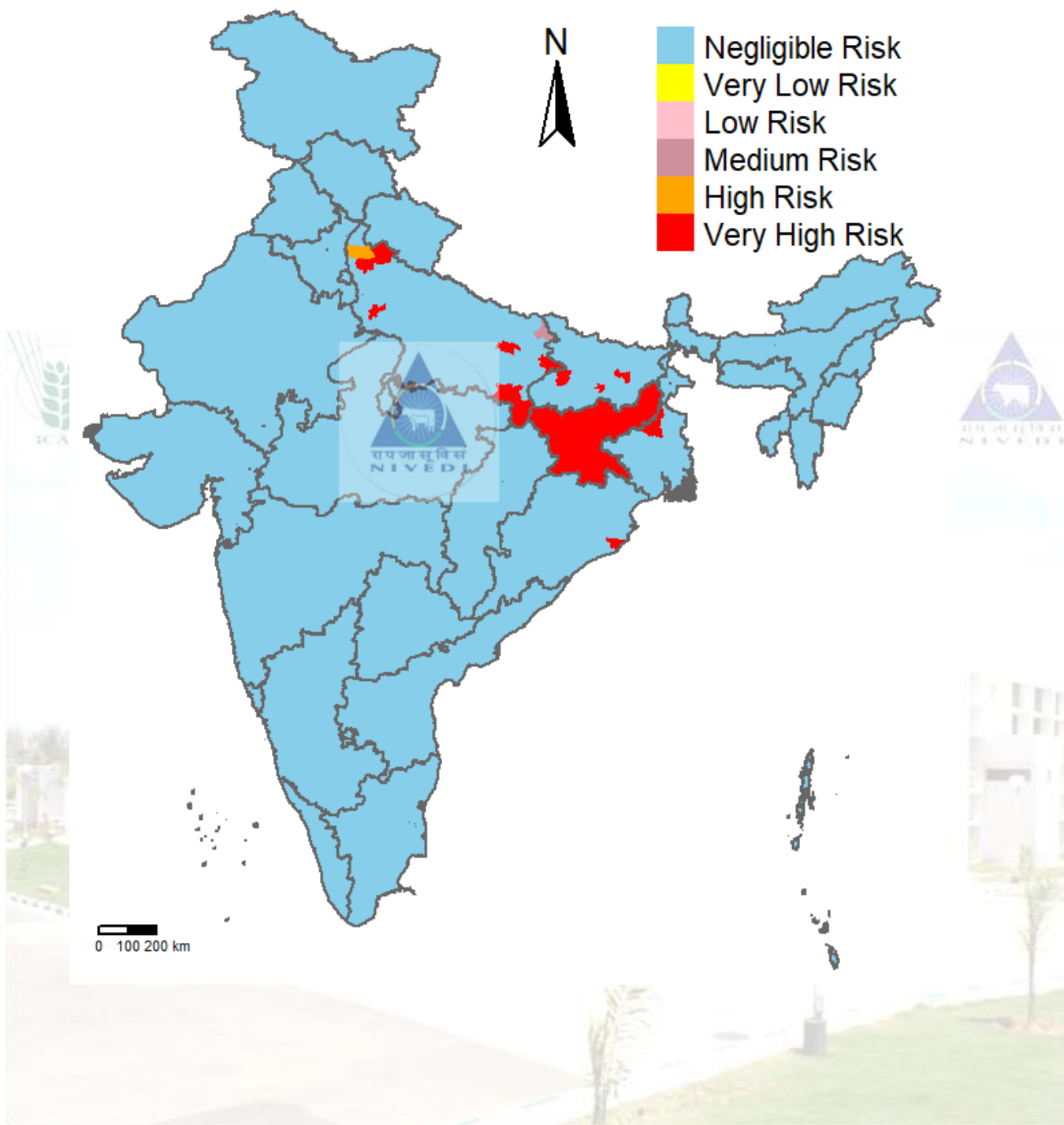
Risk Prediction of Babesiosis for the month of February 2023
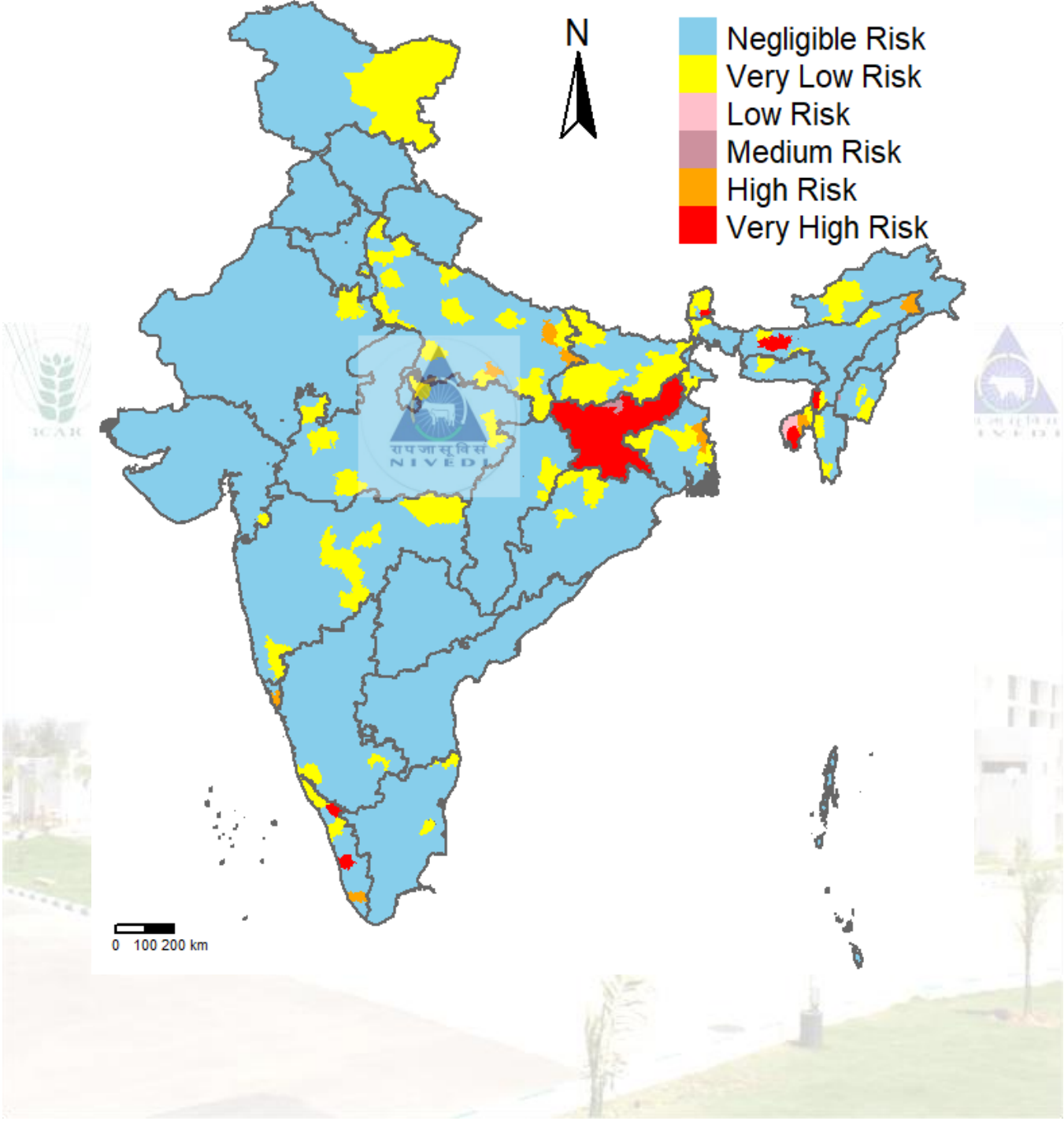
Risk Prediction of Black quarter for the month of February 2023

N

| Negligible Risk |
| Very Low Risk |
| Low Risk |
| Medium Risk |
| High Risk |
| Very High Risk |

0   100 200 km
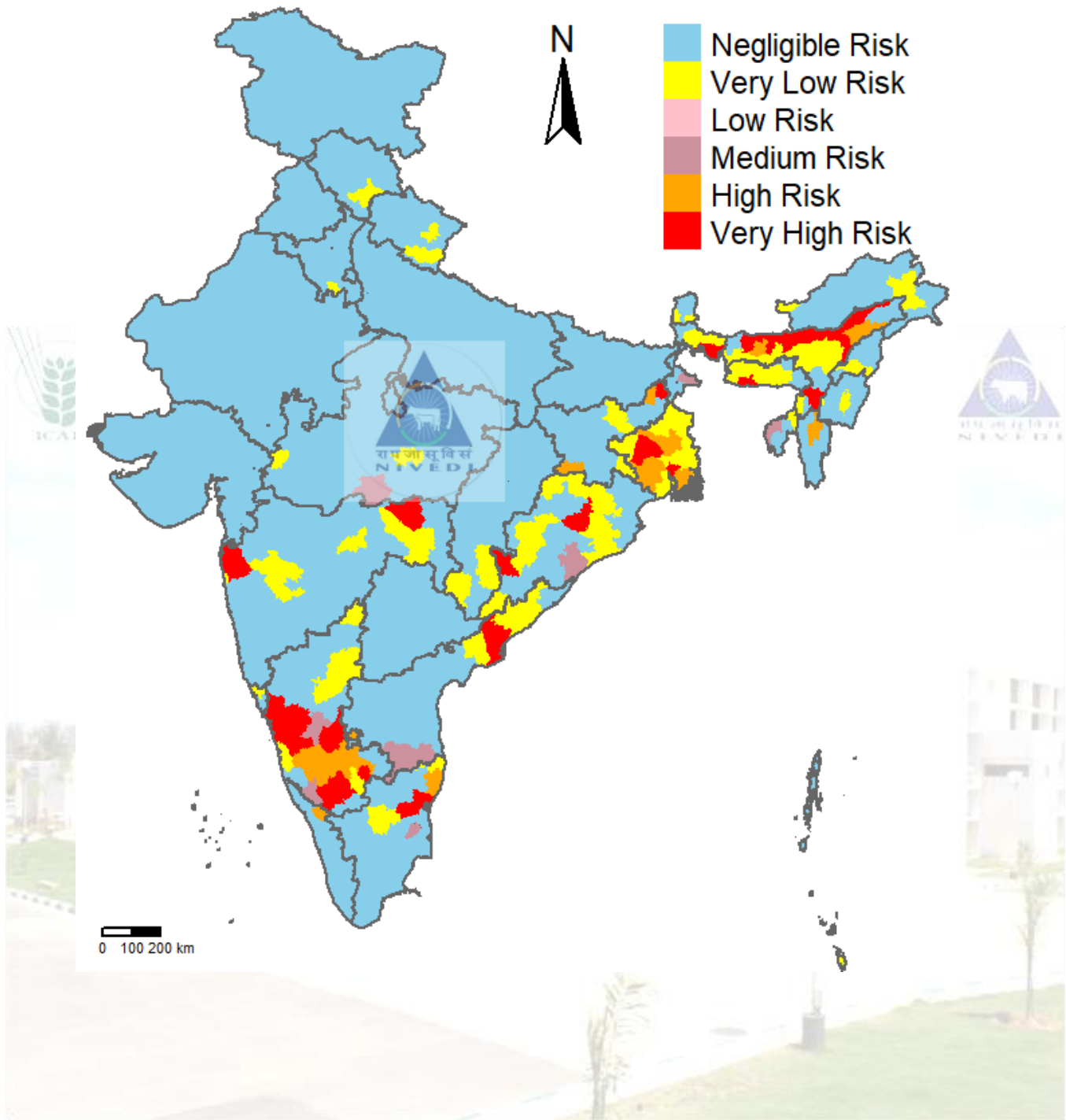
Risk Prediction of Bluetongue for the month of February 2023
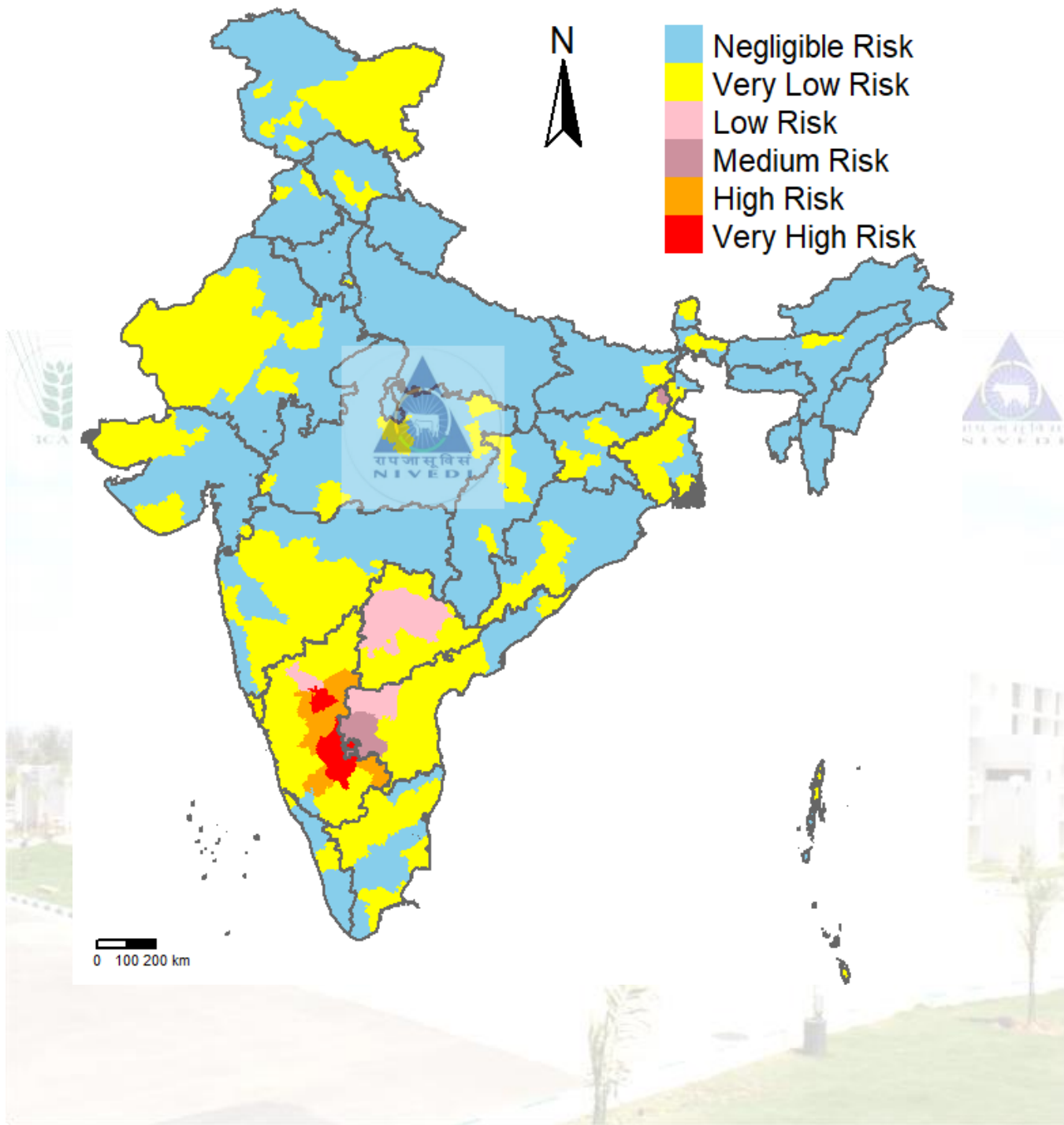
Risk Prediction of Enterotoxemia for the month of February 2023
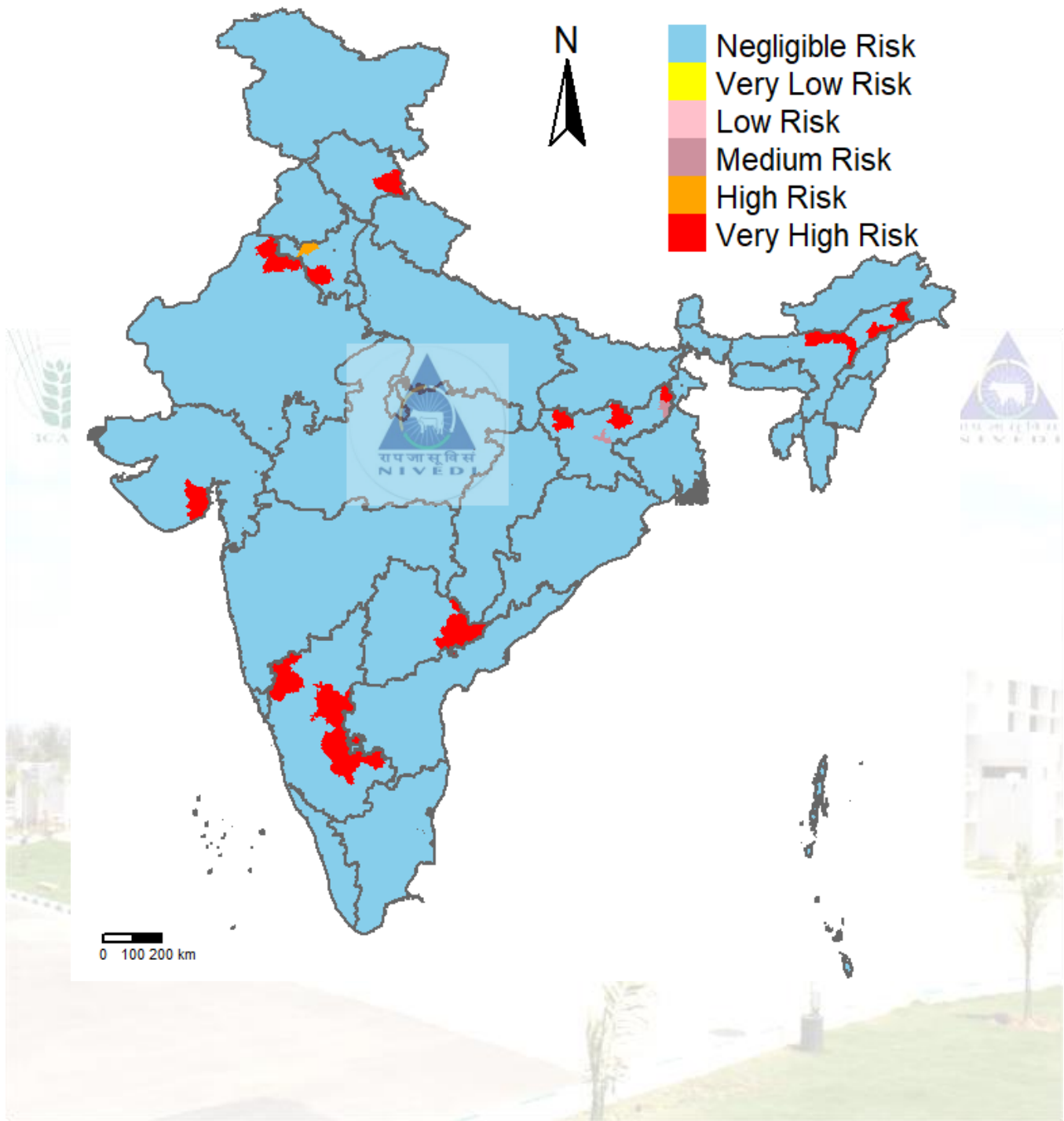
Risk Prediction of Fascioliasis for the month of February 2023

Risk Prediction of Foot and mouth disease for the month of February 2023

Risk Prediction of Haemorrhagic septicaemia for the month of February 2023

Legend:
- Negligible Risk
- Very Low Risk
- Low Risk
- Medium Risk
- High Risk
- Very High Risk
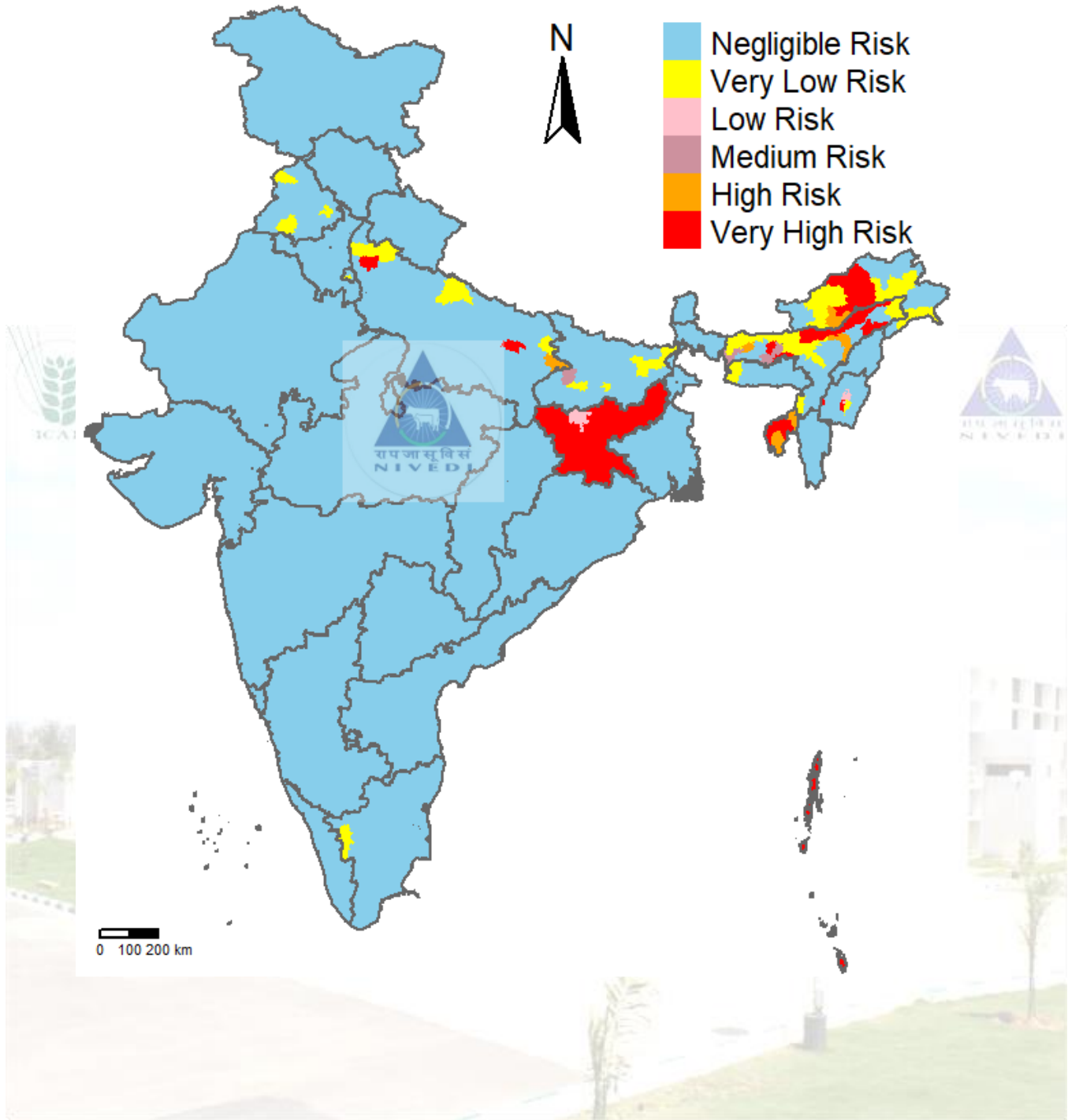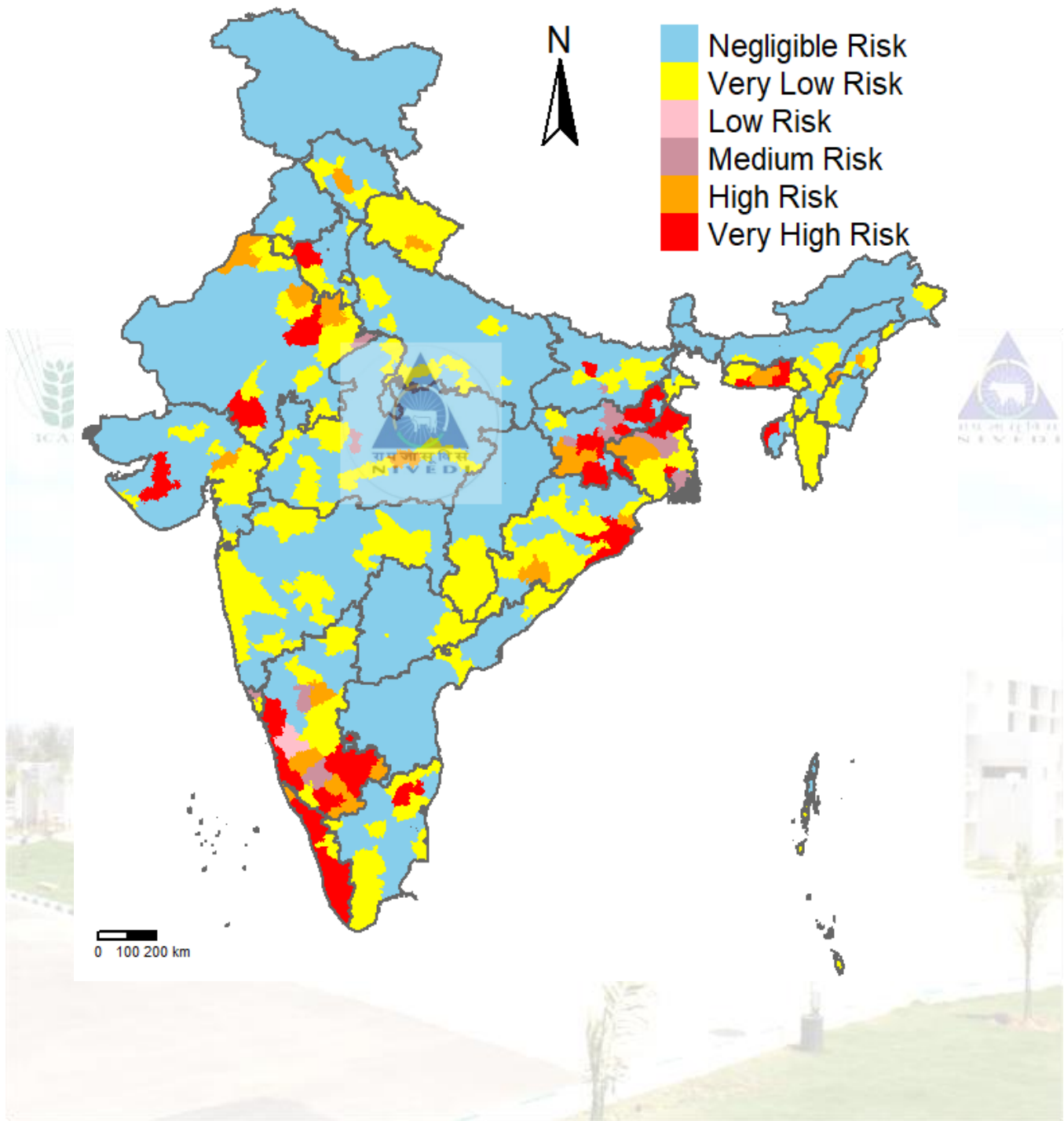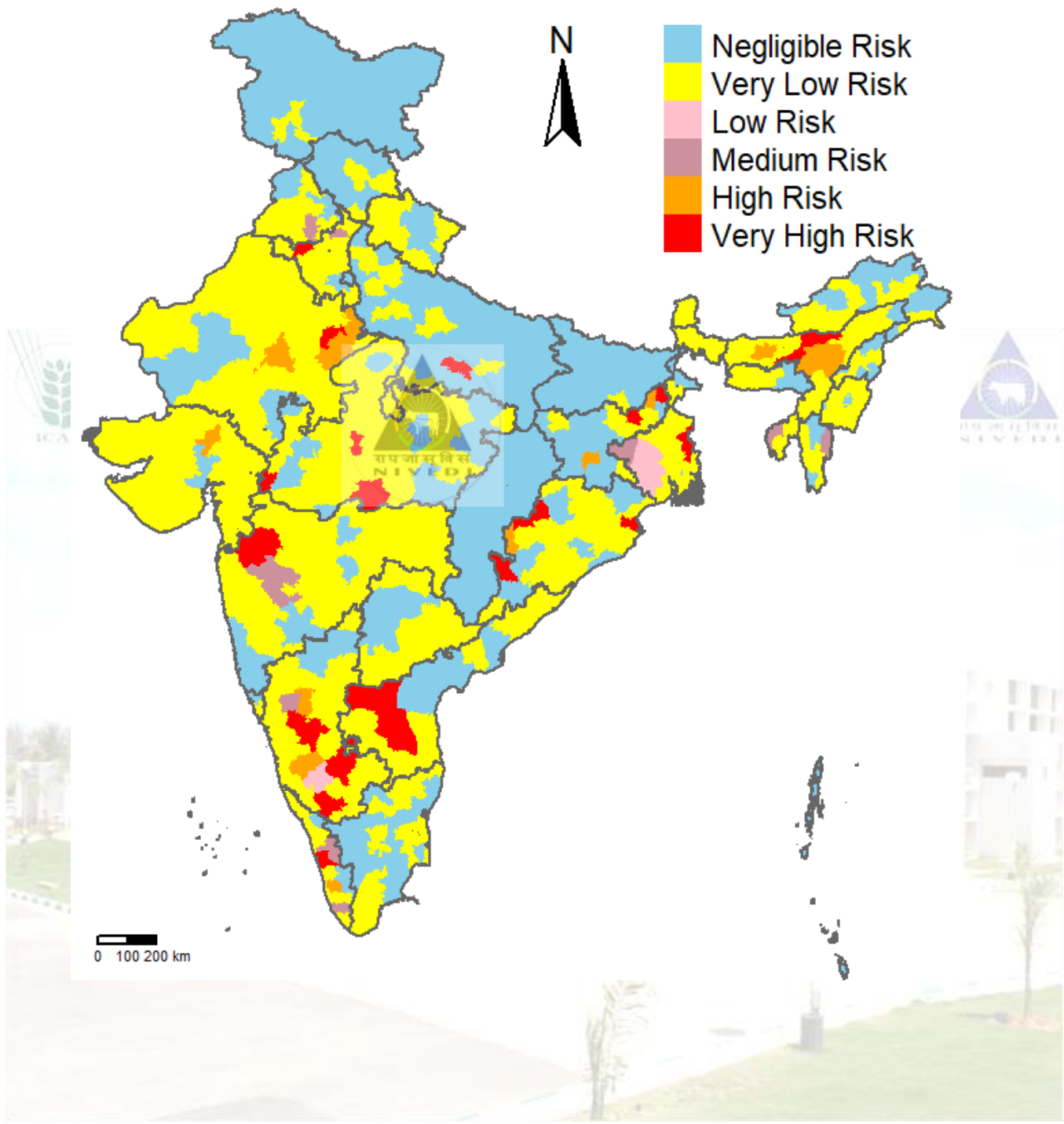
Risk Prediction of Peste des petits ruminants for the month of February 2023

N

	Negligible Risk
	Very Low Risk
	Low Risk
	Medium Risk
	High Risk
	Very High Risk

0 100 200 km
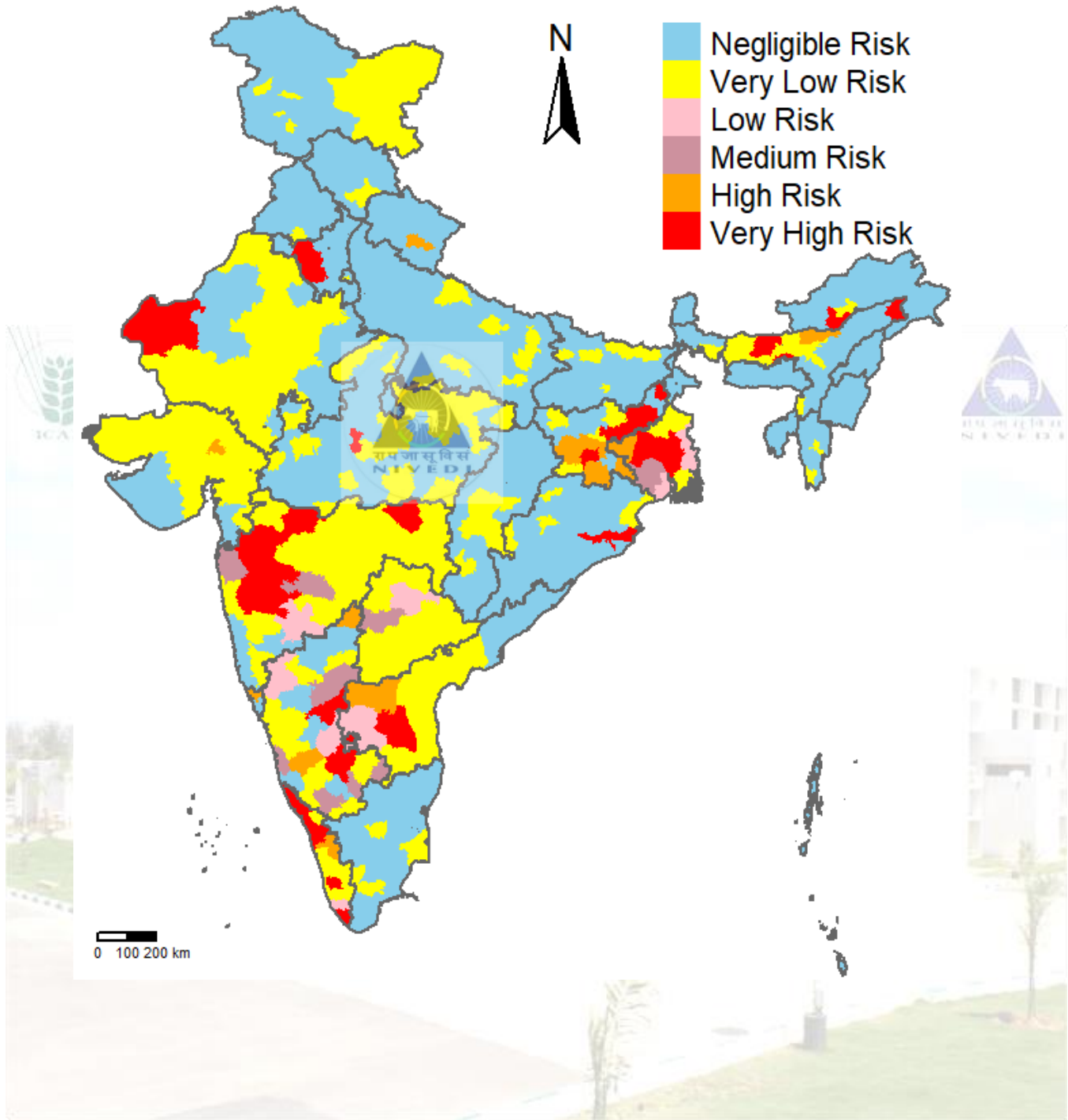
V. Forecasting of remote sensing and meteorological parameters till, 2022(*Ex*. *Jharkhand*)

Forecasting of Minimum.temparature_in.degrees till 2022

Forecasting of Maximun.temparature_in.degrees till 2022

Forecasting of Mean.temparature_in.degrees till 2022

Forecasting of Specific_Humidity till 2022

Forecasting of Cloud.cover till 2022

Forecasting of Precipitation till 2022

Forecasting of Vapour.Pressure till 2022

Forecasting of Wet.dry.frequency till 2022

Forecasting of Wind.Speed till 2022

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VI. SIGNIFICANT WEATHER PARAMETERS TABLE USING DISCRIMINANT FUNCTION ANALYSIS

Disease Names	Significant Parameters
Anthrax	Precipitable Water, Surface Pressure
Babesiosis	Air Temperature, Precipitation, Surface Pressure, Minimum Temperature, Vapour Pressure, Dew Point Temperature, Wind Speed, NDVI and LST Night
Black quarter	Precipitable Water, Precipitation, Surface Pressure, Sea Level Pressure and Vapour Pressure
Bluetongue	Air Temperature, Cloud, Precipitable Water, Precipitation, Surface Pressure, Uwind, Vwind, Vapour Pressure, Elevation, NDVI and PET
Classical Swine Fever	Cloud, Precipitation, relative humidity Minimum Temperature, Vapour Pressure and Rainfall
Enterotoxaemia	Surface Pressure, NDVI and PET
Fasciolosis	Air Temperature, Precipitation, relative humidity, Temperature, Maximum Temperature, Vapour Pressure, Vwind, Rainfall, Soil Moisture, NDVI and EVI
Foot and Mouth Disease	Precipitable Water, Uwind, Vwind, wet_dry frequency, LST Night and EVI
HaemorrhagicSepticaemia	Cloud, Precipitation and Vwind
Peste des Petits Ruminants	Cloud, Precipitable Water, Surface Pressure, Sea Level Pressure, Maximum Temperature, Vwind and NDVI
Sheep & Goat pox	Cloud, Surface Pressure, Maximum Temperature, Vwind, DTP, NDVI and PET
Theileriosis	Air Temperature, Precipitation, Vapour Pressure, NDVI and LST Night
Trypanosomosis	Air Temperature, Precipitation, Surface Pressure, Vapour Pressure, NDVI and LST Night

Table 7.1: Significant weather parameters govern the Livestock disease incidence (forecast).

9. POST PREDICTION VALIDATION

DIMAPUR | Publish Date: 4/14/2019 AH&VS TEAM VISITS AFFECTED AREAS UNDER MEDZIPHEMA,
Source: http://www.nagalandpost.com

Following reports of a good number of buffaloes dying in a recent outbreak of suspected Haemorrhagic septicaemia (HS), a team from Animal Husbandry and Veterinary Services (AH&VS) department visited the affected areas under Medziphema on April 12. (Haemorrhagic septicaemia is a contagious bacterial disease that affects cattle and water buffaloes with a high mortality rate in infected animals).

AH&VS, deputy director & principal investigator, AICRP-ADMAS, Dr S. Amenla Walling, in a press release reported that the team consisted of the department's director, Dr Temsumeren, along with additional director, Dr. Budhi Lama, and other officials from the department. The press release added that the area is prone to such kind of disease outbreaks and the department officials reminded villagers to cooperate with the department and vaccinate their animals against such outbreaks. The team told the villagers that even an outbreak can be contained more effectively if villagers report the matter on time to the nearest Veterinary Health Centre.

The villagers admitted in the meeting that they had not reported the recent outbreak to the department initially. The director appreciated the CVO Dimapur and his Rapid Response Team for their quick action after receiving information and for remaining stationed in the outbreak area to date. Free medicine was also distributed among the villagers. The department, through the press release also appealed to everyone to report such matters to the nearest Veterinary Health Centre (so that qualified staff may intervene quickly), instead of publicizing it in other ways. It stated that the department is prepared to extend services to any outbreak of diseases in animals to control such things.

The press release also pointed out that to control the recent outbreak, the department had to direct its officials to make their own transport arrangements to go to the affected areas because the State Election department did not consider an appeal to exempt the department's emergency duty vehicle from election duty.

Meanwhile, when contacted, Dr S. Amenla Walling told Nagaland Post that it is difficult to say if the disease has been fully contained since its free grazing season for the animals, but the department is doing its best under the circumstances.

NIVEDI PREDICITONS

Districts of Nagaland	HS prediction for February 2019	HS prediction for March 2019	HS prediction for April 2019
Peren	VLR	VLR	VHR
Dimapur	VLR	NR	HR
Kohima	VLR	VLR	NR
Wokha	VLR	NR	VLR

Risk Prediction of Haemorrhagic septicaemia for the month of April 2019

- Very High Risk
- High Risk
- Medium Risk
- Low Risk
- Very Low Risk
- No Risk / No Data
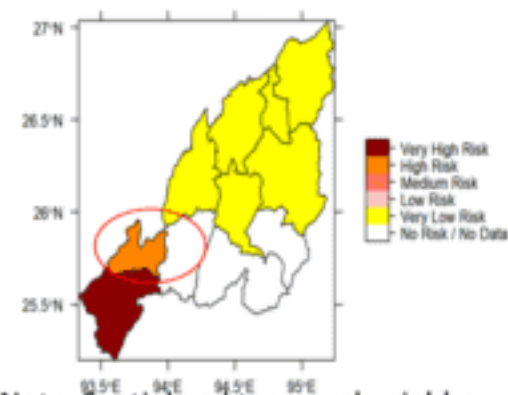
Note: Spatial and temporal neighbours

Andaman and Nicobar Report June-2020

NIVEDI Prediction

District wise Livestock Disease forewarning for June 2020: Andaman and Nicobar

Districts of Andaman and Nicobar	Anthrax	Babesiosis	BQ	BT	ET	Fasciolosis	FMD	HS	PPR	S&G Pox	SF	Theileriosis	Trypanosomiasis
Nicobar	NR	NR	NR	NR	NR	VHR	NR	NR	NR	NR	NR	NR	NR
North & Middle Andaman	NR	NR	NR	NR	NR	VHR	NR	NR	NR	NR	NR	NR	NR
South Andaman	NR	NR	NR	NR	NR	VHR	NR	NR	NR	NR	NR	NR	NR

If vaccination is already been done please ignore the disease forecast for that disease.

No risk/No data available (NR), Very low risk (VLR), Low risk (LR), Moderate risk (MR); High risk (HR);Very high risk (VHR)

ANDAMAN & NICOBAR ISLANDS Risk Prediction of Fascioliasis for the month of June 2021

Legend:
- Very High Risk
- High Risk
- Medium Risk
- Low Risk
- Very Low Risk
- No Risk / No Data

Andaman and Nicobar Report June-2020
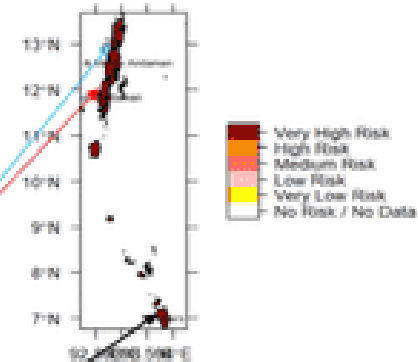
monthly report June 2020

Number of cases of of parasitic cases and other diseases reported from A & N Islands during the month of June 2020

CASES	FASCIOLIASIS	ASCARIASIS	AMPHISTOME	STRONGYLOIDS	COCCIDIOSIS	MASTITIS	TOTAL
South Andaman	24	48	192	34	2	7	307
N&M Andaman	258	43	14	5	3	10	333
Nicobar	79	31	0	0	0	0	110
TOTAL	361	122	206	39	5	17	750

Dr. Jai Sunder

PI, AICRP-ADMAS

Port Blair

HIMACHAL PRADESH REPORT AUGUST-2020

KERALA REPORT JUNE-2021

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Anglophone Africa   South Asia   Middle East/North Africa   Antimicrobial Resistance

Published Date: 2021-06-18 03:52:33 IST

Subject: PRO/AH/EDR> Foot & mouth disease - India (02): (KL) cattle, RFI

Archive Number: 20210617.8456180

FOOT & MOUTH DISEASE - INDIA (02): (KERALA) CATTLE, REQUEST FOR INFORMATION
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A ProMED-mail post
http://www.promedmail.org
ProMED-mail is a program of the
International Society for Infectious Diseases
http://www.isid.org

Date: Wed 16 Jun 2021 12:34 IST
Source: The Hindu [edited]
https://www.thehindu.com/news/national/kerala/steps-to-tackle-fmd-in-alappuzha/article34822360.ece

The Animal Husbandry Department has ramped up measures to tackle the spread of foot-and-mouth disease (FMD) in Alappuzha.

Around 3000 head of cattle have been affected by the outbreak in the district in the last 1.5 months. At least 193 cattle died of the disease during the period. Around 550 head of cattle have contracted the disease, and 100 perished in the worst-affected Ambalapuzha South and Ambalapuzha North grama panchayats [for Kerala's decentralised administrative structure terminology, see https://kerala.gov.in/local-self-government - Mod.AS]. The disease has also been reported from Thakazhi, Thalavady, Edathua, Chettikulangara, Aryad, Pandanad, and Chengannur.

Treatment and vaccination are being carried out to check the spread of the disease. The department has deployed 140 teams in the affected areas. Special teams with doctors have been deployed to the worst-affected Ambalapuzha South and Ambalapuzha North grama panchayats. Doctors have been appointed to Chengannur, Ambalapuzha, and Veliyanad blocks to deal with emergencies during night.

Minister of Animal Husbandry J. Chinchurani said the department had taken measures to bring the outbreak under control.

District Animal Husbandry Officer A.G. Geo said the department had started a vaccination drive on 22 Apr [2021] soon after the FMD cases started to [be reported] in the district. As many as 6140 cattle in 51 grama panchayats have so far been vaccinated against FMD.

The outbreak of the disease was attributed to missed rounds of vaccination due to the COVID-19 pandemic.

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Communicated by:
ProMED
<promed@promedmail.org>

NIVEDI prediction in June 2021

District wise Livestock Disease Risk Forewarning for June 2021: Kerala

Districts of Kerala	Livestock Diseases												
	Anthrax	Babesiosis	BQ	BT	ET	Fascioliasis	FMD	HS	PPR	S&G Pox	SF	Theileriosis	Trypanosomiasis
Alappuzha	NR	NR	NR	NR	NR	NR	*VHR*	MR	VLR	NR	NR	NR	NR
Ernakulam	NR	NR	NR	NR	NR	NR	*VHR*	*HR*	*HR*	NR	*VHR*	NR	NR
Idukki	*VHR*	VLR	VLR	VLR	NR	NR	*HR*	NR	VLR	NR	NR	NR	NR
Kannur	NR	VLR	NR	NR	NR	NR	*VHR*	*VHR*	VLR	NR	NR	NR	NR
Kasaragod	NR	NR	NR	NR	NR	NR	NR	NR	VLR	NR	NR	NR	NR
Kollam	NR	VLR	VLR	NR	NR	NR	*VHR*	*VHR*	*HR*	NR	NR	NR	NR
Kottayam	NR	NR	NR	NR	NR	NR	*VHR*	*VHR*	VLR	NR	NR	NR	NR
Kozhikode	NR	NR	NR	NR	NR	NR	*VHR*	NR	*VHR*	NR	NR	NR	NR
Malappuram	NR	VLR	NR	NR	NR	NR	*VHR*	*VHR*	VLR	NR	NR	NR	NR
Palakkad	NR	VLR	NR	NR	NR	NR	*VHR*	*HR*	*HR*	NR	NR	*VHR*	NR
Pathanamthitta	*VHR*	VLR	NR	NR	NR	NR	*VHR*	VLR	VLR	NR	NR	NR	NR
Thiruvananthapuram	NR	NR	NR	NR	NR	NR	*VHR*	*VHR*	*HR*	NR	NR	NR	*VHR*
Thrissur	NR	VLR	NR	NR	NR	NR	*VHR*	*VHR*	*HR*	NR	NR	NR	NR
Wayanad	NR	VLR	NR	NR	NR	NR	*VHR*	NR	NR	NR	NR	*VHR*	NR

If vaccination hasalready been done please ignore the disease forecast for that disease.

KERALA Risk Prediction of Foot and mouth disease for the month of June 2021
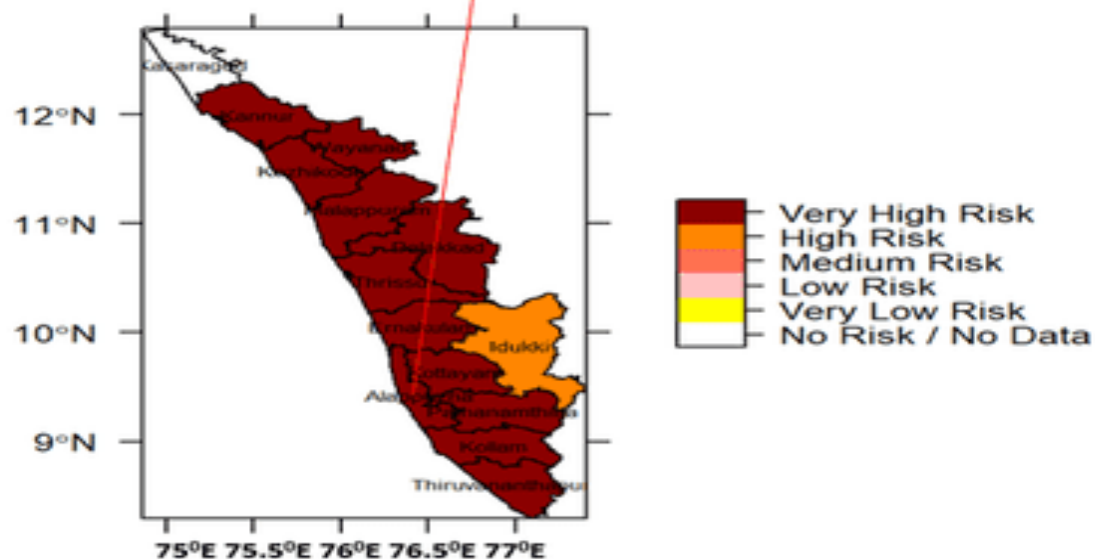
KARNATAKA REPORT SEPTEMBER-2021

District wise Livestock Disease Risk Forewarning for September 2021: Karnataka

ProMED

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Anglophone Africa   South Asia   Middle East/North Africa   Antimicrobial Resistance

Published Date: 2021-04-14 00:02:23 IST

Subject: PRO/AH/EDR> Foot & mouth disease - India: (AR) mithun, RFI

Archive Number: 20210413.8305677

FOOT AND MOUTH DISEASE - INDIA: (ARUNACHAL PRADESH) MITHUN, REQUEST FOR INFORMATION
****

A ProMED-mail post
http://www.promedmail.org
ProMED-mail is a program of the
International Society for Infectious Diseases
http://www.isid.org

Date: Tue 13 Apr 2021
Source: Sentinel Assam [abridged, edited]
http://www.sentinelassam.com/north-east-india-news/arunachal-news/many-mithuns-infected-with-fmd-foot-and-mouth-disease-533689

A large number of mithuns have been affected by FMD (foot and mouth disease) in various parts of Arunachal Pradesh, and a few have died, said official sources on Monday [13 Apr 2021].

Animal Husbandry & Veterinary Department Deputy director Dr Taba Heli, a top mithun expert in North Eastern region, reported that the disease has taken a severe form in the entire Siang belt, particularly in East Siang, West Siang, and Upper Siang districts [map at https://tinyurl.com/tft28s3c].

Though the number of deaths is yet to be known, the disease has spread in

scattered areas of Papum Pare district also. The Department has allocated district funds for procurement of medicines to take all possible steps to contain the disease, he said. Mithun deaths have been reported also from Itanagar and Jullang area.

Pointing out that mithuns are the pride of indigenous people in the state, Nyishi Elite Society president Bengia Tolum has urged the department to take all possible steps to save them.

--
Communicated by:
ProMED from HealthMap Alerts
<promed@promedmail.org>

[Mithun, also known as "Cattle of Mountain," is a bovine species of the northeastern hill region of India. This massive bovine is reared under free-range conditions in the hill forests at an altitude of 1000 to 3000 meters above mean sea level.

It is important to obtain information on the serotype and genotype of the virus strain involved, as well as of the vaccination history of the affected animals.

FMD is a disease of cloven-hoofed animals, including cattle, buffalo, small ruminants, and swine. It is the most contagious disease of mammal animals, having a great potential for causing severe economic loss in susceptible animals. Mortality, generally, is up to 2-3% but may be significantly higher in young stock.

The disease is regarded as endemic in India; effective mass vaccination, applying potent vaccines -- which include matching vaccine strains -- is essential for its control. Continued circulation of the virus may affect India's exports, such as frozen buffalo meat, of which India is the largest producer and exporter, globally. An example of the said export issue is to be found at https://agriculture.gov.mu.org/Documents/Report/foot%20and%20mouth%20disease.pdf. - Mod.AS

NIVEDI prediction in April 2021

District wise Livestock Disease Risk Forewarning for April 2021: Arunachal Pradesh

Districts of Arunachal Pradesh	Livestock Diseases												
	Anthrax	Babesiosis	BQ	BT	ET	Fascioliasis	FMD	HS	PPR	S&G Pox	SF	Theileriosis	Trypanosomiasis
Anjaw	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Changlang	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Dibang Valley	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
East Kameng	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
East Siang	NR	NR	NR	NR	NR	NR	*VHR*	NR	VLR	NR	*VHR*	NR	NR
Kurung Kumey	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Lohit	NR	VLR	VLR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Lower Dibang Valley	NR	NR	VLR	NR	NR	NR	VLR	VLR	VLR	NR	*VHR*	NR	NR
Lower Subansiri	NR	NR	NR	NR	NR	NR	*VHR*	NR	NR	NR	NR	VLR	NR
Papum Pare	NR	NR	NR	NR	NR	NR	*VHR*	NR	*VHR*	NR	*VHR*	NR	NR
Tawang	NR	NR	NR	NR	NR	NR	*HR*	NR	NR	NR	NR	NR	NR
Tirap	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Upper Siang	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Upper Subansiri	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
West Kameng	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
West Siang	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR

If vaccination has already been done please ignore the disease forecast for that disease.

*No risk/No data available (NR), Very low risk (VLR), Low risk (LR), Moderate risk (MR), High risk (HR),Very high risk (VHR)

ARUNACHAL PRADESH Risk Prediction of Foot and mouth disease for the month of April 2021
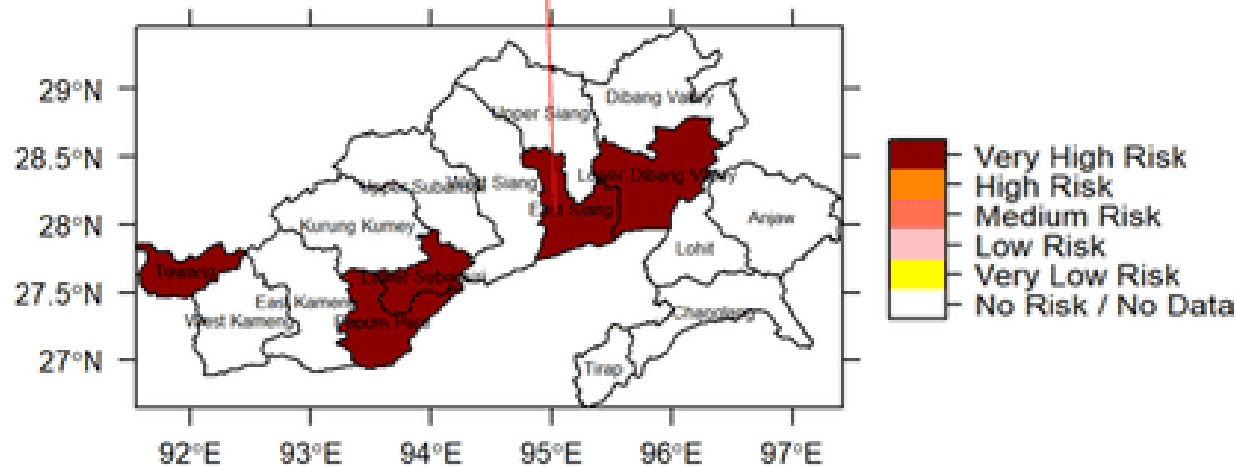
9.1 Correlational Assessment

The number of outbreaks predicted and outbreaks actually reported were mentioned in table 9.1. It has been observed from the table that outbreaks predicted two months in advance and timely alerts were issued that helped the stakeholders to take appropriate preventive measures with in time and accordingly the reported outbreaks were very less. Though the use of artificial intelligence system is more beneficial for accurately predicting the livestock disease outbreaks, there are yet number of limitations, namely, there are expected to be under reporting and also non-reporting cases which created the uncertainties in the model predictions while translating model inputs in to model outputs. However, identifying these uncertainties in the prediction using statistical models and highlighting the importance of quality data may improve the model accuracy and confidence while building the model for livestock disease forecasting.

Table 9.1: Number of districts predicted for livestock diseases risk events and reported outbreaks

Sl No	Livestock diseases	April-2022		May-2022	
		No. of districts predicted for the disease risk events	No. of districts reported the disease outbreaks*	No. of districts predicted for the disease risk events	No. of districts reported the disease outbreaks*
1	Anthrax	27	2	16	1
2	Babesiosis	47	32	61	35
3	Black Quarter (BQ)	46	7	60	3
4	Bluetongue (BT)	0	0	0	2
5	Enterotoxaemia (ET)	22	7	9	15
6	Fasciolosis	46	15	44	10
7	Foot & Mouth Disease (FMD)	53	4	48	3
8	Haemorrhagic Septicaemia (HS)	46	3	42	5
9	Peste des Petits Ruminants (PPR)	76	11	55	17
10	Sheep & Goat Pox	50	9	38	12
11	Swine Fever	64	6	45	5
12	Theileriosis	62	18	62	29
13	Trypanosomosis	30	29	68	25

*Which takes in to account of action taken for prediction and non-reporting of cases

10. LAUNCH OF MOBILE ANDROID APP&LINK TO DOWNLOAD

Livestock forewarning application **(**LDF**)** can be downloaded following the link provided**:**http**://**www**.**nivedi**.**res**.**in**/**android_nadres**/**LDF**.**apkand google play storelinkalso provided https**://**play**.**google**.**com**/**store**/**apps**/**details?id**=**info**.**androidhive**.**ldf

Further launch of LDF application was done, the news provided below**.**

Livestock Disease Forewarning (LDF Mobile App)
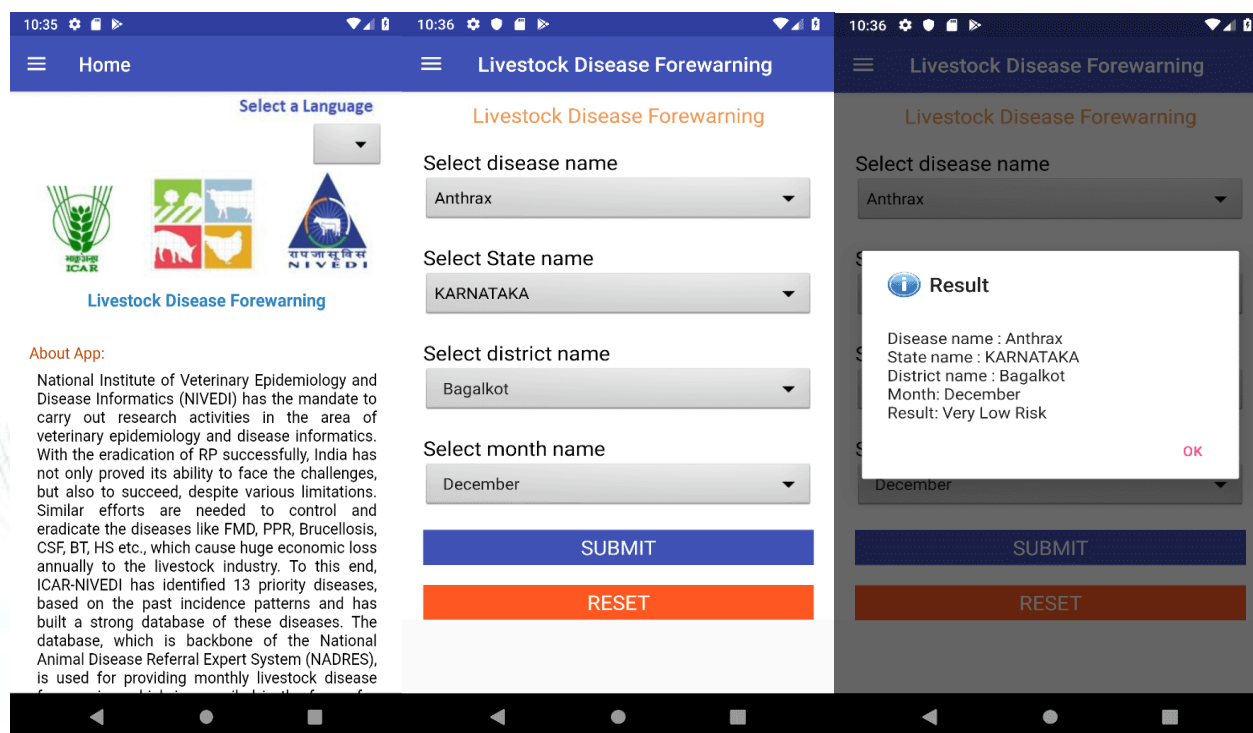
To extend the reach of the NADRES forewarning bulletin among the various stakeholders, a Mobile Application named Livestock Disease forewarning app "LDF-Mobile *App"*was developed. The forewarning methodology adapted in the "mobile app" remains the same as monthly bulletin; it provides user interface to know the predicted forewarning results stored in NADRES MySQL database. A PHP web-based service is developed in Java to extract the results of forewarning two months in advance by keying state name, district name and disease name and display the same in the mobile app. In addition to forewarning, the LDF-Mobile App also provides the details of clinical samples to be collected in case of outbreaks of the listed diseases for laboratory confirmation and immediate preventive measures to be taken up in case of positive prediction/disease confirmation. The LDF mobile app is available at ICAR-NIVEDI website. It is available on Google play store.

11. FARMERS EMPOWERMENT THROUGH IT: DISEASE RISK COMMUNICATION (COLLABORATION WITH FRUITS, NIC, GOVT. OF KARNATAKA)

In addition to NADRES V_2 (The National Animal Disease Referral Expert System), ICAR-NIVEDI collaborated with NIC, Govt. of Karnataka, Karnataka State for sending the SMS alerts directly to the farmers who have registered in FRUITS (Farmers Registration and Unified Beneficiary Information System). The information alerts on risk prediction of three livestock diseases were sent through SMS to farmers is presented in Table 11.A. During November 2022, a total of **1816919** SMS alerts were sent to farmers.

Table 11.A: Number of famers received the SMS alert through FRUITS application during November 2022.

Disease Name	District Name	No. of farmers received SMS	Disease Name	District Name	No. of farmers received SMS
Anthrax			**Black Quarter**	Chikmagalur	17326
	Bellary	3183		Chitradurga	17301
	Chamrajnagar	28694		Gulbarga	7100
	Chitradurga	17298		Hassan	88615
	Koppal	17295		Mandya	117929
	Raichur	6403		Mysore	122363
	Tumkur	98197		Shimoga	38914
				Tumkur	98253
				Uttar Kannada	13379
Blue Tongue	Bangalore Rural	38544	**FMD**	Bangalore Urban	26926
	Bellary	3183		Bangalore Rural	38544
	Chikkaballapur	41441		Chamrajnagar	28757
	Chitradurga	17306		Chikkaballapur	41441
	Davangere	28357		Chikmagalur	17347
	Gadag	14817		Dakshina Kannada	39718
	Haveri	28871		Hassan	88773
	Kolar	28154		Kodagu	3363
	Koppal	17321		Kolar	28154
	Mysore	122401		Mandya	118020
	Shimoga	38942		Mysore	122401
	Tumkur	98330		Ramnagar	61842
				Udupi	31716
Grand Total					**1816919**

12.1. MODEL BASED HOT-SPOT AREA MAPS OF LIVESTOCK INFECTIOUS DISEASES IN INDIA

a) FMD Hotspot by Poisson Model: FMD in India (1989-2022)
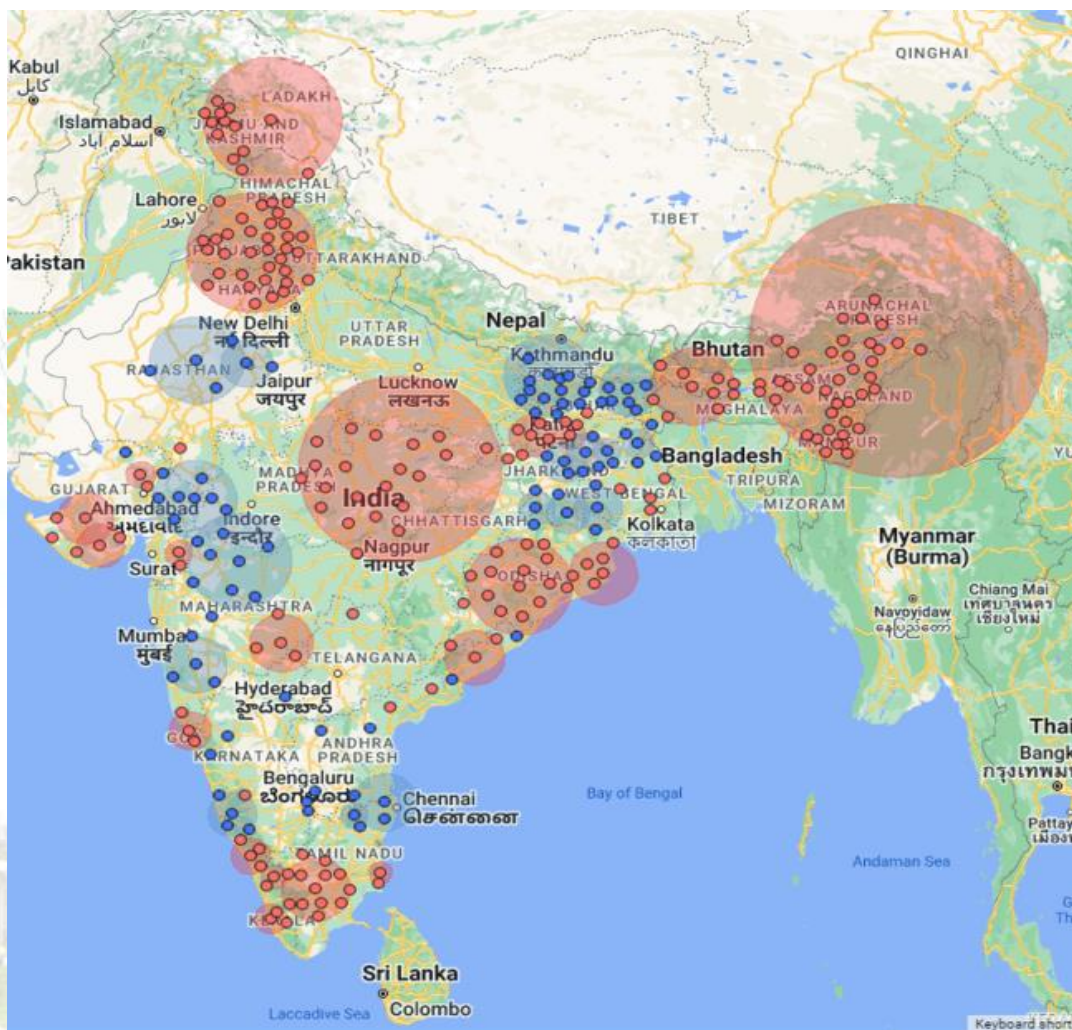
Model Specifications

- **Retrospective Analysis: Space-Time**
- **Probability Model: Space-Time Poisson Model**
  - With the Space-Time Poissonmodel, the number of cases in each location is Poisson-distributed.
  - The model requires case and population counts for a set of data locations and geographical coordinates for each of the locations.
  - SaTScan does a linear interpolation based on the population at the census times immediately preceding and following.
- **Advance Analysis Features:**
- **Circle radius:**1 km.
- **Time Aggregation:** 1 year.
- **Output obtained with no geographical overlap-** Total hotspots–69 (High- 36, Low- 33).
- The output is generated using **SaTScanv9. 6.**

Note: Red Dot: High Disease Cluster

Blue Dot: Low Disease Cluster

b) PPR Hotspot by Poisson Model: PPR in India (1995-2022)
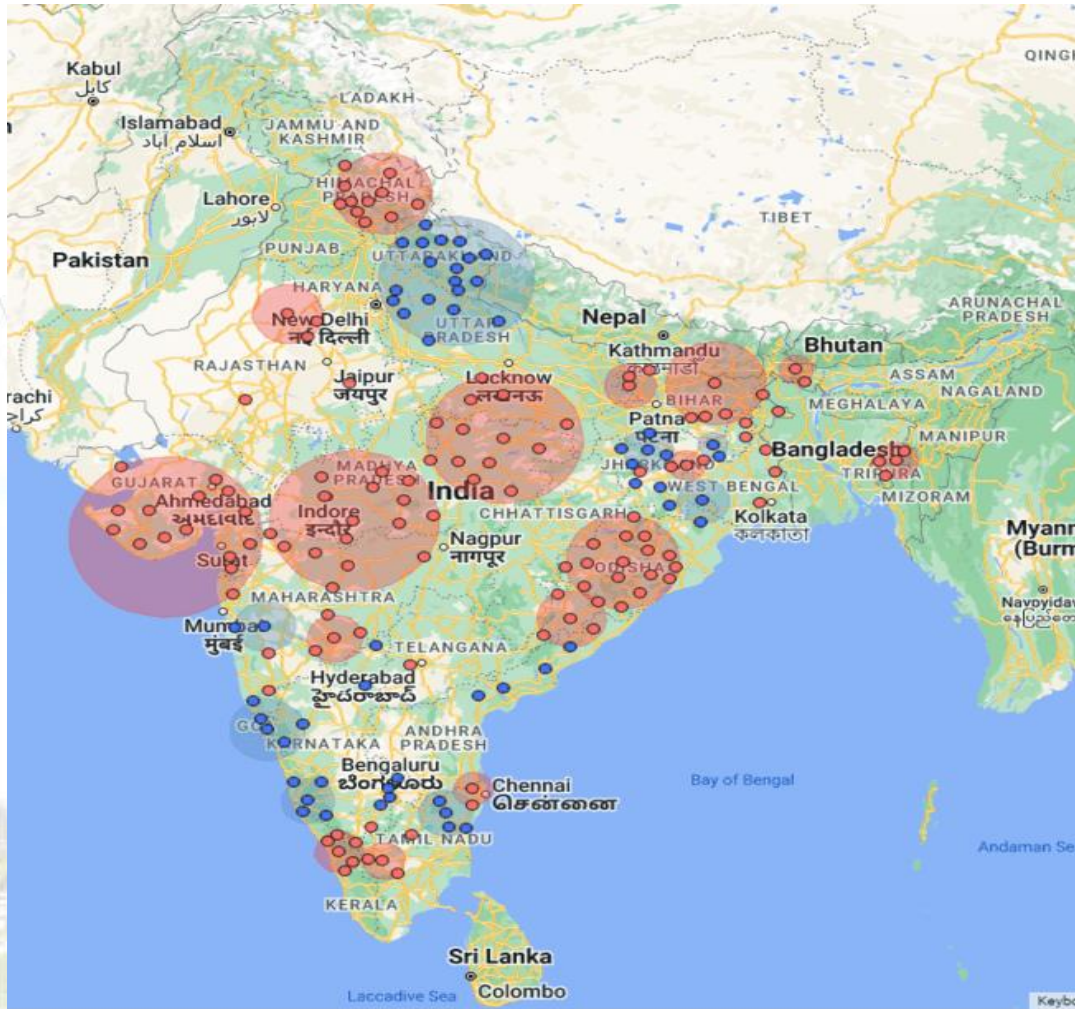
Model Specifications

- **Retrospective Analysis: Space-Time**
- **Probability Model: Space-Time Poisson Model**
  - With the Space-Time Poissonmodel, the number of cases in each location is Poisson-distributed.
  - The model requires case and population counts for a set of data locations and geographical coordinates for each of the locations.
  - SaTScan does a linear interpolation based on the population at the census times immediately preceding and following.
- **Advance Analysis Features:**
  Circle radius: 1 km.
- **Time Aggregation:** 1 year.
- **Output obtained with no geographical overlap-** Total hotspots– 51 (High- 30, Low- 21).
- The output is generated using **SaTScanv9. 6.**

Note: Red Dot: High Disease Cluster

Blue Dot: Low Disease Cluster

c) CSF Hotspot by Poisson Model: CSF in India (1992-2022)
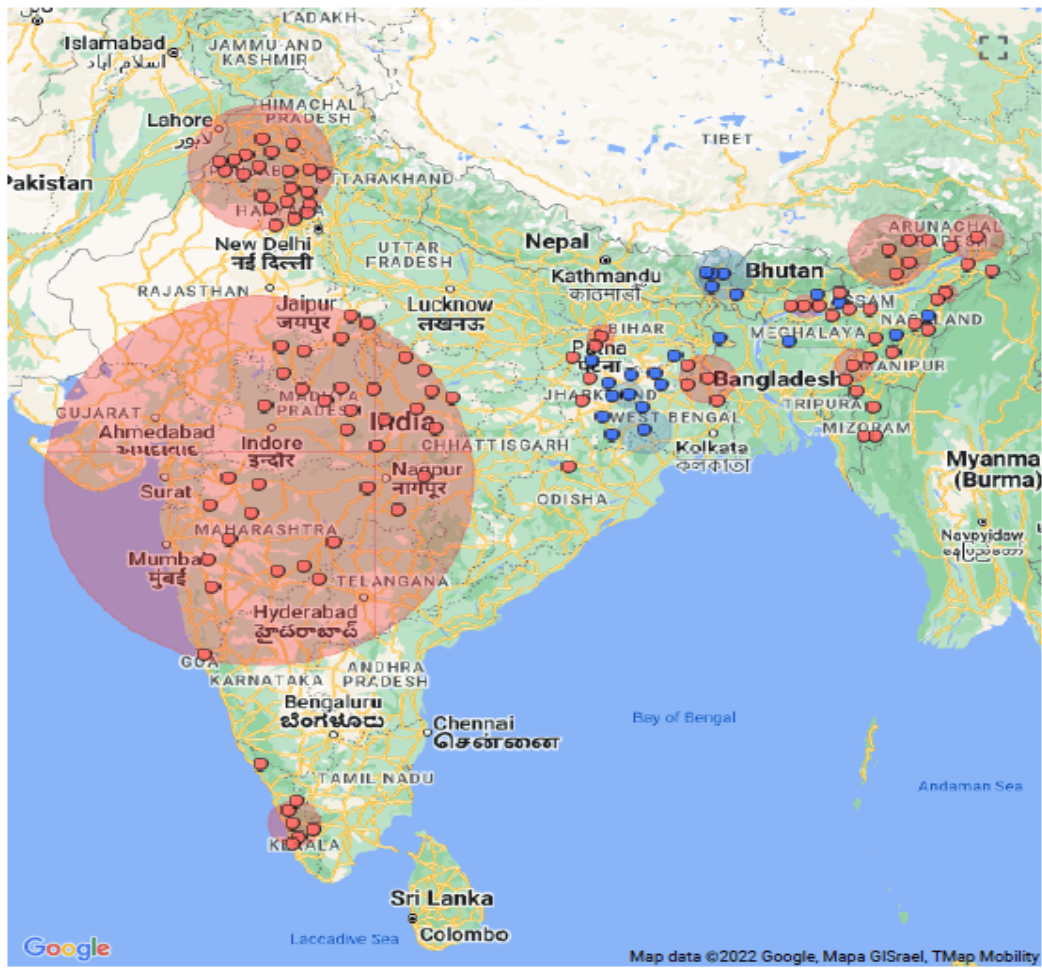
Model Specifications

- **Retrospective Analysis: Space-Time**
- **Probability Model: Space-Time Poisson Model**
    With the Space-Time Poissonmodel, the number of cases in each location is Poisson-distributed.
  - The model requires case and population counts for a set of data locations and geographical coordinates for each of the locations.
  - SaTScan does a linear interpolation based on the population at the census times immediately preceding and following.
- **Advance Analysis Features:**
  Circle radius:1 km.
- **Time Aggregation:** 1 year.
- **Output obtained with no geographical overlap-** Total hotspots– 46 (High- 29, Low- 17).
- The output is generated using **SaTScanv9. 6.**

Note: Red Dot: High Disease Cluster

Blue Dot: Low Disease Cluster

d) Bluetongue Hotspot by Poisson Model: Bluetongue in India (2001-2022)
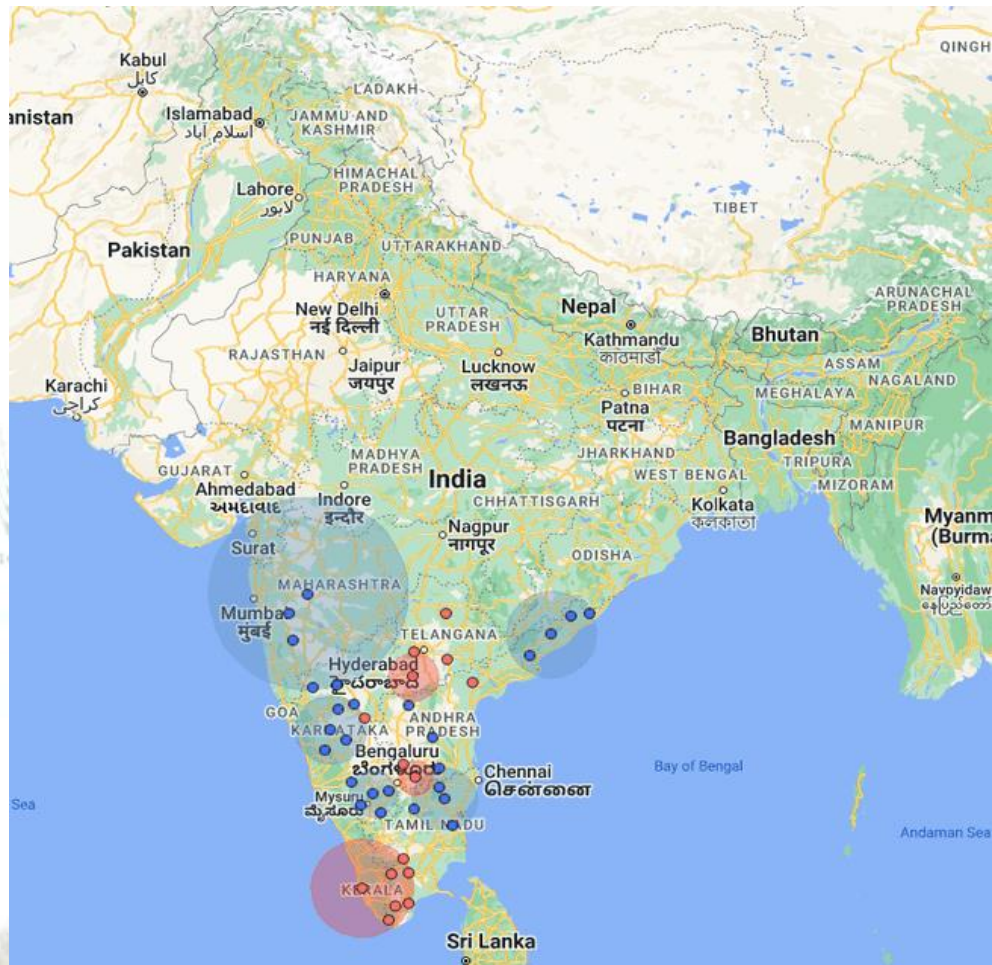
Model Specifications

- **Retrospective Analysis: Space-Time**
- **Probability Model: Space-Time Poisson Model**
  - With the Space-Time Poissonmodel, the number of cases in each location is Poisson-distributed.
  - The model requires case and population counts for a set of data locations and geographical coordinates for each of the locations.
  - SaTScan does a linear interpolation based on the population at the census times immediately preceding and following.
- **Advance Analysis Features:**
  Circle radius: 1 km.
- **Time Aggregation:** 1 year.
- **Output obtained with no geographical overlap-** Total hotspots– 14 (High- 7, Low- 7).
- The output is generated using **SaTScanv9. 6.**

Note: Red Dot: High Disease Cluster

      Blue Dot: Low Disease Cluster

d) LSD Hotspot by Poisson Model: LSD in India (2019-2022)
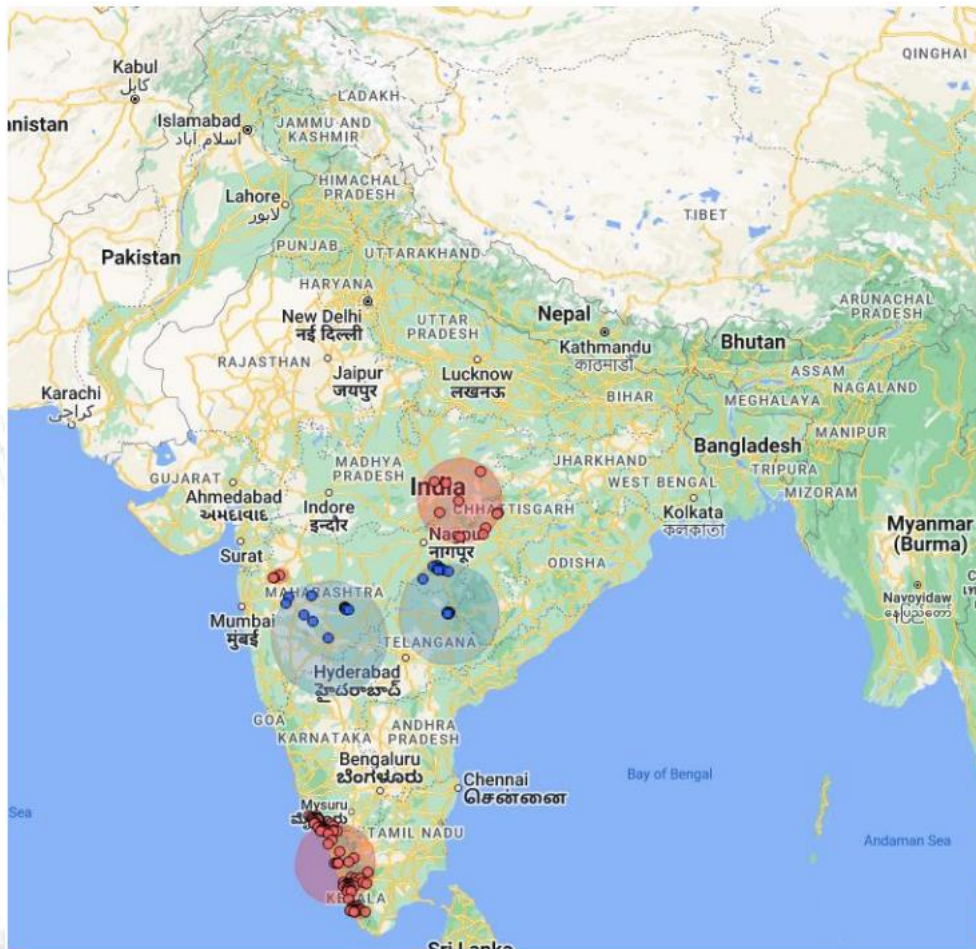
Model Specifications

- **Retrospective Analysis: Space-Time**
- **Probability Model: Space-Time Poisson Model**
  - With the Space-Time Poissonmodel, the number of cases in each location is Poisson-distributed.
  - The model requires case and population counts for a set of data locations and geographical coordinates for each of the locations.
  - SaTScan does a linear interpolation based on the population at the census times immediately preceding and following.
- **Advance Analysis Features:**
  Circle radius: 1 km.
- **Time Aggregation:** 1 year.
- **Output obtained with no geographical overlap-** Total hotspots– 7 (High- 5, Low- 2).
- The output is generated using **SaTScanv9. 6.**

Note: Red Dot: High Disease Cluster

Blue Dot: Low Disease Cluster

12.2. MODEL BASED RISK MAPS OF LIVESTOCK INFECTIOUS DISEASES IN INDIA

Incidence of LSD in India
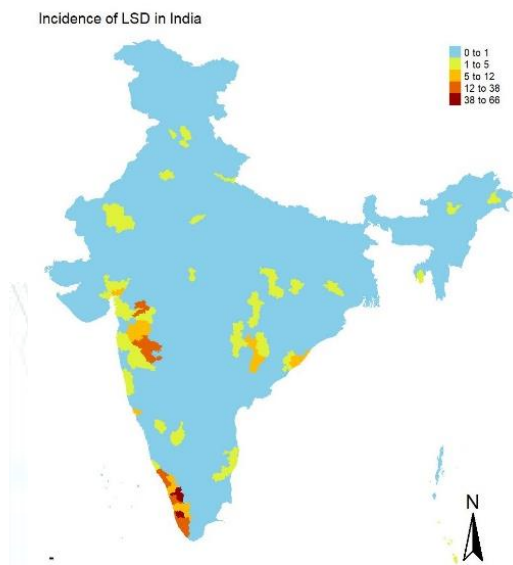
Risk map for LSD in India
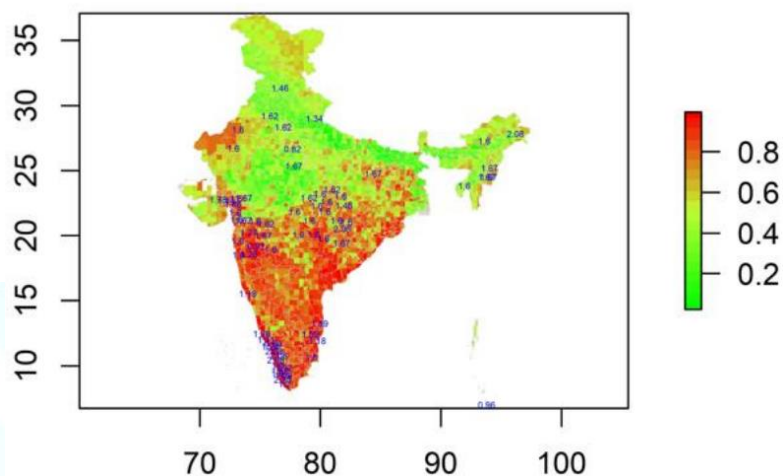
Risk map for Avian Influenza in India
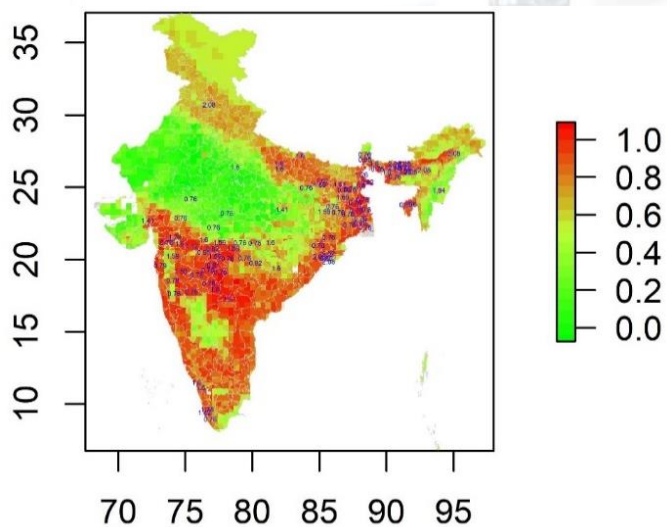
Risk prediction for Anthrax Disease for Southern India
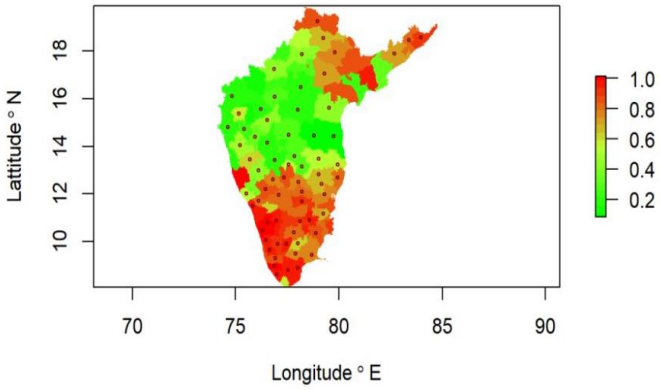
Risk prediction for Enterotoxaemia Disease for Southern India
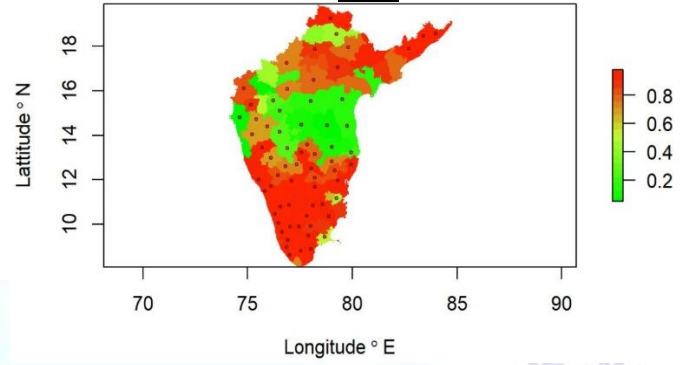
Risk prediction for ASF for North Eastern India
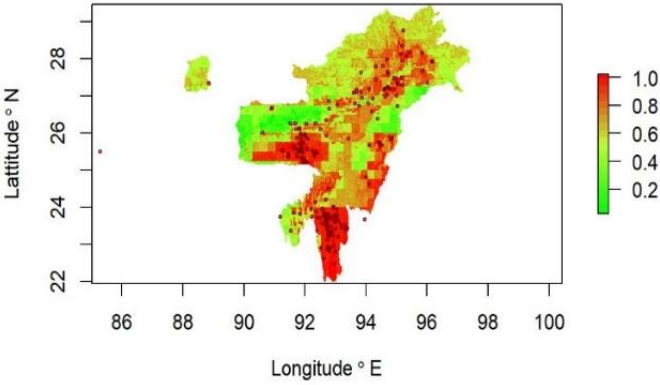
Karnataka Risk map Bluetongue
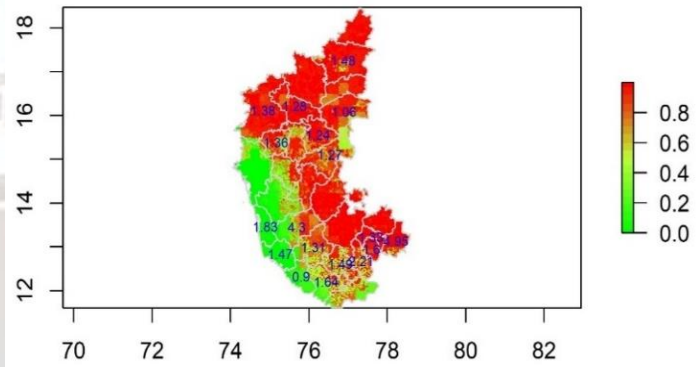
Risk map of Anaplasmosis in Kerala
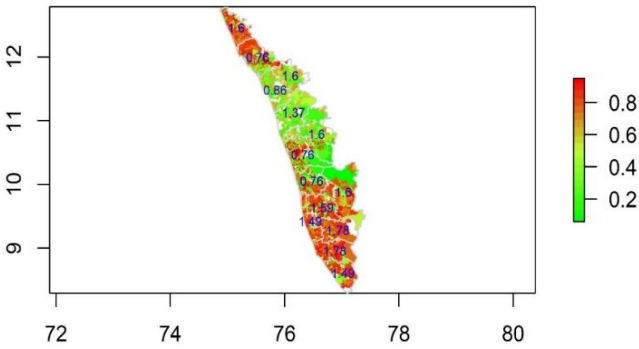
Risk map of Bluetongue in Andhra Pradesh
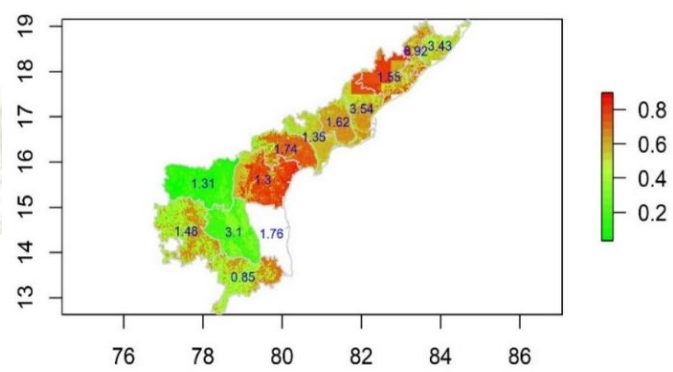
Forecasted risk maps for Classical Swine Fever disease in Assam

Disease Risk Prediction (Average score model) - Classical Swiner Fever 2019-30

Disease Risk Prediction (Average score model) - Classical Swiner Fever 2021-23
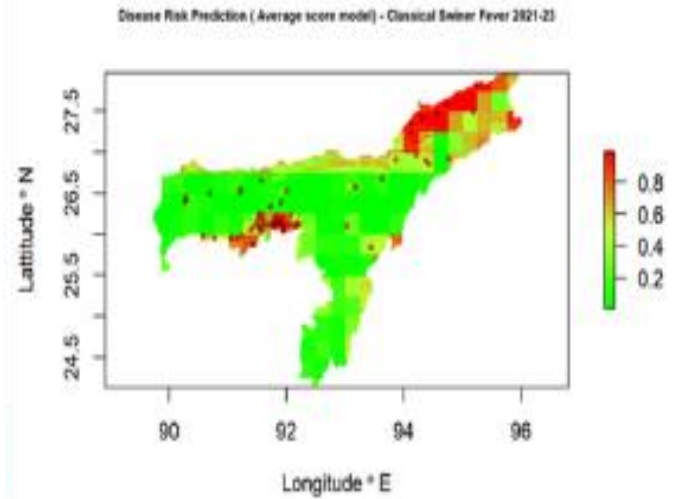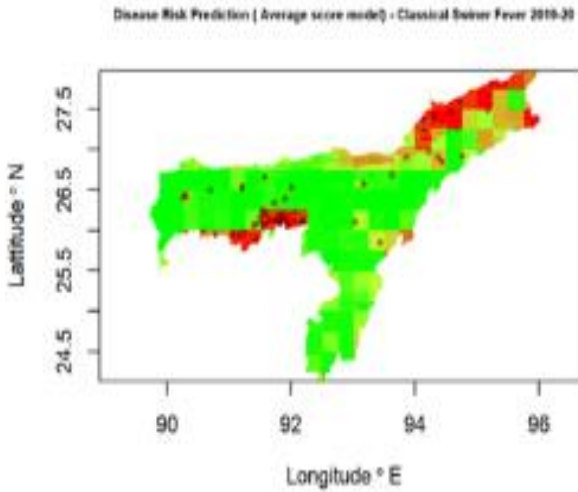
Risk map for Bluetongue in Andhra Pradesh
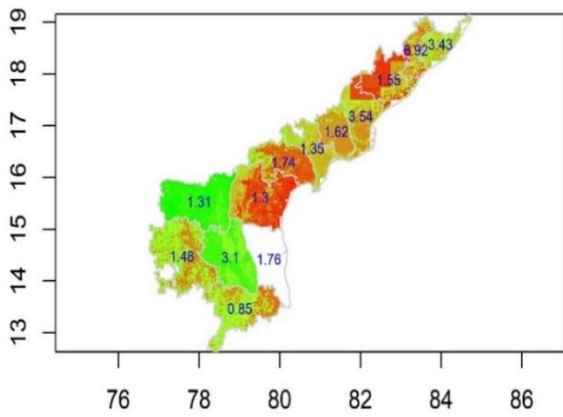
Risk map for Babesiosis in Haryana
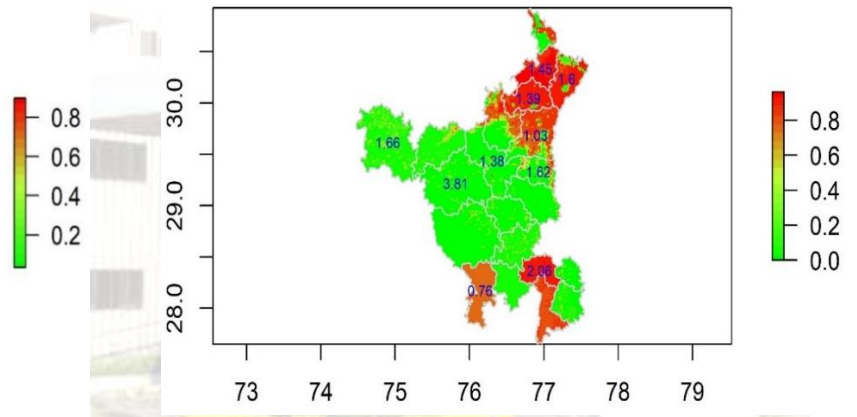
Risk map for Theileriosis in Haryana
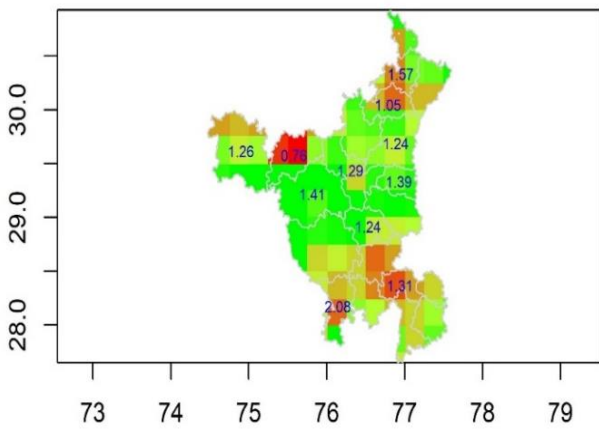
Risk map for Trypanosomiasis in Haryana

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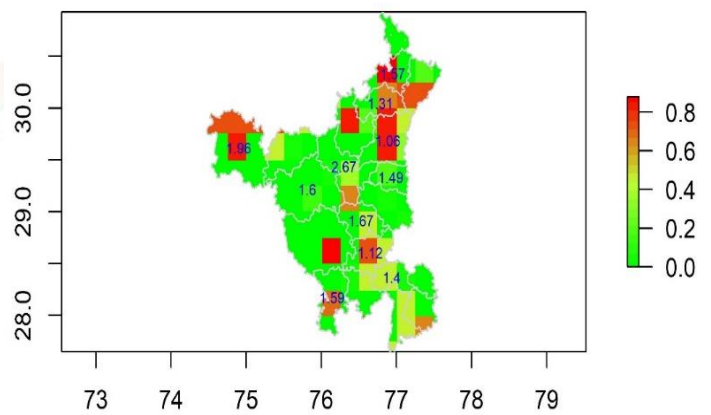
13. APPLICATION OF META ANALYSIS FOR UNDERSTANDING THE DISEASE PREVALENCE

Meta-analysis of classical swine fever prevalence in pigs in India: A 5-year study

S. S. Patil, K. P. Suresh, S. Saha, A. Prajapati, D. Hemadri and P. Roy

Indian Council of Agricultural Research - National Institute of Veterinary Epidemiology and Disease Informatics (ICAR-NIVEDI), PBNO-6450, Yelahanka, Bengaluru, Karnataka, India.
Corresponding author: S. S. Patil, e-mail: ss.patil@icar.gov.in
Co-authors: KPS: sureshkp97@gmail.com, SS: sneha.saha88@gmail.com, AP: avi75prajapati@gmail.com, DH: divakar.hemadri@gmail.com, PR: director.nivedi@icar.gov.in
Received: 18-11-2017, Accepted: 18-01-2018, Published online: 13-03-2018

Abstract

Aim: The aim of the study was to determine the overall prevalence of classical swine fever (CSF) in pigs in India, through a systematic review and meta-analysis of published data.

Materials and Methods: Consortium for e-Resources in Agriculture, India, Google Scholar, PubMed, annual reports of All India Coordinated Research Project on Animal Disease Monitoring and Surveillance,and All India Animal Disease database of NIVEDI (NADRES) were used for searching and retrieval of CSF prevalence data (seroprevalence, virus antigen, and virus nucleic acid detection) in India using a search strategy combining keywords and related database-specific subject terms from January 2011 to December 2015 in English only.

Results: A total of 22 data reports containing 6,158 samples size from 18 states of India were used for the quantitative synthesis, and overall 37% (95% confidence interval [CI]=0.24, 0.51) CSF prevalence in India was estimated. The data were classified into 4 different geographical zones of the country: 20% (95% CI=0.05, 0.55), 31% (95% CI=0.18, 0.47), 55% (95% CI=0.32, 0.76), and 34% (95% CI=0.14, 0.62). CSF prevalence was estimated in northern, eastern, western, and southern regions, respectively.

Conclusion: This study indicates that overall prevalence of CSF in India is much lower than individual published reports.

Keywords: Classical swine fever, India, meta-analysis, pigs, prevalence.

Meta-analysis of the prevalence of livestock diseases in North Eastern Region of India

Nagendra Nath Barman[1], Sharanagouda S. Patil[2], Rashmi Kurli[3], Pankaj Deka[1], Durlav Prasad Bora[1], Giti Deka[1], Kempanahalli M. Ranjitha[2], Channappagowda Shivaranjini[2], Parimal Roy[4] and Kuralayanapalya P. Suresh[3]

1. Department of Veterinary Microbiology, College of Veterinary Science, Assam Agriculture University, Guwahati, Assam, India; 2. Department of Virology, ICAR-National Institute of Veterinary Epidemiology and Disease Informatics, Bengaluru, Karnataka, India; 3. Department of Spatial Epidemiology, ICAR-National Institute of Veterinary Epidemiology and Disease Informatics, Bengaluru, Karnataka, India; 4. Director, ICAR-National Institute of Veterinary Epidemiology and Disease Informatics, Bengaluru, Karnataka, India.
Corresponding author: Kuralayanapalya P. Suresh, e-mail: sureshkp97@gmail.com
Co-authors: NNB: nnbarman@gmail.com, SSP: ss.patil@icar.gov.in, RK: rashmikurli@yahoo.in,
PD: drpankajaau@gmail.com, DPB: drdpbora@gmail.com, GD: gitideka8906@gmail.com, KMR: ranjuckm10@gmail.com,
CS: shivaranjinicveena@gmail.com, PR: director.nivedi@icar.gov.in
Received: 26-07-2019, Accepted: 22-11-2019, Published online: 11-01-2020

Abstract

Aim: The study aimed to determine the overall prevalence of livestock diseases in North Eastern Region (NER) of India, through a systematic review and meta-analysis of published data.

Materials and Methods: The articles used for the study were retrieved from PubMed, J-Gate Plus, Indian Journals, and Google scholar, R open-source scripting software 3.4.3. Metafor, Meta. The Chi-square test was conducted to assess for the heterogeneity, forest plot (confidence interval [CI] plot) is a method utilized to present the results of meta-analysis, displaying effect estimate and their CIs for each study were used for searching and retrieval of livestock diseases prevalence data in India using a search strategy combining keywords and related database-specific subject terms from 2008 to 2017 in English only.

Results: The prevalence of various livestock diseases are foot-and-mouth disease (21%), bluetongue (28%), brucellosis in bovine (17%), brucellosis in caprine (2%), brucellosis in porcine (18%), brucellosis in sheep and goat (3%), babesiosis (6%), theileriosis (26%), porcine reproductive and respiratory syndrome (1%), porcine cysticercosis (6%), classical swine fever (31%), *Porcine circovirus* (43%), and Peste des petits ruminants (15%). This information helps policymakers to take appropriate measures to reduce the disease burden.

Conclusion: This study indicates that the overall prevalence of various livestock diseases in NER of India.

Keywords: babesiosis, brucellosis, classical swine fever, foot-and-mouth disease, forest plot, livestock, meta-analysis, North Eastern regions, Peste des petits ruminants, *Porcine circovirus*, porcine cysticercosis, porcine reproductive and respiratory syndrome, prevalence, seroprevalence, theileriosis.

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Review Article

Peste Des Petits Ruminants in Atypical Hosts and Wildlife: Systematic Review and Meta-Analysis of the Prevalence between 2001 and 2021

SowjanyaKumari, S[1,2], Bhavya, A. P[1], Akshata, N[1], Kumar, K, V[1], Bokade, P. P[1], Suresh, K. P[1], Shome, B. R[1], Balamurugan, V[1] *

1. Indian Council of Agricultural Research, National Institute of Veterinary Epidemiology and Disease Informatics (ICAR-NIVEDI), Yelahanka, Bengaluru, Karnataka, India
2. Department of Microbiology, Jain University, Bengaluru, Karnataka, India

Abstract

Peste des petits ruminants (PPR) or goat plague is considered a leading, highly contagious, and most lethal infectious viral disease of small ruminants affecting the worldwide livestock economy and international animal trade. Although sheep and goats are the primarily affected, the PPR Virus (PPRV) host range has expanded to other livestock (large ruminants) and wildlife animals over the last few decades, resulting in serious concern to the ongoing PPR global eradication program, which is primarily optimized, designed, and targeted towards accessible sheep and goat population. A systematic review and meta-analysis study was conducted to estimate the prevalence and spill-over infection of PPRV in large ruminants (bovine and camel) and wildlife. Published articles from 2001 to October 2021 on the "PPR" were searched in four electronic databases of PubMed, Scopus, Science direct, and Google Scholars. The articles were then selected using inclusion criteria (detection/prevalence of PPRV in bovine, camel, and wildlife population), exclusion criteria (only sheep or goats, lack of prevalence data, experimental trial, test evaluation, and reviews written in other languages or published before 2001), and the prevalence was estimated by random effect meta-analysis model. In the current study, all published articles belonged to Africa and Asia. The overall pooled prevalence of PPR estimates was 24% (95% CI: 15-33), with 30% in Asia (95% CI: 14-49) and 20% in Africa (95% CI: 11-30). The overall estimated pooled prevalence at an Africa-Asia level in bovine and camel was 13% (95% CI: 8-19), and in wildlife, it was 52% (95% CI: 30-74) with significant heterogeneity ($I^2 = 97\%$) in most pooled estimates with a high prevalence in atypical hosts and wildlife across Asia and Africa. Over the last two decades, the host range has increased drastically in the wildlife population, even for prevalent PPR in the unnatural hosts only for a short time, contributing to virus persistence in multi-host systems with an impact on PPR control and eradication program. This observation on the epidemiology of the PPRV in unnatural hosts demands appropriate intervention strategies, particularly at the livestock-wildlife interface.

Keywords: PPR; Bovine; Camel; Wildlife; Systemic Review; Meta-analysis, Prevalence

Web Link https://nivedi.res.in/Nadres_v2/bioinfo.php

14. APPLICATION OF BIOINFORMATICS FOR UNDERSTANDING THE DYNAMICS OF LIVESTOCK INFECTIOUS DISEASES

a) **An extensive analysis of Codon usage pattern, Evolutionary rate and Phylogeographic reconstruction in Foot and mouth disease (FMD) serotypes (A, Asia 1 and O) of six major climatic zones of India: A Comparative study**

Abstract

Foot and mouth disease (FMD) is a major economically important viral disease of cloven mhoofed livestock globally. The FMD virus (FMDV) spreads widely in confined, cool and humid climatic conditions. Being an RNA virus, FMDV is genetically unstable, and its genome evolution is highly influenced by the mutational pressure. The climatic and environmental conditions have a significant impact on mutational pressure. The present study is a primary effort to establish a comprehensive relationship between climatic factors and molecular evolutionary pattern of serotypes FMDV circulating in India. In this study, isolates of three serotypes (A, Asia 1 and O) were selected from six major climatic zones of India (Montane, Humid subtropical, Tropical wet and dry, Tropical wet, Semi-arid and Arid). Based on the full genome nucleotide sequence data, the codon usage bias, evolutionary and phylogeographic analysis were carried out. The study revealed that the codon use bias indicators in the FMDV serotypes differed significantly depending on the climatic zones. It implies that the selection and mutational pressure influence the codon usage pattern indices (eNC, CAI, RCDI, GRAVY, Aromo), with mutational pressure taking precedence in determining the codon usage bias of the FMDV genome. The tMRCA was estimated to be 1960, 1956 and 1961 for Indian FMD virus serotype-A, Asia 1 and O respectively, which is around 17, 29 and 36 years before its actual identification in the field. Virus transmission across the region was evident from phylogeographic analysis. The integrated analysis of codon usage bias, evolutionary rate and phylogeography analysis signifies the major role of mutational and selection pressure, implying that the in FMD virus co-evolution and adaptations are highly influenced by the climatic/environmental factors.

b) **Relative Analysis of Codon Usage and Nucleotide Bias between Anthrax Toxin Genes Subsist**

Inpxo1 Plasmid of *Bacillus Anthracis*

Abstract

Anthrax is an ancient and acuteillness that affects alarge quantity of animal species and is caused by a bacterium *Bacillus anthracis*, which is a rod-shaped, gram-positive and spore forming bacterium. Virulent forms of *B.anthracis* has two large pathogenicity related plasmids pXO1 and pXO2. pXO1 has the different anthrax toxin genes *cya*, *lef*, and *pagA*where as pXO2 has the genes accountable for capsule synthesis and degradation, *capA*, *capB*, *capC*, and *capD*. *B. anthracis* express its pathogenic activity mostly over the capsule and the manufacture of a toxic compound involving three proteins known as edema factor (EF), lethal factor (LF) and protective antigen (PA). These two enormous plasmids of *B.anthracis* are crucial for full pathogenicity, exclusion of either of the plasmids extremely weakens the malignity of *B. anthracis.* In the current study we conducted the relative analysis of the codon usage and nucleotide bias of virulent genes subsist in pXO1 plasmid of *B.anthracis*. Codon usage bias not only plays a substantial role at the extent of gene expression, but also supports to improve the efficacy and accurateness of translation. Codon usage pattern analysis of *B.anthracis* genome is essential for understanding the evolutionary characteristicsin the different species. To examine the codon usage arrangement of the*B.anthracis*genome, Nucleotide sequences

of the virulent genes *viz cya, lef and pag* were collected from National Center for Biotechnology Information (NCBI). The correlations between GC3s, whole GC content, Effective No. of Codons (ENC), Codon Adaptation Index (CAI), Codon Bias Index (CBI), Frequency of Optimal Codons (FOP), General average hydropathicity (Gravy) and Aromaticity (Aroma), of the selected genes were determined. The ENC-plot i.e., ENc values vs GC3s, Pr2 plot i.e., relationship between A3 / (A3 +T3) and G3 / (G3 +C3), Neutrality plot i.e., GC12 versus GC3s, and the RSCU of the genes, all shows codon usage bias existence in all the virulent genes subsists in pXO1 plasmid of *B. anthracis* genome. These results expresses the codon usage bias existing in the pXO1 plasmid's virulent genes of *B.anthracis* genome could be utilized for further exploration on their evolutionary analysis as in design of primers, design of transgenes, determine of origin of species as well as prediction of gene expression level and gene function.

c) **Reverse vaccinology based *in silico* analysis of Epitope prediction in *cya*, *lef* and *pagA* genes from *Bacillus anthracis* against Anthrax infected species: An Immunoinformatics approach**

Abstract

Bacillus anthracis is a Gram-positive spore-forming bacterium that causes the zoonotic disease: anthrax, an abrupt illness that disproportionately impacts grazing livestock and wild ruminants. Anthrax's geographical reach despite years of research on anthrax epizootic and epidemics behaviour, to date, remains to be elucidated. Existing therapeutics, however, are ineffective in combating this infectious disease, necessitating the development of a better vaccine to pause the pandemic using immunoinformatics approaches, this study intended to predict an efficient epitope for a vaccine against anthrax in animals and humans of the toxin genes such as cya, lef and pagA of B. anthracis against anthrax. The B-cell and T-cell epitopes were predicted utilizing various bioinformatics tools/software and docking analysis was performed. Consequently, it was found that the evaluated epitopes had no allergenicity, no toxicity and had high antigenicity that provides an effectual and most rapid technique to estimate peptide synthetic vaccines to impede anthrax.
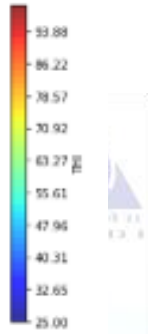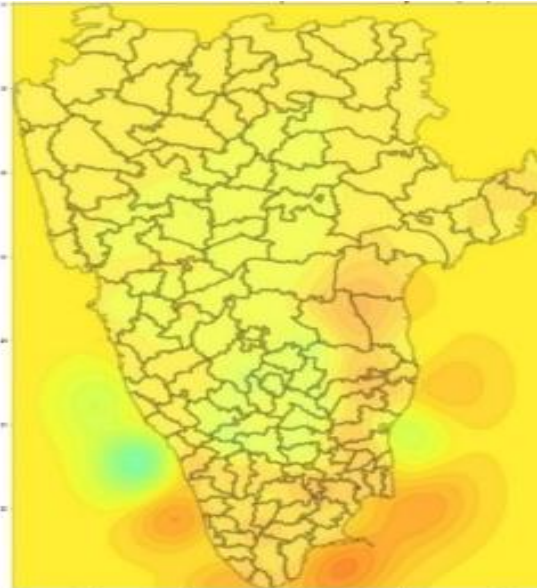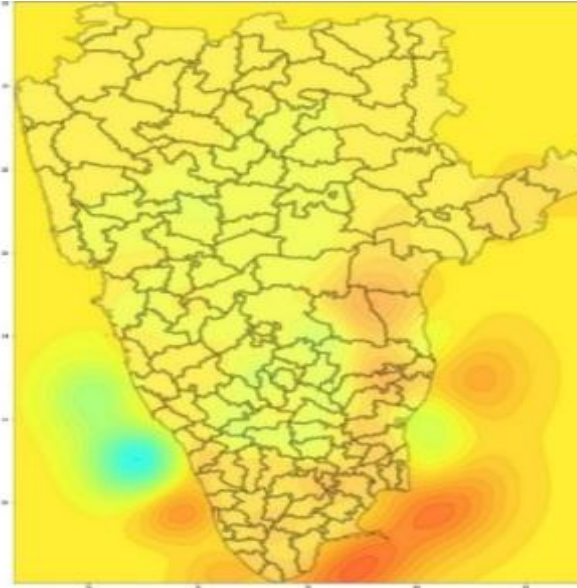
15. IMPACT OF CLIMATE CHANGE ON LIVESTOCK DISEASE INCIDENCE

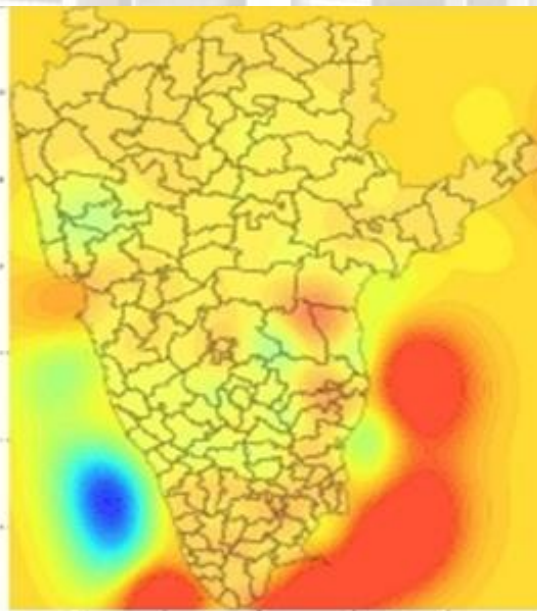## 15.1 Southern StatesTemperature Humidity Index (THI) 2001-2021
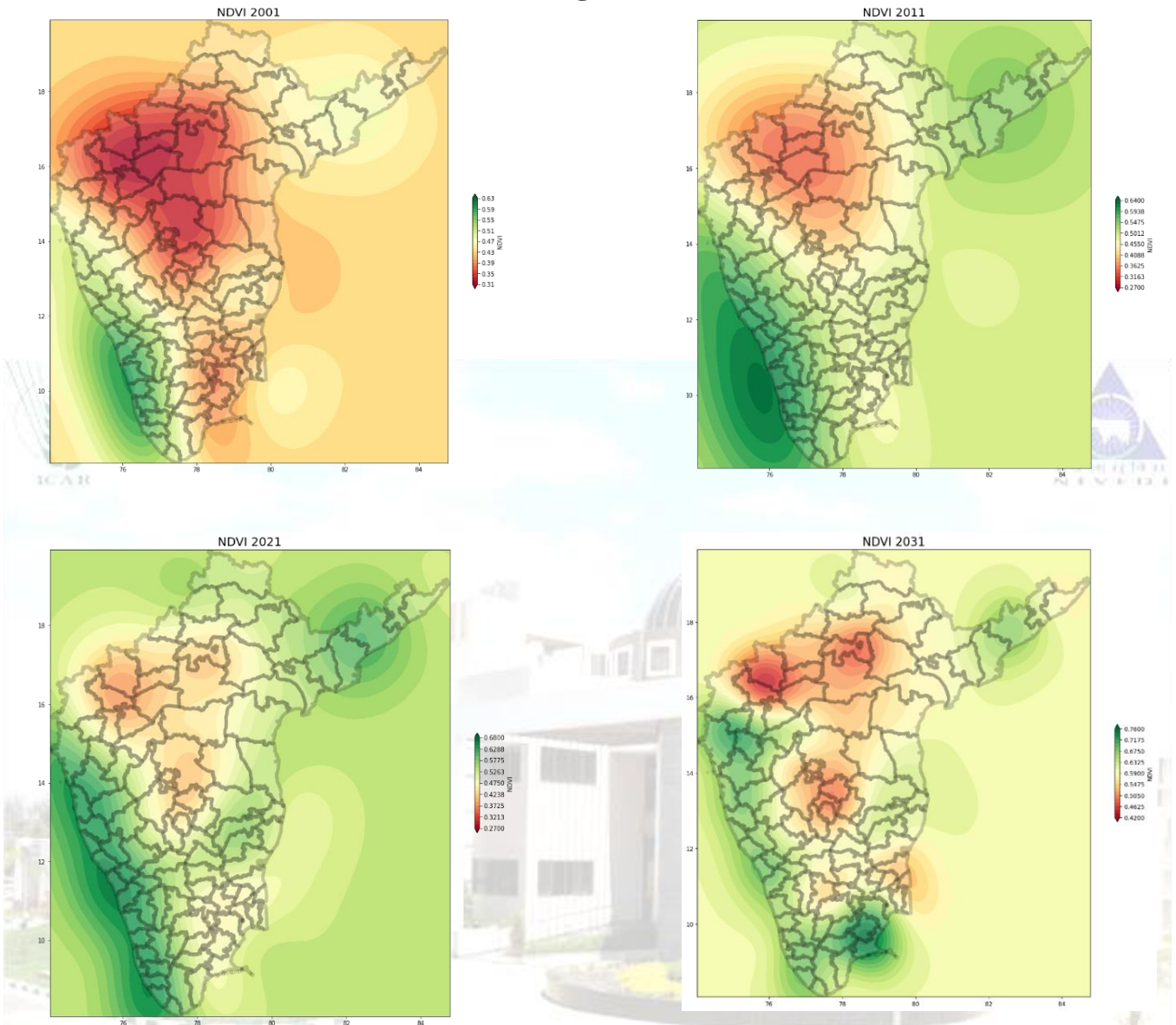
THI for 2001

THI for 2011
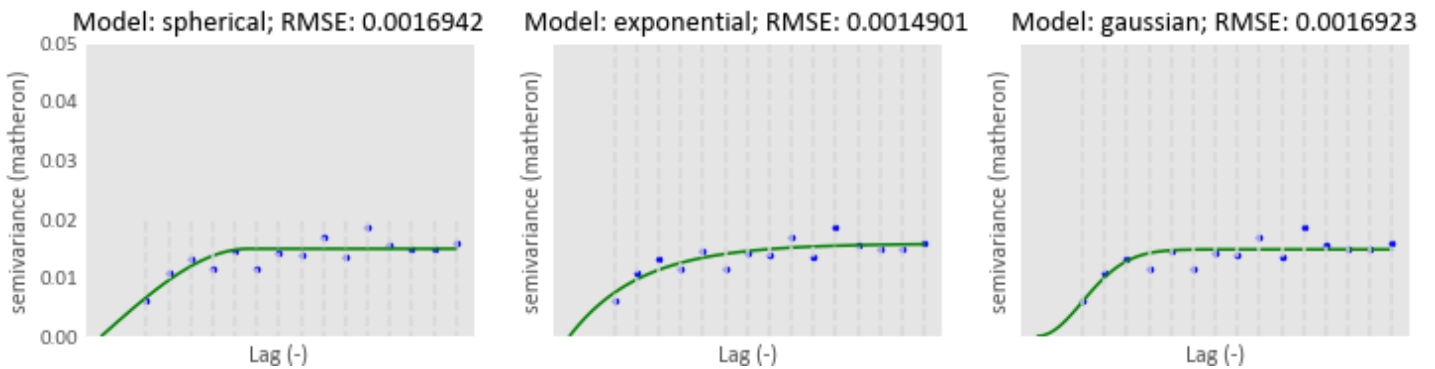

THI for 2021

THI for 2023 (Predicted)

15.2. Southern States Normalized DifferenceVegitation Index (NDVI)
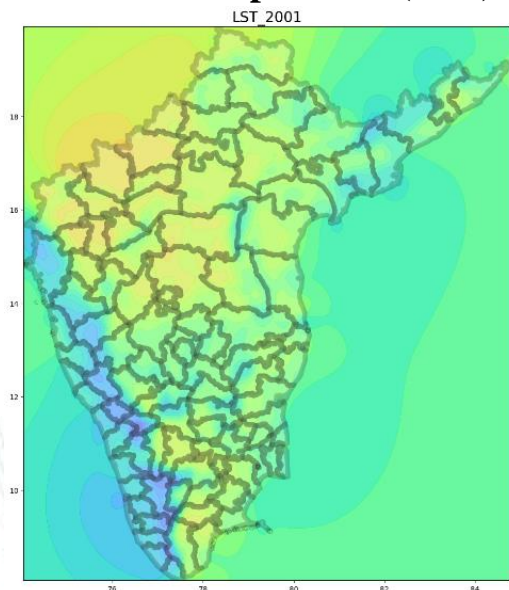

NDVI 2001

NDVI 2011

NDVI 2021

NDVI 2031

Best fit Variogram model for NDVI:

After comparing various variogram models, we could choose the one that would fit kriging the best based on the RMSE value. Based on the result with the lowest RMSE, we may say that the exponential model was best specified.
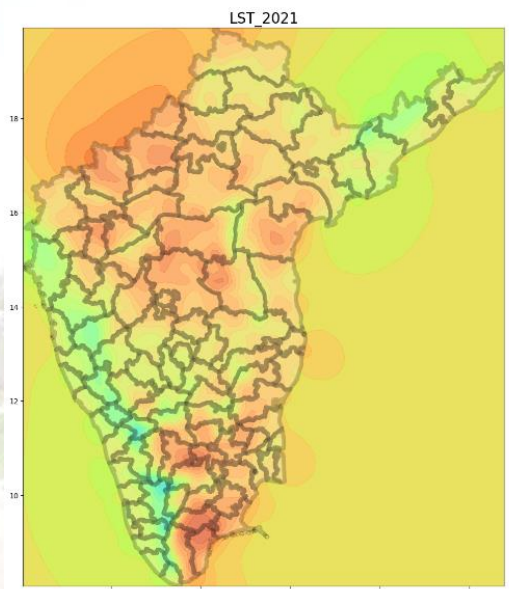

Model: spherical; RMSE: 0.0016942

Model: exponential; RMSE: 0.0014901

Model: gaussian; RMSE: 0.0016923

15.3 Land Surface Temperature (LST) - 2001-2031
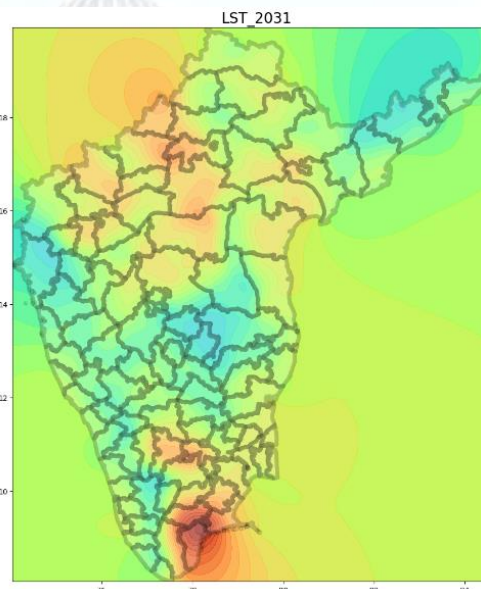

LST-2001
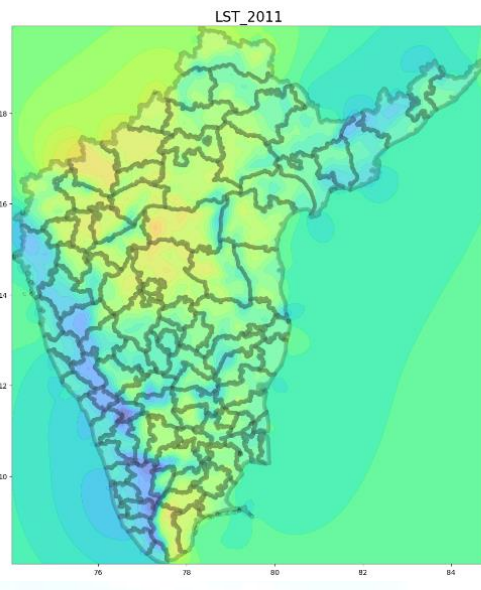
LST-2011

LST-2021

LST-2031(Predicted)

Kriging Results

Models:

- **Ordinary Kriging**: Ordinary Kriging is a spatial estimation method where the error variance is minimized

- **variogram_model:** Gaussian Model
  p·(1−e−d2(47r)2)+n

  Variables are defined as:

  dd = distance values at which to calculate the variogram

  pp = partial sill (psill = sill - nugget)

  rr = range

  nn = nugget

  ss = scaling factor or slope

  ee = exponent for power model

- **Spatial data:10km/grid**

- **THI (Temperature Humidity Index) data:** The THI data Generate using Air Temperature and Relative Humidity and the Following   equation
  THI= (1.8*AT+32)-[(0.0055-0055*RH)*(1.8*AT-26)]
  AT: Airtemparture
  RH: Relative Humidity

APPENDIX
Abbreviations

NADRES   :   National Animal Disease Referral Expert System

R   :   R environment for statistical computing

BQ   :   Black Quarter

BT   :   Bluetongue

ET   :   Enterotoxaemia

FMD   :   Foot and Mouth disease

HS   :   HaemorrhagicSepticaemia

PPR   :   Peste des Petits Ruminants

SGP   :   Sheep and Goat pox

SF   :   Swine Fewer

hPa   :   Hectopascals

NR   :   No risk/No data available

VLR   :   Very low risk

LR   :   Low risk

MR   :   Moderate risk

HR   :   High risk

VHR   :   Very high risk

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ICAR - National Institute of Veterinary Epidemiology and Disease Informatics

Customer/Client Feedback Form
Feedback for the Livestock Diseases Risk Forewarning Bulletin of December-2022, Volume 10 and Issue 12

(Please return this duly fill in after receiving the outbreak report of February-2023)

1. **Details of the number of districts with diseases reported vs. forecast in your state.**

Sl. No	Disease Name	No. of districts in which outbreaks occurred but not alerted**	Measures taken in case of disease forecasted: Yes or No.**	Any other
1.	Anthrax			
2.	Babesiosis			
3.	Black Quarter			
4.	Bluetongue			
5.	Enterotoxaemia			
6.	Fasciolosis			
7.	Foot and mouth disease			
8.	Haemorrhagic septicaemia			
9.	Peste des Petits Ruminants			
10.	Sheep & Goat pox			
11.	Classical Swine fever			
12.	Theileriosis			
13.	Trypanosomosis			

**Details may be written here.

2. What are the preventive measures taken in case of predicted outbreaks?

3. How would you rate your satisfaction with the following aspects of the services you have received or accessed?

Description	Very satisfied	Satisfied	Unsatisfied	Not sure
Quality of services provided				
Timeliness of alerts received				
Benefits from forecasting of livestock diseases				
Your awareness of this service				

4. Suggestions for further improvement of report.

Sign and Signature with Designation

AICRP centre:

Dated:

ICAR-National Institute of Veterinary Epidemiology and Disease Informatics (ICAR_NIVEDI),

P. B. No.6450, Yelahanka, Bengaluru-560064

Phone: +91-80-23093111, Fax: +91-80-23093222, E-mail: director.nivedi@icar.gov.in