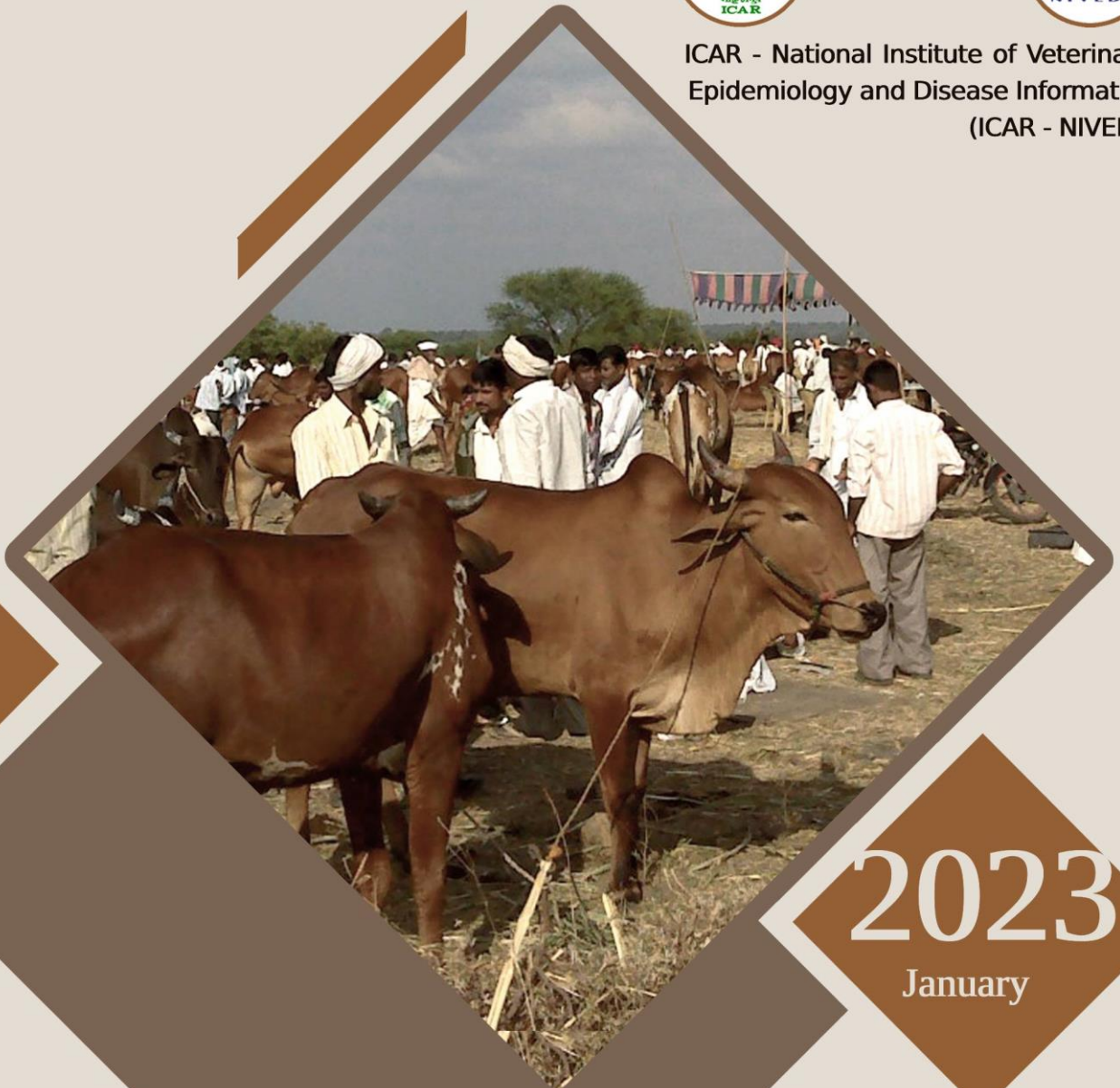


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ICAR - National Institute of Veterinary  
Epidemiology and Disease Informatics  
(ICAR - NIVEDI)



2023  
January

# LIVESTOCK DISEASE RISK FOREWARNING BULLETIN

Powered by Artificial Intelligence

PUBLISHED BY:  
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ICAR-NIVEDI

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FARMER REGISTRATION AND UNIFIED  
BENEFICIARY INFORMATION SYSTEM  
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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**

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Director (Acting)  
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 5<sup>th</sup> 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 January 2023 revealed Jharkhand, Karnataka, Uttar Pradesh and West Bengal 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 and PPR outbreaks are high in Jharkhand, 15 and 13 respectively. Further the co-occurrence of FMD and HS can be expected in Andhra Pradesh, Gujarat, Jharkhand, Karnataka, Kerala, Madhya Pradesh, Manipur, Meghalaya, Odisha, Rajasthan, Tripura and West Bengal. Among the different diseases in livestock, the predicted outbreaks are expected to be high for FMD (97) and PPR (93).

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 January- 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	4	0	0	0	2	0	1	1	3	0	0	0	0	11
3	Arunachal Pradesh	0	0	0	0	0	2	0	0	1	1	2	0	0	6
4	Assam	0	0	9	0	3	10	0	1	1	2	11	0	0	37
5	Bihar	0	0	0	0	0	0	4	0	2	0	0	0	1	7
6	Goa	0	1	0	0	0	0	0	0	1	0	1	0	0	3
7	Gujarat	0	0	0	0	0	2	5	3	2	0	0	0	2	14
8	Haryana	0	0	0	0	1	0	1	0	4	1	4	1	0	12
9	Himachal Pradesh	0	0	0	0	0	0	0	0	2	2	0	0	0	4
10	Jammu & Kashmir	0	0	0	0	0	0	1	0	2	12	0	0	0	15
11	Jharkhand	1	21	10	0	4	22	15	13	13	1	5	21	19	145
12	Karnataka	6	0	9	12	9	0	12	15	11	10	0	1	0	85
13	Kerala	1	3	0	0	0	0	11	6	5	1	2	2	0	31
14	Madhya Pradesh	1	0	0	0	0	0	6	7	2	0	3	0	0	19
15	Maharashtra	0	0	1	0	0	0	0	3	5	3	4	0	0	16
16	Manipur	0	1	6	0	0	3	3	1	0	0	1	0	0	15
17	Meghalaya	1	0	2	0	0	0	5	2	0	0	6	0	0	16
18	Mizoram	0	0	1	0	0	1	1	0	0	0	3	0	0	6
19	Nagaland	0	0	0	0	0	1	3	0	0	0	3	0	0	7
20	Odisha	1	0	8	0	0	0	4	1	3	1	1	1	0	20
21	Puducherry	0	3	0	0	0	2	0	0	1	1	0	0	0	7
22	Punjab	0	0	0	0	0	0	0	0	1	0	2	0	0	3
23	Rajasthan	0	0	0	0	1	0	7	3	6	2	1	1	0	21
24	Sikkim	0	1	0	0	0	0	0	0	0	0	0	0	0	1
25	Tamil Nadu	6	0	0	0	0	0	1	0	8	3	0	0	0	18
26	Telangana	1	0	0	0	2	0	0	0	0	0	0	0	0	3
27	Tripura	0	2	1	0	0	3	2	2	0	2	4	0	0	16
28	Uttar Pradesh	0	27	0	0	1	4	1	0	9	1	0	20	9	72
29	Uttarakhand	0	0	0	0	0	0	2	0	0	0	0	0	0	2
30	West Bengal	2	4	7	0	0	1	12	6	11	4	0	8	2	57
<b>Total number of districts likely for risk of disease</b>		<b>24</b>	<b>63</b>	<b>54</b>	<b>12</b>	<b>23</b>	<b>54</b>	<b>97</b>	<b>64</b>	<b>93</b>	<b>47</b>	<b>53</b>	<b>55</b>	<b>33</b>	<b>672</b>

### **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 and is ready for release.

#### **How it is different from previous version?**

In brief, it can be said that NADRES v<sub>2</sub> 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.

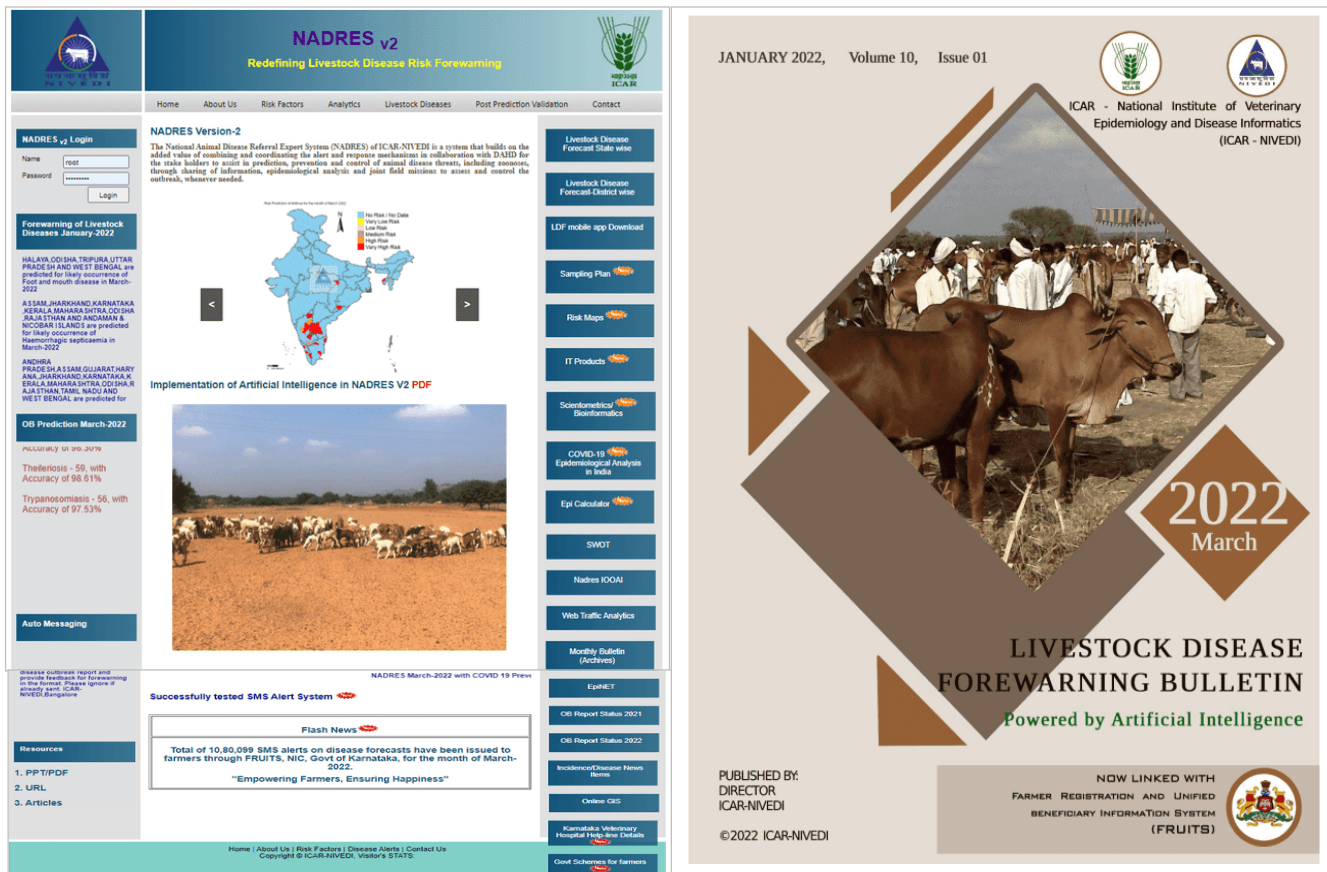


Fig 3.1.NADRES V<sub>2</sub> Home page

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 v<sub>2</sub> 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 20<sup>th</sup> 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
<b>Total Livestock</b>			<b>512056</b>	<b>536761</b>	<b>4.8</b>



### **Meteorological and Remotely Sensed Data:**

The parameters such as air temperature ( $^{\circ}\text{C}$ ), 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;

<b>PRODUCT</b>	<b>Science Data Sets (HDF Layers)</b>
<b>MOD15A2H</b>	Lai_500m (Leaf area index) 8 days average
<b>MOD16A2</b>	PET_500m (Total Potential Evapotranspiration) 8 days average
<b>MOD11A2</b>	LST_Day_1km (Daytime Land Surface Temperature) 8 days average
<b>MOD13A1</b>	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**



### III. Weighted Outbreak Score

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.

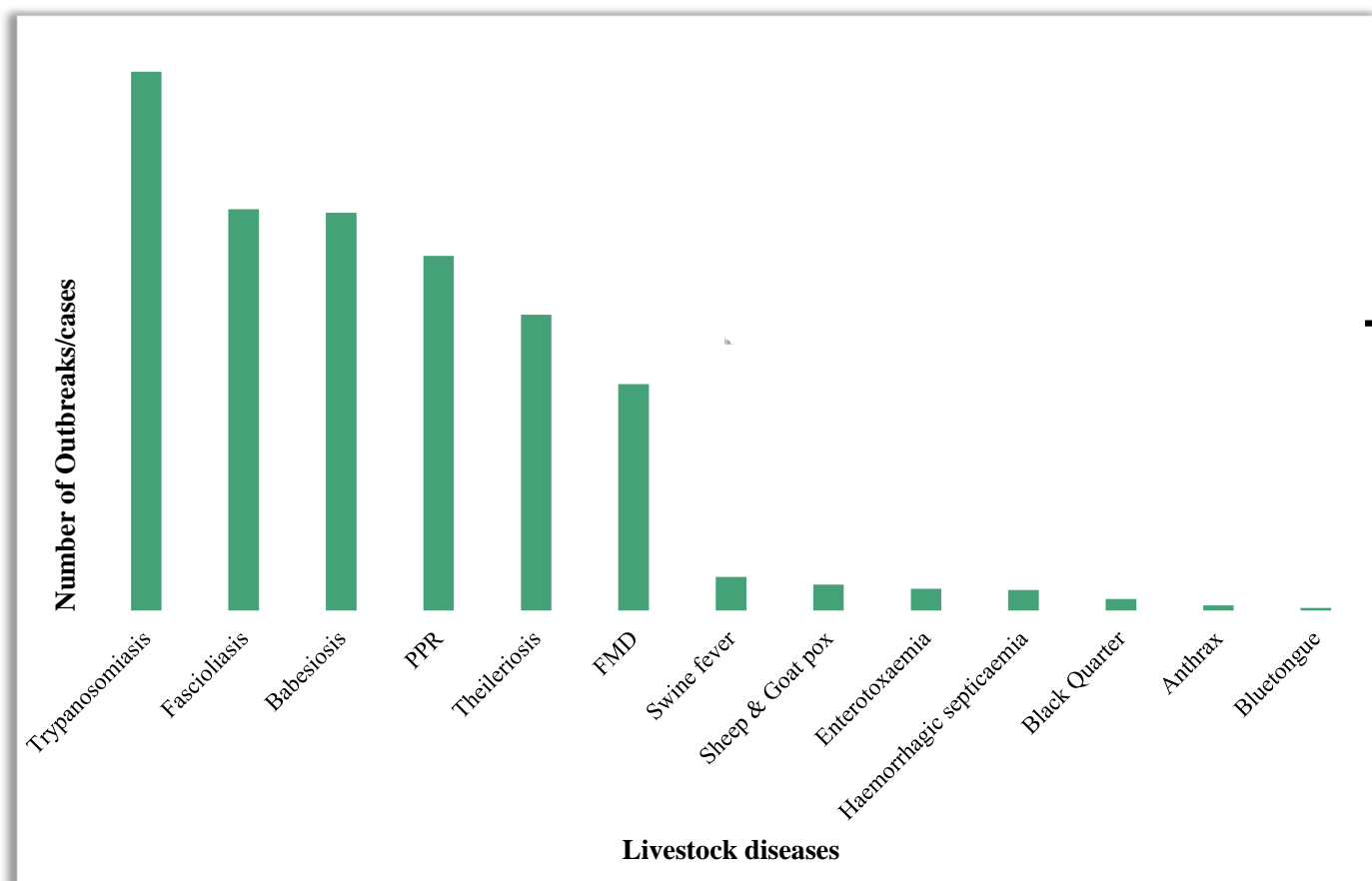


Fig 4.3. Top ten livestock diseases (2021)

### IV. Forecasting of Weather Parameters

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 situation in 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 validation of our forecasts ([https://mausam.imd.gov.in/imd\\_latest/contents/extendedrangeforecast.php](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,

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

Where,  $Y_t$  is the differenced time series value,  $\phi$  and  $\theta$  are unknown parameters and  $\epsilon$  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.	<b>Anthrax</b>	<b>99.54</b>
2.	<b>Babesiosis</b>	<b>98.30</b>
3.	<b>Black quarter</b>	<b>97.84</b>
4.	<b>Bluetongue</b>	<b>99.54</b>
5.	<b>Enterotoxaemia</b>	<b>100</b>
6.	<b>Fasciolosis</b>	<b>100</b>
7.	<b>Foot and mouth disease</b>	<b>93.98</b>
8.	<b>Haemorrhagic septicaemia</b>	<b>94.91</b>
9.	<b>Peste des petits ruminants</b>	<b>95.06</b>
10.	<b>Sheep &amp; Goat pox</b>	<b>98.46</b>
11.	<b>Swine fever</b>	<b>97.69</b>
12.	<b>Theileriosis</b>	<b>99.85</b>
13.	<b>Trypanosomosis</b>	<b>98.92</b>

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 *openxlsx*, *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 JANUARY, 2023

### i). District wise Livestock Disease forewarning:

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

Districts of Andaman and Nicobar	Livestock Diseases												
	Anthrax	Babesiosis	BQ	BT	ET	Fasciolosis	FMD	HS	PPR	S&G Pox	SF	Theileriosis	Trypanosomosis
Nicobars	NR	NR	NR	NR	NR	<i>VHR</i>	NR	NR	NR	NR	NR	NR	NR
North & Middle Andaman	NR	NR	NR	VLR	NR	<i>VHR</i>	NR	NR	NR	NR	NR	NR	NR
South Andaman	NR	NR	NR	NR	NR	<i>VHR</i>	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 January, 2023: Andhra Pradesh

Districts of Andhra Pradesh	Livestock Diseases												
	Anthrax	Babesiosis	BQ	BT	ET	Fasciolosis	FMD	HS	PPR	S&G Pox	SF	Theileriosis	Trypanosomosis
Anantapur	<b>VHR</b>	NR	NR	VLR	NR	NR	NR	NR	<b>VHR</b>	NR	NR	NR	NR
Chittoor	MR	NR	NR	VLR	NR	NR	NR	<b>VHR</b>	NR	NR	NR	NR	NR
East Godavari	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Guntur	NR	NR	NR	VLR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Krishna	NR	NR	NR	VLR	<b>VHR</b>	NR	NR	VLR	NR	NR	NR	NR	NR
Kurnool	<b>VHR</b>	NR	NR	VLR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Prakasam	<b>VHR</b>	NR	NR	NR	<b>VHR</b>	NR	NR	NR	NR	NR	NR	NR	NR
Sri PottiSriramulu Nellore	<b>VHR</b>	NR	NR	VLR	NR	NR	NR	NR	<b>VHR</b>	VLR	NR	NR	NR
Srikakulam	NR	NR	NR	VLR	NR	NR	<b>HR</b>	NR	NR	NR	NR	NR	NR
Visakhapatnam	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Vizianagaram	NR	NR	NR	VLR	NR	NR	VLR	NR	NR	NR	NR	NR	NR
West Godavari	NR	NR	VLR	NR	NR	NR	VLR	NR	<b>VHR</b>	NR	NR	NR	VLR
Y.S.R.	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 January, 2023: Arunachal Pradesh

Districts of Arunachal Pradesh	Livestock Diseases												
	Anthrax	Babesiosis	BQ	BT	ET	Fasciolosis	FMD	HS	PPR	S&G Pox	SF	Theileriosis	Trypanosomosis
Anjaw	NR	NR	VLR	NR	NR	NR	NR	NR	NR	VLR	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	VLR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
East Siang	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	<b>VHR</b>	NR	NR
KurungKumey	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Lohit	NR	NR	MR	NR	NR	NR	NR	VLR	NR	NR	NR	NR	NR
Lower Dibang Valley	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Lower Subansiri	NR	NR	VLR	NR	NR	<b>VHR</b>	NR	NR	NR	NR	<b>VHR</b>	NR	NR
Papum Pare	NR	NR	NR	NR	NR	<b>VHR</b>	NR	NR	<b>VHR</b>	NR	NR	NR	NR
Tawang	NR	NR	NR	NR	NR	NR	NR	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	VLR	NR	NR	NR	NR	NR
Upper Subansiri	NR	NR	NR	NR	NR	NR	NR	NR	NR	<b>VHR</b>	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 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 January, 2023: Assam

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

Continued

Districts of Assam	Livestock Diseases												
	Anthrax	Babesiosis	BQ	BT	ET	Fasciolosis	FMD	HS	PPR	S&G Pox	SF	Theileriosis	Trypanosomosis
Nagaon	NR	NR	<b>VHR</b>	NR	NR	NR	VLR	VLR	NR	NR	NR	NR	NR
Nalbari	NR	NR	VLR	NR	NR	<b>VHR</b>	NR	NR	NR	NR	<b>VHR</b>	NR	NR
Sivasagar	NR	NR	NR	NR	<b>VHR</b>	NR	NR	VLR	NR	NR	NR	NR	NR
Sonitpur	NR	NR	<b>VHR</b>	NR	<b>VHR</b>	NR	NR	<b>HR</b>	<b>VHR</b>	NR	NR	NR	NR
Tinsukia	NR	NR	NR	NR	NR	NR	NR	VLR	NR	<b>VHR</b>	<b>VHR</b>	NR	NR
Udalguri	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 January, 2023: Bihar

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

Continued

Districts of Bihar	Livestock Diseases												
	Anthrax	Babesiosis	BQ	BT	ET	Fasciolosis	FMD	HS	PPR	S&G Pox	SF	Theileriosis	Trypanosomosis
Nalanda	NR	NR	NR	NR	NR	NR	<b>VHR</b>	NR	NR	NR	NR	NR	NR
Nawada	NR	NR	NR	VLR	NR	NR	VLR	NR	NR	NR	NR	NR	NR
PashchimChampan	NR	NR	NR	NR	NR	NR	VLR	NR	NR	NR	NR	NR	NR
Patna	NR	MR	VLR	VLR	NR	NR	<b>VHR</b>	MR	NR	NR	NR	NR	NR
PurbaChampan	NR	NR	NR	NR	NR	NR	VLR	NR	NR	NR	NR	NR	NR
Purnia	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Rohtas	NR	NR	NR	VLR	NR	NR	VLR	VLR	NR	NR	NR	NR	NR
Saharsa	NR	NR	NR	VLR	NR	NR	VLR	NR	NR	NR	NR	NR	NR
Samastipur	NR	NR	NR	VLR	NR	NR	<b>HR</b>	NR	NR	NR	NR	NR	NR
Saran	NR	NR	NR	NR	NR	NR	VLR	NR	NR	NR	NR	NR	NR
Sheikhpura	NR	MR	VLR	VLR	NR	NR	<b>VHR</b>	NR	NR	NR	NR	NR	<b>VHR</b>
Sheohar	NR	NR	NR	NR	NR	NR	VLR	NR	NR	NR	NR	NR	NR
Sitamarhi	NR	NR	NR	NR	NR	NR	MR	NR	NR	NR	NR	NR	NR
Siwan	NR	NR	NR	NR	NR	NR	NR	NR	<b>VHR</b>	NR	NR	NR	NR
Supaul	NR	NR	NR	NR	NR	NR	VLR	NR	NR	NR	NR	NR	NR
Vaishali	NR	NR	NR	VLR	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 January, 2023: Chandigarh

Districts of Chandigarh	Livestock Diseases												
	Anthrax	Babesiosis	BQ	BT	ET	Fasciolosis	FMD	HS	PPR	S&G Pox	SF	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 January, 2023: Chhattisgarh

Districts of Chhattisgarh	Livestock Diseases												
	Anthrax	Babesiosis	BQ	BT	ET	Fasciolosis	FMD	HS	PPR	S&G Pox	SF	Theileriosis	Trypanosomosis
Bastar	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Bijapur	NR	NR	NR	NR	NR	NR	VLR	NR	NR	NR	NR	NR	NR
Bilaspur	NR	NR	NR	NR	NR	NR	VLR	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	VLR	NR	NR	NR	NR	NR	NR
Durg	NR	NR	NR	NR	NR	NR	VLR	NR	NR	NR	NR	NR	NR
Janjgir-champa	NR	NR	NR	VLR	NR	NR	VLR	NR	NR	NR	NR	NR	NR
Jashpur	NR	NR	NR	NR	NR	NR	VLR	NR	NR	NR	NR	NR	NR
Kabeerdham	NR	NR	NR	NR	NR	NR	VLR	NR	NR	NR	NR	NR	NR
Korba	NR	NR	NR	NR	NR	NR	VLR	NR	NR	NR	NR	NR	NR
Koriya	NR	NR	NR	NR	NR	NR	VLR	NR	NR	NR	NR	NR	NR
Mahasamund	NR	NR	NR	VLR	NR	NR	VLR	NR	NR	NR	NR	NR	NR
Narayanpur	NR	NR	NR	NR	NR	NR	VLR	NR	NR	NR	NR	NR	NR
Raigarhh	NR	NR	NR	NR	NR	NR	VLR	NR	NR	NR	NR	NR	NR
Raipur	NR	NR	NR	NR	NR	NR	VLR	NR	NR	NR	NR	NR	NR
Rajnandgaon	NR	NR	NR	NR	NR	NR	VLR	NR	NR	NR	NR	NR	NR
Surguja	NR	NR	NR	NR	NR	NR	VLR	NR	NR	NR	NR	NR	NR
Uttar BastarKanker	NR	NR	NR	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 Risk Forewarning for January, 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	SF	Theileriosis	Trypanosomosis
Dadra and Nagar Haveli	NR	NR	NR	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 Risk Forewarning for January, 2023: Daman and Diu

Districts of Daman and Diu	Livestock Diseases												
	Anthrax	Babesiosis	BQ	BT	ET	Fasciolosis	FMD	HS	PPR	S&G Pox	SF	Theileriosis	Trypanosomosis
Daman	NR	NR	VLR	VLR	NR	NR	VLR	NR	NR	NR	NR	NR	NR
Diu	NR	NR	NR	VLR	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 January, 2023: Goa

Districts of Goa	Livestock Diseases												
	Anthrax	Babesiosis	BQ	BT	ET	Fasciolosis	FMD	HS	PPR	S&G Pox	SF	Theileriosis	Trypanosomosis
North Goa	NR	<b>VHR</b>	NR	VLR	NR	NR	NR	MR	<b>VHR</b>	NR	NR	NR	NR
South Goa	NR	NR	NR	VLR	NR	NR	NR	VLR	NR	NR	<b>VHR</b>	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 January, 2023: Gujarat

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

**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 January, 2023: Haryana

Districts of Haryana	Livestock Diseases												
	Anthrax	Babesiosis	BQ	BT	ET	Fasciolosis	FMD	HS	PPR	S&G Pox	SF	Theileriosis	Trypanosomosis
Ambala	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Bhiwani	NR	NR	NR	NR	NR	NR	VLR	NR	<b>VHR</b>	<b>VHR</b>	<b>VHR</b>	NR	NR
Faridabad	NR	NR	NR	NR	NR	NR	NR	VLR	NR	NR	NR	NR	NR
Fatehabad	NR	NR	NR	NR	NR	NR	VLR	NR	NR	NR	NR	NR	NR
Gurgaon	NR	NR	NR	NR	NR	NR	NR	NR	<b>VHR</b>	NR	NR	NR	NR
Hisar	NR	NR	NR	NR	<b>VHR</b>	NR	<b>VHR</b>	NR	<b>VHR</b>	NR	<b>VHR</b>	<b>VHR</b>	NR
Jhajjar	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	<b>VHR</b>	NR	NR
Jind	NR	NR	NR	NR	NR	NR	NR	VLR	NR	NR	NR	NR	NR
Kaithal	NR	NR	NR	NR	NR	NR	VLR	VLR	NR	NR	NR	NR	NR
Karnal	NR	NR	NR	NR	NR	NR	VLR	VLR	NR	NR	NR	NR	NR
Kurukshetra	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Mahendragarh	NR	NR	NR	NR	NR	NR	VLR	VLR	NR	NR	NR	NR	NR
Mewat	NR	NR	NR	NR	NR	NR	VLR	VLR	NR	NR	NR	NR	NR
Palwal	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Panchkula	NR	NR	NR	NR	NR	NR	VLR	NR	NR	NR	NR	NR	NR
Panipat	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Rewari	NR	NR	NR	NR	NR	NR	VLR	MR	NR	NR	NR	NR	NR
Rohtak	NR	NR	NR	NR	NR	NR	VLR	VLR	NR	NR	NR	NR	NR
Sirsa	NR	NR	NR	NR	NR	NR	VLR	VLR	<b>VHR</b>	NR	NR	NR	NR
Sonipat	NR	NR	NR	NR	NR	NR	VLR	NR	NR	NR	<b>VHR</b>	NR	NR
Yamunanagar	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 January, 2023: Himachal Pradesh

Districts of Himachal Pradesh	Livestock Diseases												
	Anthrax	Babesiosis	BQ	BT	ET	Fasciolosis	FMD	HS	PPR	S&G Pox	SF	Theileriosis	Trypanosomosis
Bilaspur	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Chamba	NR	NR	NR	NR	NR	NR	VLR	NR	NR	NR	NR	NR	NR
Hamirpur	NR	NR	NR	NR	NR	NR	VLR	NR	NR	NR	NR	NR	NR
Kangra	NR	NR	NR	VLR	NR	NR	VLR	VLR	NR	NR	NR	NR	NR
Kinnaur	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Kullu	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Lahul&Spiti	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Mandi	NR	NR	NR	VLR	NR	NR	VLR	VLR	<b>VHR</b>	NR	NR	NR	NR
Shimla	NR	NR	NR	VLR	NR	NR	VLR	VLR	<b>VHR</b>	<b>VHR</b>	NR	NR	NR
Sirmaur	NR	NR	NR	NR	NR	NR	VLR	NR	NR	<b>HR</b>	NR	NR	NR
Solan	NR	NR	NR	NR	NR	NR	VLR	VLR	NR	NR	NR	NR	NR
Una	NR	NR	NR	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 Risk Forewarning for January, 2023: Jammu and Kashmir

Districts of Jammu and Kashmir	Livestock Diseases												
	Anthrax	Babesiosis	BQ	BT	ET	Fasciolosis	FMD	HS	PPR	S&G Pox	SF	Theileriosis	Trypanosomosis
Anantnag	NR	NR	NR	NR	NR	NR	VLR	NR	NR	<b>VHR</b>	NR	NR	NR
Badgam	NR	NR	NR	NR	NR	NR	VLR	NR	NR	<b>VHR</b>	NR	NR	NR
Bandipore	NR	NR	NR	NR	NR	NR	VLR	NR	NR	<b>VHR</b>	NR	NR	NR
Baramula	NR	NR	NR	NR	NR	NR	VLR	NR	NR	<b>VHR</b>	NR	NR	NR
Doda	NR	NR	NR	NR	NR	NR	VLR	NR	NR	VLR	NR	NR	NR
Ganderbal	NR	NR	NR	NR	NR	NR	VLR	NR	NR	NR	NR	NR	NR
Jammu	NR	NR	NR	NR	NR	NR	NR	NR	NR	<b>HR</b>	NR	NR	NR
Kargil	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Kathua	NR	NR	NR	NR	NR	NR	VLR	VLR	NR	VLR	NR	NR	NR
Kishtwar	NR	NR	NR	NR	NR	NR	NR	NR	NR	<b>HR</b>	NR	NR	NR
Kulgam	NR	NR	NR	NR	NR	NR	VLR	NR	NR	<b>VHR</b>	NR	NR	NR
Kupwara	NR	NR	NR	VLR	NR	NR	VLR	NR	<b>VHR</b>	<b>VHR</b>	NR	NR	NR
Leh(Ladakh)	NR	NR	NR	NR	NR	NR	NR	NR	NR	VLR	NR	NR	NR
Pulwama	NR	NR	NR	NR	NR	NR	NR	NR	<b>VHR</b>	<b>VHR</b>	NR	NR	NR
Punch	NR	NR	NR	VLR	NR	NR	VLR	NR	NR	MR	NR	NR	NR
Rajouri	NR	NR	NR	VLR	NR	NR	VLR	NR	NR	<b>HR</b>	NR	NR	NR
Ramban	NR	NR	NR	NR	NR	NR	VLR	NR	NR	VLR	NR	NR	NR
Reasi	NR	NR	NR	NR	NR	NR	VLR	NR	NR	NR	NR	NR	NR
Samba	NR	NR	NR	NR	NR	NR	NR	VLR	NR	NR	NR	NR	NR
Shupiyan	NR	NR	NR	NR	NR	NR	NR	NR	NR	<b>VHR</b>	NR	NR	NR
Srinagar	NR	NR	NR	NR	NR	NR	<b>HR</b>	NR	NR	<b>HR</b>	NR	NR	NR
Udhampur	NR	NR	NR	NR	NR	NR	VLR	VLR	NR	VLR	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 January, 2023: Jharkhand

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

**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 January, 2023: Karnataka

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

Continued

Districts of Karnataka	Livestock Diseases												
	Anthrax	Babesiosis	BQ	BT	ET	Fasciolosis	FMD	HS	PPR	S&G Pox	SF	Theileriosis	Trypanosomosis
Gulbarga	NR	NR	<b>HR</b>	VLR	NR	NR	VLR	NR	NR	NR	NR	NR	NR
Hassan	NR	NR	<b>HR</b>	VLR	NR	NR	<b>HR</b>	LR	<b>VHR</b>	NR	NR	NR	NR
Haveri	NR	NR	VLR	<b>HR</b>	NR	NR	LR	<b>HR</b>	NR	LR	NR	NR	NR
Kodagu	NR	NR	NR	VLR	NR	NR	<b>HR</b>	MR	NR	NR	NR	NR	NR
Kolar	MR	NR	LR	<b>HR</b>	NR	NR	<b>HR</b>	<b>VHR</b>	<b>VHR</b>	<b>VHR</b>	NR	NR	NR
Koppal	<b>HR</b>	NR	VLR	<b>VHR</b>	<b>VHR</b>	NR	VLR	<b>HR</b>	NR	<b>VHR</b>	NR	NR	NR
Mandya	NR	NR	<b>HR</b>	VLR	<b>VHR</b>	NR	<b>VHR</b>	VLR	<b>VHR</b>	NR	NR	NR	NR
Mysore	NR	NR	<b>VHR</b>	<b>HR</b>	<b>VHR</b>	NR	<b>VHR</b>	VLR	NR	<b>HR</b>	NR	NR	NR
Raichur	<b>HR</b>	NR	MR	MR	NR	NR	VLR	<b>HR</b>	NR	VLR	NR	NR	NR
Ramanagara	NR	NR	NR	VLR	<b>VHR</b>	NR	<b>VHR</b>	VLR	<b>VHR</b>	<b>VHR</b>	NR	NR	NR
Shimoga	NR	NR	<b>VHR</b>	<b>HR</b>	NR	NR	MR	<b>VHR</b>	<b>VHR</b>	MR	NR	<b>VHR</b>	NR
Tumkur	<b>VHR</b>	NR	<b>VHR</b>	<b>VHR</b>	<b>VHR</b>	NR	MR	<b>VHR</b>	<b>VHR</b>	<b>VHR</b>	NR	NR	NR
Udupi	NR	NR	NR	VLR	NR	NR	<b>HR</b>	VLR	NR	NR	NR	NR	NR
Uttara Kannada	NR	NR	<b>HR</b>	VLR	<b>VHR</b>	NR	MR	<b>VHR</b>	<b>VHR</b>	NR	NR	NR	NR
Yadgir	NR	NR	NR	VLR	NR	NR	VLR	MR	NR	VLR	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 January, 2023: Kerala

Districts of Kerala	Livestock Diseases												
	Anthrax	Babesiosis	BQ	BT	ET	Fasciolosis	FMD	HS	PPR	S&G Pox	SF	Theileriosis	Trypanosomosis
Alappuzha	NR	NR	NR	NR	NR	NR	<b>VHR</b>	VLR	NR	NR	NR	NR	NR
Ernakulam	NR	NR	NR	NR	NR	NR	<b>VHR</b>	VLR	<b>VHR</b>	NR	NR	NR	NR
Idukki	NR	<b>VHR</b>	NR	VLR	NR	NR	<b>VHR</b>	VLR	NR	NR	NR	<b>VHR</b>	NR
Kannur	NR	NR	NR	NR	NR	NR	<b>HR</b>	NR	NR	NR	<b>HR</b>	NR	NR
Kasaragod	NR	NR	NR	VLR	NR	NR	<b>HR</b>	<b>VHR</b>	NR	NR	NR	NR	NR
Kollam	NR	<b>HR</b>	NR	NR	NR	NR	<b>VHR</b>	<b>HR</b>	<b>VHR</b>	NR	NR	NR	NR
Kottayam	NR	NR	NR	NR	NR	NR	<b>VHR</b>	<b>VHR</b>	NR	NR	NR	NR	NR
Kozhikode	NR	NR	NR	NR	NR	NR	<b>VHR</b>	VLR	NR	NR	NR	NR	NR
Malappuram	NR	NR	NR	NR	NR	NR	<b>VHR</b>	VLR	<b>VHR</b>	VLR	NR	NR	NR
Palakkad	NR	NR	NR	NR	NR	NR	MR	<b>HR</b>	<b>VHR</b>	NR	NR	<b>VHR</b>	NR
Pathanamthitta	<b>VHR</b>	NR	NR	NR	NR	NR	<b>VHR</b>	VLR	NR	NR	NR	NR	NR
Thiruvananthapuram	NR	NR	NR	NR	NR	NR	<b>VHR</b>	<b>VHR</b>	NR	NR	NR	NR	NR
Thrissur	NR	NR	NR	NR	NR	NR	MR	<b>VHR</b>	<b>VHR</b>	<b>VHR</b>	<b>VHR</b>	NR	NR
Wayanad	NR	<b>HR</b>	NR	NR	NR	NR	MR	NR	MR	NR	NR	MR	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 January, 2023: Lakshadweep

Districts of Lakshadweep	Livestock Diseases												
	Anthrax	Babesiosis	BQ	BT	ET	Fasciolosis	FMD	HS	PPR	S&G Pox	SF	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 January, 2023: Madhya Pradesh

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



Continued

Districts of Madhya Pradesh	Livestock Diseases												
	Anthrax	Babesiosis	BQ	BT	ET	Fasciolosis	FMD	HS	PPR	S&G Pox	SF	Theileriosis	Trypanosomosis
Khargone (West Nimar)	NR	NR	NR	NR	NR	NR	VLR	VLR	NR	NR	NR	NR	NR
Mandla	NR	NR	NR	NR	NR	NR	<b>HR</b>	<b>VHR</b>	NR	NR	NR	NR	NR
Mandsaur	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Morena	NR	NR	NR	NR	NR	NR	VLR	VLR	NR	NR	NR	NR	NR
Narsimhapur	NR	NR	NR	NR	NR	NR	VLR	VLR	NR	NR	NR	NR	NR
Neemuch	NR	NR	NR	NR	NR	NR	VLR	VLR	NR	NR	NR	NR	NR
Panna	NR	NR	NR	NR	NR	NR	NR	VLR	NR	NR	NR	NR	NR
Raisen	NR	NR	NR	NR	NR	NR	VLR	VLR	NR	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	NR	VLR	NR	NR	NR	NR	NR
Rewa	NR	NR	NR	VLR	NR	NR	VLR	VLR	NR	NR	NR	NR	NR
Sagar	NR	NR	NR	NR	NR	NR	NR	<b>HR</b>	NR	NR	NR	NR	NR
Satna	NR	NR	NR	VLR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Sehore	NR	NR	NR	NR	NR	NR	VLR	VLR	NR	NR	NR	NR	NR
Seoni	NR	NR	NR	NR	NR	NR	<b>HR</b>	VLR	NR	NR	NR	NR	NR
Shahdol	NR	NR	NR	VLR	NR	NR	VLR	MR	NR	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	VLR	VLR	NR	NR	NR	NR	NR
Shivpuri	NR	NR	NR	NR	NR	NR	VLR	VLR	NR	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	VLR	NR	NR	NR	NR	NR	NR
Tikamgarh	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Ujjain	NR	NR	NR	NR	NR	NR	VLR	VLR	NR	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	<b>VHR</b>	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 January, 2023: Maharashtra

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

Continued

Districts of Maharashtra	Livestock Diseases												
	Anthrax	Babesiosis	BQ	BT	ET	Fasciolosis	FMD	HS	PPR	S&G Pox	SF	Theileriosis	Trypanosomosis
Parbhani	NR	NR	NR	NR	NR	NR	NR	VLR	NR	NR	NR	NR	NR
Pune	NR	NR	MR	VLR	NR	NR	NR	NR	<b>VHR</b>	<b>VHR</b>	NR	NR	NR
Raigarh	NR	NR	NR	VLR	NR	NR	VLR	VLR	NR	NR	NR	NR	NR
Ratnagiri	NR	NR	NR	VLR	NR	NR	VLR	VLR	NR	NR	NR	NR	NR
Sangli	NR	NR	NR	VLR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Satara	NR	NR	VLR	VLR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Sindhudurg	NR	NR	NR	NR	NR	NR	VLR	VLR	NR	NR	NR	NR	NR
Solapur	NR	NR	NR	VLR	NR	NR	NR	NR	NR	<b>VHR</b>	NR	NR	NR
Thane	NR	NR	NR	NR	NR	NR	VLR	<b>HR</b>	NR	NR	NR	NR	NR
Wardha	NR	NR	NR	VLR	NR	NR	NR	VLR	NR	NR	<b>VHR</b>	NR	NR
Washim	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Yavatmal	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 January, 2023: Manipur

Districts of Manipur	Livestock Diseases												
	Anthrax	Babesiosis	BQ	BT	ET	Fasciolosis	FMD	HS	PPR	S&G Pox	SF	Theileriosis	Trypanosomosis
Bishnupur	NR	NR	<b>VHR</b>	NR	NR	NR	<b>HR</b>	VLR	NR	NR	NR	NR	NR
Chandel	NR	NR	NR	NR	NR	NR	VLR	VLR	NR	NR	NR	NR	NR
Churachandpur	NR	NR	<b>HR</b>	NR	NR	NR	VLR	NR	NR	NR	NR	NR	NR
Imphal East	NR	NR	<b>VHR</b>	NR	NR	<b>VHR</b>	<b>VHR</b>	VLR	NR	NR	NR	NR	NR
Imphal West	NR	NR	<b>VHR</b>	NR	NR	<b>VHR</b>	VLR	VLR	NR	NR	NR	NR	NR
Senapati	NR	NR	<b>HR</b>	NR	NR	<b>VHR</b>	VLR	NR	NR	NR	NR	NR	NR
Tamenglong	NR	NR	VLR	NR	NR	NR	VLR	VLR	NR	NR	<b>VHR</b>	NR	NR
Thoubal	NR	<b>VHR</b>	VLR	NR	NR	NR	<b>VHR</b>	<b>VHR</b>	NR	NR	NR	NR	NR
Ukhrul	NR	NR	<b>HR</b>	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 January, 2023: Meghalaya

Districts of Meghalaya	Livestock Diseases												
	Anthrax	Babesiosis	BQ	BT	ET	Fasciolosis	FMD	HS	PPR	S&G Pox	SF	Theileriosis	Trypanosomosis
East Garo Hills	NR	NR	NR	NR	NR	NR	VLR	VLR	NR	VLR	<b>VHR</b>	NR	NR
East Jaintia Hills	NR	NR	VLR	VLR	NR	NR	VLR	VLR	NR	NR	NR	NR	NR
East Khasi Hills	<b>VHR</b>	NR	<b>VHR</b>	NR	NR	NR	<b>VHR</b>	NR	NR	NR	<b>VHR</b>	NR	NR
Jaintia Hills	NR	NR	NR	NR	NR	NR	<b>HR</b>	NR	NR	NR	NR	NR	NR
North Garo Hills	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	<b>VHR</b>	NR	NR
Ribhoi	NR	NR	NR	NR	NR	NR	<b>VHR</b>	NR	NR	NR	<b>HR</b>	NR	NR
South Garo Hills	NR	NR	NR	NR	NR	NR	VLR	VLR	NR	NR	<b>VHR</b>	NR	NR
Southwest Garo Hills	NR	NR	VLR	VLR	NR	NR	<b>HR</b>	<b>HR</b>	NR	NR	NR	NR	NR
Southwest Khasi Hills	NR	NR	NR	VLR	NR	NR	VLR	VLR	NR	NR	NR	NR	NR
West Garo Hills	NR	NR	<b>HR</b>	NR	NR	NR	<b>HR</b>	<b>VHR</b>	NR	VLR	<b>VHR</b>	NR	NR
West Khasi Hills	NR	NR	VLR	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 January, 2023: Mizoram

Districts of Mizoram	Livestock Diseases												
	Anthrax	Babesiosis	BQ	BT	ET	Fasciolosis	FMD	HS	PPR	S&G Pox	SF	Theileriosis	Trypanosomosis
Aizawl	NR	NR	<b>HR</b>	NR	NR	NR	LR	NR	NR	NR	<b>VHR</b>	NR	NR
Champhai	NR	NR	NR	NR	NR	<b>VHR</b>	VLR	MR	NR	NR	NR	NR	NR
Kolasib	NR	NR	NR	NR	NR	NR	VLR	NR	NR	NR	<b>VHR</b>	NR	NR
Lawngtlai	NR	NR	NR	NR	NR	NR	VLR	VLR	NR	NR	<b>VHR</b>	NR	NR
Lunglei	NR	NR	NR	NR	NR	NR	VLR	VLR	NR	NR	NR	NR	NR
Mamit	NR	NR	NR	NR	NR	NR	VLR	VLR	NR	NR	NR	NR	NR
Saiha	NR	NR	NR	NR	NR	NR	<b>VHR</b>	VLR	NR	NR	NR	NR	NR
Serchhip	NR	NR	NR	NR	NR	NR	LR	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 January, 2023: Nagaland

Districts of Nagaland	Livestock Diseases												
	Anthrax	Babesiosis	BQ	BT	ET	Fasciolosis	FMD	HS	PPR	S&G Pox	SF	Theileriosis	Trypanosomosis
Dimapur	NR	NR	VLR	NR	NR	NR	<b>HR</b>	VLR	NR	NR	NR	NR	NR
Kiphire	NR	NR	VLR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Kohima	NR	NR	VLR	NR	NR	NR	<b>HR</b>	NR	NR	NR	<b>VHR</b>	NR	NR
Longleng	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	<b>VHR</b>	NR	NR
Mokokchung	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Mon	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Peren	NR	NR	VLR	NR	NR	NR	VLR	VLR	NR	NR	NR	NR	NR
Phek	NR	NR	VLR	NR	NR	NR	VLR	NR	NR	NR	NR	NR	NR
Tuensang	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Wokha	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Zunheboto	NR	NR	VLR	NR	NR	<b>VHR</b>	<b>HR</b>	NR	NR	NR	<b>VHR</b>	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 January, 2023: NCT of Delhi

Districts of NCT of Delhi	Livestock Diseases												
	Anthrax	Babesiosis	BQ	BT	ET	Fasciolosis	FMD	HS	PPR	S&G Pox	SF	Theileriosis	Trypanosomosis
Central	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
East	NR	NR	NR	VLR	NR	NR	NR	NR	NR	NR	NR	NR	NR
New Delhi	NR	NR	NR	NR	NR	NR	VLR	NR	NR	NR	NR	NR	NR
North	NR	NR	NR	VLR	NR	NR	NR	NR	NR	NR	NR	NR	NR
North East	NR	NR	NR	NR	NR	NR	VLR	NR	NR	NR	NR	NR	NR
North West	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
South	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
South West	NR	NR	NR	NR	NR	NR	VLR	NR	NR	VLR	NR	NR	VLR
West	NR	NR	NR	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 Risk Forewarning for January, 2023: Odisha

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

Continued

Districts of Odisha	Livestock Diseases												
	Anthrax	Babesiosis	BQ	BT	ET	Fasciolosis	FMD	HS	PPR	S&G Pox	SF	Theileriosis	Trypanosomosis
Mayurbhanj	NR	NR	NR	NR	NR	NR	VLR	NR	MR	NR	NR	NR	VLR
Nabarangapur	NR	NR	NR	VLR	NR	NR	NR	VLR	NR	NR	<b>VHR</b>	NR	NR
Nayagarh	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Nuapada	NR	NR	NR	NR	NR	NR	VLR	MR	NR	NR	NR	NR	NR
Puri	NR	NR	<b>HR</b>	NR	NR	NR	VLR	NR	NR	NR	NR	NR	NR
Rayagada	NR	NR	<b>VHR</b>	VLR	NR	NR	NR	VLR	NR	NR	NR	NR	NR
Sambalpur	NR	NR	NR	NR	NR	NR	VLR	VLR	MR	NR	NR	NR	NR
Subarnapur	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Sundargarh	NR	NR	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 January, 2023: Puducherry

Districts of Puducherry	Livestock Diseases												
	Anthrax	Babesiosis	BQ	BT	ET	Fasciolosis	FMD	HS	PPR	S&G Pox	SF	Theileriosis	Trypanosomosis
Karaikal	NR	<b>VHR</b>	NR	VLR	NR	NR	NR	VLR	NR	NR	NR	NR	NR
Mahe	NR	<b>VHR</b>	NR	VLR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Puducherry	NR	<b>VHR</b>	NR	VLR	NR	<b>VHR</b>	NR	NR	<b>VHR</b>	<b>VHR</b>	NR	NR	NR
Yanam	NR	NR	VLR	VLR	NR	<b>VHR</b>	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 January, 2023: Punjab

Districts of Punjab	Livestock Diseases												
	Anthrax	Babesiosis	BQ	BT	ET	Fasciolosis	FMD	HS	PPR	S&G Pox	SF	Theileriosis	Trypanosomosis
Amritsar	NR	NR	NR	VLR	NR	NR	VLR	NR	NR	NR	NR	NR	NR
Barnala	NR	NR	NR	NR	NR	NR	NR	VLR	NR	NR	NR	NR	NR
Bathinda	NR	NR	NR	VLR	NR	NR	NR	NR	NR	NR	<b>VHR</b>	NR	NR
Faridkot	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Fatehgarh Sahib	NR	NR	NR	VLR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Firozpur	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Gurdaspur	NR	NR	NR	NR	NR	NR	NR	VLR	NR	NR	NR	NR	NR
Hoshiarpur	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Jalandhar	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Kapurthala	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Ludhiana	NR	NR	NR	VLR	NR	NR	NR	VLR	<b>VHR</b>	NR	<b>HR</b>	NR	NR
Mansa	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Moga	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Muktsar	NR	NR	NR	VLR	NR	NR	NR	VLR	NR	NR	NR	NR	NR
Patiala	NR	NR	NR	NR	NR	NR	NR	VLR	NR	NR	NR	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	NR	NR	NR	NR	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	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 January, 2023: Rajasthan

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

Continued

Districts of Rajasthan	Livestock Diseases												
	Anthrax	Babesiosis	BQ	BT	ET	Fasciolosis	FMD	HS	PPR	S&G Pox	SF	Theileriosis	Trypanosomosis
Kota	NR	NR	NR	NR	NR	NR	VLR	NR	NR	NR	NR	NR	NR
Nagaur	NR	NR	NR	NR	NR	NR	VLR	VLR	NR	VLR	NR	NR	NR
Pali	NR	NR	NR	VLR	NR	NR	VLR	VLR	NR	NR	NR	NR	NR
Pratapgarh	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Rajsamand	NR	NR	NR	VLR	NR	NR	VLR	NR	NR	NR	NR	NR	NR
Sawai Madhopur	NR	NR	NR	NR	NR	NR	NR	VLR	NR	NR	NR	NR	NR
Sikar	NR	NR	NR	NR	NR	NR	<b>VHR</b>	NR	NR	NR	NR	NR	NR
Sirohi	NR	NR	NR	NR	NR	NR	VLR	NR	NR	NR	NR	NR	NR
Tonk	NR	NR	NR	NR	NR	NR	VLR	VLR	<b>HR</b>	NR	NR	NR	NR
Udaipur	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 January, 2023: Sikkim

Districts of Sikkim	Livestock Diseases												
	Anthrax	Babesiosis	BQ	BT	ET	Fasciolosis	FMD	HS	PPR	S&G Pox	SF	Theileriosis	Trypanosomosis
East District	NR	<b>VHR</b>	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
North District	NR	NR	VLR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
South District	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
West District	NR	NR	NR	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 Risk Forewarning for January, 2023: Tamil Nadu

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



Continued

Districts of Tamil Nadu	Livestock Disease												
	Anthrax	Babesiosis	BQ	BT	ET	Fasciolosis	FMD	HS	PPR	S&G Pox	SF	Theileriosis	Trypanosomosis
Tiruchirappalli	NR	NR	NR	VLR	NR	NR	VLR	NR	NR	NR	NR	NR	NR
Tirunelveli	NR	NR	NR	VLR	NR	NR	MR	VLR	<b>VHR</b>	NR	NR	NR	NR
Tiruppur	NR	NR	NR	VLR	NR	NR	VLR	NR	NR	NR	NR	NR	NR
Tiruvannamalai	<b>VHR</b>	NR	NR	NR	NR	NR	VLR	NR	<b>VHR</b>	NR	NR	NR	NR
Vellore	<b>VHR</b>	NR	NR	VLR	NR	NR	VLR	NR	<b>VHR</b>	NR	NR	NR	NR
Viluppuram	<b>VHR</b>	NR	NR	VLR	NR	NR	VLR	NR	<b>VHR</b>	NR	NR	NR	NR
Virudhunagar	NR	NR	NR	VLR	NR	NR	VLR	NR	NR	<b>VHR</b>	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 January, 2023: Telangana

Districts of Telangana	Livestock Diseases												
	Anthrax	Babesiosis	BQ	BT	ET	Fasciolosis	FMD	HS	PPR	S&G Pox	SF	Theileriosis	Trypanosomosis
Adilabad	NR	NR	NR	NR	NR	NR	NR	VLR	NR	NR	NR	NR	NR
Hyderabad	NR	NR	NR	VLR	NR	NR	VLR	NR	NR	NR	NR	NR	NR
Karimnagar	NR	NR	NR	VLR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Khammam	NR	NR	NR	NR	<b>VHR</b>	NR	VLR	NR	NR	NR	NR	NR	NR
Mahbubnagar	NR	NR	NR	VLR	NR	NR	NR	VLR	NR	NR	NR	NR	NR
Medak	NR	NR	NR	VLR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Nalgonda	<b>VHR</b>	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Nizamabad	NR	NR	NR	VLR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Rangareddy	NR	NR	NR	VLR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Warangal	NR	NR	NR	VLR	<b>VHR</b>	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 January, 2023: Tripura

Districts of Tripura	Livestock Disease												
	Anthrax	Babesiosis	BQ	BT	ET	Fasciolosis	FMD	HS	PPR	S&G Pox	SF	Theileriosis	Trypanosomosis
Dhalai	NR	NR	VLR	NR	NR	NR	MR	VLR	NR	NR	<b>VHR</b>	NR	NR
North Tripura	NR	NR	VLR	NR	NR	<b>VHR</b>	<b>VHR</b>	VLR	NR	VLR	<b>VHR</b>	NR	NR
South Tripura	NR	<b>VHR</b>	NR	NR	NR	<b>VHR</b>	MR	<b>VHR</b>	NR	<b>VHR</b>	<b>VHR</b>	NR	NR
West Tripura	NR	<b>VHR</b>	<b>VHR</b>	NR	NR	<b>VHR</b>	<b>VHR</b>	<b>VHR</b>	NR	<b>VHR</b>	<b>VHR</b>	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 January, 2023: Uttar Pradesh

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

Continued

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

Continued

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

**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 January, 2023: Uttarakhand

Districts of Uttarakhand	Livestock Disease												
	Anthrax	Babesiosis	BQ	BT	ET	Fasciolosis	FMD	HS	PPR	S&G Pox	SF	Theileriosis	Trypanosomosis
Almora	NR	NR	NR	NR	NR	NR	<b>VHR</b>	NR	NR	NR	NR	NR	NR
Bageshwar	NR	NR	NR	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	NR	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	NR	NR	NR	NR	NR	NR
Hardwar	NR	NR	NR	NR	NR	NR	VLR	VLR	NR	NR	NR	NR	NR
Nainital	NR	NR	NR	NR	NR	NR	VLR	NR	NR	NR	NR	NR	NR
Pithoragarh	NR	NR	NR	NR	NR	NR	VLR	NR	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	NR	NR	NR	NR	NR	NR
Udham Singh Nagar	NR	NR	NR	NR	NR	NR	<b>HR</b>	VLR	NR	NR	NR	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 January, 2023: West Bengal

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



## 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.	Anantapur, Kurnool, Prakasam, Sri Potti Sriramulu Nellore	Four	Antrax
2.	Krishna and Prakasam	Two	Enterotoxaemia
3.	Srikakulam	One	Foot and Mouth Disease
4.	Chittoor	One	Haemorrhagic Septicaemia
5.	Anantapur, Sri Potti Sriramulu Nellore and West Godavari	Three	Peste des Petits Ruminants

### 3. Arunachal Pradesh

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

### 4. Assam

Sl. No	Disease prone districts	Number of districts prone for disease	Disease Name
1.	Barpeta, Bongaigaon, Cachar, Darrang, Dhemaji, Jorhat, Lakhimpur, Nagaon and Sonitpur	Nine	Black Quarter
2.	Kokrajhar, Sivasagar and Sonitpur	Three	Enterotoxaemia
3.	Barpeta, Darrang, Dhemaji, Dhubri, Golaghat, Kamrup, Kamrup	Ten	Fasciolosis

	Metropolitan, Kokrajhar, Morigaon and Nalbari		
4.	Sonitpur	One	Haemorrhagic Septicaemia
5.	Sonitpur	One	Peste des Petits Ruminants
6.	Kamrup and Tinsukia	Two	Sheep & Goat pox
7.	Dhemaji, Dibrugarh, Dima Hasao, Kamrup, Kamrup Metropolitan, Karbi Anglong, Kokrajhar, Lakhimpur, Morigaon, Nalbari and Tinsukia	Eleven	Swine Fever

## 5. Bihar

Sl. No	Disease prone districts	Number of districts prone for disease	Disease Name
1.	Nalanda, Patna, Samastipur and Sheikhpura	Four	Foot and Mouth Disease
2.	Gaya and Siwan	Two	Peste des Petits Ruminants
3.	Sheikhpura	One	Trypanosomiasis

## 6. Goa

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

## 7. Gujarat

Sl. No	Disease prone districts	Number of districts prone for disease	Disease Name
1.	Junagadh and Porbandar	Two	Fascioliasis
2.	Junagadh, Kheda, Mahesana, Porbandar and Rajkot	Five	Foot and Mouth Disease
3.	Anand, Gandhinagar and Mahesana	Three	Haemorrhagic Septicaemia
4.	Bhavnagar and Junagadh	Two	Peste des Petits Ruminants
5.	Junagadh	One	Trypanosomiasis

## 8. Haryana

Sl. No	Disease prone districts	Number of districts prone for disease	Disease Name
1.	Hisar	One	Enterotoxaemia
2.	Hisar	One	Foot and Mouth Disease
3.	Bhiwani, Gurgaon, Hisar and Sirsa	Four	Peste des Petits Ruminants
4.	Bhiwani	One	Sheep & Goat pox
5.	Bhiwani, Hisar, Jhajjar and Sonipat	Four	Swine fever
6.	Hisar	One	Theileriosis

## 9. Himachal Pradesh

Sl. No	Disease prone districts	Number of districts prone for disease	Disease Name
1.	Mandi and Shimla	Two	Peste des Petits Ruminants
2.	Shimla and Sirmaur	Two	Sheep & Goat pox

## 10. Jammu & Kashmir

Sl. No	Disease prone districts	Number of districts prone for disease	Disease Name
1.	Srinagar	One	Foot and mouth Disease
2.	Kupwara and Pulwama	Two	Peste des Petits Ruminants
3.	Anantnag, Badgam, Bandipore, Baramula, Jammu, Kishtwar, Kulgam, Kupwara, Pulwama, Rajouri, Shupiyan and Srinagar	Twelve	Sheep and Goat pox

## 11. Jharkhand

Sl. No	Disease prone districts	Number of districts prone for disease	Disease Name
1.	Dhanbad	One	Anthrax
2.	All districts except Ramgarh Ranchi and Sahibganj	Twenty-one	Babesiosis
3.	Bokaro, Chatra, Deoghar, Dhanbad, Dumka, Giridih, Hazaribagh, Jamtara, Pashchimi Singhbhum and Purbi Singhbhum	Ten	Black Quarter
4.	Bokaro, Khunti, Koderma and Palamu	Four	Enterotoxaemia

5.	All districts except Garhwa and Ramgarh	Twenty-two	Fasciolosis
6.	Deoghar, Dhanbad, Dumka, Giridih, Gumla, Jamtara, Khunti, Lohardaga, Pakur, Palamu, Pashchimi Singhbhum, Purbi Singhbhum, Ranchi, Sahibganj and Simdega	Fifteen	Foot and Mouth Disease
7.	Chatra, Deoghar, Dhanbad, Dumka, Giridih, Godda, Hazaribagh, Jamtara, Pakur, Palamu, Pashchimi Singhbhum, Purbi Singhbhum and Sahibganj	Thirteen	Haemorrhagic Septicaemia
8.	Bokaro, Deoghar, Dhanbad, Dumka, Giridih, Gumla, Khunti, Lohardaga, Pakur, Pashchimi Singhbhum, Purbi Singhbhum, Ranchi and Simdega	Thirteen	Peste des Petits Ruminants
9.	Hazaribagh	One	Sheep & Goat pox
10.	Bokaro, Dhanbad, Giridih, Khunti and Simdega	Five	Swine Fever
11.	All the districts except Chatra Latehar and Ramgarh	Twenty-one	Theileriosis
12.	All the districts except Garhwa, Jamtara Ramgarh, Ranchi and Sahibganj	Nineteen	Trypanosomosis

## 12. Karnataka

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

6.	Bangalore, Bellary, Bidar, Chikmagalur, Chitradurga, Davanagere, Dharwad, Gadag, Haveri, Kolar, Koppal, Raichur, Shimoga, Tumkur and Uttara Kannada	Fifteen	Haemorrhagic Septicaemia
7.	Bangalore, Bellary, Chikkaballapura, Chitradurga, Hassan, Kolar, Mandya, Ramanagara, Shimoga, Tumkur and Uttara Kannada	Eleven	PestedesPetits Ruminants
8.	Bellary, Chikmagalur, Chitradurga, Davanagere, Gadag, Kolar, Koppal, Mysore, Ramanagara and Tumkur	Ten	Sheep & Goat pox
9.	Shimoga	One	Theileriosis

### 13. Kerala

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



#### 14. Madhya Pradesh

Sl. No	Disease prone districts	Number of districts prone for disease	Disease Name
1	Betul	One	Anthrax
2.	Ashoknagar, Betul, Bhopal, Jabalpur, Mandla and Seoni	Six	Foot and Mouth Disease
3.	Betul, Dindori, Indore, Jabalpur, Katni, Mandla and Sagar	Seven	Haemorrhagic Septicaemia
4.	Bhopal and Jabalpur	Two	Peste des Petits Ruminants
5.	Chhatarpur, Jabalpur and Vidisha	Three	Swine fever
6.	Narsimhapur	One	Trypanosomiasis

#### 15. Maharashtra

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

#### 16. Manipur

Sl. No	Disease prone districts	Number of districts prone for disease	Disease Name
1.	Thoubal	One	Babesiosis
2.	Bishnupur, Churachandpur, Imphal East, Imphal West, Senapati and Ukhrul	Six	Black Quarter
3.	Imphal East, Imphal West and Senapati	Three	Fasciolosis
4.	Bishnupur, Imphal East and Thoubal	Three	Foot and Mouth Disease
5.	Thoubal	One	Haemorrhagic Septicaemia
6.	Tamenglong	One	Swine fever

## 17. Meghalaya

Sl. No	Disease prone districts	Number of districts prone for disease	Disease Name
1.	East Khasi Hills	One	Anthrax
2.	East Khasi Hills and West Garo Hills	Two	Black Quarter
3.	East Khasi Hills, Jaintia Hills, Ribhoi, Southwest Garo Hills and West Garo Hills	Five	Foot and Mouth Disease
4.	Southwest Garo Hills and West Garo Hills	Two	Haemorrhagic Septicaemia
5.	East Garo Hills, East Khasi Hills, North Garo Hills, Ribhoi, South Garo Hills and West Garo Hills	Six	Swine Fever

## 18. Mizoram

Sl. No	Disease prone districts	Number of districts prone for disease	Disease Name
1.	Aizawl	One	Black Quarter
2.	Champhai	One	Fascioliasis
3.	Saiha	One	Foot and Mouth Disease
4.	Aizawl, Kolasib and Lawngtlai	Three	Swine Fever

## 19. Nagaland

Sl. No	Disease prone districts	Number of districts prone for disease	Disease Name
1.	Zunheboto	Two	Fascioliasis
2.	Dimapur, Kohima and Zunheboto	Three	Foot and Mouth Disease
3.	Kohima, Longleng and Zunheboto	Three	Swine fever

## 20. Odisha

Sl. No	Disease prone districts	Number of districts prone for disease	Disease Name
1.	Koraput	One	Anthrax
2.	Anugul, Cuttack, Ganjam, Jagatsinghapur, Kendujhar, Khordha, Puri and Rayagada	Eight	Black Quarter
3.	Cuttack, Ganjam, Kendrapara and Khordha	Four	Foot and Mouth Disease
4.	Kendrapara	One	Haemorrhagic Septicaemia
5.	Jajapur, Kendujhar and Malkangiri	Three	Peste des Petits Ruminants
6.	Kendrapara	One	Sheep & Goat pox
7.	Nabarangapur	One	Swine fever
8.	Ganjam	One	Theileriosis

## 21. Puducherry

Sl. No	Disease prone districts	Number of districts prone for disease	Disease Name
1.	Karaikal, Mahe and Puducherry	Three	Babesiosis
2.	Puducherry and Yanam	Two	Fasciolosis
3.	Puducherry	One	Peste des Petits Ruminants
4.	Puducherry	One	Sheep & Goat pox

## 22. Punjab

Sl. No	Disease prone districts	Number of districts prone for disease	Disease Name
1.	Ludhiana	One	Peste des Petits Ruminants
2.	Bathinda and Ludhiana	Two	Swine fever

## 23. Rajasthan

Sl. No	Disease prone districts	Number of districts prone for disease	Disease Name
1.	Dausa	One	Haemorrhagic Septicaemia



2.	Ajmer, Alwar, Bhilwara, Dausa, Ganganagar, Jaipur and Sikar	Seven	Foot and Mouth Disease
3.	Dausa, Jodhpur and Karauli	Three	Haemorrhagic Septicaemia
4.	Barmer, Churu, Dausa, Jaipur, Jodhpur and Tonk	Six	Peste des Petits Ruminants
5.	Churu and Jhunjhunun	Two	Sheep and Goat pox
6.	Jaipur	One	Swine fever
7.	Hanumangarh	One	Theileriosis

#### 24. Sikkim

Sl. No	Disease prone districts	Number of districts prone for disease	Disease Name
1.	East District	One	Babesiosis

#### 25. Tamil Nadu

Sl. No	Disease prone districts	Number of districts prone for disease	Disease Name
1.	Ariyalur, Theni, Thoothukkudi, Tiruvannamalai, Vellore and Viluppuram	Anthrax	Anthrax
2.	Kancheepuram	One	Foot and Mouth Disease
3.	Coimbatore, Dindigul, Kancheepuram, Sivaganga, Tirunelveli, Tiruvannamalai, Vellore and Viluppuram	Eight	Peste des Petits Ruminants
4.	Dharmapuri, Thiruvallur and Virudhunagar	Three	Sheep & Goat pox

## 26. Tripura

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

## 27. Uttar Pradesh

Sl. No	Disease prone districts	Number of districts prone for disease	Disease Name
1.	Agra, Allahabad, Baghpat, Ballia, Banda, Bara Banki, Bareilly, Bijnor, Budaun, Chitrakoot, Farrukhabad, Fatehpur, Firozabad, Gorakhpur, Hardoi, Jalaun, Kanpur Nagar, Kushinagar, Lalitpur, Mahrajganj, Meerut, Mirzapur, Moradabad, Saharanpur, Sant Kabir Nagar, Sonbhadra and Varanasi	Twenty seven	Babesiosis
2.	Lucknow	One	Enterotoxaemia
3.	Ballia, Jaunpur, Lucknow and Meerut	Four	Fasciolosis
4.	Sitapur	One	Foot and mouth disease
5.	Bareilly, Fatehpur, Gonda, Gorakhpur, Hardoi, Kanpur Nagar, Kheri, Meerut and Mirzapur	Nine	PestidesPetitsRuminants
6.	Agra	One	Sheep and Goat pox
7.	Agra, Allahabad, Ballia, Banda, Bara, Banki, Budaun, Farrukhabad, Fatehpur, Gonda, Gorakhpur, Hardoi, Kanpur Nagar, Kanshiram Nagar, Kushinagar, Lalitpur,	Twenty	Theileriosis

	Mahrajganj, Meerut, Moradabad, Saharanpur and Sitapur		
8.	Agra, Bareilly, Bijnor, Budaun, Hardoi, Lucknow, Meerut, Saharanpur and Sonbhadra	Nine	Trypanosomosis

## 28. Uttarakhand

Sl. No	Disease prone districts	Number of disease prone for districts	Disease Name
1.	Almora and Udham Singh Nagar	Two	Foot and Mouth disease

## 29. West Bengal

Sl. No	Disease prone districts	Number of districts prone for disease	Disease Name
1.	Murshidabad and Nadia	Two	Anthrax
2.	Hugli, Maldah, Murshidabad and Puruliya	Four	Babesiosis
3.	Barddhaman, Birbhum, Dakshin Dinajpur, Haora, Jalpaiguri, Nadia and Puruliya	Seven	Black quarter
4.	Jalpaiguri	One	Fascioliasis
5.	Bankura, Barddhaman, Birbhum, Dakshin Dinajpur, Haora, Hugli, Murshidabad, Nadia, North Twenty Four Parganas, Paschim Medinipur, Puruliya and South Twenty Four Parganas	Twelve	Foot and Mouth Disease
6.	Bankura, Barddhaman, Birbhum, Haora, Hugli, Jalpaiguri, Maldah, Nadia, Paschim Medinipur, Puruliya and Uttar Dinajpur	Eleven	Peste des Petits Ruminants
7.	Barddhaman, Birbhum, Haora, Hugli, Paschim Medinipur and Puruliya	Six	Haemorrhagic Septicaemia
8.	Barddhaman, Hugli, North Twenty Four Parganas and South Twenty Four Parganas	Four	Sheep & Goat pox
9.	Bankura, Barddhaman, Birbhum, Haora, Hugli, Nadia, Purba Medinipur and South Twenty Four Parganas	Eight	Theileriosis
10.	Dakshin Dinajpur South Twenty Four Parganas	Two	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 mucocutaneous 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, submandibular 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 treated with Carbon tetrachloride/Rafoxanide/Nitroxynil/Niclofolan/Closantel/Oxyclozanide, under the strict supervision of veterinarian.



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, scrotum, 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.

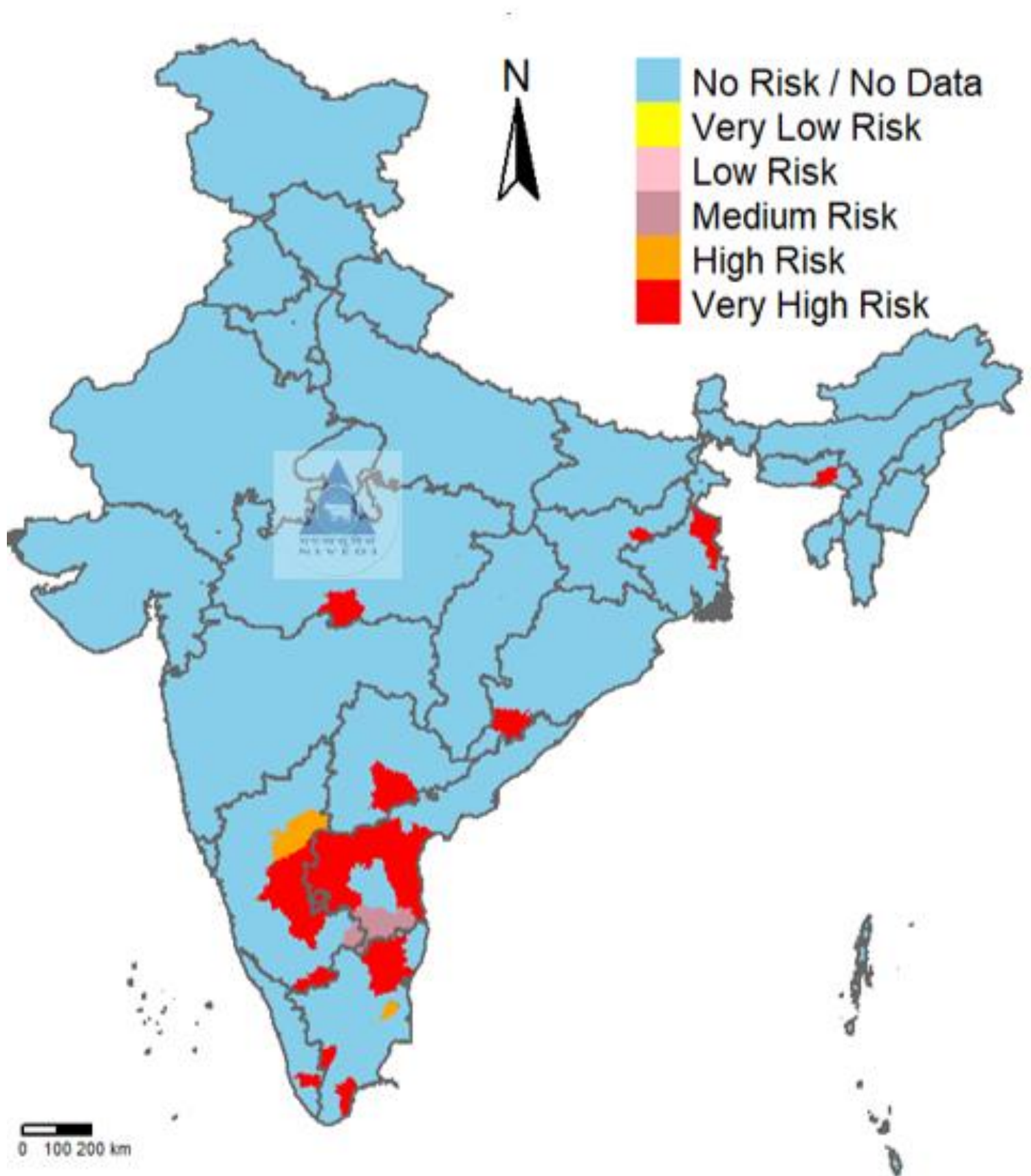
13.	Trypanosomosis (TR)	Domestic and wild carnivores and herbivores including cattle, buffalo, horse, donkey, camel, dog and cats. Buffaloes are known as carriers.	Fluctuating high fever which is not responded by antibiotics, swollen lymph gland, chronic emaciation and weakness, loss of appetite, gradual 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.
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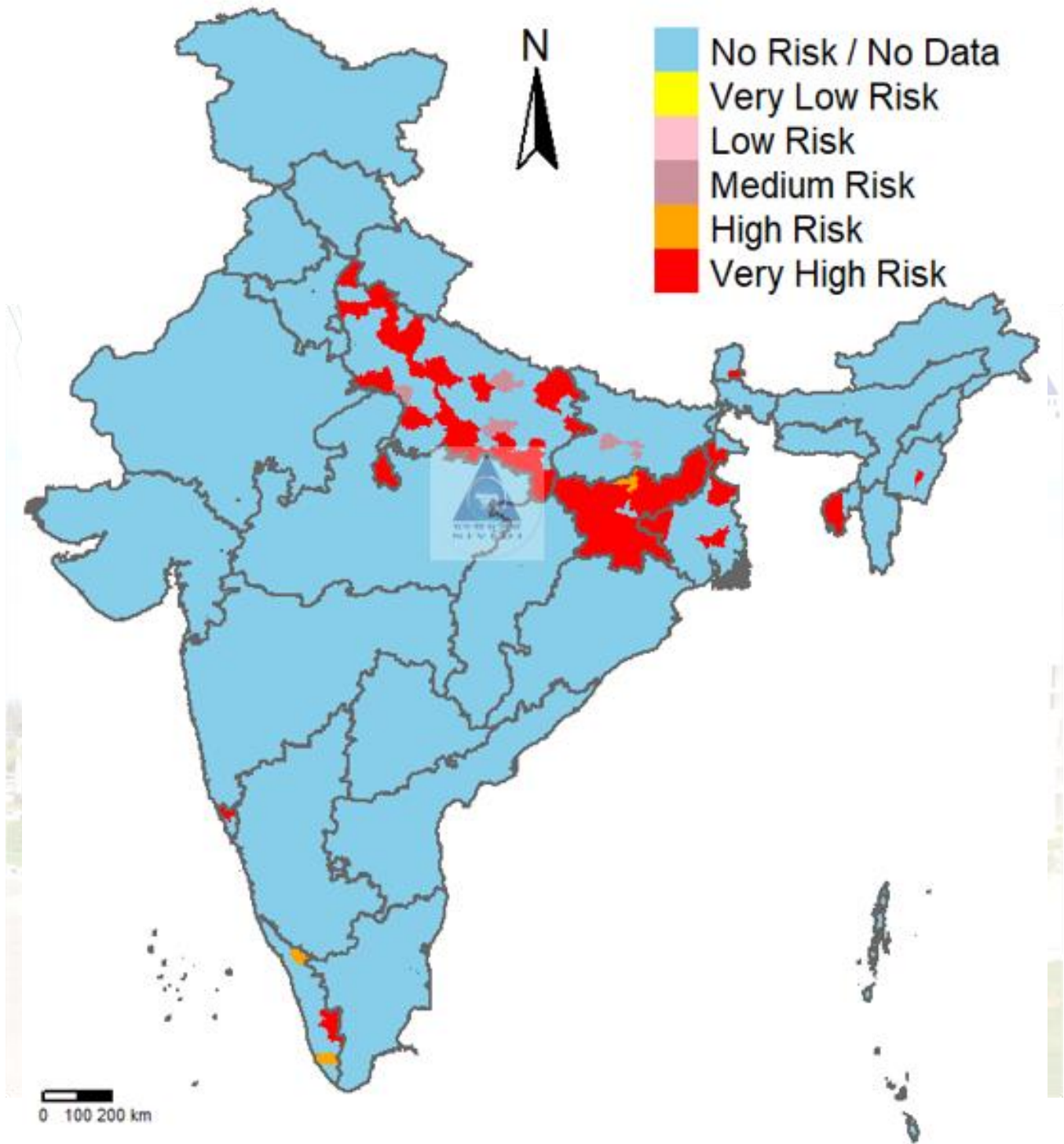


#### iv). Risk Prediction - Livestock Disease Forewarning Maps

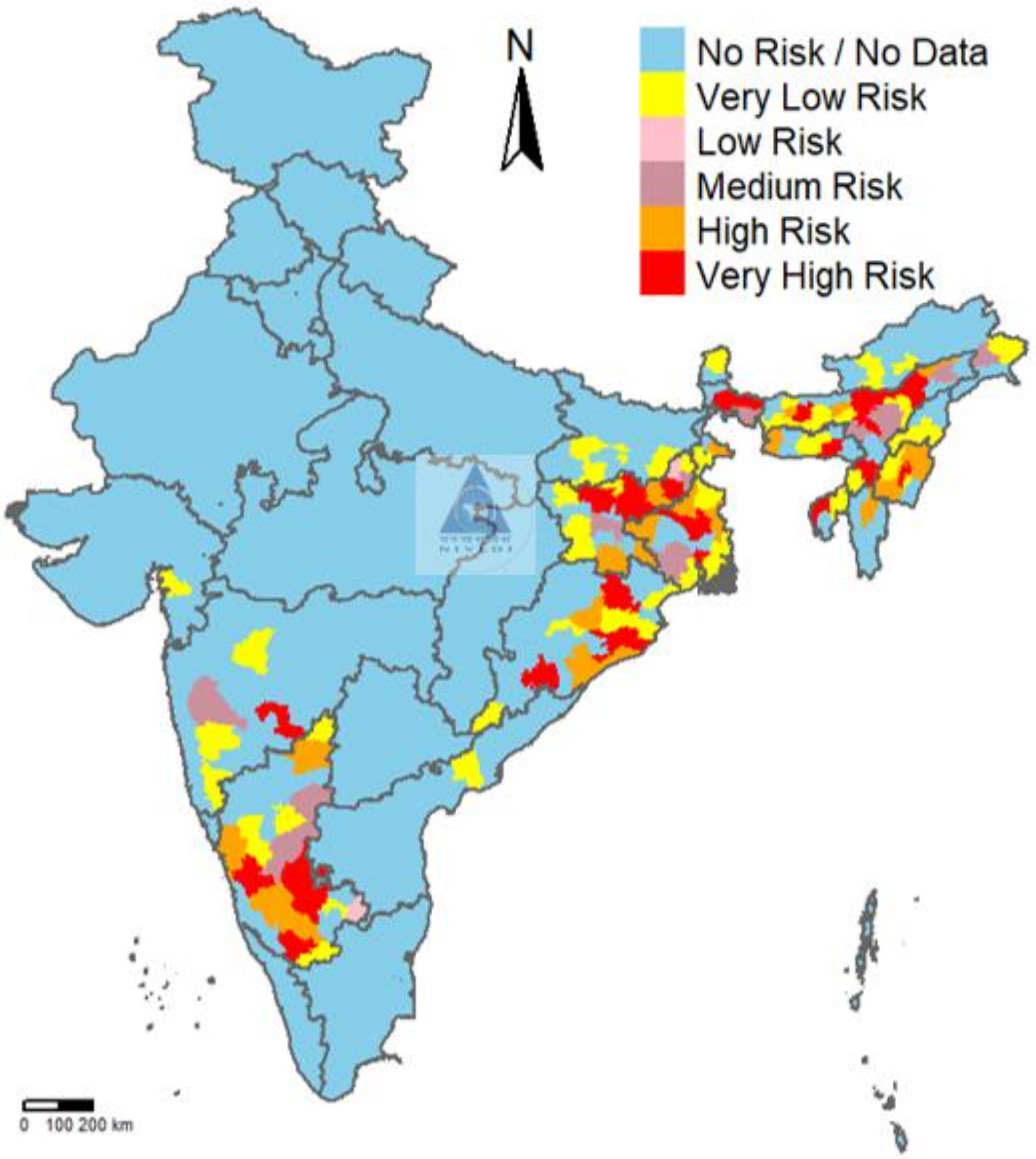
Risk prediction of Anthrax for the month of January 2023



Risk Prediction of Babesiosis for the month of January 2023

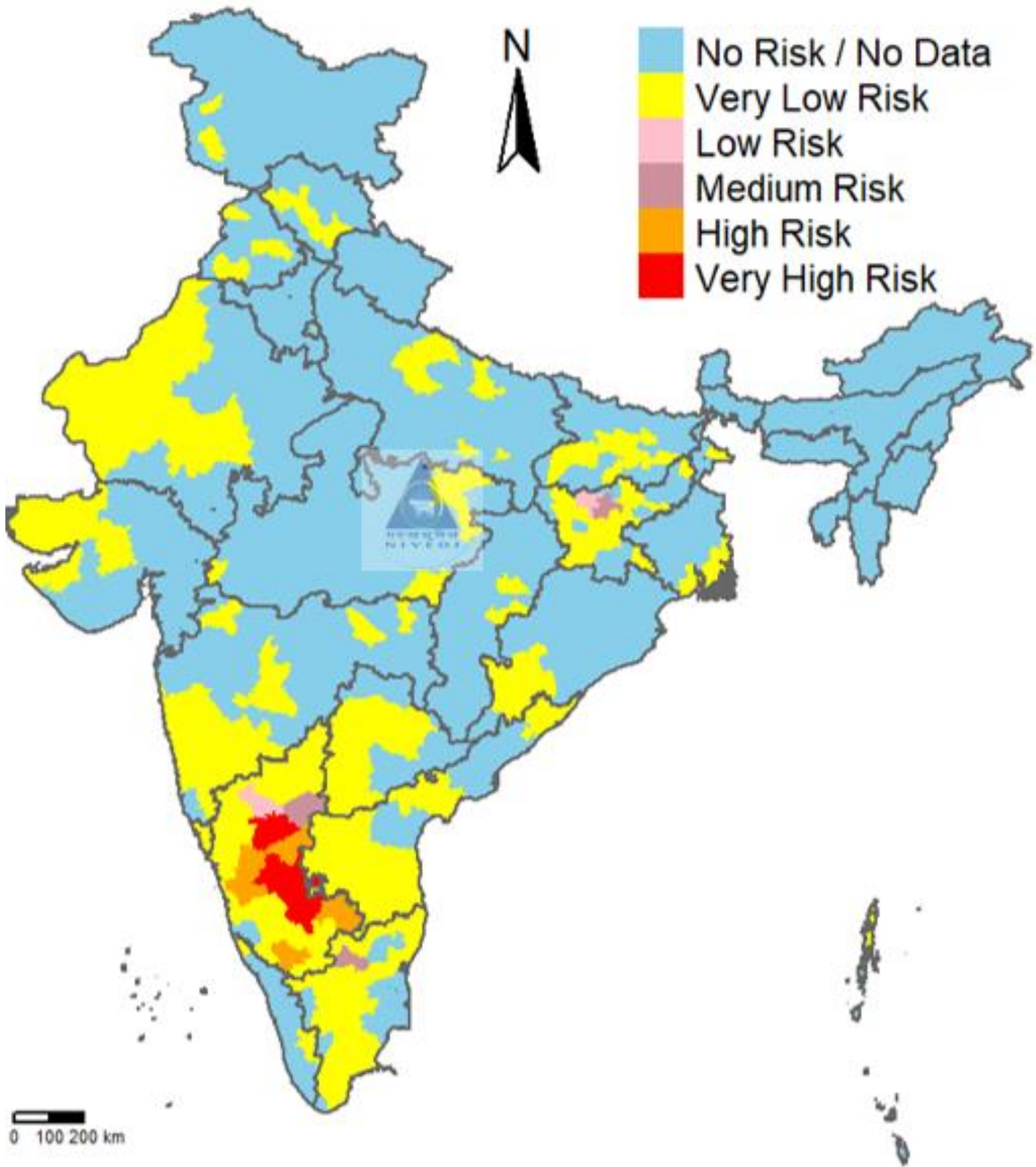


# Risk Prediction of Black quarter for the month of January 2023

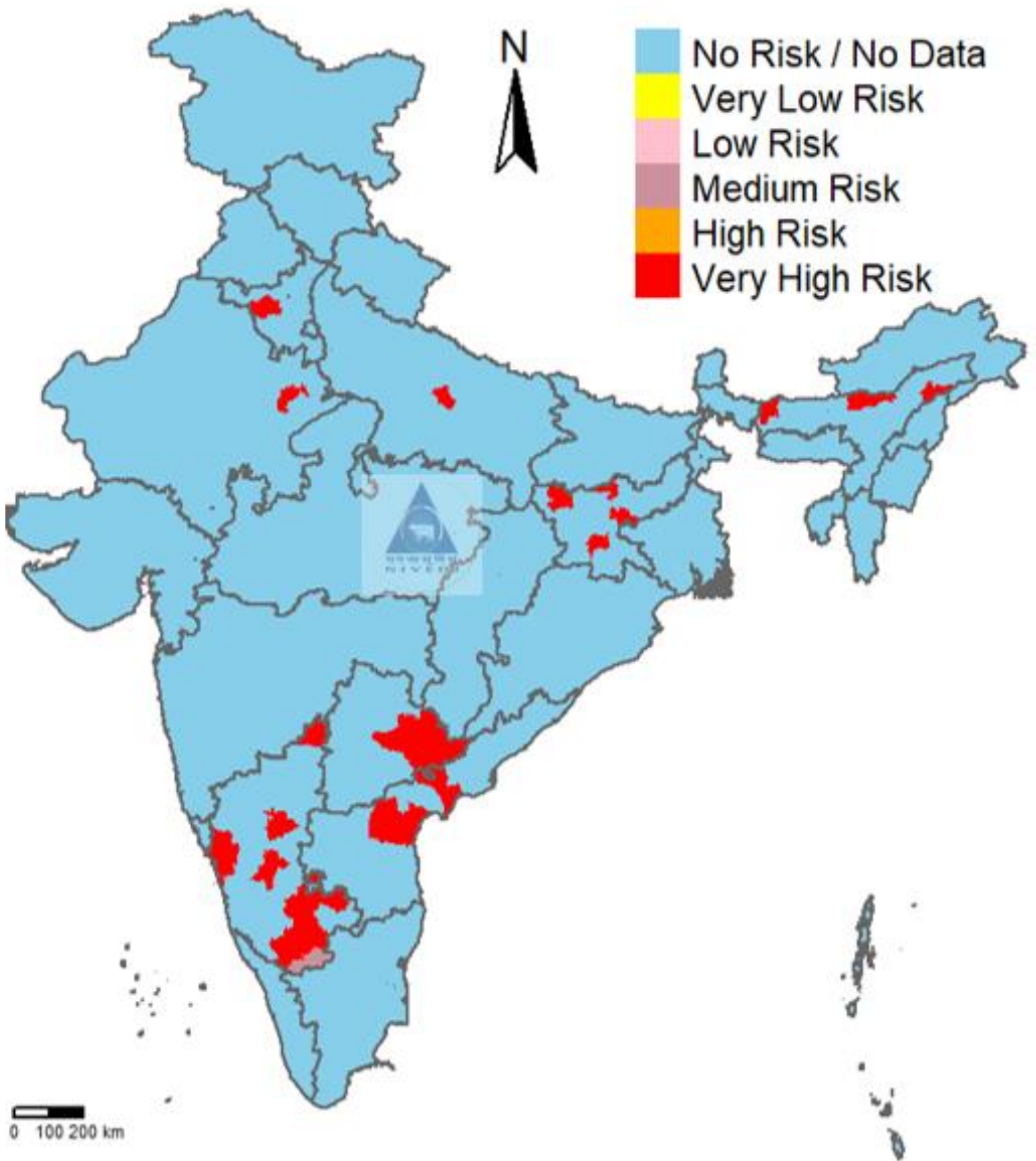




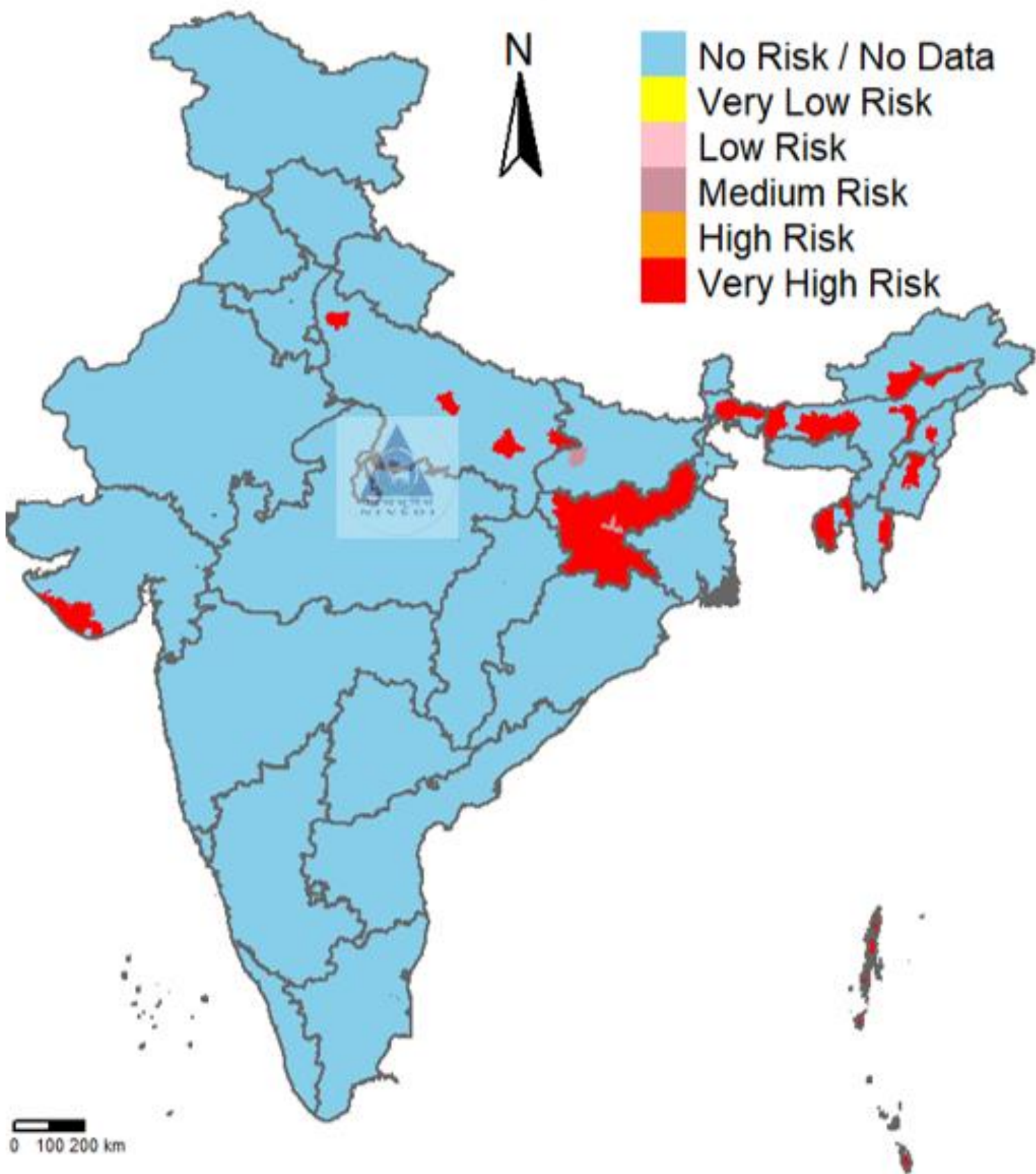
# Risk Prediction of Bluetongue for the month of January 2023



Risk Prediction of Enterotoxaemia for the month of January 2023

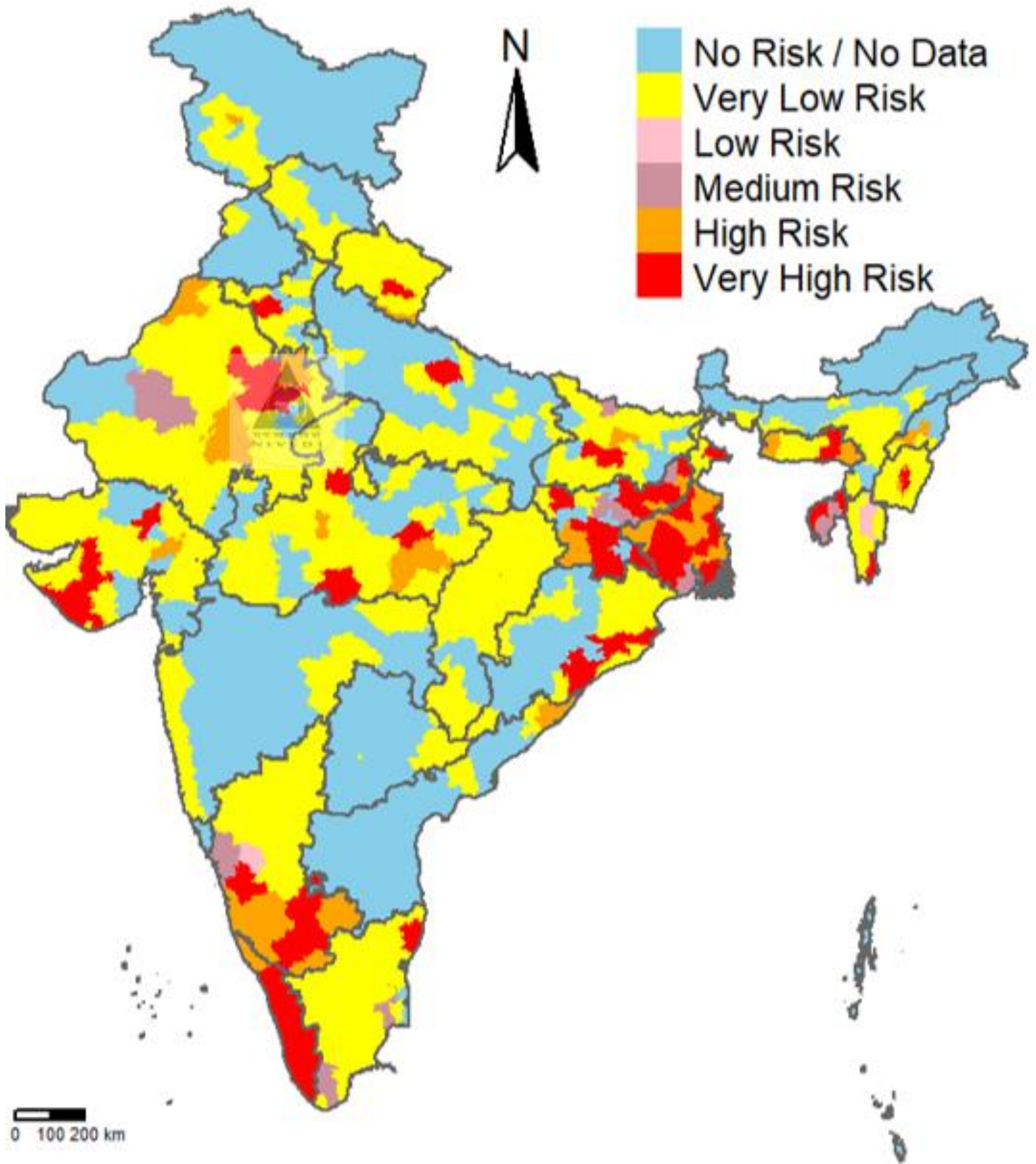


Risk Prediction of Fascioliasis for the month of January 2023

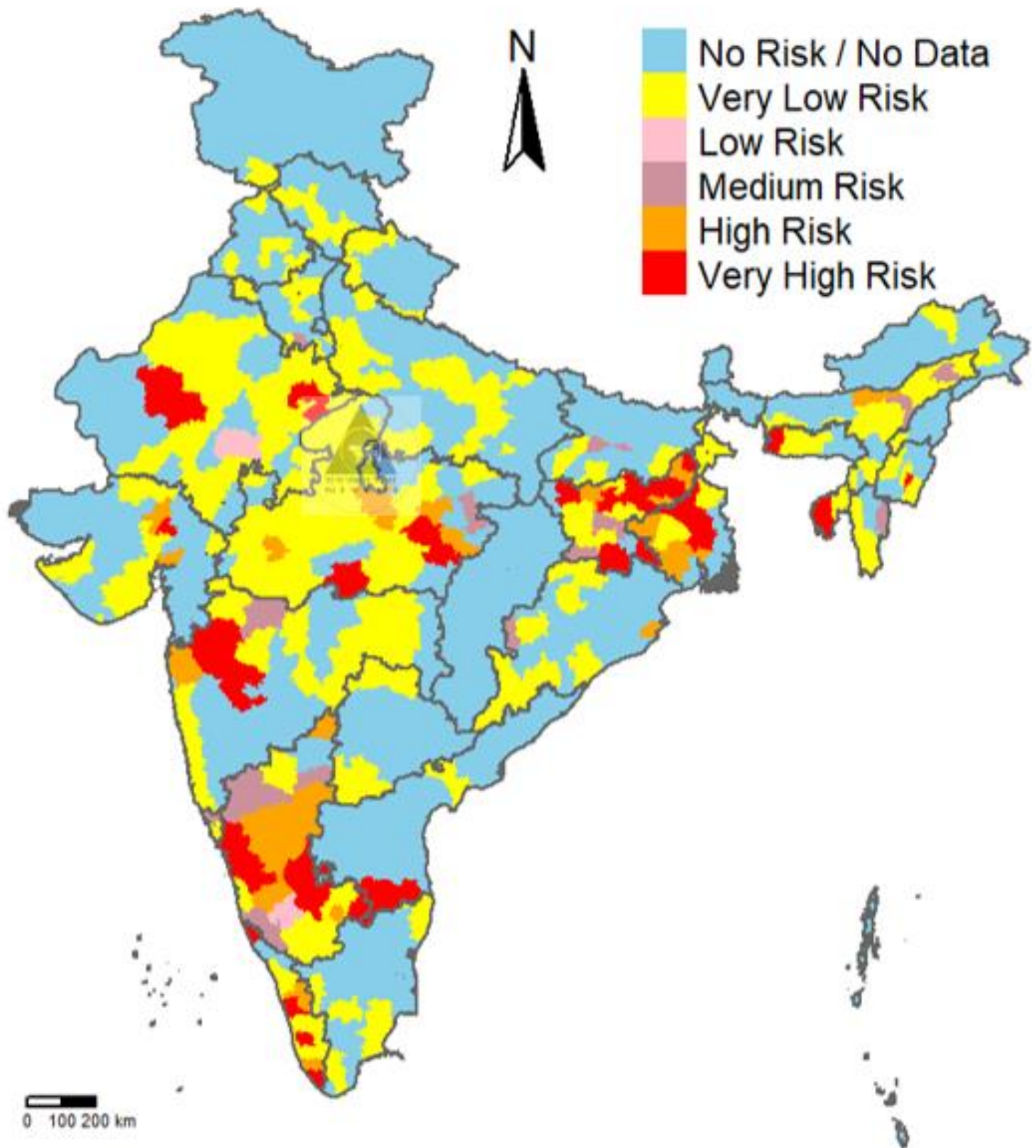




Risk Prediction of Foot and mouth disease for the month of January 2023

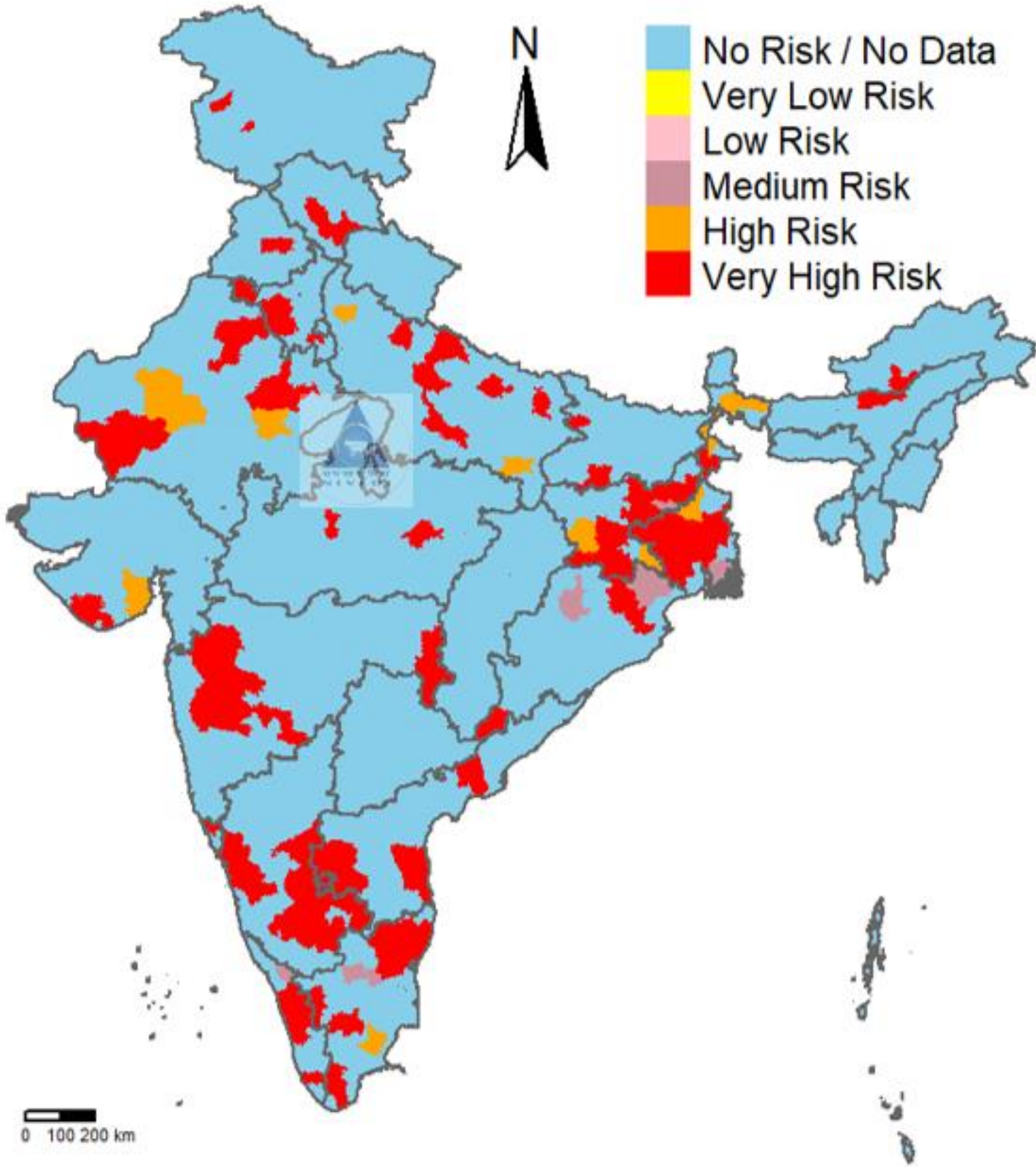


Risk Prediction of Haemorrhagic Septicaemia for the month of January 2023

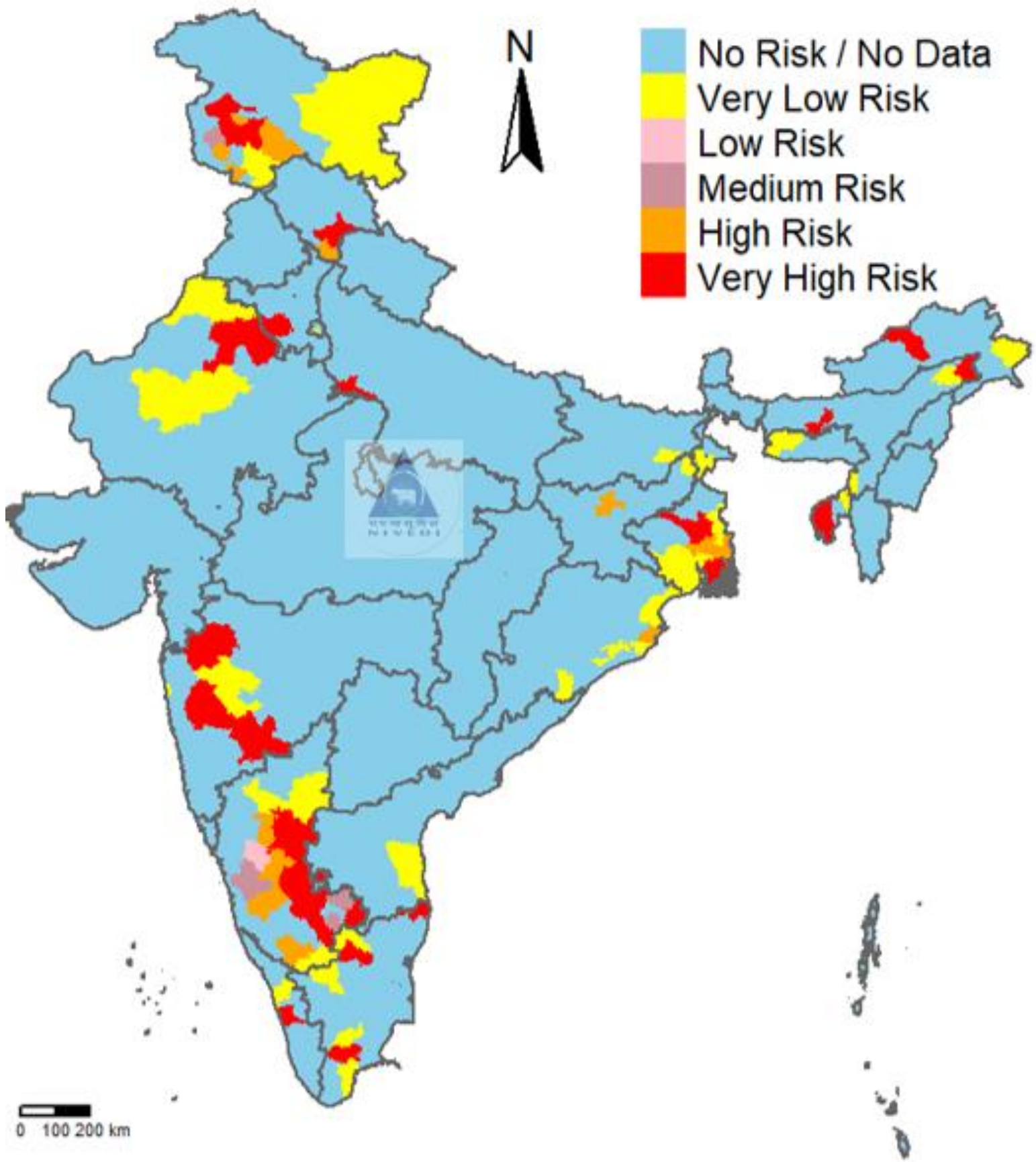




Risk Prediction of Peste des petits ruminants for the month of January 2023

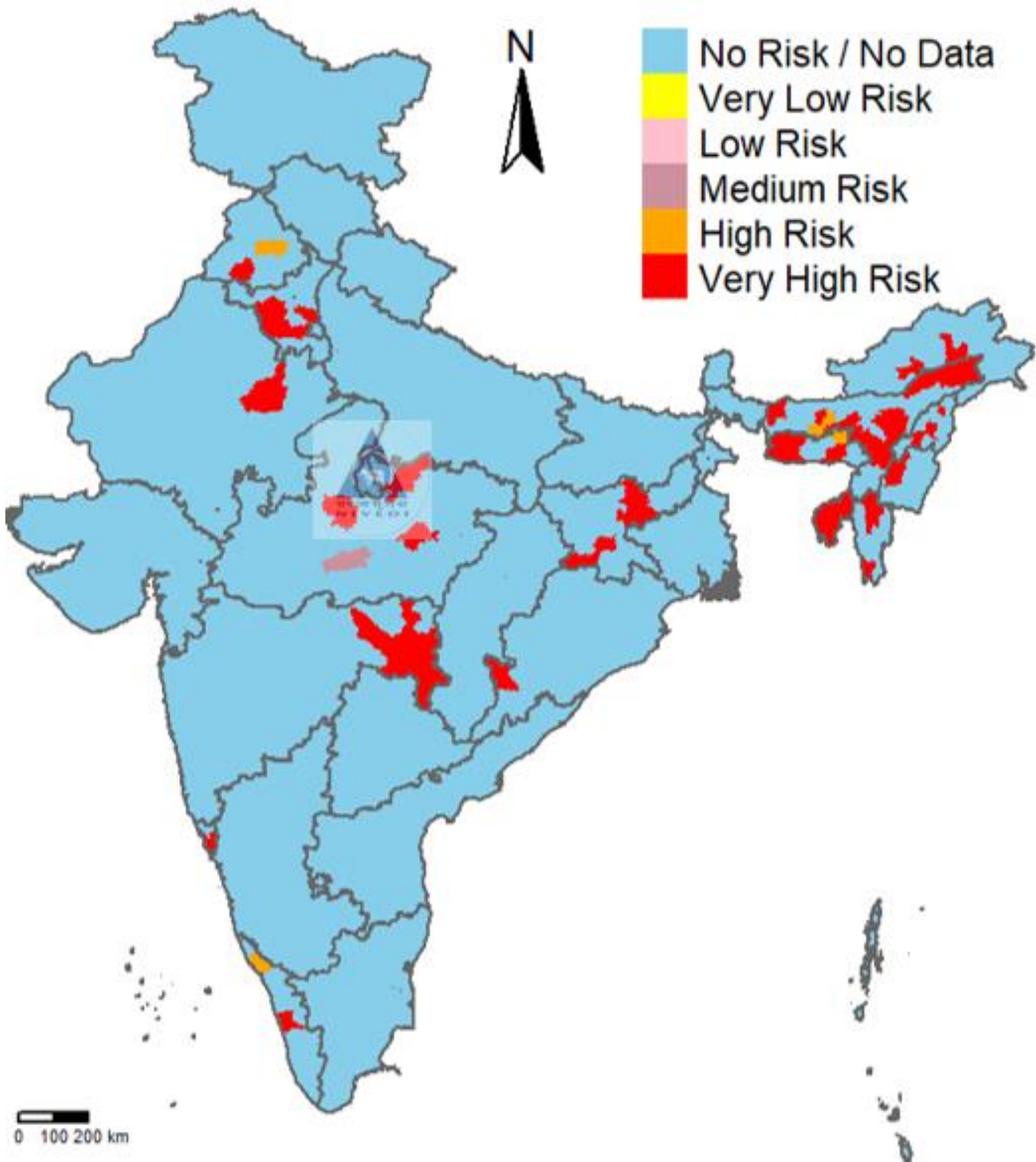


Risk Prediction of Sheep and Goat pox for the month of January 2023

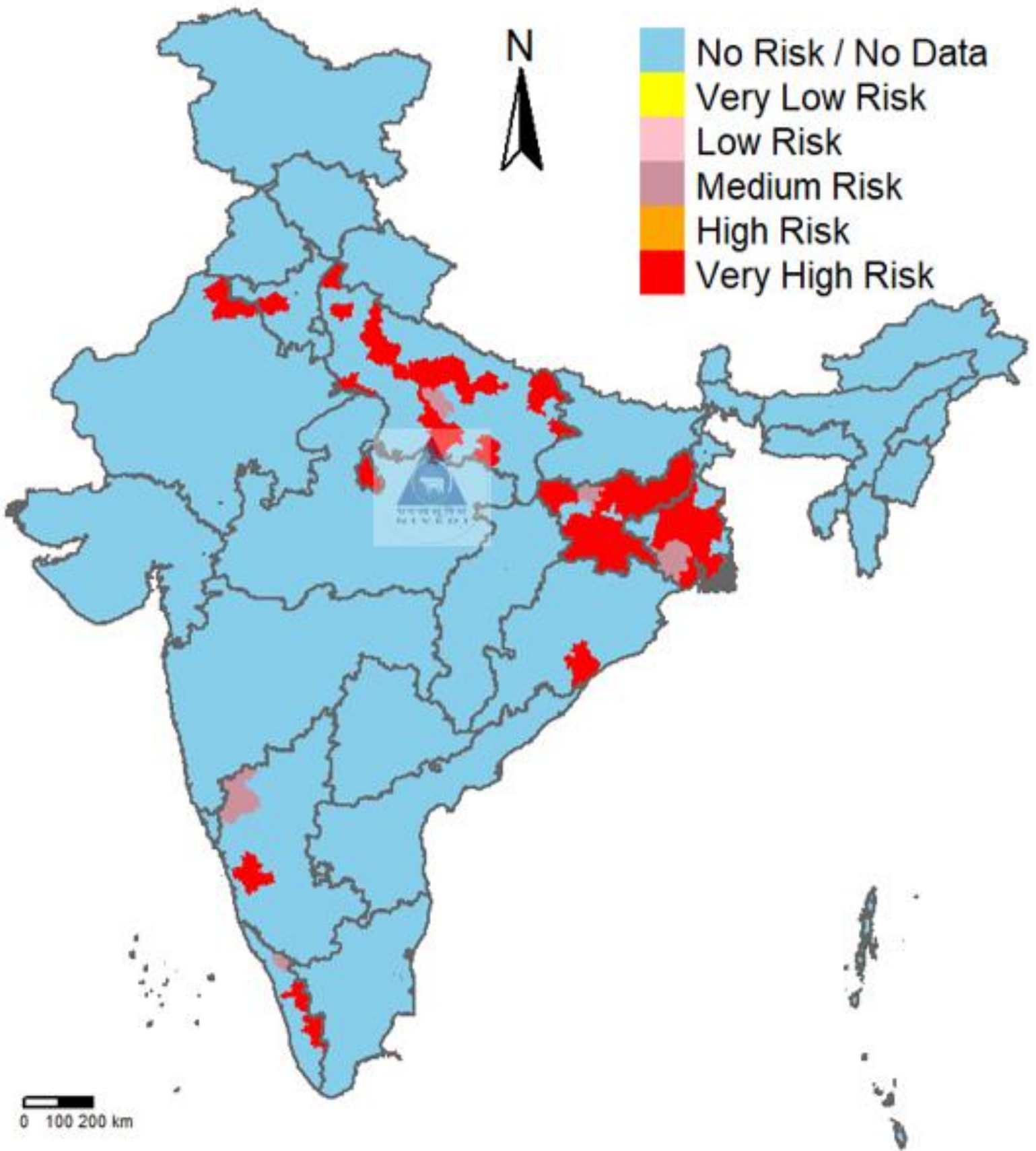




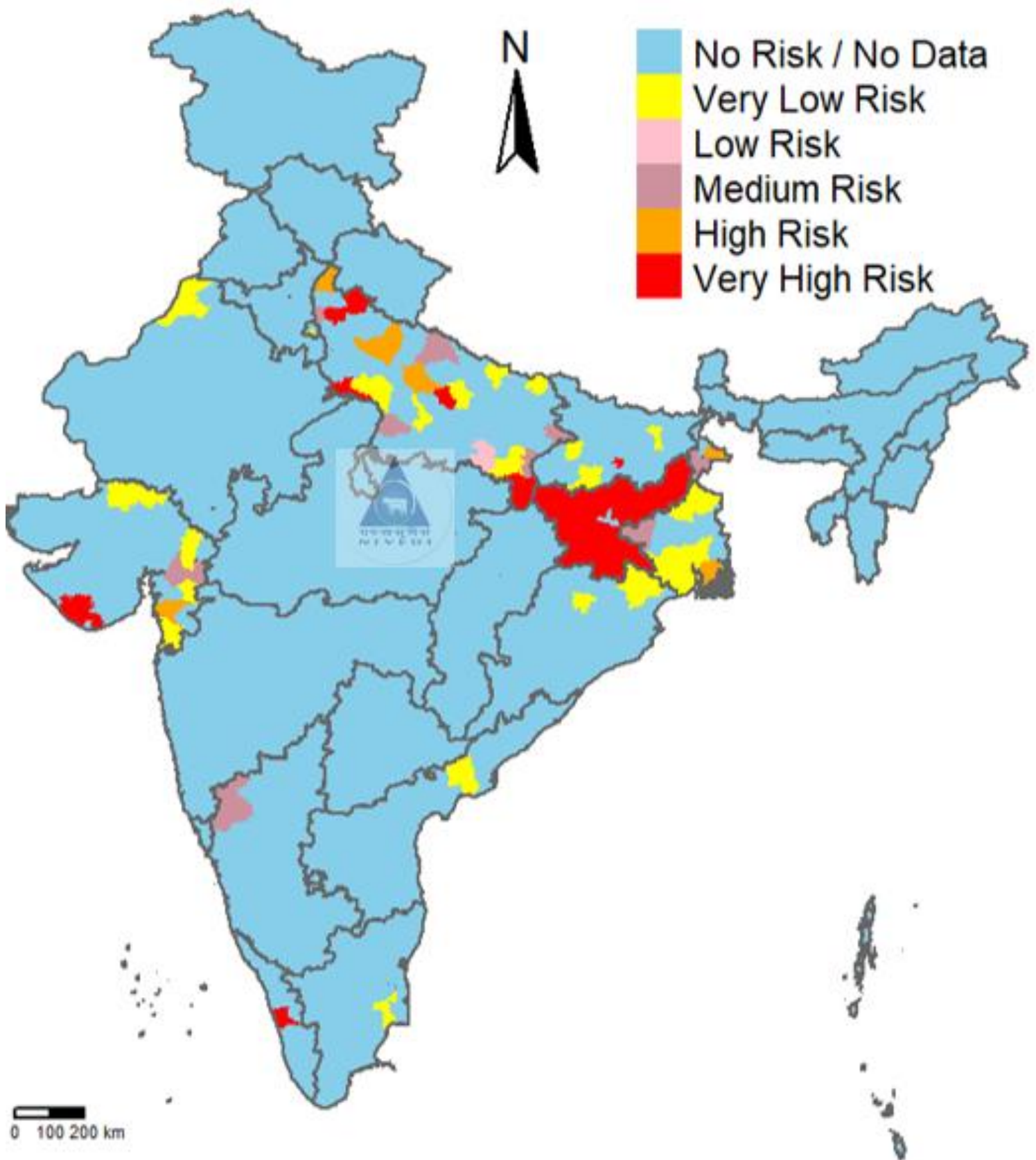
Risk Prediction of Swine Fever for the month of January 2023



# Risk Prediction of Theileriosis for the month of January 2023

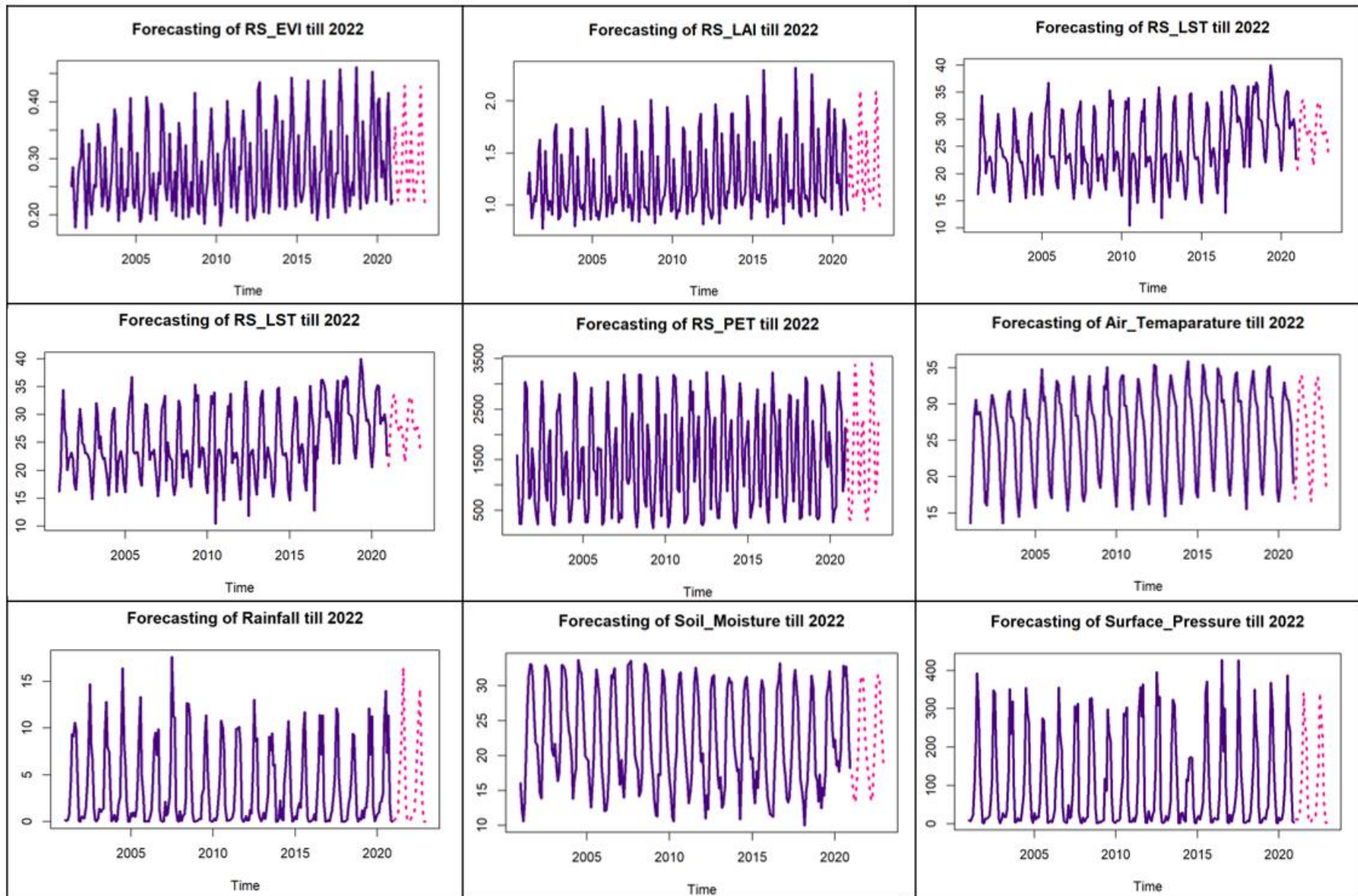


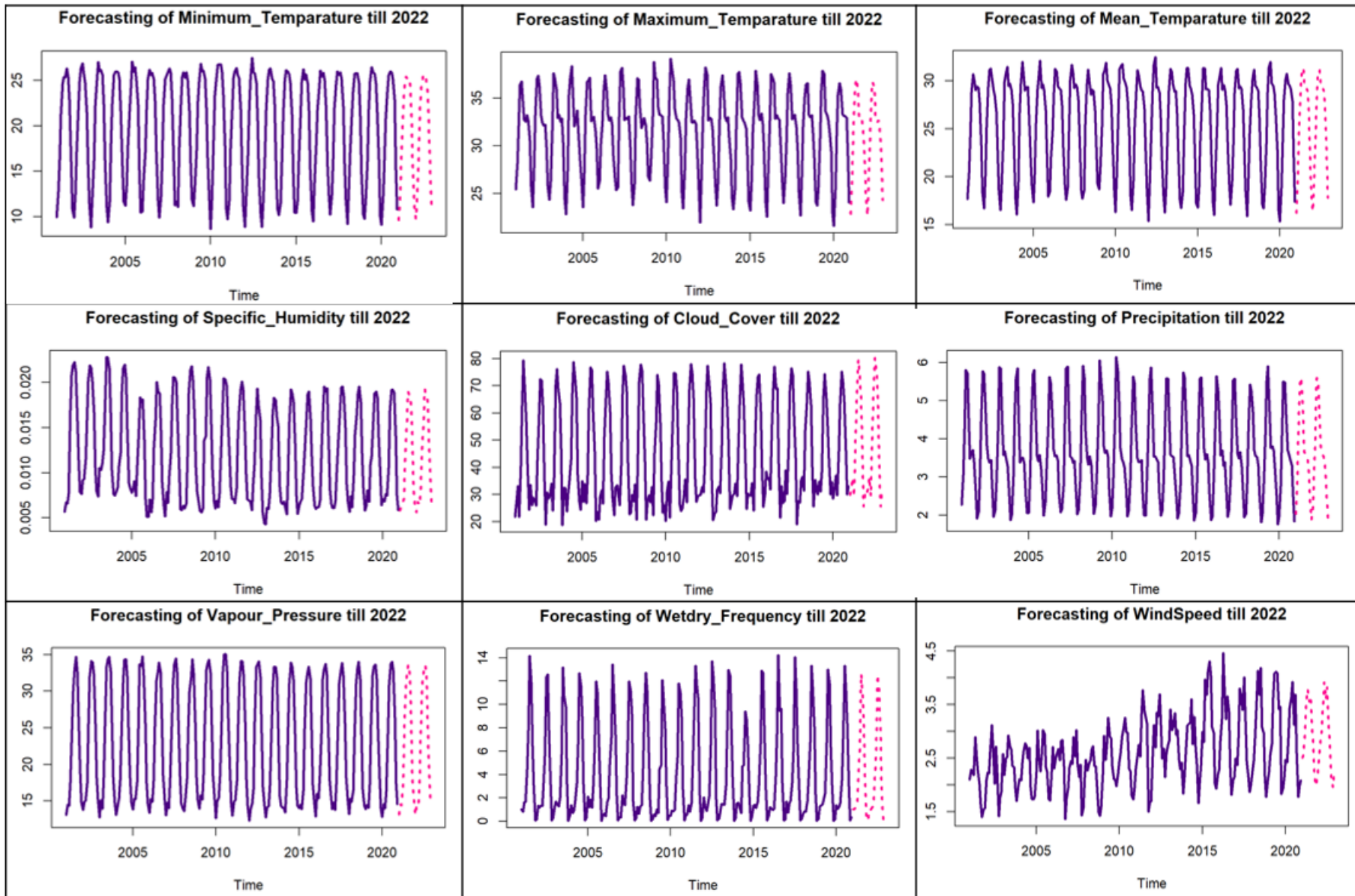
# Risk Prediction of Trypanosomiasis for the month of January 2023





## V. Forecasting of remote sensing and meteorological parameters till, 2022(Ex. Karnataka)





## VI. SIGNIFICANT WEATHER PARAMETERS TABLE USING DISCRIMINANT FUNCTION ANALYSIS

<b>Disease Names</b>	<b>Significant Parameters</b>
<b>Anthrax</b>	Precipitable Water, Surface Pressure
<b>Babesiosis</b>	Air Temperature, Precipitation, Surface Pressure, Minimum Temperature, Vapour Pressure, Dew Point Temperature, Wind Speed, NDVI and LST Night
<b>Black quarter</b>	Precipitable Water, Precipitation, Surface Pressure, Sea Level Pressure and Vapour Pressure
<b>Bluetongue</b>	Air Temperature, Cloud, Precipitable Water, Precipitation, Surface Pressure, Uwind, Vwind, Vapour Pressure, Elevation, NDVI and PET
<b>Classical Swine Fever</b>	Cloud, Precipitation, relative humidity Minimum Temperature, Vapour Pressure and Rainfall
<b>Enterotoxaemia</b>	Surface Pressure, NDVI and PET
<b>Fasciolosis</b>	Air Temperature, Precipitation, relative humidity, Temperature, Maximum Temperature, Vapour Pressure, Vwind, Rainfall, Soil Moisture, NDVI and EVI
<b>Foot and Mouth Disease</b>	Precipitable Water, Uwind, Vwind, wet_dry frequency, LST Night and EVI
<b>HaemorrhagicSepticaemia</b>	Cloud, Precipitation and Vwind
<b>Peste des Petits Ruminants</b>	Cloud, Precipitable Water, Surface Pressure, Sea Level Pressure, Maximum Temperature, Vwind and NDVI
<b>Sheep &amp; Goat pox</b>	Cloud, Surface Pressure, Maximum Temperature, Vwind, DTP, NDVI and PET
<b>Theileriosis</b>	Air Temperature, Precipitation, Vapour Pressure, NDVI and LST Night
<b>Trypanosomosis</b>	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. Amenia Walling, in a press release reported that the team consisted of the department's director, Dr Temsummeren, 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.

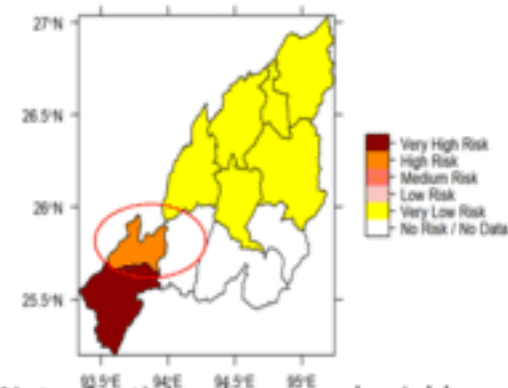
Meanwhile, when contacted, Dr S. Amenia Walling told Nagaland Post that it is difficult to say if the disease has been fully contained since its free grazing season for the animals, but the department is doing its best under the circumstances.

### 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



Note: Spatial and temporal neighbours

## NIVEDI Prediction

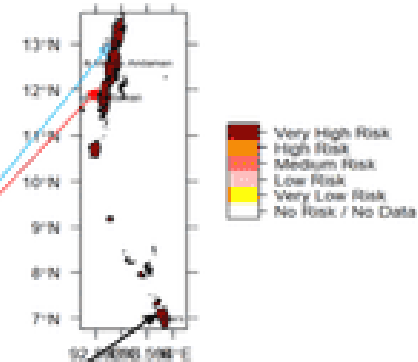
District wise Livestock Disease forwarning for June 2020: Andaman and Nicobar

Districts of Andaman and Nicobar	Livestock Diseases												
	Anthrax	Buberculosis	BQ	BT	ET	Fasciolosis	FMD	HN	PPV	SGP Pox	SF	Theileriosis	Trypanosomiasis
Nicobar	NR	NR	NR	NR	NR	VLR	NR	NR	NR	NR	NR	NR	NR
North & Middle Andaman	NR	NR	NR	NR	NR	VLR	NR	NR	NR	NR	NR	NR	NR
South Andaman	NR	NR	NR	NR	NR	VLR	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)

NDAMAN & NICOBAR ISLANDS Risk Prediction of Fascioliasis for the month of June 2020



## Andaman and Nicobar 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	FASCIOILLIASI	ASCARIANSI	AMPHISTOM	STRONGYLARD	COCCHIOSI	MASTITI	TOTAL
South Andaman	24	48	192	34	2	7	307
N&M Andaman	78	43	14	5	3	10	333
Nicobar	79	31	0	0	0	0	110
<b>TOTAL</b>	<b>361</b>	<b>122</b>	<b>206</b>	<b>39</b>	<b>5</b>	<b>17</b>	<b>700</b>

Dr. Jai Sunder  
 PL, ACRP-ADMAS  
 Port Blair



## KERALA REPORT JUNE-2021



HOME ABOUT OUR TEAM IN THE NEWS FROM THE FIELD

SUBMIT INFO SEARCH POSTS

ProMED-mail Portuguese Español Pyocast Mikong Basin Afrique Francophone

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](mailto:promed@promedmail.org)>

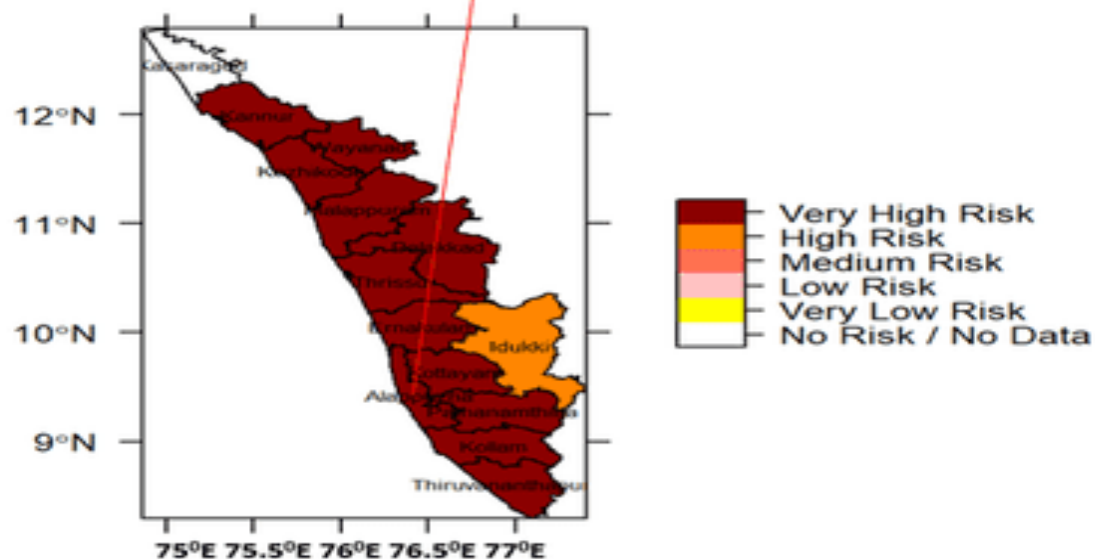
# NIVEDI prediction in June 2021

## District wise Livestock Disease Risk Forewarning for June 2021: Kerala

Districts of Kerala	Livestock Diseases												
	Anthrax	Babesiosis	BQ	BT	ET	Fascioliasis	FMD	HIS	PPR	S&G Pox	SF	Theileriosis	Trypanosomiasis
Alappuzha	NR	NR	NR	NR	NR	NR	VHR	MR	VLR	NR	NR	NR	NR
Ernakulum	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 has already 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



Published Date: 2021-09-30 11:40:53  
 Subject: PRO/SOAS> Foot & mouth disease - India (10): (Karnataka) cattle  
 Archive Number: 20210930.8698795

FOOT & MOUTH DISEASE - INDIA (10): KARNATAKA CATTLE

A ProMED mail post  
<https://www.promedmail.net>  
 ProMED mail is a program of the  
 International Society for Infectious Diseases  
<https://www.isid.org>

Date: Fri 24 Sep 2021 08:33:57  
 Source: The Hindu (India)

<https://www.thehindu.com/news/national/karnataka/foot-and-mouth-disease-reported-in-karnataka/article2727271.html>

District wise Livestock Disease Risk Forewarning for September 2021: Karnataka

District of Karnataka	Livestock Diseases												
	Acidosis	Breastmilk	BC	BT	ET	Fasciolosis	FMD	HS	PPK	SAC	SP	Theriac	Trypanosomiasis
Chikmagalur	50	50	50	50	50	50	50	50	50	50	50	50	50
Dakshina Kannada	50	50	100	50	50	50	100	50	50	100	50	50	50
Dodda Ballari	100	50	50	50	50	50	50	50	50	50	50	50	50
Kudalgi	50	50	50	50	50	50	100	50	50	50	50	50	50
Kolar	50	50	50	50	50	50	50	50	50	50	50	50	50
Koppal	100	50	50	50	50	50	50	50	50	50	50	50	50
Maddur	50	50	50	50	50	50	100	50	50	50	50	50	50
Mysuru	50	50	100	50	50	50	100	50	50	50	50	50	50
Raichur	100	50	50	50	50	50	50	50	50	50	50	50	50
Ramanagara	50	50	50	50	50	50	100	50	50	50	50	50	50
Shimoga	50	50	100	50	100	50	100	50	50	50	50	50	50
Tandur	100	50	50	50	50	50	100	100	50	50	50	50	50
Udupi	50	50	50	50	50	50	50	50	50	50	50	50	50
Uttara Kannada	50	50	50	50	50	50	50	50	50	50	50	50	50
Yadgi	50	50	50	50	50	50	50	50	50	50	50	50	50

The outbreak of foot-and-mouth disease (FMD) among cattle in Hassan has left both farmers and veterinarians worried.

Cases have been reported from Kulkalgudi, Anandpur, Channarayana, and Sankleshwar taluks. Within the farming community, depending on cattle for regular incomes, and worried about their livelihood, the veterinarians are struggling hard to provide treatment, amidst a dearth of staff members.

The Department of Veterinary and Animal Husbandry has reported over 150 cases in the district so far. As of (31.29.2021), the animals in 16 villages of the district are being treated. So far the death of one animal had been reported. However, farmers claim more animals have died over the last month. The death of cattle has an impact on milk production, affecting milk producers.

The vaccination for cattle is done once in six months under the National Animal Disease Control Programme. However, the vaccination drive was not done in the last year, owing to the COVID-19 pandemic. "The outbreak of foot and mouth disease is due to the failure of the government in conducting the vaccination. If the vaccination had been done as per the schedule, farmers would not have suffered", H. Suresh Kumar, president of Prokav Club in Kulkalgudi, told media.

Following reports of the disease, veterinarians have been treating affected animals. "Against 24 vaccination posts of veterinary doctors in Kulkalgudi taluk, we are only five people. Every doctor is in charge of 2 or more hospitals. We are struggling hard to treat animals", said a veterinarian.

Owing to the vacancies were filled up the department cannot deliver services fully. There was a shortage of staff members of other taluks as well, he added.

Considering the cases, the department has launched a ring vaccination programme. Under this, the animals in a 5-kilometre (3.1-mile) radius of the village, where the disease outbreak was reported, should be vaccinated. "We have sufficient stock for the ring vaccination. We are planning a mass vaccination in December (2021), where we will cover 6.58 lakh (6.58 000) animals," said MR Ramani, Deputy Director of Veterinary and Animal Husbandry in Hassan.

Communicated by:  
 ProMED-SoAs from HealthMap (India)  
[reporter@so.asia.promedmail.org](mailto:reporter@so.asia.promedmail.org)

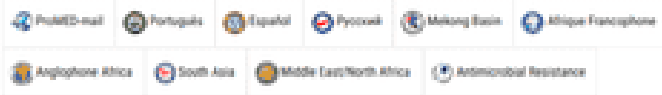
## ARUNACHAL PRADESH REPORT APRIL-2022



HOME ABOUT OUR TEAM IN THE NEWS FROM THE FIELD

SUBMIT INFO

SEARCH POSTS



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, Nylshi Elite Society president Bengla Tolum has urged the department to take all possible steps to save them.

..

Communicated by:  
ProMED from HealthMap Alerts  
<[promed@promedmail.org](mailto: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.in/Documents/Report/foot%20and%20mouth%20disease.pdf>. - Mod.A5

# NIVEDI prediction in April 2021

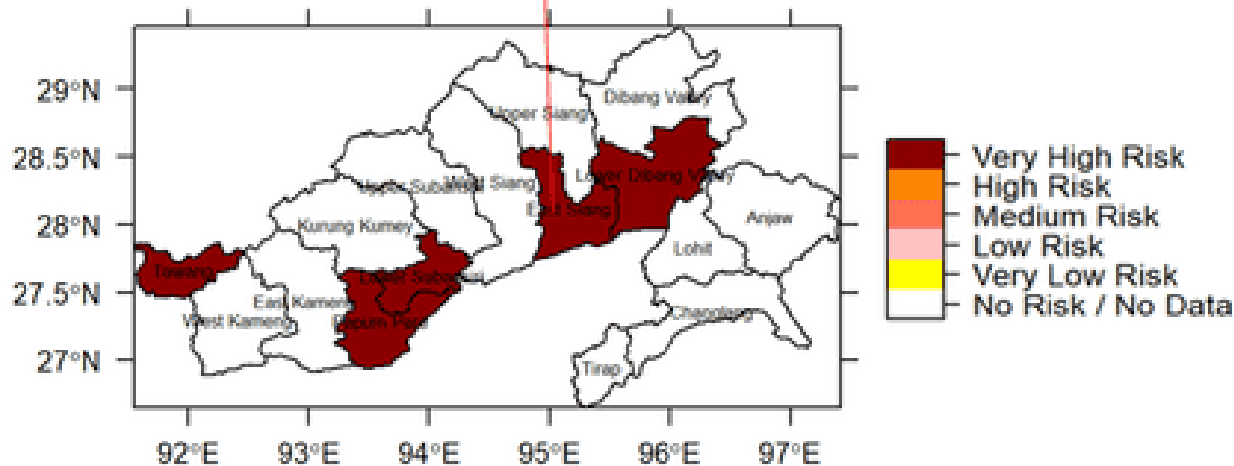
## District wise Livestock Disease Risk Forewarning for April 2021: Arunachal Pradesh

Districts of Arunachal Pradesh	Livestock Diseases													
	Anthrax	Babesiosis	BQ	BT	ET	Fascioliasis	FMD	HS	PPR	S&G Pox	SF	Tuberculosis	Trypanosomiasis	
Anjaw	NR	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	NR
Dibang Valley	NR	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	NR
East Siang	NR	NR	NR	NR	NR	NR	<b>FHR</b>	NR	VLR	NR	<b>FHR</b>	NR	NR	NR
Kurang Kumey	NR	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	NR
Lower Dibang Valley	NR	NR	VLR	NR	NR	NR	VLR	VLR	VLR	NR	<b>FHR</b>	NR	NR	NR
Lower Subansiri	NR	NR	NR	NR	NR	NR	<b>FHR</b>	NR	NR	NR	NR	VLR	NR	NR
Papum Pare	NR	NR	NR	NR	NR	NR	<b>FHR</b>	NR	<b>FHR</b>	NR	<b>FHR</b>	NR	NR	NR
Tawang	NR	NR	NR	NR	NR	NR	<b>HR</b>	NR	NR	NR	NR	NR	NR	NR
Tirap	NR	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	NR
Upper Subansiri	NR	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	NR
West Siang	NR	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	<b>Anthrax</b>	27	2	16	1
2	<b>Babesiosis</b>	47	32	61	35
3	<b>Black Quarter (BQ)</b>	46	7	60	3
4	<b>Bluetongue (BT)</b>	0	0	0	2
5	<b>Enterotoxaemia (ET)</b>	22	7	9	15
6	<b>Fasciolosis</b>	46	15	44	10
7	<b>Foot &amp; Mouth Disease (FMD)</b>	53	4	48	3
8	<b>Haemorrhagic Septicaemia (HS)</b>	46	3	42	5
9	<b>Peste des Petits Ruminants (PPR)</b>	76	11	55	17
10	<b>Sheep &amp; Goat Pox</b>	50	9	38	12
11	<b>Swine Fever</b>	64	6	45	5
12	<b>Theileriosis</b>	62	18	62	29
13	<b>Trypanosomosis</b>	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

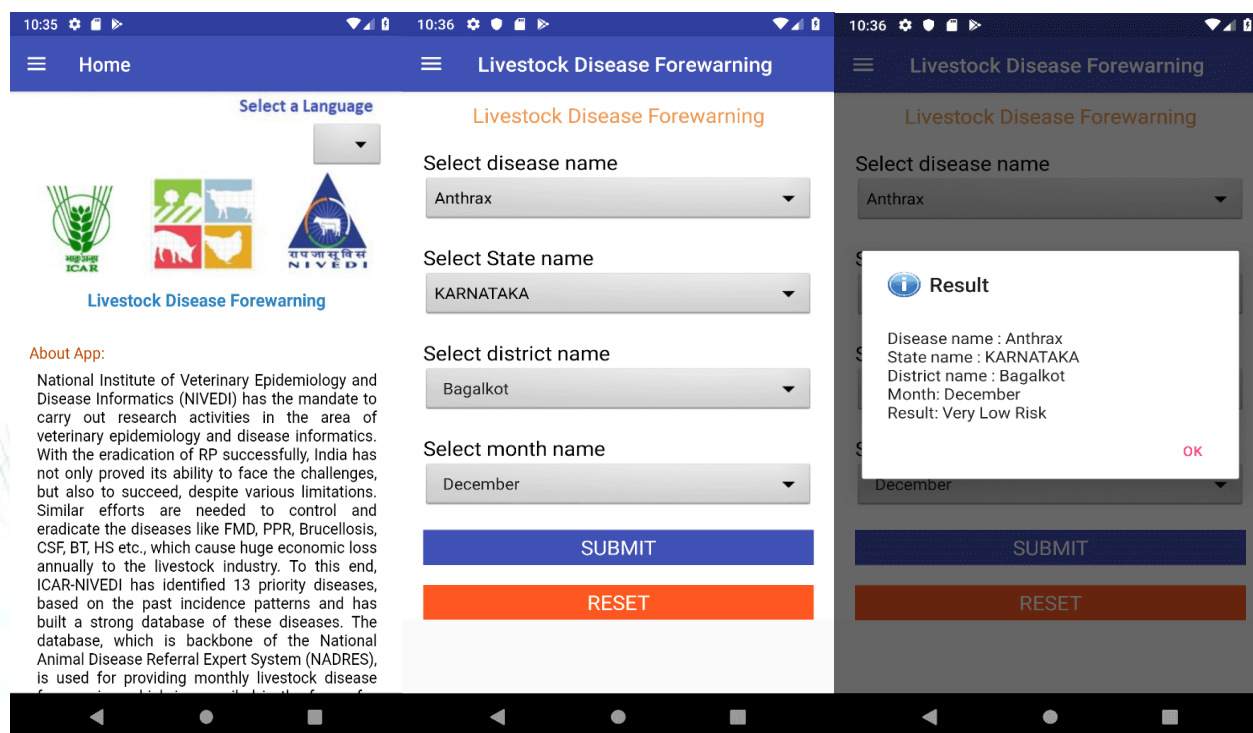
Livestock forewarning application (LDF) can be downloaded following the link provided:[http://www.nivedi.res.in/android\\_nadres/LDF.apk](http://www.nivedi.res.in/android_nadres/LDF.apk) and google play store link also provided <https://play.google.com/store/apps/details?id=info.androidhive.ldf>

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



Radha Mohan Singh on Twitter: "Developed by @ICAR-NIVEDI, this app works on Android smart-phones and takes up 2.5 MB space."

## 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<sub>2</sub> (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 October 2022, a total of **1974188** SMS alerts were sent to farmers.

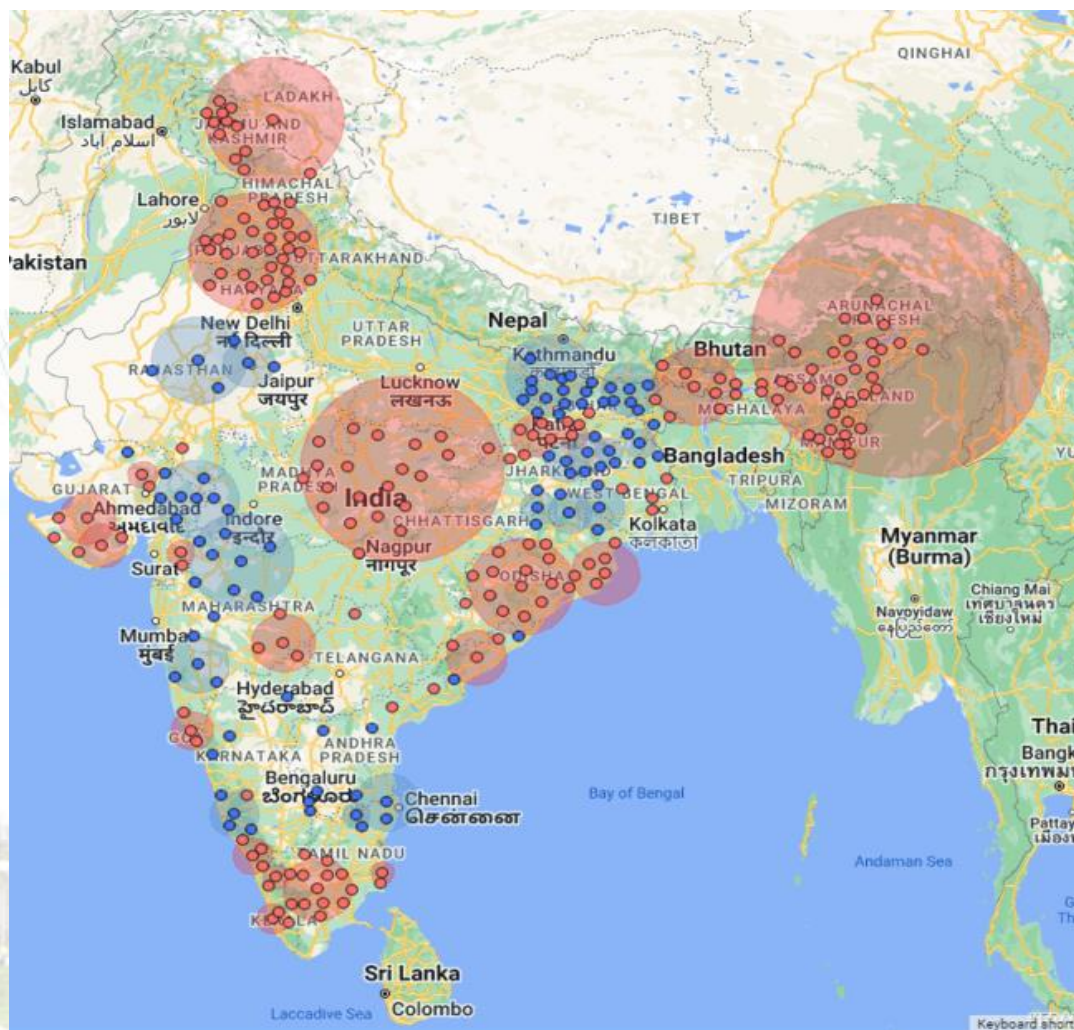
Table 11.A: Number of famers received the SMS alert through FRUITS application during October 2022.

Disease Name	District Name	No. of farmers received SMS	Disease Name	District Name	No. of farmers received SMS
<b>Anthrax</b>	Bangalore Rural	38341	<b>Blue Tongue</b>	Bellary	3140
	Bellary	3136		Chitradurga	17083
	Chamrajnagar	28433		Davangere	27992
	Chikkaballapur	41129		Kolar	27858
	Davangere	27970		Koppal	17019
	Koppal	17009		Mysore	121266
	Mandya	117061		Ramnagar	61526
	Ramnagar	61464		Tumkur	97410
	Tumkur	97288			
<b>Black Quarter</b>	Bangalore Rural	38345	<b>FMD</b>		
	Bangalore Urban	26803			
	Bellary	3136		Bangalore Urban	26816
	Bidar	9542		Bangalore Rural	38345
	Chamrajnagar	28443		Chamrajnagar	28500
	Chikmagalur	17184		Chikkaballapur	41130
	Chitradurga	17074		Chikmagalur	17205
	Gulbarga	6969		Dakshina Kannada	39478
	Hassan	88087		Hassan	88118
	Mandya	117110		Kodagu	3305
	Mysore	121212		Mandya	117263
	Shimoga	38375		Ramnagar	61534
	Tumkur	97341		Tumkur	97450
	Yadgir	298			
<b>Grand Total</b>				<b>1974188</b>	



## 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)



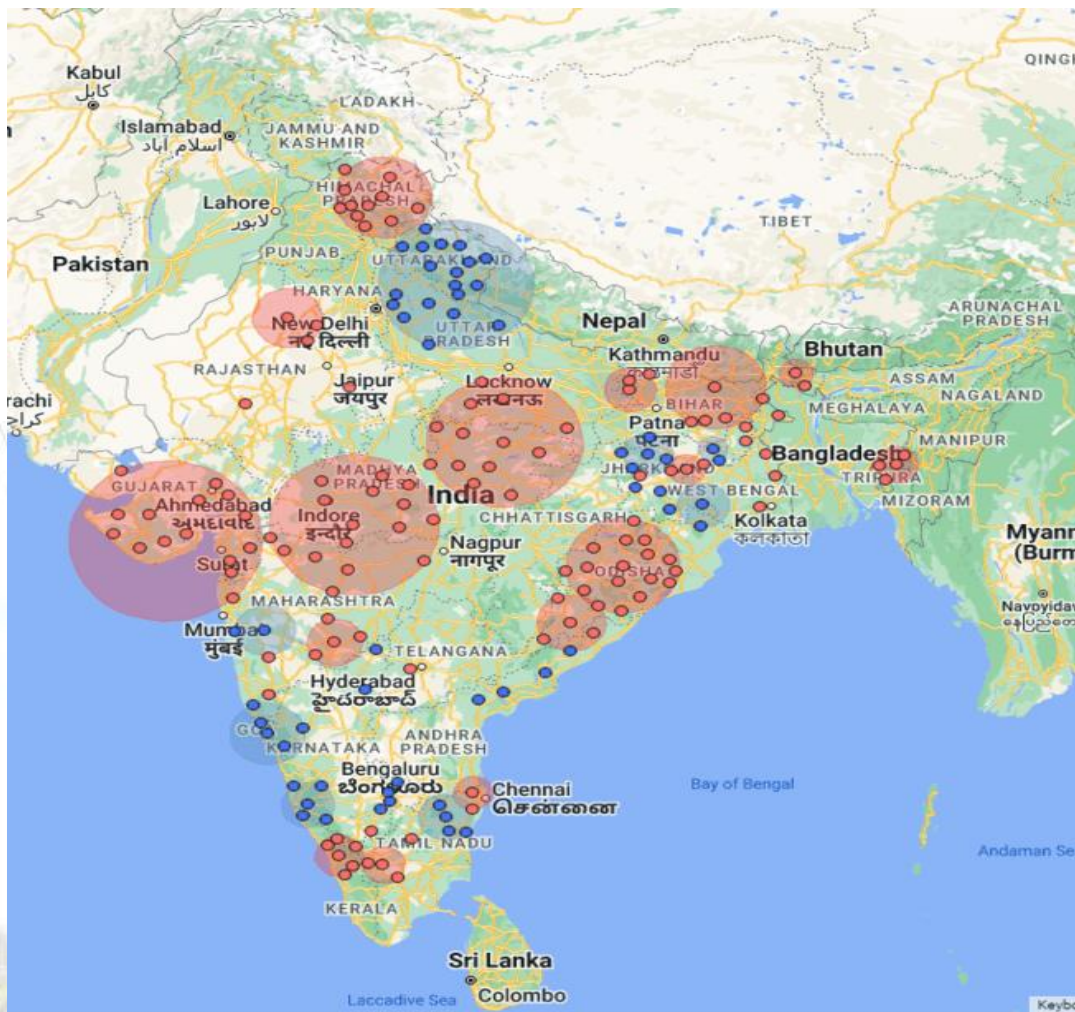
#### Model Specifications

#### Note: Red Dot: High Disease Cluster

- **Retrospective Analysis: Space-Time**
- **Probability Model: Space-Time Poisson Model**
  - With the Space-Time Poisson model, 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 SaTScan v9. 6.**

#### Blue Dot: Low Disease Cluster

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



**Model Specifications**

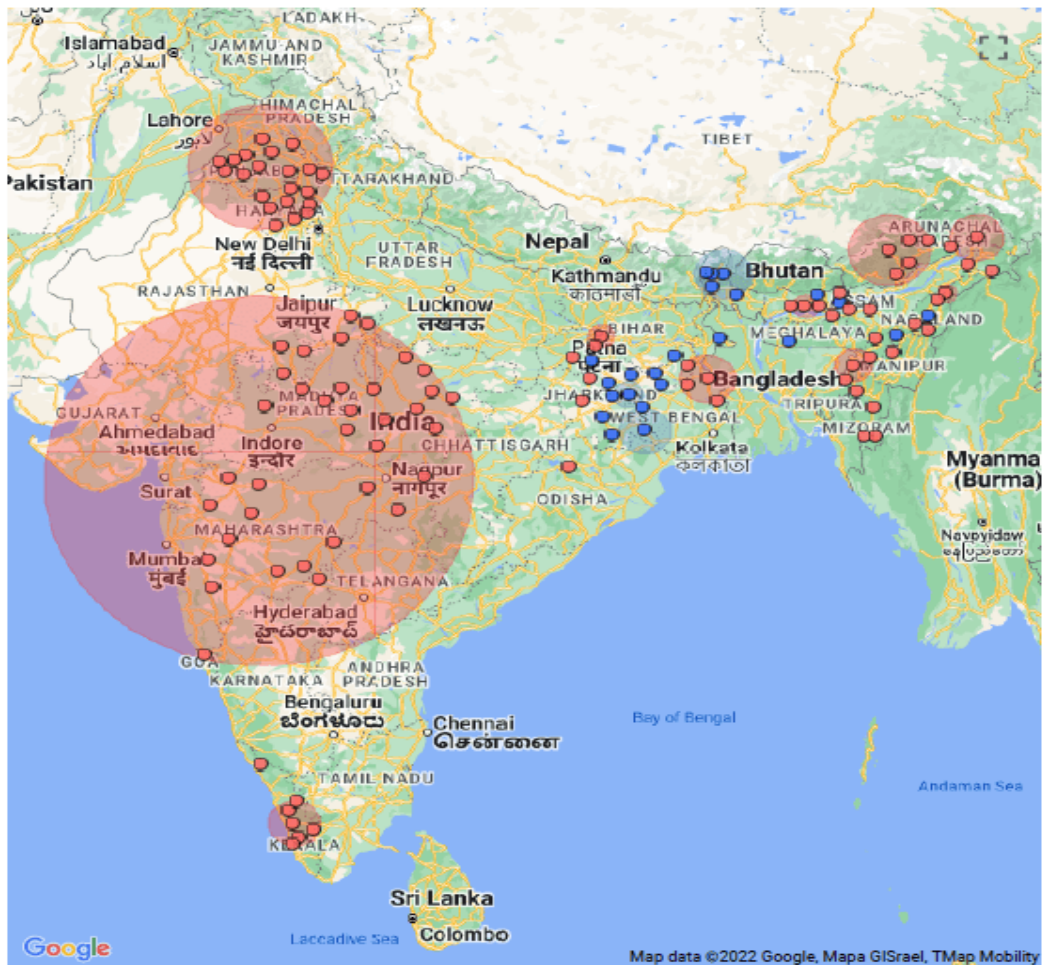
- **Retrospective Analysis: Space-Time**
- **Probability Model: Space-Time Poisson Model**
  - With the Space-Time Poisson model, the number of cases in each location is Poisson-distributed.
  - The model requires case and population counts for a set of data locations and geographical coordinates for 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 SaTScan v9. 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

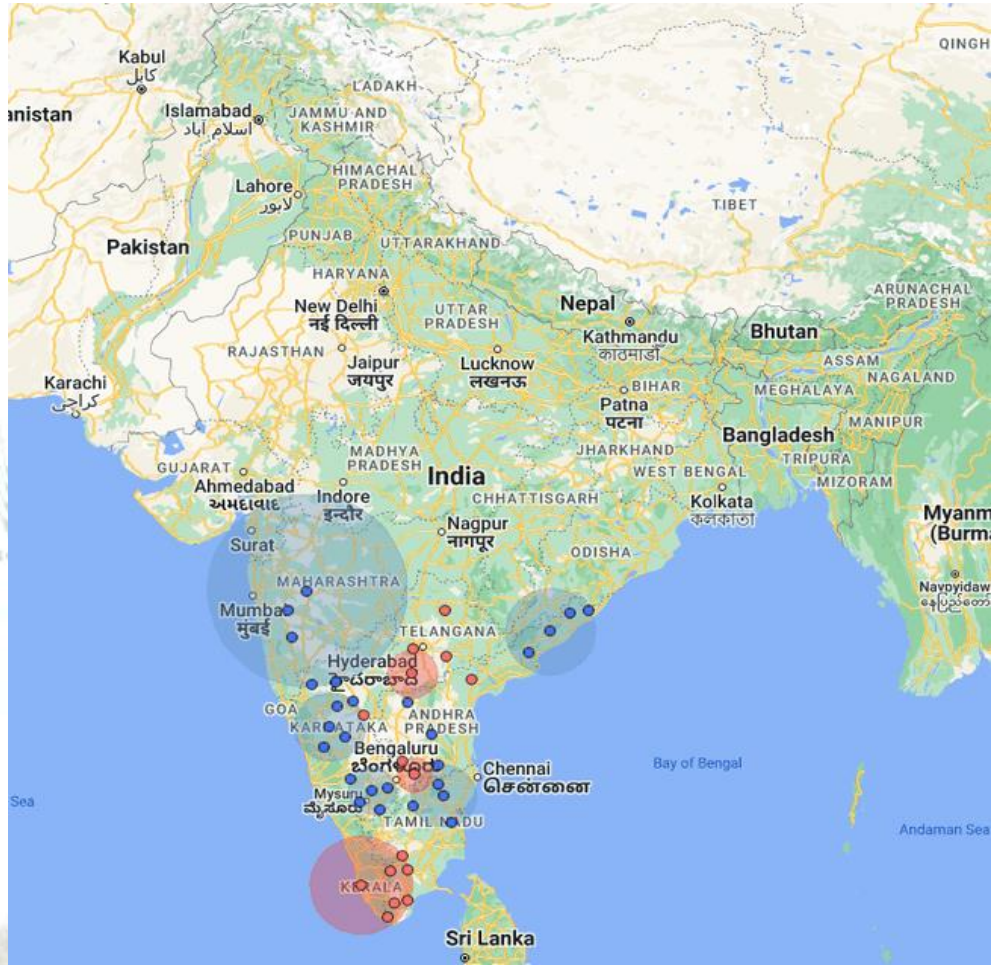
- **Retrospective Analysis: Space-Time**
- **Probability Model: Space-Time Poisson Model**
  - With the Space-Time Poisson model, the number of cases in each location is Poisson-distributed.
  - The model requires case and population counts for a set of data locations and geographical coordinates for 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 **SaTScan v9. 6**.

**Note: Red Dot: High Disease Cluster**

**Blue Dot: Low Disease Cluster**



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



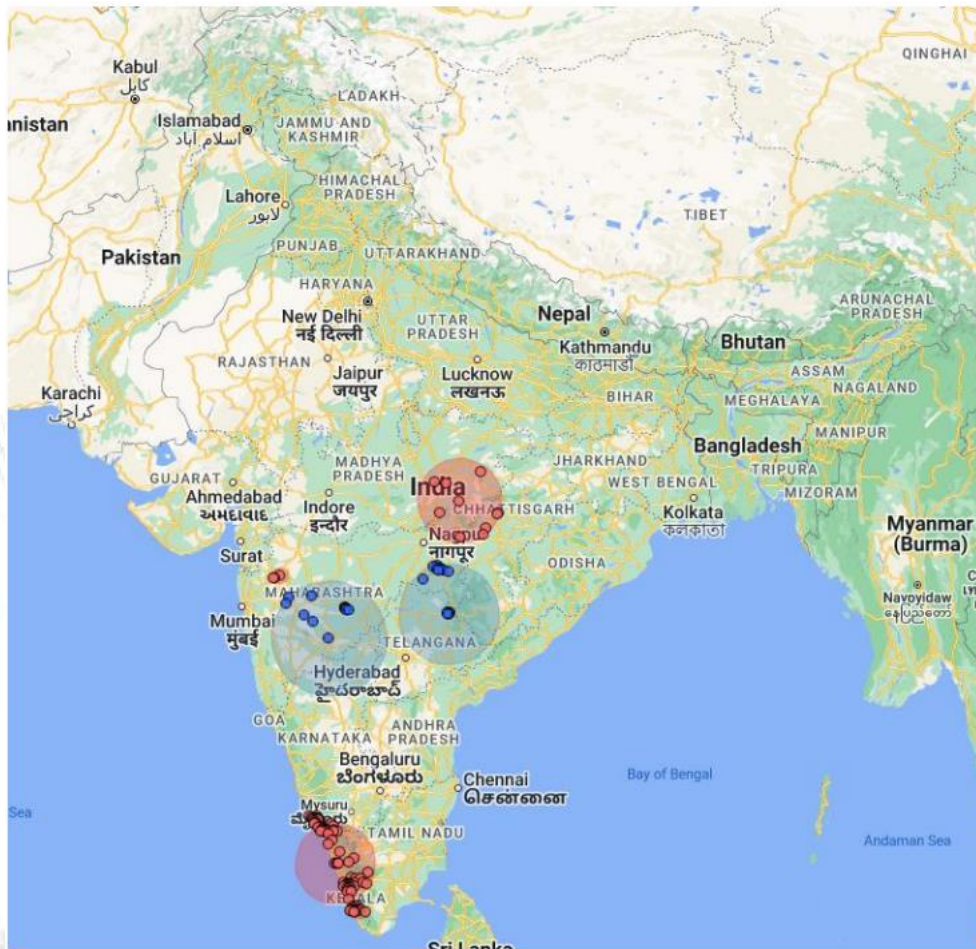
#### Model Specifications

- **Retrospective Analysis: Space-Time**
- **Probability Model: Space-Time Poisson Model**
  - With the Space-Time Poisson model, 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 SaTScan v9. 6.**

**Note: Red Dot: High Disease Cluster**

**Blue Dot: Low Disease Cluster**

#### d) LSD Hotspot by Poisson Model: LSD in India (2001-2022)



#### Model Specifications

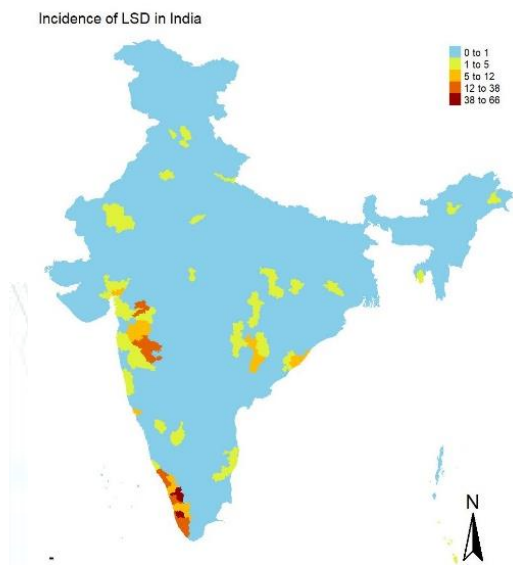
- **Retrospective Analysis: Space-Time**
- **Probability Model: Space-Time Poisson Model**
  - With the Space-Time Poisson model, the number of cases in each location is Poisson-distributed.
  - The model requires case and population counts for a set of data locations and geographical coordinates for 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 SaTScan v9. 6.**

**Note: Red Dot: High Disease Cluster**

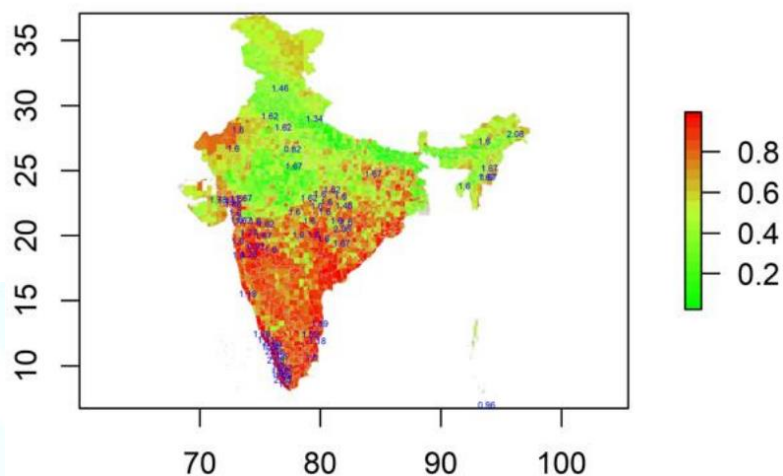
**Blue Dot: Low Disease Cluster**

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

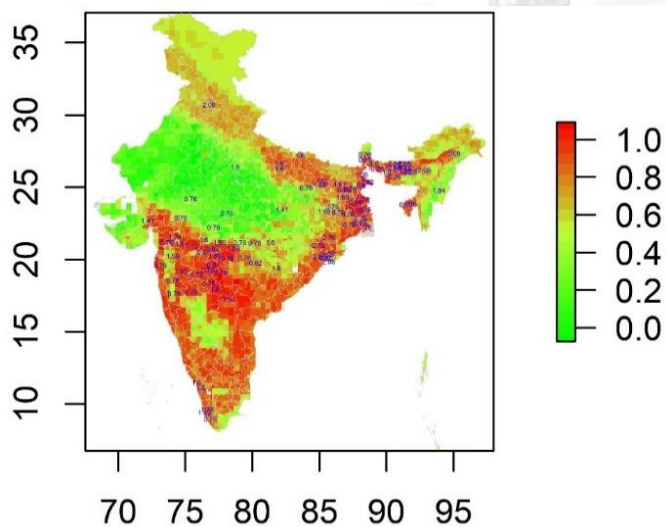
**Incidence of LSD in India**



**Risk map for LSD in India**

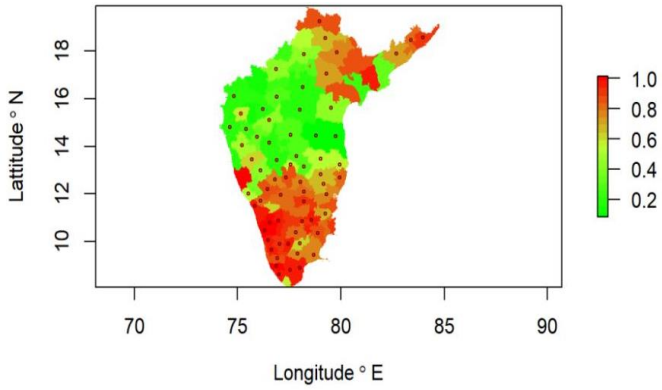


**Risk map for Avian Influenza in India**

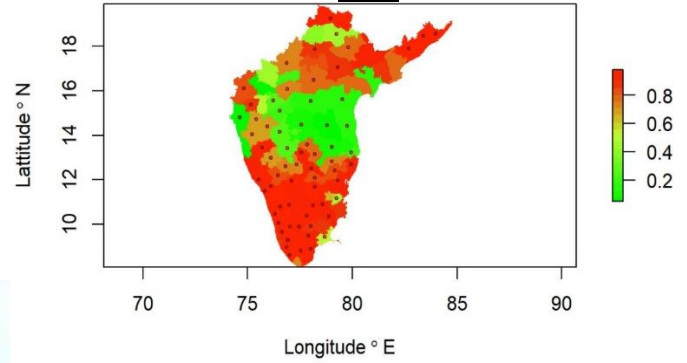




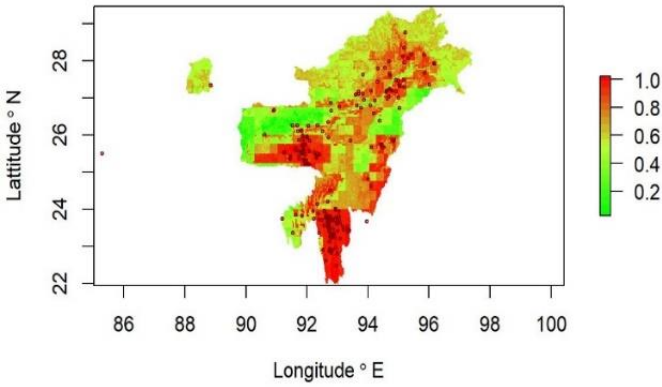
**Risk prediction for Anthrax Disease for Southern India**



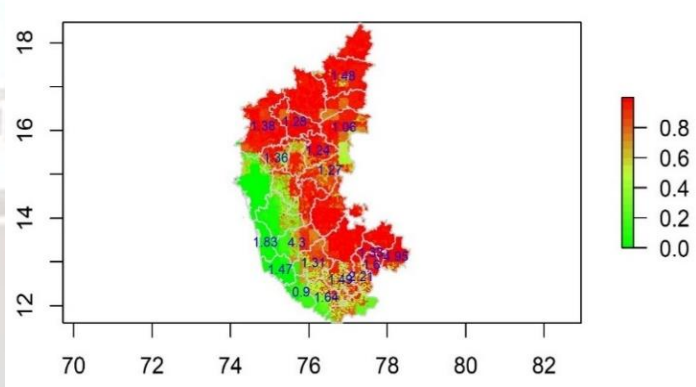
**Risk prediction for Enterotoxaemia Disease for Southern India**



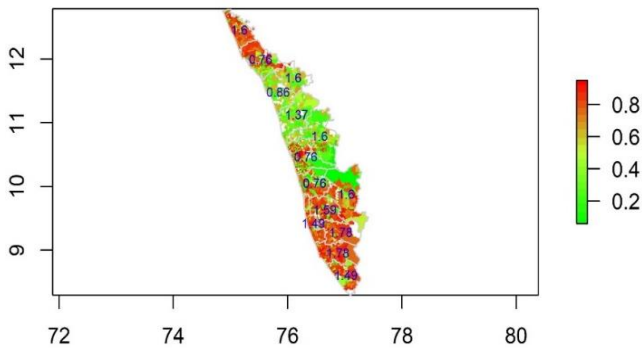
**Risk prediction for ASF for North Eastern India**



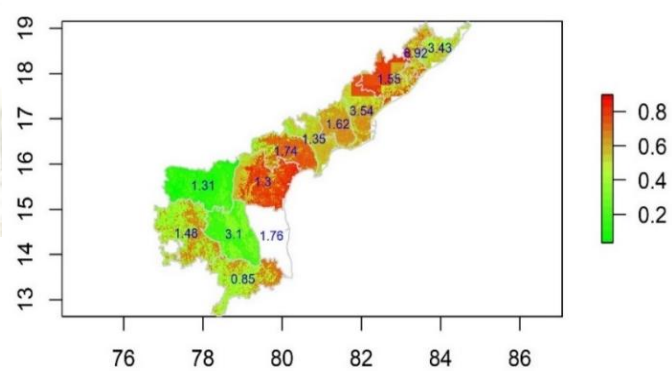
**Karnataka Risk map Bluetongue**



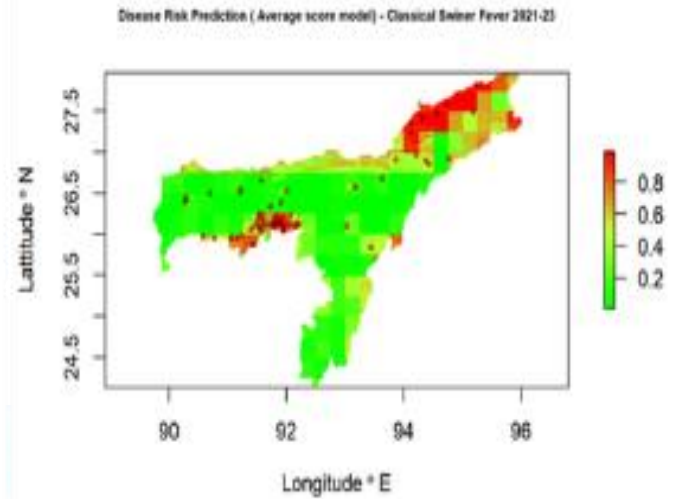
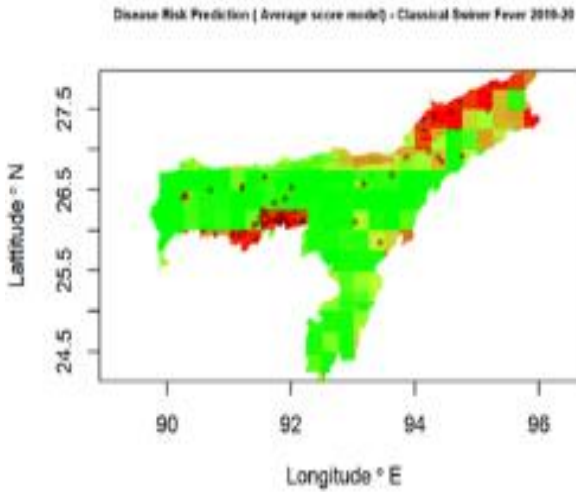
**Risk map of Anaplasmosis in Kerala**



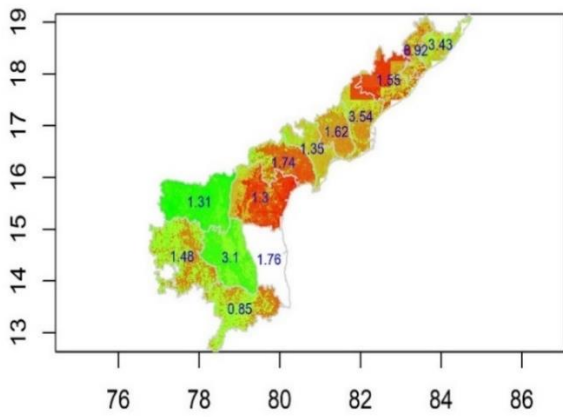
**Risk map of Bluetongue in Andhra Pradesh**



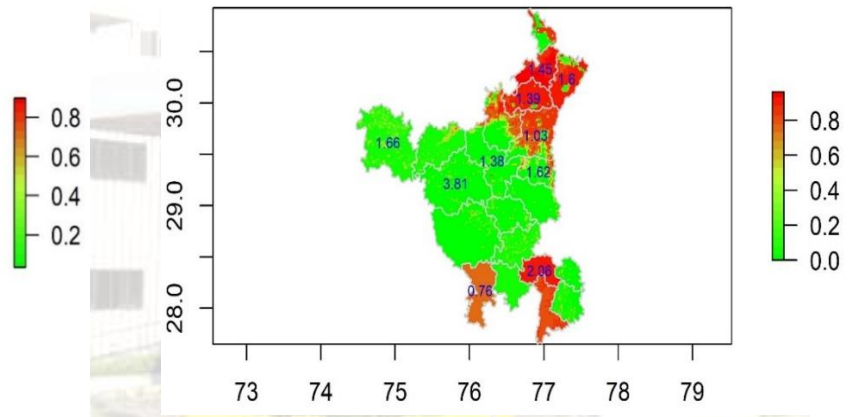
**Forecasted risk maps for Classical Swine Fever disease in Assam**



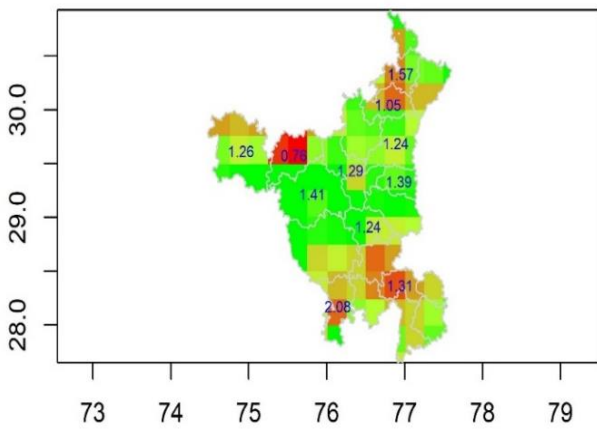
**Risk map for Bluetongue in Andhra Pradesh**



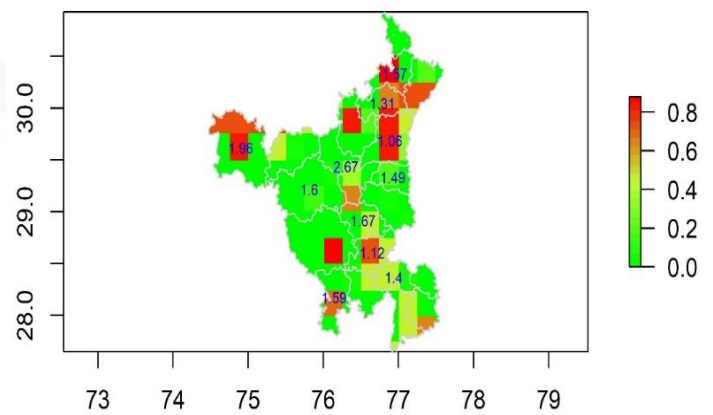
**Risk map for Babesiosis in Haryana**



**Risk map for Theileriosis in Haryana**



**Risk map for Trypanosomiasis in Haryana**



# 13. APPLICATION OF META ANALYSIS FOR UNDERSTANDING THE DISEASE PREVALENCE

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Available at [www.veterinaryworld.org/Vol.11/March-2018/7.pdf](http://www.veterinaryworld.org/Vol.11/March-2018/7.pdf)

RESEARCH ARTICLE  
Open Access

## **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](mailto:ss.patil@icar.gov.in)

**Co-authors:** KPS: [sureshkp97@gmail.com](mailto:sureshkp97@gmail.com), SS: [sneha.saha88@gmail.com](mailto:sneha.saha88@gmail.com), AP: [avi75prajapati@gmail.com](mailto:avi75prajapati@gmail.com), DH: [divakar.hemadri@gmail.com](mailto:divakar.hemadri@gmail.com), PR: [director.nivedi@icar.gov.in](mailto:director.nivedi@icar.gov.in)

**Received:** 18-11-2017, **Accepted:** 18-01-2018, **Published online:** 13-03-2018

**doi:** 10.14202/vetworld.2018.297-303 **How to cite this article:** Patil SS, Suresh KP, Saha S, Prajapati A, Hemadri D, Roy P (2018) Meta-analysis of classical swine fever prevalence in pigs in India: A 5-year study, *Veterinary World*, 11(3): 297-303.

### **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<sup>1</sup>, Sharanagouda S. Patil<sup>2</sup>, Rashmi Kurli<sup>3</sup>, Pankaj Deka<sup>1</sup>, Durlav Prasad Bora<sup>1</sup>, Giti Deka<sup>1</sup>,  
Kempanahalli M. Ranjitha<sup>2</sup>, Channappagowda Shivaranjini<sup>2</sup>, Parimal Roy<sup>4</sup> and Kuralayanapalya P. Suresh<sup>3</sup>

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](mailto:sureshkp97@gmail.com)

**Co-authors:** NNB: [nnbarman@gmail.com](mailto:nnbarman@gmail.com), SSP: [ss.patil@icar.gov.in](mailto:ss.patil@icar.gov.in), RK: [rashmikurli@yahoo.in](mailto:rashmikurli@yahoo.in), PD: [drpankajaau@gmail.com](mailto:drpankajaau@gmail.com), DPB: [drdpbora@gmail.com](mailto:drdpbora@gmail.com), GD: [gitideka8906@gmail.com](mailto:gitideka8906@gmail.com), KMR: [ranjuckm10@gmail.com](mailto:ranjuckm10@gmail.com), CS: [shivaranjinicveena@gmail.com](mailto:shivaranjinicveena@gmail.com), PR: [director.nivedi@icar.gov.in](mailto:director.nivedi@icar.gov.in)

**Received:** 26-07-2019, **Accepted:** 22-11-2019, **Published online:** 11-01-2020

**doi:** [www.doi.org/10.14202/vetworld.2020.80-91](http://www.doi.org/10.14202/vetworld.2020.80-91) **How to cite this article:** Barman NN, Patil SS, Kurli R, Deka P, Bora DP, Deka G, Ranjitha KM, Shivaranjini C, Roy P, Suresh KP (2020) Meta-analysis of the prevalence of livestock diseases in North Eastern region of India, *Veterinary World*, 13(1): 80-91.

### 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.





***Review Article*****Peste Des Petits Ruminants in Atypical Hosts and Wildlife:  
Systematic Review and Meta-Analysis of the Prevalence  
between 2001 and 2021****Sowjanya Kumari, S<sup>1,2</sup>, Bhavya, A. P<sup>1</sup>, Akshata, N<sup>1</sup>, Kumar, K, V<sup>1</sup>, Bokade, P. P<sup>1</sup>, Suresh,  
K. P<sup>1</sup>, Shome, B. R<sup>1</sup>, Balamurugan, V<sup>1</sup> \****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*

Received 18 November 2021; Accepted 14 December 2021

Corresponding Author: balavirol@gmail.com

**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](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 hooved 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 acute illness that affects a large 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 characteristics in 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.

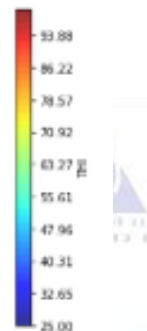
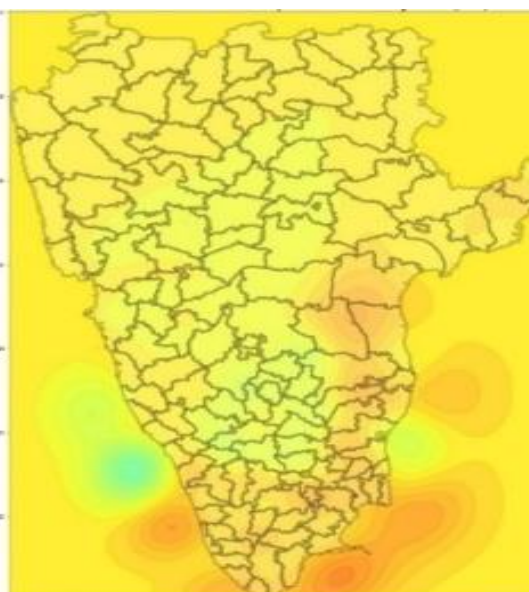
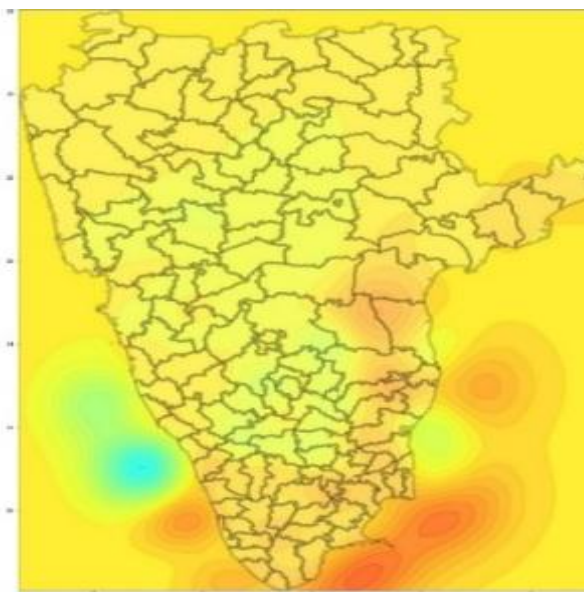


# 15. IMPACT OF CLIMATE CHANGE ON LIVESTOCK DISEASE INCIDENCE

## 15.1 Southern States Temperature Humidity Index (THI) 2001-2021

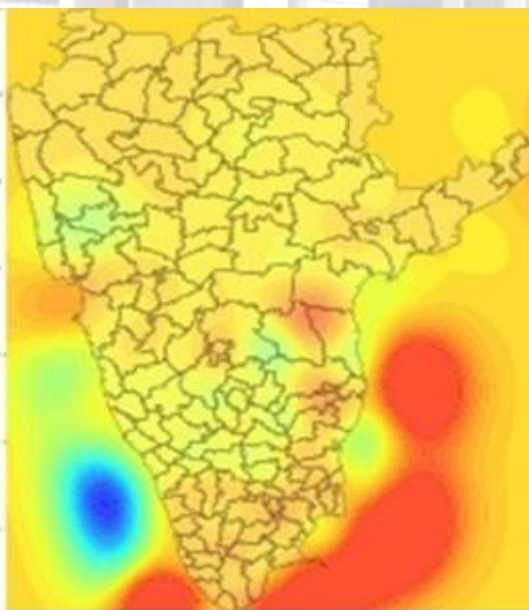
THI for 2001

THI for 2011

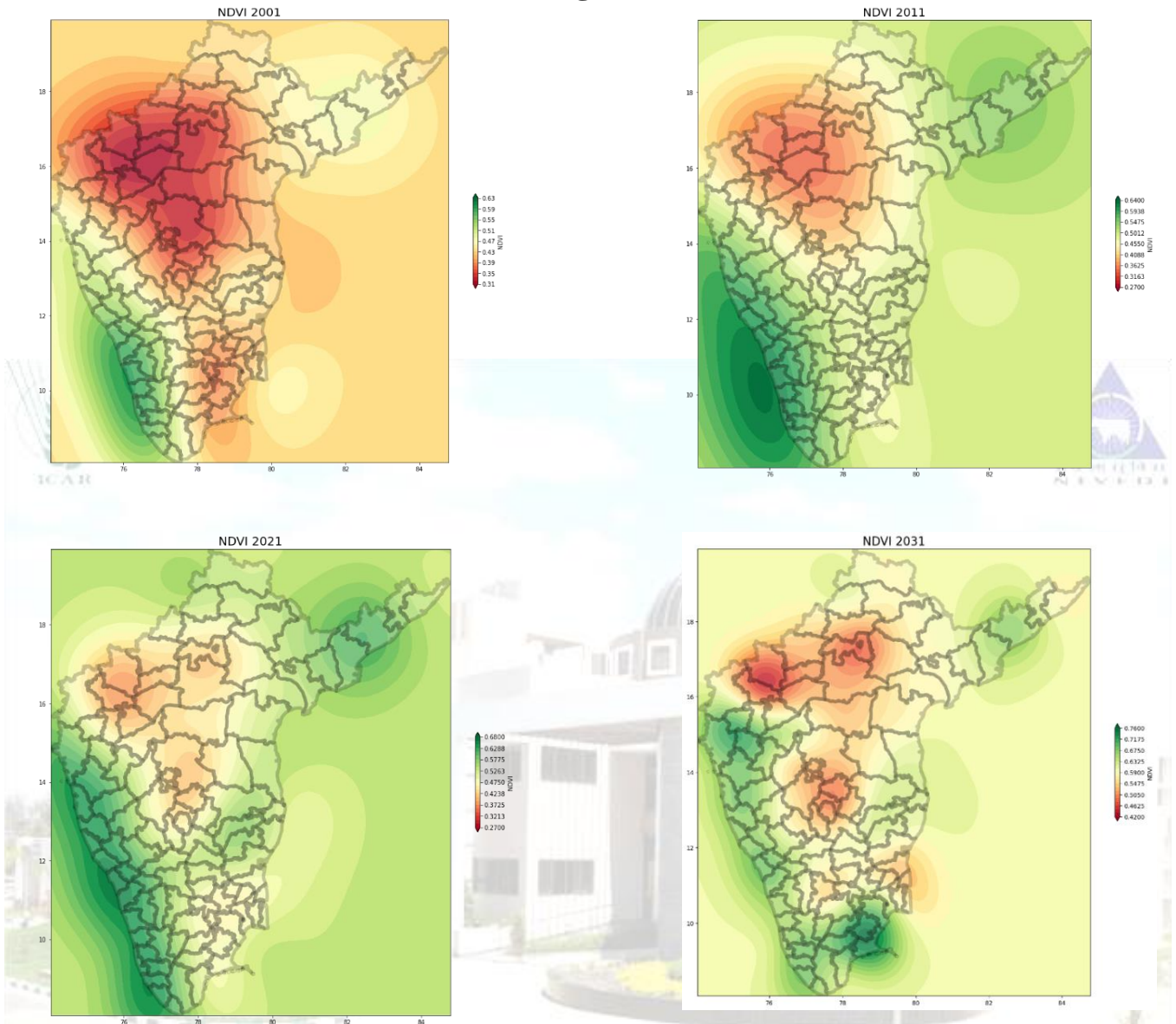


THI for 2021

THI for 2023 (Predicted)

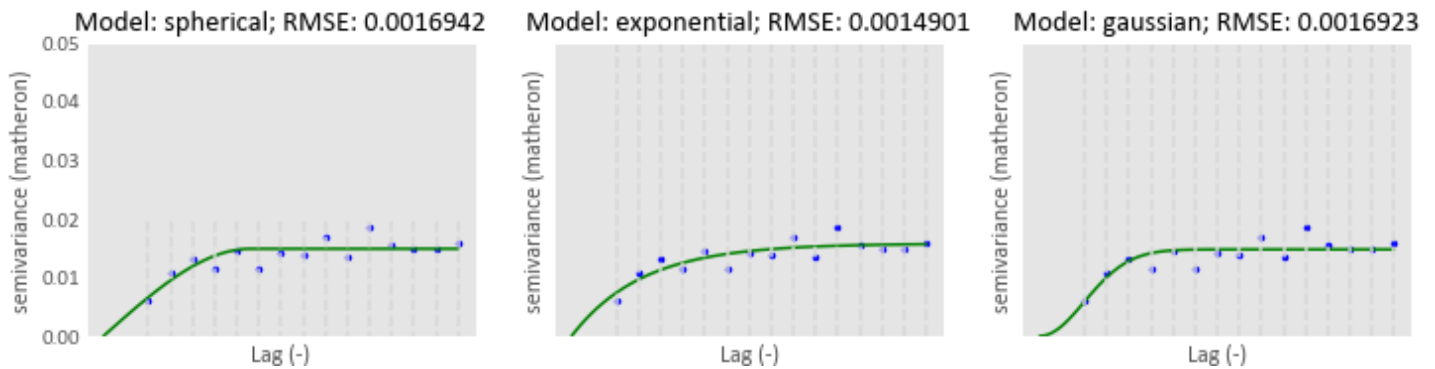


## 15.2. Southern States Normalized Difference Vegetation Index (NDVI)



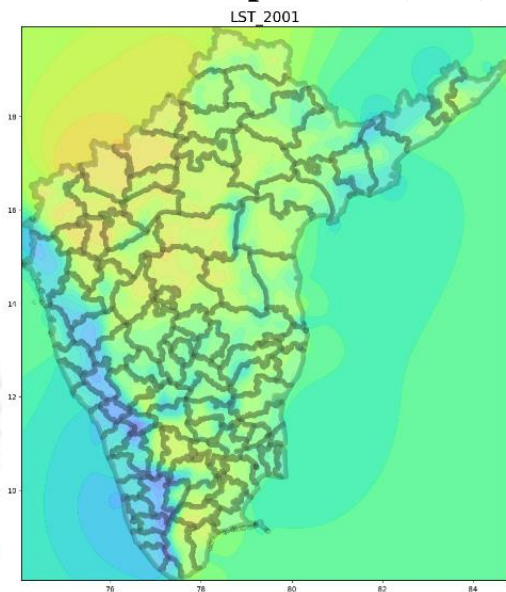
### Best fit Variogram model for NDVI:

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.

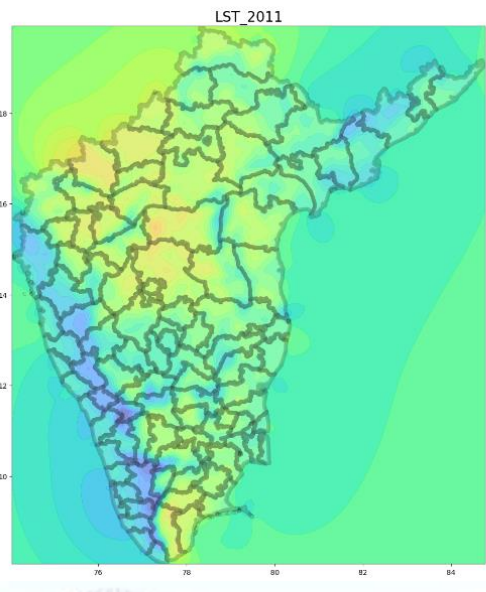




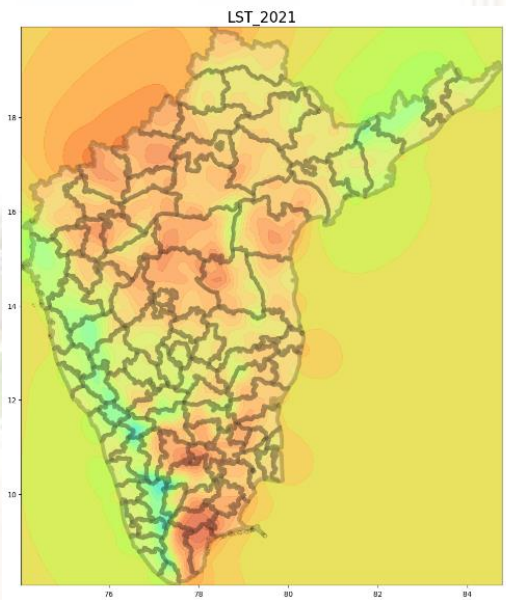
### 15.3 Land Surface Temperature (LST) - 2001-2031



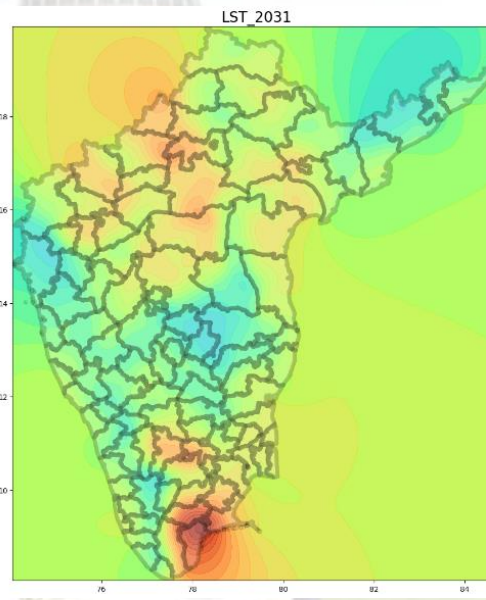
**LST-2001**



**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  
 $p \cdot (1 - e^{-d^2/(4r^2)}) + n$

#### 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

$$\text{THI} = (1.8 \cdot \text{AT} + 32) - [(0.0055 - 0.0055 \cdot \text{RH}) \cdot (1.8 \cdot \text{AT} - 26)]$$

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** : Haemorrhagic Septicaemia

**PPR** : Peste des Petits Ruminants

**SGP** : Sheep and Goat pox

**SF** : Swine Fever

**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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## Customer/Client Feedback Form

Feedback for the Livestock Diseases Risk Forewarning Bulletin of November-2022, Volume 10 and Issue 11

**(Please return this duly fill in after receiving the outbreak report of January-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.	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:**





हर कदम, हर डगर  
किसानों का हमसाफर  
भारतीय कृषि अनुसंधान परिषद

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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](mailto:director.nivedi@icar.gov.in)