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Supplementary for Karnataka (Block Level) Forewarning



LIVESTOCK DISEASE FOREWARNING BULLETIN- October 2018

(SIMPLIFIED SOLUTION! MAGNIFIED OPPORTUNITY!)



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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

We would like to acknowledge the constant support and inspiration from honourable Secretary, DARE & DG, ICAR, Government of India, New Delhi.

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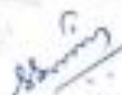
We would also like to express sincere gratitude to Department of Animal Husbandry, Dairying and Fisheries, Government of India for providing the livestock population data for preparation of this bulletin.


Animal Husbandry Departments of state governments and also AICRP on ADMAS centers are gratefully acknowledged for the timely report of disease outbreak data. We are thankful to all the scientific and technical staff of ICAR-NIVEDI for their feedback and support.

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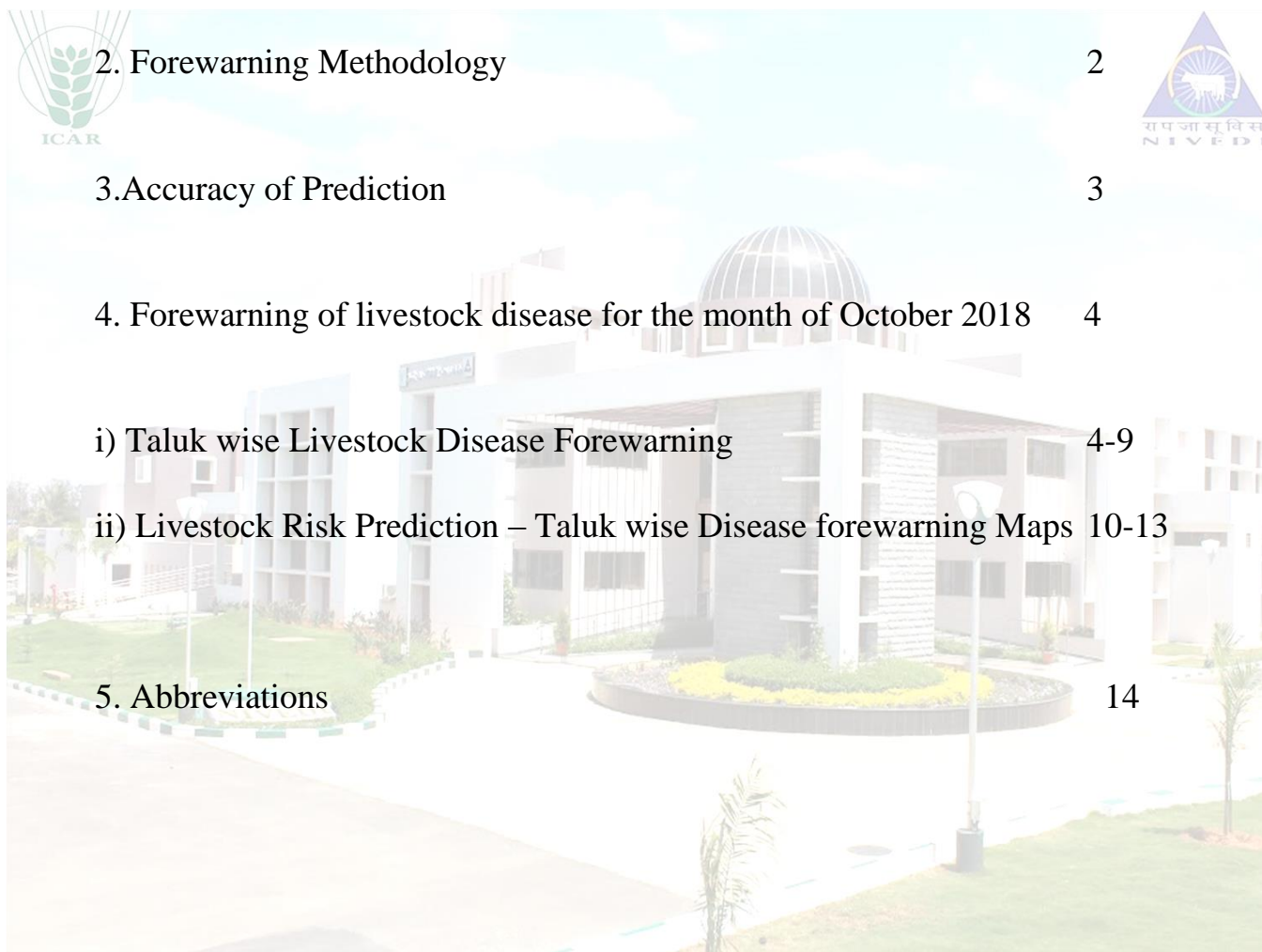
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1. About the bulletin...

Livestock sector also plays a critical role in the welfare of India's rural population. This enterprise provides a flow of essential food products, draught power, manure, employment, income, and export earnings. 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 international market, which in turn demands safe animal health for better products. Therefore, livestock development programmes cannot succeed unless a well-organized animal health service is built up and protection of livestock against diseases and pests particularly against the deadly infections is assured.

India has achieved eradication of rinderpest (RP), CBPP, AHS and Dourine. However, there are several other infectious and non-infectious diseases prevailing in the country causing huge economic loss annually. 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 the diseases like FMD, PPR, Brucellosis, CSF, BT, HS etc., which cause huge economic loss annually to the livestock industry. To this end, ICAR-NIVEDI has identified 4 priority diseases, based on the past incidence patterns and has built a strong database of these diseases. The database, which is backbone of the National Animal Disease Referral Expert System (NADRES), 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.

After realising the difficulties in implementing the forewarning results at district level and also considering the importance of forewarning at block level, ICAR-NIVEDI attempted to develop models for predictive analytics at block levels. Similar risk factors like Meteorological and remote sensing variables were used for forewarning at block level. We started providing the forewarning results for Karnataka state on Foot & Mouth disease, Black quarter, HS and PPR on pilot basis.

2. Forewarning Methodology

I) Materials.

Livestock disease data

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

Livestock population data

District wise livestock population data from 19th Livestock census (2012)

Meteorological data

Variables such as precipitation (mm/month), pressure (millibar), relative humidity(%), sea level pressure(millibar), minimum temperature (°C), maximum temperature(°C), wind speed(m/s), vapour pressure (hPa), soil moisture(%), perceptible water(mm), potential evaporation transpiration(mm/day) and cloud (%) were extracted from NCEP-National centre environmental prediction/IMD-Indian meteorological Database/NICRA-National Innovation Climate Resilient Agriculture and other sources for the past five years. Monthly average for the past five years have been calculated and used.

Remote sensing data

Remote sensing variables such as NDVI-Normalised difference vegetation index, EVI-Enhanced vegetation index and LST - Land surface temperature were calculated using MODIS LANDSAT/IRS satellite images for the past five years. Monthly average for the past five years have been calculated and used. Details of the parameters are tabulated below.

SDS Layer Name	Resolution	Description	Units	Data Type	Scaling Factor
500m_16_days_NDVI	500 sq. m	16 day NDVI average	NDVI	16-bit signed integer	0.0001
500m_16_days_EVI	500 sq. m	16 day EVI average	EVI	16-bit signed integer	0.0001
LST_Day_1km	1 sq. km	Day Land Surface Temperature	Kelvin	16-bit unsigned integer	0.02
Lai_1km	1 sq. km	Leaf Area Index	m ² plant/m ² ground	8-bit unsigned integer	0.1

II) Method.

Disease outbreak was predicted by Generalised Linear Model (Logistic Regression) from the master chart containing the above parameters using a R programme and the probability of disease outbreak was categorised in 6 risk levels- No risk (NR), Very low risk (VLR), Low risk (LR), Moderate risk (MR), High risk (HR) and Very high risk (VHR) for enabling the stake holders to take appropriate control measures by suitably allocating available resources.

Given below is the probability distribution of risk interpretations.

S. No.	Probability of risk	Interpretation
1	0	No risk/No or inadequate data
2	0-0.20	Very low risk
3	0.21-0.40	Low risk
4	0.41-0.60	Moderate risk
5	0.61-0.80	High risk
6	0.8-1.0	Very high risk

3. Accuracy of Prediction.

Serial No.	Diseases	Accuracy (%)
1.	Black quarter	97.72
2.	Foot and mouth disease	93.75
3.	Haemorrhagic septicaemia	89.20
4.	Peste des petits ruminants	100



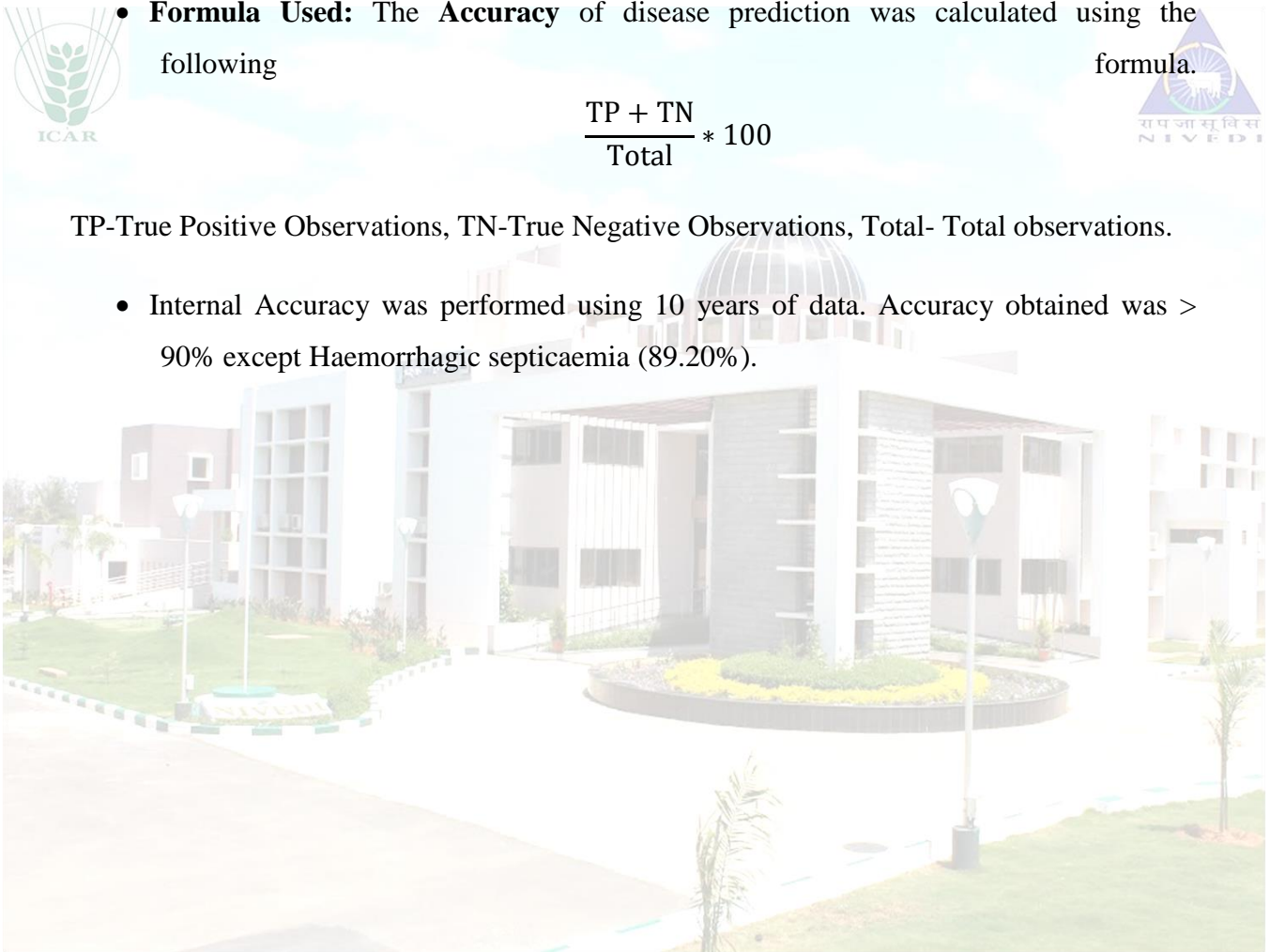
- **Formula Used:** The **Accuracy** of disease prediction was calculated using the following formula.

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



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

- Internal Accuracy was performed using 10 years of data. Accuracy obtained was > 90% except Haemorrhagic septicaemia (89.20%).



4. Forewarning of livestock disease for the month of October 2018

i) Taluk/Block wise Livestock Disease Forewarning

KARNATAKA TALUK/BLOCK LEVEL FOREWARNING: OCTOBER 2018					
DISTRICT	Taluk/Block	Black quarter	Foot and mouth disease	Haemorrhagic septicaemia	Peste des petits ruminants
BAGALKOT	Badami	NR	NR	VLR	NR
BAGALKOT	Bagalkot	NR	NR	VLR	NR
BAGALKOT	Bilgi	VLR	LR	VLR	NR
BAGALKOT	Hungund	NR	NR	LR	NR
BAGALKOT	Jamkhandi	NR	VLR	NR	NR
BAGALKOT	Mudhol	NR	VLR	VLR	NR
BANGALORE	Anekal	VLR	NR	VLR	NR
BANGALORE	Bangalore North	NR	VLR	LR	NR
BANGALORE	Bangalore South	LR	NR	VLR	NR
BANGALORE RURAL	Devanahalli	VLR	VLR	VLR	NR
BANGALORE RURAL	DodBallapur	VLR	NR	VLR	NR
BANGALORE RURAL	Hosakote	VLR	VHR	LR	NR
BANGALORE RURAL	Nelamangala	NR	NR	VLR	NR
BELGAUM	Athni	VLR	NR	NR	NR
BELGAUM	Belgaum	NR	VLR	VLR	NR
BELGAUM	Chikodi	NR	NR	VLR	NR
BELGAUM	Gokak	NR	VLR	NR	NR
BELGAUM	Hukeri	NR	VLR	LR	NR
BELGAUM	Khanapur	NR	VLR	NR	NR
BELGAUM	Parasgad	NR	NR	VLR	NR
BELGAUM	Ramdurg	NR	VLR	VLR	NR
BELGAUM	Raybag	NR	NR	VLR	NR
BELGAUM	Sampgaon	LR	NR	HR	NR
BELLARY	Bellary	NR	NR	VLR	NR
BELLARY	Hadagalli	VLR	NR	VLR	NR
BELLARY	Hagaribommanahalli	VLR	NR	VLR	NR

BELLARY	Hospet	VLR	VLR	VLR	NR
BELLARY	Kudligi	NR	VLR	VLR	NR
BELLARY	Sandur	NR	VLR	VLR	NR
BELLARY	Siruguppa	VLR	VLR	NR	NR
BIDAR	Aurad	NR	NR	VLR	NR
BIDAR	Basavakalyan	VLR	VLR	VLR	NR
BIDAR	Bhalki	VLR	VLR	VLR	NR
BIDAR	Bidar	NR	VLR	NR	NR
BIDAR	Homnabad	NR	VLR	VLR	NR
BIJAPUR	BasavanaBagevadi	NR	NR	VLR	NR
BIJAPUR	Bijapur	NR	NR	VLR	NR
BIJAPUR	Indi	VLR	NR	VLR	NR
BIJAPUR	Muddebihal	NR	VLR	VLR	NR
BIJAPUR	Sindgi	NR	LR	VLR	VHR
CHAMARAJANAGAR	Chamarajanagar	NR	NR	NR	NR
CHAMARAJANAGAR	Gundlupet	NR	NR	VLR	NR
CHAMARAJANAGAR	Kollegal	VLR	VLR	NR	NR
CHAMARAJANAGAR	Yelandur	NR	NR	NR	NR
CHIKKABALLAPURA	Bagepalli	NR	VLR	VLR	NR
CHIKKABALLAPURA	Chikkaballapura	NR	VLR	VLR	NR
CHIKKABALLAPURA	Chintamani	NR	NR	VLR	NR
CHIKKABALLAPURA	Gauribidanur	NR	VLR	NR	NR
CHIKKABALLAPURA	Gudibanda	NR	VLR	VLR	NR
CHIKKABALLAPURA	Sidlaghatta	VLR	VLR	VLR	VHR
CHIKMAGALUR	Chikmagalur	VLR	VLR	VLR	NR
CHIKMAGALUR	Kadur	NR	NR	VLR	NR
CHIKMAGALUR	Koppa	VLR	VLR	VLR	NR
CHIKMAGALUR	Mudigere	NR	VLR	VLR	NR
CHIKMAGALUR	Narasimharajapura	NR	VLR	VLR	NR
CHIKMAGALUR	Sringeri	NR	VLR	VLR	NR

CHIKMAGALUR	Tarikere	VLR	VLR	VLR	NR
CHITRADURGA	Challakere	NR	VLR	VLR	NR
CHITRADURGA	Chitradurga	NR	NR	VLR	NR
CHITRADURGA	Hiriyur	NR	VLR	VLR	NR
CHITRADURGA	Holalkere	VLR	VLR	VLR	NR
CHITRADURGA	Hosdurga	NR	VLR	VLR	NR
CHITRADURGA	Molakalmuru	NR	VLR	VLR	NR
DAKSHINA KANNADA	Bantval	NR	NR	NR	NR
DAKSHINA KANNADA	Beltangadi	NR	NR	NR	NR
DAKSHINA KANNADA	Mangalore	NR	NR	NR	NR
DAKSHINA KANNADA	Puttur	NR	NR	NR	NR
DAKSHINA KANNADA	Sulya	NR	VLR	NR	NR
DAVANAGERE	Channagiri	NR	VLR	VLR	NR
DAVANAGERE	Davanagere	NR	VLR	VLR	NR
DAVANAGERE	Harapanahalli	NR	NR	VLR	NR
DAVANAGERE	Harihar	NR	NR	VLR	NR
DAVANAGERE	Honnali	NR	VLR	VLR	NR
DAVANAGERE	Jagalur	NR	NR	VLR	NR
DHARWAD	Dharwad	NR	NR	VLR	NR
DHARWAD	Hubli	NR	VLR	LR	NR
DHARWAD	Hubli city	NR	NR	VLR	NR
DHARWAD	Kalghatgi	VLR	NR	VLR	NR
DHARWAD	Kundgol	NR	NR	LR	NR
DHARWAD	Navalgund	NR	NR	VLR	NR
GADAG	Gadag	NR	NR	LR	NR
GADAG	Mundargi	VLR	NR	VLR	NR
GADAG	Nargund	NR	NR	MR	NR
GADAG	Ron	NR	NR	LR	NR
GADAG	Shirhatti	NR	NR	LR	NR
GULBARGA	Afzalpur	NR	VLR	NR	NR

GULBARGA	Aland	NR	LR	VLR	NR
GULBARGA	Chincholi	NR	VLR	VLR	NR
GULBARGA	Chitapur	VLR	NR	VLR	NR
GULBARGA	Gulbarga	NR	VLR	VLR	NR
GULBARGA	Jevargi	NR	NR	NR	NR
GULBARGA	Sedam	NR	VLR	VLR	NR
HASSAN	Alur	VLR	VLR	VLR	NR
HASSAN	Arkalgud	VHR	NR	VHR	NR
HASSAN	Arsikere	HR	VLR	VLR	NR
HASSAN	Belur	HR	VLR	VLR	NR
HASSAN	Channarayapatna	NR	NR	VLR	VHR
HASSAN	Hassan	NR	MR	VLR	NR
HASSAN	Hole Narsipur	VLR	VLR	NR	NR
HASSAN	Sakleshpur	NR	VLR	VLR	NR
HAVERI	Byadgi	NR	NR	VLR	NR
HAVERI	Hangal	NR	NR	VLR	NR
HAVERI	Haveri	NR	NR	VLR	NR
HAVERI	Hirekerur	NR	VLR	NR	NR
HAVERI	Ranibennur	VHR	NR	MR	NR
HAVERI	Savanur	NR	NR	VLR	NR
HAVERI	Shiggaon	NR	NR	LR	NR
KODAGU	Madikeri	NR	NR	VLR	NR
KODAGU	Somvarpet	VLR	VLR	VLR	NR
KODAGU	Virajpet	NR	NR	NR	NR
KOLAR	Bangarapet	NR	NR	VLR	NR
KOLAR	Kolar	VLR	NR	VLR	NR
KOLAR	Malur	NR	VLR	VLR	NR
KOLAR	Mulbagal	VLR	VLR	VLR	NR
KOLAR	Srinivasapur	NR	VLR	NR	NR
KOPPAL	Gangawati	VLR	VLR	VLR	NR

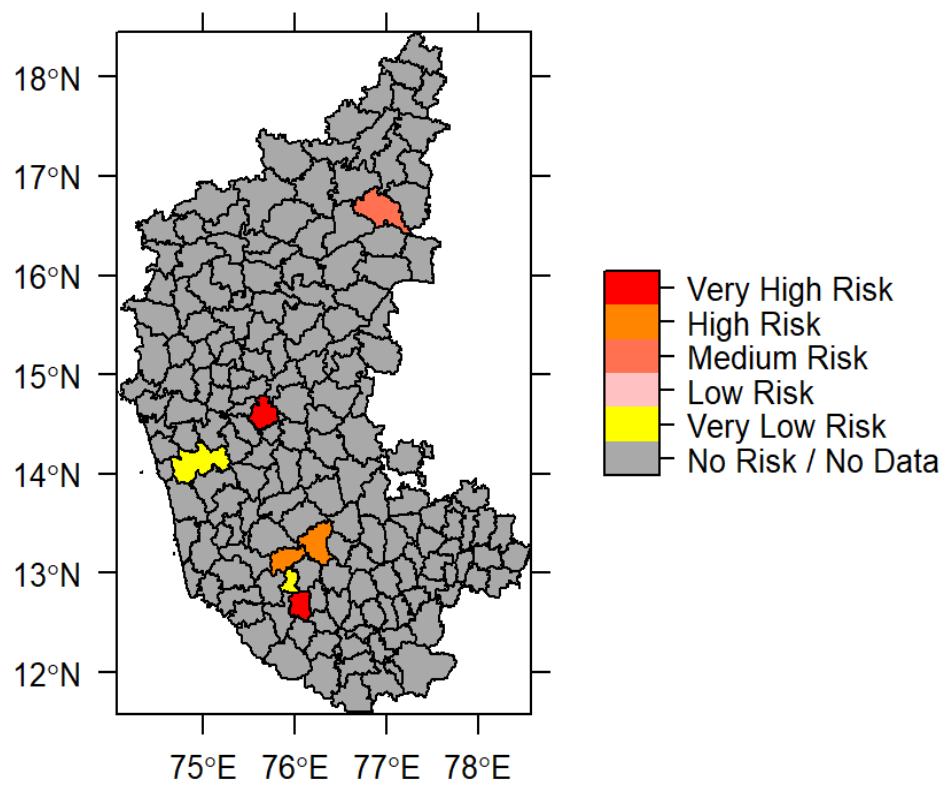
KOPPAL	Koppal	NR	NR	VLR	NR
KOPPAL	Kushtagi	NR	NR	VLR	NR
KOPPAL	Yelbarga	VLR	MR	VLR	NR
MANDYA	Krishnarajpet	NR	NR	VLR	NR
MANDYA	Maddur	NR	LR	NR	NR
MANDYA	Malavalli	NR	VLR	NR	NR
MANDYA	Mandya	NR	VLR	VLR	NR
MANDYA	Nagamangala	VLR	VLR	VLR	NR
MANDYA	Pandavapura	NR	NR	NR	NR
MANDYA	Shrirangapattana	NR	VLR	NR	NR
MYSORE	Heggadadevankote	NR	VLR	NR	NR
MYSORE	Hunsur	NR	VLR	VLR	NR
MYSORE	Krishnarajanagara	NR	VLR	VLR	NR
MYSORE	Mysore	NR	VLR	VLR	NR
MYSORE	Nanjangud	NR	VLR	NR	NR
MYSORE	Piriyapatna	NR	VLR	VLR	NR
MYSORE	Tirumakudal - Narsipur	NR	VLR	NR	NR
RAICHUR	Devadurga	VLR	VLR	VLR	NR
RAICHUR	Lingsugur	NR	VHR	VLR	NR
RAICHUR	Manvi	NR	VLR	VLR	NR
RAICHUR	Raichur	NR	VLR	VLR	NR
RAICHUR	Sindhur	VLR	VLR	LR	NR
RAMANAGARA	Channapatna	VLR	VLR	NR	NR
RAMANAGARA	Kanakapura	NR	HR	NR	NR
RAMANAGARA	Magadi	NR	VLR	NR	NR
RAMANAGARA	Ramanagara	VLR	VLR	VLR	NR
SHIMOGA	Bhadravati	NR	VLR	VLR	NR
SHIMOGA	Hosanagara	NR	VLR	VLR	NR
SHIMOGA	Sagar	VLR	NR	VLR	NR
SHIMOGA	Shikarpur	NR	NR	VLR	NR

SHIMOGA	Shimoga	VLR	VLR	HR	NR
SHIMOGA	Sorab	NR	VLR	NR	NR
SHIMOGA	Tirthahalli	VLR	NR	VLR	NR
TUMKUR	Chiknayakanhalli	NR	VLR	VLR	NR
TUMKUR	Gubbi	NR	VLR	VLR	VHR
TUMKUR	Koratagere	NR	VLR	VLR	NR
TUMKUR	Kunigal	NR	VLR	VLR	NR
TUMKUR	Madhugiri	NR	NR	VLR	NR
TUMKUR	Pavagada	NR	NR	VLR	NR
TUMKUR	Sira	NR	VLR	VLR	VHR
TUMKUR	Tiptur	NR	VLR	VLR	NR
TUMKUR	Tumkur	NR	NR	VLR	NR
TUMKUR	Turuvekere	NR	NR	VLR	NR
UDUPI	Karkal	NR	VLR	NR	NR
UDUPI	Kundapura	NR	VLR	NR	NR
UDUPI	Udupi	NR	NR	NR	NR
UTTARA KANNADA	Ankola	NR	VLR	NR	NR
UTTARA KANNADA	Bhatkal	NR	NR	VLR	NR
UTTARA KANNADA	Haliyal	VLR	VLR	NR	NR
UTTARA KANNADA	Honavar	NR	NR	NR	NR
UTTARA KANNADA	Karwar	NR	VLR	NR	NR
UTTARA KANNADA	Kumta	NR	VHR	NR	NR
UTTARA KANNADA	Mundgod	NR	VLR	NR	NR
UTTARA KANNADA	Siddapur	NR	HR	NR	NR
UTTARA KANNADA	Sirsi	NR	VLR	NR	NR
UTTARA KANNADA	Supa	NR	VHR	NR	NR
UTTARA KANNADA	Yellapur	VLR	VLR	NR	NR
YADGIR	Shahpur	MR	MR	VLR	NR
YADGIR	Shorapur	NR	LR	NR	NR
YADGIR	Yadgir	NR	VLR	NR	NR

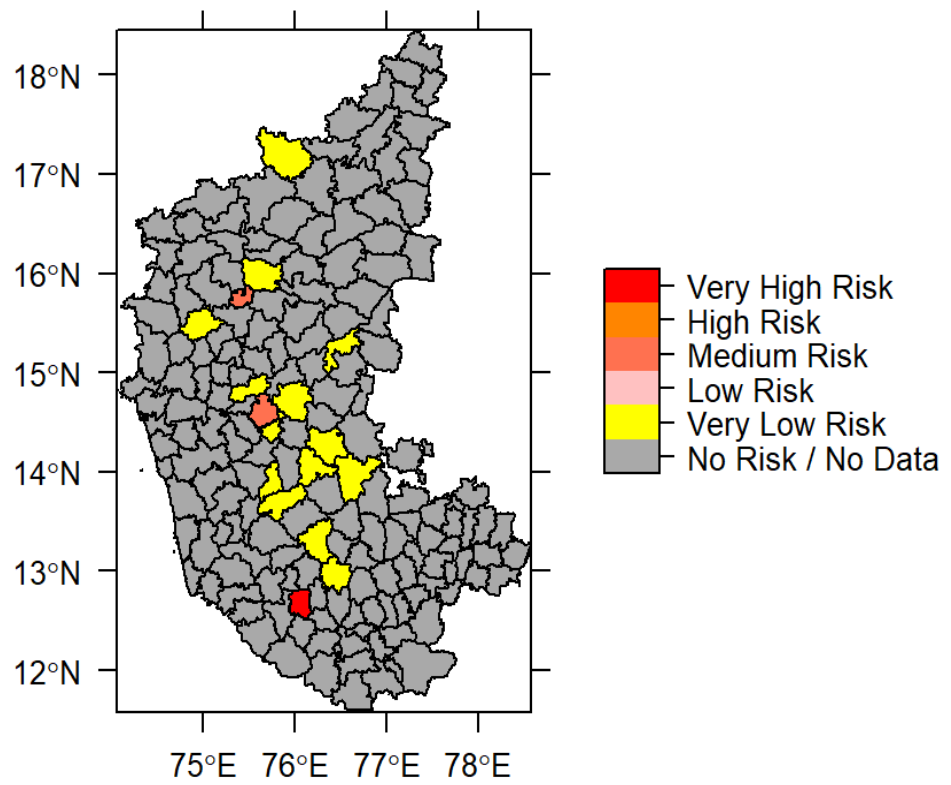
*Number of predicted disease incidence was summarised considering only High risk and Very high risk (VHR+HR)

ii) Livestock Risk Prediction – Taluk wise Disease forewarning Maps

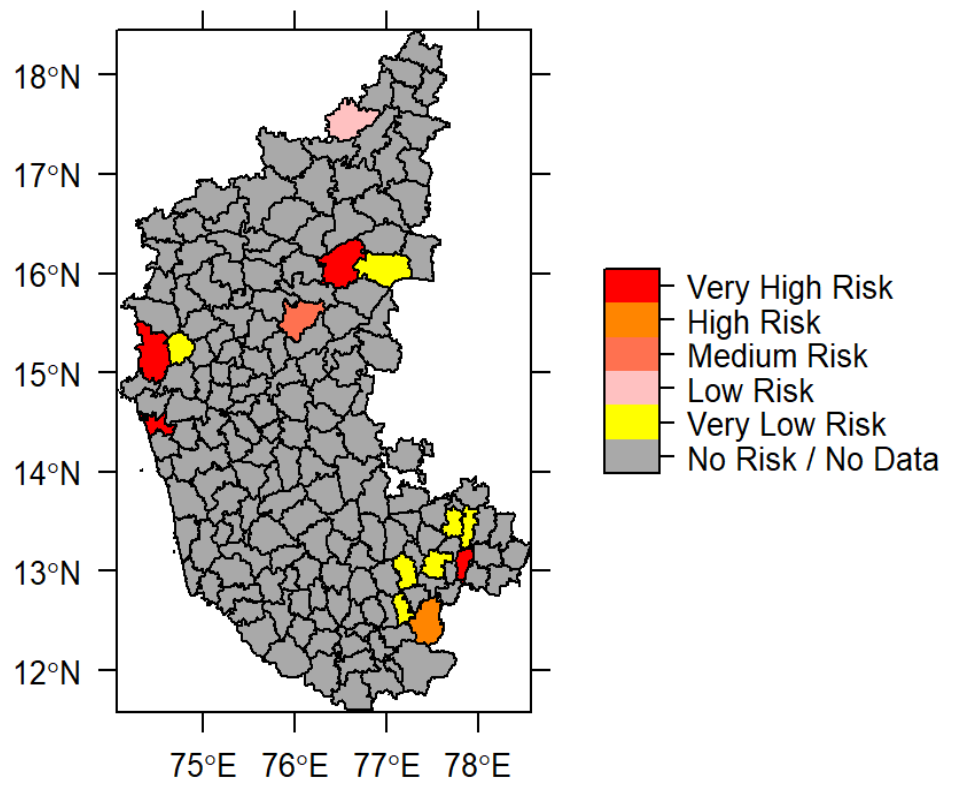
Risk Prediction of Black quarter for the month of October 2018 in Karnataka



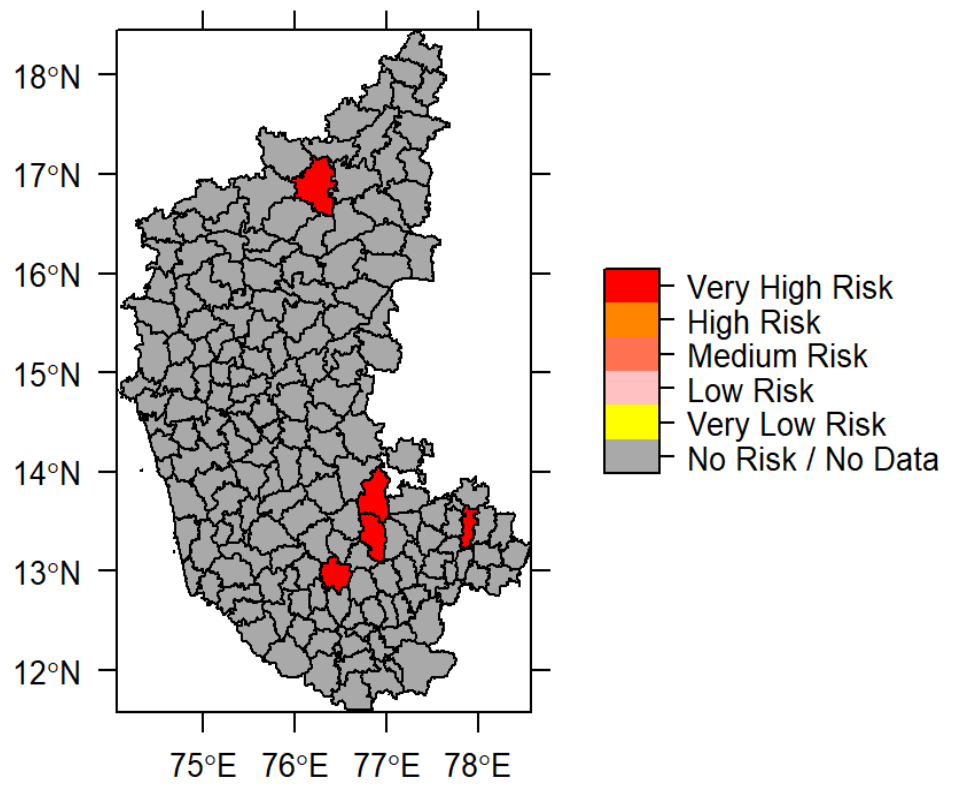
Risk Prediction of Haemorrhagic septicaemia for the month of October 2018 in Karnataka



Risk Prediction of Foot and mouth disease for the month of October 2018 in Karnataka



Risk Prediction of Peste des petits ruminants for the month of October 2018 in Karnataka



5. Abbreviations

NADRES : National Animal Disease Referral Expert System

R : R environment for statistical computing

BQ : Black Quarter

FMD : Foot and Mouth disease

HS : Haemorrhagic Septicaemia

PPR : Peste des petits ruminants

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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