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

February 2019, Volume 7, Issue 2

Supplementary for Karnataka (Block Level) Forewarning

LIVESTOCK DISEASE FOREWARNING BULLETIN- April 2019

(SIMPLIFIED SOLUTION! MAGNIFIED OPPORTUNITY!)

Published By: **Director**

ICAR-NIVEDI

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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.

We would like to express sincere everlasting gratitude to honourable Deputy Director-General (Animal Science) for his constant encouragement and guidance.

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.

Furthermore, we would also like to acknowledge with much appreciation, the crucial role of Scientists Dr. M. Nagalingam and Dr. Siju Susan Jacob and SRF/YP Dheeraj R, Rashmi R. Kurli, Kiran Kumar S. and Charitha J. in preparation of this report.

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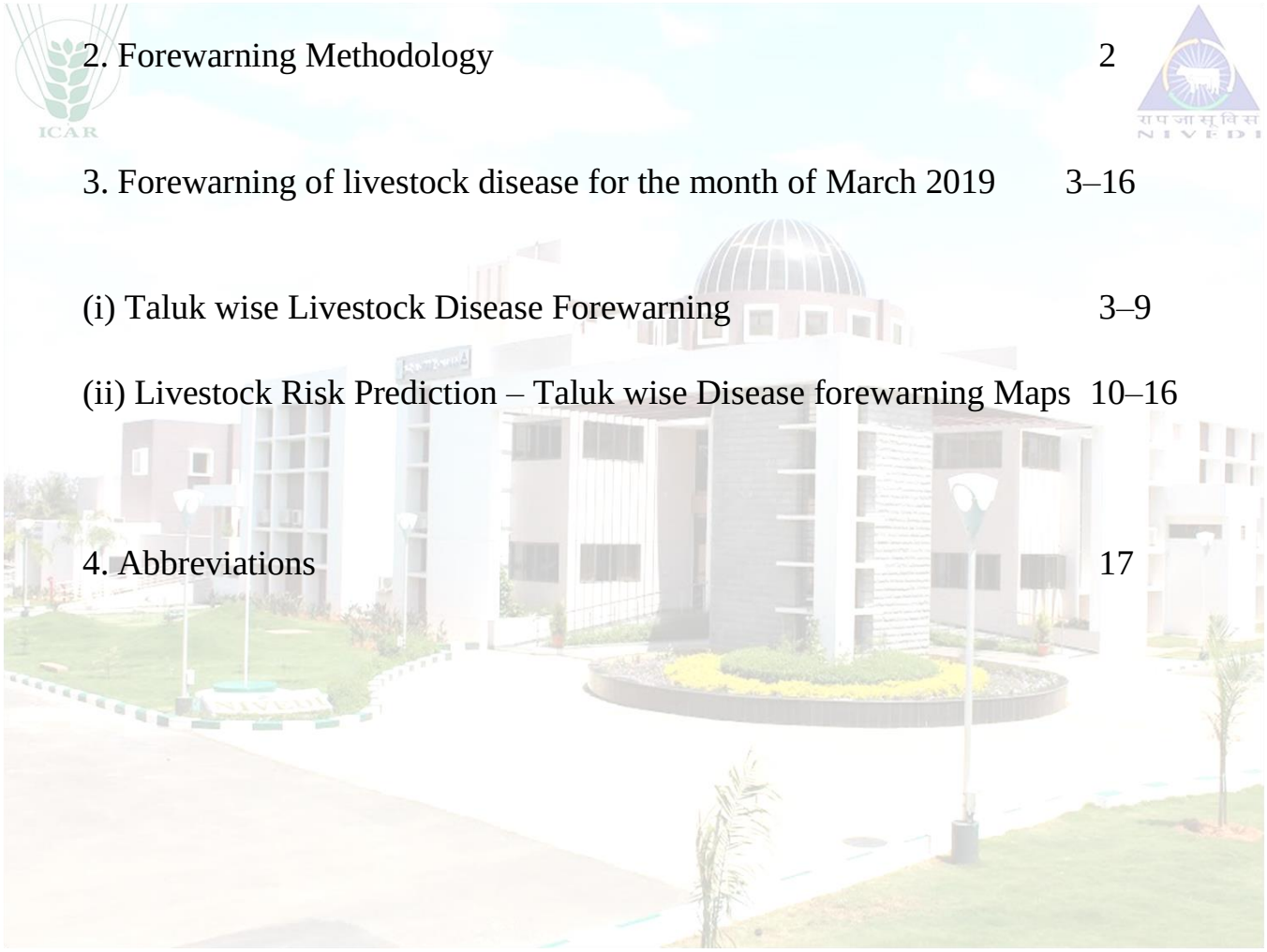

1. About the bulletin…

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

Village wise Disease data for the state of Karnataka since 2011 was collected from department of state animal husbandry.

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 unsinged integer	0.02
Lai_1km	1 sq. km	Leaf Area Index	m2plant/m2ground	8-bit unsigned integer	0.1

Data alignment

Livestock disease outbreak data was linked with Risk factors data to perform the disease climate modelling.

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. Forewarning of livestock disease for the month of April 2019

(i) Taluk/Block wise Livestock Disease Forewarning

Taluk	Anthrax	Blue Tongue	BQ	ET	FMD	HS	PPR	SGP
Afzalpur	VHR	MR	HR	HR	MR	HR	VHR	HR
Aland	LR	HR	VHR	HR	MR	HR	VHR	HR
Alur	MR	HR	VHR	HR	VHR	VHR	MR	HR
Anekal	MR	VHR	VHR	VHR	VHR	VHR	VHR	VHR
Ankola	VLR	VLR	VLR	VLR	VLR	VLR	VLR	VLR
Arkalgud	MR	VHR	VHR	HR	VHR	VHR	HR	HR
Arsikere	VHR	VHR	VHR	VHR	VHR	VHR	VHR	VHR
Athni	LR	MR	MR	MR	MR	MR	LR	HR
Aurad	MR	HR	HR	HR	MR	HR	HR	HR
Badami	LR	HR	LR	HR	LR	MR	VLR	HR
Bagalkot	LR	HR	MR	HR	LR	HR	LR	HR
Bagepalli	VLR	HR	VLR	LR	HR	LR	VLR	LR
Bangalore East	MR	VHR	HR	HR	VHR	HR	VHR	HR
Bangalore North	MR	VHR	HR	HR	VHR	HR	HR	HR
Bangalore South	LR	VHR	HR	VHR	VHR	VHR	HR	VHR
Bangarapet	VLR	VHR	LR	HR	VHR	HR	MR	HR
Bantval	VLR	VLR	VHR	VLR	LR	LR	LR	LR
Basavakalyan	MR	HR	VHR	VHR	MR	HR	VHR	VHR
Basavana Bagevadi	LR	HR	HR	HR	MR	HR	HR	HR
Belgaum	VLR	LR	LR	MR	LR	LR	VLR	LR
Bellary	MR	LR	VLR	VHR	VLR	LR	VLR	LR
Beltangadi	VLR	VLR	LR	LR	MR	LR	LR	LR
Belur	LR	HR	VHR	HR	VHR	VHR	HR	HR
Bhadravati	VLR	LR	MR	VLR	VLR	LR	VLR	VHR

Bhalki	MR	HR	VHR	VHR	MR	HR	VHR	VHR
Bhatkal	VLR	VLR	VLR	VLR	VLR	VLR	VLR	VLR
Bidar	MR	HR	HR	HR	MR	HR	VHR	VHR
Bijapur	LR	HR	HR	HR	MR	HR	MR	HR
Bilgi	LR	HR	MR	HR	LR	HR	MR	VHR
Byadgi	VLR	LR	VLR	VLR	VLR	VLR	VLR	VLR
Challakere	VLR	VHR	VLR	LR	VLR	LR	VLR	VLR
Chamarajanagar	VHR	HR	VHR	VHR	VHR	VHR	HR	HR
Channagiri	VLR	MR	MR	VLR	VLR	MR	VLR	MR
Channapatna	LR	HR	VHR	HR	VHR	HR	VHR	VHR
Channarayapatna	MR	VHR	VHR	VHR	VHR	VHR	HR	VHR
Chikkaballapura	MR	VHR	MR	MR	VHR	MR	MR	MR
Chikmagalur	LR	HR	VHR	HR	VHR	HR	HR	HR
Chiknayakanhalli	LR	VHR	HR	VHR	HR	HR	HR	VHR
Chikodi	VLR	LR	VLR	LR	LR	LR	VLR	LR
Chincholi	MR	HR	VHR	VHR	MR	HR	VHR	VHR
Chintamani	LR	VHR	LR	MR	VHR	VHR	MR	MR
Chitapur	MR	MR	VHR	VHR	MR	VHR	VHR	HR
Chitradurga	VLR	VHR	VLR	LR	VLR	LR	VLR	LR
Davanagere	LR	MR	VLR	VLR	VLR	MR	VLR	LR
Devadurga	MR	HR	MR	VHR	MR	HR	HR	VHR
Devanahalli	MR	VHR	HR	HR	VHR	HR	HR	HR
Dharwad	VLR	VLR	LR	VLR	VLR	LR	VLR	VLR
Dod Ballapur	MR	VHR	HR	HR	VHR	HR	HR	HR
Gadag	VLR	HR	VLR	LR	VLR	LR	VLR	VLR
Gangawati	MR	LR	LR	MR	VLR	MR	VLR	MR
Gokak	VLR	LR	LR	MR	VLR	LR	VLR	MR
Gubbi	LR	VHR	MR	VHR	VHR	HR	HR	VHR
Gudibanda	LR	VHR	LR	VHR	VHR	VHR	LR	LR
Gulbarga	MR	HR	VHR	VHR	MR	VHR	VHR	HR

Gundlupet	MR	VHR	VHR	HR	VHR	VHR	HR	HR
Guribidanur	LR	VHR	VLR	HR	HR	MR	MR	MR
Hadagalli	VLR	LR	VLR	VLR	VLR	VHR	VLR	VLR
Hagaribommanahalli	LR	LR	VLR	VLR	VLR	VLR	VLR	VLR
Haliyal	VLR	VLR	LR	VLR	VLR	LR	VLR	VLR
Hangal	VLR	VLR	VLR	VLR	VLR	VLR	VLR	VLR
Harapanahalli	VLR	LR	VLR	VLR	VLR	VLR	VLR	VLR
Harihar	LR	VLR	VLR	VLR	VLR	LR	VLR	LR
Hassan	MR	HR	VHR	HR	VHR	VHR	HR	HR
Haveri	VLR	LR	VLR	VLR	VLR	VLR	VLR	VLR
Heggadadevankote	LR	HR	VHR	HR	HR	VHR	MR	HR
Hirekerur	VLR	VLR	VLR	VLR	VLR	LR	VLR	VLR
Hiriyur	LR	VHR	VLR	MR	VLR	MR	LR	LR
Holalkere	VLR	VHR	LR	LR	VLR	MR	VLR	LR
Hole Narsipur	MR	VHR	VHR	VHR	VHR	VHR	HR	HR
Homnabad	MR	HR	VHR	VHR	MR	HR	VHR	VHR
Honavar	VLR	VLR	VLR	VLR	VLR	VLR	VLR	VLR
Honnali	VLR	VLR	LR	VLR	VLR	LR	VLR	VLR
Hosakote	MR	VHR	HR	HR	VHR	HR	HR	HR
Hosanagara	VLR	VLR	LR	VLR	VLR	VLR	VLR	VLR
Hosdurga	VLR	VHR	MR	HR	LR	HR	VHR	MR
Hospet	LR	LR	VLR	MR	VLR	MR	VLR	LR
Hubli	VLR	LR	VLR	VLR	VLR	LR	VLR	VLR
Hukeri	VLR	LR	VLR	MR	VHR	LR	VLR	LR
Hungund	LR	HR	LR	HR	LR	VHR	LR	HR
Hunsur	LR	VHR	VHR	HR	VHR	VHR	MR	HR
Indi	LR	HR	HR	HR	MR	HR	HR	HR
Jagalur	VLR	HR	VLR	VLR	VLR	LR	VLR	VLR
Jamkhandi	LR	MR	MR	HR	LR	HR	LR	VHR
Jevargi	MR	HR	HR	HR	MR	HR	VHR	HR

Kadur	LR	VHR	HR	HR	HR	HR	HR	HR
Kalghatgi	VLR	VLR	VLR	VLR	VLR	LR	VLR	VLR
Kanakapura	LR	HR	VHR	HR	HR	HR	VHR	HR
Karkal	VLR	VLR	VLR	VLR	LR	LR	VLR	VLR
Karwar	VLR	VLR	VLR	VLR	VLR	VLR	VLR	VLR
Khanapur	VLR	VLR	LR	VLR	VLR	VLR	VLR	VLR
Kolar	MR	VHR	MR	HR	VHR	HR	VHR	HR
Kollegal	LR	HR	VHR	HR	HR	HR	VHR	MR
Koppa	VLR	VLR	MR	LR	LR	LR	LR	VHR
Koppal	MR	MR	VHR	MR	VLR	LR	VLR	LR
Koratagere	LR	VHR	MR	HR	VHR	HR	HR	HR
Krishnarajanagara	LR	VHR	VHR	HR	VHR	VHR	HR	HR
Krishnarajpet	MR	HR	VHR	VHR	VHR	VHR	VHR	VHR
Kudligi	VLR	HR	VLR	VHR	VLR	LR	VLR	VLR
Kumta	VLR	VLR	VLR	VLR	VLR	VLR	VLR	VLR
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Lingsugur	MR	MR	MR	HR	LR	HR	LR	HR
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Madikeri	LR	LR	VHR	MR	MR	MR	LR	HR
Magadi	MR	VHR	VHR	VHR	VHR	VHR	VHR	VHR
Malavalli	LR	MR	HR	MR	MR	HR	MR	MR
Malur	LR	VHR	MR	HR	VHR	HR	HR	HR
Mandya	LR	HR	HR	HR	HR	HR	MR	HR
Mangalore	VLR	VLR	VLR	VLR	LR	LR	VLR	VLR
Manvi	HR	MR	LR	HR	LR	VHR	MR	HR
Molakalmuru	LR	VHR	VLR	LR	VLR	LR	VLR	VHR

Muddebihal	LR	HR	MR	HR	MR	HR	HR	HR
Mudhol	LR	MR	LR	HR	LR	MR	VLR	HR
Mudigere	LR	MR	VHR	MR	HR	MR	LR	HR
Mulbagal	VHR	VHR	MR	VHR	VHR	MR	MR	MR
Mundargi	LR	MR	VLR	LR	VLR	LR	VLR	VLR
Mundgod	VLR	VLR	VLR	VLR	VLR	VLR	VLR	VLR
Mysore	LR	VHR	VHR	HR	VHR	VHR	MR	HR
Nagamangala	MR	VHR	VHR	HR	VHR	VHR	HR	HR
Nanjangud	LR	HR	VHR	HR	HR	VHR	MR	MR
Narasimharajapura	VLR	LR	MR	LR	LR	MR	LR	LR
Nargund	VLR	MR	LR	MR	VLR	LR	VLR	MR
Navalgund	VLR	LR	VHR	LR	VLR	LR	VLR	VLR
Nelamangala	MR	VHR	HR	HR	VHR	HR	VHR	HR
Pandavapura	MR	VHR	VHR	VHR	VHR	VHR	VHR	VHR
Parasgad	VLR	MR	LR	VHR	VLR	LR	VLR	LR
Pavagada	VLR	MR	VLR	LR	VLR	LR	VLR	LR
Piriyapatna	MR	VHR	VHR	HR	VHR	VHR	HR	HR
Puttur	VLR	VLR	LR	LR	MR	LR	LR	LR
Raichur	MR	HR	LR	MR	MR	HR	MR	HR
Ramanagara	LR	VHR	VHR	VHR	VHR	VHR	VHR	VHR
Ramdurg	LR	MR	LR	MR	VLR	MR	VLR	MR
Ranibennur	VLR	LR	VLR	VLR	VLR	VHR	VLR	VLR
Raybag	VLR	LR	LR	MR	MR	MR	VLR	HR
Ron	LR	MR	LR	MR	VLR	VHR	VLR	MR
Sagar	VLR	VLR	VLR	VLR	VLR	VLR	VLR	VLR
Sakleshpur	LR	MR	VHR	MR	HR	HR	LR	HR
Sampgaon	VLR	LR	LR	LR	VLR	LR	VLR	VLR
Sandur	LR	MR	VLR	VLR	VLR	LR	VLR	VLR
Savanur	VLR	LR	VLR	VLR	VLR	VLR	VLR	VLR
Sedam	MR	HR	HR	VHR	MR	HR	VHR	HR

Shahpur	HR	HR	HR	VHR	MR	VHR	VHR	VHR
Shiggaon	VLR	VLR	VLR	VLR	VLR	VLR	VLR	VLR
Shikarpur	VLR	VLR	VLR	VLR	VLR	LR	VLR	VLR
Shimoga	VLR	LR	MR	VLR	VLR	LR	VLR	VLR
Shirhatti	VLR	LR	VLR	VLR	VLR	VLR	VLR	VLR
Shorapur	MR	HR	HR	VHR	MR	HR	VHR	VHR
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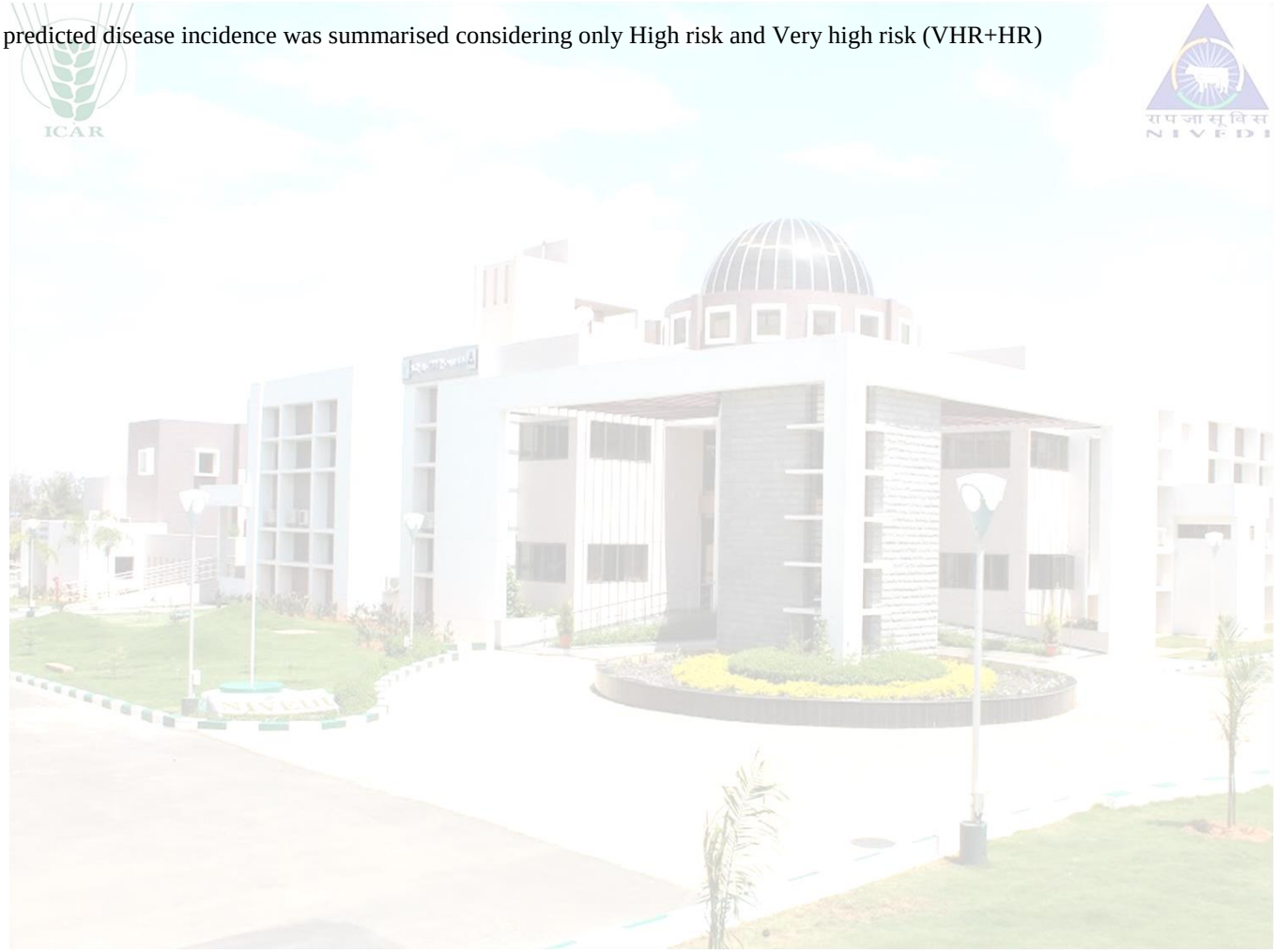
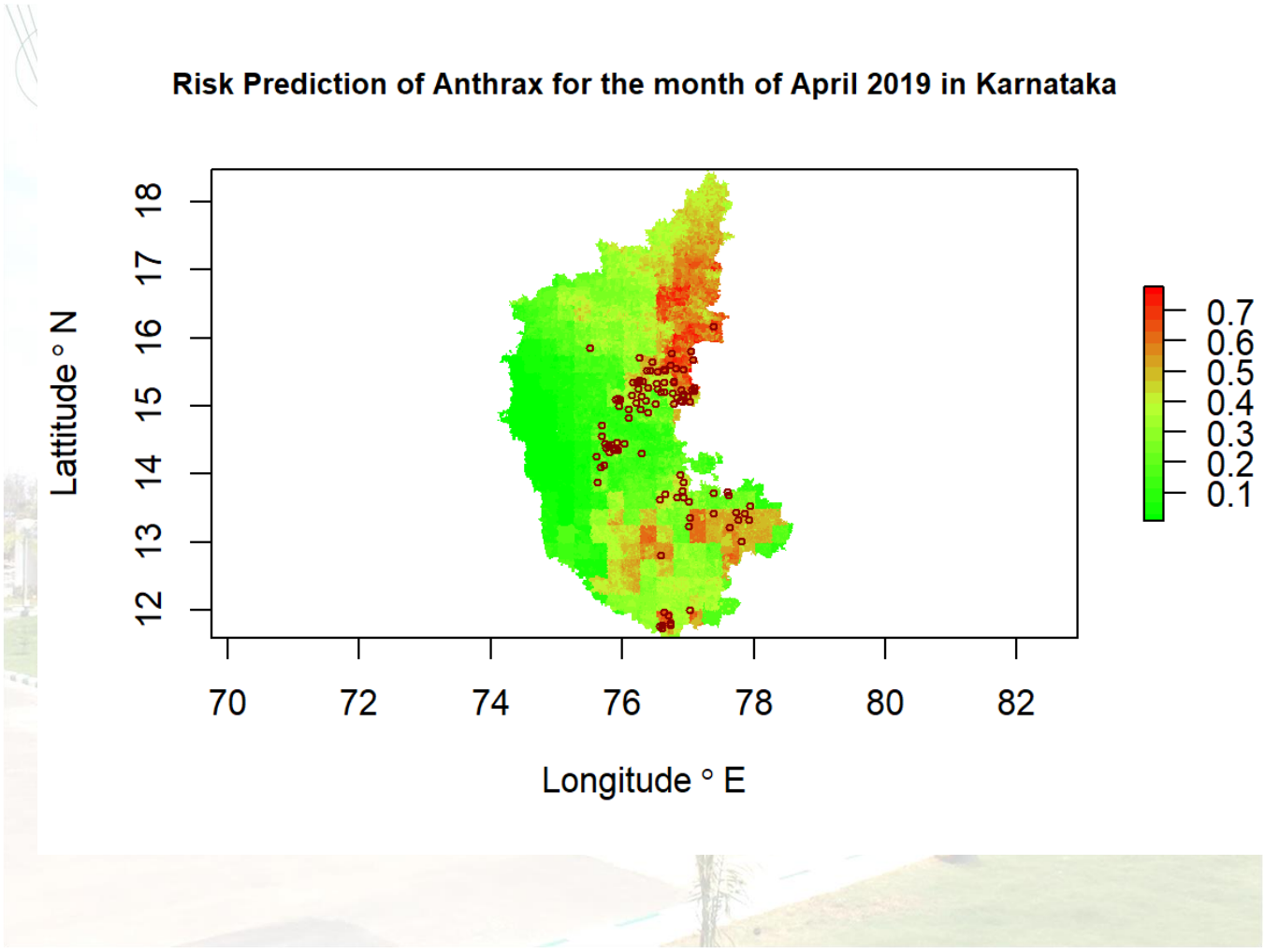
Siddapur	VLR	VLR	VLR	VLR	VLR	VLR	VLR	VLR
Sidlaghatta	MR	VHR	MR	MR	VHR	MR	MR	MR
Sindgi	LR	HR	HR	HR	MR	HR	HR	HR
Sindhnur	VHR	LR	LR	MR	LR	MR	VLR	HR
Sira	LR	VHR	LR	HR	LR	HR	HR	MR
Sirsi	VLR	VLR	VLR	VLR	VLR	VLR	VLR	VLR
Siruguppa	HR	LR	LR	MR	VLR	LR	LR	HR
Somvarpet	MR	VHR	VHR	MR	HR	HR	MR	VHR
Sorab	VLR	VLR	VLR	VLR	VLR	VLR	VLR	VLR
Sringeri	VLR	VLR	MR	LR	LR	LR	VHR	LR
Srinivaspur	VHR	VHR	MR	MR	VHR	MR	MR	MR
Sulya	VLR	VLR	LR	VLR	MR	LR	VLR	VLR
Supa	VLR	VLR	VLR	VLR	VLR	VLR	VLR	VLR
Tarikere	LR	HR	VHR	MR	HR	HR	MR	HR
Tiptur	MR	VHR	VHR	VHR	VHR	VHR	VHR	VHR
Tirthahalli	VLR	VLR	LR	VLR	VLR	LR	VLR	VLR
Tirumakudal Narsipur	LR	HR	VHR	MR	HR	HR	MR	MR
Tumkur	MR	VHR	HR	VHR	VHR	HR	VHR	VHR
Turuvekere	LR	VHR	VHR	VHR	VHR	VHR	HR	VHR
Udupi	VLR	VLR	VLR	VLR	VLR	VLR	VLR	VLR
Virajpet	LR	MR	VHR	HR	HR	VHR	MR	HR
Yadgir	MR	HR	HR	HR	MR	VHR	VHR	HR
Yelandur	MR	HR	VHR	HR	VHR	HR	VHR	MR

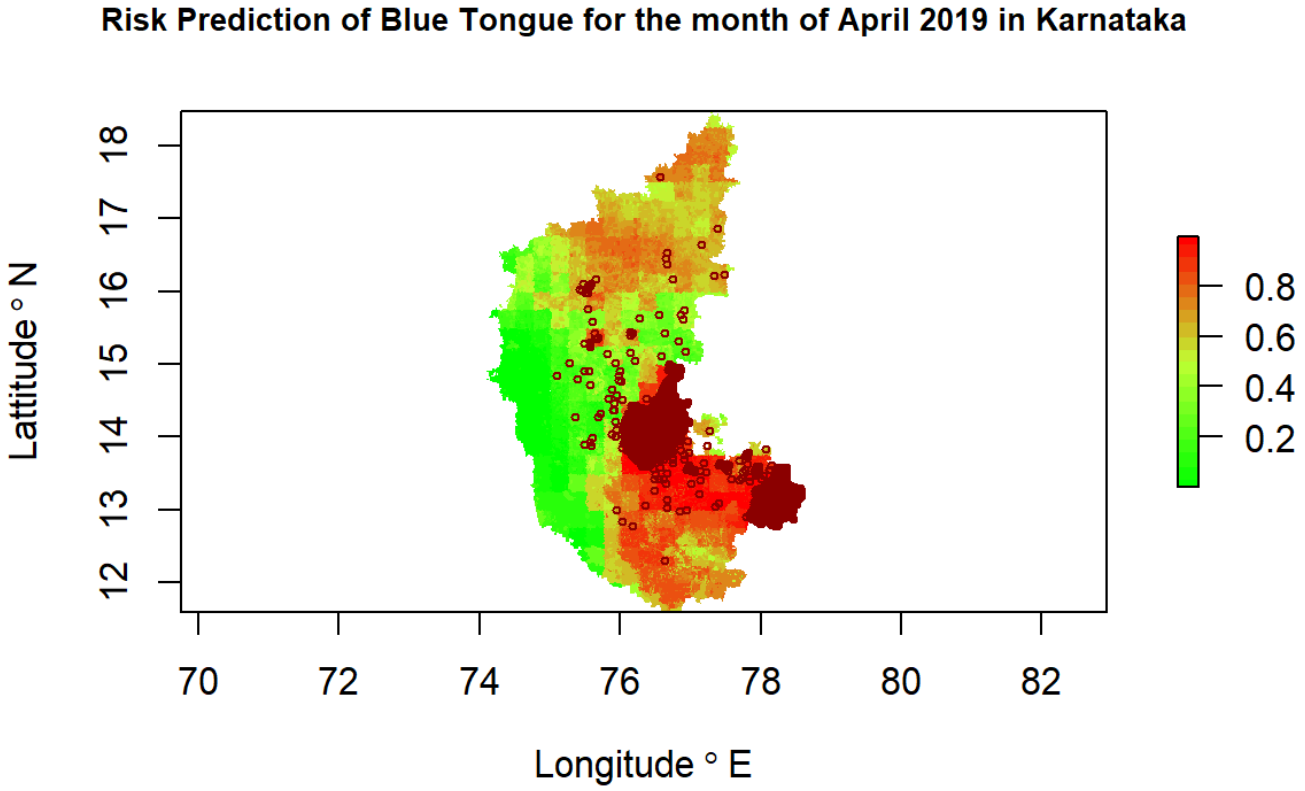
Yelbarga	LR	MR	VLR	MR	VLR	VLR	VLR	LR
Yellapur	VLR	VLR	VLR	VLR	VLR	VLR	VLR	VLR

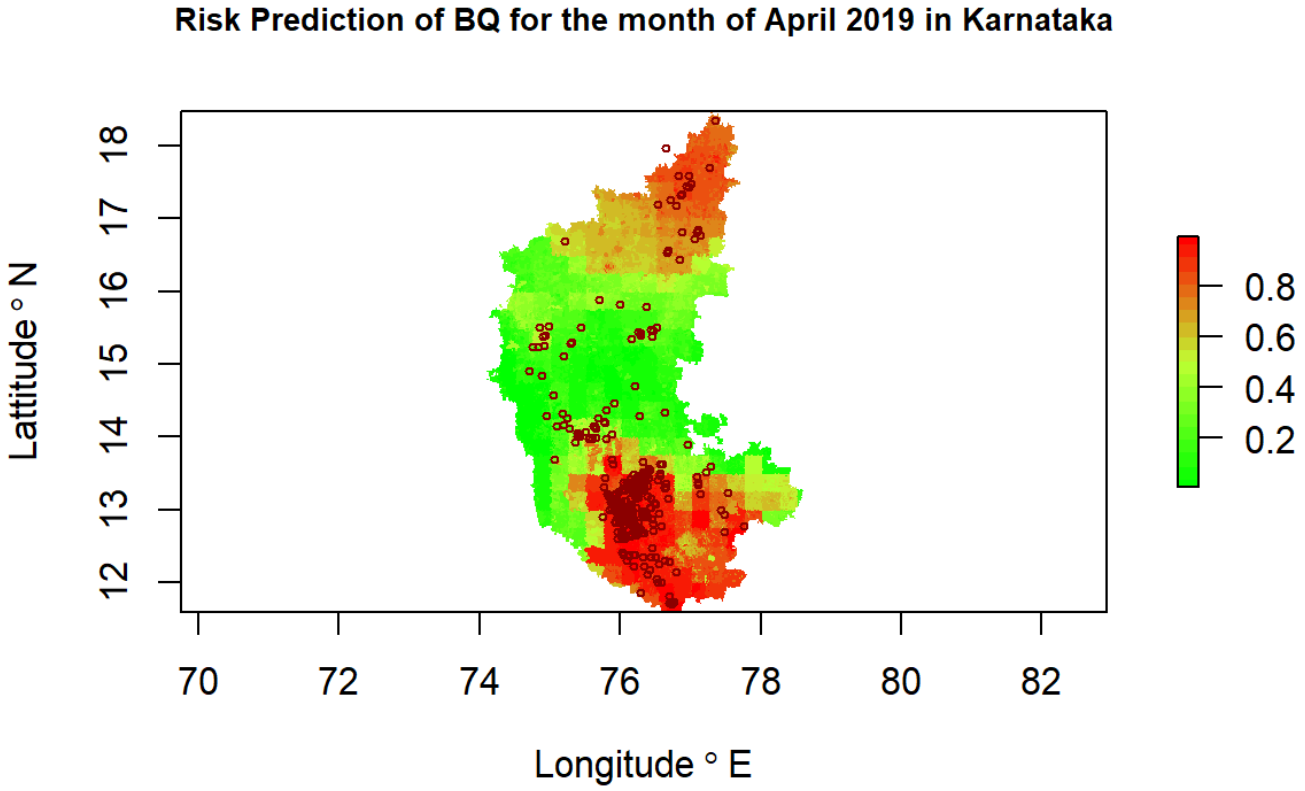
*Number of predicted disease incidence was summarised considering only High risk and Very high risk (VHR+HR)

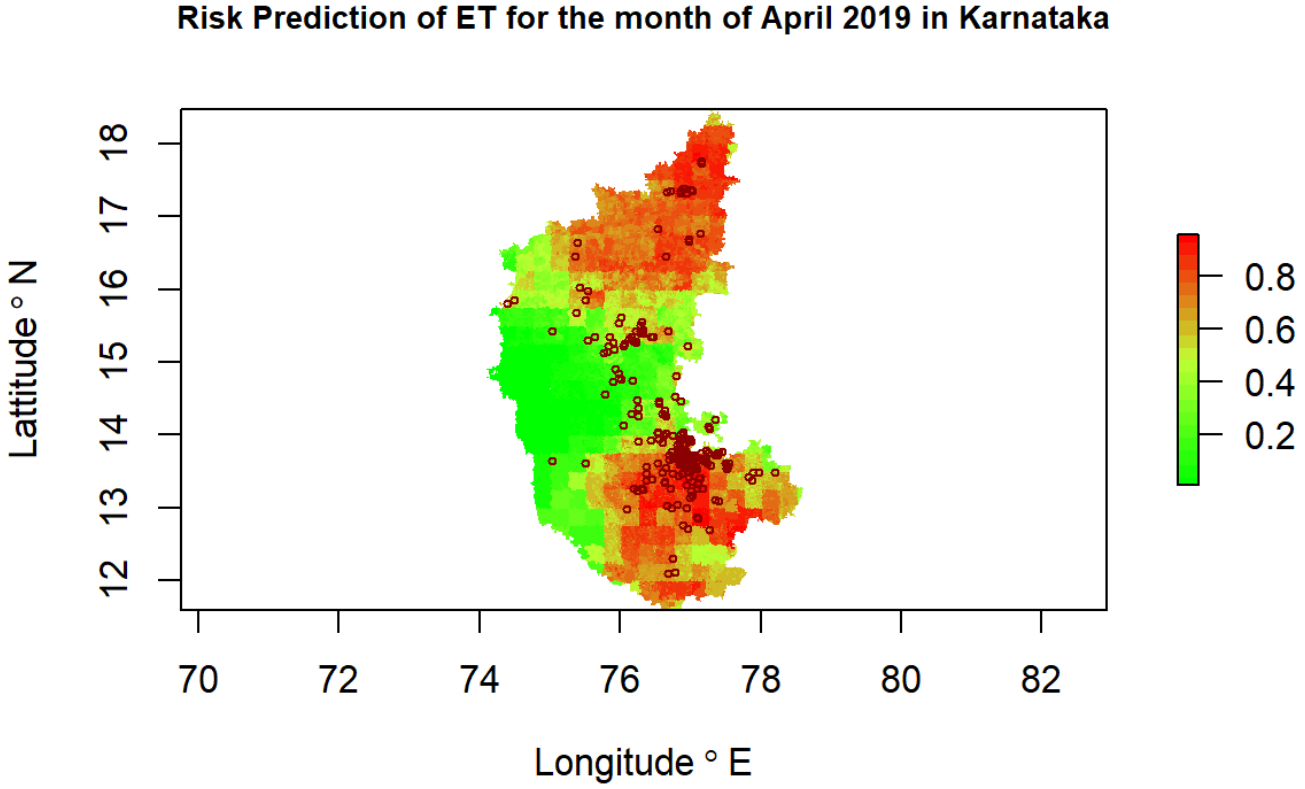


ii) Livestock Risk Prediction – Taluk-wise Disease forewarning Maps




Risk Prediction of Blue Tongue for the month of April 2019 in Karnataka
Lattitude ° N
12
13
14
15
16
17
18
70
72
74
76
78
80
82
Longitude ° E
0.8
0.6
0.4
0.2


Risk Prediction of BQ for the month of April 2019 in Karnataka
Lattitude ° N
18
17
16
15
14
13
12
70
72
74
76
78
80
82
Longitude ° E
0.8
0.6
0.4
0.2


Risk Prediction of ET for the month of April 2019 in Karnataka
Lattitude ° N
18
17
16
15
14
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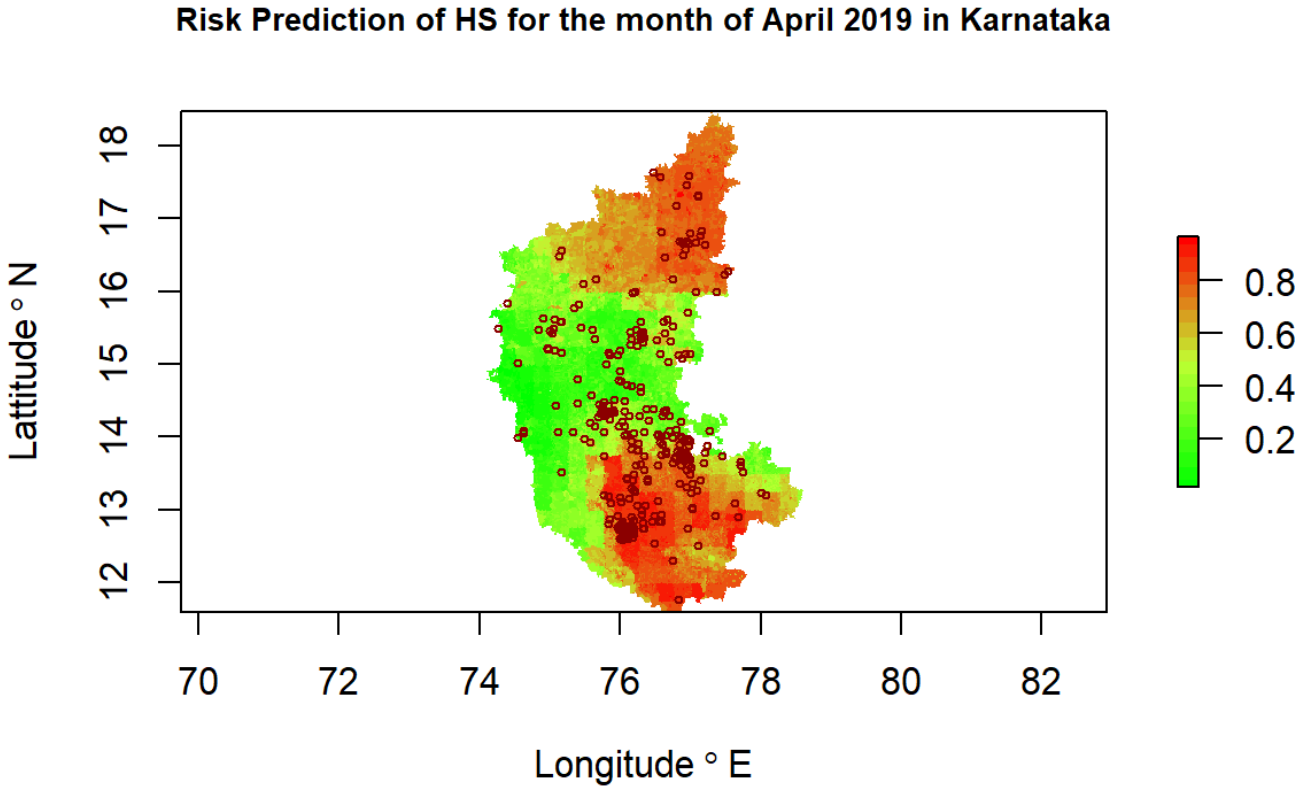
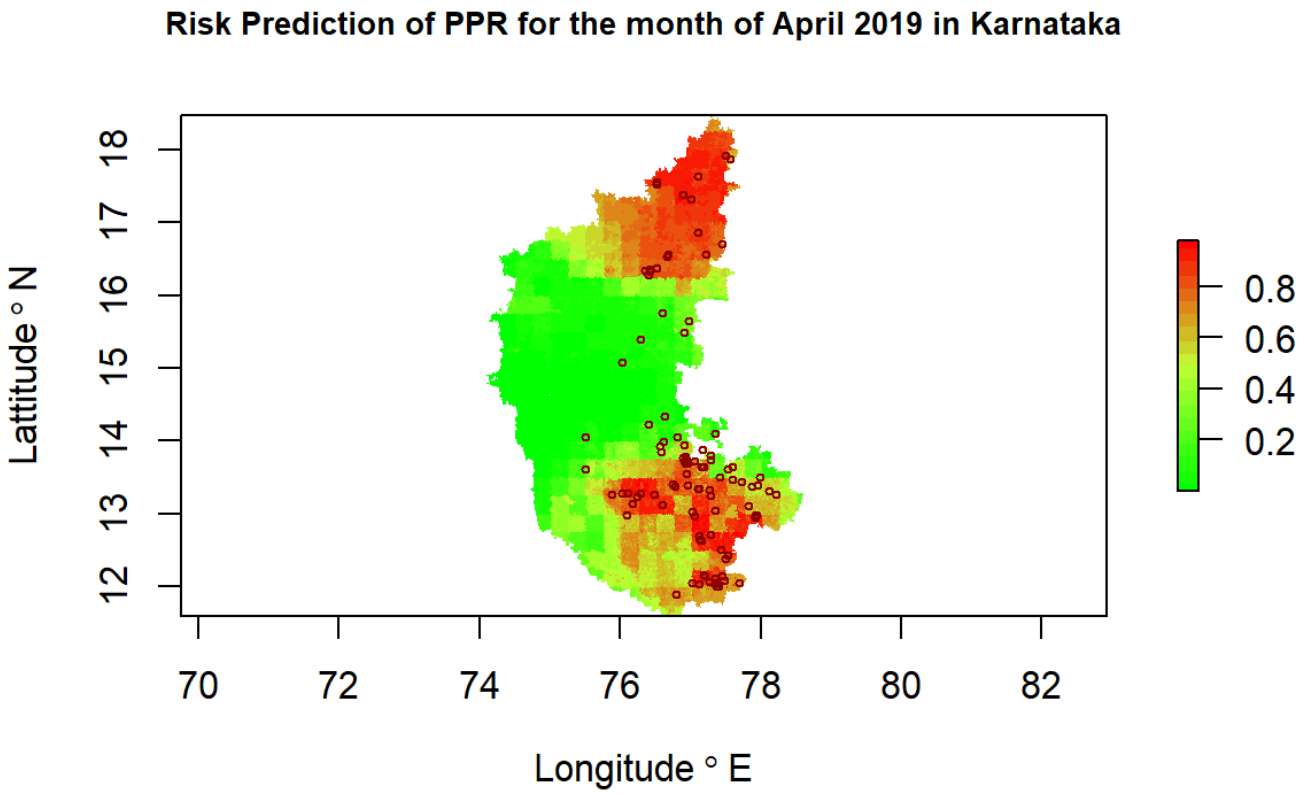
12
70
72
74
76
78
80
82
Longitude ° E
0.8
0.6
0.4
0.2


Risk Prediction of HS for the month of April 2019 in Karnataka
Lattitude ° N
18
17
16
15
14
13
12
70
72
74
76
78
80
82
Longitude ° E
0.8
0.6
0.4
0.2


Risk Prediction of PPR for the month of April 2019 in Karnataka
Lattitude ° N
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13
14
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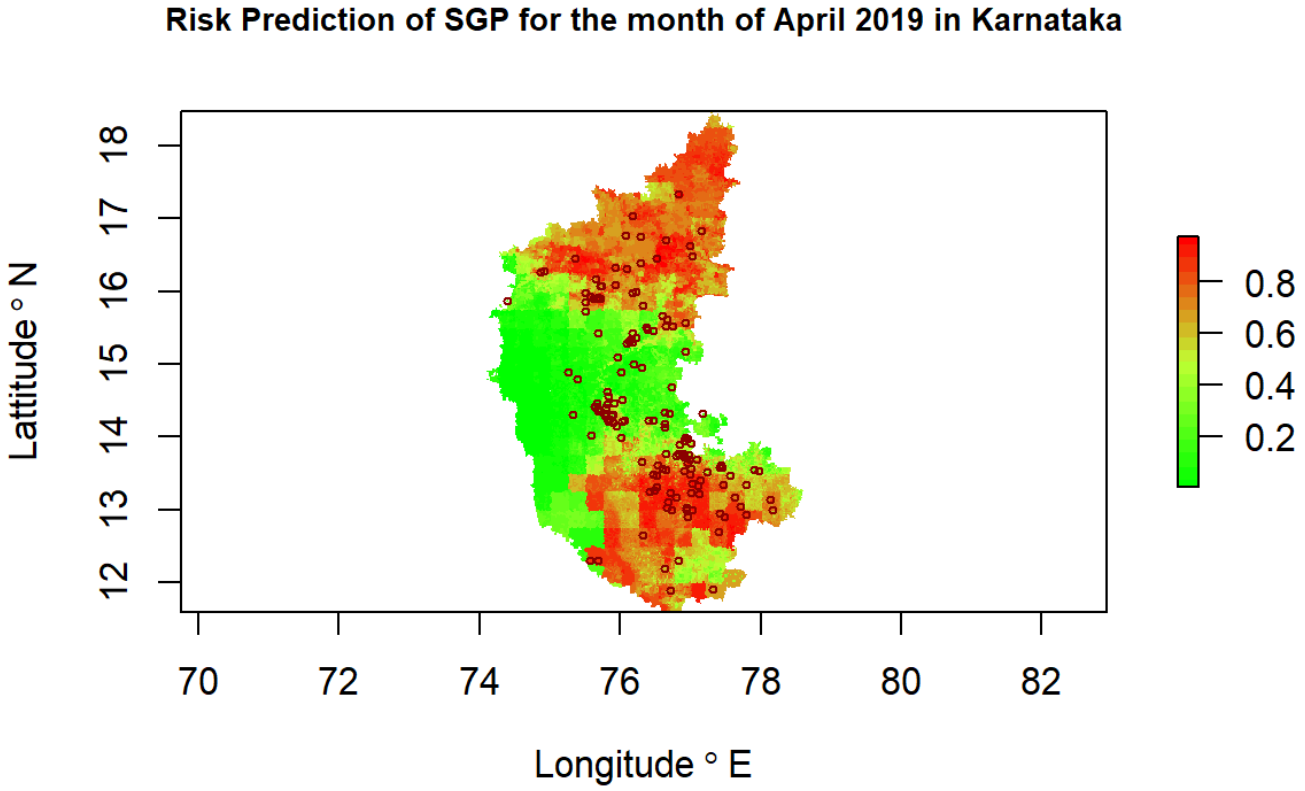
72
74
76
78
80
82
Longitude ° E
0.8
0.6
0.4
0.2


Risk Prediction of SGP for the month of April 2019 in Karnataka
Lattitude ° N
12
13
14
15
16
17
18
70
72
74
76
78
80
82
Longitude ° E
0.8
0.6
0.4
0.2

4. 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

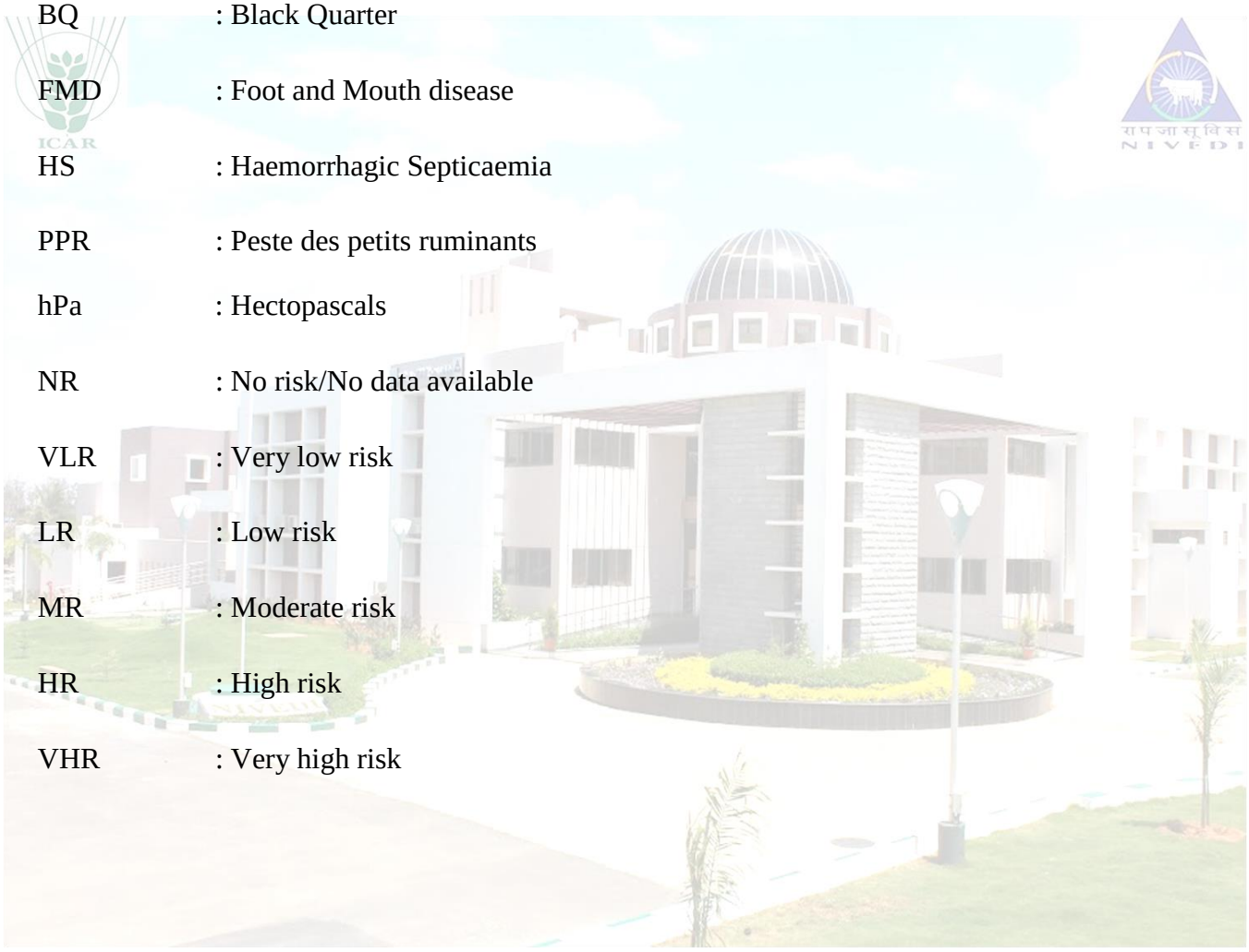
VLR : Very low risk

LR : Low risk

MR : Moderate risk

HR : High risk

VHR : Very high risk



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