



भाकृअनुष-राष्ट्रीयपशुरोगजानपदिकएवंसूचनाविज्ञानसंस्थान  
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# **NATIONAL ANIMAL DISEASES REFERRAL EXPERT SYSTEM -INTEGRATING DATA-DRIVEN DISEASE SURVEILLANCE AND PREDICTIVE ANALYTICS FOR LIVE-STOCK DISEASES (NADRES V2)**

# Artificial Intelligence/Machine Learning-Based Surveillance Model Development

## Passive Surveillance model

- Not sample based only opportunistic model

## Event-based Surveillance model

- Host factors acts as signal/source early detection of outbreaks

## Risk-based Surveillance model

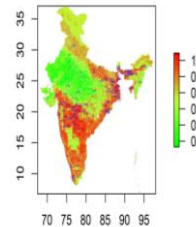
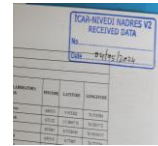
- Risk other than host such as ecological, environment, trade etc., by risk based probability sampling method

## Active surveillance model

- Systematic or regular recording of cases of a designated disease or a group of diseases by probability sampling method

## Environmental Surveillance model

- Non-invasive method of surveillance that involves the collection of environmental samples by advanced probability sampling methods



[https://www.nivedi.res.in/Nadres\\_v2/](https://www.nivedi.res.in/Nadres_v2/)

### Adoptive probability sampling

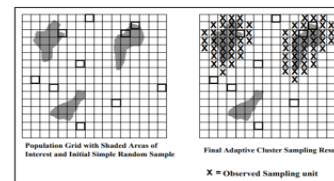


Figure 9-3. Comparison of Initial Sample with Final Sample

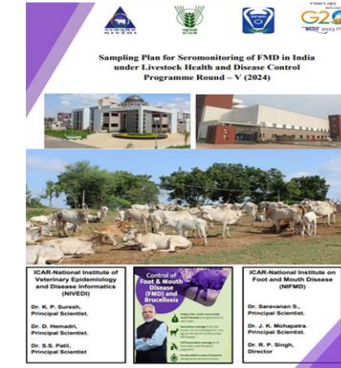
PDDES

<https://nivedi.res.in/PDDES/>

CaDDES

<https://nivedi.res.in/nicra/>

## FMD Seromonitoring Round V



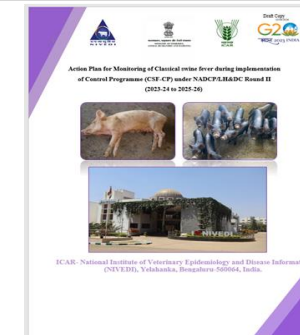
States & UTs: **36**  
Districts: **851**  
Blocks: **2085**  
Villages: **2823**  
Samples: **38272**

## FMD Serosurveillance 2024



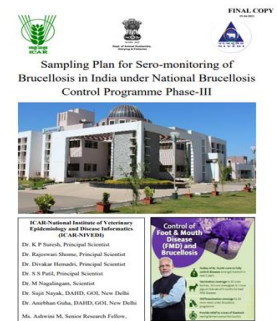
States & UTs : **36**  
Districts: **761**  
Blocks: **4012**  
Villages: **8288**  
Samples: **119059**

## CSF CP Seromonitoring Round II



States & UTs : **28**  
Districts: **467**  
Blocks: **1363**  
Villages: **2561**  
Samples: **32760**

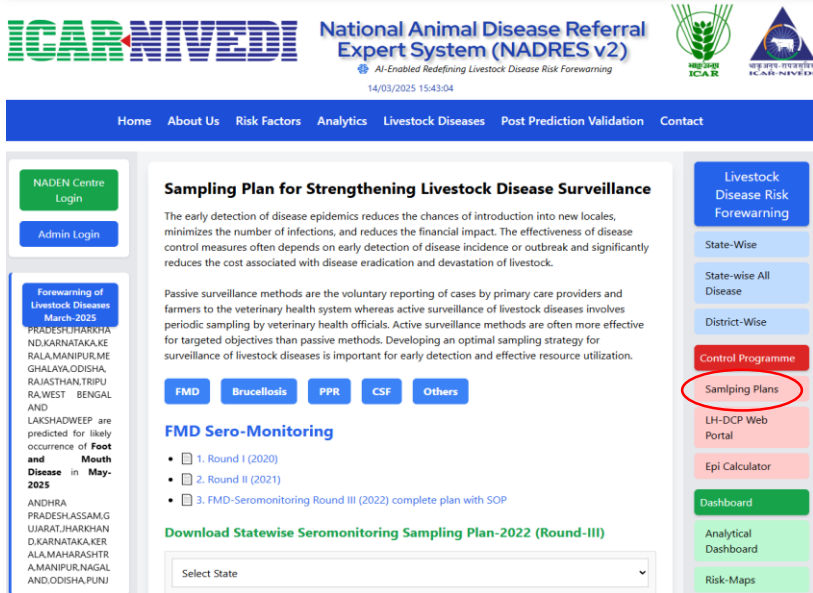
## Brucellosis Seromonitoring Phase II



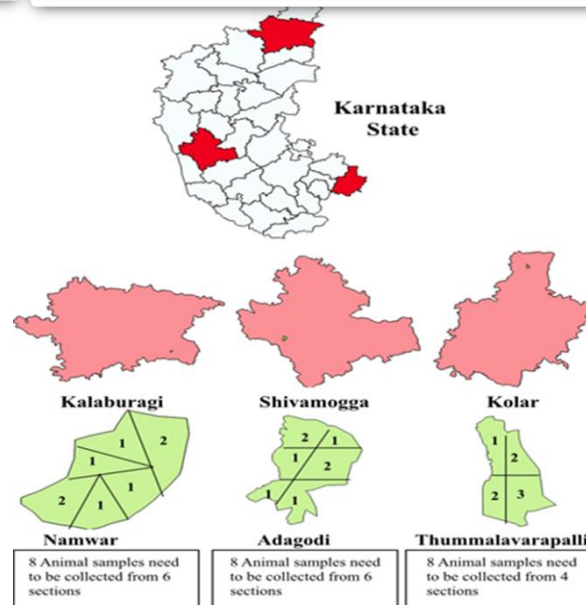
States & UTs : **35**  
Districts: **697**  
Blocks: **2291**  
Villages: **3528**  
Samples: **46398**

Involved in providing village-level Nationwide surveillance plans for FMD, Brucellosis, PPR and CSF

Sampling Plan tab under NADRES Website	Schematic representation of Two-stage stratified random sampling and formula
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Sampling Plan tab under NADRES Website	Schematic representation of Two-stage stratified random sampling and formula
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**LH-DCP Portal : Cloud-Based Digital Platform for Active Livestock Disease Surveillance and Control**  
[https://nivedi.res.in/Nadres\\_v2/lhdcp/index](https://nivedi.res.in/Nadres_v2/lhdcp/index)

**LH-DCP Portal : Cloud-Based Digital Platform for Active Livestock Disease Surveillance and Control**  
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[Home Page](#)
[Disease Dashboard](#)

[Home Page](#)
[Disease Dashboard](#)

## Data Requirements Specifications (DRS)

DRS of Brucellosis Seromonitoring Phase III- 2023										Results				Brucellosis Seromonitoring Phase IV- 2024						
State	State	Prevalence	Cluster Level	Sensitivity	Specificity	No of Villages	No of Animals	Phase-I	Phase-II	Phase-III	Average	Protection Level	Prevalence	Cluster Level	Sensitivity	Specificity	No of Villages	No of Animals		
1	Andaman & Nicobar	0.2	0.048	0.9	0.9	48	589				80.23667	32.094667	0.32	0.04	0.9	0.9	82	738		
2	Andhra Pradesh	0.2	0.024	0.9	0.9	138	1794	73.25	71.51	64.52	69.76	27.9904	0.28	0.04	0.9	0.9	82	1065		
3	Assam	0.2	0.43	0.9	0.9	75	810				45.52	18.286	0.18	0.02	0.9	0.9	122	1830		
4	Aizam	0.2	0.022	0.9	0.9	150	1950		75.67	50.76	63.215	25.208	0.25	0.03	0.9	0.9	110	1210		
5	Bihar	0.2	0.02	0.9	0.9	165	2145		59.93		59.93	23.972	0.24	0.03	0.9	0.9	91	1092		
6	chandigarh	0.2	0.2	0.9	0.9	16	193	99.49	68.68	72.54	80.23667	32.094667	0.32	0.04	0.9	0.9	82	656		
7	Chhattisgarh	0.2	0.027	0.9	0.9	122	1586	78.63	69.07		73.85	29.54	0.3	0.04	0.9	0.9	82	738		
8	Diu and daman	0.2	0.17	0.9	0.9	18	195	80.76			80.76	32.934	0.32	0.04	0.9	0.9	82	656		
9	Delhi	0.2	0.11	0.9	0.9	334	8947	64.17			64.17	31.788	0.33	0.03	0.9	0.9	99	238		
10	Goa	0.2	0.04	0.9	0.9	83	916	92.12	94.8		93.46	17.384	0.27	0.07	0.9	0.9	66	462		
11	Gujarat	0.2	0.024	0.9	0.9	138	1794	80.12			80.12	32.048	0.32	0.04	0.9	0.9	82	656		
12	Haryana	0.2	0.031	0.9	0.9	106	1378	66.84	66	72.3	68.38	27.352	0.27	0.04	0.9	0.9	82	820		
13	Himachal Pradesh	0.2	0.033	0.9	0.9	99	1081	81.64	66.36		74	29.6	0.3	0.04	0.9	0.9	82	738		
14	Jammu and Kashmir	0.2	0.039	0.9	0.9	84	1092	73.31			73.31	29.324	0.29	0.04	0.9	0.9	82	738		
15	Jharkhand	0.2	0.028	0.9	0.9	118	1534	73.95	42.41		58.18	23.272	0.23	0.03	0.9	0.9	110	1320		
16	Karnataka	0.2	0.026	0.9	0.9	127	1651	96.67	70.47	53	73.38	29.352	0.29	0.04	0.9	0.9	110	1320		
17	Kerala	0.2	0.036	0.9	0.9	96	1020	68.78	48.64		58.71	24.484	0.23	0.03	0.9	0.9	110	1320		
18	Ladakh	0.2	0.085	0.9	0.9	34	394	80.18	76.48		78.33	31.332	0.31	0.04	0.9	0.9	82	738		
19	Madhya Pradesh	0.2	0.024	0.9	0.9	137	1781	59.43	39.48		49.225	19.69	0.2	0.03	0.9	0.9	165	2310		
20	Maharashtra	0.2	0.027	0.9	0.9	121	1435		60.82		60.82	24.328	0.24	0.03	0.9	0.9	110	1210		
21	Manipur	0.2	0.026	0.9	0.9	126	1381	85.66			85.66	34.264	0.34	0.05	0.9	0.9	66	528		
22	Meghalaya	0.2	0.038	0.9	0.9	87	978	45.52			45.52	18.208	0.18	0.02	0.9	0.9	165	2475		
23	Mizoram	0.2	0.033	0.9	0.9	100	1273	89.36			89.36	35.744	0.36	0.05	0.9	0.9	66	528		
24	Nagaland	0.2	0.033	0.9	0.9	99	693				68.38	27.352	0.27	0.04	0.9	0.9	82	820		
25	Nadisha	0.2	0.031	0.9	0.9	101	1171	70.91	65.9	90.95	64.8	31.924	0.3	0.04	0.9	0.9	82	820		
26	Puducherry	0.2	0.043	0.9	0.9	76	803				84.81	23.924	0.34	0.07	0.9	0.9	66	594		
27	Punjab	0.2	0.031	0.9	0.9	105	1365				68.38	27.352	0.27	0.04	0.9	0.9	82	820		
28	Rajasthan	0.2	0.043	0.9	0.9	76	988				68.38	27.352	0.27	0.04	0.9	0.9	82	820		
29	Sikkim	0.2	0.031	0.9	0.9	105	1288	86.74	62.17	52.03	66.98	26.792	0.27	0.04	0.9	0.9	82	820		
30	Tamilnadu	0.2	0.026	0.9	0.9	126	1638	88.03	77.75	88.65	84.81	33.924	0.34	0.04	0.9	0.9	66	528		
31	Telangana	0.2	0.024	0.9	0.9	138	1794	70.76	70.75		70.735	28.294	0.28	0.04	0.9	0.9	82	820		
32	Tripura	0.2	0.036	0.9	0.9	91	1183				45.52	18.208	0.18	0.02	0.9	0.9	122	1830		
33	Uttar Pradesh	0.2	0.031	0.9	0.9	105	1191	64.8			64.8	25.92	0.26	0.04	0.9	0.9	110	1210		
34	Uttar Pradesh	0.2	0.026	0.9	0.9	127	1651	71.96			71.96	28.784	0.28	0.04	0.9	0.9	82	820		
35	West Bengal	0.2	0.024	0.9	0.9	138	1794	86.03			86.03	34.412	0.34	0.07	0.9	0.9	66	66		
TOTAL						3528	42369	76.47	63.05	66.24	2485.49						3153	33444		

## Sampling Plan

Sample ID	District_Name	Block_Name	Village_Name	Buffaloes	Cattle	Cattle + Buffalo	Number of units to sample	Buffalo Proportion	Cattle Proportion	Probability Value
pachmu(1621-1630)	Palakkad	Chittur	Muthalamada(GP) ÔCÔWardNo.9	0	862	862	10	0	10	6.20E-07
pamash(1631-1640)	Palakkad	Mannarkad	Sholayur(GP)ÔCÔ WardNo.14	5	924	929	10	0	10	5.75E-07
pamash(1641-1650)	Palakkad	Mannarkad	Sholayur(GP)ÔCÔ WardNo.6	0	962	962	10	0	10	5.55E-07
pachmu(#)	Palakkad*	Chittur	Muthalamada(GP) jÔCÔWardNo.10	54	1061	1115	10	0	10	4.79E-07
			Total	2634	53344	55978	1660	66	1594	0.000295694

\*Reserved villages :to be used for sampling if any selected village in a given district is not accessible, has logistic problem or any other issues; # The replaced village Sample Numbers are used with the reserved village sample IDs, i.e., if a village with sample id chngng(1015-1027) is replaced with the reserved village then the sample id is replaced with the reserved village id and the sample numbers are same as of replaced village (gogoda(1015-1027))

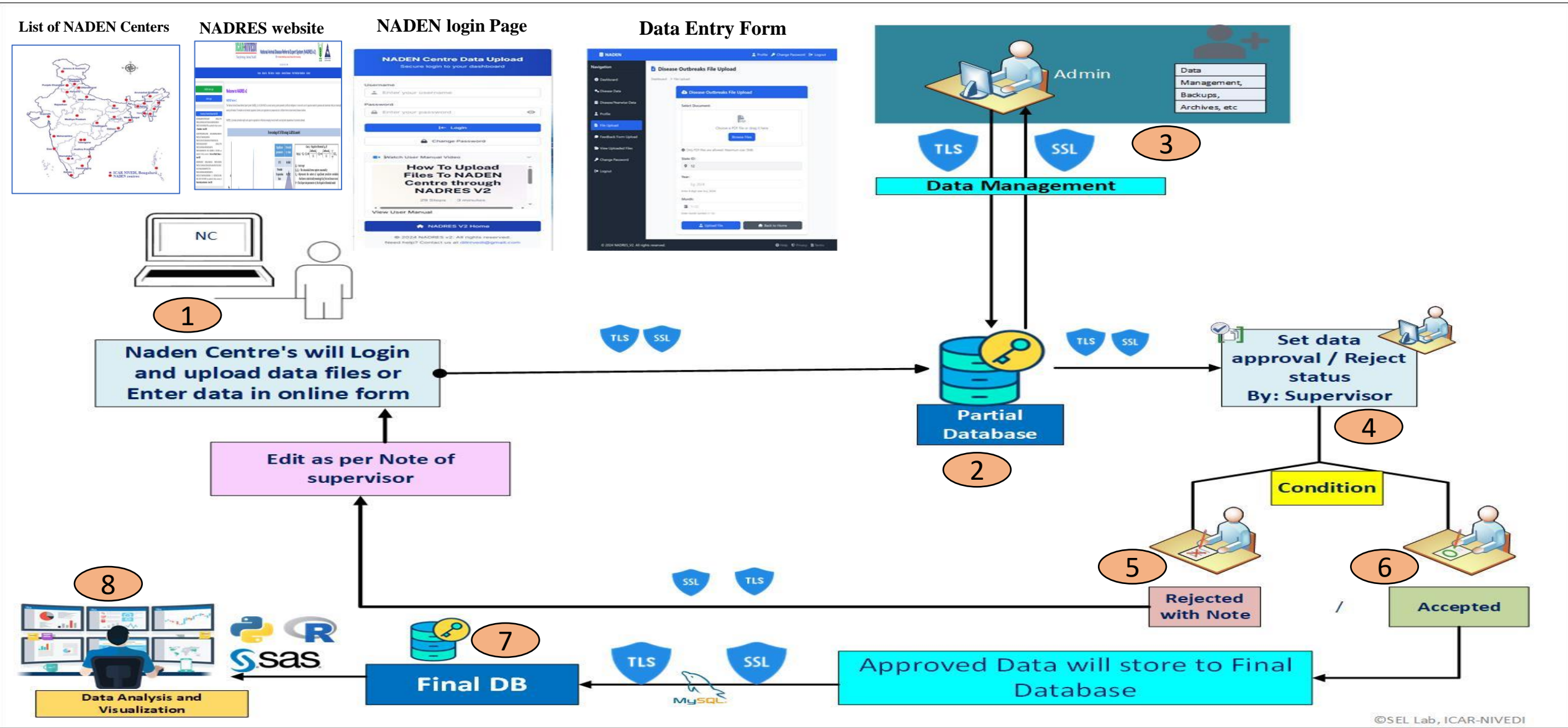
Approximately **5,39,535** samples are allocated annually across India for monitoring and surveillance of four prioritized animal diseases (FMD, Brucellosis, PPR, and CSF) supporting nationwide disease tracking and control initiatives.

## Sampling plan Bulletin





# Real time/Near Real time Data Capture and Storage Workflow: NADRES V2 Database Flow Diagram



Epidemiological data were compiled at the state, district and village levels from multiple sources, and a subsample of cases was confirmed in the laboratory; the dataset includes information on susceptible populations, attack rates and outbreak-associated mortality

# Livestock Disease Risk Forewarning Through AI & ML Based Disease Modelling

## NADRES V2- NATIONAL ANIMAL DISEASE REFERRAL EXPERT SYSTEM

[https://nivedi.res.in/Nadres\\_v2/index.php](https://nivedi.res.in/Nadres_v2/index.php)

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, and guide the farmers and organizations to prepare and act appropriately and in sufficient time to reduce the livestock disease incidence.



National Animal Disease Referral Expert System

(NADRES v2)

Transforming Animal Health

AI Enabled Reducing Livestock Disease Risk Forewarning

4/23/2025 12:53:25 PM

Home

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Livestock Diseases

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Forewarning of Livestock Diseases April 2025 and Month Disease in June 2025

KARNATAKA WEST BENGAL HIMACHAL PRADESH ANDHRA PRADESH GUJARAT KERALA MADHAYA PRADESH MAHARASHTRA MIZORAM NAGALAND NARAYANA PRADESH ODISHA PUNJAB RAJASTHAN SIKHIM TAMIL NADU TELANGANA TRIPURA UP WEST BENGAL

Risk Prediction of Classical Swine Fever for the month of June 2025

No Risk / No Data

Very Low Risk

Low Risk

Medium Risk

High Risk

Very High Risk

Risk Prediction: June 2025

Accuracy: 42 Risk districts, 96.0% Accuracy

Subacute: 120 Risk districts, 96.42% Accuracy

Black Quarter: 64 Risk districts, 96.41% Accuracy

Bluetongue: 1 Risk districts, 99.86% Accuracy

Classical Swine Fever: 15 Risk districts, 94.33% Accuracy

Enterotoxaemia: 14 Risk districts, 93.52% Accuracy

Fasciolosis: 55 Risk districts, 91.73% Accuracy

Livestock Disease Risk Forewarning

State-Wise

State-wise All Disease

District-Wise

Control Programme

Sampling Plans

LIV-DCP Web Portal

Epi Calculator

Dashboard

Analytical Dashboard

Risk Maps

Online GIS Maps

Monthly Bulletin/Articles

Monthly Prediction Bulletin

Outbreak Report Status

2025

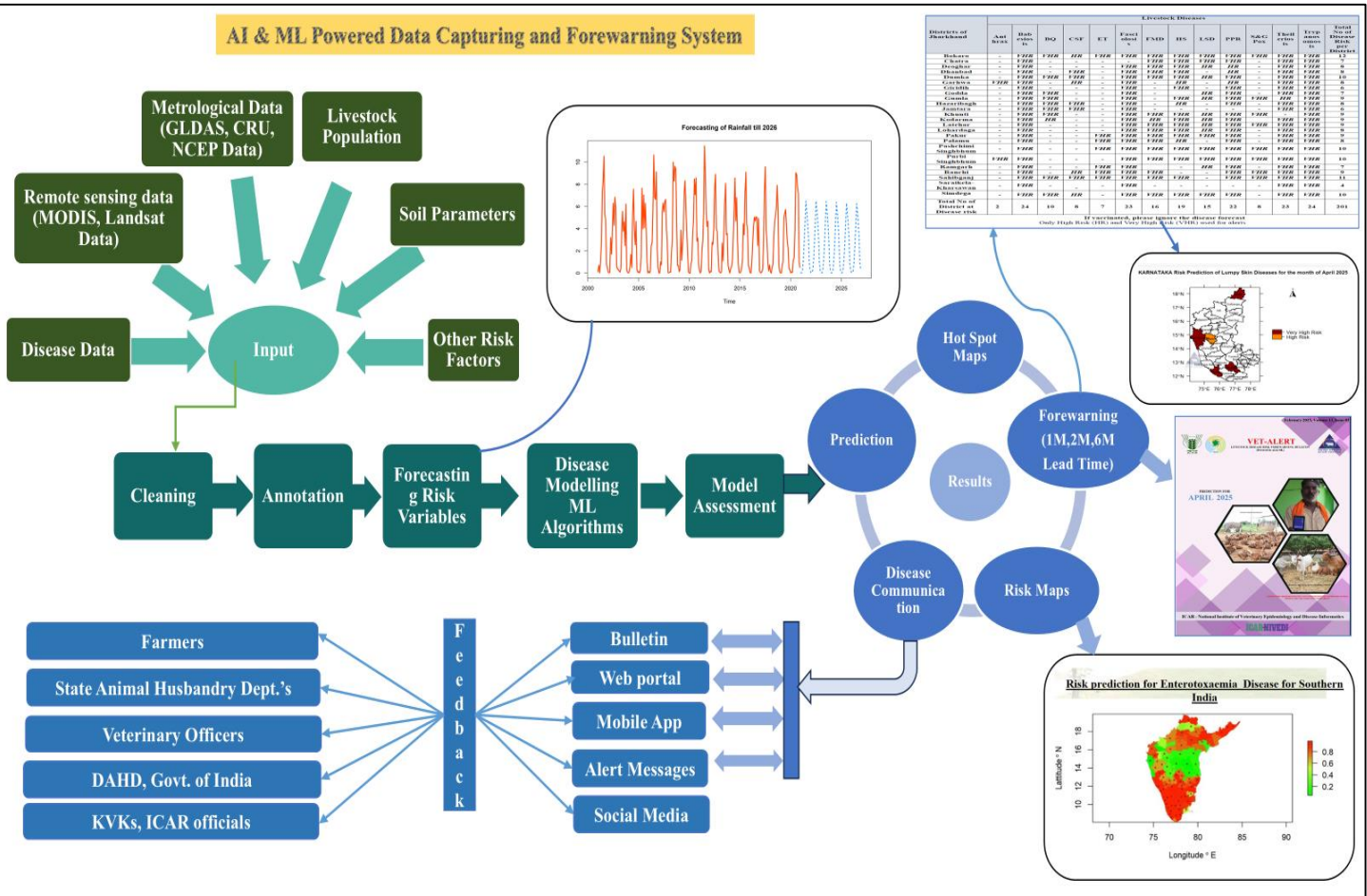
2024

Publications

Scientometrics/Bioinformatic

Incidence/Disease News

Latest News



Sl. No	List of Diseases
1	African Swine Fever
2	Anthrax
3	Babesiosis
4	Black Quarter
5	Bluetongue
6	Classical swine fever
7	Enterotoxaemia
8	Fasciolosis
9	Foot and mouth disease
10	Haemorrhagic septicaemia
11	Lumpy Skin Disease
12	Peste des petits ruminants
13	Sheep and Goat pox
14	Theileriosis
15	Trypanosomosis

# Real Time Climatic Factors used for Forecasting, Forewarning and Developing Risk maps

## Livestock Population

Livestock data (Numbers)	
Cattle	19,63,79,000
Buffalo	11,04,24,984
Sheep	15,01,13,442
Goat	7,32,94,702
Pig	92,94,830
Villages-664369	
Blocks-5564	
Source: 20 <sup>Th</sup> Livestock census, DAHD, GoI	

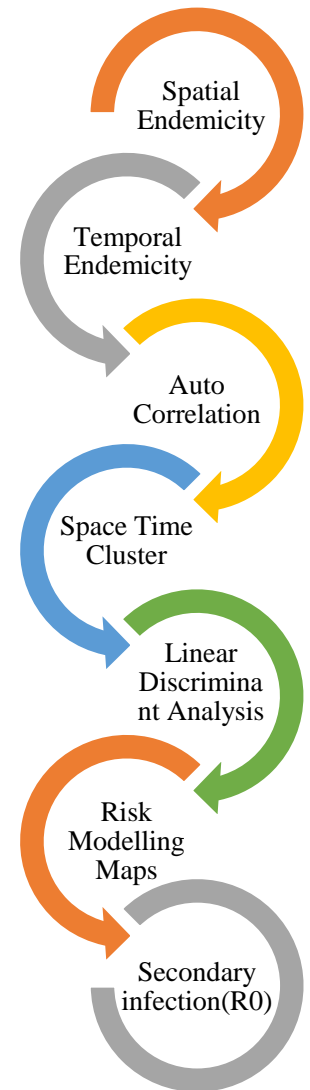
## Remote Sensing

Remote sensing	Units
LST	°C
NDVI & EVI	-1 to 1
PET	mm
LAI	m <sup>2</sup> /m <sup>2</sup>
LST Resolution: 1km	NDVI & EVI, PET, LAI Resolution: 500 m.
Source: <a href="https://ladsweb.modaps.eosdis.nasa.gov/">https://ladsweb.modaps.eosdis.nasa.gov/</a> <a href="https://search.earthdata.nasa.gov/">https://search.earthdata.nasa.gov/</a>	

## Meteorological

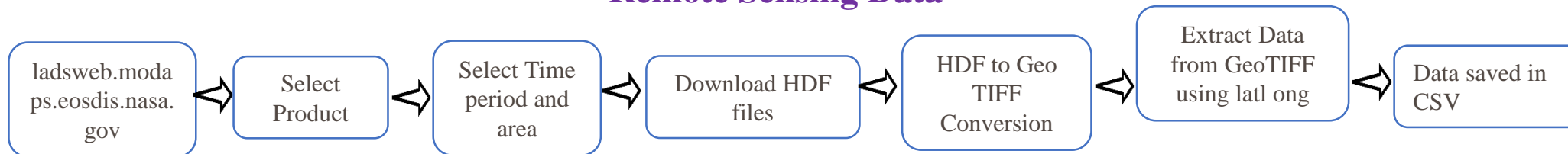
Meteorological	Units
Air Temperature	k
Potential Evaporation Rate	w/m <sup>2</sup>
Rainfall	kg/m <sup>2</sup> /s
Soil Moisture	kg/m <sup>2</sup>
Specific Humidity	kg/kg
Surface Pressure	Pa
Wind Speed	m/s
Source: <a href="https://disc.gsfc.nasa.gov/datasets/GLDAS_NOAH025_M_2.1/summary?keywords=GLDAS">https://disc.gsfc.nasa.gov/datasets/GLDAS_NOAH025_M_2.1/summary?keywords=GLDAS</a>	
Resolution: 0.25 * 0.25 degree	

Meteorological	Units
Cloud Cover	%
Relative Humidity	%
Temperature	°C
Temperature Max	°C
Temperature Min	°C
Vapour Pressure	hPa
Wet dry Frequency	days
Source: <a href="https://crudata.uea.ac.uk/cru/data/hrg/cru_ts_4.05/cruts.2103051243.v4.05/">https://crudata.uea.ac.uk/cru/data/hrg/cru_ts_4.05/cruts.2103051243.v4.05/</a>	
Resolution: 0.5 degree	

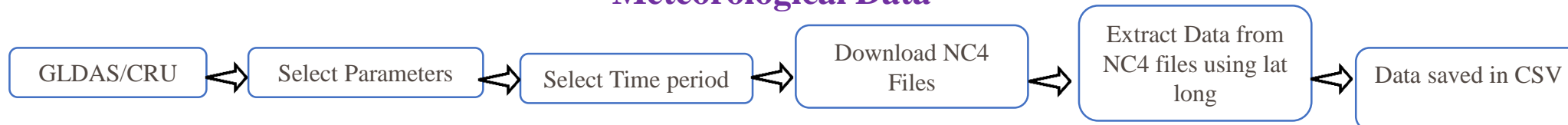


**Delta Weather Parameters:** Represents the difference between two corresponding values, typically between two time periods, to capture changes or trends.  
**Static Set:** Long-term deltas (2001–2021) showing climatic trends affecting disease patterns.  
**Dynamic Set:** Recent deltas (2018–2023 averages) capturing ongoing weather changes for short-term forecasting.

## Remote Sensing Data



## Meteorological Data



**Seven step approach used for risk Prediction**



# Machine Learning Model Building and evaluation

## Model Selection Criteria

- Akaike information criterion (AIC)
- Bayesian information criterion (BIC)
- Bridge criterion (BCCross-validation)
- Deviance information criterion (DIC),
- Likelihood-ratio test
- Mallows's Cp
- Minimum description length
- Minimum message length (MML)
- PRESS statistics
- Stepwise regression

1. Generalized Linear Model(GLM)

2. Generalized Additive Model (GAM)

3. Random Forest (RF)

4. Kernel Support Vector Machine (KSVM)

5. Boosted Regression Tree (BRT)

6. Artificial Neural Networks (NN)

7. Multiple Adaptive Regression Splines (MARS)

8. Flexible Discriminant Analysis (FDA)

9. Classification Tree Analysis (CTA)

10. Support Vector Machine (SVM)

11. Decision Trees (Tree\_prob)

12. Least Absolute Shrinkage and Selection Operator (Lasso)

13. Gaussian Process (GP)

14. Neural Network (NN)

15. Cubiset

16. Probit Regression

17. Elastic Net

18. Adaptive Boosting

19. Ridge Regression

20. Conditional Random Forest

## Presently used Indices For Model Evaluation

1. KAPPA
2. ROC
3. TSS
4. Accuracy
5. Error Rate
6. Precision
7. Sensitivity
8. Specificity
9. F1 Score
10. Log loss
11. Gini Coefficient
12. RMSE
13. MAE



NADRESv2 Monthly Bulletin Cover page

The diagram illustrates the workflow of the National Animal Disease Referral Expert System (NADRES v2) for Foot and Mouth Disease (FMD) forecasting and control measures.

**NADRES V2 Home page:** The interface includes a header with the ICAR-NIVEDI logo and navigation links. The main content area displays the "Welcome to NADRES v2" message, a brief description of the system, and a "Forecasting of FMD Rt using GARMMA model" section. A sidebar on the right lists various tools and reports.

**Foot-and-Mouth Disease (FMD) Preventive Measures:** A list of measures is provided, including ring vaccination, movement control, quarantine, and isolation of infected animals.

**Disease Distribution Map:** A map of Karnataka shows the distribution of FMD risk. A legend indicates "Very High Risk" (orange) and "High Risk" (yellow). The map shows high risk across most districts, with some areas in the south and west marked as high risk.

**Livestock Disease Forecast - Initiate Control Measures:** This section shows the process of selecting a disease (Foot and mouth disease), a state (Karnataka), and a month (July). A "Generate Forecast" button is highlighted with a red box and a "Click" label.

**Processing with AI:** A circular arrow icon and the text "Processing with AI" indicate the system is analyzing disease patterns and predicting outcomes.

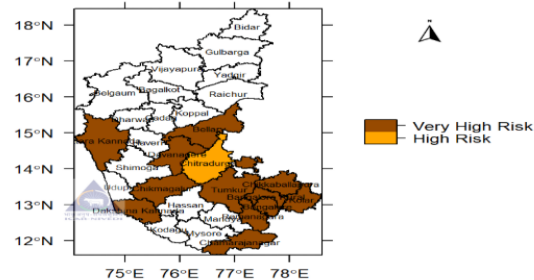
**Foot and mouth disease Livestock Disease Forecast for the July Month in KARNATAKA:** A table provides the forecasted results for various districts in Karnataka for the month of July. The table includes columns for District Name, Cattle, Buffalo, Goat, Sheep, Pig, Month, and Result.

District Name	Cattle	Buffalo	Goat	Sheep	Pig	Month	Result
Bangalore Rural	170722	16924	95156	118788	14131	July	Very High Risk
Bangalore	153861	11168	62464	82873	28046	July	Very High Risk
Bellary	263699	127407	253119	1005585	15094	July	Very High Risk
Chikmagalur	290007	34362	41040	97962	1423	July	Very High Risk
Davanagere	297377	123596	124542	505630	2418	July	Very High Risk
Tumkur	431251	142047	427926	1290008	5956	July	Very High Risk
Uttara Kannada	336312	73993	10655	8537	1193	July	Very High Risk
Chikkaballapura	213815	26397	188392	613193	2481	July	Very High Risk
Ramanagara	267502	19644	150130	127968	7102	July	Very High Risk
Chamarajanagar	249361	9918	144633	135321	1572	July	Very High Risk
Dakshina Kannada	250569	1832	32215	289	6359	July	Very High Risk
Kolar	209642	26520	93713	483882	5292	July	Very High Risk
Chitradurga	225603	113304	385058	1352087	2177	July	High Risk
Gulbarga	365580	73176	446200	112387	44221	July	Medium Risk

### Preventive Measures:

- Ring vaccination within an 8 km radius using appropriate vaccines for circulating serotypes (O, A, Asia-1).
- Strict movement control of livestock must be enforced during outbreaks.
- Quarantine measures should be implemented for newly introduced animals.
- Animals aged four months and older should receive biannual vaccinations to maintain immunity.
- Infected animals should be immediately isolated, as their excretions and secretions contain the virus.
- All feed and fodder in contact with infected animals should be discarded.

**If vaccinated, please ignore the disease forecast.**

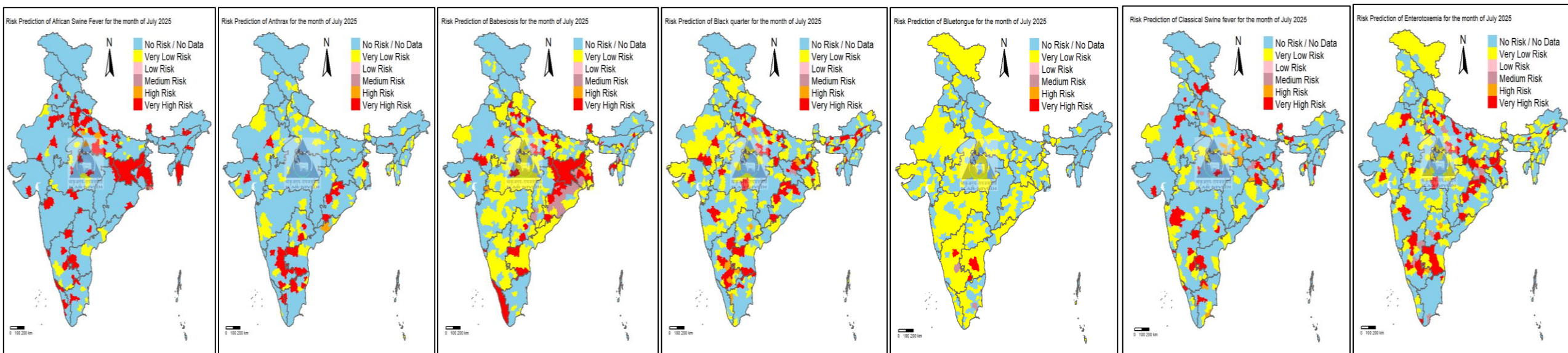
Disease: *Foot and mouth disease* | State: KARNATAKA | Month: July

### Foot and mouth disease Livestock Disease Forecast for the July Month in KARNATAKA

District Name	Cattle	Buffalo	Goat	Sheep	Pig	Month	Result
Bangalore Rural	170722	16924	95156	118788	14131	July	Very High Risk
Bangalore	153861	11168	62484	82873	28046	July	Very High Risk
Bellary	283699	127407	253119	1005565	15094	July	Very High Risk
Chikmagalur	290007	34362	41040	97962	1423	July	Very High Risk
Devanagere	297377	123596	124542	505630	2418	July	Very High Risk
Tumkur	431251	142047	427926	1290008	5956	July	Very High Risk
Uttara Kannada	336312	73993	10655	8537	1193	July	Very High Risk
Chikkaballapura	213815	26397	188392	613193	2481	July	Very High Risk
Ramanagara	287502	19644	150130	127968	7102	July	Very High Risk
Chamarajanagar	249361	9918	144633	135321	1572	July	Very High Risk
Dakshina Kannada	250569	1832	32215	289	6359	July	Very High Risk
Kolar	209642	26520	93713	483892	5292	July	Very High Risk
Chitradurga	225603	113304	385058	1352087	2177	July	High Risk
Gulbarga	385580	73176	446200	112387	44221	July	Medium Risk



# Risk Prediction - Livestock Disease Forewarning Maps (May-2025)



**African Swine  
Fever**

**Anthrax**

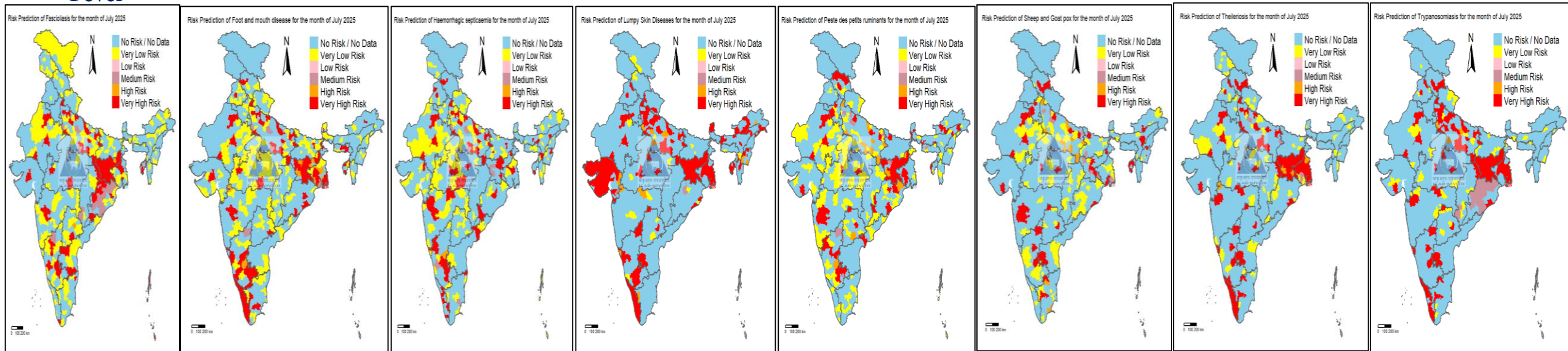
**Babesiosis**

**Black quarter**

**Bluetongue**

**Classical Swine  
Fever**

**Enterotoxemia**



**Fascioliasis**

**Foot and mouth  
disease**

**Haemorrhagic  
septicaemia**

**Lumpy Skin  
disease**

**Peste des petits  
ruminants**

**Sheep and  
Goat pox**

**Theileriosis**

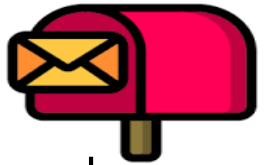
**Trypanosomiasis**

# End to End Risk Communications

Monthly Forecasting of 15 Livestock Diseases (Based on AI and ML models) Dissemination to all Stakeholders



**Hard Copy** (Vet-alert, Livestock Diseases Risk Forewarning Bulletin)  
**Dissemination by Post**



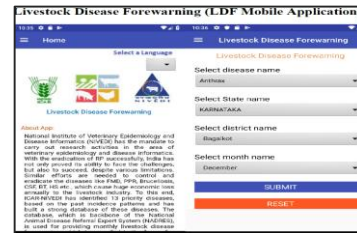
**DAHD and ICAR officials**

**Soft copy** (Vet-alert, Livestock Diseases Risk Forewarning Bulletin)  
**Via emails**



**State Veterinary Officials(52), KVKS (731), NADEN centers (55 Including PI & Co-PI)**

**LDF & NER LDF Mobile application**



**Real time access by field users (100+ Users)**

- ✓ Veterinary nodal officers use the system to create data-driven sampling plans for targeted surveillance.

**NADRES Website**



[https://nivedi.res.in/Nadres\\_v2/index.php](https://nivedi.res.in/Nadres_v2/index.php)

**Total Visitors: 26.7 Lakh Individuals (as of latest update)**

**Fruits SMS alerts to registered farmers**



- ✓ **25.7 lakh** SMS alerts were sent to farmers in April 2025.
- ✓ **23.3 million** SMS alerts disseminated via FRUITS (Apr 2024–Mar 2025).

**DLT SMS to Veterinary Doctors**



- ✓ **17,954** SMS alerts sent to veterinarians in April 2025.
- ✓ **1.09 lakh** SMS alerts sent to vets from Sep 2024 to Mar 2025.

**Social Media Platforms**

X (Twitter)  
<https://x.com/dilnivedi/status/1888899265411645536>

LinkedIn  
<https://www.linkedin.com/feed/update/urn:li:share:7294667371829436417/>

Instagram  
<https://www.instagram.com/p/DF5DkqgvmcW/?igsh=N2NvZXR5cHp3cXdj>

YouTube:  
<https://www.youtube.com/@icar-nivedi>

GitHub:  
<https://github.com/SEL-NIVEDI/>

Facebook  
<https://www.facebook.com/icarnivediofficial/>



**Informed Farming Community & Veterinary Authorities**

- Early Response
- Risk Mitigation
- Animal Health Protection



# Operational Scale & Response Time Optimization in NADRES V2 via AI/ML Automation

## Data Inputs for Monthly Livestock Disease Forecasting

- ✓ **Total Livestock Population & Animal Species Covered: 540 million** animals (Cattle, Buffalo, Sheep, Goat, and Pig)
- ✓ **Disease Surveillance Network:** Data collected from 35 NADEN (National Animal Disease Epidemiology Network) Centers

WhatsApp NADEN Group



- ✓ **Number of States & Districts Covered: 36 States& UTs, 755 Districts**
- ✓ **Number of Target Diseases: 15** economically important livestock diseases
- ✓ **Climatic Parameters: 18** key weather and climate variables considered
- ✓ **Remote Sensing Variables: 5** variables derived from satellite and geospatial data
- ✓ **Delta Variables: 23** variables capturing changes in climatic trends over time
- ✓ **Forecasting Models: 20** predictive models used for analysis
- ✓ **Indices: 13** indices to support decision-making and interpretation

## Operational Scale

Sl. No.	AI & ML-Driven Operation	Volume of Operations for One year
1	<b>Data Capturing</b>	2,08,380 records(disease data, key risk factors)
2	<b>Data Alignment</b>	7,61,046 records (additional 23 delta variables)
3	<b>Disease Modelling</b>	Forecasting 15 livestock diseases, over 12 months using 20 models and 13 performance indices across 755 districts and 15 agro climatic zones in India requires approximately <b>530 million operations per time</b>
4	<b>Risk Communication</b>	25 lakh SMS alerts to farmers in 1 year; 17 to 18 thousand DLT SMS alerts to veterinary officials every month

## Optimized Response Time in NADRES Through AI/ML Automation for Each month

Process	Before Automation	After Automation	Improvement
<b>Data Collection + Cleaning</b>	10–14 days	< 48 hours	~90% time saved
<b>Forecasting &amp; Modeling</b>	7–10 days	< 10 hours	~95% faster
<b>Report Preparation</b>	10 – 15 days	< 3 days	~90% time saved
<b>Alert Generation</b>	Manual dispatch	Instant multi-channel	Real-time communication
<b>Total Response Cycle</b>	18–24 days	< 6 days	faster response time

- ✓ Fully automated pipeline powered by **AI and ML**, Covers the entire workflow from data acquisition through to district-level risk alerts
- ✓ Over **2,346** lines of **R code** implemented across data capture, processing, and modeling stages to automate the NADRES V2 pipeline. ( [https://nivedi.res.in/Nadres\\_v2/](https://nivedi.res.in/Nadres_v2/) )
- ✓ Nearly **250** CPU hours per month devoted to continuous model execution and risk forecasting.



# NADRES V2: Future Scalability & Strategic Collaborations for Precision Livestock Disease Forecasting

## Scalability Opportunities

- ✓ **Micro-Level Forecasting:** Expansion from district to **block and village levels**, enabling hyper-localized risk predictions tailored to specific livestock practices and microclimates.
- ✓ **Model and Disease Expansion:** The number of forecasted livestock diseases is projected to increase to 20–30, with a parallel rise in machine learning models to approximately 25–30, improving prediction specificity and robustness.
- ✓ **Offline Accessibility:** Deployment of AI/ML models on mobile devices with **offline capabilities** for remote areas with poor internet.
- ✓ **Multi-Language & Voice Support:** Integration of **AI-driven voice alerts**, SMS, IVR, and community radio in **regional languages** for inclusive communication.

## Strategic Collaborations

- ✓ **NICRA (ICAR):** Leveraging agro-climatic data to **enhance prediction accuracy** under climate variability (floods, droughts).
- ✓ **IMD Integration:** Real-time meteorological data and **farmer details** across India are integrated to enhance the prediction of climate-sensitive and vector-borne diseases and to enable timely dissemination of alerts to farmers
- ✓ **Government Platforms:** Seamless integration with **NDLM, BSNL, and Digital India** initiatives for unified data exchange and delivery.

**AI & ML Adaptability:** Dynamic model recalibration using real-time feedback and new climate-disease relationships.

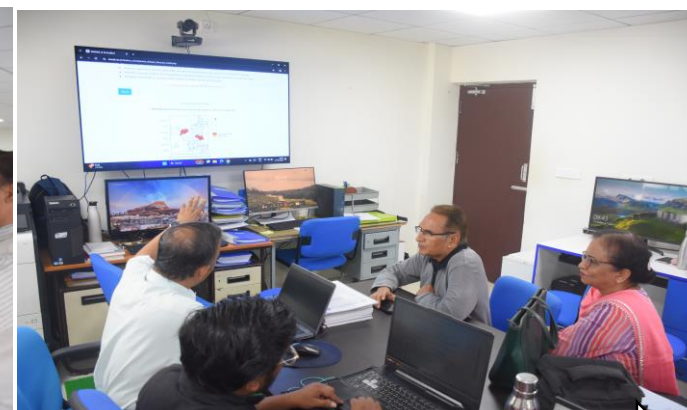
## Community-Centric Risk Communication

- ✓ **Global Inter** Engaging **village cooperatives** and **extension workers** as grassroots communication hubs.
- ✓ Dissemination through **SMS, IVR, local radio**, and **mobile-based tools** to reach digitally underserved areas.
- ✓ We will also **expand SMS alerts to farmers in their local or vernacular languages**, ensuring better understanding and adoption.

## Global Interest

- ✓ FAO experts organized a workshop on community-based early disease detection and reporting systems, and invited the NADRES V2 team to explore expanding its implementation at the community level.

# Officials were oriented on the NADRES V2 workflow during their visit to the SEL Lab




The website is currently under evaluation by the Standards and Quality Compliance Lab (STQCL) for adherence to GIGW guidelines

Parameter	NADRES v2 Website	ICAR-NIVEDI Website
Errors	0 (No critical accessibility errors)	0
Contrast Errors	0 (No contrast issues)	0
Features	32(Accessibility features implemented)	55
Structural Elements	71	86
ARIA Attributes	78	46

**WAVE Tool Accessibility Summary Report**



**atul chaturvedi** @atul1chaturvedi · 1h  
ICAR-NIVEDI is doing great job in area of disease forecasting through Artificial Intelligence tools

**Dept of Animal Husbandry & D...**   
Secretary AHD @atul1chaturvedi visited to ICAR-NIVEDI, Interacted with the Scientist Involved in veterinary disease epidemiology.



**Message Alert**



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# THANK YOU

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