

Role of technology in improving agriculture insurance implementation

Dr. Sunil Kumar Dubey

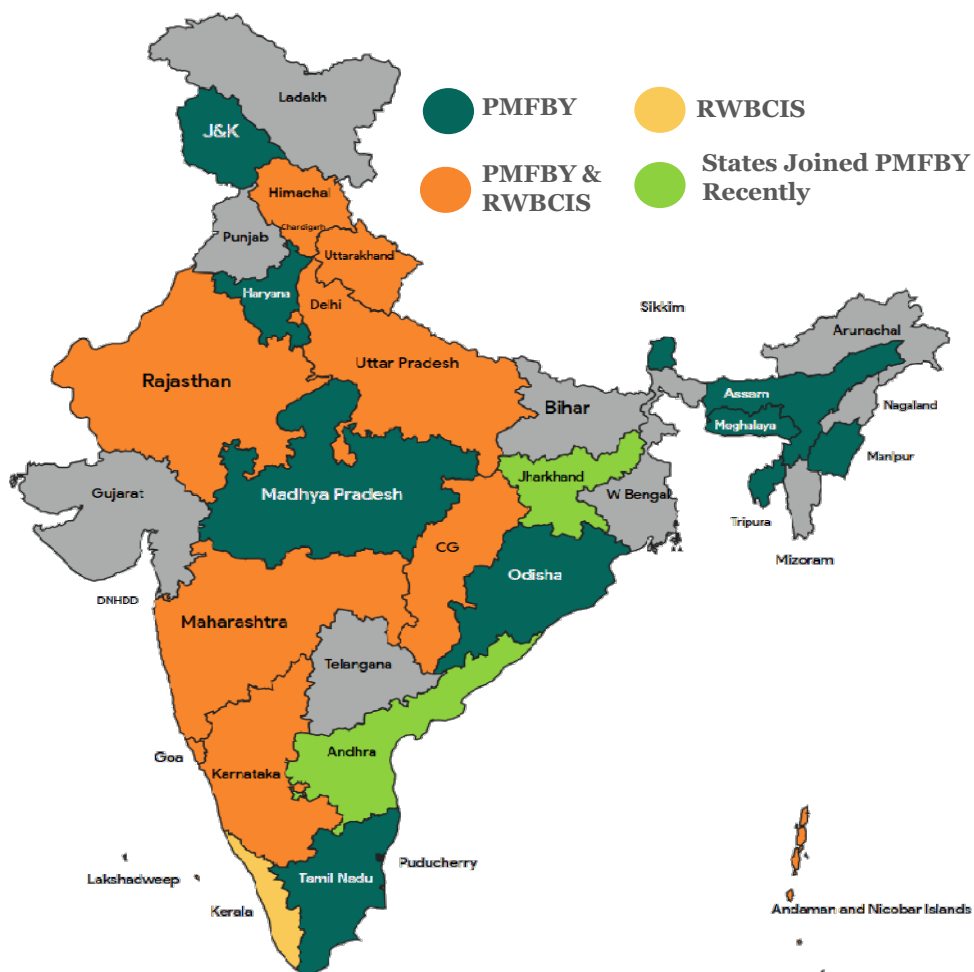
Deputy Director, MNCFC,
DA&FW, New Delhi

Email: sunil.dubey86@gov.in





PMFBY: Diversification & Presence



100+ Crops notified under PMFBY



23 States/UTs in Countrywide participation

BASIC COVER



Yield loss due to climatic risks



Parametric Weather Index Insurance

ADD-ON COVERAGE



Prevented Sowing/ Planting/
Germination Risk



Mid-Season Adversity
(Floods, dry spells & drought etc)



Post Harvest
Losses



Localized Calamities
(hailstorm, landslide, inundation,
cloud burst & natural fire-lightening)



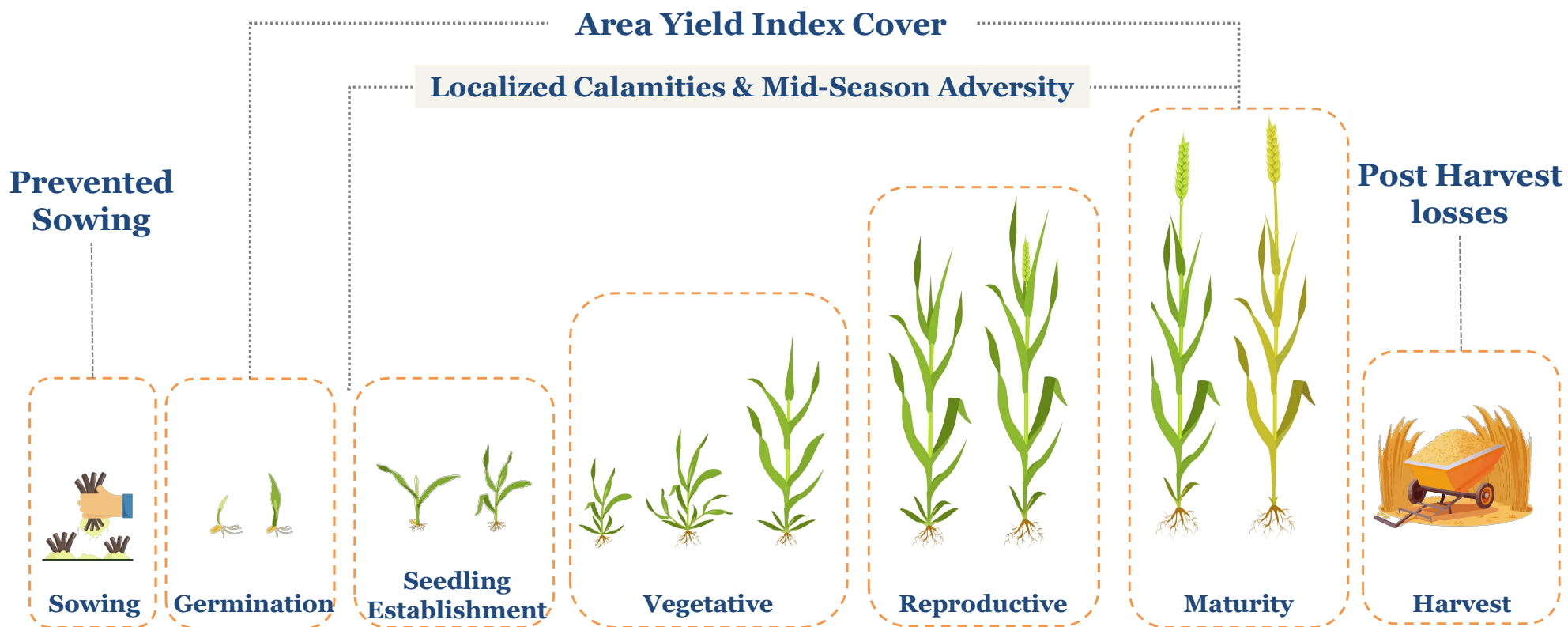
Crop loss due to attack
by wild animals

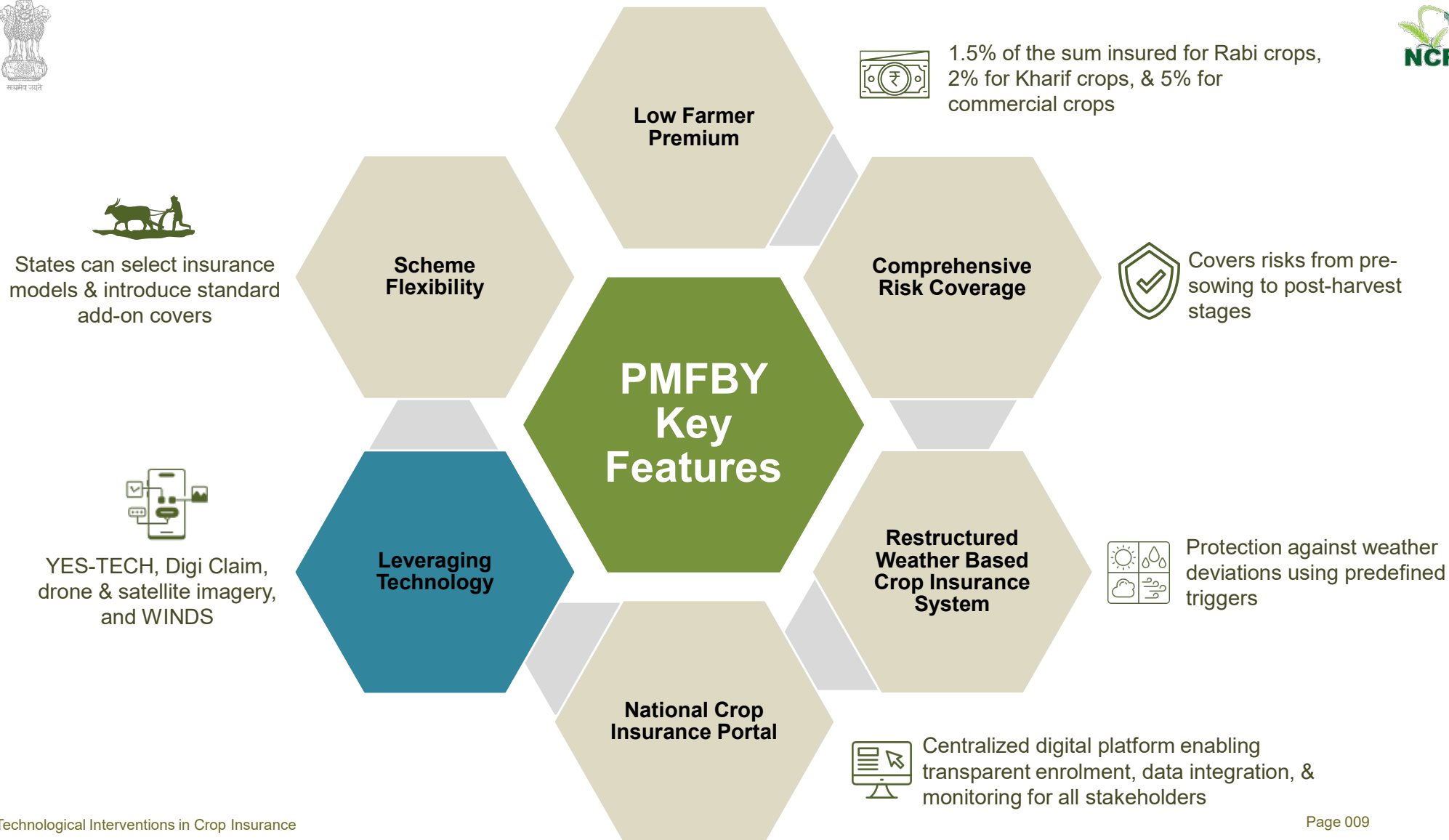




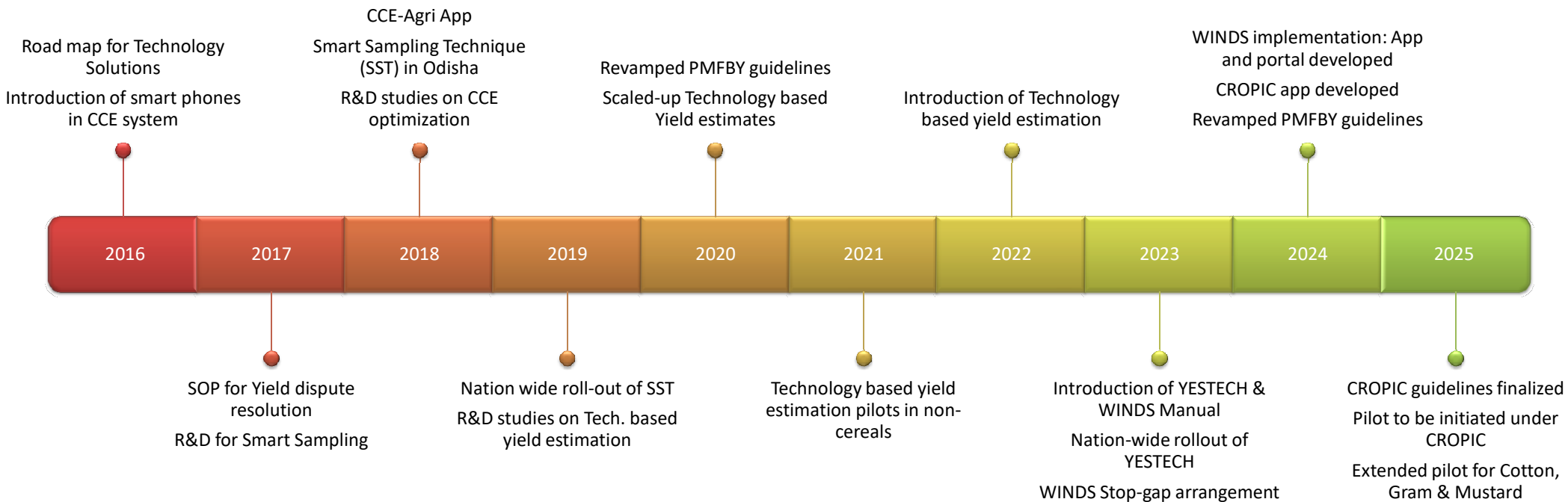
PMFBY Product Structure

A Comprehensive Insurance Product covering all Stages from Sowing to Harvesting





Technological Interventions in PMFBY





Use of technology in PMFBY



Yield Estimation System using Technology: AI, satellite, drone, and remote sensing–based yield estimation.



Smart Sampling: Planning of Crop Cutting Experiment using remote sensing derived crop situation



Collection of Real-time Observations & Photographs of Crops: Ascertain the health of crops and identify possible damages through AI powered solutions using field photograph



Weather Information and Network Data Systems: Generate long-term, hyperlocal weather data at Block and Gram Panchayat levels



Dispute resolution: Resolve crop yield and area discrepancy related to claim settlements using technology



Crop situation Assessment: Prevented/Failed Sowing, Mid-season adversity



Research and Development: Pilot studies and other initiatives for scaling-up the technological interventions.

- Rationalize crop risk assessment
- Minimize moral hazards
- Timely settlements
- Enhances transparency
- Reduce transaction costs

Direct Benefits



- Reduction in premium rates
- Increase in coverage

Spin-off benefits





Yield Estimation System using Technology



METHOD



Data collection
(Satellites/drone,
weather & soil data)



Feature extraction



Model training



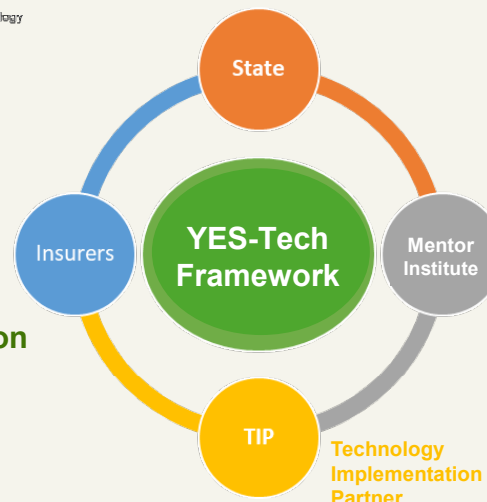
Yield Estimation



- Technology-driven crop yield estimation.
- Reduced dependence on manual CCEs.
- Accurate crop loss assessment.
- Timely and unbiased claim settlements.



**Implementation
by State/UT**



END USES



Yield
estimation



Food
production



Crop
Insurance



Disaster
management

YES-TECH MODELS



**Crop Simulation
Models**

Simulate crop
growth using
weather & soil data



**Semi Physical
Models**

Estimate yield from
satellite/drone indices
(NDVI, LAI, etc)



**AI/ML
Models**

Predict yield using
algorithms like
Random Forest &
XGBoost



**Crop Health
Factor Models**

Estimate yield by
linking vegetation
indices (NDVI, LAI, etc)
with crop health conditions



**Ensemble
Models**

Combine multiple
model predictions
for improved accuracy,
robustness & reliability

Collaboration with –Top
Technical Institutions as
MITR for mentoring





YES-Tech Implementation



- Use of blended yield for claim settlement: **Minimum 30% weightage to technological yield**
- YES-Tech implementation: **13 States/ UTs**
- Crops under YES-Tech: **Paddy, Wheat & Soybean**
- Crops proposed: **Cotton, Gram & Mustard**

States adopting different approaches:

- Semi-physical – **Andhra Pradesh, Haryana, Uttarakhand**
- AI/ML model – **Madhya Pradesh, Rajasthan, Uttar Pradesh**
- Crop Simulation model – **Maharashtra, Karnataka, Tamil Nadu, Puducherry**
- Ensemble method – **Assam**
- CHF – **Odisha**





Weather Information and Network Data Systems

One Nation One Weather Portal



- Establish a robust network of weather stations at the block and GP levels.
- Provide critical weather-related information and data.
- Advanced weather data analytics & actionable insights for informed decision-making.
- Accurate weather monitoring for planning, risk assessment, and rapid response.



WINDS COMMITTEE



**State/UT
Government**



**WINDS Implementation
Partner**



**Quality Assurance
Partner**

Hyper-local Weather Data



Weather Data

1 Automatic Weather Station:
Every Block
1 Automated Rain Gauge:
Every Gram Panchayat



WINDS PORTAL



Data sharing with
Stakeholders & Ministries





WINDS implementation status

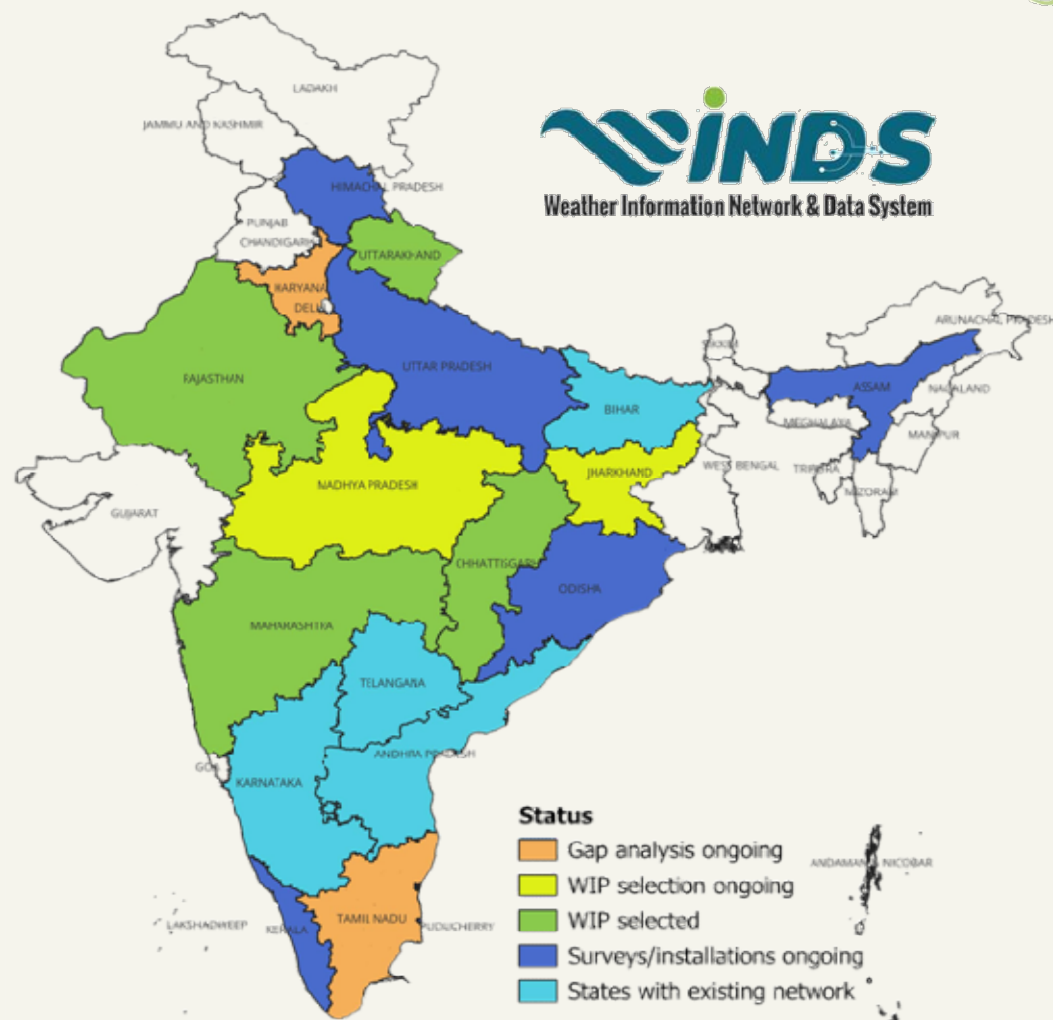


Existing network continuity plan

- **Institutional Network:** IMD
- **State Networks:**
 - UP, Maharashtra, AP, & Telangana. Karnataka, & Bihar to be included.
- **Private Networks for Crop Insurance** (Stop gap arrangement):
 - HP, Uttarakhand, Kerala, Chhattisgarh, Rajasthan

New network of AWS/ARGs

- **14 states** in different stages of WINDS implementation.
- Initial surveys started in 6 states: UP, Kerala, Odisha, Assam, HP & Puducherry.
- WIPs selected in 4 states for installation of AWS/ARGs.
- WIP selection process initiated in 2 states.
- Gap analysis ongoing in 2 states.





Collection of Real-time Observations & Photographs of Crops (CROPIC)

AI & Photo-Analytics for Loss Estimation

Real Time Crop Health Monitoring



Crop Health Monitoring



Crop Loss Surveys



Integration with RS & GIS Data



Field Tracking



Farm Geofencing



Data Analytics



Crop type detection

Crop stage detection

Crop damage assessment

Integrating Photo Analytics for direct yield estimation

Field photo collection

Data cleaning and annotation

Feature Engineering

Model training

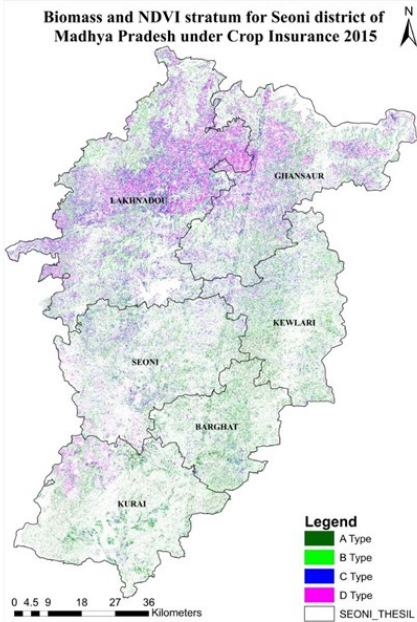
Model deployment



Crop Cutting Experiments-Smart Sampling

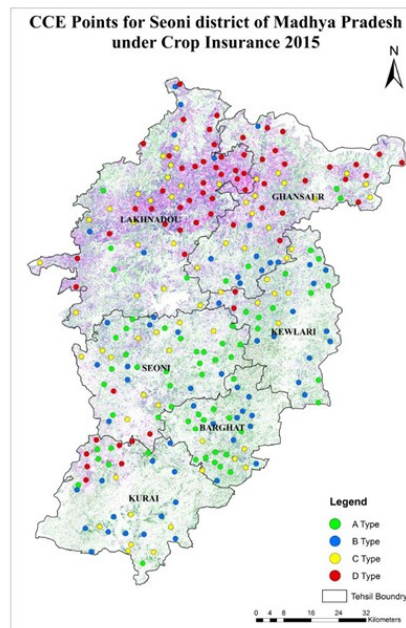
Biomass + NDVI Stratum

Biomass and NDVI stratum for Seoni district of Madhya Pradesh under Crop Insurance 2015

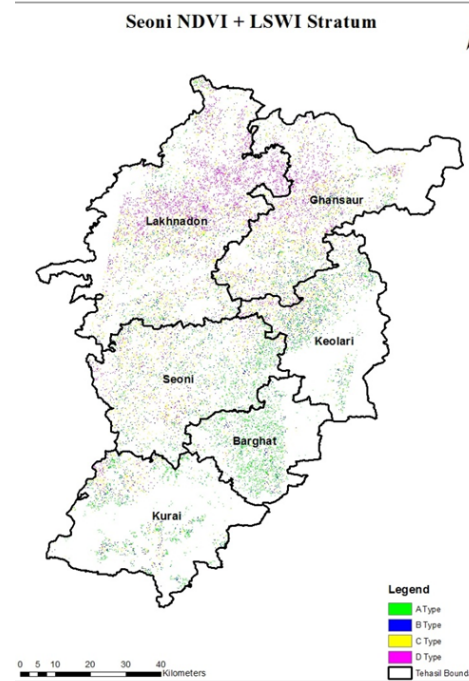


CCE Points Randomly Selected in Each Stratum

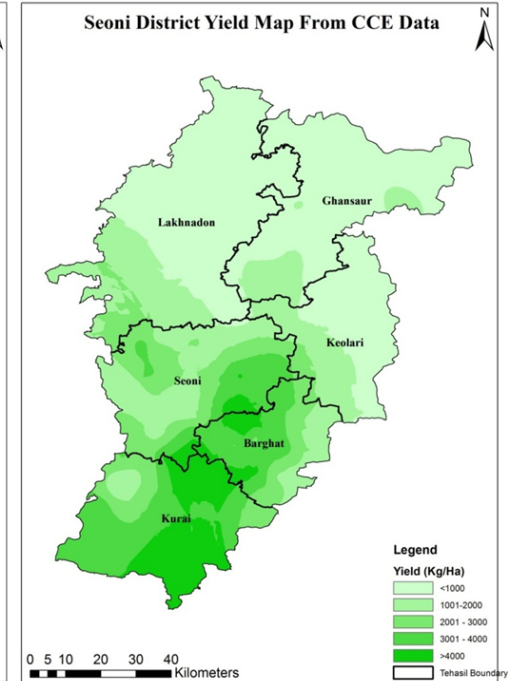
CCE Points for Seoni district of Madhya Pradesh under Crop Insurance 2015



Seoni NDVI + LSWI Stratum

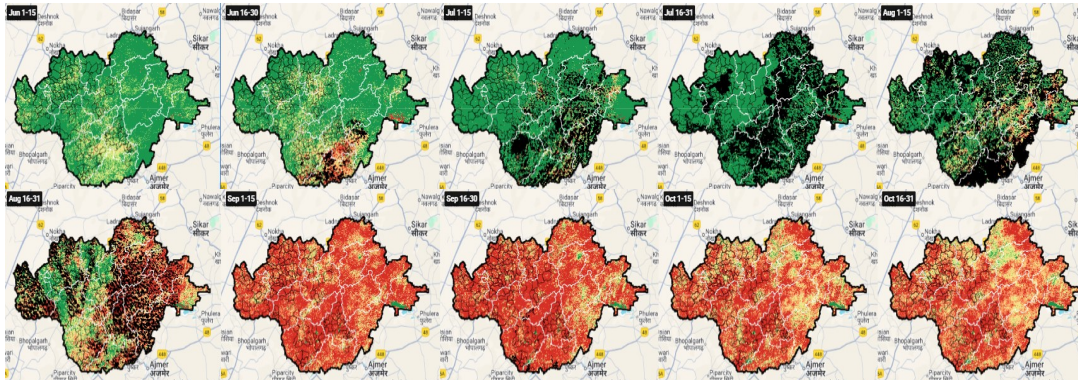


Seoni District Yield Map From CCE Data

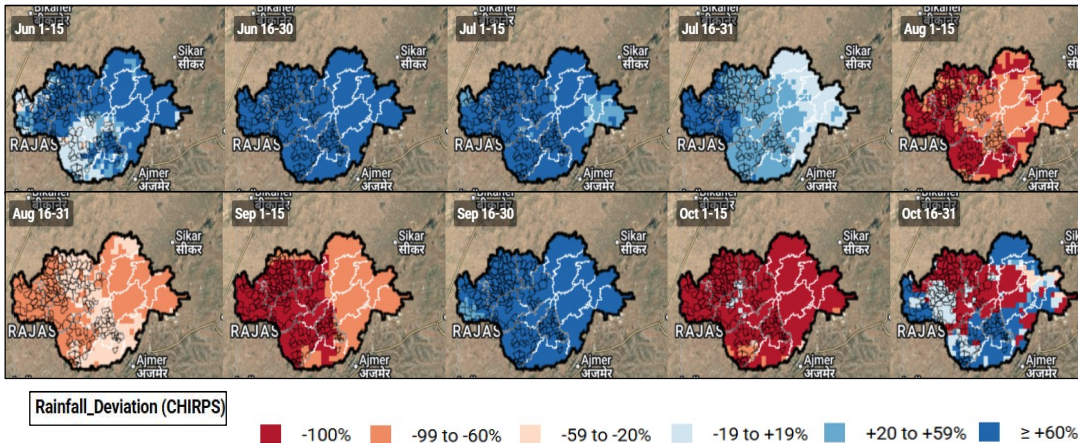


Yield dispute resolution

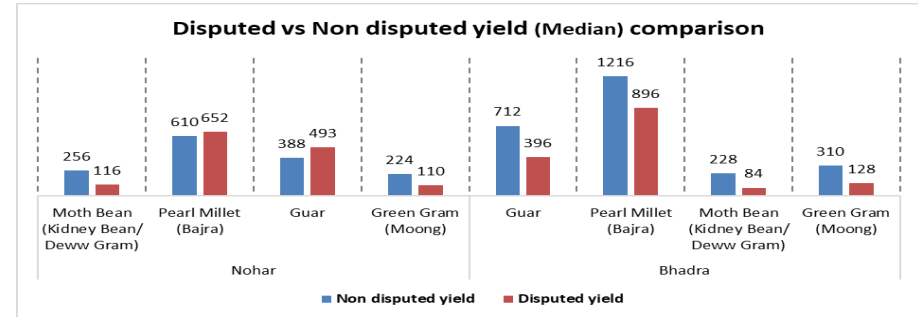
NDVI Deviation



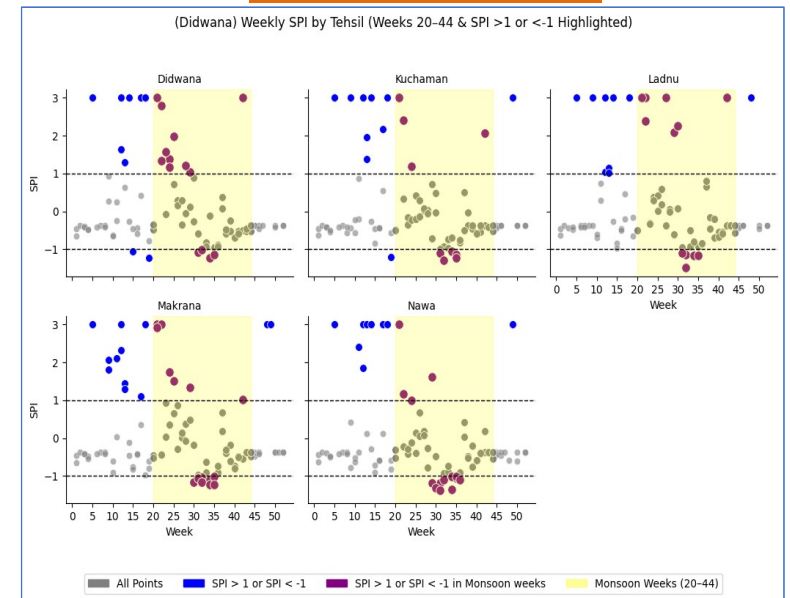
Rainfall Deviation



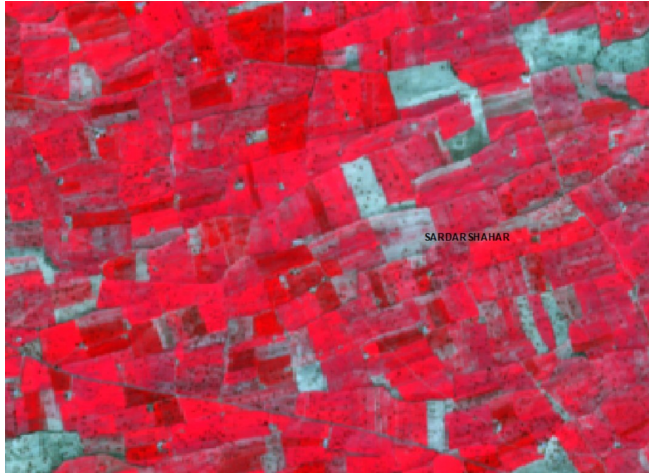
CCE data analysis



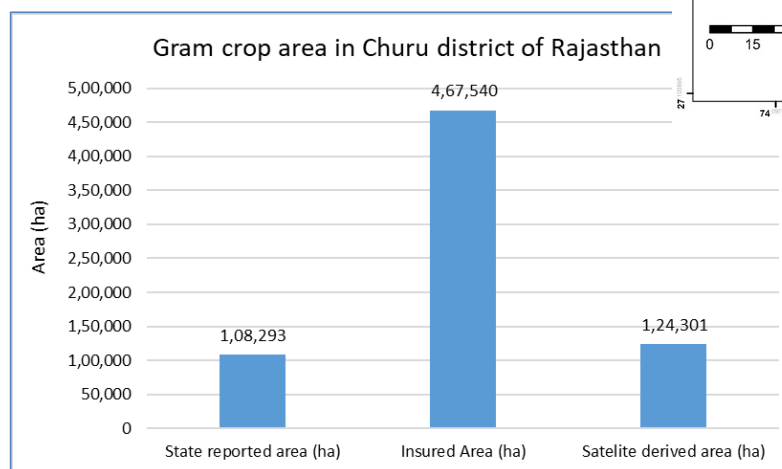
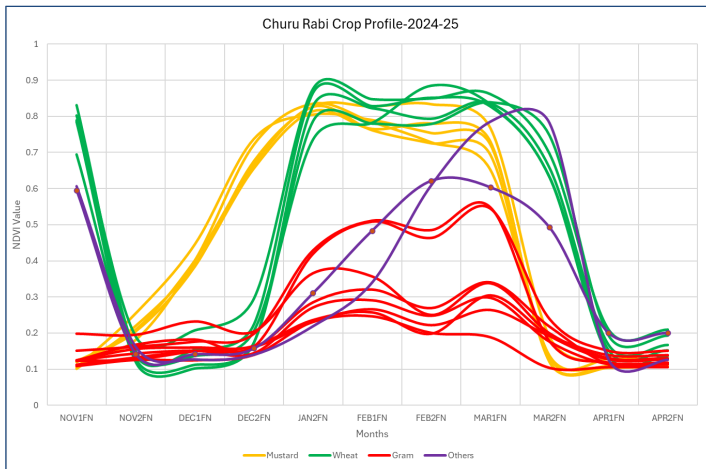
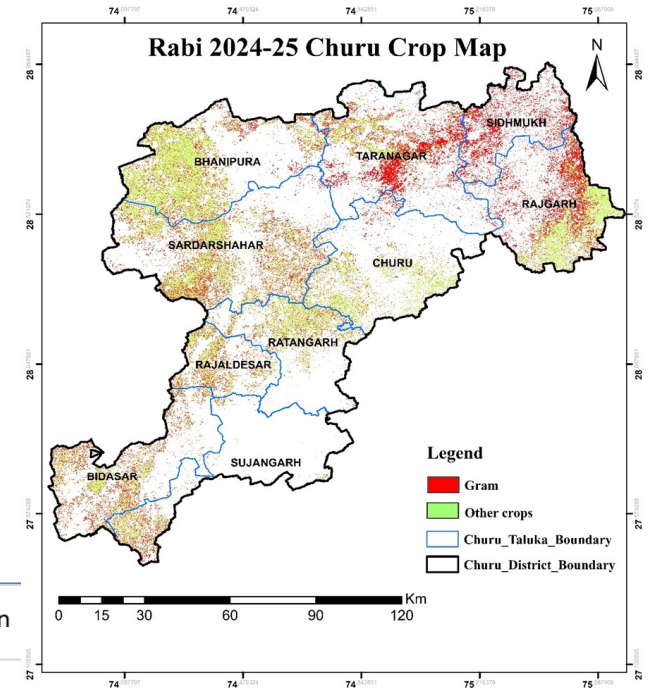
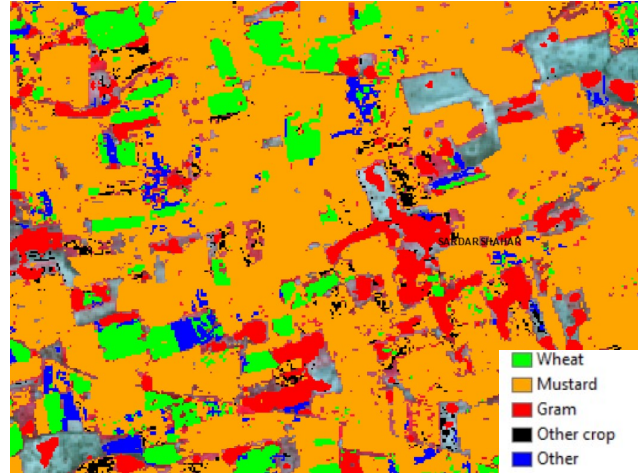
SPI during crop season



Satellite Data for Area Discrepancy



Sentinel 2 - 2FN Feb 2025



Flood Water Inundation due to heavy rains in parts of Mirzapur and Chandauli district of U.P

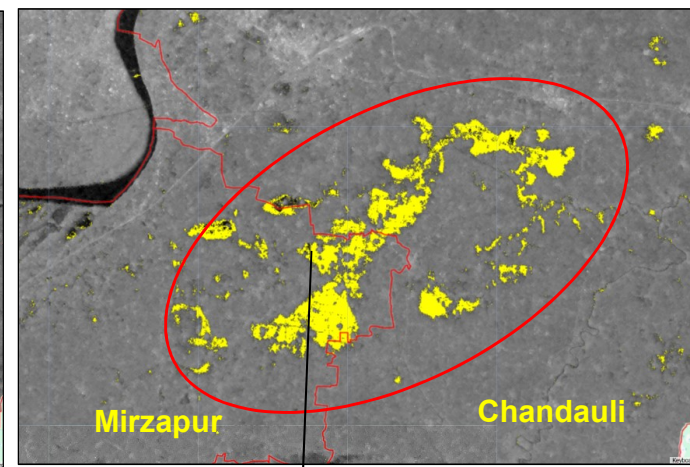
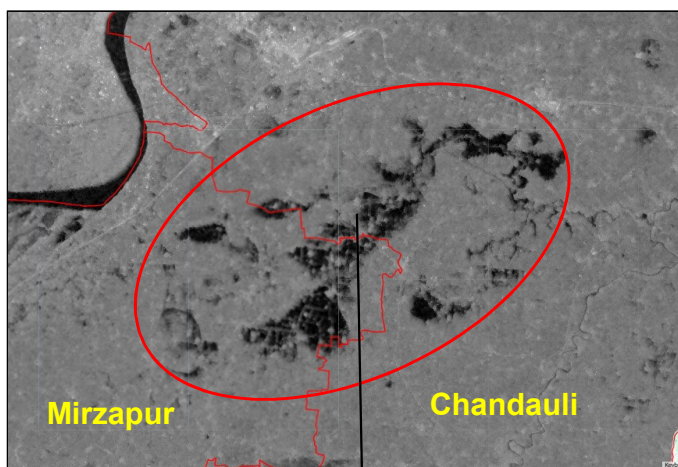
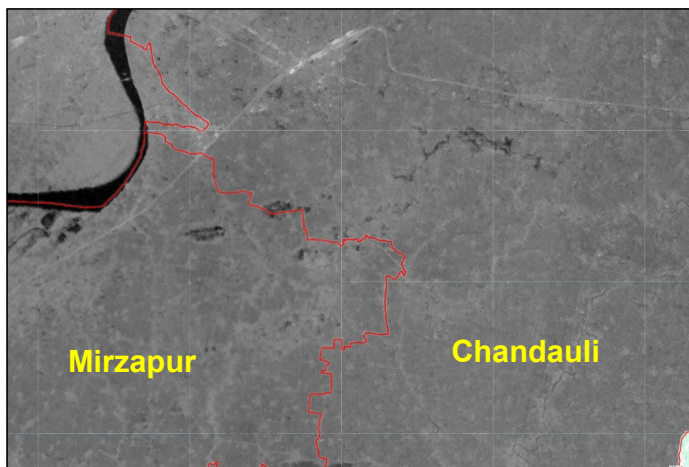
Sentinel-1 SAR Satellite Images

Mirzapur and Chandauli District of U.P

Pre event image - 15- 20 Sep 2025

Post event image - 06 Oct 2025

Water inundated due to heavy rainfall event



Inundated area: 8,700 hectares
Cropland inundated area: 8,000 hectares

Black color in the post event image represents the inundated areas due to heavy rains

Yellow color is the extracted inundated area due to heavy rains

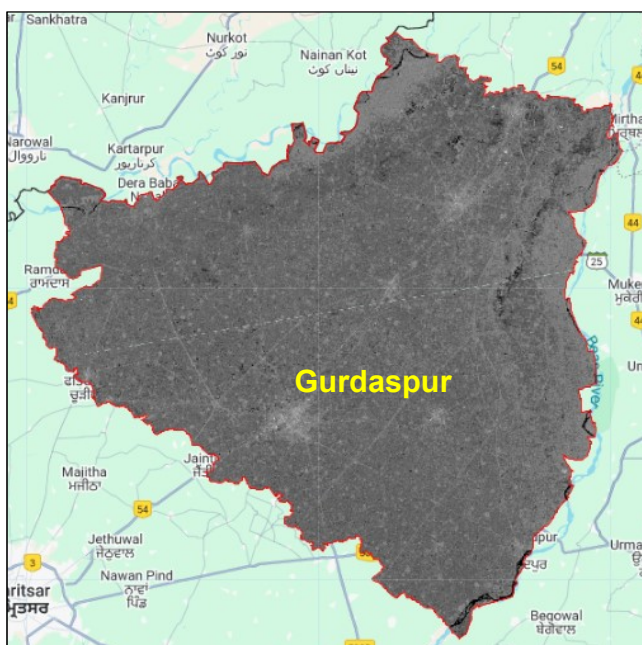
Flood Water Inundation due to heavy rains in parts of Gurdaspur District of Punjab



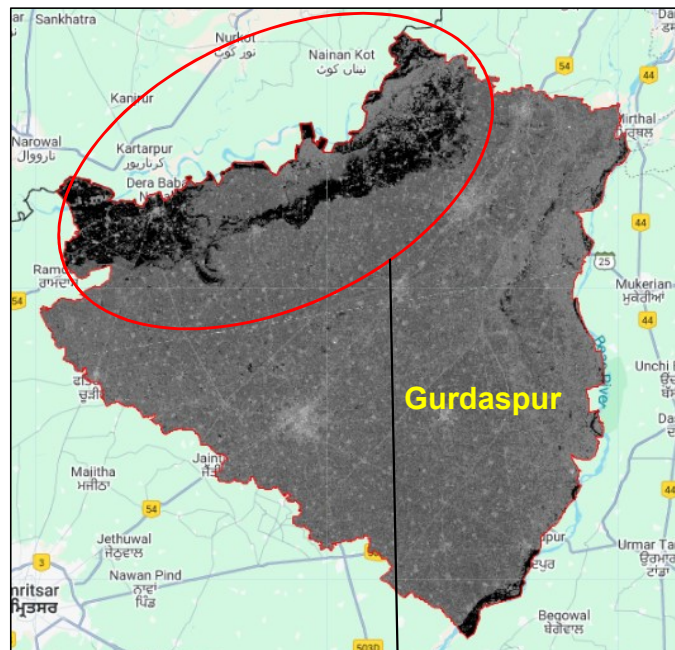
Sentinel-1 SAR Satellite Images

Gurdaspur District of Punjab

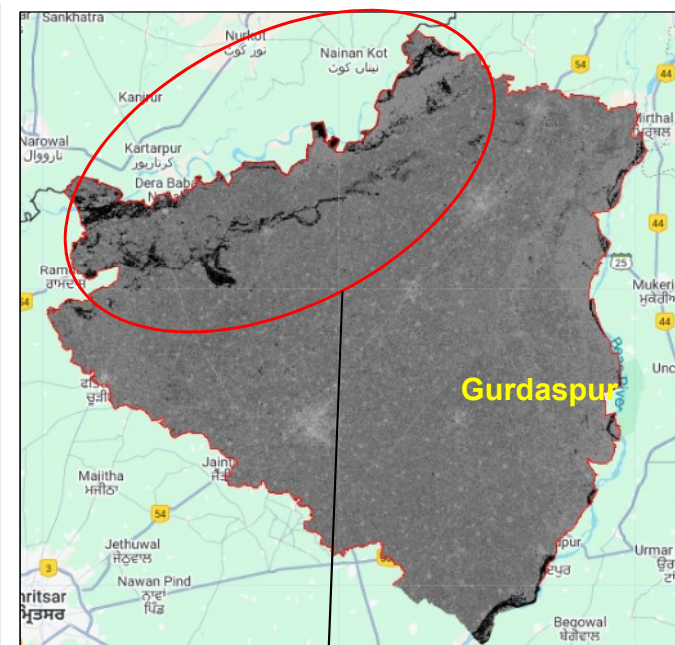
Pre event image - 03 Aug 2025



Post event image - 27 Aug 2025



Post event image - 03 Sep 2025



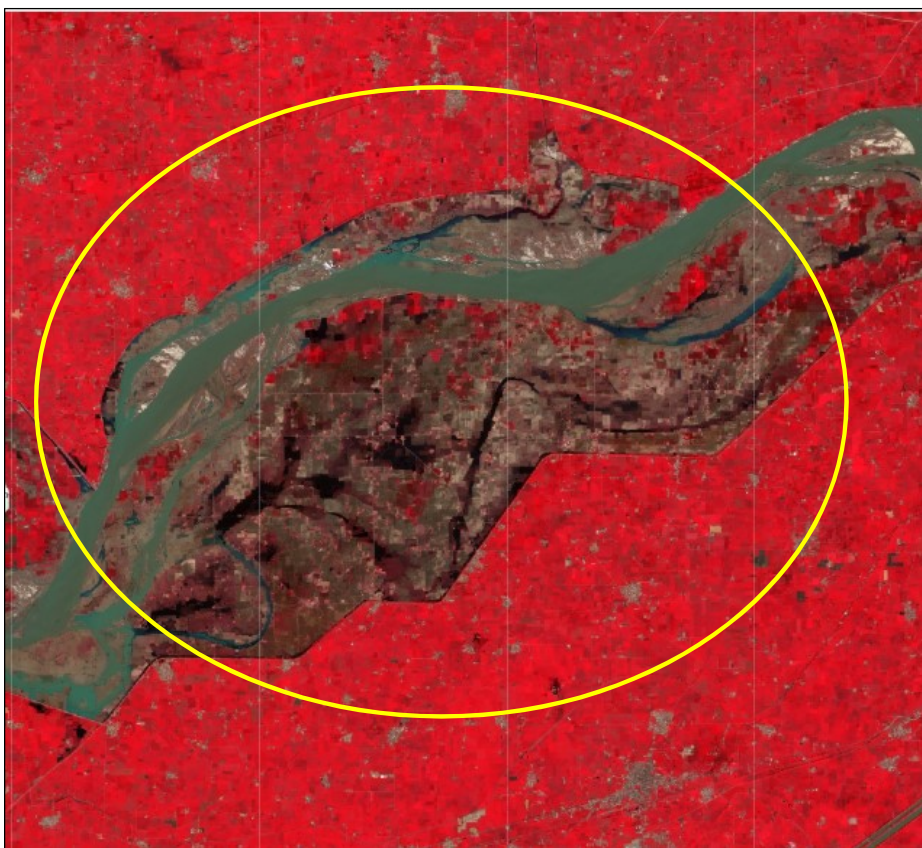
Inundated area: 26,000 hectares
Cropland inundated area: 24,300 hectares

Black color in the post event image represents the inundated areas due to heavy rains

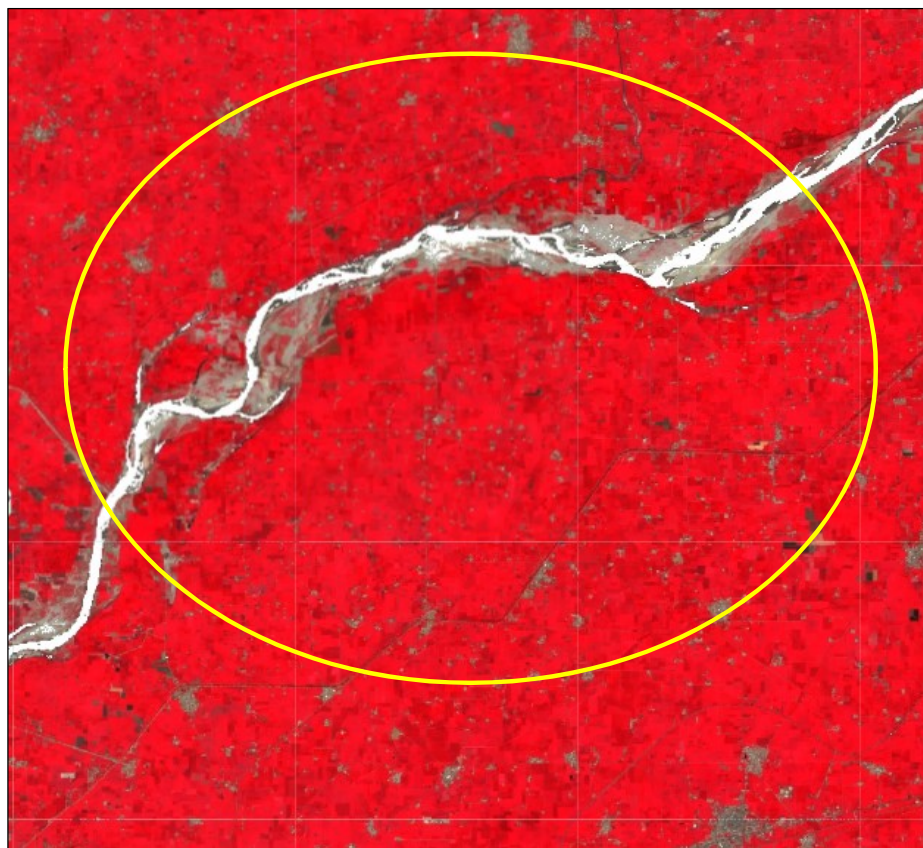
Black color in the post event image represents the inundated areas due to heavy rains

Sentinel-2 (False Colour Composite) Image comparison (2025 vs 2024)

Parts of Firozpur district – 20 -28 Sep 2025

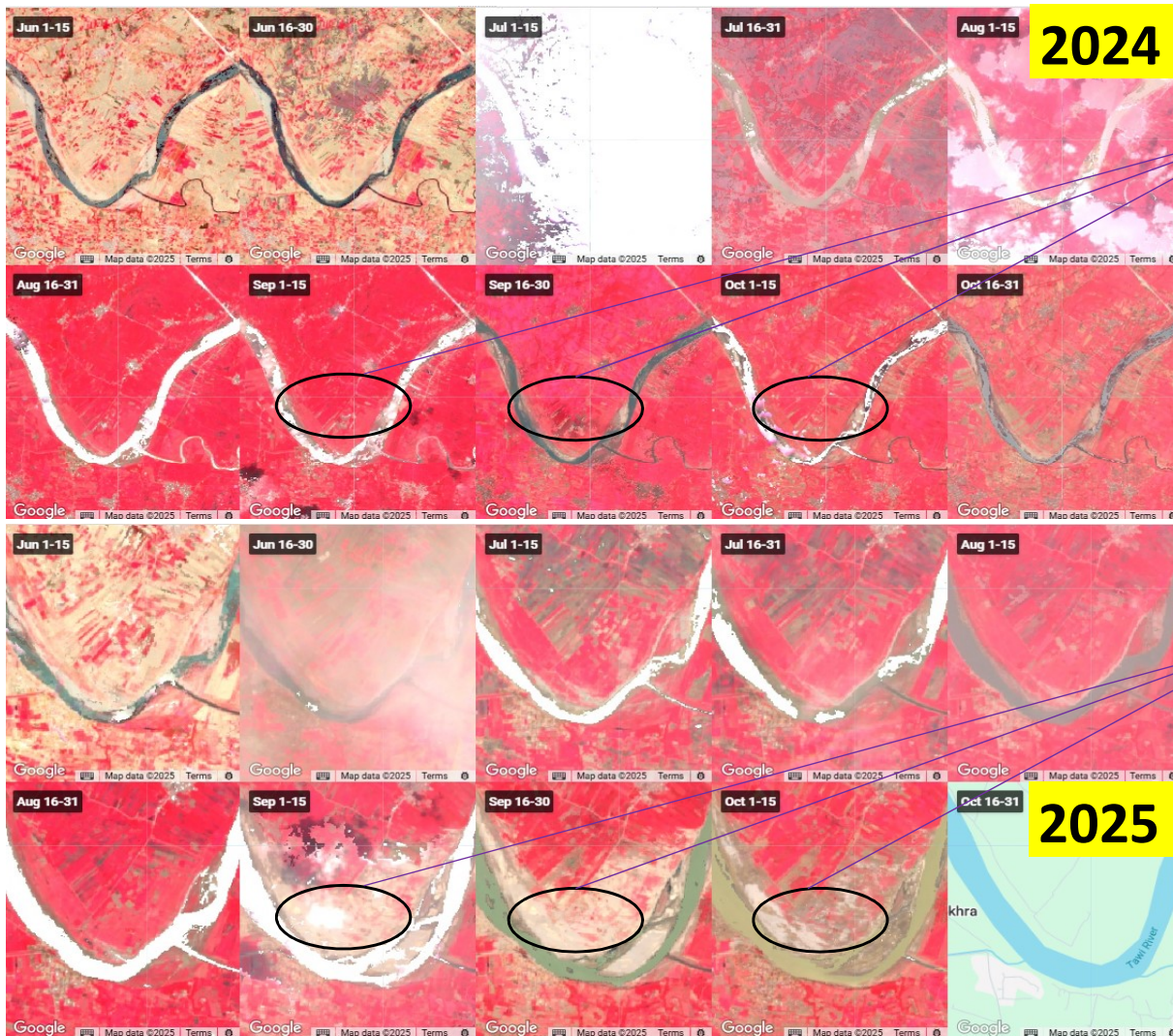


Parts of Firozpur district – 20 -28 Sep 2024



Comparison of Sentinel-2 MSI (10m) Optical Satellite images showing the impacted crop due to floods in current season w.r.t healthy crop last year

Flood impact in Jammu district during Kharif 2025



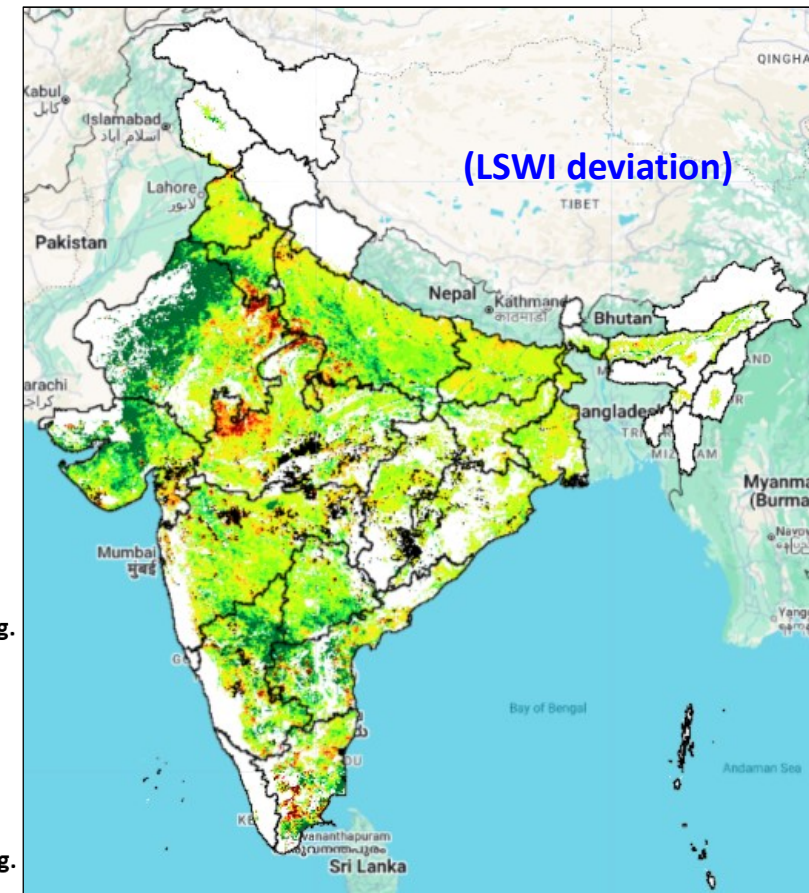
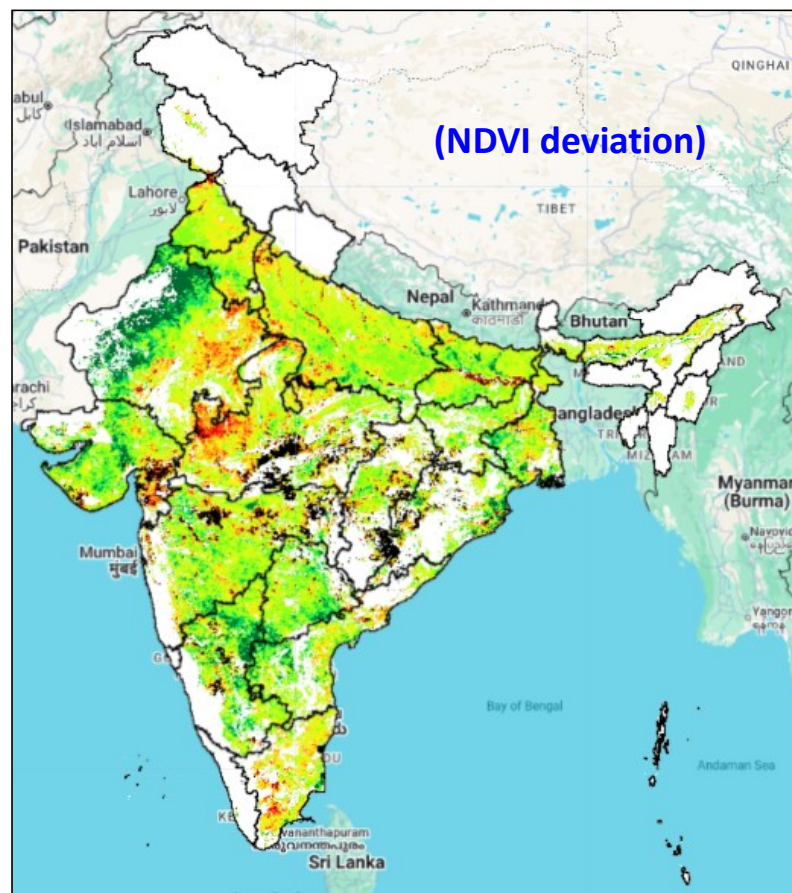
Crop situation was very good in September first fortnight, second fortnight and October first fortnight of 2024

Crop is washed out in September first fortnight, second fortnight and October first fortnight of 2025,

In the same location crop was in good category during August 1st Fortnight. Flood impacted the area in second fortnight of August, impact is visible in September

In early season NDVI is less effective when the crop canopy coverage is low. In such situation LSWI/NDWI, a surface wetness indicator is preferred.

NDVI & LSWI Anomalies w.r.t past 5 years Avg (2020-24) 29 Aug - 13 Sep 2025 (MODIS – 500 m Data)



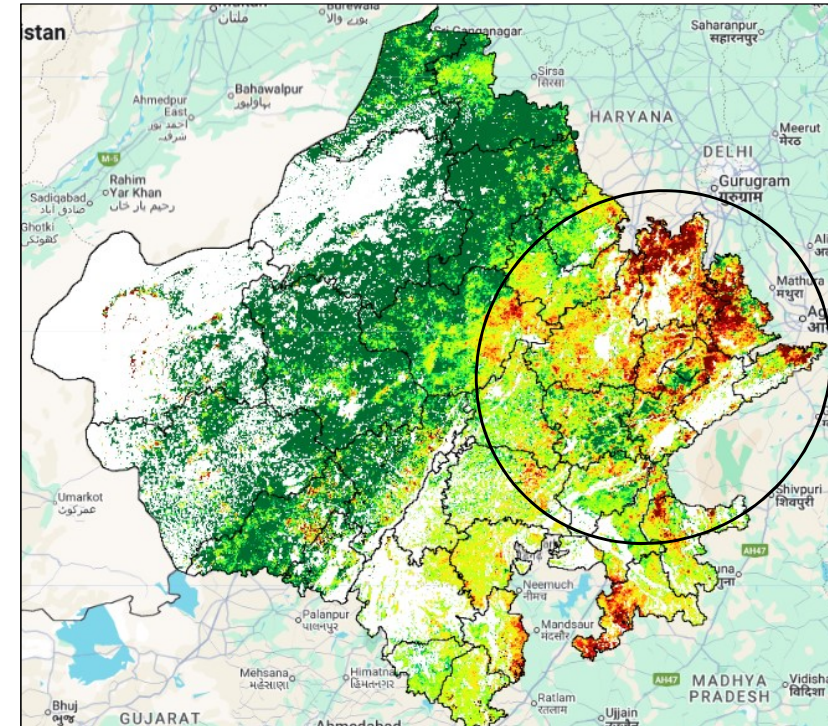
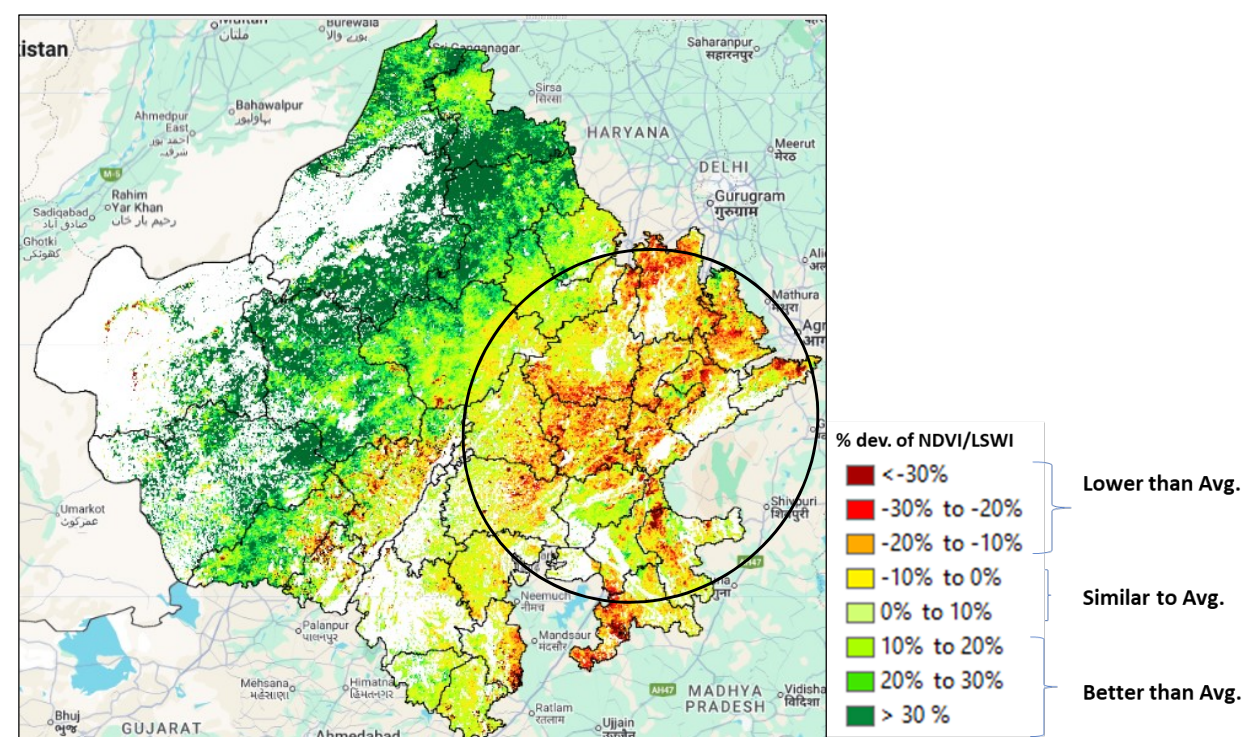
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NDVI & LSWI Anomalies w.r.t past 5 years Avg (2020-24) 29 Aug - 13 Sep 2025 (MODIS – 500 m Data)

(NDVI deviation)

Alwar, Bharatpur,
Dhaulpur, Dausa, Jhalawar,
Baran, Karauli, Jaipur

(LSWI deviation)



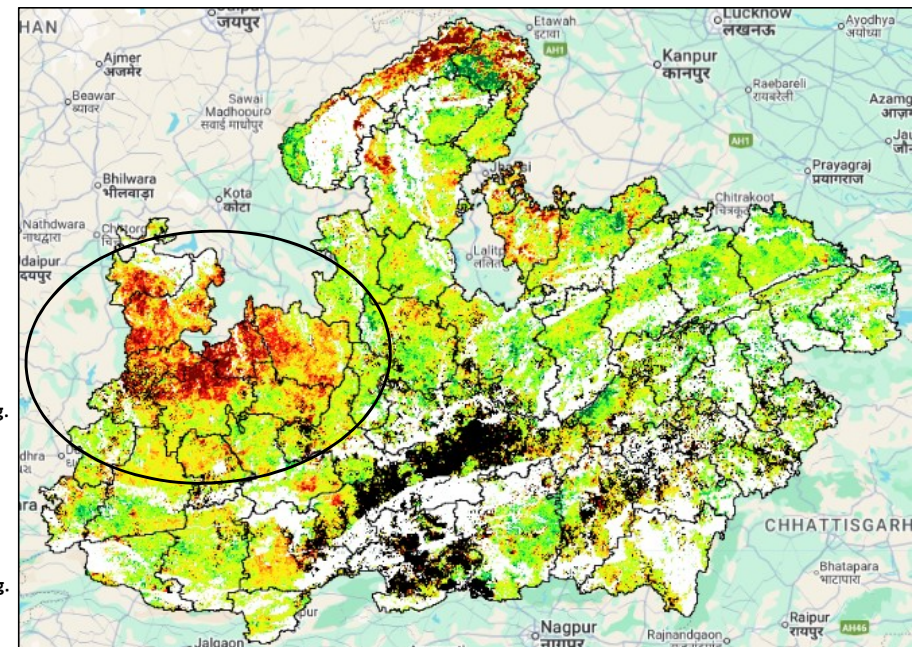
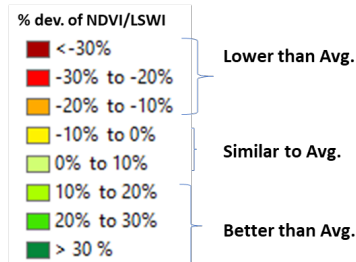
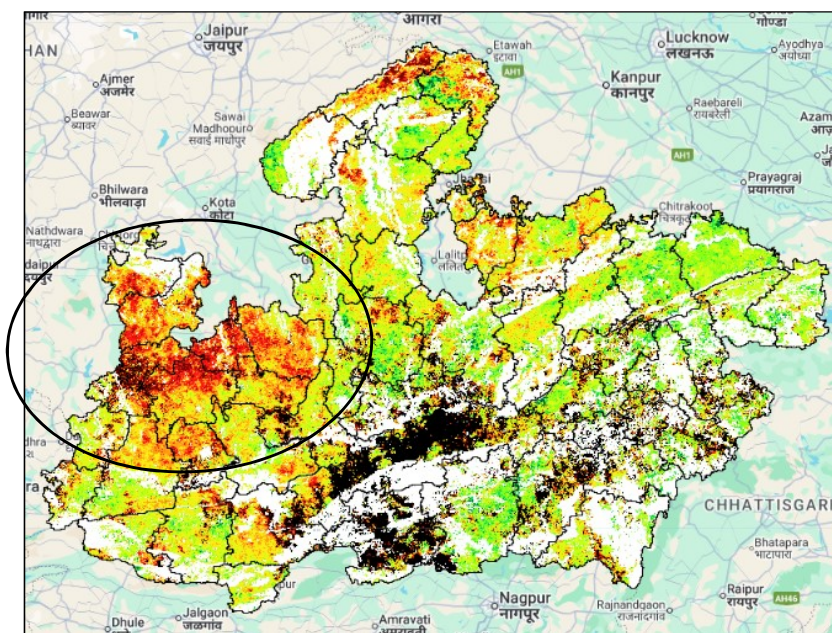
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NDVI & LSWI Anomalies w.r.t past 5 years Avg (2020-24) 29 Aug - 13 Sep 2025 (MODIS – 500 m Data)

(NDVI deviation)

Nimach, Mandsaur,
Ratlam, Ujjain, Rajgarj,
Sheopur, Morena, Bhind

(LSWI deviation)





Technology for crop insurance: Comparison

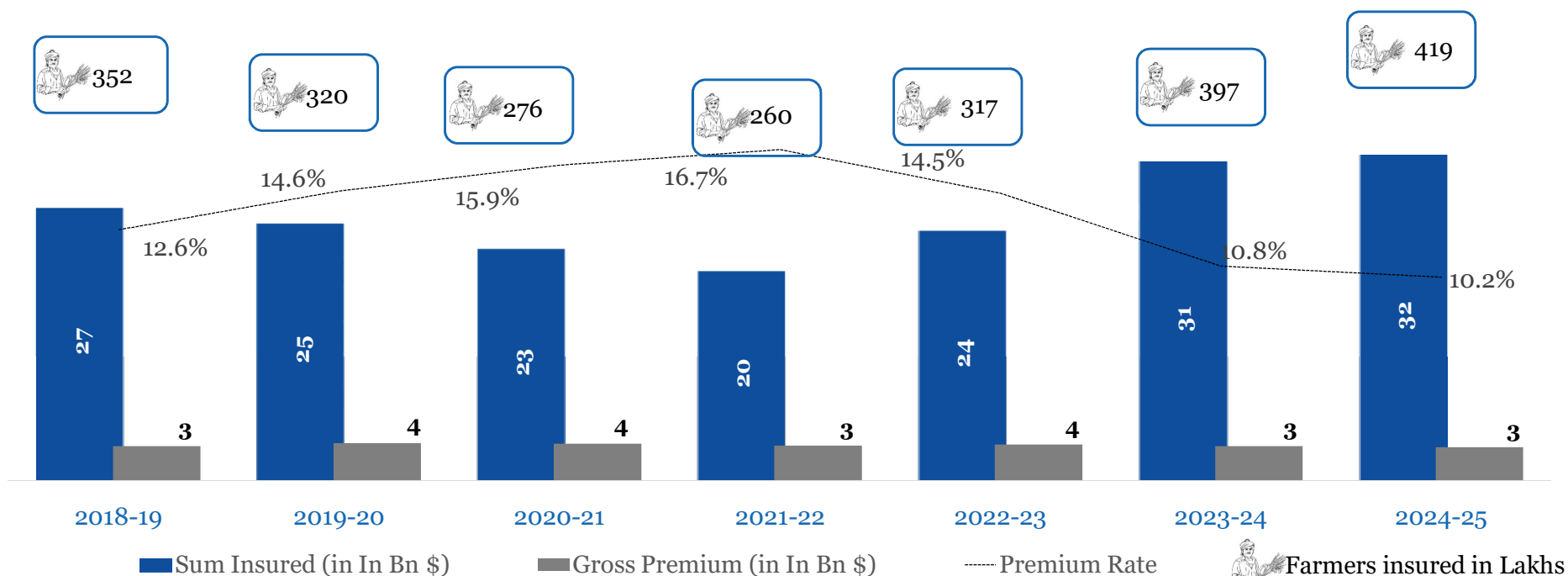


Country	Main technological interventions (tech-only)	Example platforms / actors
United States	Remote sensing / satellite imagery, GIS, data analytics, machine learning for loss detection & underwriting, automated claim triage, parametric/area triggers (growing use).	USDA Risk Management Agency (RMA) partnerships with analytics firms, pilot GIS/ML programs.
China	Remote sensing & high-resolution satellite imagery, big-data & AI underwriting, IoT & field sensors, automated loss assessment using imagery/algorithms.	Insurer and tech collaborations developing “smart agricultural insurance” solutions.
Brazil	Satellite & remote-sensing index products (NDVI/grassland indices), parametric/pasture indices, remote monitoring for large/ranch areas.	Pastagem Protegida (Airbus GPI-based products), reinsurer-insurer collaborations.
Australia	Parametric index products, satellite & weather-station data integration, crop/climate simulation models, growing use of parametric/remote triggers.	Industry parametric pilots and insurer offerings; actuarial/industry guidance on parametrics.
Kenya (and other African markets)	Satellite-based index insurance, mobile distribution & payments (mobile wallets), lightweight parametric micro-insurance, remote sensing for area/trigger design.	World Bank/partners pilots, Acre Africa, Bima Pima micro-insurance; mobile money (M-PESA) distribution.
Turkey	Satellite imagery / remote sensing, index-based approach through national pool (TARSİM), data analytics for loss assessment and area-based triggering.	TARSİM (state-supported agricultural insurance pool) integrating remote sensing technologies.





PMFBY: Rationalization of Premium Rates



Premium rates have seen a significant decrease of 40% in the 2023-25 period compared to 2020-21



Lowest Premium Rates since 2017



Decreasing burden on Governments



Increase in Farmers Coverage





Thank You.

Mahalanobis National Crop Forecast Centre
Ministry of Agriculture & Farmers Welfare
Near Krishi Vistar Sadan
Pusa Campus, New Delhi-110012, India
Email: sunil.dubey86@gov.in
+91-9452488914