GENSTREE AI BULLETIN

NEWSLETTER

Smart Village Research

This whitepaper outlines GenStree AI LLP's vision of Smart Villages-self-sustaining, digitally empowered rural communities. Central to this vision is a Crop Disaster Management System built on Sentinel-2 satellite imagery and NDVI analytics. Our approach combines geospatial intelligence with AI to detect crop stress early, classify risk levels, and recommend actionable responses.

With more than **60%** of India's population reliant on agriculture, rural resilience is essential to national progress. Smart Villages go beyond basic connectivity-they are built on data, intelligence, and sustainability. GenStree is engineering solutions that bridge satellite technology with on-ground decision-making, creating responsive agricultural systems.

Over the course of the 2025 Rabi season, we observed considerable NDVI fluctuations in select sugarcane zones. **The main problem statement** is a lack of real-time indicators to detect early stress signals before visual symptoms appear. Most damage detection today happens post-failure. Our goal is to enable preemptive, cost-effective insights using remote sensing.

Remote Sensing + AI Pipeline

The core methodology involved Sentinel-2 SR image collection (Level-2A), spatial filtering, and NDVI computation via the B8 (NIR) and B4 (Red) bands. Only cloud-free imagery with **<20% cloud coverage** was used to ensure vegetation signal clarity. Data was processed on Google Earth Engine. Over a span of 60 days, NDVI variations were visualized using line charts to highlight changes in vegetation vigor. In future versions, high-resolution imagery from PlanetScope or drone-acquired data may enrich these insights further. Apart from **NDVI, parameters like EVI, NDWI,** and surface temperature can also be extracted and correlated with stress patterns.

Location: Lakhimpur Kheri, UP (26.8103°N, 80.9119°E)
Source: Sentinel-2 (COPERNICUS/S2_SR via GEE)
Resolution: 10m | ☁ Cloud Filter: <20%
Peak NDVI: ~0.131
Crop Indicated: Likely sugarcane
Use Case: Early crop health monitoring + NDVI model training

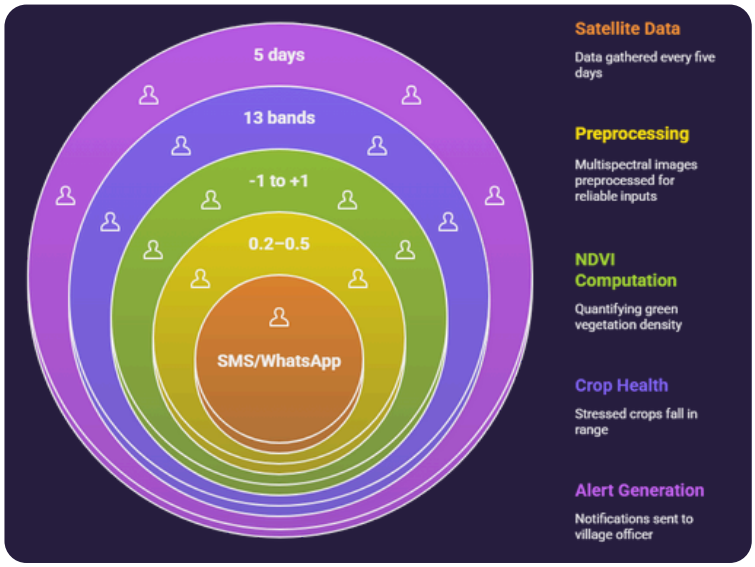
- Satellite Data Ingestion (Sentinel-2, L1C)
- NDVI Calculation for crop health using Red and NIR bands
- AI-based classification of crop types and growth stages
- Crop stress detection from multi-temporal NDVI anomalies
- Alerting framework integrated with local governance APIs

Early-Stage Data Intelligence Workflows

- Time Series Simulation: Sentinel-2 NDVI patterns model seasonal crop behavior.
- Sugarcane Yield (Pilot): Early-stage ML model using satellite and local data for yield prediction.
- Geospatial Layers: Testing village/block-level NDVI mapping for future dashboards and mobile apps.

Key Takeaways

The **NDVI** trends reflected the early vegetative fluctuations and stabilization post mid-March, likely correlating with irrigation cycles or climatic stability. Our initial pilot validates the use of open-source EO datasets in capturing crop health insights even without high-end hardware. Such systems, once scaled, can assist in yield prediction models, disaster mapping, and insurance pre-flagging.



Future Roadmap

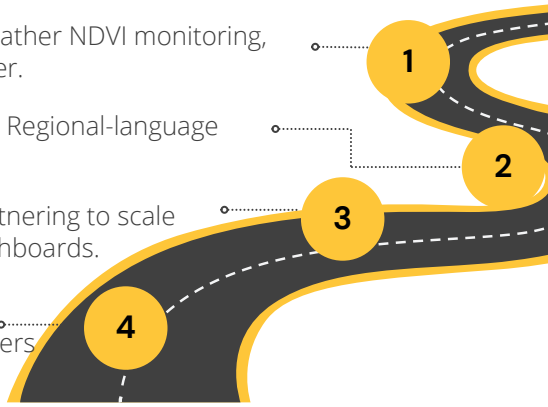
In upcoming phases, GenStree will:

SAR Integration: All-weather NDVI monitoring, overcoming cloud cover.

Hyperlocal SMS Alerts: Regional-language advisories for farmers.

Agri-Govt Synergy: Partnering to scale village intelligence dashboards.

Blockchain Insurance: NDVI-based claim triggers for transparent crop insurance.



AI equipped Farmers

The path to smart rural India lies in scalable, data-driven innovation. GenStree's Crop Disaster Management System brings together Earth observation, AI, and public infrastructure. Through Smart Villages, we aim to equip every farmer with early insights, every officer with real-time data, and every policy with ground-truth intelligence.

Disclaimer: All use cases referenced are currently under simulation or research validation using open satellite data. GenStree does not claim operational alert systems unless otherwise specified.

Data Sources & Tools: Sentinel-2 SR imagery: Copernicus Open Access Hub, NDVI Calculation: (B8 - B4) / (B8 + B4), Google Earth Engine, Farm geometry: Lakhimpur Kheri coordinates, Future data potential: PlanetScope, NDWI, LST, SoilMoisture index