

Stubble Burning Status Report 2025

International Forum for Environment, Sustainability and Technology (iFOREST)

Summary

Stubble burning across northwest India continues to cause serious environmental and public-health impacts. Yet the national farm-fire monitoring system—run by the Consortium for Research on Agroecosystem Monitoring and Modeling from Space (CREAMS) of the Indian Agricultural Research Institute (IARI), and built around NASA’s Moderate Resolution Imaging Spectroradiometer (MODIS) on the Terra and Aqua satellites and the Visible Infrared Imaging Radiometer Suite (VIIRS) on Suomi-NPP—is increasingly unable to capture the true scale of the problem. The system’s dependence on polar-orbiting satellites, which observe the landscape only at fixed times of the day, has become a structural limitation as farmers shift their burning practices.

iFOREST’s multi-satellite and multi-sensor analysis—incorporating MODIS (Terra 10:30 AM; Aqua 1:30 PM), VIIRS (Suomi-NPP 1:30 PM and 1:30 AM), Sentinel-2 Multispectral Instrument (MSI) derived burnt-area mapping, and Spinning Enhanced Visible and Infrared Imager (SEVIRI) 15-minute geostationary observations between ~05:30 and 19:30 IST—shows that this misalignment has sharpened significantly in recent years.

These monitoring gaps have far-reaching implications. Fires missed by polar-satellite sensors lead to underestimated emissions, mischaracterised aerosol and particulate-matter loads, and incorrect simulations of air-quality dynamics across India. For example, the contribution of stubble burning to Delhi’s air pollution was highly underestimated this year because MODIS/VIIRS captured only a small fraction of active fire counts. This bias now affects policymaking and regulatory action, weakening the evidence base on which interventions are designed.

iFOREST’s findings make clear that India can no longer rely on the current MODIS/VIIRS monitoring paradigm. A robust national system must integrate the spatial detail of polar-orbiting sensors, the temporal completeness of geostationary platforms, and high-resolution burnt-area mapping to accurately assess crop-residue burning. Without such a transition to a multi-platform architecture, policy decisions will continue to be shaped by incomplete and systematically biased information.

Key Findings

- MODIS and VIIRS capture active farm fires only during a narrow time window—10:30 AM to 1:30 PM.
- MODIS/VIIRS data indicate that active fire counts in 2025 have reduced by 92% in Punjab and by 90% in Haryana from their respective peaks in 2021.
- However, SEVIRI 15-minute observations (Meteosat-8 and Meteosat-9, ~05:30–19:30 IST) clearly show that the majority of large farm fires now occur after 3:00 PM, beyond the overpass times of polar satellites.

- SEVIRI data show that more than 90% of large farm fires in Punjab in 2024 and 2025 occurred after 3:00 PM. In 2021, only 3% of large fires occurred after this time.
 - In Haryana, most large farm fires have taken place after 3:00 PM since 2019; thus, MODIS/VIIRS has been underestimating fires in Haryana for several years.
 - Sentinel-2 MSI burnt-area mapping shows that burnt area in Punjab during the Kharif season declined from a peak of 31,447 km² in 2022 to about 20,000 km² in 2025—a 37% reduction.
 - Burnt area in Haryana during the Kharif season reduced from its peak of 11,633 km² in 2019 to 8,812 km² in 2025—a 25% reduction. However, burnt area has fluctuated between 7,000 km² and 10,000 km² from 2020–2025, showing no consistent trend unlike Punjab.
 - While burnt-area analysis shows clear reductions in farm fires in Punjab and Haryana (25–35%), these reductions are significantly lower than those suggested by active fire counts (>95%).
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Policy Implications

- The push to reduce stubble burning in Punjab and Haryana through in-situ and ex-situ practices is delivering positive results. However, large-scale burning—around 20,000 km² in Punjab and 8,000 km² in Haryana—continues to significantly affect air quality in both states and in Delhi-NCR.
- In-situ and ex-situ stubble-management practices must be further intensified in both states to reduce stubble burning more substantively.
- Stubble burning is increasing in other states. While the iFOREST study has not estimated burnt area in Madhya Pradesh and Uttar Pradesh, active fire-count data show a significant rise. It is time to expand policy focus beyond Punjab and Haryana.
- Active fire counts are a poor indicator of the scale and impact of stubble burning. Using them to estimate pollution contributions leads to significant inaccuracies.
- The Decision Support System (DSS) for air-quality management in Delhi, run by the Indian Institute of Tropical Meteorology (IITM), should revise its methodology to more accurately quantify the contribution of stubble burning to air-pollution loads in Delhi-NCR.
- CREAMS should begin monitoring and publishing burnt-area data to provide a comprehensive and accurate picture of stubble burning across India.