



UNDERSTANDING DELHI'S FOG CRISIS IN OCTOBER AND NOVEMBER: CAUSES, TRENDS, AND THE IMPACT OF AGRICULTURAL SHIFTS

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Delhi's smog crisis every October and November has worsened significantly in recent years, driven by a combination of agricultural practices, environmental policies, and unfavorable meteorological conditions. The problem is far more pronounced than it was a decade ago due to shifts in farming methods, timelines, and intensities, particularly with rice harvesting and stubble burning in Punjab and Haryana. Here's a detailed look at the causes of Delhi's fog and smog crisis, and how agricultural changes have intensified the issue.

The Seasonal Smog Crisis in Delhi: October-November

Delhi's annual fog in late autumn is not just a natural occurrence but a dangerous mix of smoke, particulate matter, and fog, often termed "smog." This fog contains high levels of pollutants that impact visibility, respiratory health, and overall air quality, creating a public health crisis. Several factors contribute to this phenomenon, with agricultural practices in nearby states playing a major role.

Key Contributing Factors

Stubble Burning in Punjab, Haryana, and Other Neighboring States

Stubble burning remains one of the largest contributors to Delhi's pollution during this period. As farmers in states like Punjab and Haryana finish their rice harvest, they burn leftover straw and husk in their fields to prepare for the winter wheat crop. In 2024, peak days saw over 1,500 farm fires in a single day, with stubble burning contributing to as much as 15-21% of Delhi's PM2.5 levels during high burning periods. On such days, Delhi's Air Quality Index (AQI) frequently exceeds 300, categorizing it as "Very Poor" or even "Severe," posing serious health risks to the population.

Agricultural Shifts and Compressed Crop Timelines

Over the last decade, several key developments in agriculture have altered the timing and intensity of stubble burning:

Modern Harvesting Equipment: The widespread use of combine harvesters has sped up rice harvesting and increased stubble residue. Since harvesters cut crops higher off the ground than manual methods, they leave behind more straw.

With limited time for natural decomposition, burning becomes a practical, though harmful, solution for many farmers.

Fertilizer-Intensive Crops: Fertilizer usage has contributed to quicker-growing crops with denser and more fibrous residue, which complicates residue management. The Green Revolution, aimed at boosting rice production, has had unintended consequences, creating larger volumes of crop residue that are difficult to manage sustainably.

Water Conservation Policies: To protect groundwater levels, especially in Punjab, the government mandates that rice planting not start until the monsoon arrives in mid-June. As a result, rice harvesting now aligns with late October, which forces farmers to quickly prepare their fields for the wheat season, often resorting to burning stubble. This compressed timeline has aligned stubble burning with the onset of winter, when weather conditions trap pollutants close to the ground, worsening smog conditions in Delhi.

Temperature Inversions and Seasonal Weather Patterns

In late autumn, temperature inversions—a meteorological condition where a layer of warm air traps cooler air below—are common in northern India. This "lid" effect prevents pollutants from dispersing upwards, concentrating pollution at ground level. As the temperature drops and humidity increases, the trapped pollutants combine with fog, creating thick, hazardous smog that lasts for days or weeks.

Increased Vehicular and Industrial Emissions

Delhi's high population and its role as an economic hub lead to substantial vehicle emissions, which contribute to PM2.5 and PM10 pollution. Although cleaner fuel policies have been introduced, the increase in vehicle numbers over the last decade has largely offset these gains. Industrial and construction dust also add significant pollutants to the atmosphere, making Delhi's air more toxic during this season.

Diwali Fireworks

The Hindu festival of Diwali, typically in October or November, brings a spike in firework use, which releases large amounts of particulate matter into the air. While regulations have attempted to limit this practice, it often coincides with the peak stubble-burning period, creating an additional pollution surge.

Timeline of Delhi's Smog Crisis

Late September to Early October

Stubble burning begins in Punjab and Haryana as early harvests conclude. While some early burning occurs, the weather in Delhi remains relatively mild, keeping AQI levels within moderate limits.

Mid-October to Early November

This period sees a steep increase in stubble burning incidents, often exceeding 1,000 farm fires per day. During peak burning, stubble contribution to Delhi's PM2.5 levels reaches as high as 20%, and AQI levels surpass 300, placing Delhi in the "Very Poor" category. Diwali-related fireworks further exacerbate pollution levels during this time.

Late November to Early December

Although stubble burning decreases, winter weather conditions trap pollutants, and high pollution levels persist due to local emissions from vehicles, industries, and construction. Smog lingers until strong winds or rain arrive, providing relief by dispersing the pollutants.

Conclusion

Delhi's smog crisis each autumn has worsened considerably due to changes in agricultural practices and compressed crop cycles that align stubble burning with peak winter inversion periods. Combined with increased vehicle numbers and urban pollution sources, Delhi's air quality degrades every year in October and November. Solutions to this crisis needs collaborative efforts across states to manage crop residue sustainably, vehicular emissions regulations, and urban planning adjustments. Until these solutions are fully realized, Delhi's air quality during the late autumn period will remain a significant public health concern, impacting millions of residents annually.