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# Increasing Health Threat to Greater Parts of India Due to Crop Residue Burning

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## Comments

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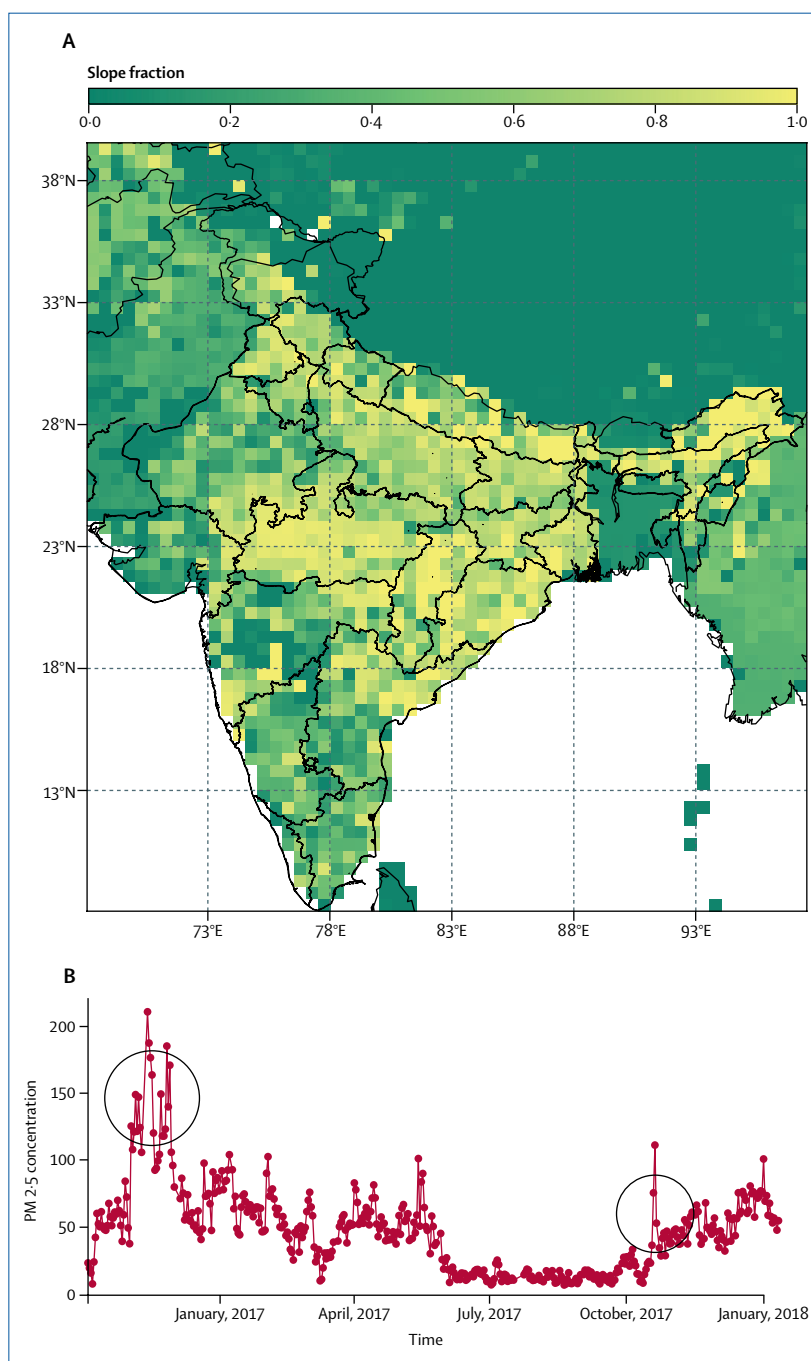
The authors

# Increasing health threat to greater parts of India due to crop residue burning



Delhi, the capital of India (in the Indo-Gangetic Plains), is one of the most polluted cities in the world.<sup>1</sup> The air quality of Delhi and Beijing is often compared. The cause of poor air quality in the two mega cities is similar, and is mainly attributed to the growing population, economic growth, coal-based power plants, vehicular emissions, growing construction activities, and crop residue burning. The westerly winds bring polluted air mass from western parts of India (including Pakistan) to the Indo-Gangetic Plains and the pollution is carried over the Indo-Gangetic Plains depending on the meteorological conditions. The extent of the pollution in the Indo-Gangetic Plains depends on the wind speed. Delhi and Beijing have different geographical settings. Delhi is surrounded by the towering Himalayas in the north, whereas Beijing is located in the plains. The poor air quality in Delhi and surroundings have a serious impact on people living in the northern parts of India compared with those in central and southern India, although no official health data are available.

Rice crop residue burning<sup>2-6</sup> during mid-October to November every year is becoming a serious health threat because of increased burning by farmers in the states of Punjab, Haryana, and western Uttar Pradesh in northern India. Crop residue burning<sup>2-6</sup> started in the late 1980s with the start of mechanised harvesting in Punjab. Farmers found burning to be an economical way of cleaning crop stalk residues that are left over by mechanised harvesters. In doing so, farmers ignore the impact of this practice on health and air quality<sup>3-6</sup> in the cities located in the Indo-Gangetic Plains. In the winter season, the severity of this problem increases as dispersion of smoke plumes is slowed down because of cold temperatures, whereas during the summer season the problem does not exist because of fast dispersion of plumes from burning. The practice of crop residue burning that started in Punjab has slowly spread to other adjoining states in northern India. We have found that the impact of crop residue burning on air quality is not restricted to cities in the Indo-Gangetic Plains alone, but is spreading to the far eastern parts of the Indo-Gangetic Plains and over central and southern parts of India, including parts of Bihar, Jharkhand,



**Figure: Changes in air quality associated with crop residue burning**  
 (A) Fraction of annual increment in methane, which is explained by agricultural waste burning, in mid-October and mid-November. (B) Sharp increase in PM<sub>2.5</sub> noted at a ground station located in the city of Aurangabad in Maharashtra (19.8N, 75.3E). Peaking of PM<sub>2.5</sub> observed between mid-October to mid-November (black circle) of 2016 and 2017. The highest concentrations of PM<sub>2.5</sub> was observed in in October and mid-November in 2016 when the crop-burning season coincided with the festival of Diwali.<sup>2</sup>

West Bengal, Madhya Pradesh, Chhattisgarh, Odisha, Telangana, and Maharashtra.<sup>6</sup> We used diverse climate datasets derived from different NASA space platforms as well as global climate models and ground stations for our analysis.<sup>6</sup>

A strong high-pressure system develops over the northwestern states of India and the wind flows from the north, northwest towards the south and east, carrying incomplete burn residues. Increased amounts of such fine-grained carbonaceous particles can have adverse effects on the climate, human health, and overall air quality. We found evidence of increasing amounts of black carbon, during November, over areas in central and southern India.<sup>6</sup> We also found 80% or more of all recent methane increases (figure) in states such as Madhya Pradesh, Odisha, parts of Maharashtra, Telangana, Chhattisgarh, Bihar, and west Bengal to be tied to transport of methane from the north in November.

We also observed a sharp increase in respiratory suspended particulate matter and PM<sub>2.5</sub> (figure), during November, from ground observations in some of these central and southern areas of India, which indicates a sudden increase in concentrations of finer particles.<sup>6</sup> The increase in such finer particles in these areas can raise ambient values of these particles by 50% or more.

The Government of India has introduced a law against crop residue burning, which needs to be strictly enforced as the impact of crop burning has been accelerating since 2010.

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We declare no competing interests.

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