An overview of the statistics on the extent, rate, and impacts of agricultural burning in Asian countries

Regional Knowledge Sharing Event: Agricultural Burning: Sectoral to Regional Impacts and Solutions

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CLEAN AIR ASIA

Agricultural Crop Residue Burning

Introduction

Agricultural burning is the intentional use of fire for vegetation management in areas such as agricultural fields, orchards, rangelands and forests. Agricultural burning helps farmers remove crop residues left in the field after harvesting grains, such as hay and rice.

Ambient PM2.5 exposure due to crop residue burning is specifically associated with **a three-fold greater risk of acute respiratory infection.**

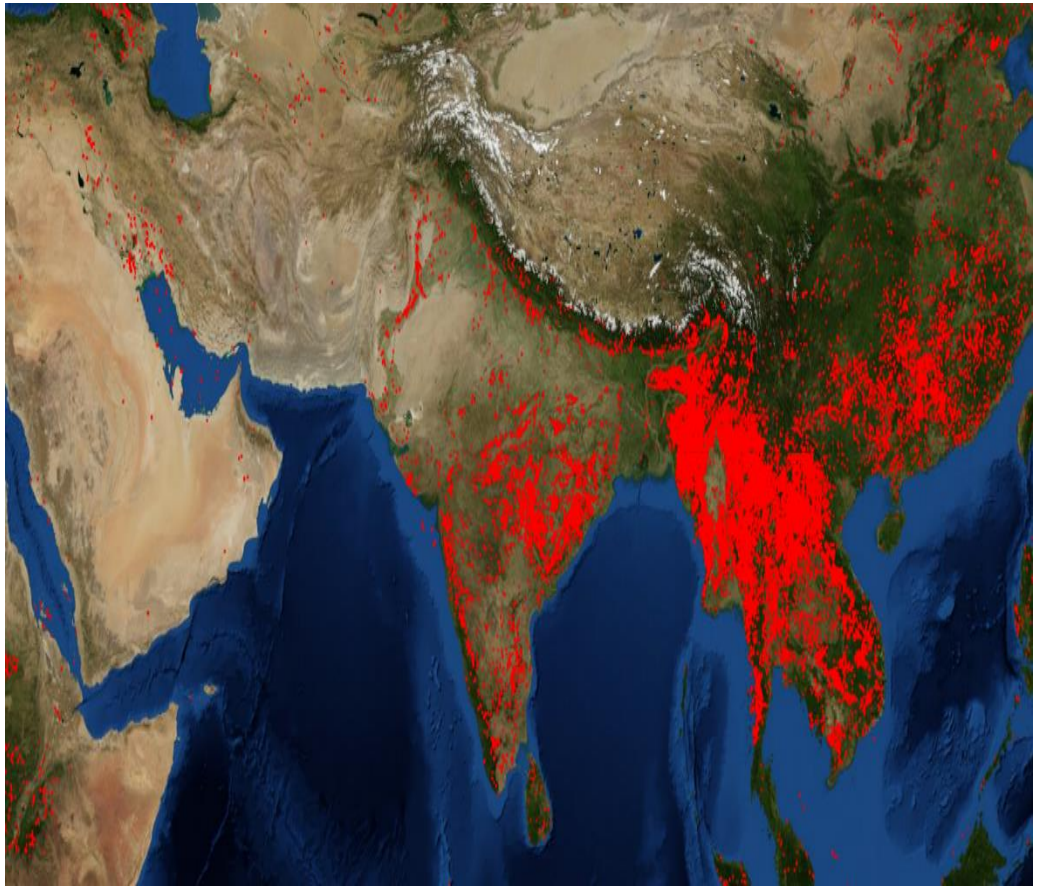
Open burning of biomass contributes **~37% of total global black carbon** including burning of forest, savannah and agricultural residue.

Agricultural crop residue burning contribute towards the emission of **greenhouse gases (CO_2, N_2O, CH_4), air pollutants (CO, NH_3, NO_x, SO_2, NMHC, volatile organic compounds), particulates matter and smoke** (Jain et al.,2014)

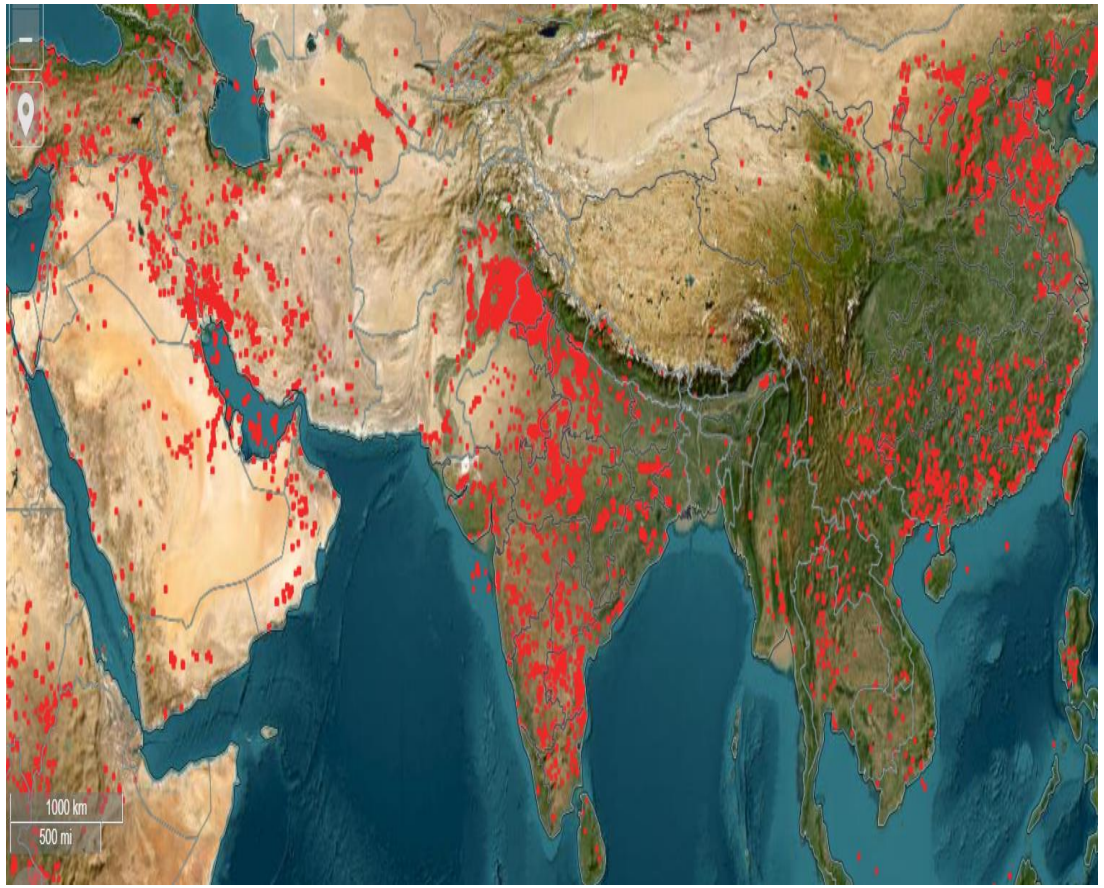
Objective

To understand the extent and impact of agricultural burning in Asian countries.

Crop Residue Burning in SE Asia

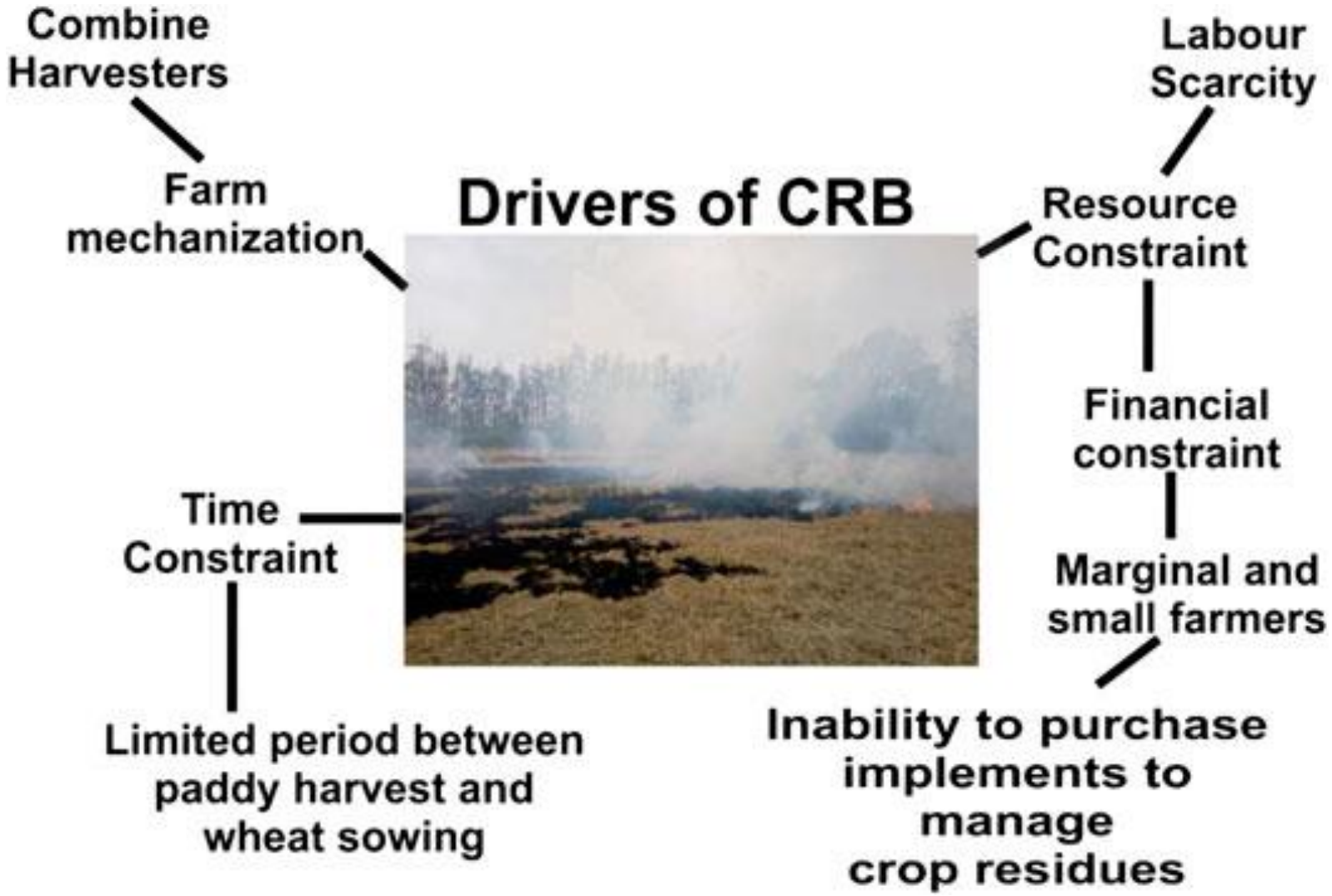


High Biomass burning from MODIS 17-03-2012 (Terra and Aqua) (source: FIRMS)



High Biomass burning from MODIS 27-10-2022 (Terra and Aqua) (source: FIRMS)

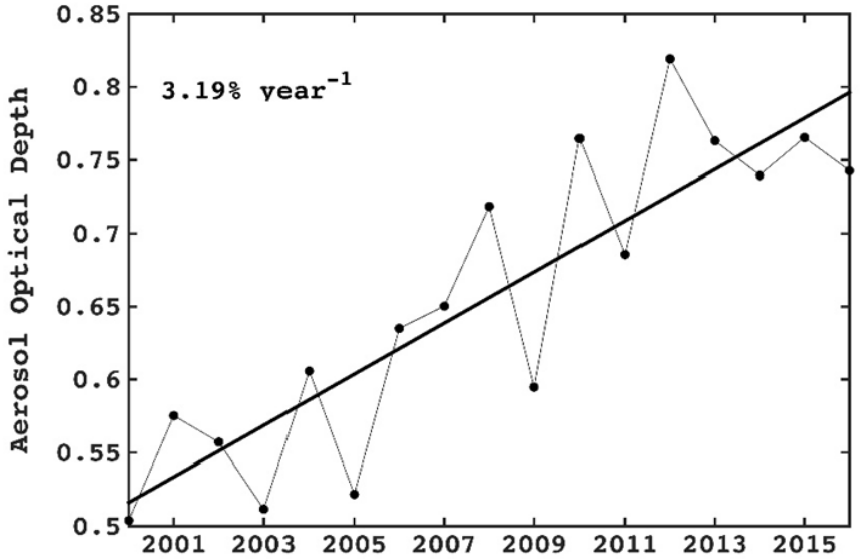
General Drivers of CRB

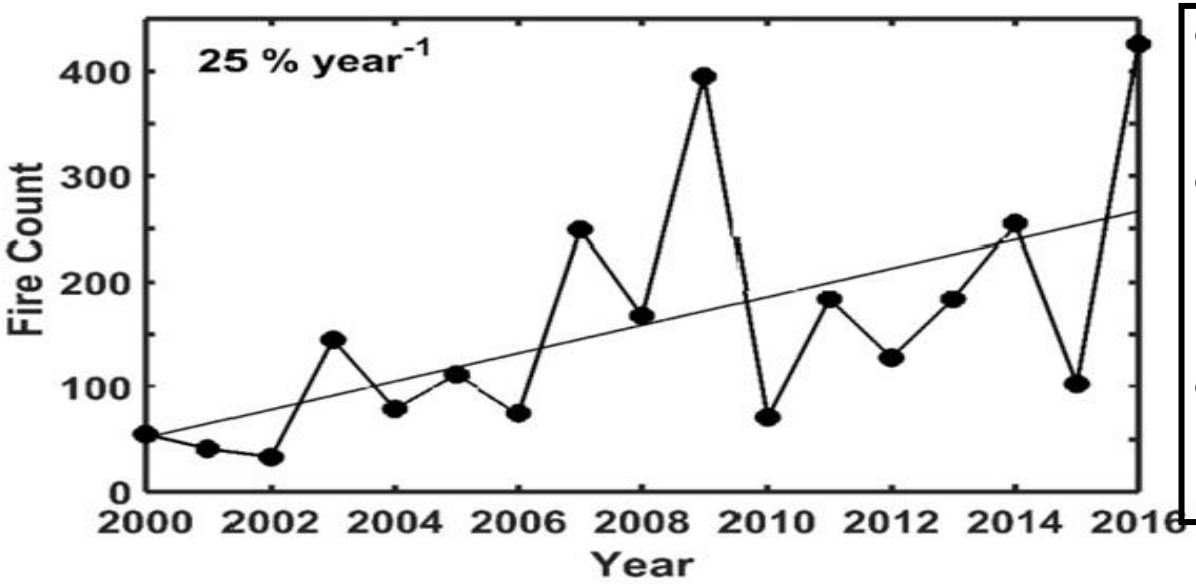


Venkatraman et_al 2021

Agricultural burning in India

- Crop residual burning is a recuring problems nowadays in North western region of India **(Punjab, Haryana and western Uttar Pradesh) during the October – November months.**
- **Rice straw made up 40% of the total residue burnt, while wheat straw and sugarcane residue constituted 22% and 20%, respectively.**
- The CRB triggered **several post-monsoonal pollution episodes**



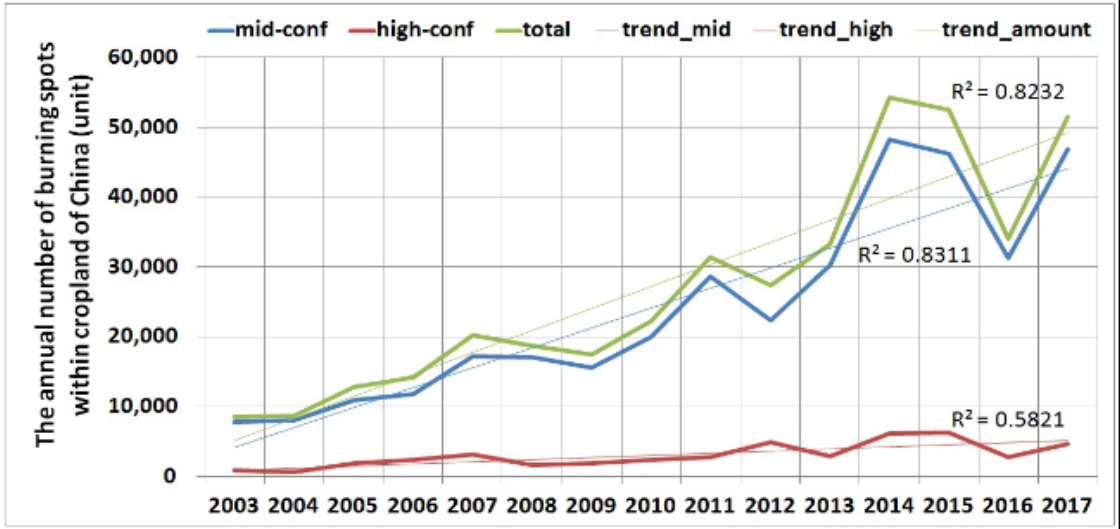


- Short-term rise in suspended PM from crop residue burning results in **a significant deterioration in health** after exposure
- It is estimated that the annual economic cost of exposure to air pollution from crop residue burning in Punjab, Haryana and Delhi alone at **US$ 30 billion.**
- Regarding the reduction in yield and nutrient loss, it is approximately **Rs 500 crore per year.**

Agricultural burning in China

Zhuang et_al 2018

- **Regions:** Eastern, Northern Plain, Northeastern, and Southern.
- **Agricultural straw and firewood** are the major biomass sources, contributing more than 90% of various atmospheric pollutants.
- **Two distinct peaks-** summer and autumn harvest periods **(June and October),** followed by a smaller peak in April.
- The most important source in northeastern China is crop residue burning, accounting for **47 %** of total emissions.
- Agricultural fires **contributed 84 % to total emissions in summer** (winter wheat straw burning in the North China Plain).



Pozzer et al (2017) estimated that outdoor air pollution caused approximately 1.3 million premature mortalities in China, of which an estimated **300 000 were due to emissions from the agriculture sector.**

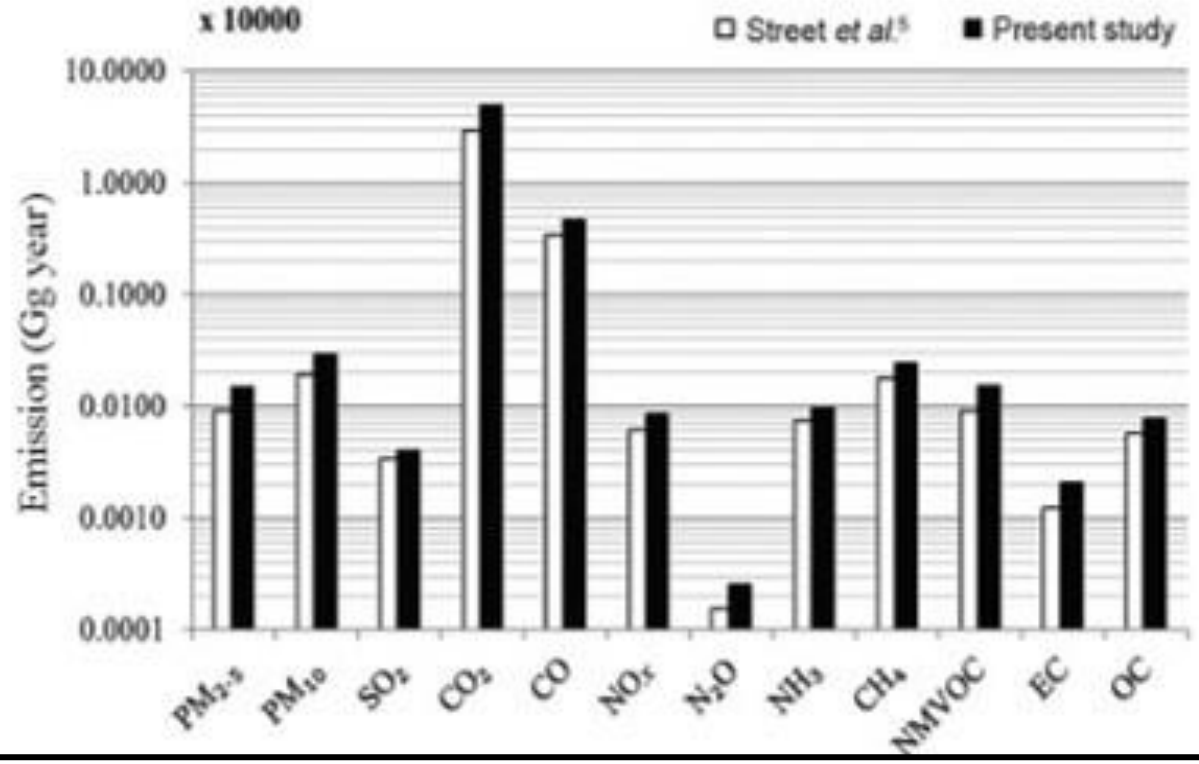
Agricultural burning in Philippines

Mendoza 2015

- Rice and sugarcane production in the Philippines had contributed a total of **177.5 million tons of carbon as through crop residue burning or about 649.65 tons of CO_2** assuming all the C were released as CO2 in the atmosphere.
- Rice straw burning is prevalent at 76 % of all rice farms. About 32 % of the 22 million tones (valued at PhP 18.41 billion compost) rice straws produced in the 4.4 Mha harvested areas are burned.
- Mendoza et al reported that **149,184 tons during early harvest (Oct-Dec), 1,660,560 tons during regular harvest (Jan-Mar), and 732,600 tons during late harvest (Apr-May)** sugarcane biomass is burned.

Agricultural burning in other Asian Countries

- **45 million tons** of crop residue burn every year in **Indonesia.**
- In October 2015, vegetation resulted in the pollution standard index (PSI) reaching a level of 2400, the maximum hazardous level being 1000.
- **CRB percentage: 36%**



- **Thailand:** October-April with peaks in November-December.

central (rice) and northeastern regions.

CRB percentage: 14.8%

- **Vietnam:** February-March followed by May -June and August-October.

Mekong River delta, Red River delta and the central coastal region.

CRB percentage: 21%

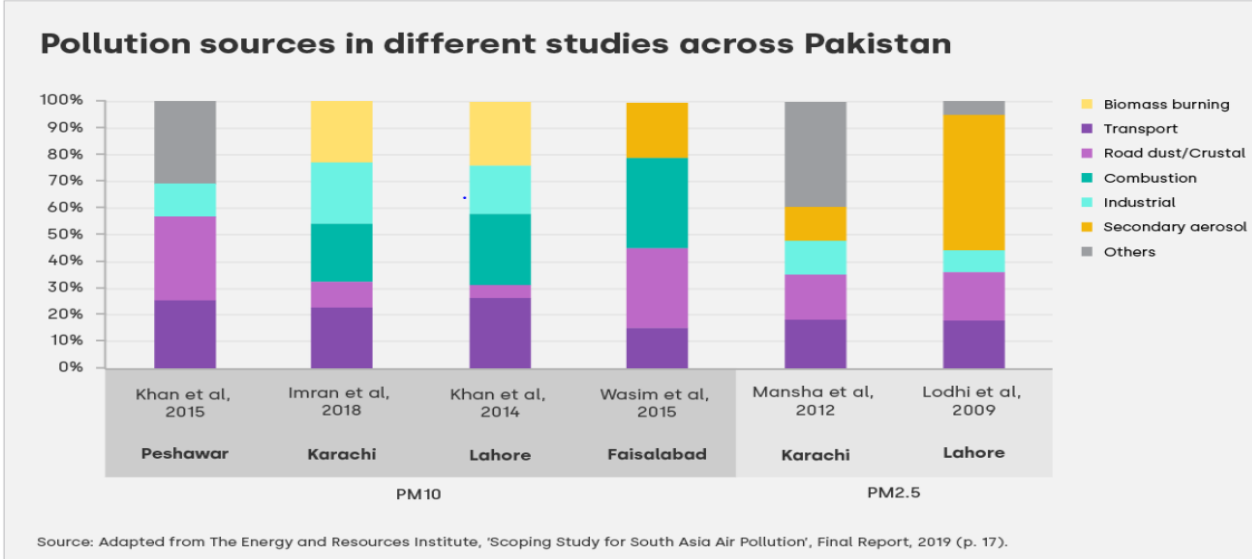
- **Myanmar:** November-December.

CRB percentage: 15%

- **Malaysia:** August-October.

Agricultural burning in other Asian Countries

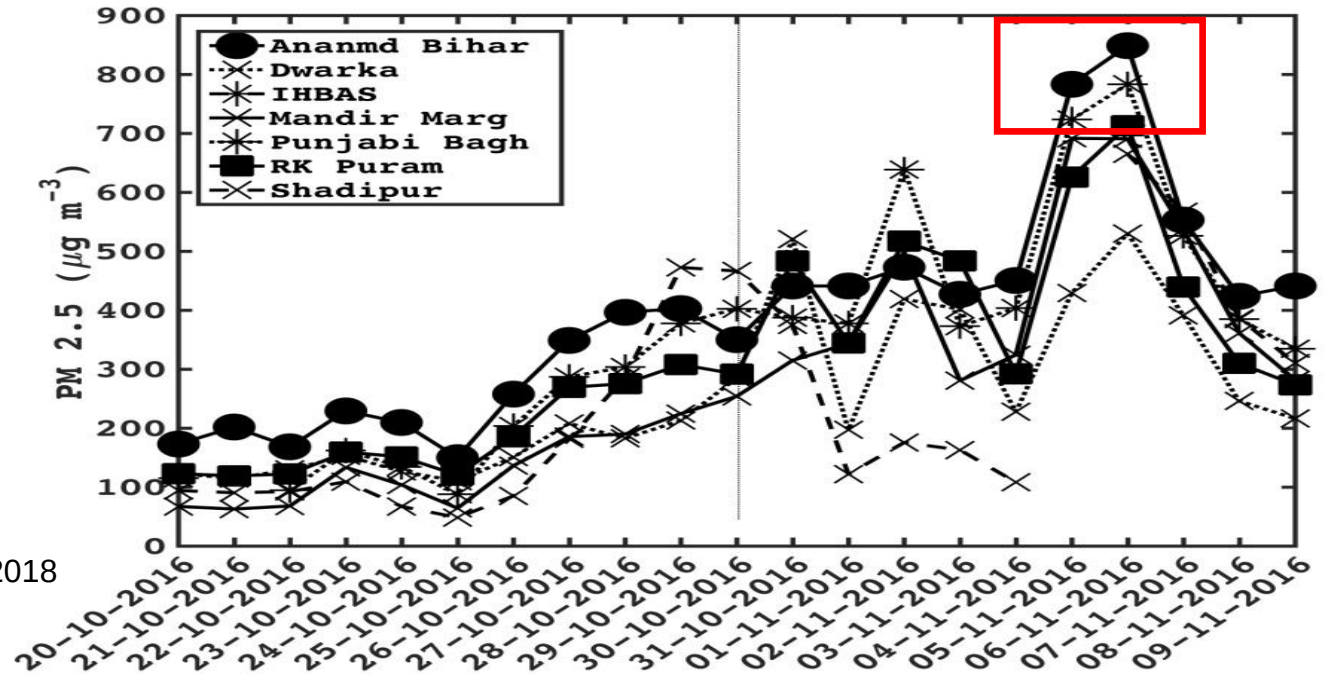
- Seasonal crop residue burning being a major contributor by up **to 70% in PM2.5 and over 40% increase in black carbon concentrations** in peak period which is from October-January in India, Pakistan, Nepal and Bangladesh.
- **In Bangladesh**, rice residue comprises **70% of the total yearly crop residue produced and mostly the Aman rice were burned.**
- **In Nepal,** the total crop residue open burning was estimated at 2280 Gg in 2003/04, which increased to 2908 Gg by 2016/17, indicating that **up to 25% of crop residue was burnt** in the period.
- In Nepal, **respiratory diseases** is one of the main reasons for outpatients' consultations in 2013/14 and chronic obstructive pulmonary disease is one of the leading causes of mortality among inpatients.



Source: Adapted from The Energy and Resources Institute, 'Scoping Study for South Asia Air Pollution', Final Report, 2019 (p. 17).

- In Pakistan between October and January **every year 3.6 to 5 million tons of rise residue is burnt.**
- Punjab and Sindh provinces have higher emissions due to intensive agricultural activities.
- **Wheat constituted 48%, rice straw and sugarcane residue 23% each, while maize straw accounted for 6% of crops residues burnt.**
- The cost including all can reach up to 6.5% of annual GDP.

2016 Scenario from Observation



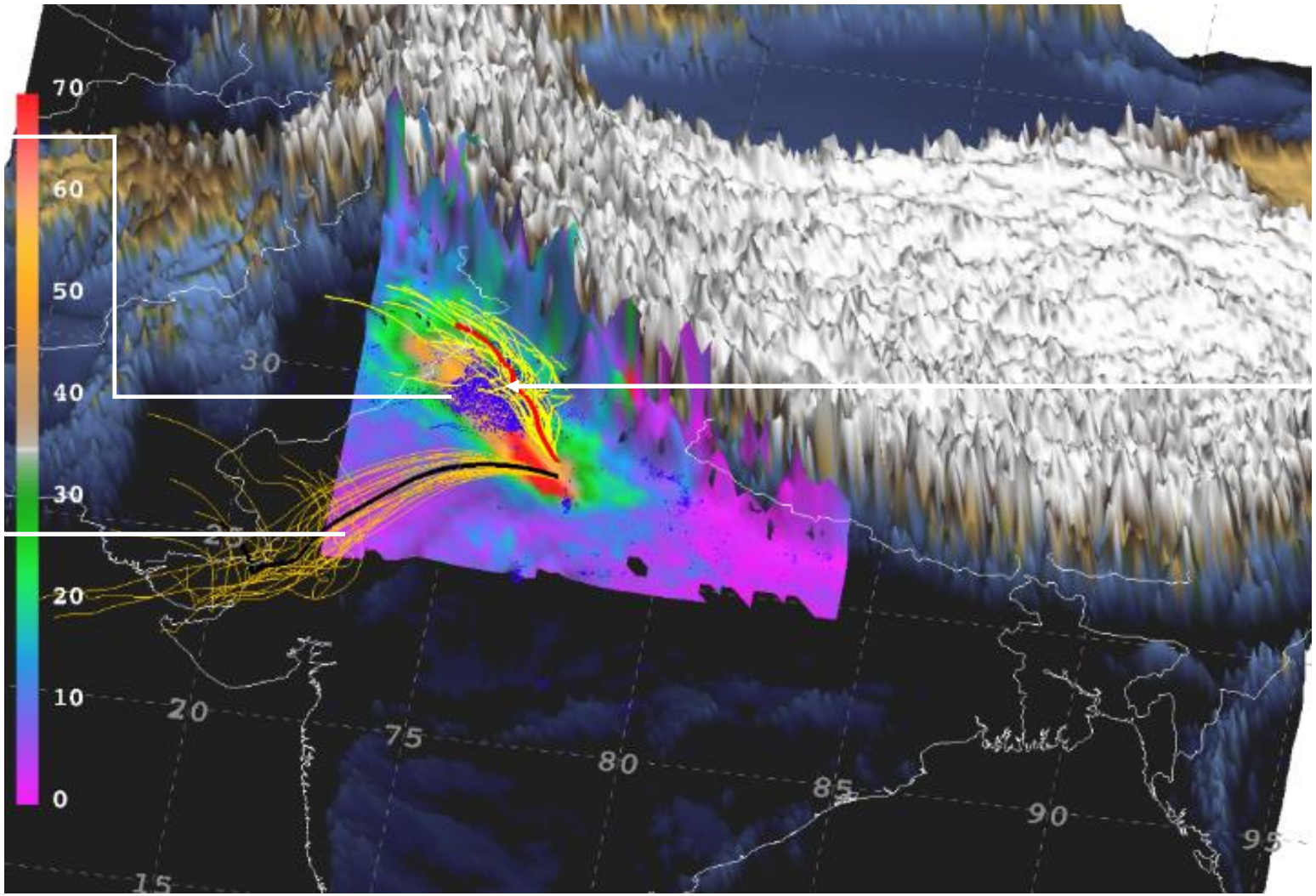
Mukherjee et_al 2018

The PM2.5 levels went up to a daily mean value of **~800 µg m^{-3}** on 5th November, about 6 to 7 days after Diwali.

It can be seen that prior to 26th of October 2016, the PM2.5 values were **~ 100 µg m^{-3}.**

Sources of Pollution

Fire Pixels

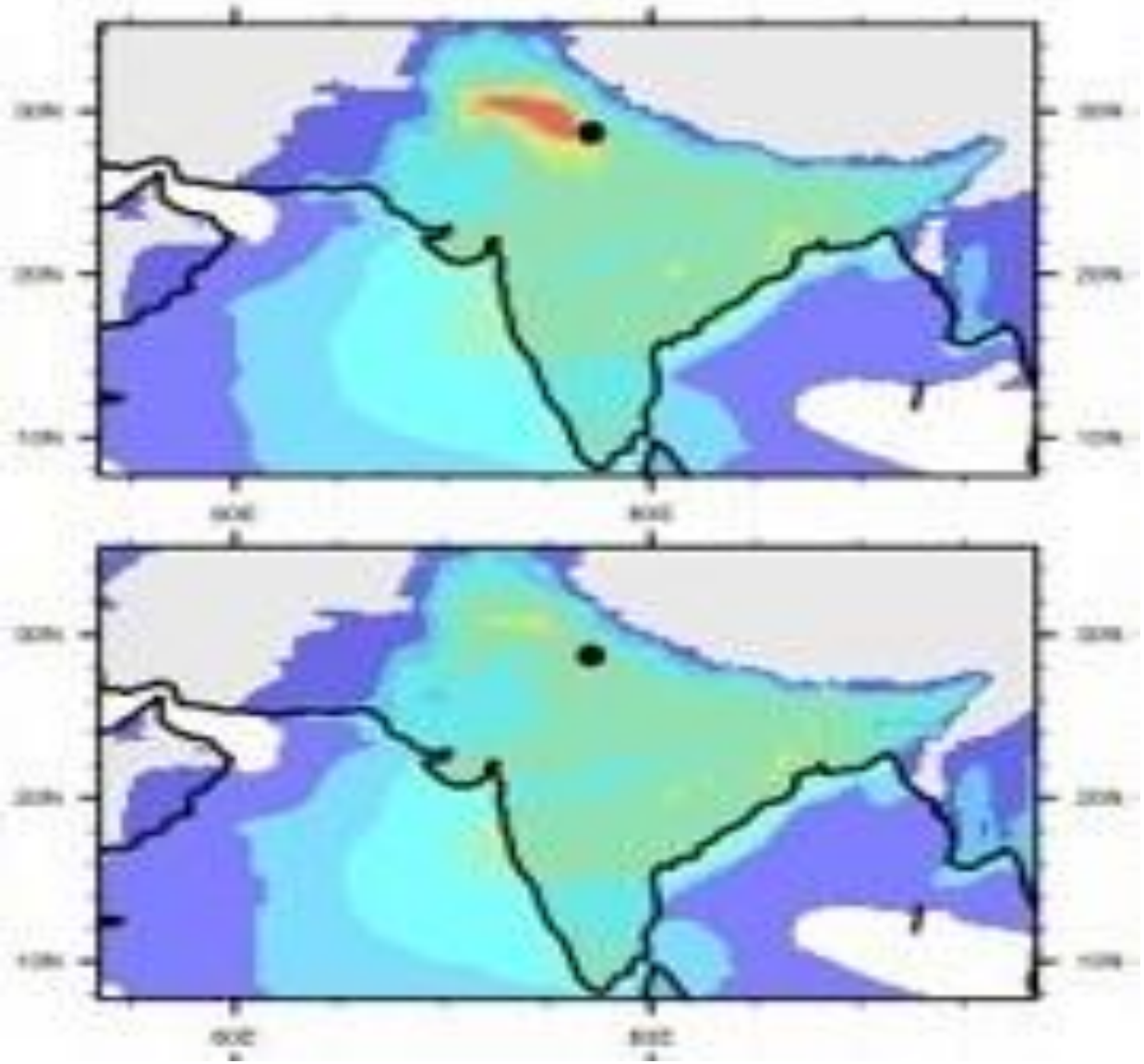


High PM2.5

Low PM2.5

Mukherjee et_al 2018

Sources of Pollution



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Thank You

Clean Air Asia- India

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