

AAKASH Project

An Interdisciplinary Study towards Clean Air, Public Health and Sustainable Agriculture:
The Case of Crop Residue Burning in North India

Sachiko HAYASHIDA

Research Institute for Humanity and Nature (RIHN)



Acknowledgements: Prabir K. Patra, A. Biswal, M. Poonam, N. Yasutomi, H. Araki and All members of Aakash project

Agriculture in Punjab

(semi-arid/arid land)

Mixed farming (wheat and cattle)
Increased production of wheat, sugar cane and maize

In 2010–11 Punjab produced 24 percent of the nation's rice and 42 percent of the nation's wheat and contributed 8.6 million tons of rice and 10.2 million tons of wheat to the national food grain.

Historical Events

1858 the Government of India Act

(British Rule)

Irrigation of the Indus Basin by developing canals

1947 Independence

Development of canals by Indian Govt.

1960s~ Green Revolution

Introduction of HYV
Increase in fertilizer & chemical use

1965 CACP & FCI established MSP started

Support for electricity in agriculture

1980s~ Mechanization

Use of Combine Harvesters

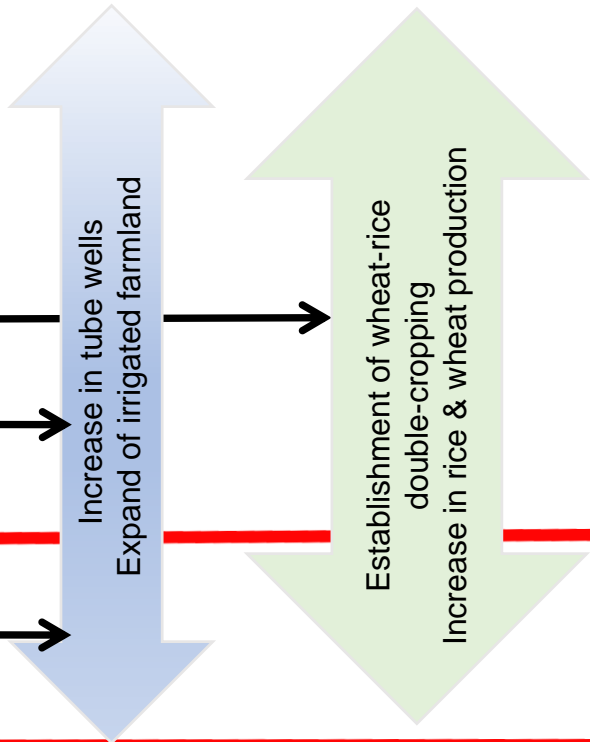
Long stubbles left in the field

1997 Free electricity

2009 Water Act

2018-19 CSSPAM Subsidies for new machinery

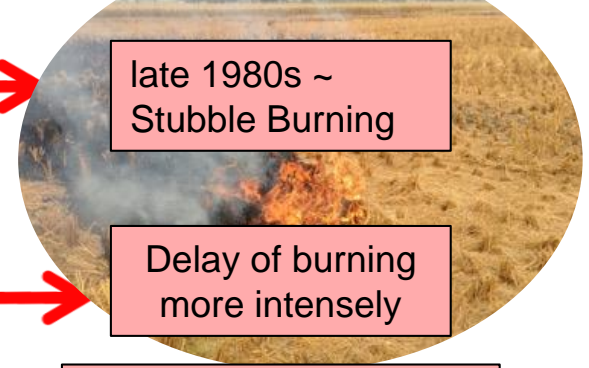
Introduction of new system for straw management Happy Seeder/Super Seeder etc.



Environmental Problems

Excessive pumping of groundwater

Groundwater depletion

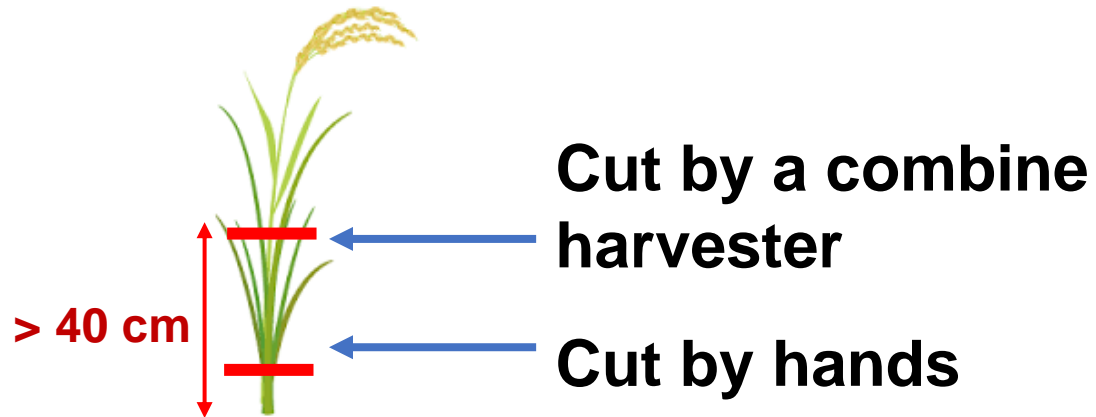
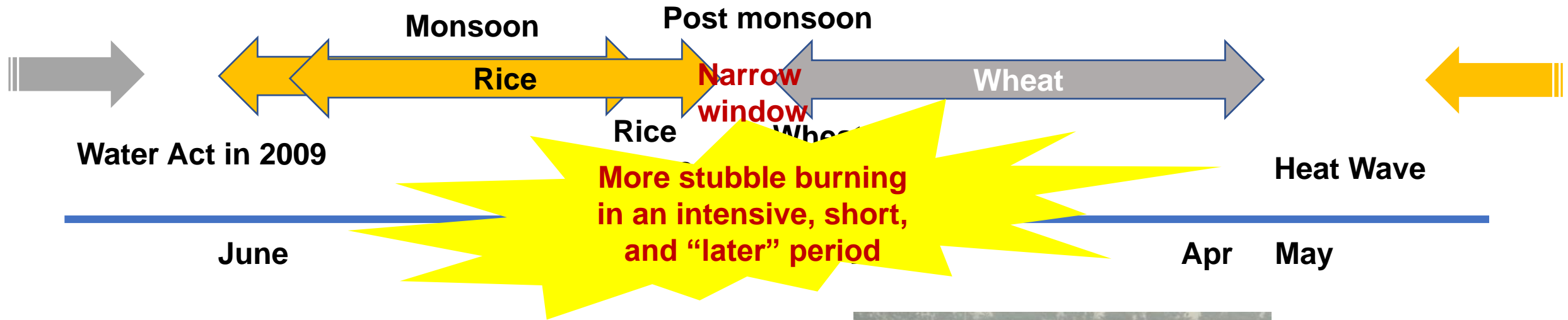


late 1980s ~ Stubble Burning

Delay of burning more intensely

2010s~ Severe air pollution in Delhi

Why do farmers burn rice straw?



7th Nov, 2023

NOV 07, 2023 / 12:45 PM

Delhi AQI LIVE Updates: SC directs Punjab, Haryana, Rajasthan, UP to halt crop burning, holds top officials accountable

Delhi AQI LIVE Update: The Air Quality Index (AQI) is reported at 432 in Anand Vihar, 437 in R K Puram, 439 in Punjabi Bagh, and 410 in New Moti Bagh.

[f](#) [x](#) [in](#) [v](#) [e](#) [m](#)

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<https://www.moneycontrol.com/news/india/latest-daily-news-live-india-world-delhi-aqi-israel-amas-war-breaking-news-and-updates-liveblog-11680251.html>

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Delhi pollution: No school, no play for city's children

18 hours ago



<https://www.bbc.com/news/world-asia-india-67330016>

6th Nov, 2023

HT Hindustan Times

Education India World Cities Entertainment Lifestyle

News / India News / Delhi's air quality 'severe'; Noida AQI improves; Gurugram, Faridabad schools closed: Latest updates

By Aniruddha Dhar

Nov 07, 2023 06:51 AM IST

Delhi Air Pollution Today: On Tuesday morning, the AQI in Anand Vihar was 432, RK Puram recorded 437, and New Moti Bagh showed a reading of 410.

A Student in Noida going to school amid increasing air pollution. (Sunil Ghosh/HT)

Delhi-NCR Air Pollution Updates: Air quality across Delhi continued to remain in the 'severe' category on Tuesday, the

<https://www.hindustantimes.com/india-news/delhis-air-quality-severe-noida-aqi-improves-gurugram-faridabad-schools-closed-latest-updates-on-air-pollution-101699317084519.html>

CH World Africa Americas Asia Australia China Europe India Middle East United Kingdom

Choking New Delhi smog shuts schools and shrouds Cricket World Cup

By Fizza Mogul, CHN

4 minute read · Updated 9:41 PM EST, Mon November 6, 2023

THE TIMES OF INDIA

Delhi AQI: Peak farm fire season begins, brace for more trouble

Priyangi Agarwal / TNN / Updated: Nov 3, 2023, 08:35 IST

New For You

Karnataka official who took on mining mafia killed in Bengaluru home

Teh planning se hota hai... Wasim Akram on India's unbeaten run in...

Orvy SLAPPED for inappropriate pose with Kareena Kapoor Khan, All

The peak stubble burning season has begun in north-west India, with an increase in farm fires. Last year, there were between 2,500 and 3,500 daily burning events from November 2 to 12. This year, there have been 9,594 events in Punjab, 1... [Read More](#)

Representative image

NEW DELHI: The peak stubble burning season has begun, with farm fires in north-west India showing a rise. Usually, the intense burning takes place in the

HT Hindustan Times

Education India World Cities Entertainment Lifestyle

Air quality dips as farm fires rage in Punjab

By Navrajdeep Singh, Vishal Joshi

Nov 03, 2023 09:00 AM IST

Smog engulfs several parts of Punjab, particularly southern districts, where paddy harvesting is in full swing

With a spike in stubble burning cases, the air quality in some Punjab districts has deteriorated to "poor" and "very poor" category.

Jalandhar/Bathinda: With a spike in stubble burning cases, the air quality in some Punjab districts has deteriorated to "poor" and "very poor" category.

<https://www.hindustantimes.com/cities/chandigarh-news/air-quality-dips-as-farm-fires-rage-in-punjab-101698953518626.html>

Many of the media reports have argued that Delhi's air pollution is related to rice straw burning in Punjab.

dailyo

Delhi-NCR chokes in toxic smog: What can be done to improve the AQI

The main focus should be on the issue of crop stubble burning in states like Punjab and Haryana (Photo: AFP)

On Friday (November 3), Delhi's Air Quality Index (AQI) hit a year-high of 471, falling into the 'severe plus' category. This marked a significant deterioration as it was at 422 on Thursday at 10 pm and had been steadily worsening in recent days.

The 24-hour average AQI was 364 on Wednesday, 359 on Tuesday, 347 on Monday, 325 on Sunday, 304 on Saturday, and 261 on Friday.

<https://www.dailyo.in/news/delhi-ncr-chokes-in-toxic-smog-what-can-be-done-to-improve-the-aqi-42261>

What's the reason of the extreme air pollution in Nov. in Delhi ?

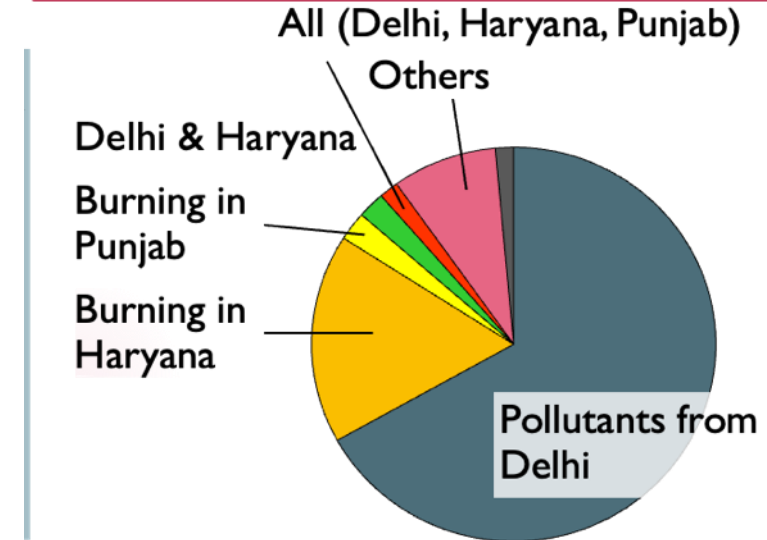
The citizens of Delhi complain “this terrible air pollution is caused by rice straw burning in neighbouring states after the rice harvest”



Kejriwal (Chief Minister of Delhi) has called on neighboring states to enforce laws against **burning agricultural waste**.

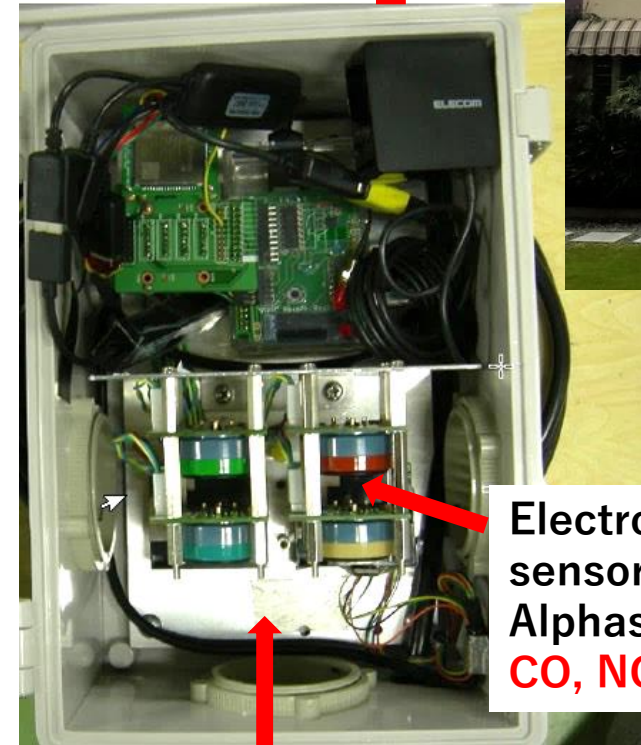
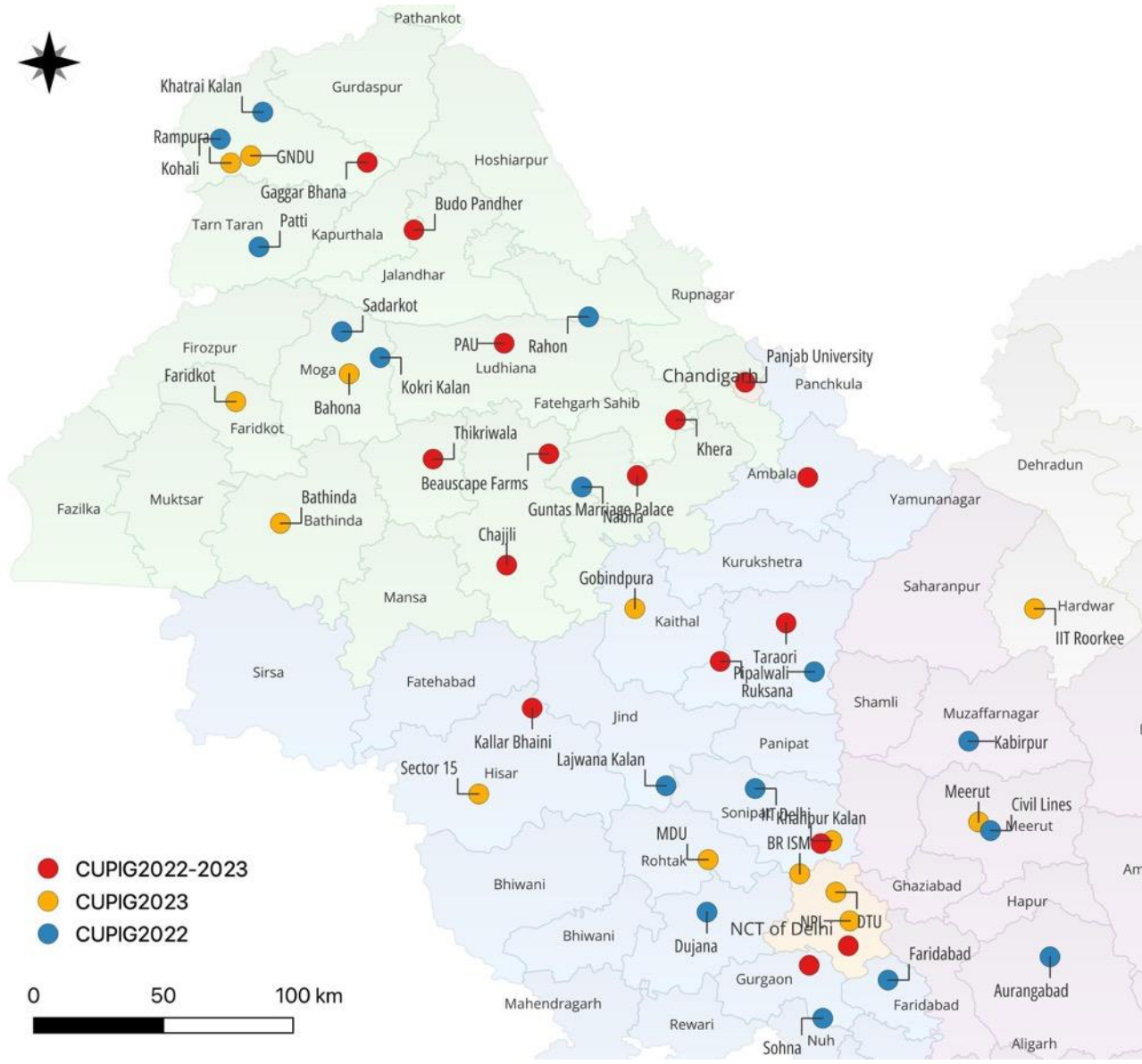
It is difficult to quantitatively assess the extent to which rice straw burning has impacted air pollution in Delhi, because most monitoring stations for air pollutants are located in urban areas, with **no data available for rural areas**.

What do you think about the cause of air pollution in Delhi?



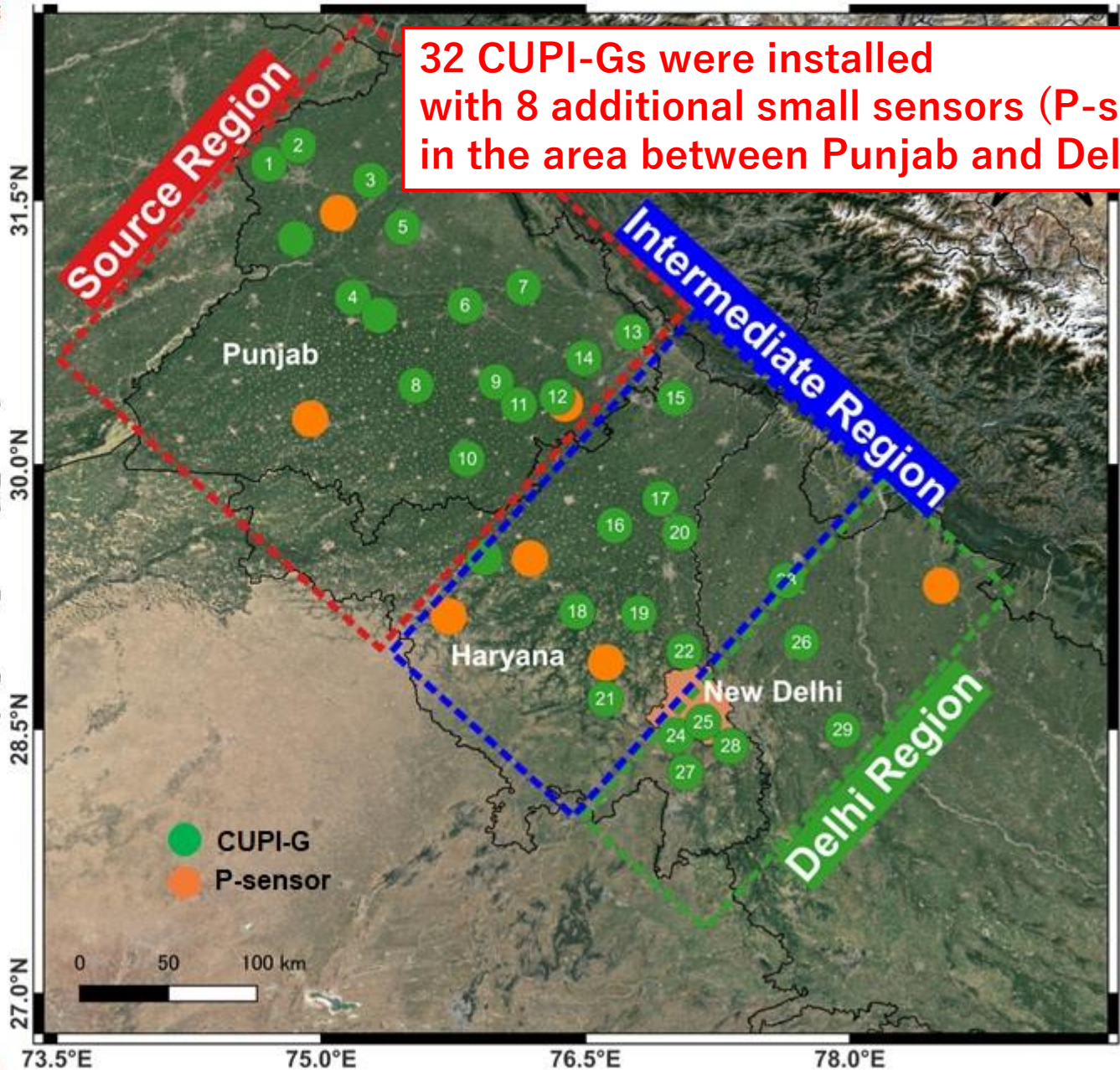
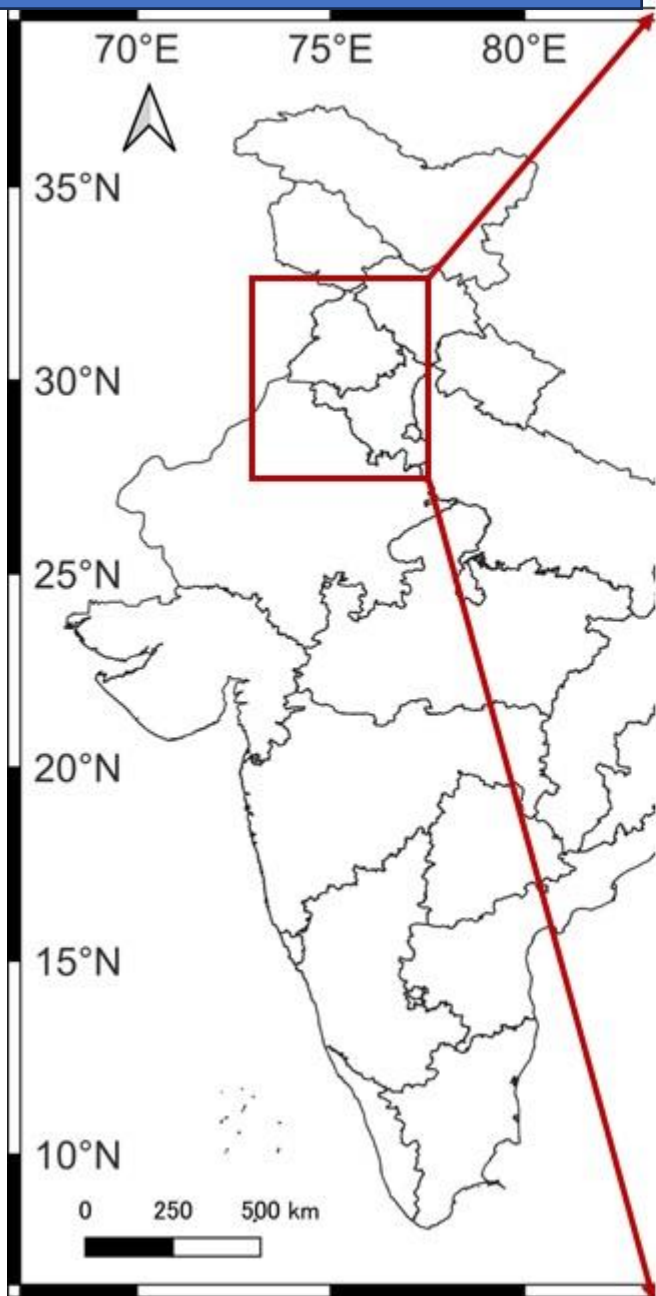
After the questionnaire survey by Aakash in 2020 (Yang et al., paper in preparation)

Awareness CHANGE



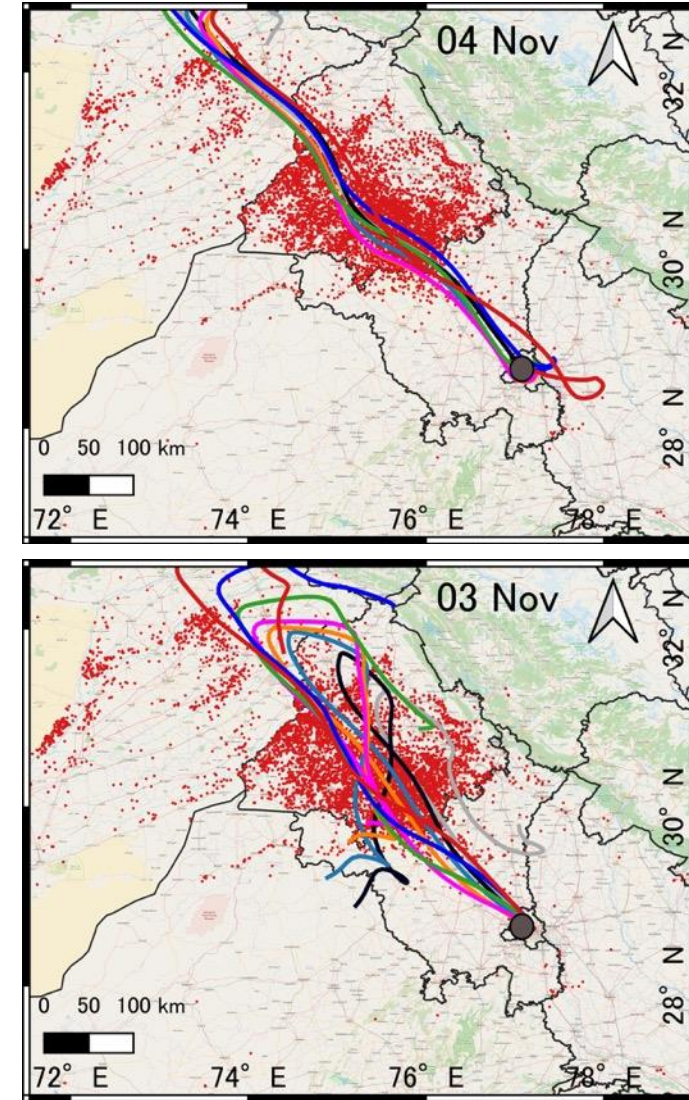
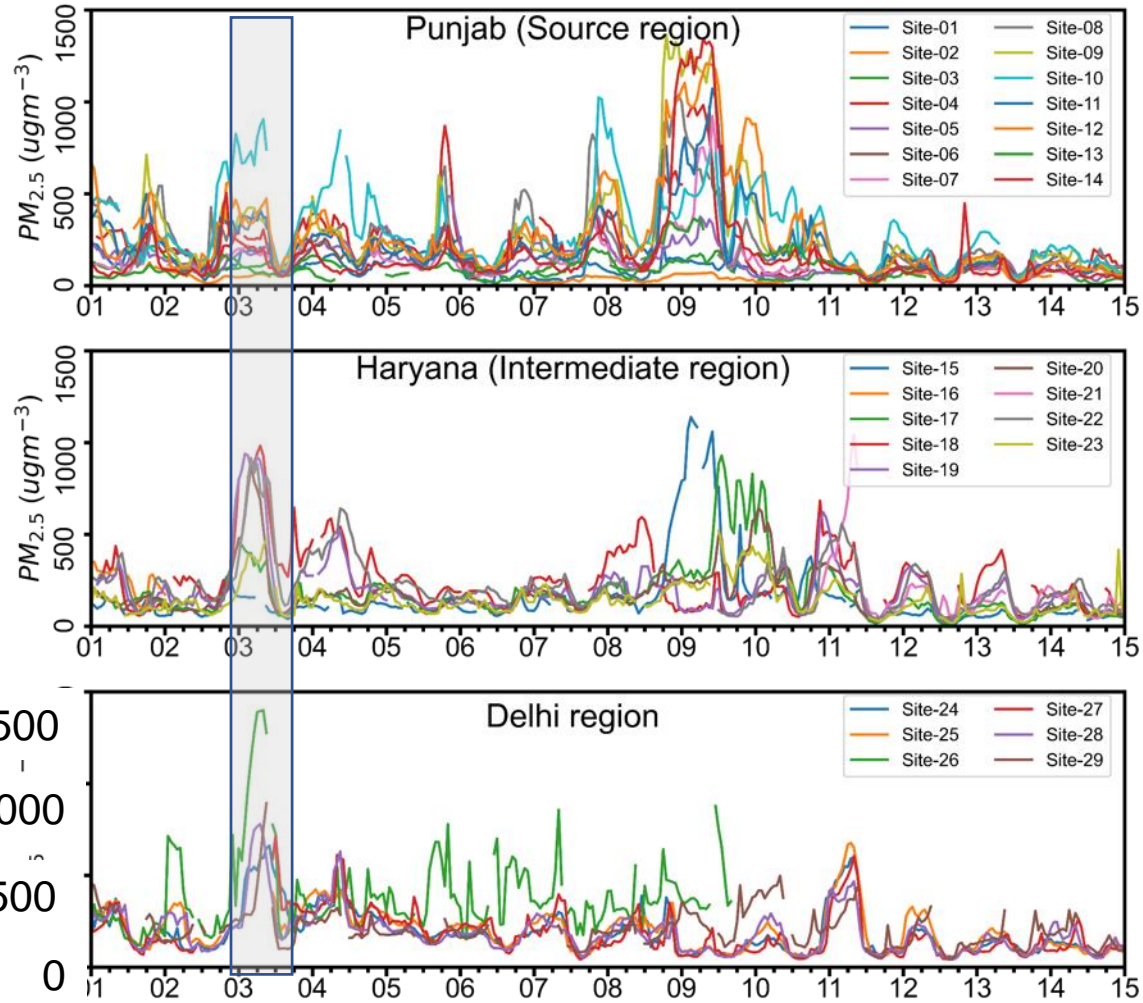
Electro-chemical sensors
Alphasense corp.
CO, NO₂, NO, Ox(=O₃+NO₂)

PM2.5 sensor
(Developed by Nagoya Univ. and Panasonic Corp.)



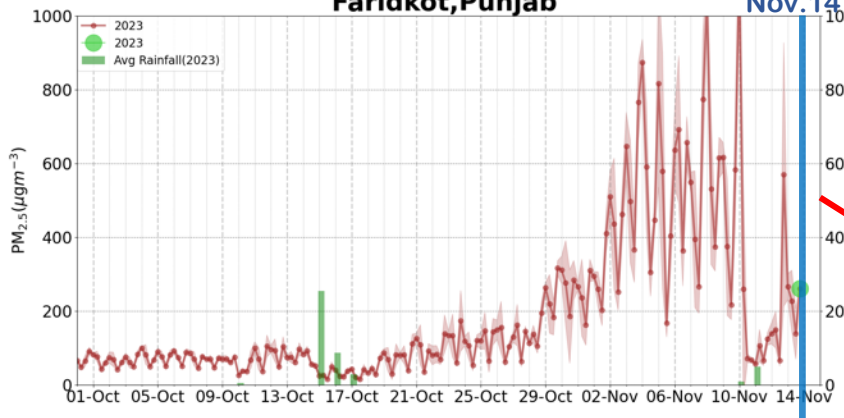
Hourly data pf $PM_{2.5}$

Backward trajectories at 500m height above Delhi on 03 November & 04 November 2022 along with paddy straw fires of pervious day at 01:30 pm IST

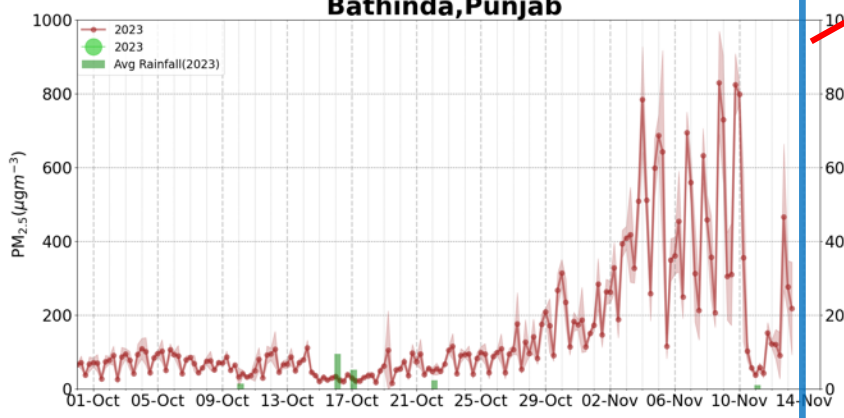


New Delhi, Nov. 4th

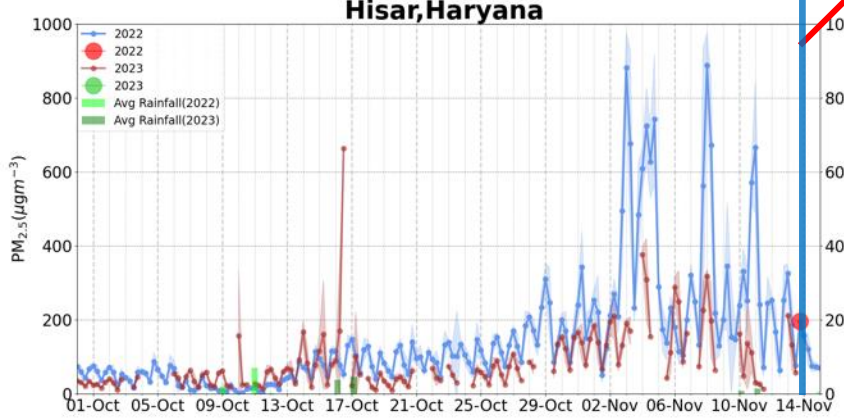
Faridkot[NS-Site04]
Faridkot, Punjab



Bathinda[NS-Site08]
Bathinda, Punjab



Kallar Bhaini[NS-Site15]
Hisar, Haryana

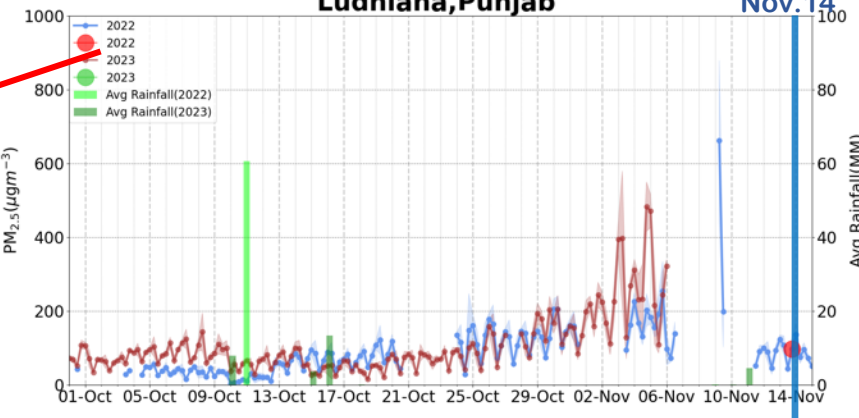


Aakash, RIHN

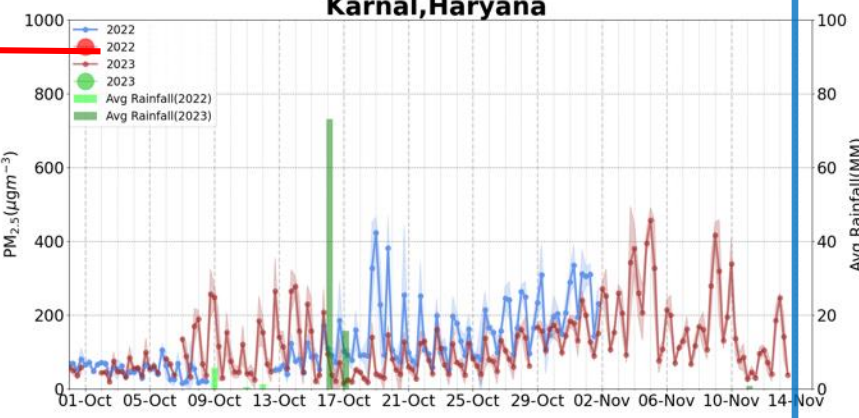


14 Nov. 2023

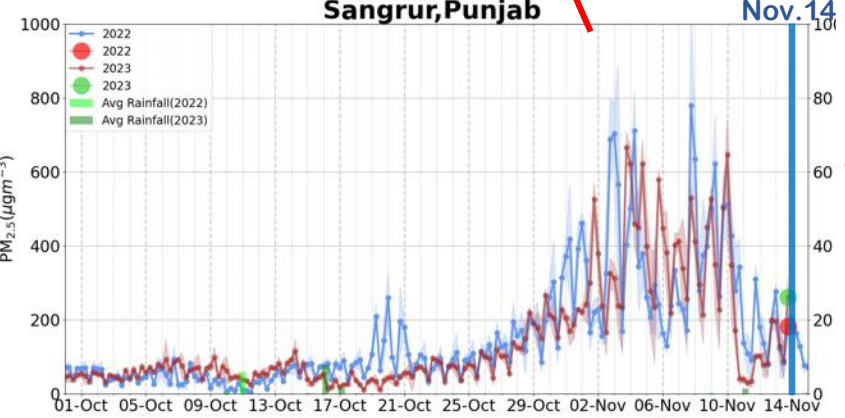
Punjab Agricultural University[NS-Site07]
Ludhiana, Punjab



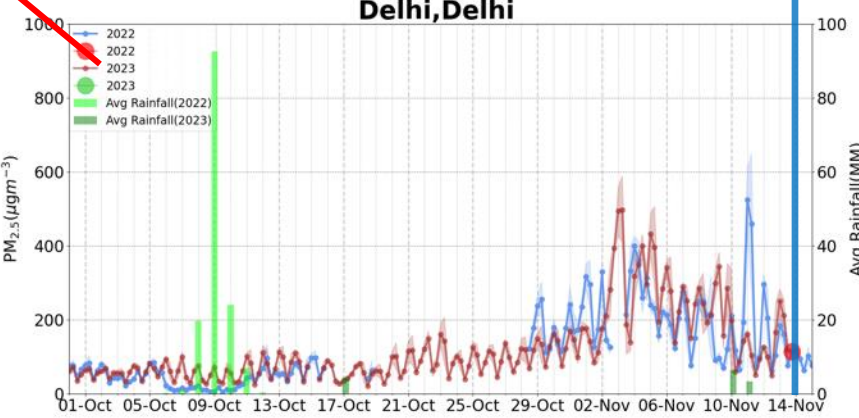
Ruksana[NS-Site19]
Karnal, Haryana



Chhajili[NS-Site11]
Sangrur, Punjab



Jawaharlal Nehru University[NS-Site28]
Delhi, Delhi



You can look at the measured data weekly or daily at the Aakash HP

<https://aakash-rihn.org/en/data-set/>

Campaign 2023

Results of RIHN Aakash Intensive Field Campaign studies in Oct. – Nov. 2023 Week10

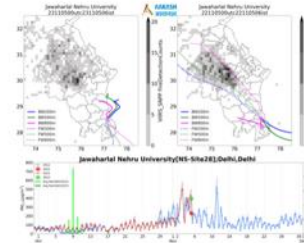
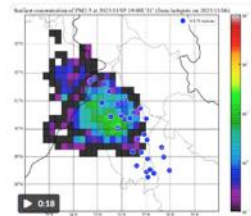
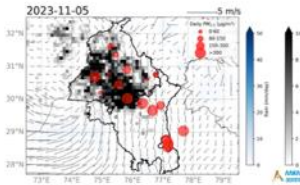
11/09/2023

Date Daily mean PM2.5 (red dots), Rainfall and fire count maps, and Wind vectors (credits: Aakash Project, RIHN)

Transport of emission signal from crop residue burning by FLEXPART model (credits: M. Takigawa, JAMSTEC)

Backward (solid line) and forward (dotted line) trajectories arriving/originating at JNU, Delhi (credits: Aakash Project, India-Japan collaboration)

11/05



JAPANESE



Aakash project

Aakash project, Research Institute for Humanity and Nature (RIHN), Kyoto - official site

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Towards reducing straw burning

Mitigation options for the stubble burning problem

Compensation

Not successful

Subsidies for the introduction of new machinery (In-situ straw management)

Increasing crop diversification : root solution to prevent groundwater depletion

LPU – Aakash collaboration

Ex-situ management of rice straw

Biochar

Non- Energy Use

Energy Use

Fertilization Effectiveness

Soil improvement effect

Others

cattle feed
paper-making material
mulch for other crops
bedding for garlic/mushrooms
packaging material
compost for fertilizer

Biofuel

Generation of Bio-ethanol, Bio gas, Bio Coal Hydrogen etc.

Pellets/Briquettes

Cofiring of pellets with coal

SAMARTH (Sustainable Agrarian Mission on use of Agro Residue in Thermal Power Plants)

Co-firing of thermal plants (5%-10%)

- India needs 76 Mega tons of pellets for co-firing (5%) and 152 Mega tons (10%)

(Prof. Kamal Vatta, seminar at RIHN, 2022)

India-Japan Environment Week

The Ministry of the Environment, Japan(MOEJ), and the Ministry of Environment, Forest and Climate Change (MOEFCC), India, jointly organized.

Date: Friday, Jan 12-13, 2023

Venue: The Imperial, New Delhi



Ministry of the Environment



Aakash project Seminar, "Toward clean air in North India"

Opening Ceremony, Jan. 12th

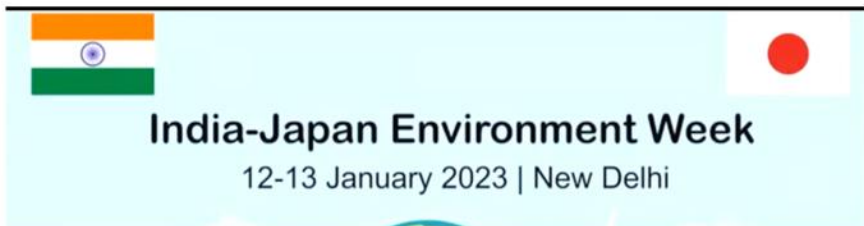


Mr Akihiro Nishimura,
Minister of the Environment,
Japan **MoE**

Mr Bhupender Yadav, Union
Minister for Environment,
Forest and Climate Change,
India **MoEFCC**

Biochar production

(National Agriculture and Food Research Organization, Japan)



Seminar 4 [India Japan Environment Week]



Seminar 4 [India Japan Environment Week]

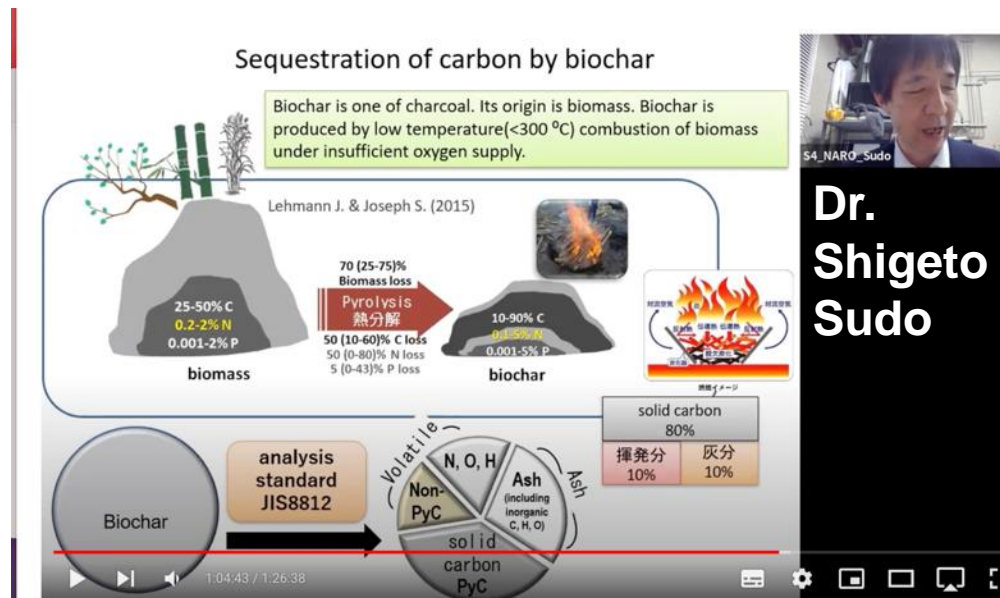
Grind Mill



Seminar 4 [India Japan Environment Week]



Seminar 4 [India Japan Environment Week]



Seminar 4 [India Japan Environment Week]



Dr. Shigeto Sudo

Active Discussion on energy use of crop residue

Briquet made of 100 % rice-husk or rice-straw (TROMSO, Japan)

JCM : Joint Crediting Mechanism

HAIDE MEMOIRE
ON THE JOINT CREDITING MECHANISM
BETWEEN
THE MINISTRY OF THE ENVIRONMENT OF JAPAN
AND
THE MINISTRY OF ENVIRONMENT, FOREST AND CLIMATE CHANGE OF
THE REPUBLIC OF INDIA

The Ministry of the Environment of Japan and the Ministry of Environment, Forest and Climate Change of the Republic of India (hereinafter referred to individually as a "Ministry" and jointly referred to as the "Ministries") hereby express their intent to establish a Joint Crediting Mechanism (hereinafter referred to as the "JCM") that aims to facilitate diffusion of, among others, leading decarbonizing technologies, products, systems, services and infrastructure as well as the implementation of mitigation actions in line with their respective policies and measures.

The Ministries mutually recognize that part of JCM credits issued from emission reductions and removals may be used towards the achievement of Japan's nationally determined contribution, and the rest of the said JCM credits may contribute to the achievement of the Republic of India's nationally determined contribution, while ensuring that double counting is avoided on the basis of corresponding adjustments, consistent with the guidance on cooperative approaches, referred to in Article 6, paragraph 2 of the Paris Agreement.

The Ministries will work in close cooperation for the establishment of the JCM. Furthermore, the Ministry of Japan will facilitate technological and capacity building support necessary for the administration of the JCM by the Ministry of the Republic of India.

The Ministries will strive to sign a Memorandum of Cooperation on the JCM as soon as their necessary arrangements are developed.

This Aide Memoire is not legally binding and does not affect any rights and obligations under domestic or international law.

Signed in New Delhi on 17 March 2023, in two originals in the English language.

For the Ministry of the Environment of Japan For the Ministry of Environment, Forest and
Climate Change of India



Ambassador, Embassy of Japan, New Delhi



Additional Secretary, Environment, Forest
and Climate Change

Agreement between Japan and India partners expected to be signed soon

We hope that JCM's new business will be launched with Japanese technology.

Summary

- Aakash project conducted the intensive measurement campaigns during straw burning season in 2022 and 2023.
 - Clear linkage between Delhi's severe air pollution in Nov. 2022
 - Considerable local pollution contribution as well as straw burning in 2023 (preliminary)
- Crop diversification experiments with LPU
 - Biochar usage and study of GHG gas emissions
- Biofuel usage of rice straw may be possible
 - JCM project in future?



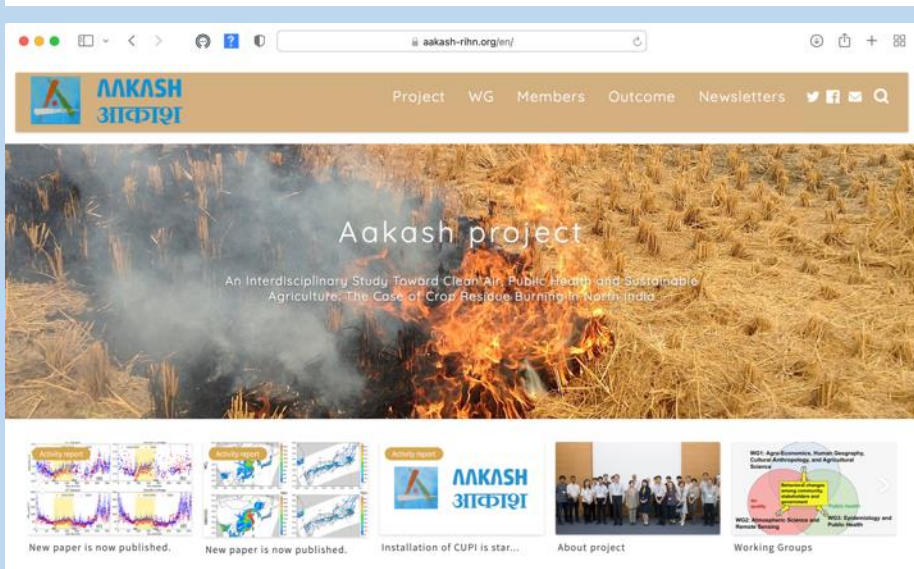
AAKASH
आकाश

Aakash

toward clean air, public health, and sustainable agriculture:

Look Videos!

HomePage: <https://aakash-rihn.org/en/>



THANK YOU !