

# Regional overview of agricultural open burning and wildfires: emissions and effects on local and transboundary haze pollution in ASEAN

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**Asian Institute of Technology**

11 March 2026; 15:30-17:00

Strengthening Regional Cooperation to Manage Agricultural Open Burning and Wildfires in Southeast Asia and Beyond



# BOB: emission and effects

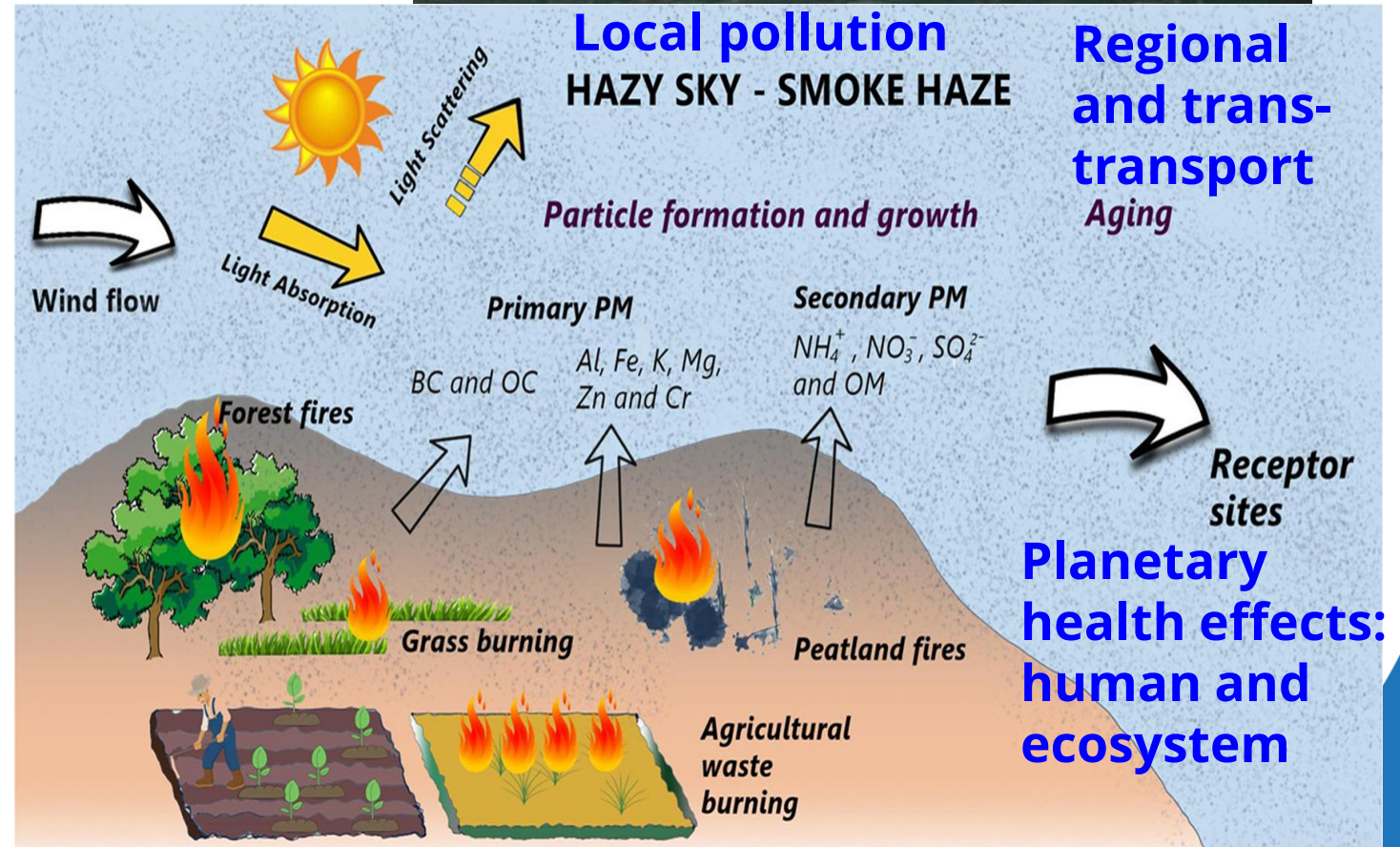
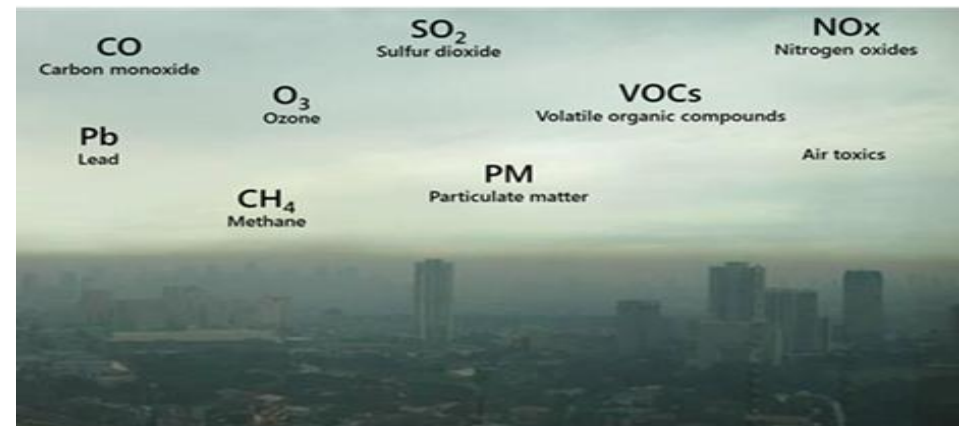
## ➤ Emissions:

- Toxic pollutants, GHGs, SLCFs (BC, OC, etc.)

## ➤ Effects:

- Air quality, Health, Climate
- Atmospheric visibility
- Ecosystem damage
- Economy: health, property, tourism, etc.

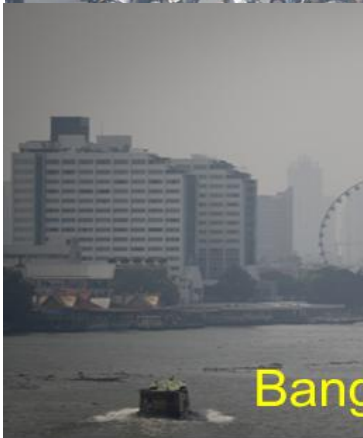
➔ Local and transboundary: haze episodes



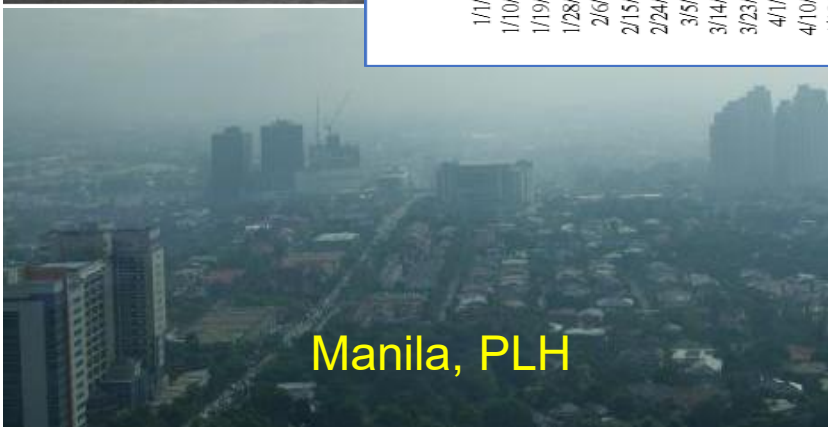
# Air pollution episodes in SEA during dry - burning seasons



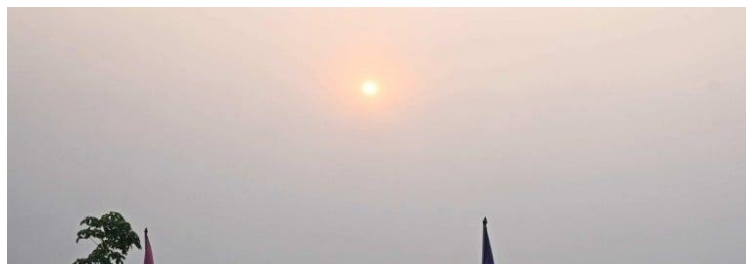
Hanoi, 28 Nov 2023 (Internet)



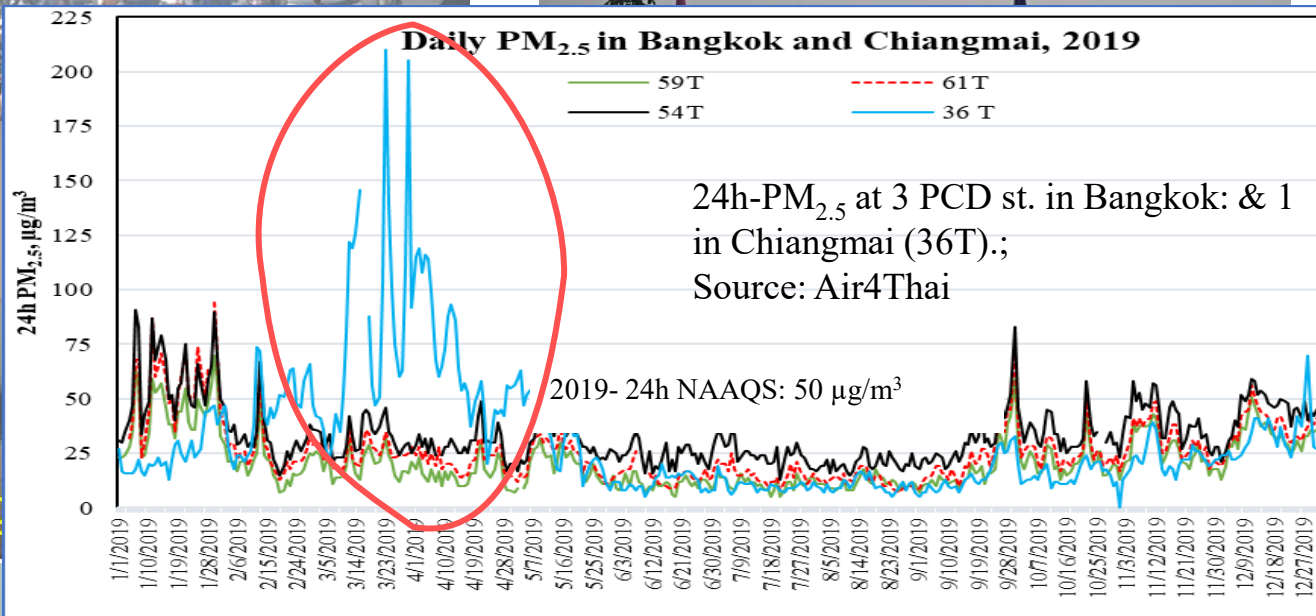
Bang



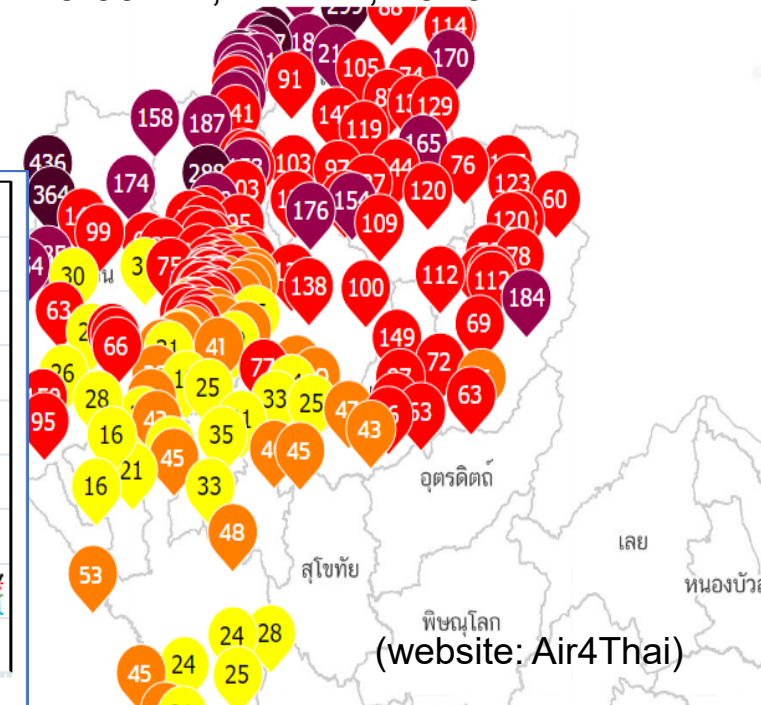
Manila, PLH



Vientiane, Apr 2019 (BoB)



PM<sub>2.5</sub>, air quality in N. Thailand  
9:00 am, Mar 24, 2023



Recommendations for the public to prevent the health effects of air pollution  
\*Fading the table left-right for more information.

AQHI (PM <sub>2.5</sub> 24 (< hour))	PM <sub>2.5</sub> 24 (mcg/m <sup>3</sup> )	People in risk groups	General public
Good weather 0-50	0-12	All citizens live a normal life.	
Medium 51-100	13-35	Live a normal life. (People who are more sensitive to pollution than the average person should reduce outdoor activities that are heavy or prolonged in use.)	
Not good for the risk group 101-150	36-55	Reduce outdoor activities that are heavy or prolonged	Live a normal life.
Bad weather 151-200	56-150	Refrain from outdoor activities that are heavy or prolonged	Reduce outdoor activities that are heavy or prolonged
Extremely bad 201-300	151-250	All outdoor activities are prohibited.	Refrain from outdoor activities that are heavy or prolonged
Danger 301-500	251-500	All outdoor activities are prohibited.	

note

1. Risk groups include children, adolescents, and the elderly. Pregnant women. People with respiratory diseases. Heart disease and stroke.  
2. An index value exceeding 500 is considered too much to report. [Read more here.](#)

# Main types of BOB in ASEAN

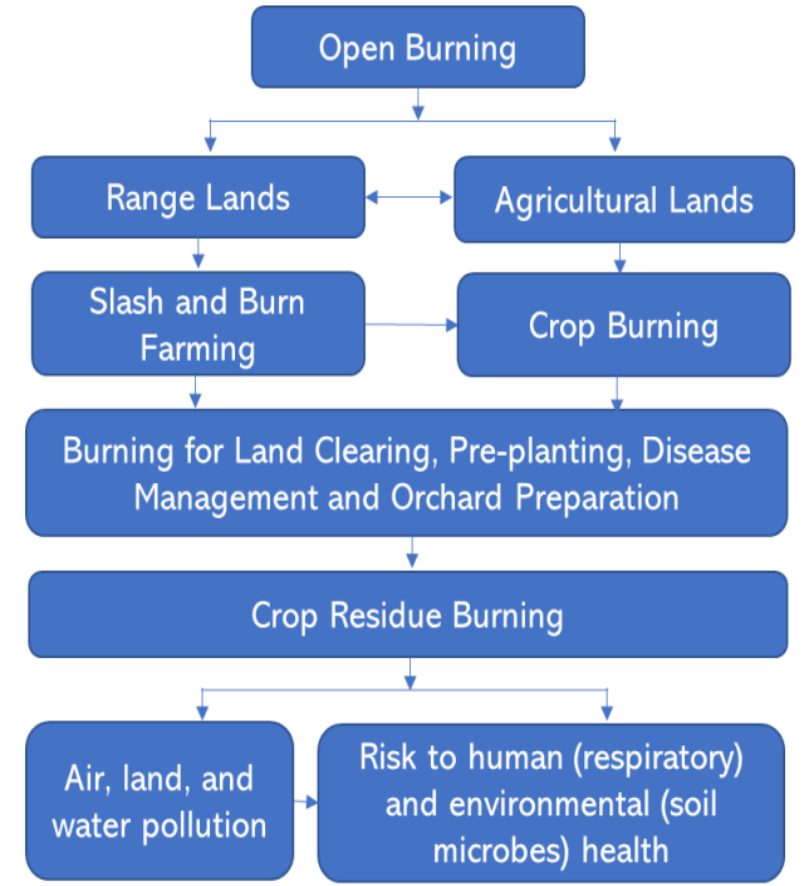
## CROB: crop residue open burning



## Wildfires



## ASEAN Guidelines on the Reduction of Crop Burning



# Burning seasons in ASEAN

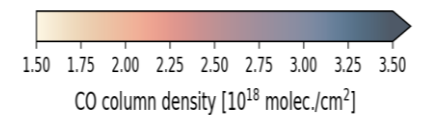
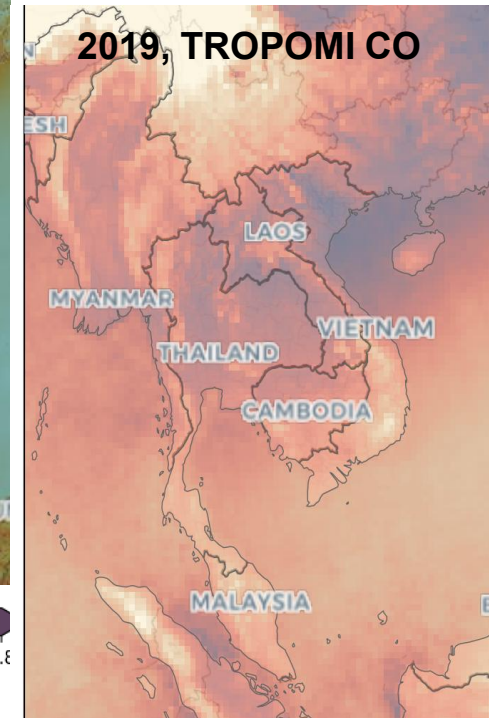
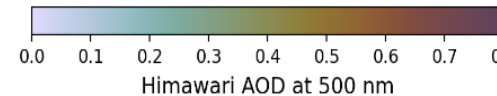
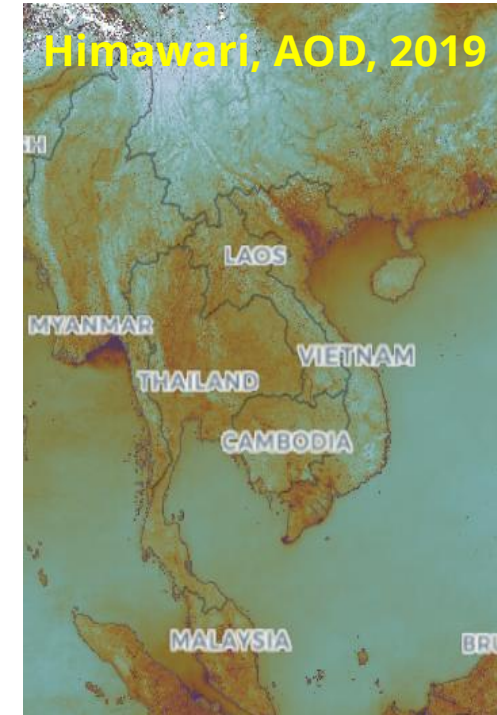
Cambodia, Laos, Myanmar, Thailand, Vietnam



Indonesia: forest fires and peat fires

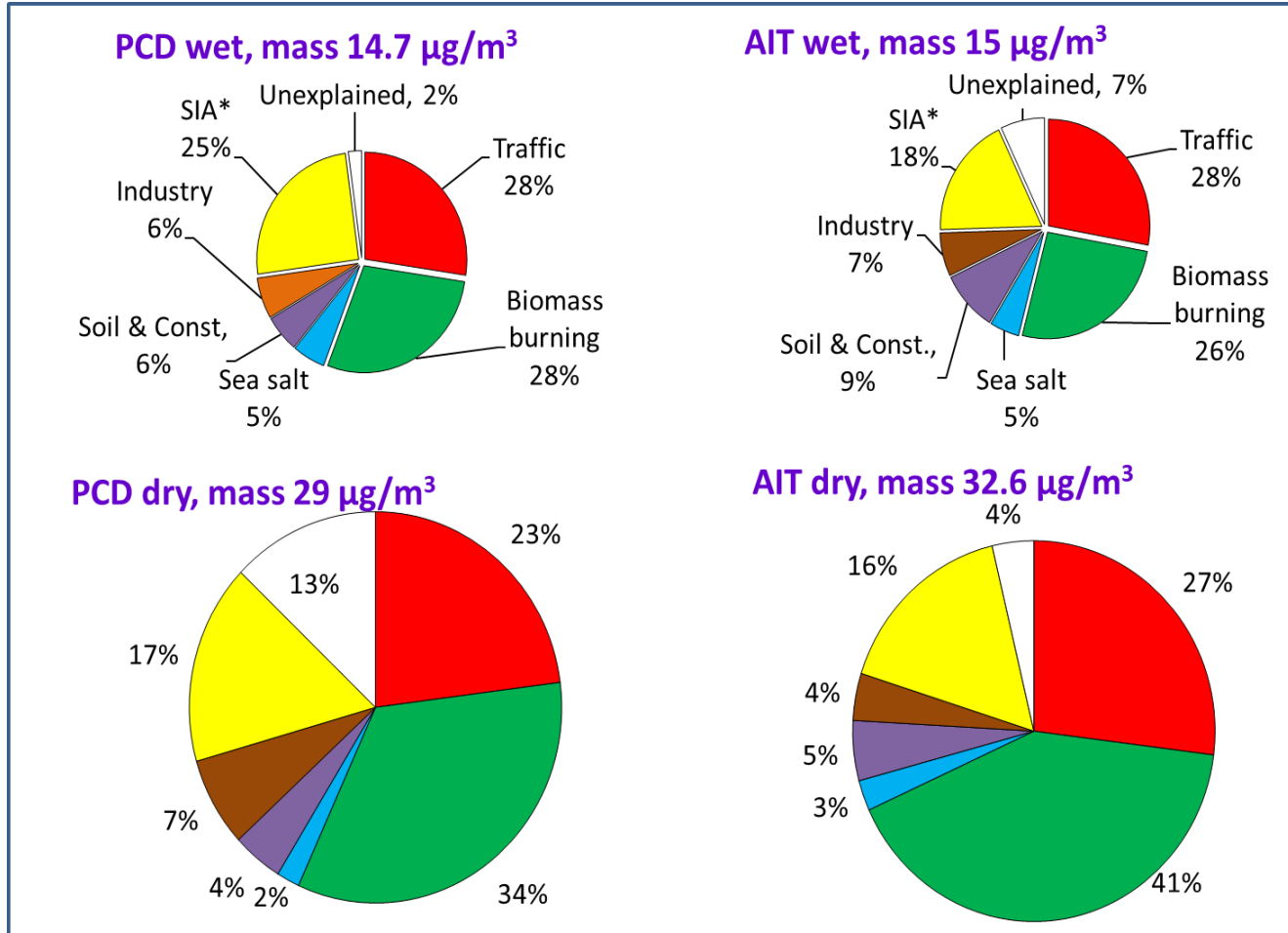


Regional airsheds



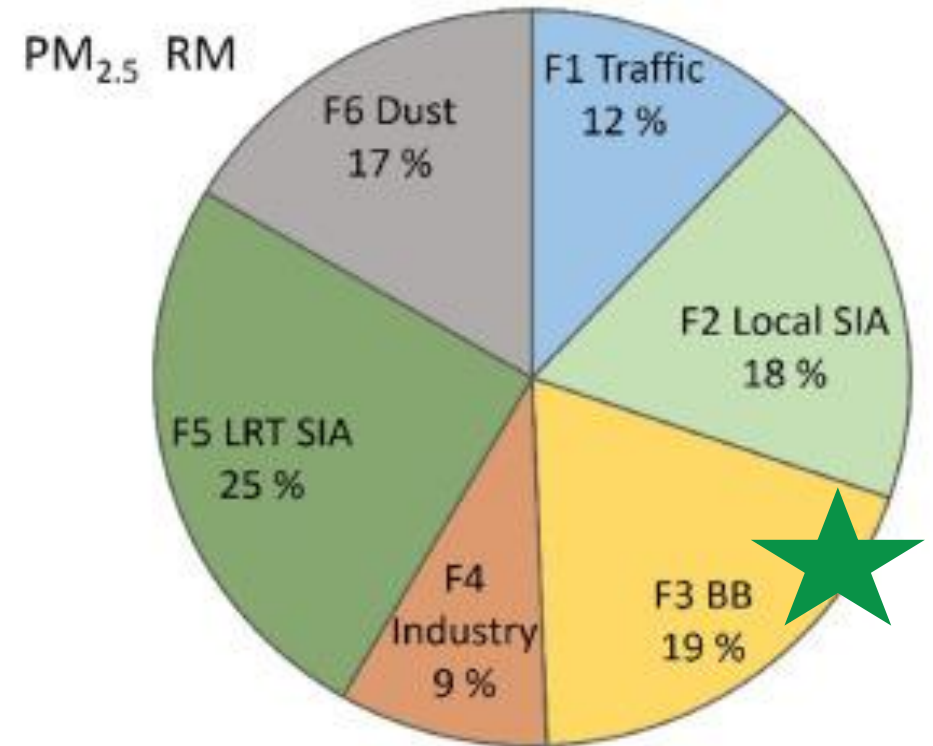
# Contributions of BOB to ambient PM<sub>2.5</sub> (source apportionment by receptor model)

Bangkok: 2016-2017  
Annual PM<sub>2.5</sub>: ~20 µg/m<sup>3</sup>



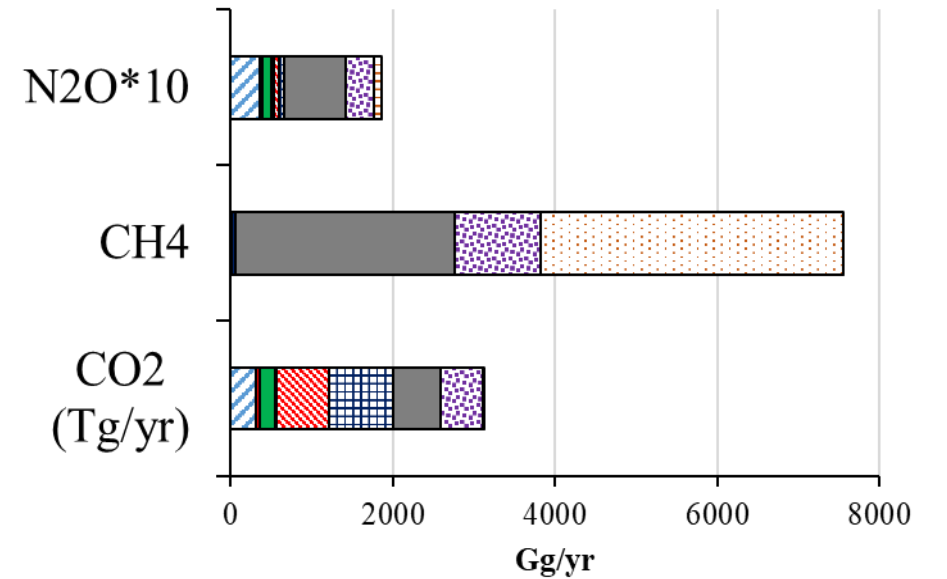
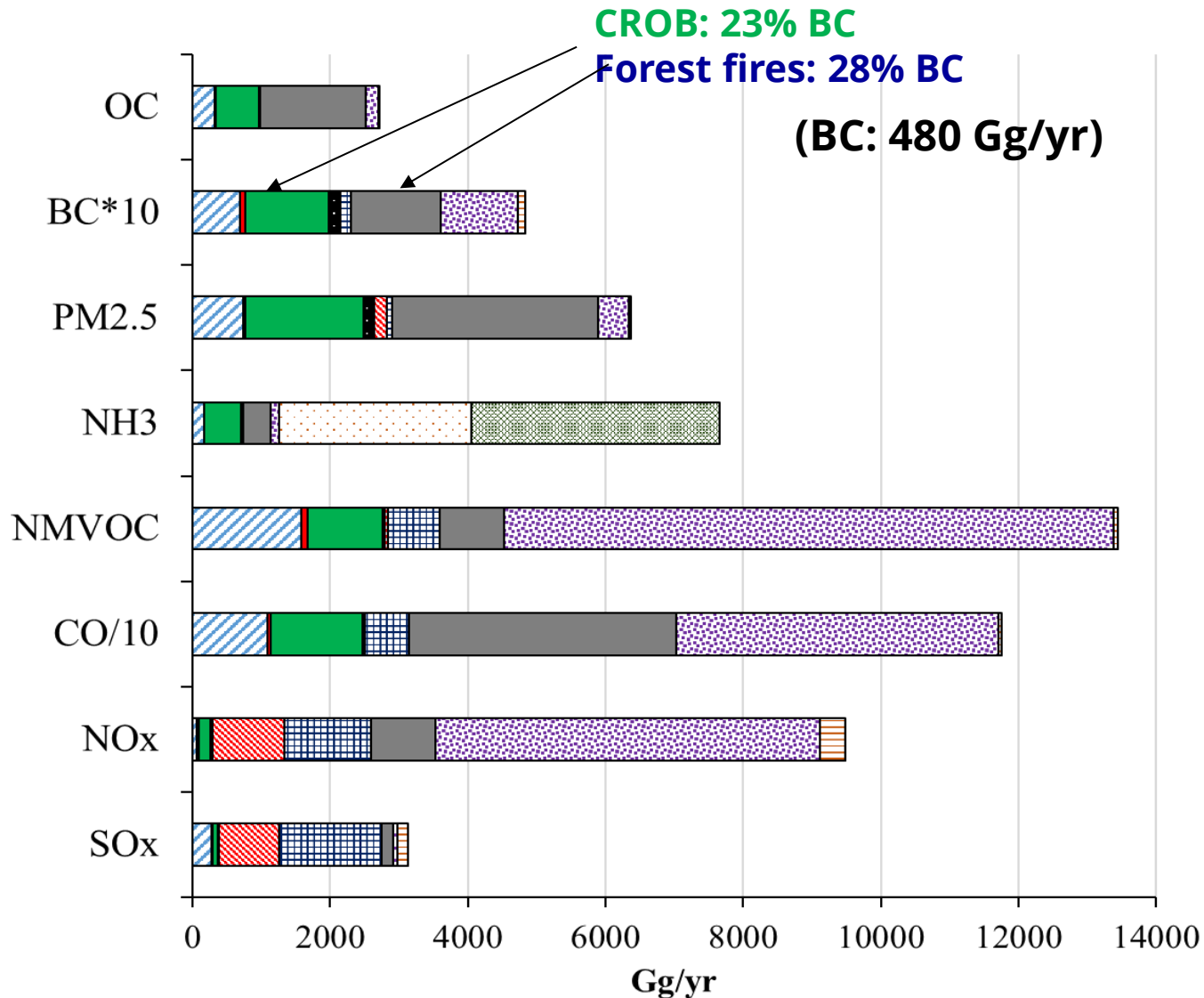
Narita et al. (2019)

Hanoi: 2019-2020  
Annual PM<sub>2.5</sub>: 45-50 µg/m<sup>3</sup>



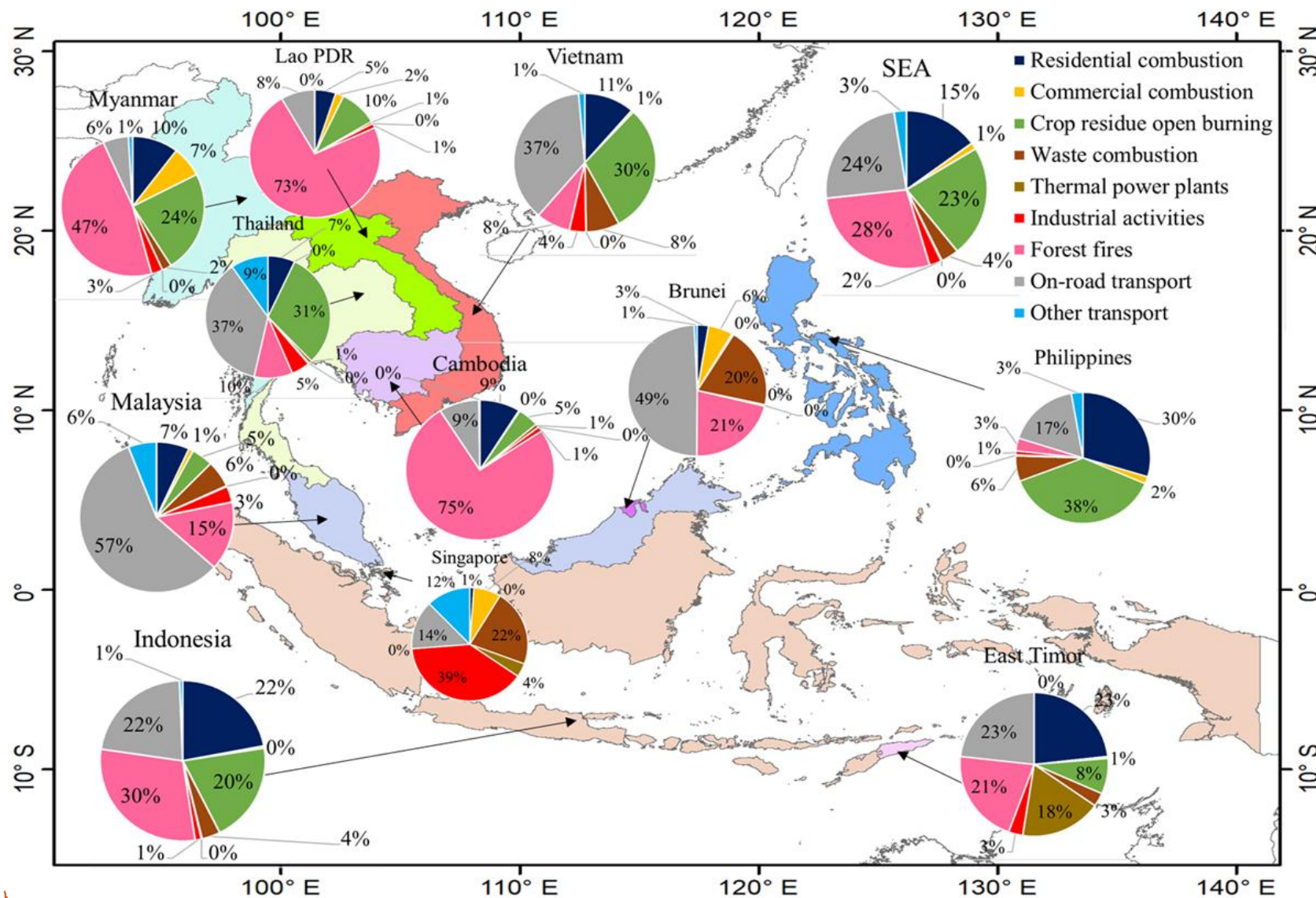
Mallocken et al. (2023)

# Emission shares of BOB in the annual emission in SEA (2010 – 2018)



- ▨ Residential combustion
- ▨ Commercial combustion
- ▨ Crop residue open burning
- ▨ Waste combustion
- ▨ Thermal power plants
- ▨ Industrial activities
- ▨ Forest fires
- ▨ On-road transport
- ▨ Other transport
- ▨ Livestocks
- ▨ Fertilizer

# Example: Sector-wise BC emissions by country (annual aver during 2010 – 2018)

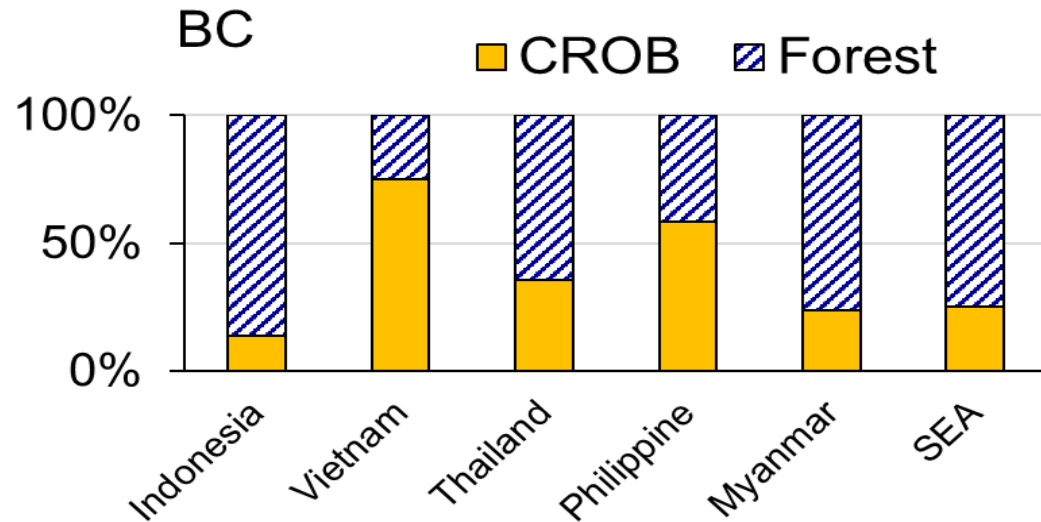
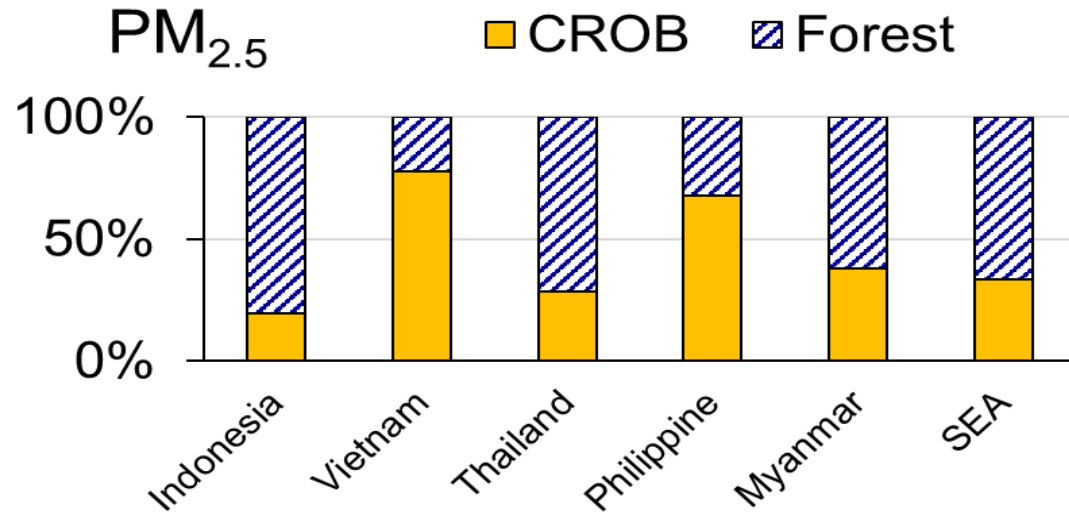


ASEAN total BC emissions: 480 Gg/yr

CROB: 23%

Forest fires: 28%

# CROB vs. forest fire emissions in SEA



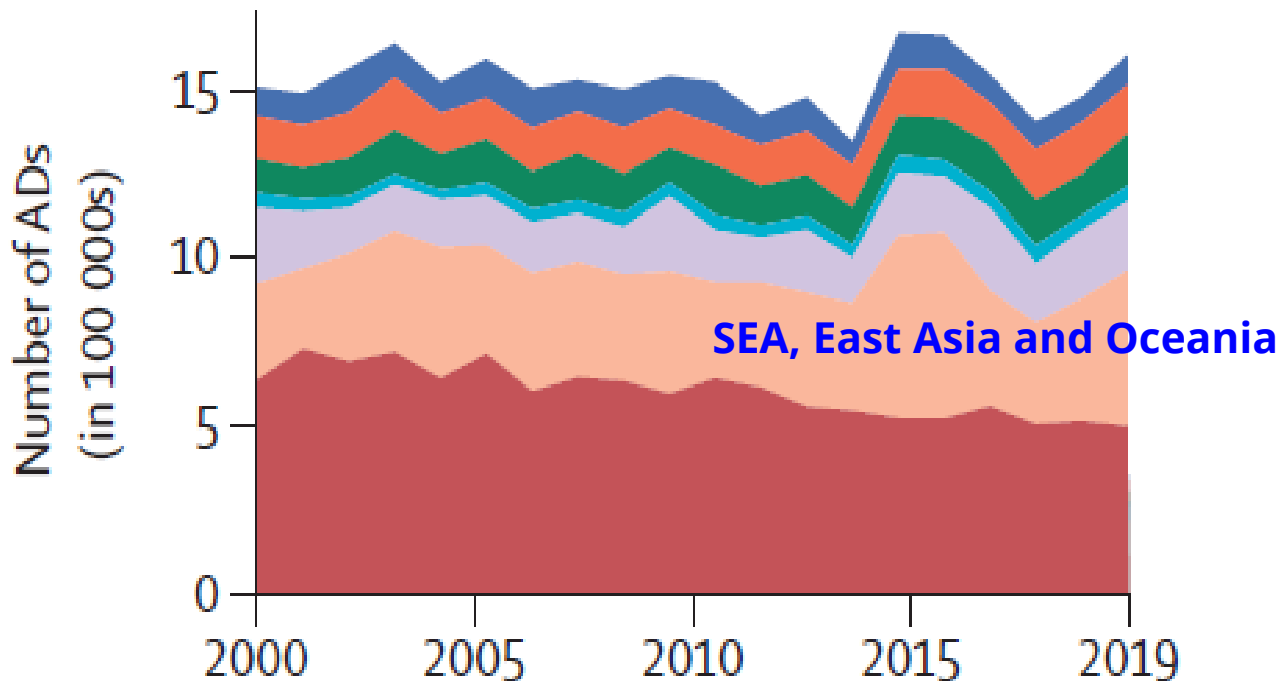
- CROB contributes 12-45% of the total SEA OB emission of different species
- Compared to forest fires: CROB emissions are higher in Vietnam and Philippines, and lower in Indonesia, Thailand, Myanmar
- CROB happens daily over extended period and where people are → health risks

# Health effects: attributable deaths (AD) to open burning air pollution (Xu et al, 2024)

GBD super regions

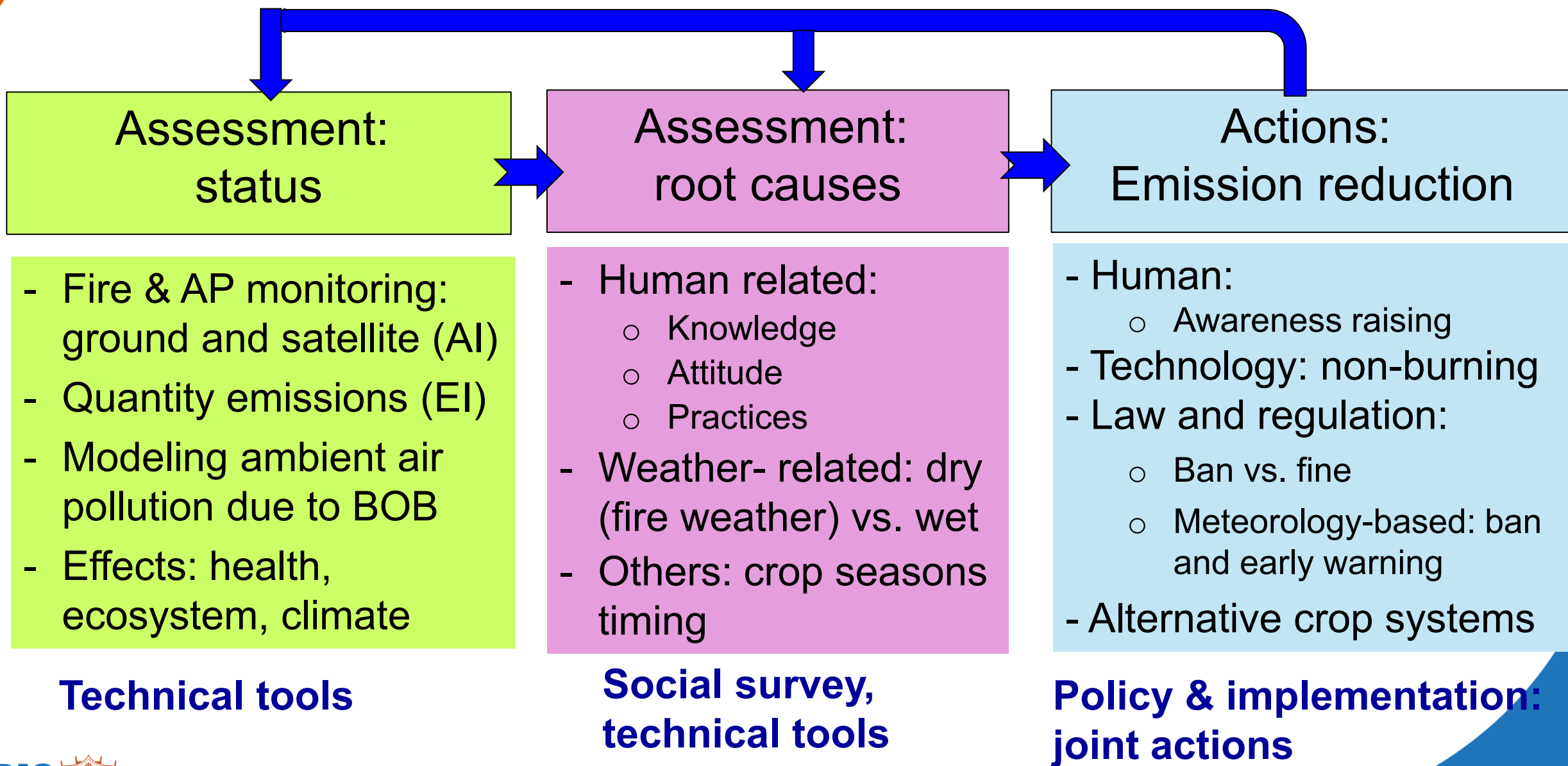
Central Europe, eastern Europe, and central Asia   High-income   Latin America and Caribbean   North Africa and Middle East  
South Asia   Southeast Asia, east Asia, and Oceania   Sub-Saharan Africa

## A Global all-cause ADs



- Globally: ~8 mil deaths per year due to AP → **1.53 mil AD to air pollution from landscape fires (BOB)**
- ASEAN: 650,000 die due to AP → **206,817 AD to BOB**
- South Asia: 170,800 AD to BOB
- East Asia: 147,290 AD to BOB

# Management framework: BOB



# Examples: non-burning alternatives for sustainable rice straw management



Policy Brief

(2014-2016-2019)



- Making rice straw pellets for cooking in Mimimoto gasifier stoves
- Emission reduction:  $PM_{2.5}$  emission rate from RS is 1/3 of OB emission
- Reduce reliance on fossil fuel and wood fuel
- Financial incentives to farmers → **Business Models**



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# Thank you !

