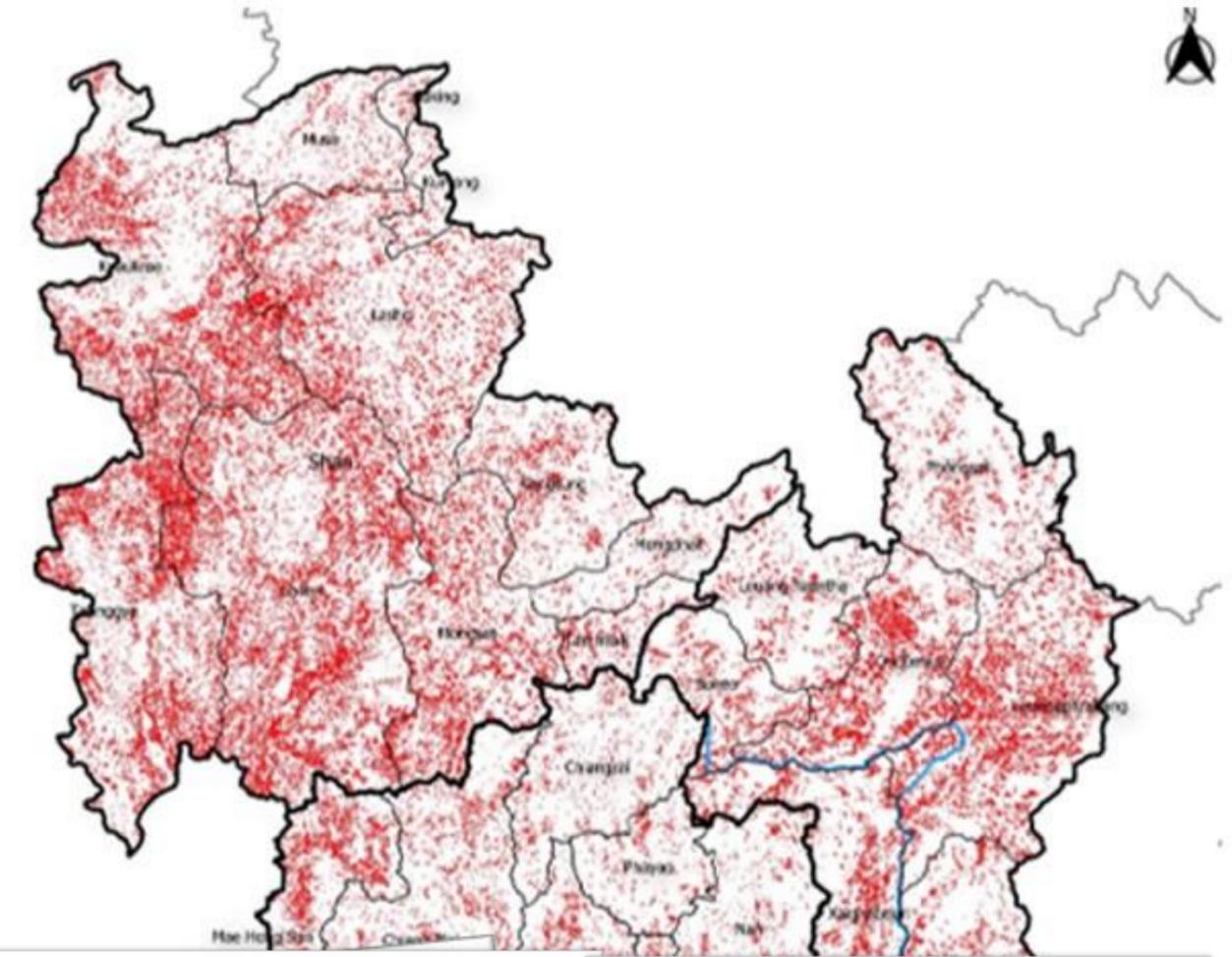# Key Air Pollution Challenges in Chiang Rai and Potential Project Seeds toward Sustainable Solutions in Thailand

Clean air is a triple win: for human health,

for the economy, and for climate stability

Present By : Asst. Prof. Dr. Nion Sirimongkonlertkun
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Located in northern Thailand, Chiang Rai covers approximately 2.88 million acres.

Chiang Rai Province, Thailand

Economic Profile of Chiang Rai Province

• The provincial economy is primarily driven by agriculture, which serves as the main source of livelihood for a large share of the population.

• Key agricultural products include rice, maize, tea, coffee, and perennial crops.

• Border trade and logistics with neighboring countries contribute to the local economy and offer

Chiang Rai faces significant challenges due to the burning of agricultural waste, especially from corn and rice plantations, which contributes to greenhouse gas emissions and PM2.5 pollution

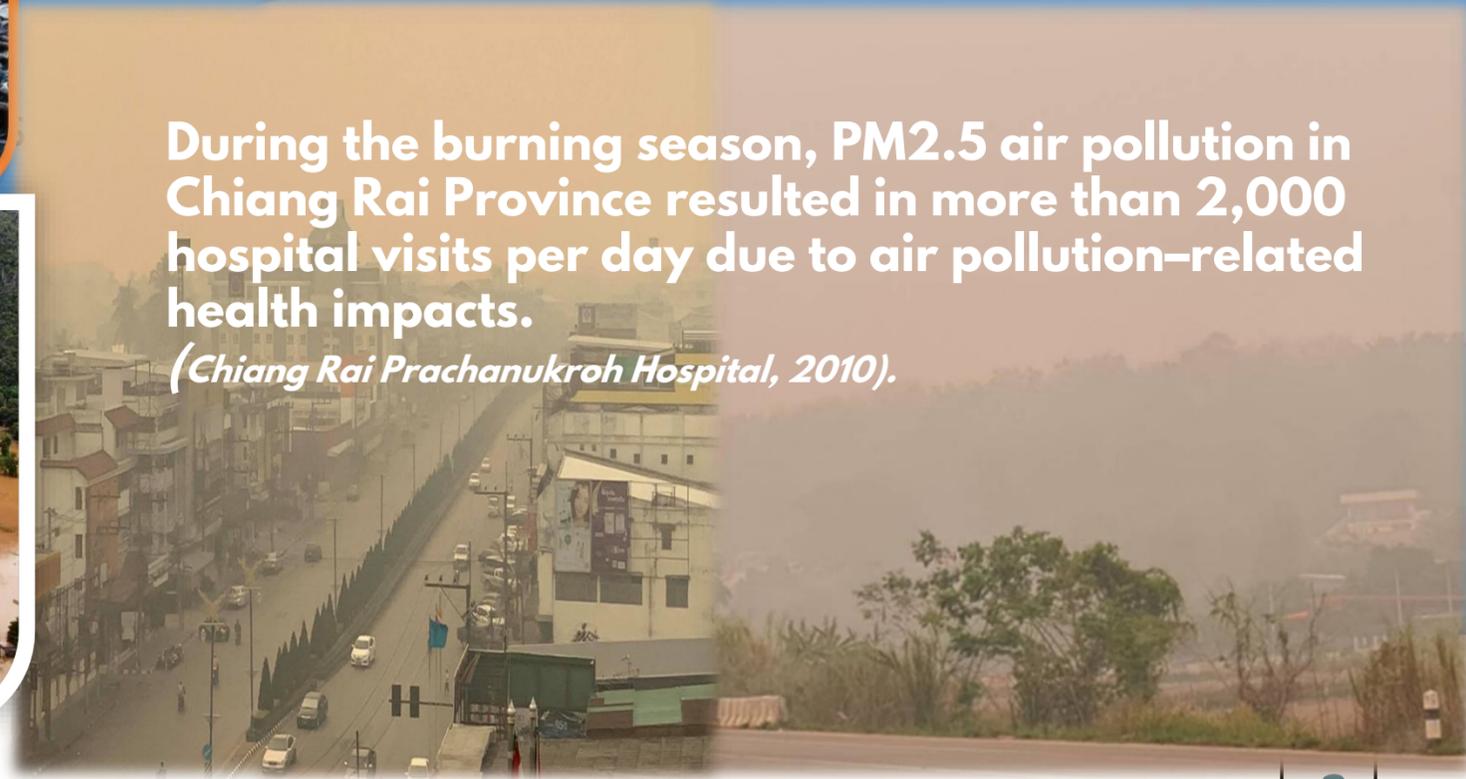**Human Health**

Biodiversity Loss

Climate Change

Disaster (Flood, 2024 ,Water Pollution

During the burning season, PM2.5 air pollution in Chiang Rai Province resulted in more than 2,000 hospital visits per day due to air pollution–related health impacts.
(Chiang Rai Prachanukroh Hospital, 2010).

ต.เวียง อ.เมือง, เชียงราย

PM2.5

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มีผลกระทบต่อสุขภาพ

Burning Season in Chiang Rai

Period: Fire hotspots typically occur from November to May each year
Key Drivers: Closely linked to agricultural land-use practices

Early Stage: Post-harvest burning in rice fields
Later Stage: Upland land preparation for monoculture crops, particularly maize

Peak Period: Fire hotspots peak in March–April
Impact: These months show a statistically significant increase in PM2.5 concentrations
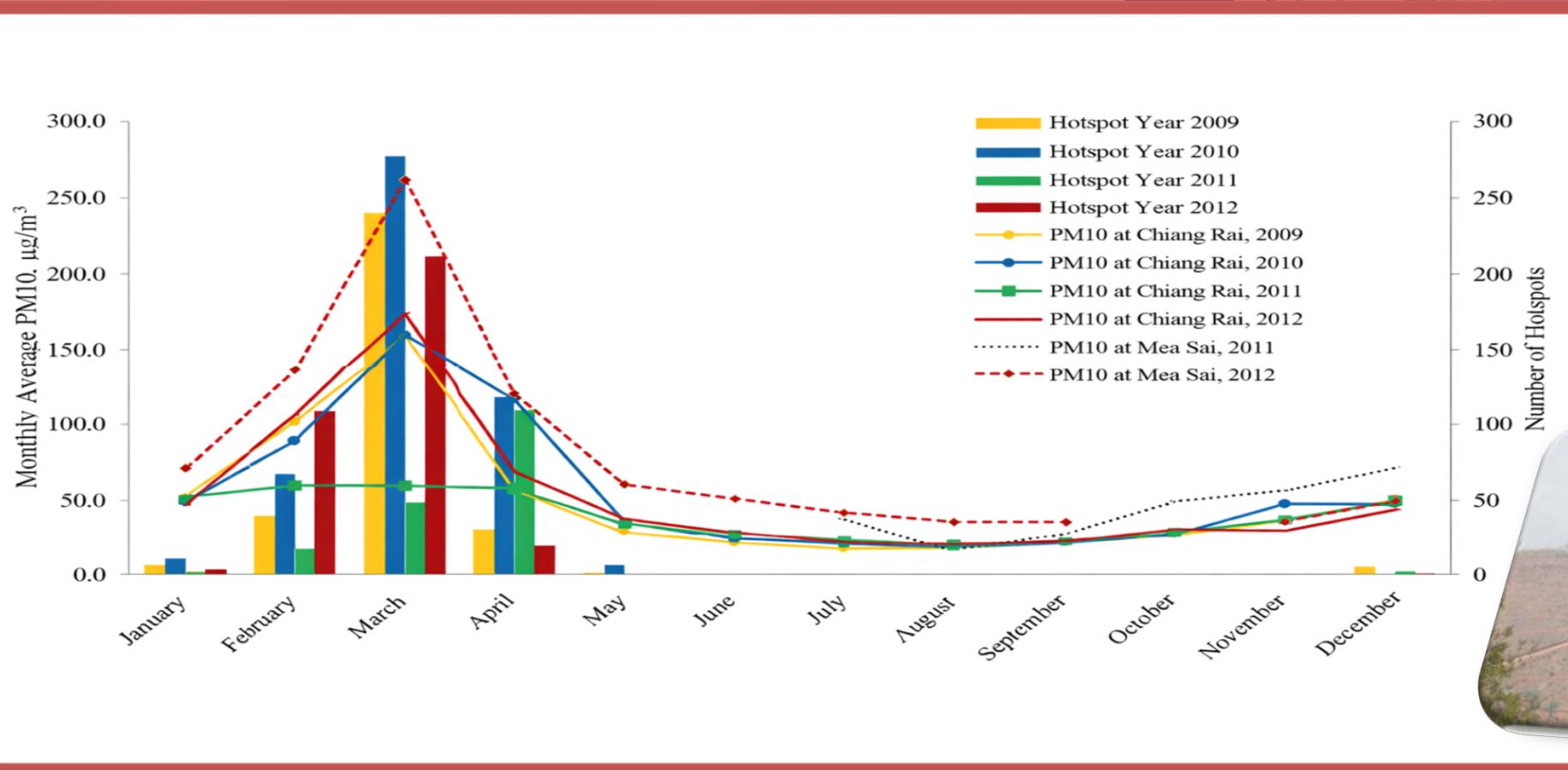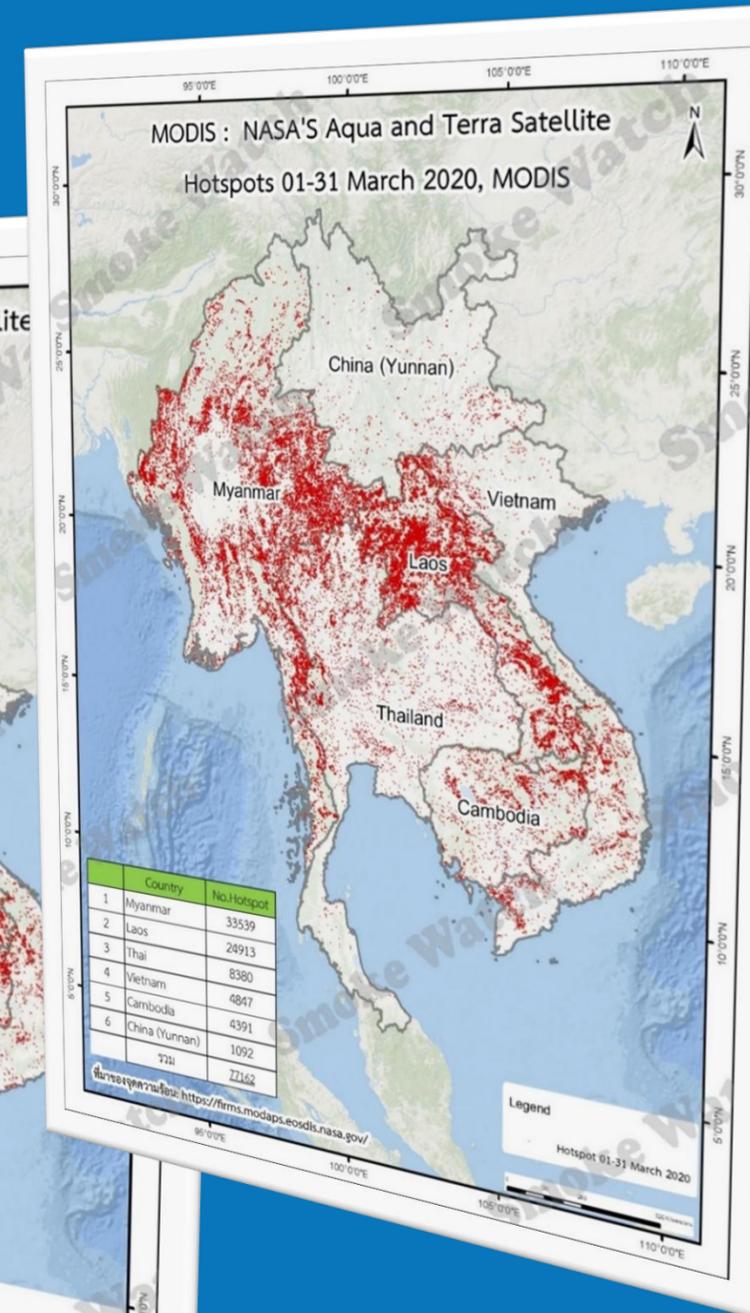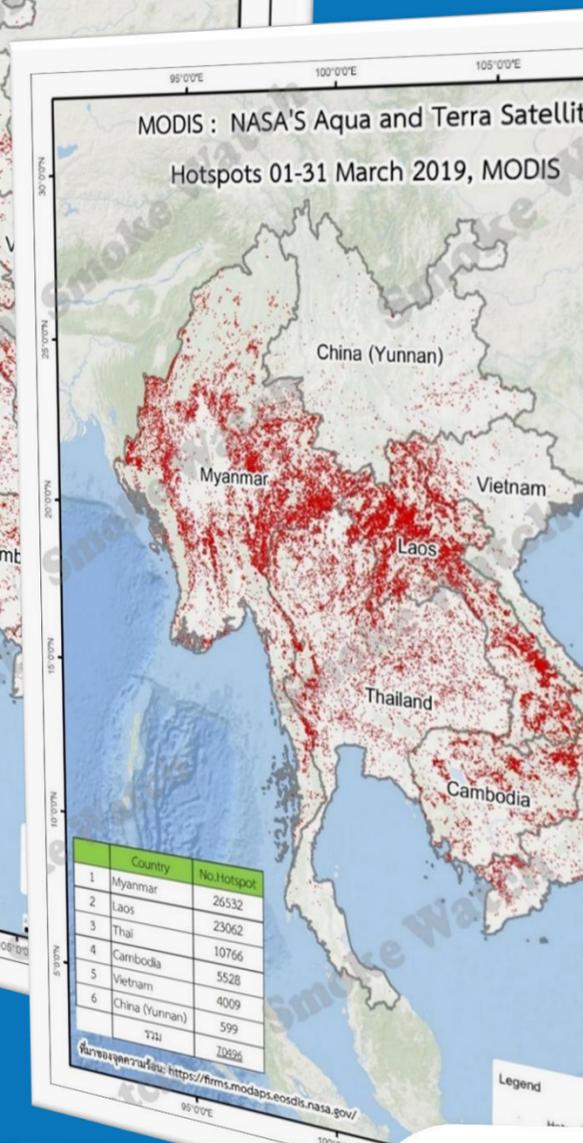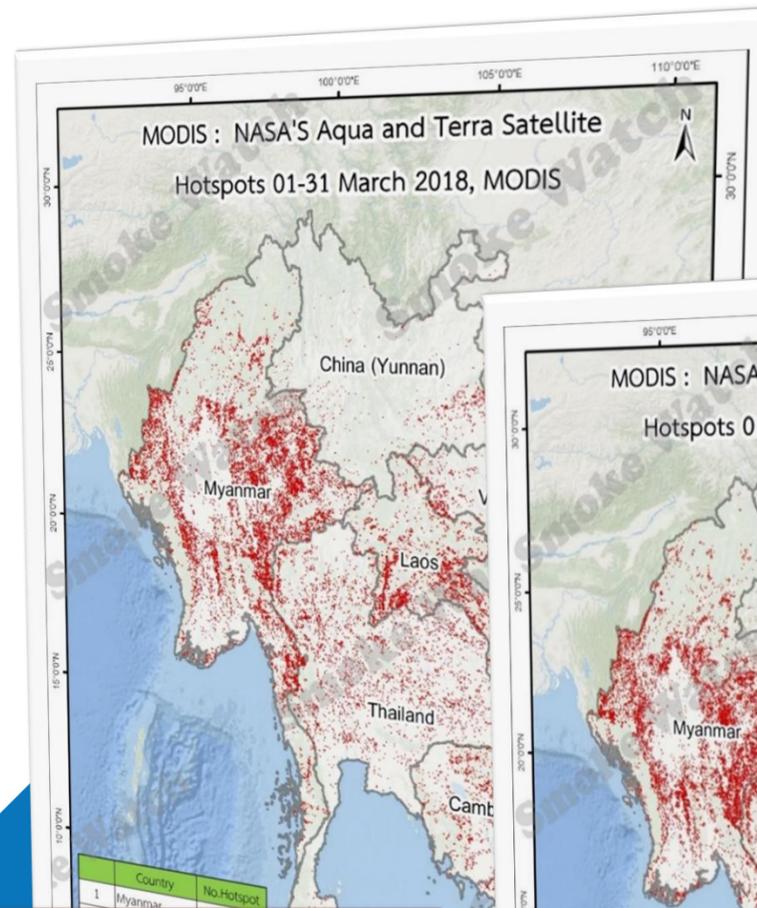
Three Key Economic Crops in Chiang Rai Province
Associated with Seasonal Open Burning after Harvest

Rice

Chiang Rai ranks 19th nationwide in rice cultivation area, with approximately 1.41 million rai (~558,700 acres). The province is also among the **leading rice producers** in Northern Thailand, reflecting high productivity.

(Rice Department of Thailand; Office of Agricultural Economics, 2022-223)

Maize (Livestock Corn)

Registered maize farms in Chiang Rai cover 183,594 rai. After harvest, about ~36,807 tons of maize residues (stalks and cobs) remain, requiring proper management before the next cropping cycle.

(Rice Department of Thailand; Office of Agricl-Agricultural Economics, 2022-2023)

Longan

In 2021, Chiang Rai Province ranked 4th nationwide in terms of longan plantation area, following Chiang Mai and Lamphun.

Mae Suai District (the district with the highest number of fire hotspots in Chiang Rai)

Longan cultivation area: ~17.4 acres (44 rai)

Estimated biomass requiring management; Longan: ~62.5 tons of biomass.

(Office: Agricultural Economics, Ministry of Agriculture and Cooperatives, 2022)

Maize residues: ~700 kg per rai | **Longan residues:** ~1,400 kg per rai
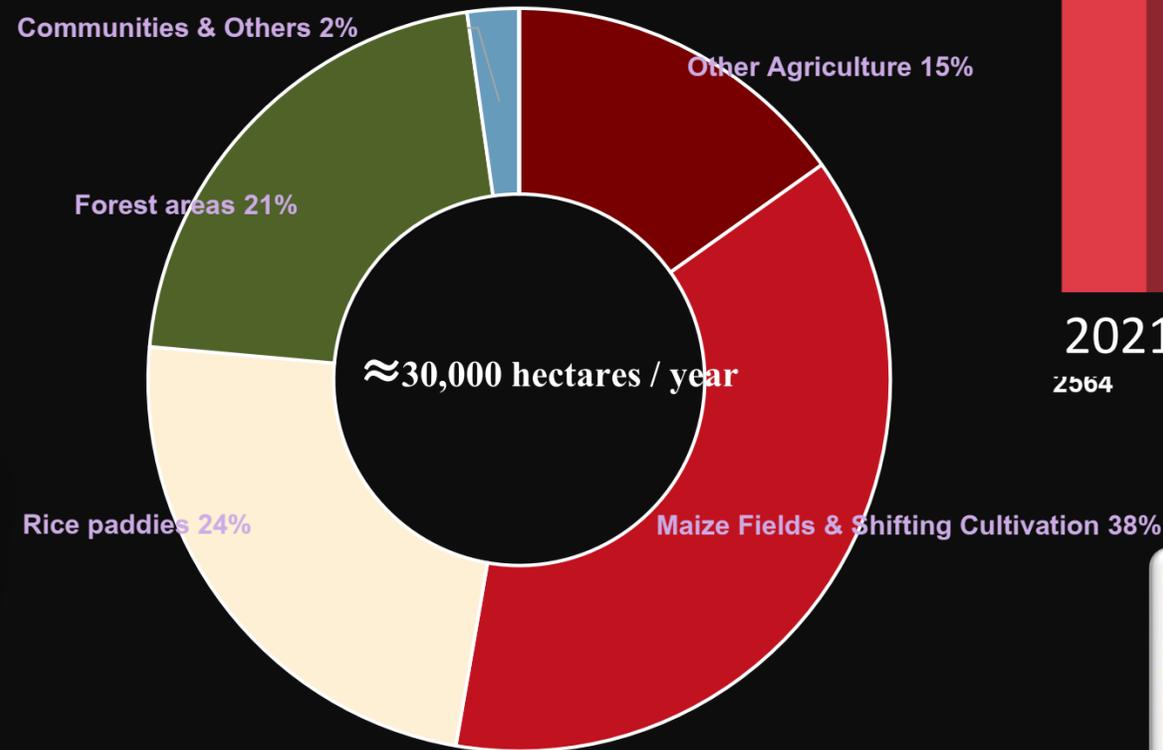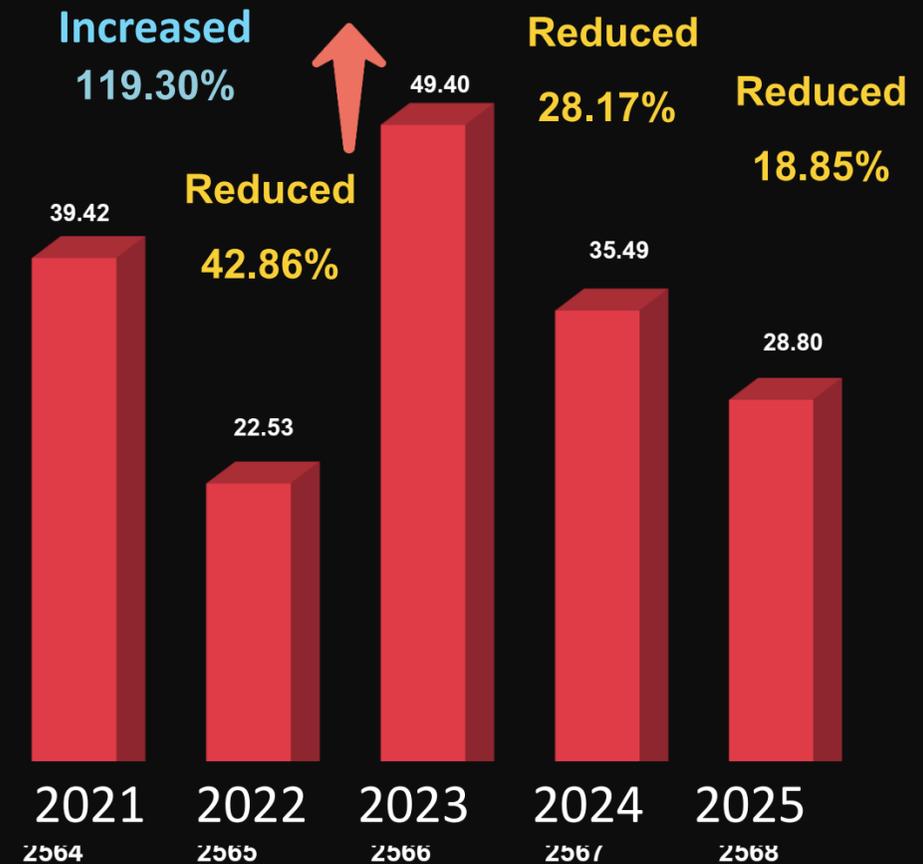
❑ An average burned area of ≈30,000 hectares per year
Approximately 0.27 million tons of CO_2 are emitted per year
Burning agricultural waste is a major emissions hotspot

❑ Most fires occurred in:
Reserved forests: 53%
Agricultural areas: 21%

❑ Highest land-use categories:
Maize fields and shifting cultivation: 38%
Rice paddies: 24%

Average PM$_{2.5}$ (µg/m³)

Increased
119.30%

Reduced
42.86%

Reduced
28.17%

Reduced
18.85%

39.42
22.53
49.40
35.49
28.80

| 2021 | 2022 | 2023 | 2024 | 2025 |
| 2564 | 2565 | 2566 | 2567 | 2568 |

Communities & Others 2%

Other Agriculture 15%

Forest areas 21%

≈30,000 hectares / year

Rice paddies 24%

Maize Fields & Shifting Cultivation 38%

Source: IPCC 2006/2019 Guidelines – Biomass Burning (6–10 tCO₂/ha)

Clear Sky Strategy

Clear Sky Strategy

Chiang Rai Clear Sky Strategy

Clear Sky Strategy

was launched in October 2024 by Thailand, Lao PDR, and Myanmar.

-It is a joint action plan (2024–2030) to address **transboundary haze** and open burning.

Key focus areas include fire control, **hotspot reduction**, sustainable biomass and agriculture management, monitoring, and enforcement.

-The strategy is mainly **implemented** during the **dry/haze season** (January–April/May), with some measures extending through **November–April**, depending on air quality forecasts.

was launched in 2023 to address haze and PM2.5 pollution, focusing on openburning reduction and sustainable biomass management through

Collaboration among government, agencies, local authorities, communities, farmers, and youth.

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The **Chiang Rai Fa Sai Strategy** implements integrated actions across forest areas, agriculture, and urban zones, combined with public health protection and strict law enforcement, to reduce open burning, lower PM2.5 levels, and mitigate transboundary haze.

Leveraging JCM to Transform Agricultural Waste into Clean Energy in Chiang Rai

Central Biomass Facility

- Serves as a centralized hub for processing agricultural waste
- Focuses on corn residues and other local biomass sources

Pyrolysis Technology

- Converts organic biomass into **high-quality biochar**
- Biochar benefits:
- Improves soil water retention
- Enhances soil nutrients
- Supports microbial activity
- Sequesters carbon, reducing GHG emissions

Biomass Gasification

- Produces syngas for:
- Electricity generation
- Use as a renewable fuel, reducing reliance on fossil fuels

50% of agricultural waste (~16,800 ha) redirected to the biomass facility could prevent approximately 0.13 million tons CO$_2$ annually.

https://bioenergyinternational.com/groundbreaking-held-for-hau-giang-biomass-power-plant/