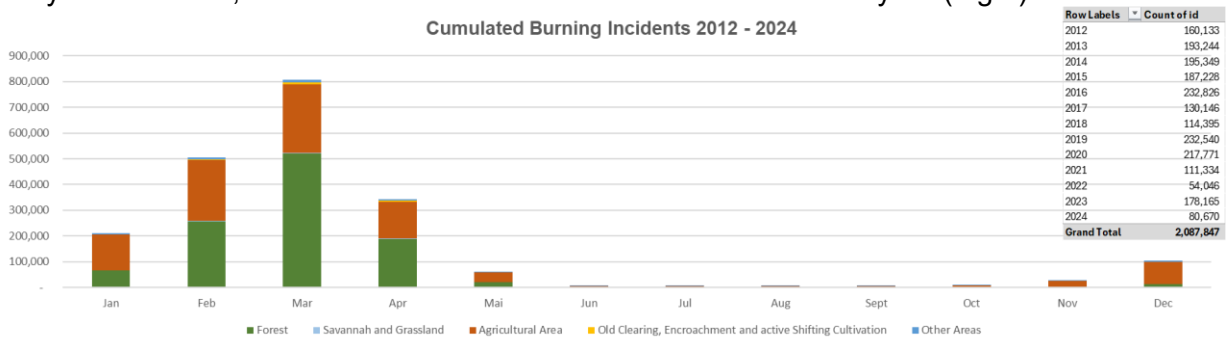
Backgound: Air Pollution, Open burning of Biomass, Corn Production 2023/2024 and estimate of residues at hilly terrains

The Fire Information for Resource Management System of the NASA (FIRMS, https://firms.modaps.eosdis.nasa.gov/map) displays burning incidents for Thailand throughout the year. However, most of the incidents occur in the first half of the year (Fig 1).



Row Labels	Count of id
2012	160,133
2013	193,244
2014	195,349
2015	187,228
2016	232,826
2017	130,146
2018	114,395
2019	232,540
2020	217,771
2021	111,334
2022	54,046
2023	178,165
2024	80,670
Grand Total	2,087,847

Fig.1: Data on Burning incidents from Source: https://firms.modaps.eosdis.nasa.gov mapped on GIS data on agricultural land use

PM2.5 emissions from biomass burning in Thailand was in the past released mainly from the Northeast and North part, followed by the Central and South region. Agricultural Burning and Wildfires contribute differently to the emissions from the regions (Fig. 2).

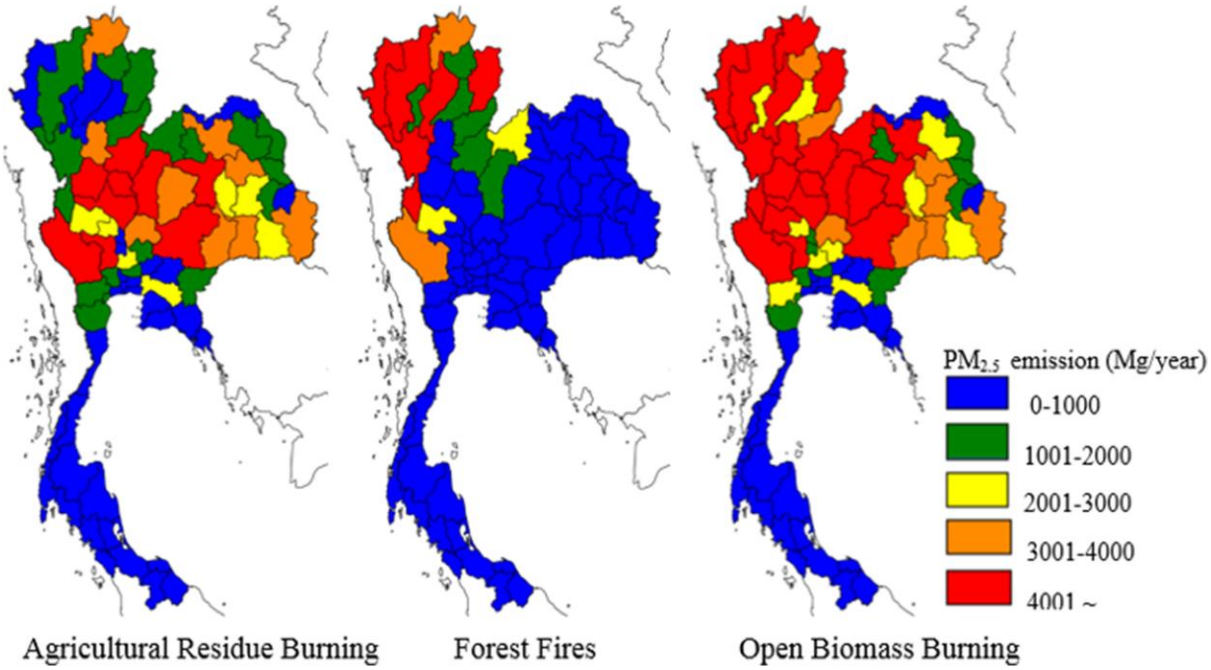


Fig.2: Source: Airborne particulate matter from biomass burning in Thailand: Recent issues, challenges, and options; Phuchiwan Suriyawong et al.; Article in Heliyon, March 2023

The emissions from agriculture result mainly from the burning of rice, sugarcane, and corn residues. Different sources judge the contribution to the overall emissions from agricultural burning of these three crops differently, but agree that the burning of rice residues is responsible for most of the emissions.

While mechanization might address the challenge of burning crop residues in the central and north-eastern lowlands, as well as in flat areas in northern Thailand, the same solutions might not be suitable in steep and uneven terrain. Thus, the AgriSpark Hackathon focuses on the burning challenges on hilly terrain, and corn as the most prominent crop burned in this area.

As an orientation for the applicants of the AgriSpark Hackathon we have tried to display the locations and assess the amount of corn residues from hilly terrains in the Northern Uplands of Thailand.

As per the Agricultural Statistics of Thailand 2023 from the Office of Agricultural Economics in the year 2023 6,667,442 rai of corn were harvested with a production of 4,954,166 mt of Corn. Based on several sources, the amount of residues (corn straw / stover), removable from the field, is estimated to be around 450 kg/ rai, leading to an overall available amount of 2,208,776 M of crop residues for Thailand (Table 01).

Table 01:

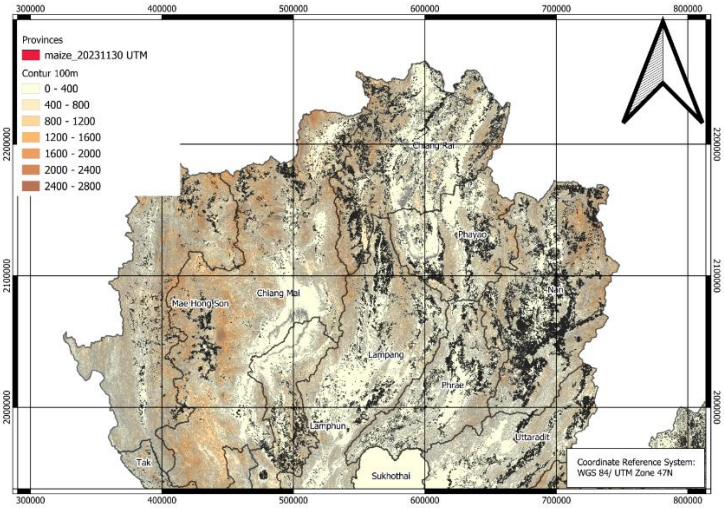
Corn at Thailand	Item	Unit	2023	Source
Production	Area	rai	6,667,442	Office of Agricultural Economics, Agricultural Statistics of Thailand 2023
	Volume	mt	4,954,166	Office of Agricultural Economics, Agricultural Statistics of Thailand 2023
	Yield	mt/rai	0.74	Calculation
Residues	Volume	mt	2,208,776	Calculation
	Yield	mt/rai	0.45	Estimate on residue volume (mt/ rai) and recovery (%), web and discussion with farmers

Most of the corn is grown in the northern provinces (Table 02, Map 01):

Table 02:

Corn at Northern Thailand	Item	Unit	2023	Source
Production	Area	rai	4,509,278	Office of Agricultural Economics, Agricultural Statistics of Thailand 2023
	Volume	mt	3,350,711	Office of Agricultural Economics, Agricultural Statistics of Thailand 2023
	Yield	mt/rai	0.74	Calculation
Residues	Volume	mt	2,010,427	Calculation
	Yield	mt/rai	0.45	Estimate on residue volume (mt/ rai) and recovery (%), web and discussion with farmers

Map 01: Locations of corn production in northern Thailand in 2023



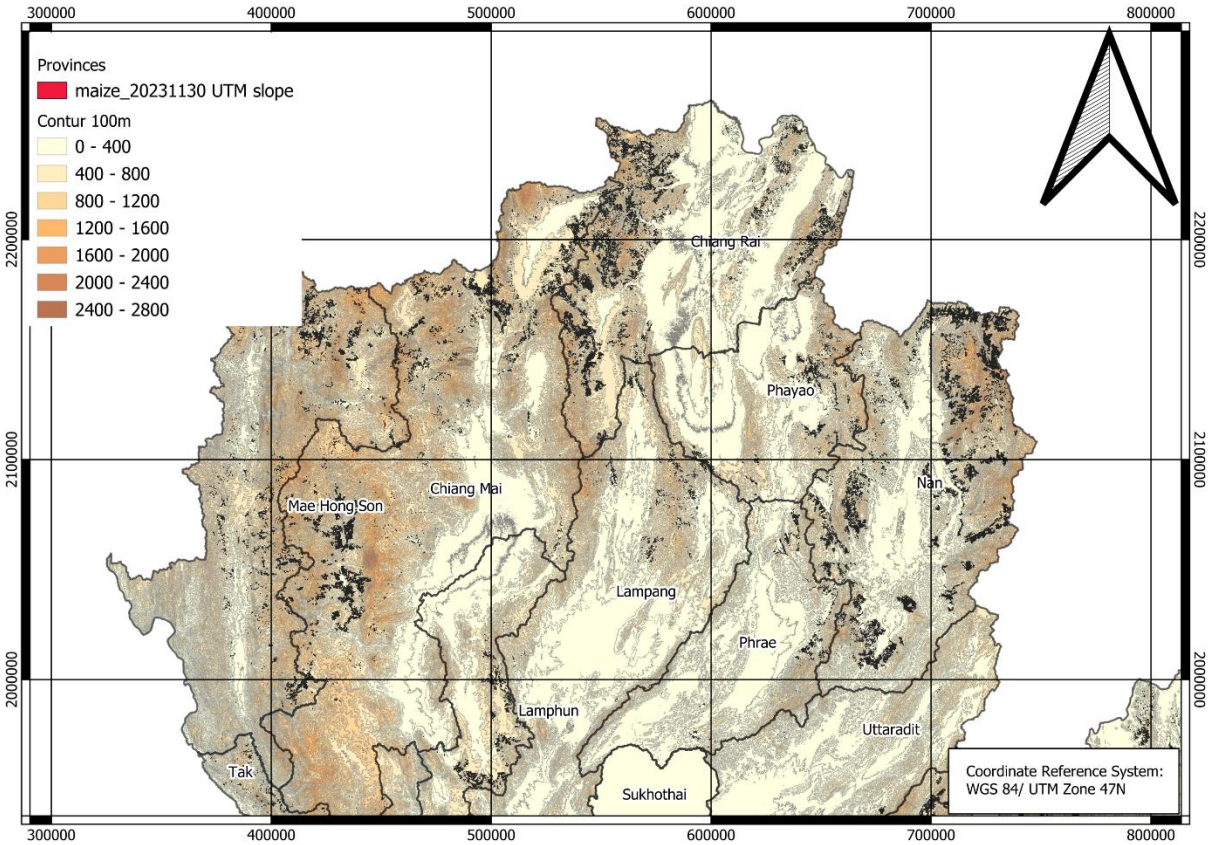
Source: Department of Agricultural Extension,
GIS mapping of available data)

For the challenges of this Hackathon the areas with flat terrain are not relevant. It focuses on the challenges of use cases to add value to the residues from corn production in areas with hilly terrain in northern Thailand. Depending on the degree and the evenness of the slope plowing of fields to incorporate the residues might be an option also on hilly terrain. For the mapping of the production area on hilly terrains in northern Thailand and for the calculation of the corn production area and volume as well as the amount of residues a slope greater than 14 degrees (25%) was used for filtering the displayed locations. Using the data of the Office of Agricultural Economics and available GIS data the area of corn production on hilly terrain in northern Thailand is estimated around 1,000,000 rai with an amount of removable residues of around 320,000 MT (Table 03, Map 02).

Table 03:

Corn at Nothern Slopes	Item	Unit	2023	Source
Production	Area	rai	942,555	Estimate based on Office of Agricultural Economics, Agricultural Statistics of Thailand 2023 and GIS Mapping of Corn production area from 2023
	Volume	mt	700,355	Calculation
	Yield	mt/rai	0.74	Calculation
Residues	Volume	mt	312,248	Calculation
	Yield	mt/rai	0.45	Estimate on residue volume (mt/ rai) and recovery (%), web and discussion with farmers

Map 02: Locations of corn production on hilly terrain in northern Thailand in 2023



Source: Department of Agricultural Extension,
GIS mapping of available data)