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Inventories, Monitoring and Mitigation
Hanoi, 1st – 3rd February, 2023

Status of Biomass Burning in Lao PDR

Chittana Phompila

Faculty of Forest Science, NUoL

Some of the works!
Krishna and colleagues
& PhD research student

An Overview of Satellite Derived Fire Statistics in Laos Krishna Vadrevu^{*}, Chittana Phompila[^] and Aditya Eaturu[†]

^{*}NASA Marshall Spaceflight Center, Huntsville, Alabama

[^]Faculty of Forest Sciences (FFS), National University of Laos (NUoL), Laos

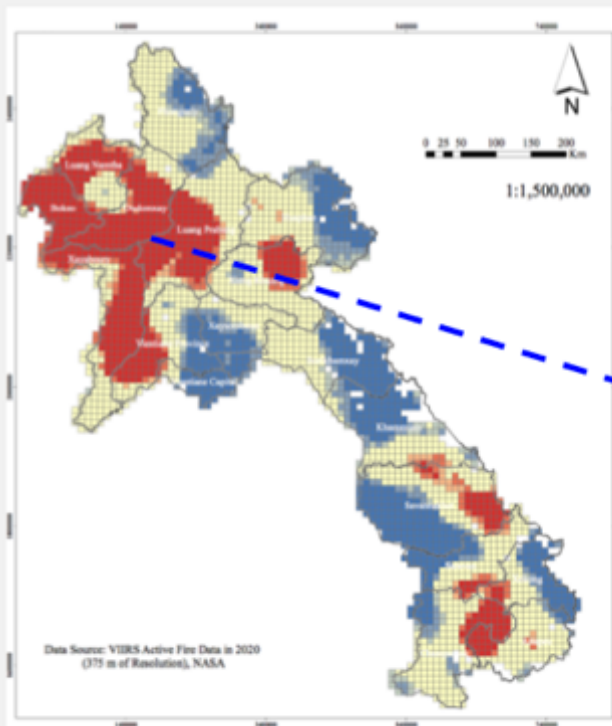
[†]University of Alabama Huntsville, Alabama, USA

Corresponding author

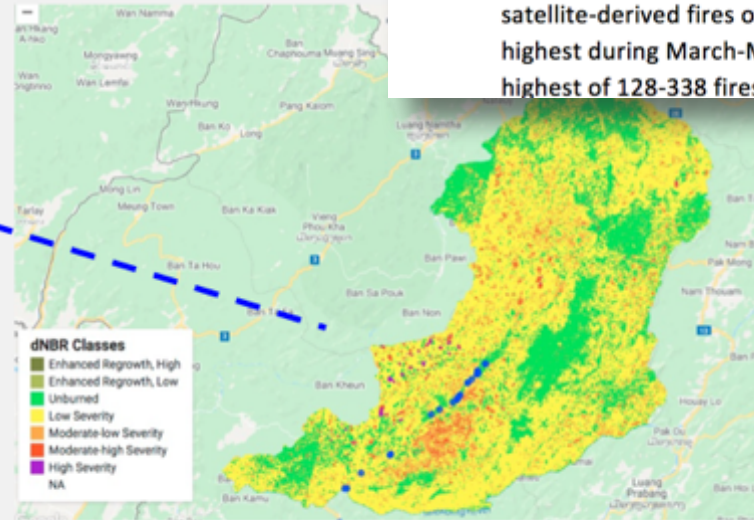
Krishna Vadrevu: krishna.p.vadrevu@nasa.gov

Abstract

Of the different countries in Southeast Asia, Laos had the most recurrent fires. This study highlights the vegetation fire characteristics in Laos using various satellite datasets. The European Space Agency [Worldcover](#) (10m) data in Laos suggested tree cover as the dominant class with 78.2%, followed by grasslands (12.8%), croplands (7.29%), and with the least percentage of built-up areas (0.31%). These land cover statistics suggest that the country still has rich tree cover, which is under threat due to various drivers of change, including fires. VIIRS satellite-derived fires over Laos for 10 years suggested a mean of 138934 fire counts, with the highest during March-May every year. The spatial patterns suggested a mean of 0-23 and the highest of 128-338 fires per 5-minute grid cells. Similarly, the fire radiative power (FRP) varied



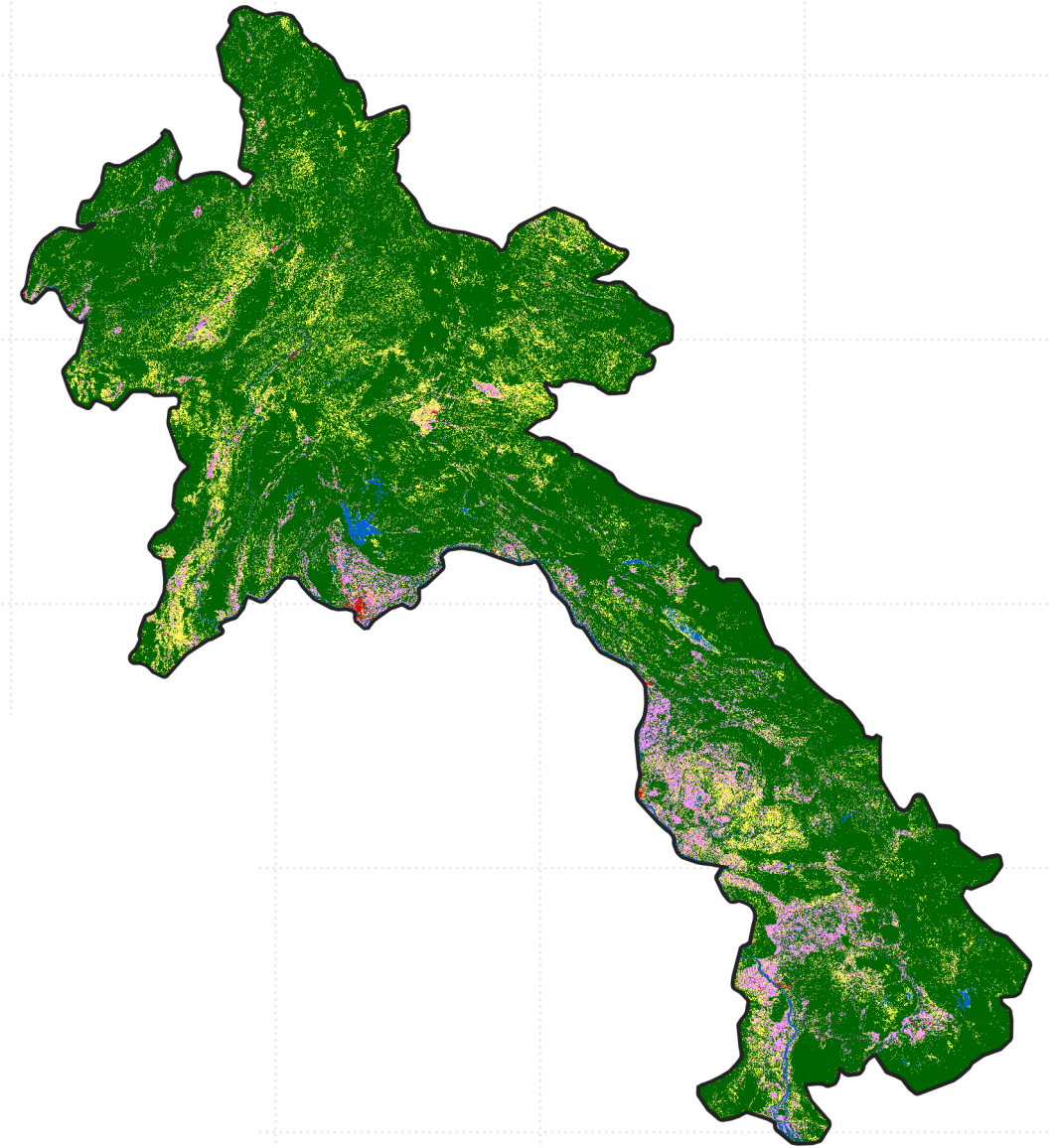
- dNBR identifying occurred in 2020
- Land preparation



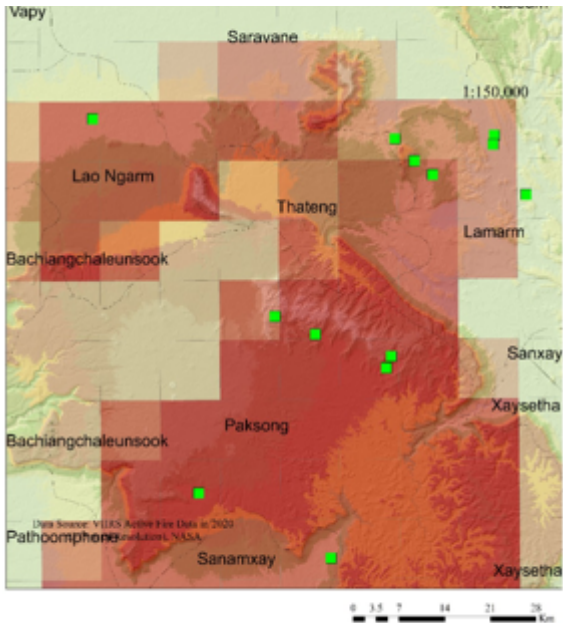
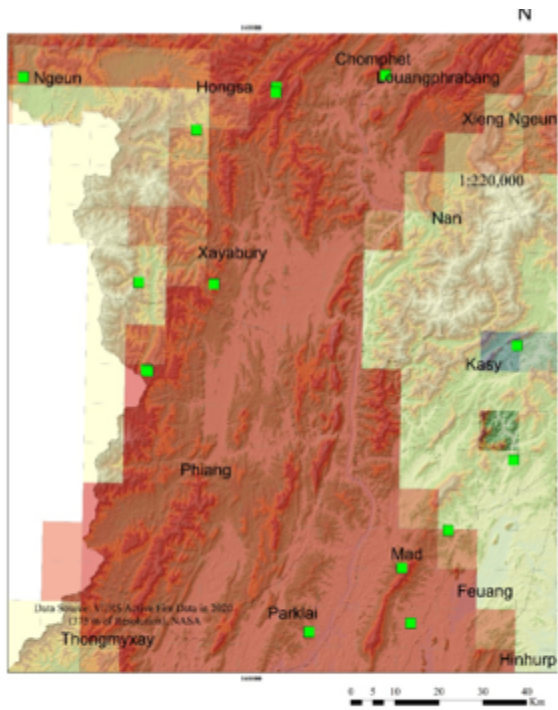
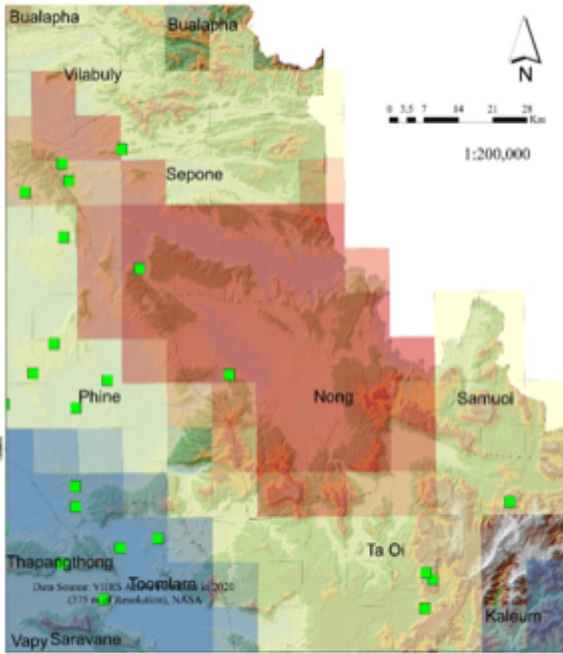
<https://www.sciencedirect.com/science/article/abs/pii/S2352938521000264>

Laos is one of the richest biodiversity countries in Southeast Asia.
Its forest cover > **62%** of the total land cover (*DoF, 2019*).

- Mixed deciduous forest; mixed C and broadleaved ~ 10 mil. ha (42,3%)
- Evergreen forest ~2.87 mil. ha (12.2%)
- Dry dipterocarp forest ~ 1,3 mil. ha (5.5%)

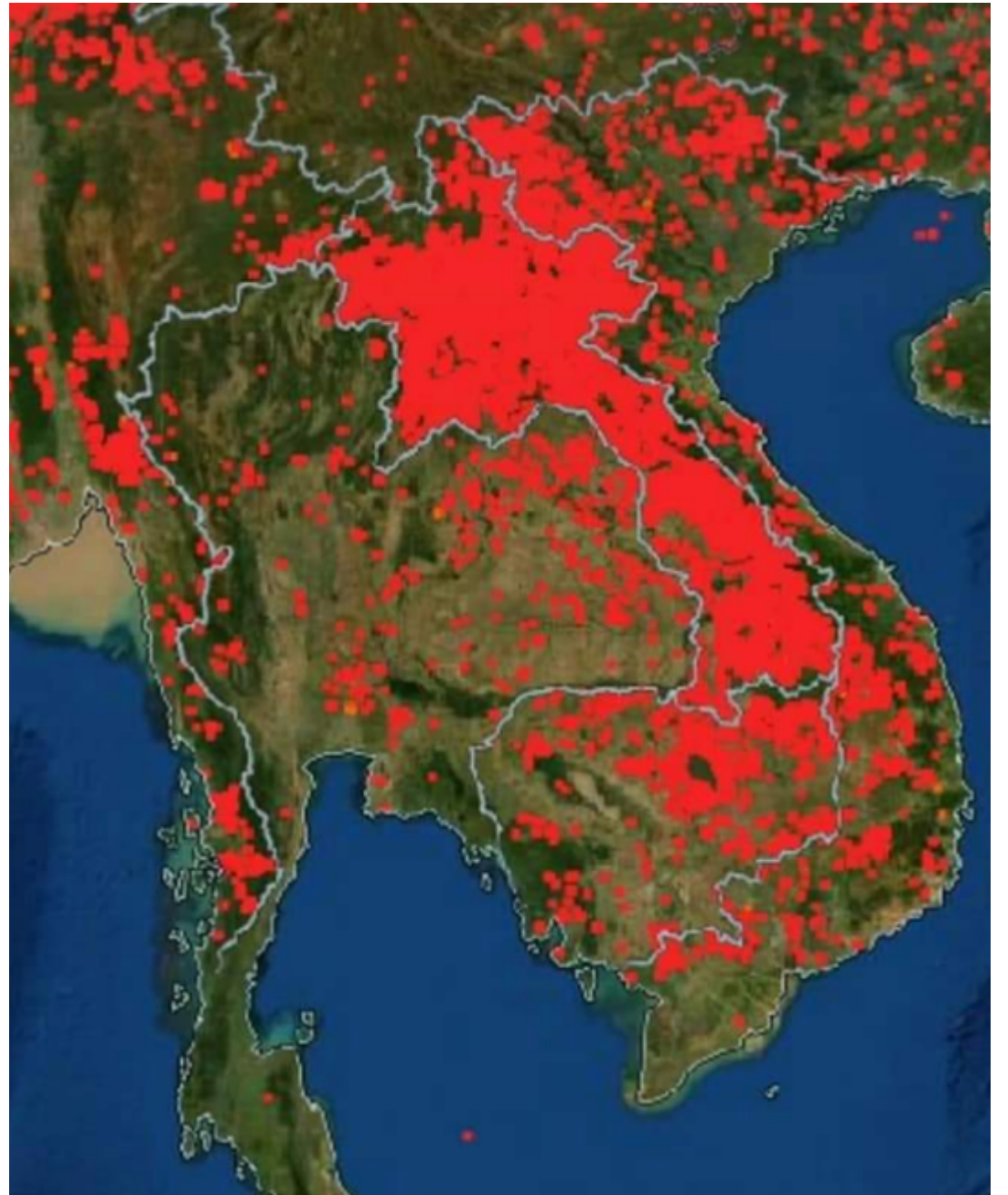


0 100 200 km



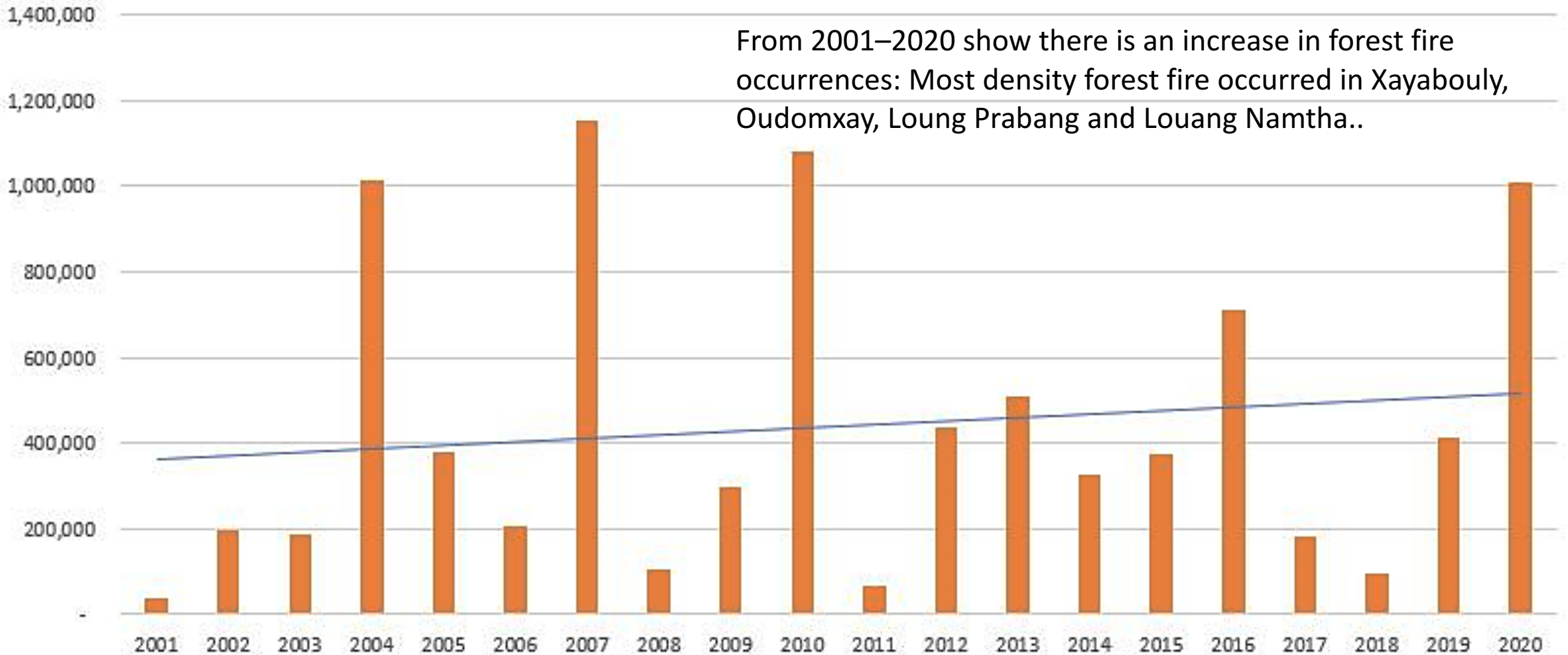
However, Laos is also one of the hotspots of forest fire occurrences

From MODIS or VIIRS

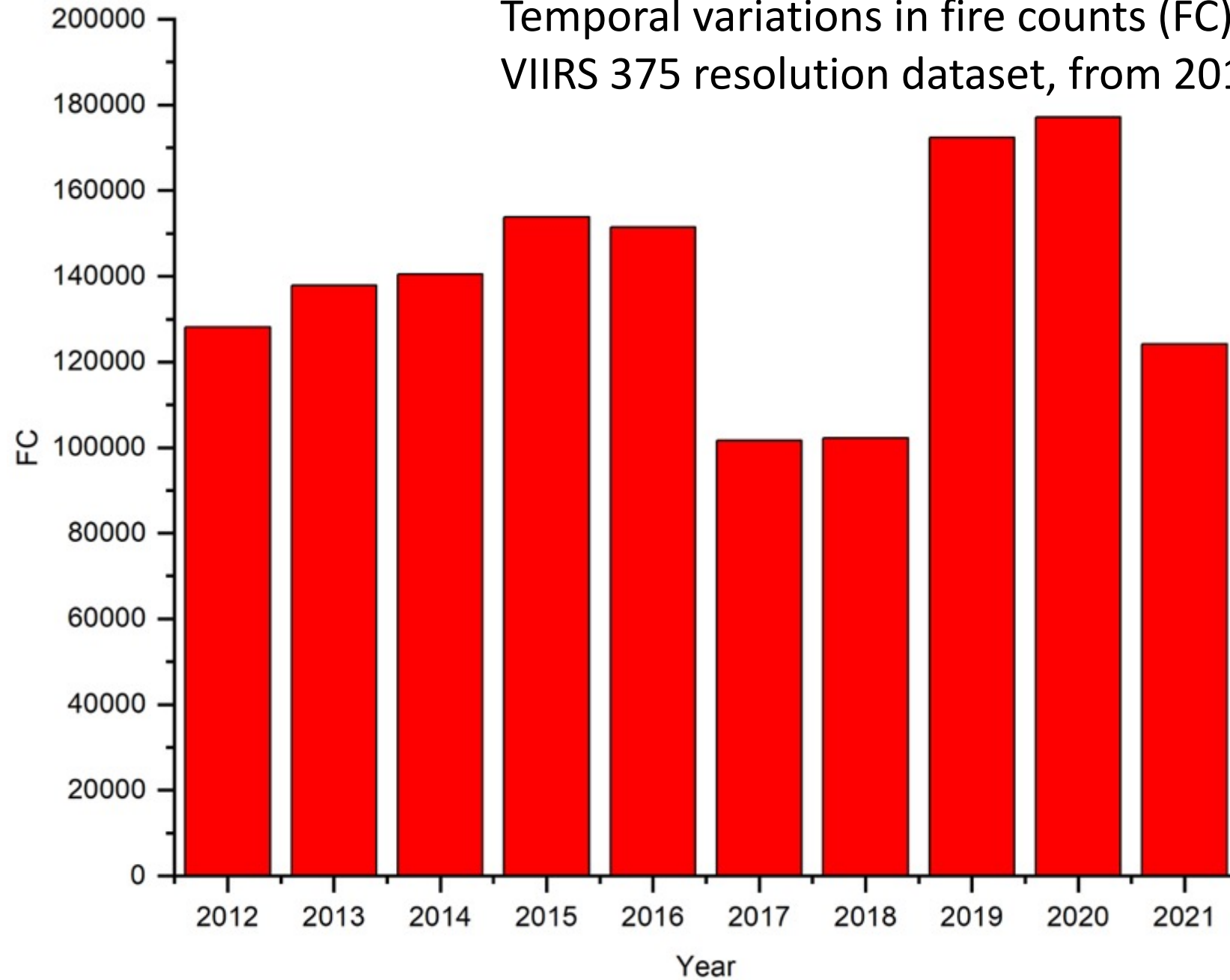


Overall Trend of Forest Fires in Laos: 20 years

Annual Burned Area (Ha)



Temporal variations in fire counts (FC) derived from VIIRS 375 resolution dataset, from 2012-2021



Forest Fire has potential impacts:

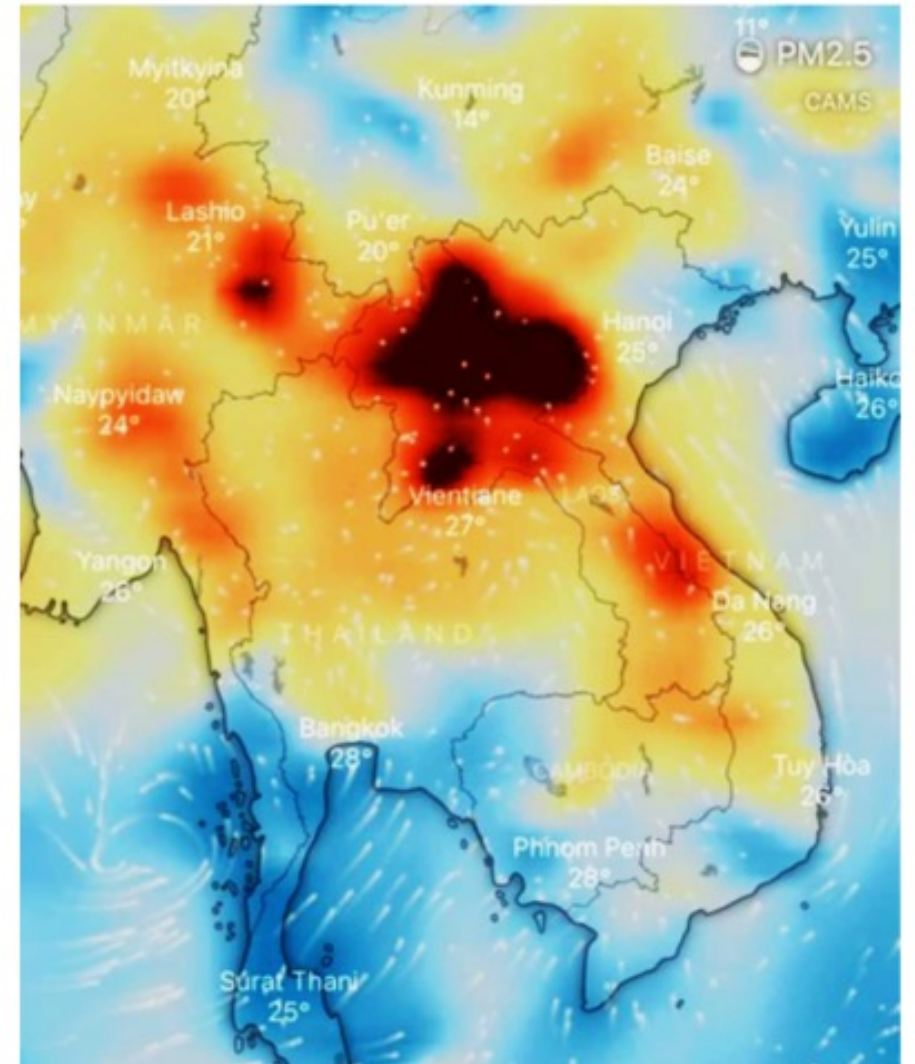
- *Loss of biodiversity*
- *Wildlife habitats*
- ***Air pollution***
- *However, a lack of forest fire monitoring system; limited technical and financial capacity*



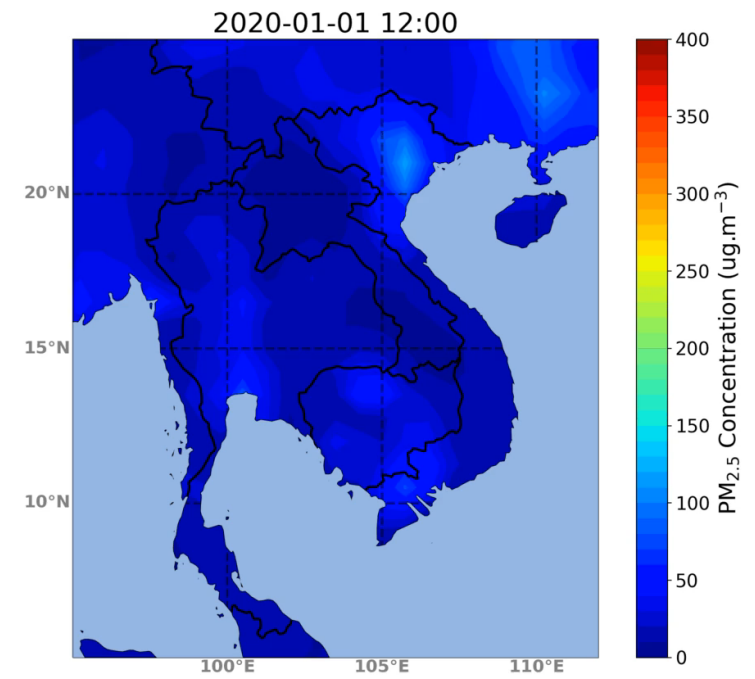
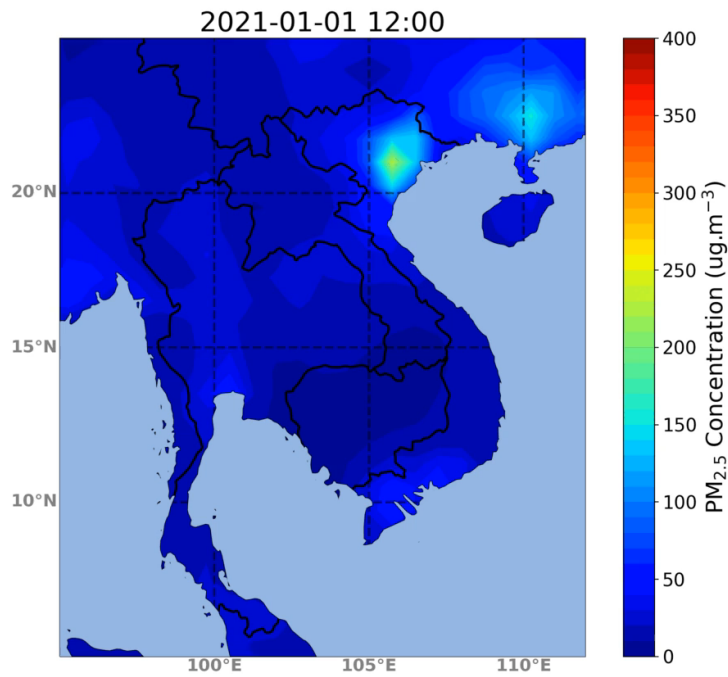
Its potential impact on air quality

- Highly concentration of PM2.5 in the north

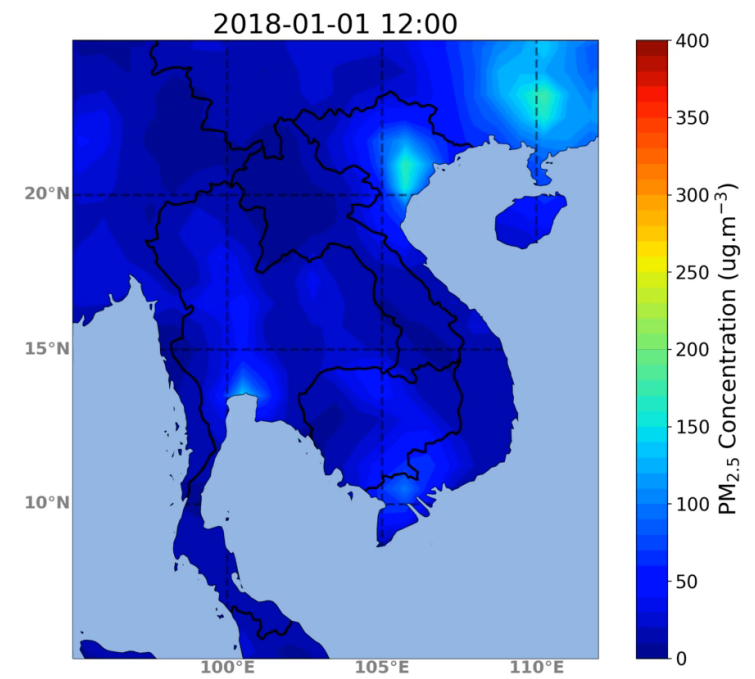
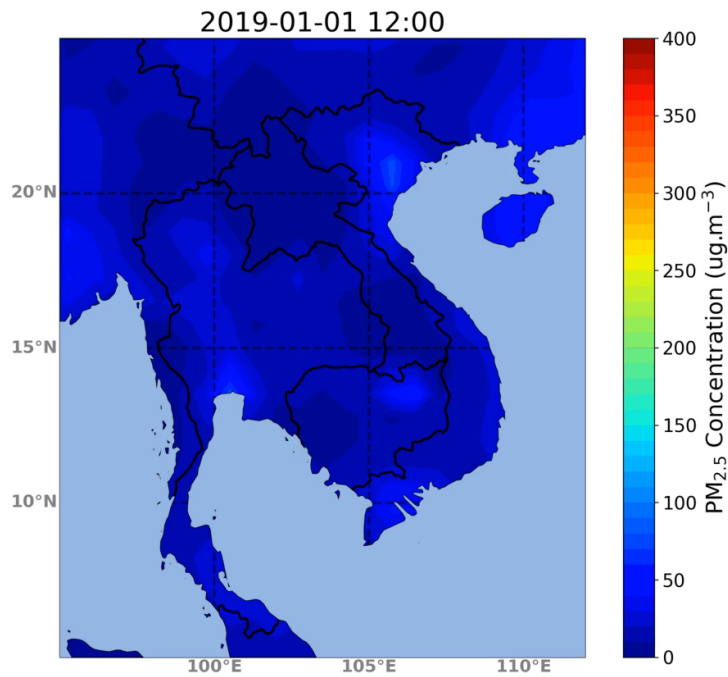
Some model data showing PM2.5 concentrations over southeast Asia for the last few years (King's Collage London).



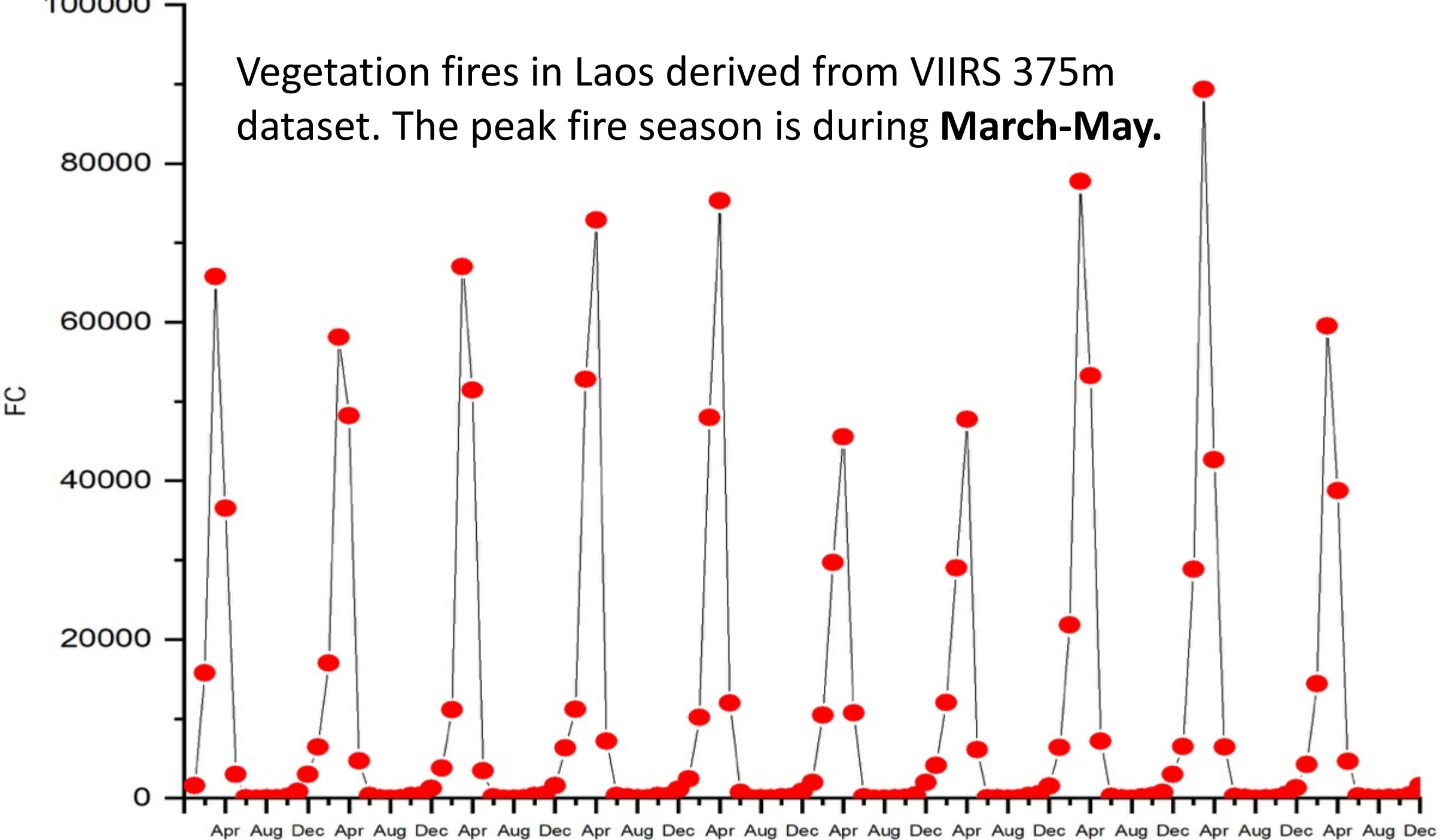
<https://aqicn.org/map/asia/>

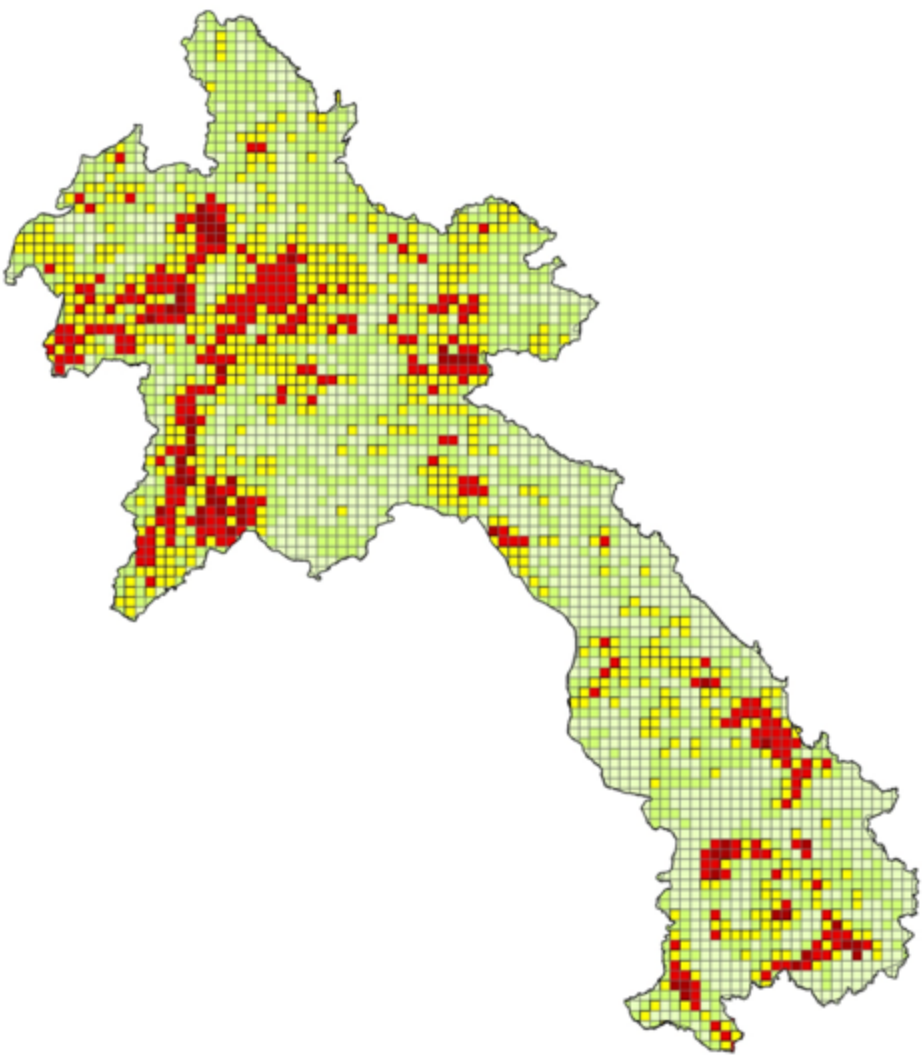


Source: KCL, 2022

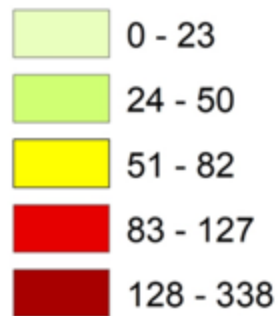


Vegetation fires in Laos derived from VIIRS 375m dataset. The peak fire season is during **March-May**.

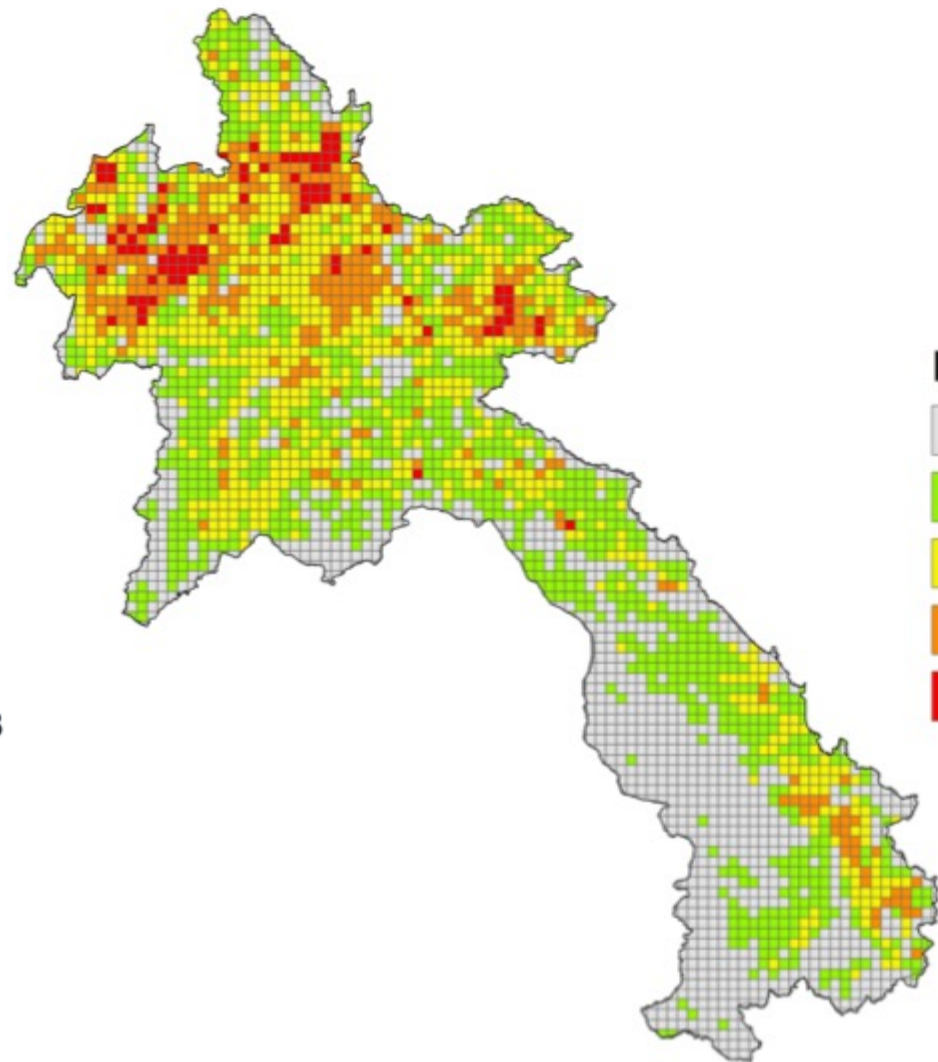




Mean FC



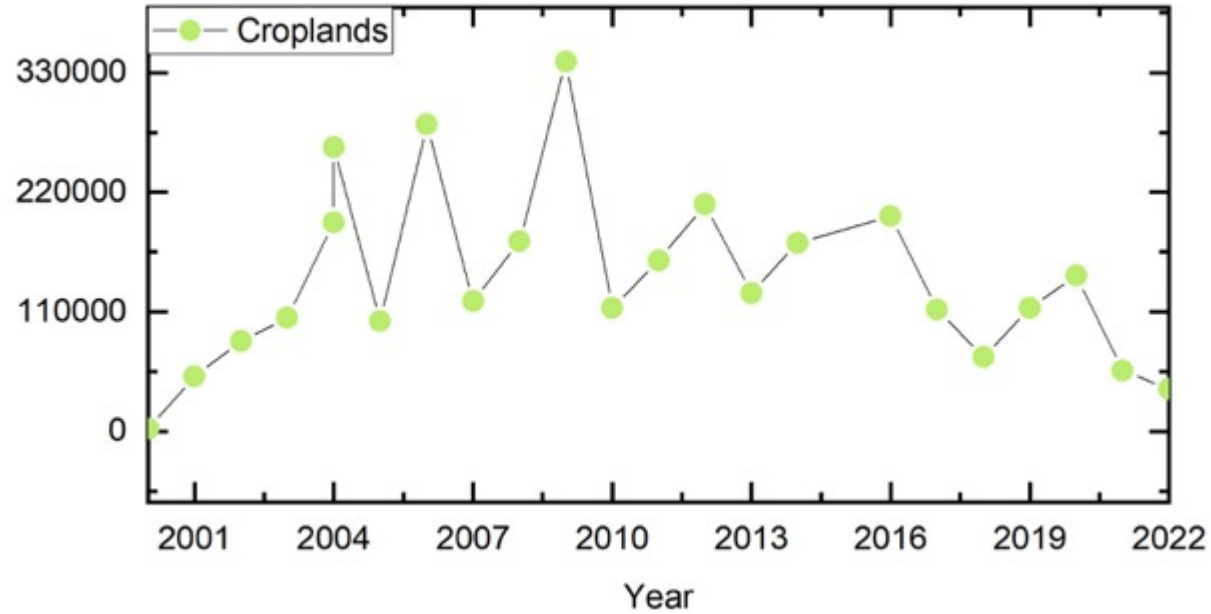
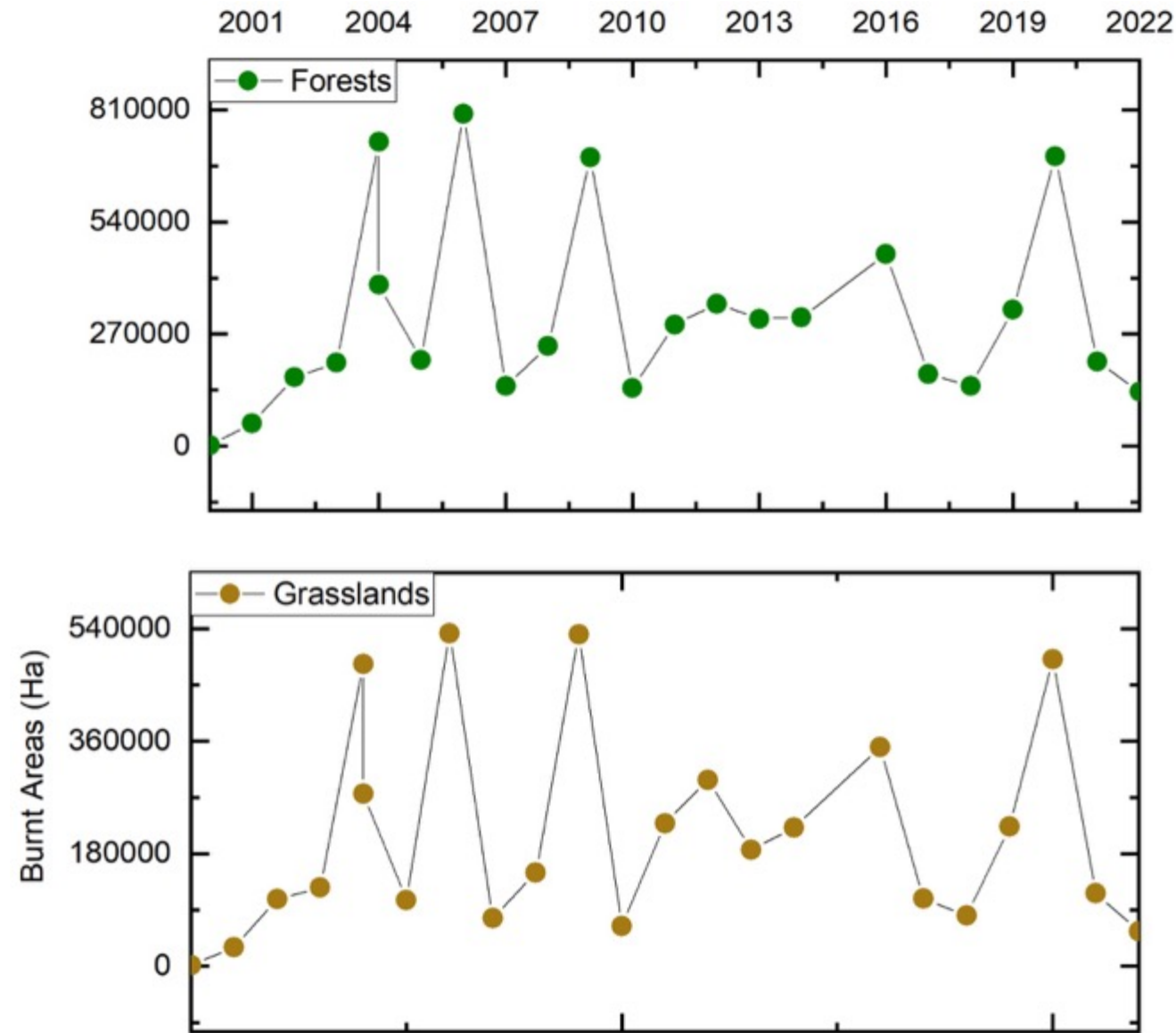
0 50 100 200 300 400 Miles



FRP_Mean



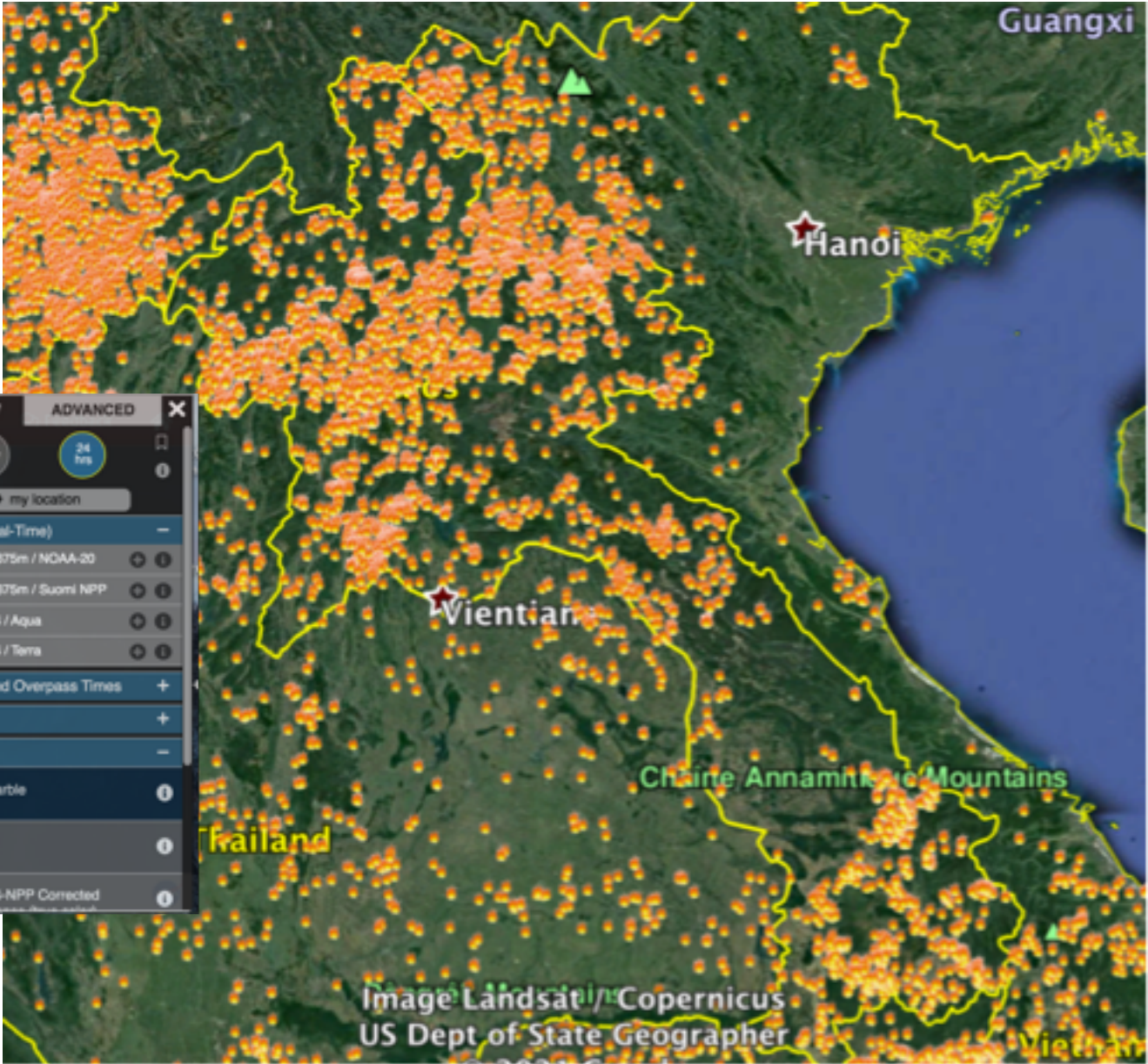
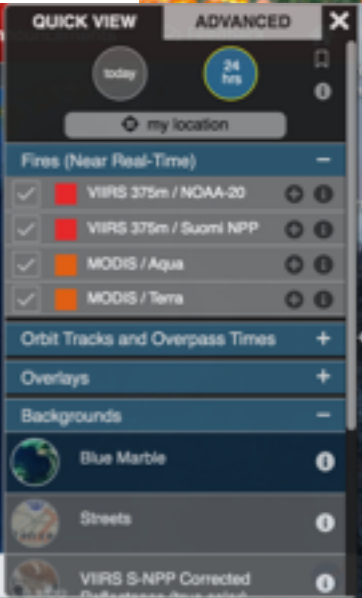
0 50 100 200 300 400 Miles



MODIS derived burnt areas (in ha) in Laos; Forests had the highest annual burnt areas followed by grasslands and croplands.

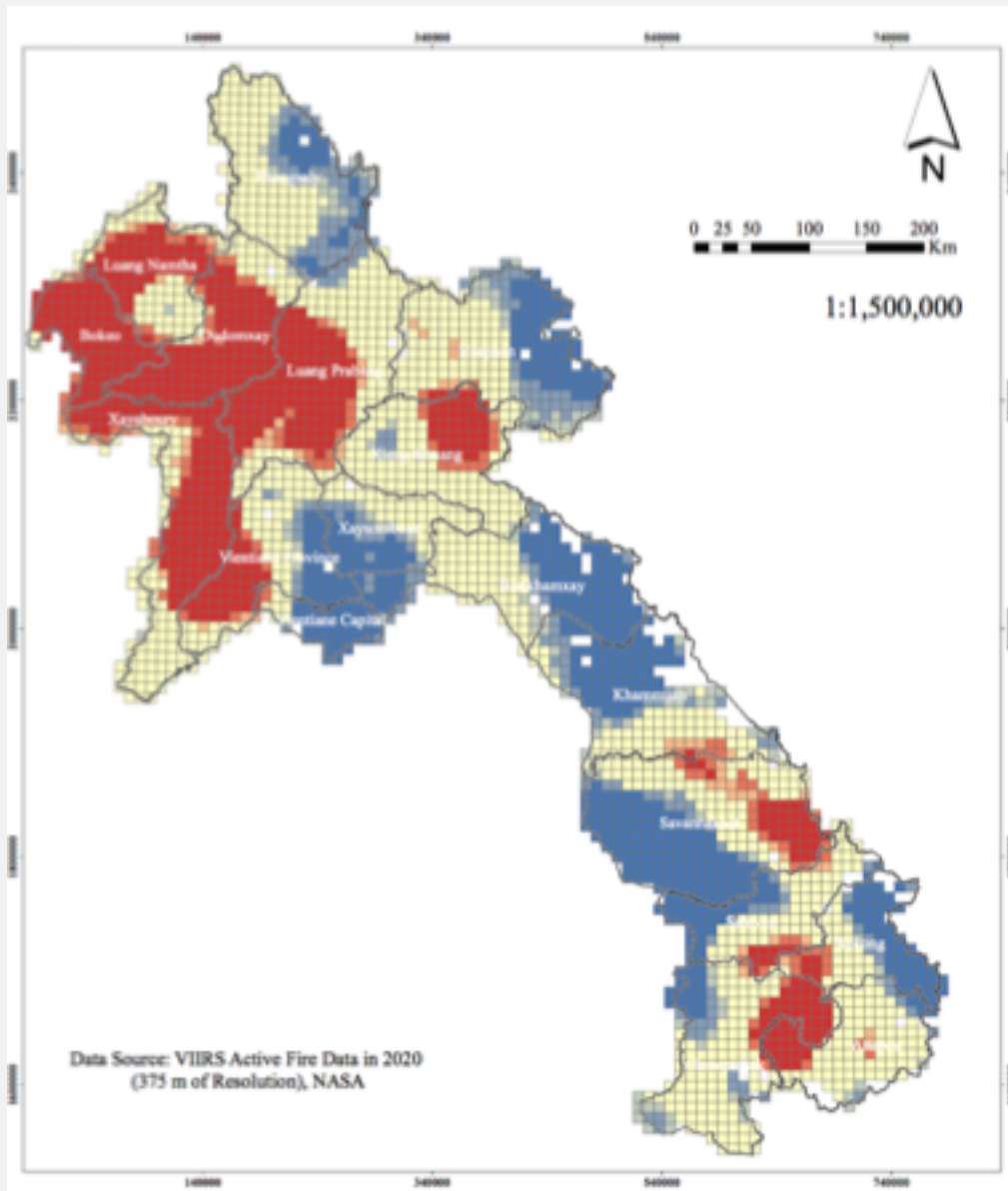
Mapping Approach Used

MODIS + VIIRS



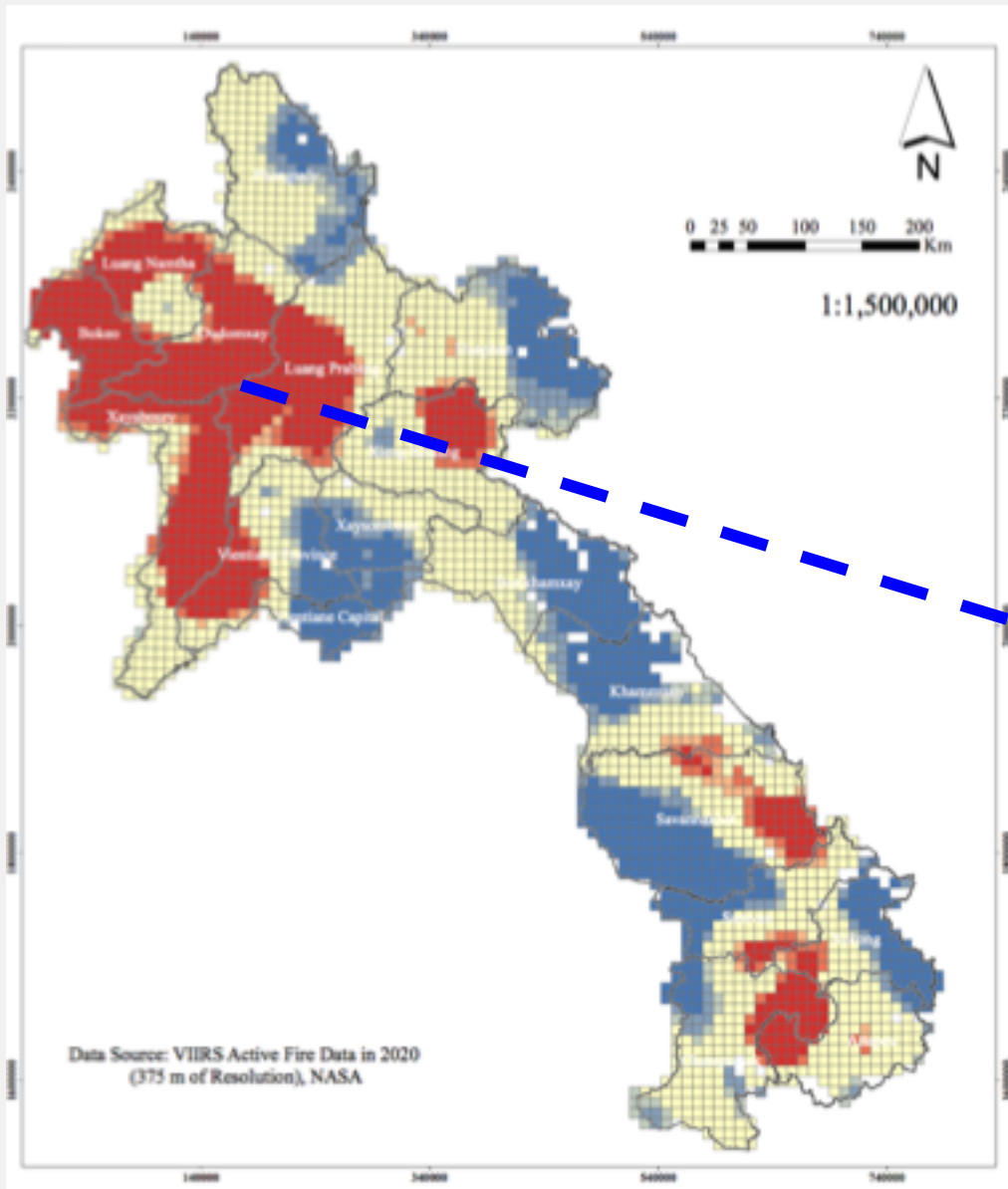
<https://firms2.modaps.eosdis.nasa.gov/>

From Hotspot Maps

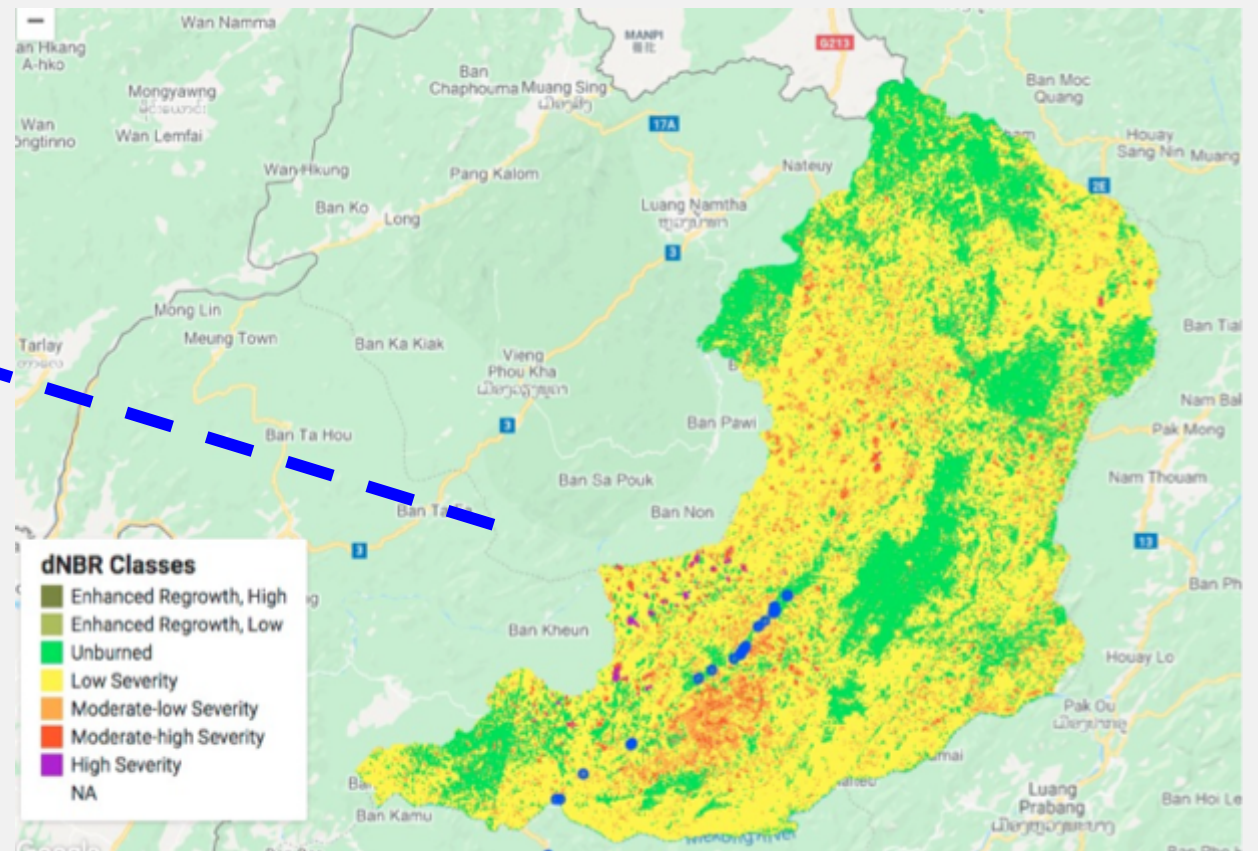


- *VIIRS data 2016, 2018 and 2020 (Jan-Apr) were used hotspot maps (375 m resolution)*
- *This indicates forest fires in the north of Laos*
- *Burned areas were estimated at national scale*

Zoom in Burned Areas



- *dNBR identifying Fire incident occurred in 2020 (Jan-Mar)*
- *Land preparation for upland cultivation*



Burned Area Maps

- Sentinel Data Analysis using a standard approach:
- <https://www.sciencedirect.com/science/article/abs/pii/S2352938521000264>



A rapid assessment of burned areas in Nam Kading National Biodiversity Conservation Area (NBCA), Laos

Barkham Chanthavong ^{1,2}, Chittana Phompila ^{3,4,5,6}, Phung Van Khoa ⁴, Keigo Noda ⁴, Sithong Thongmanivong Houngphet Chanthavong ^{*}

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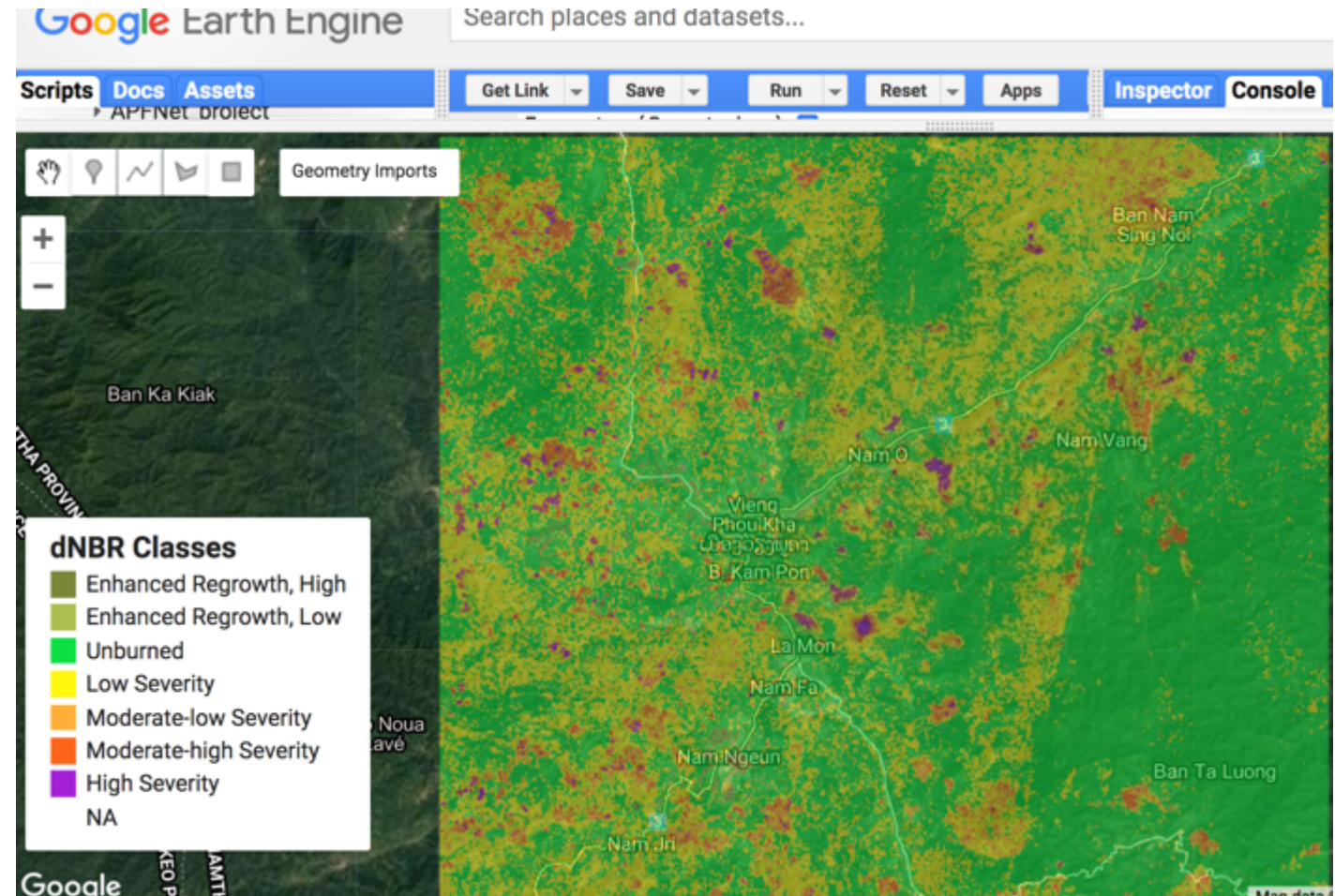
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<https://doi.org/10.1016/j.rsase.2021.100490>

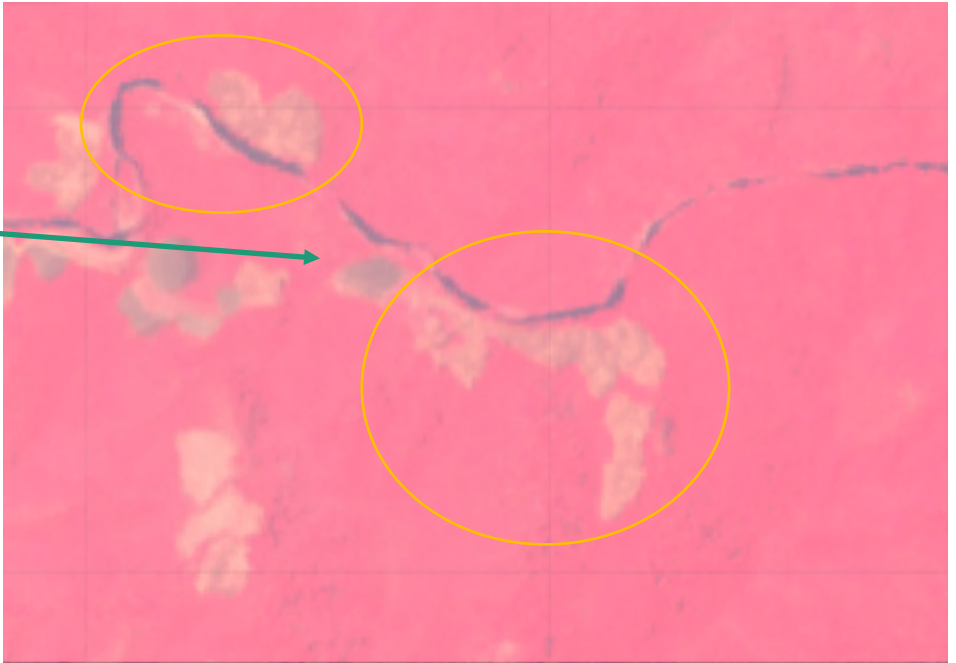
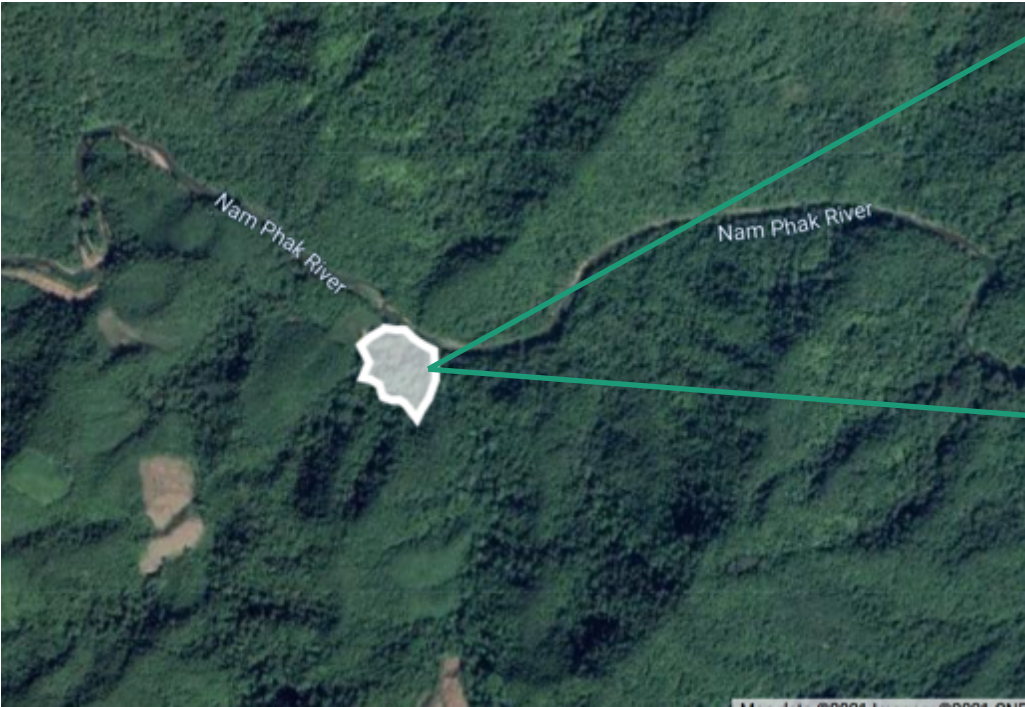
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Abstract

Severity of natural hazards and related disasters are increasing worldwide. Of the several disasters, forest fires are most common in South/Southeast Asia including Laos. In this study, we use the satellite imagery to detect forest fires in the prior to forming and to quickly estimate the total area of forest burned due to the farmers'



Sentinel 2 data (Optical Sensor)

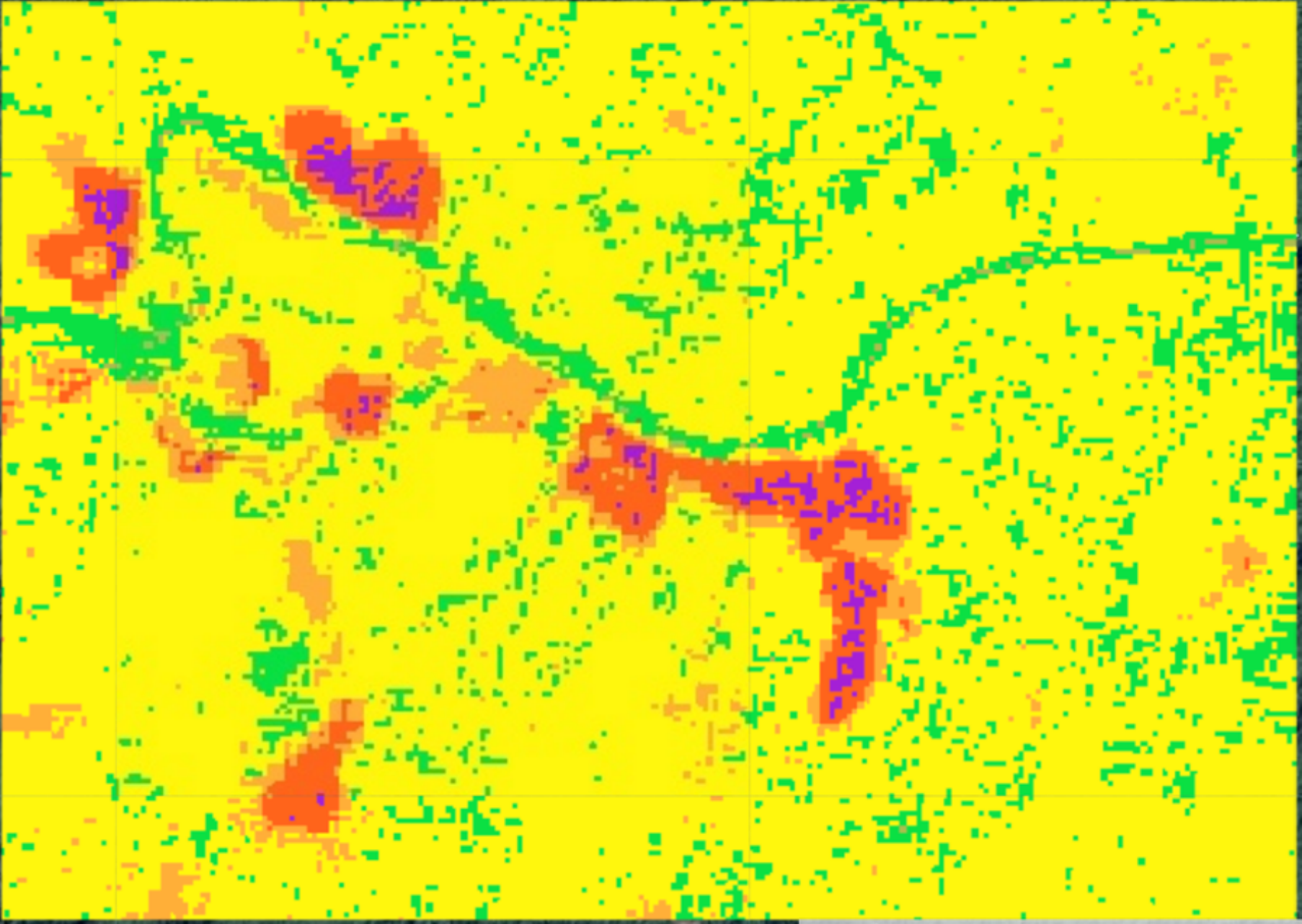




Geometry Imports



Nam Phak River



dNBR Classes

- Enhanced Regrowth, High
- Enhanced Regrowth, Low
- Unburned
- Low Severity
- Moderate-low Severity
- Moderate-high Severity
- High Severity
- NA



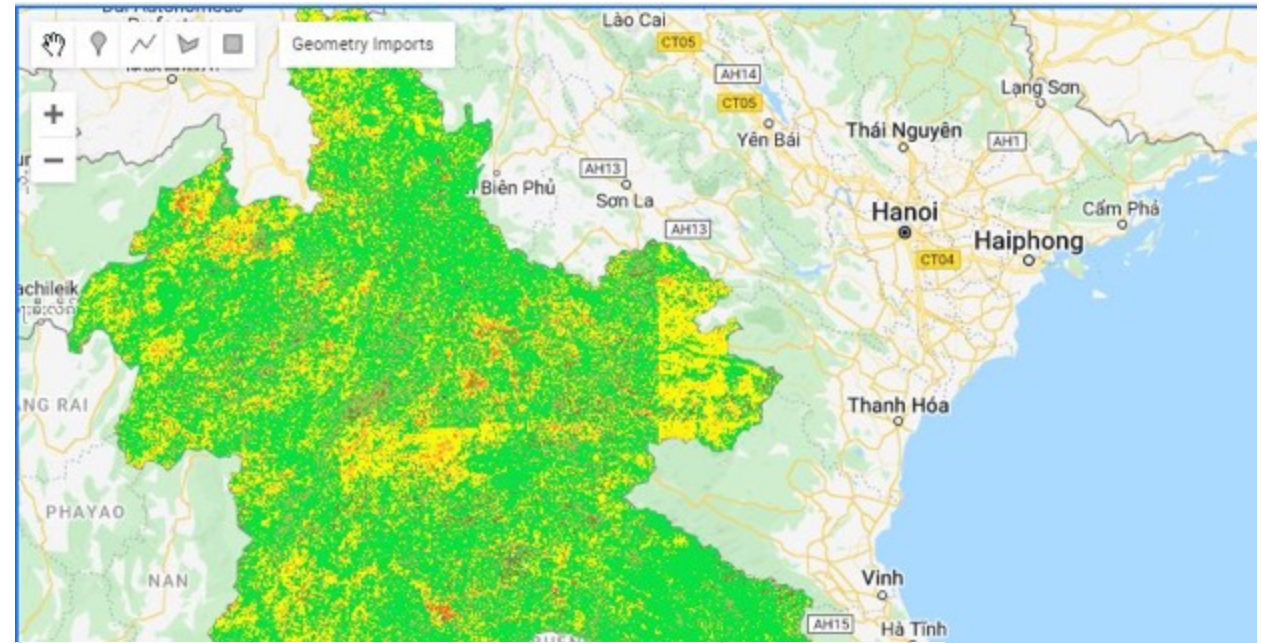




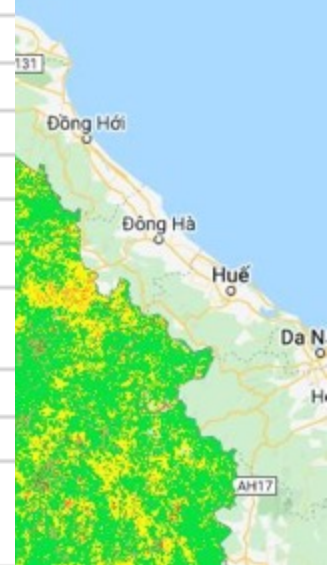
Applying d-NBR

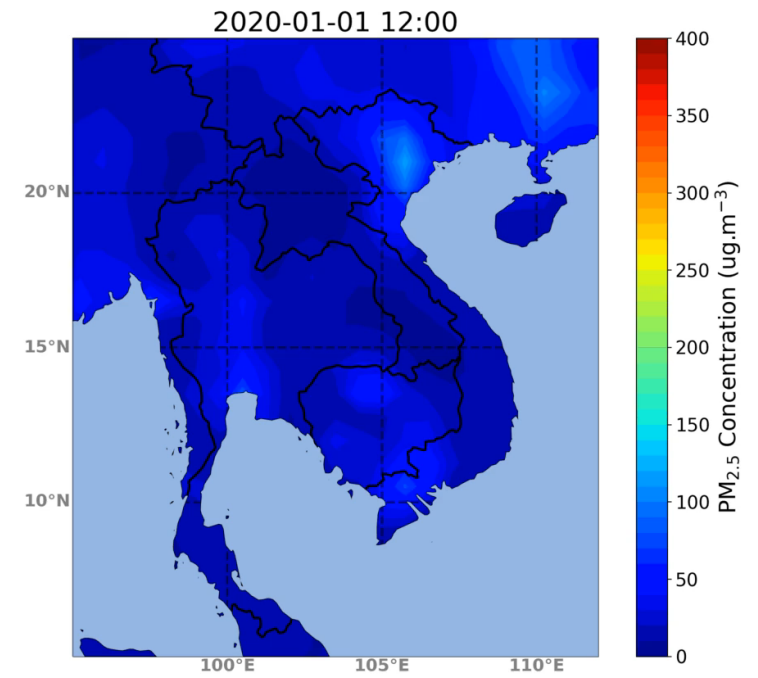
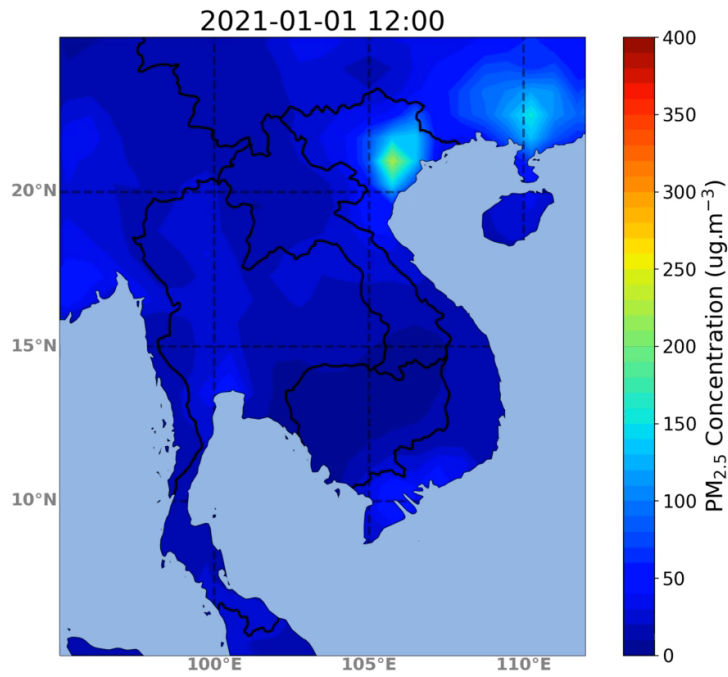
Overlaying with forest cover map (2020);

1. Regenerating Vegetation (138k) &
2. Mixed Deciduous Forests (114k);
3. Evergreen Forests (12k)

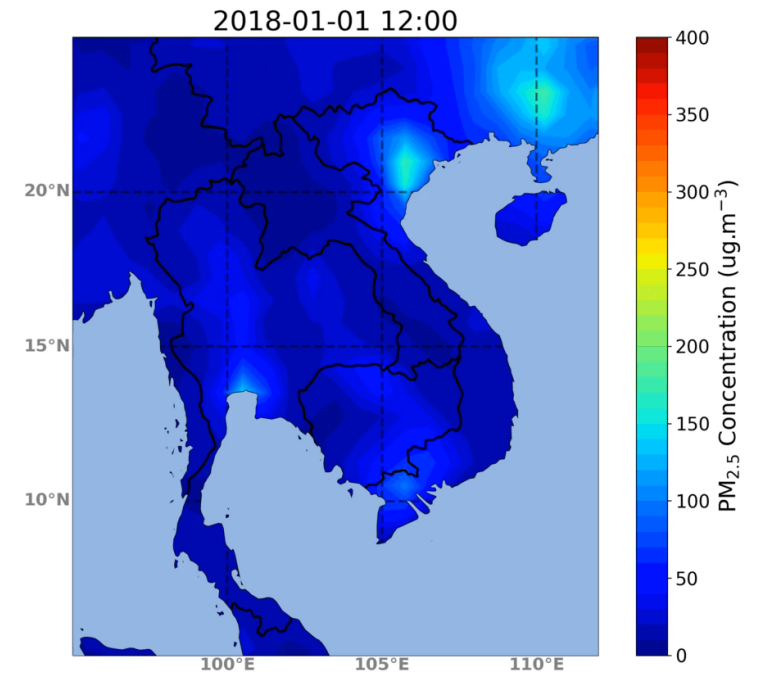
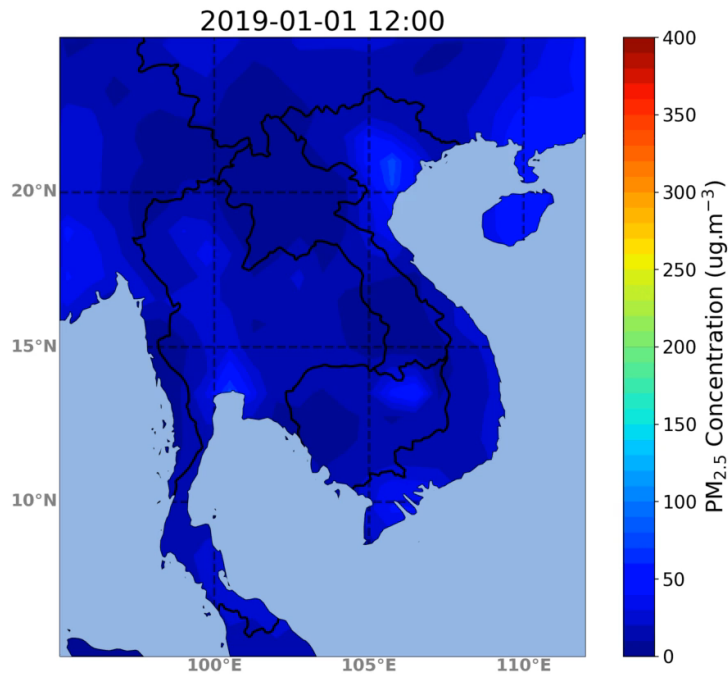


IPCC Definition	National Level Classification System for Lao PDR			High Severity Burned Areas in 2020		
	Level 1	Level 2	Code	Hectars	%	
Forest Land	Current Forest	Evergreen Forest	EF	11	12,035.85	0.05
		Mixed Deciduous Forest	MD	12	114,330.87	0.48
		Dry Dipterocarp Forest	DD	13	98.87	0.00
		Coniferous Forest	CF	14	404.64	0.00
		Mixed Coniferous and Broadleaved Forest	MCB	15	278.20	0.00
		Forest Plantation	P	16	1,947.09	0.01
	Regenerating Vegetation	Bamboo	B	21	1,445.69	0.01
		Regenerating Vegetation	RV	22	138,207.35	0.58
	Savannah	SA	31	-	-	



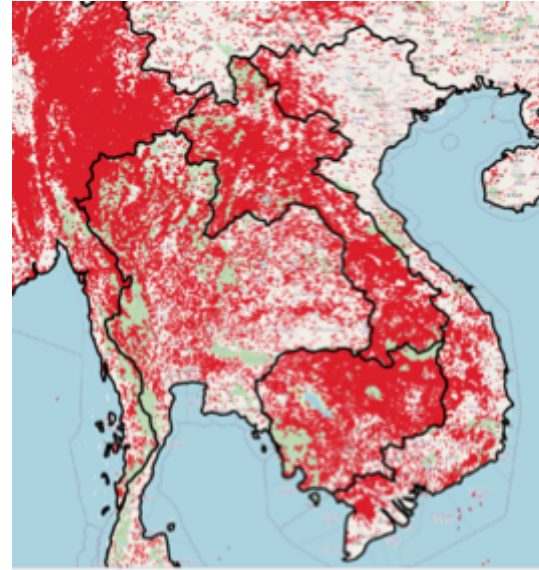
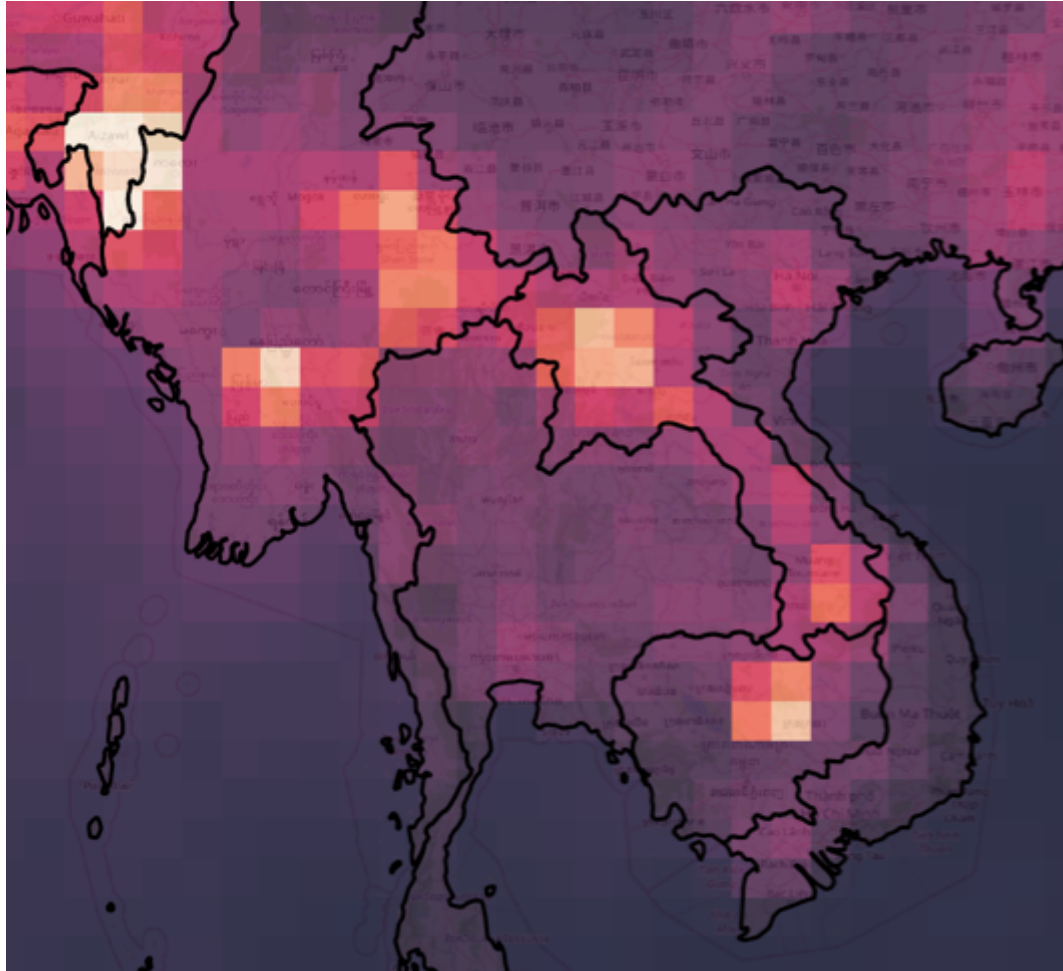


Source: KCL, 2022



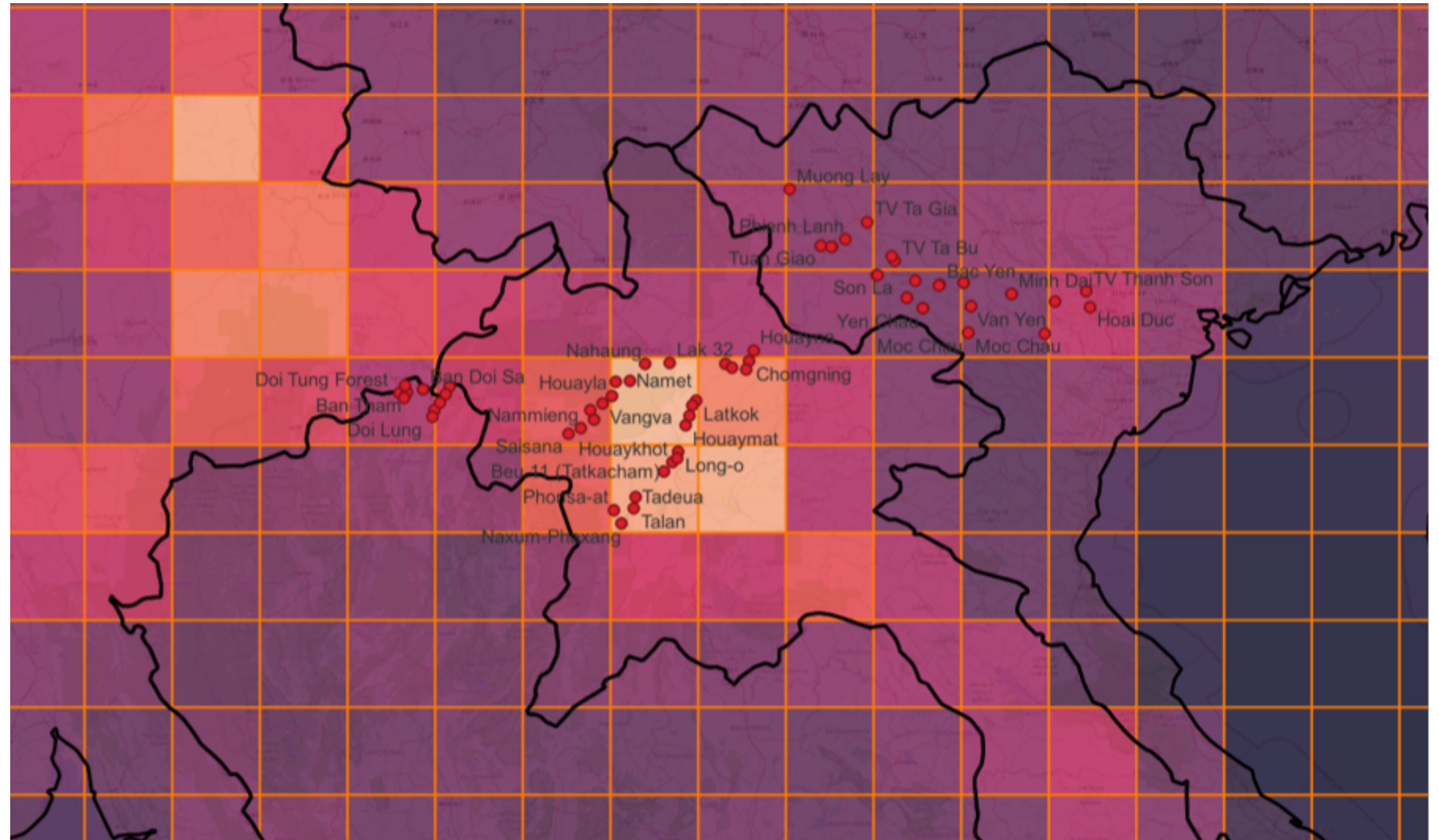
CAMS_pm2.5_2021_median_March

Band 1 (Gray)

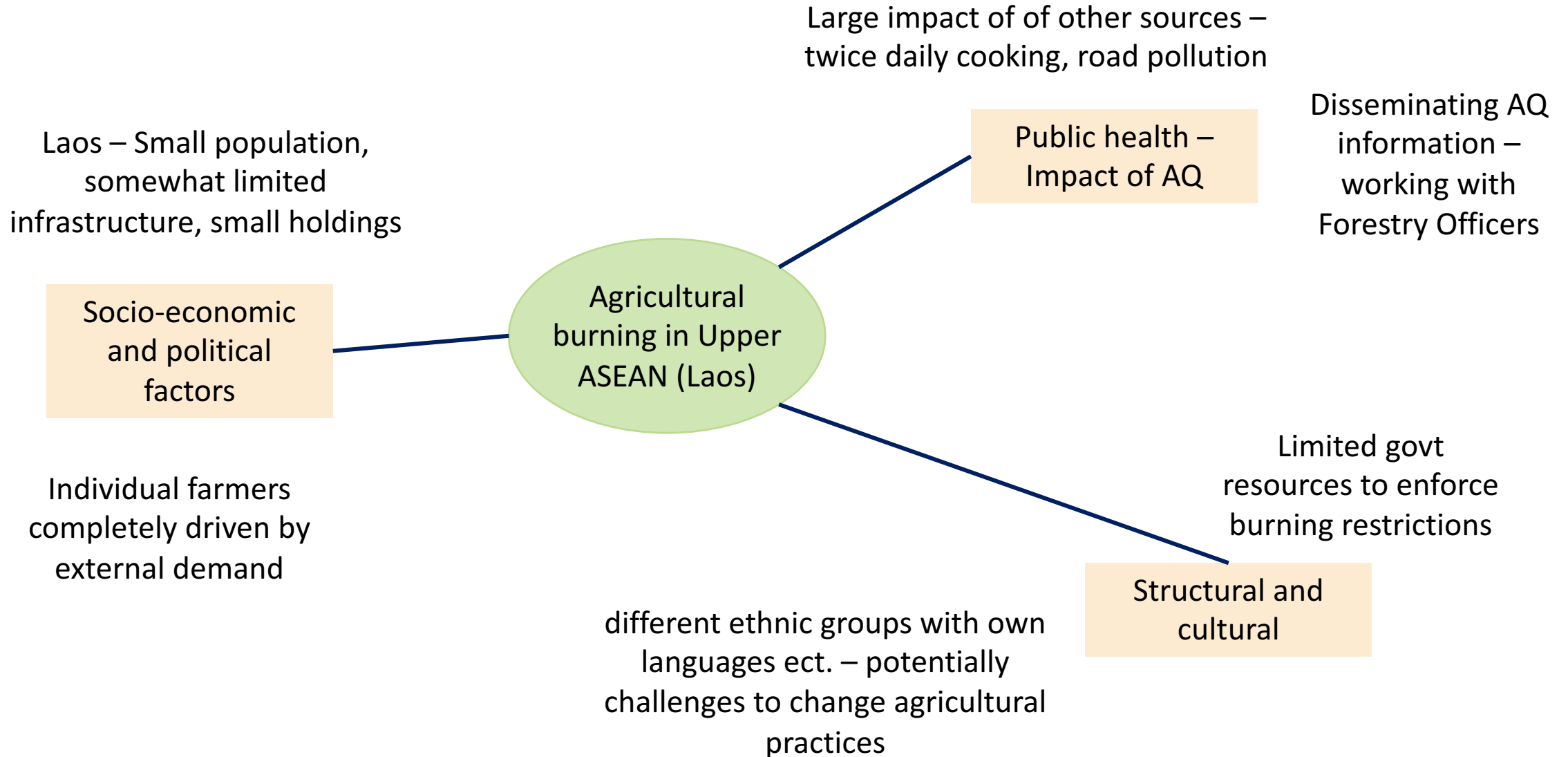


CAMS_pm2.5_2021_median_March

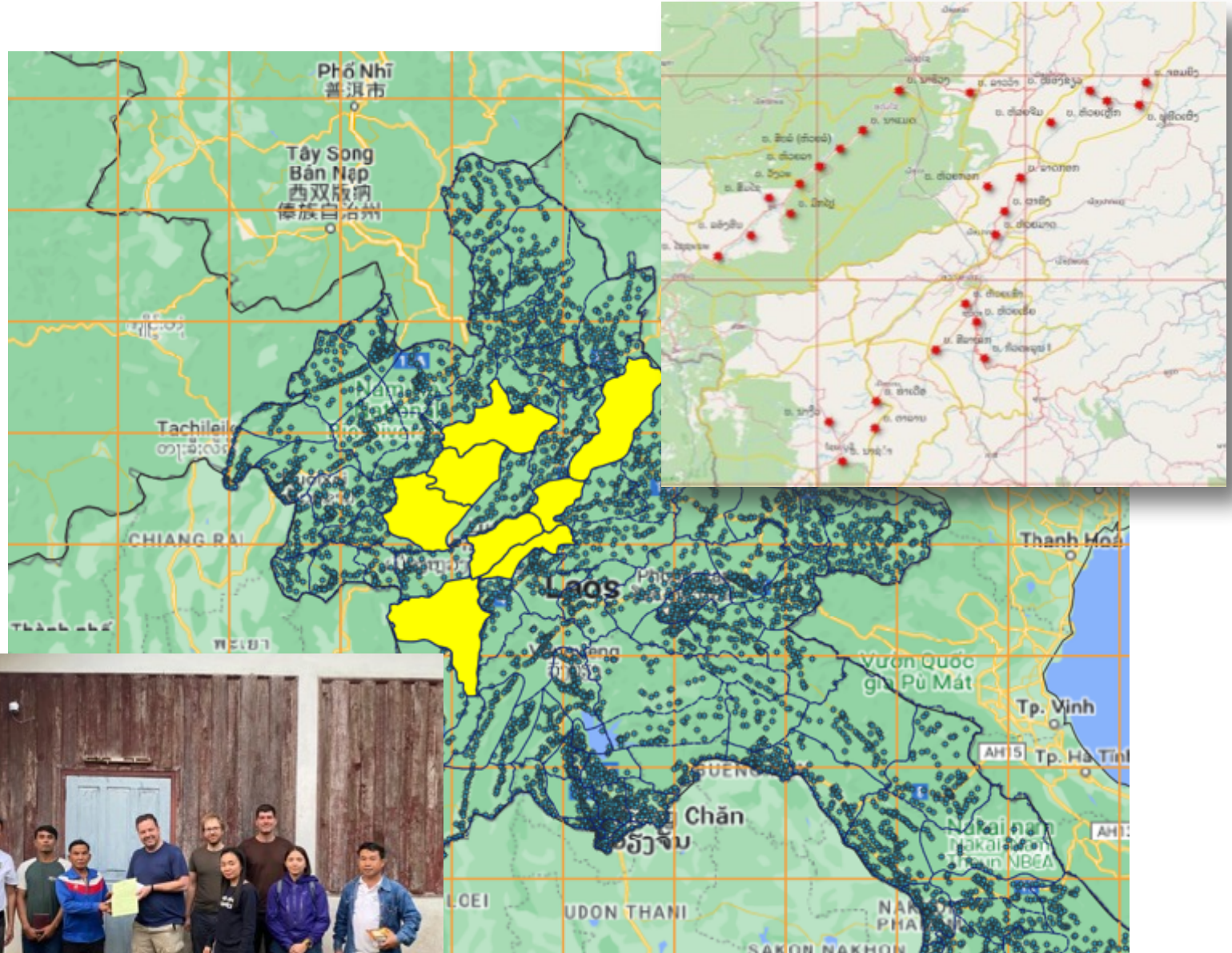
Band 1 (Gray)



Index	1	2	3	4	5	6	7	8	9	10
Band	Low	Low	Low	Moderate	Moderate	Moderate	High	High	High	Very High
μgm^{-3}	0-11	12-23	24-35	36-41	42-47	48-53	54-58	59-64	65-70	71 or more

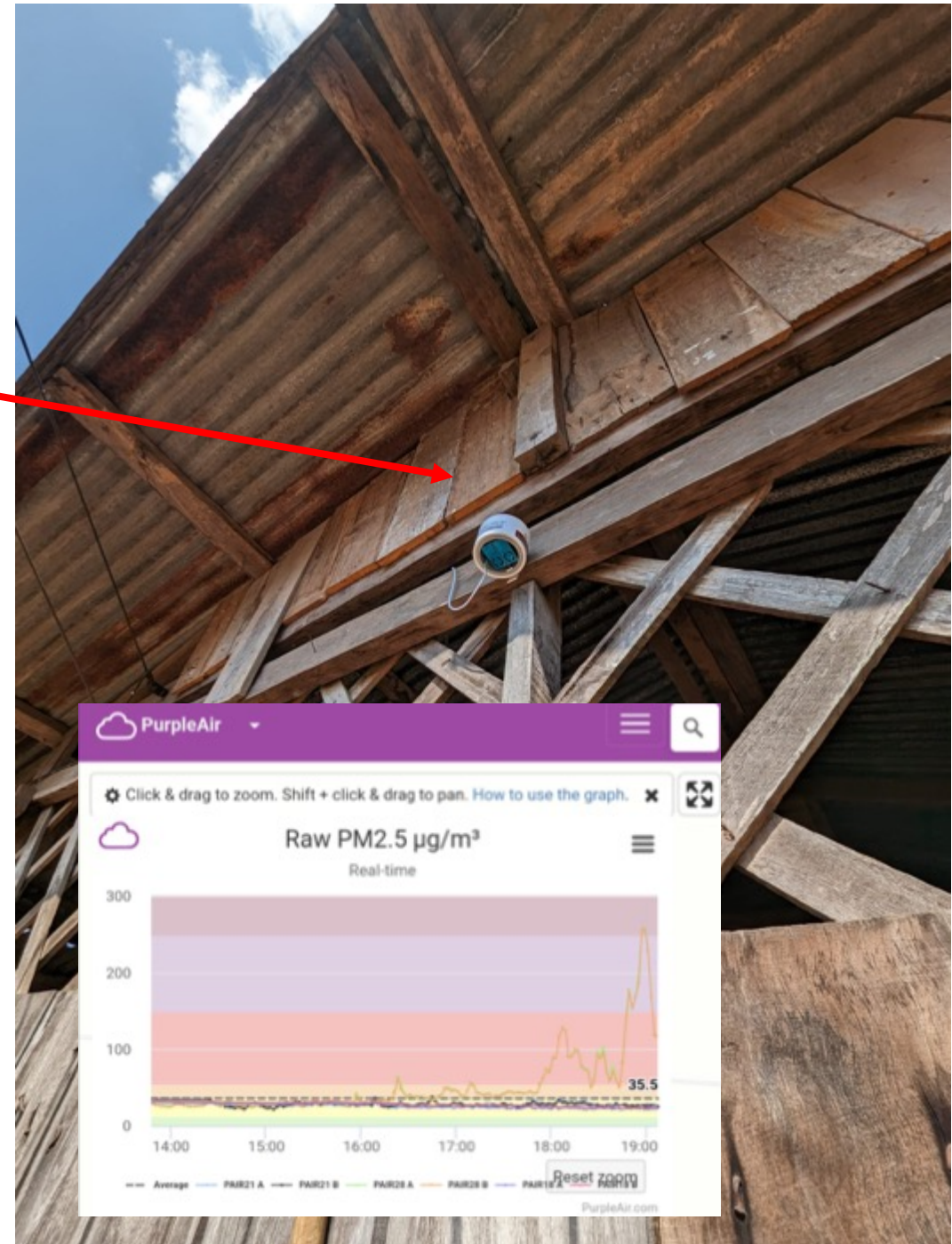


On-going In-situ air pollution measurement



Scientific Researchers from KCL

On-going In-situ air pollution measurement

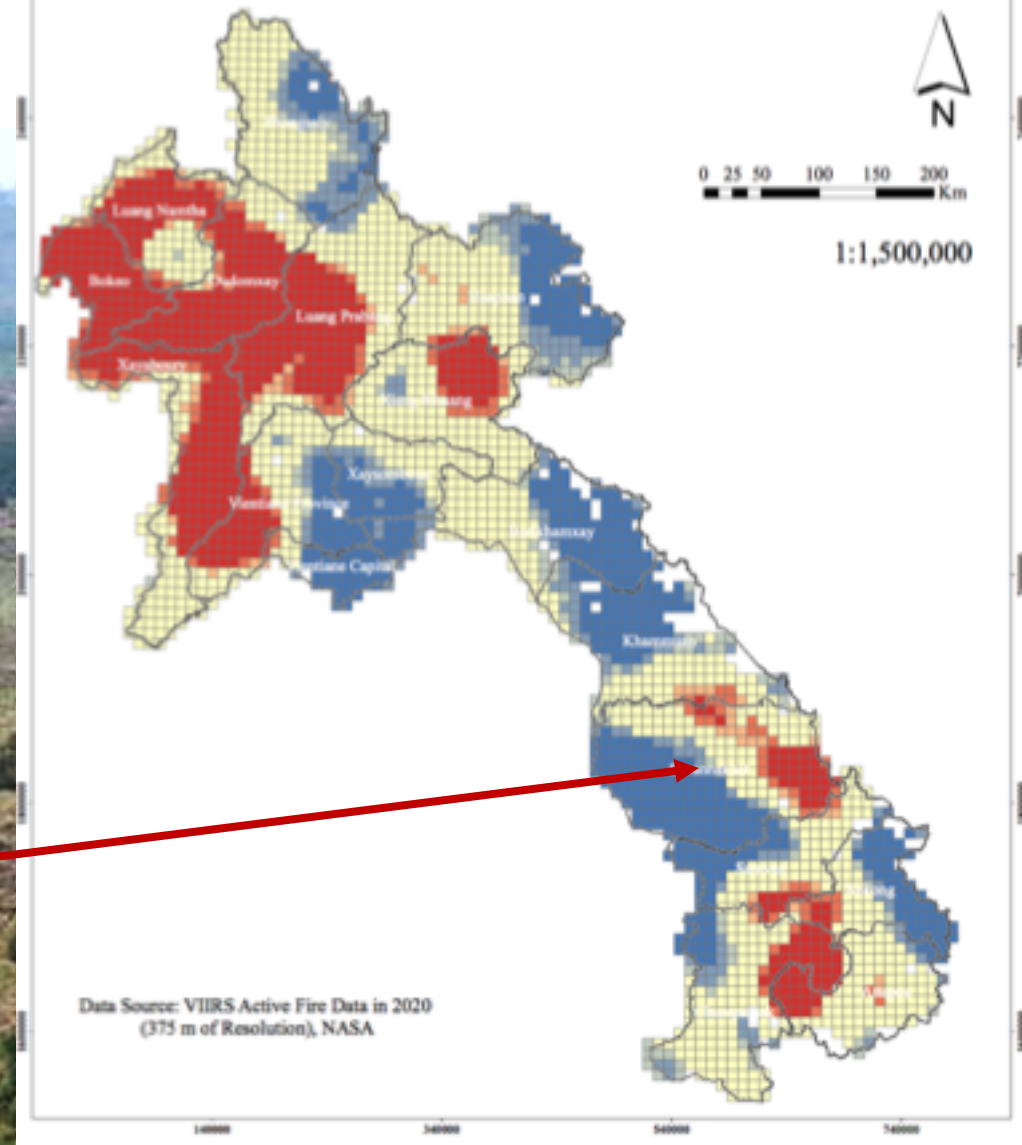


26 sensors in 7 districts; 2 North provinces





~6 Sensors in south province; Sepon.



Thank you