

# Crop Mapping and Monitoring in Thailand and CLM (Cambodia, Laos and Myanmar) Countries

Panu Nueangjumnong

Geo-informatics Specialist

Geo-Informatics and Space Technology Development Agency,  
Thailand

International Workshop On Land Cover/Land Use Changes, Forestry, and Agriculture in South/Southeast Asia,  
Phnom Penh, Cambodia, August 8-10<sup>th</sup> 2022.

# OUTLINES

- Why crops monitoring in Thailand?
- How to monitor crops area?
- How to estimate crops production?
- Utilization of crops monitoring in Thailand?
- Rice Monitoring project in CLM counties?
- Conclusion

# Why crops monitoring?

**43%** of Thailand area are agricultural area.

- Thailand: The World's large exporter of rice, cassava sugarcane and para rubber.
- Information of crops area and production estimation is important.
- To support the government, private sectors and local organizations for the effective development of agricultural management.
- Space Technology can deliver the near-real time information.



**Population:** 69 million

**Area:** 513,115 km<sup>2</sup>



# 6 Major economic crops (90% of Agricultural area)



**Rice**



**Maize**



**Cassava**



**Sugarcane**



**Para Rubber**



**Oil Palm**



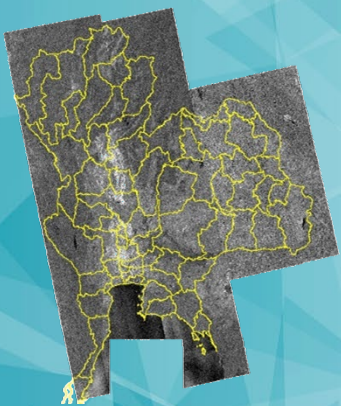
# How to crops monitoring? Several passive and active sensors onboard different satellites were used to monitor the crop areas over Thailand

Passive sensor



LANDSAT 8,9  
SENTINEL-2  
THEOS

Active sensor



RADARSAT-2  
SENTINEL-1

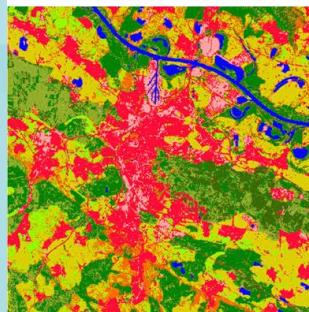
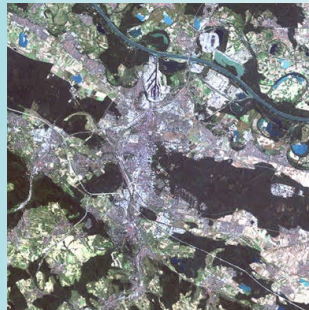
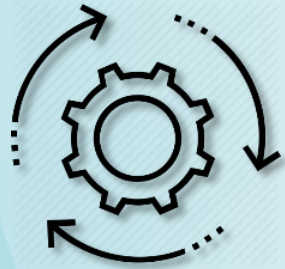
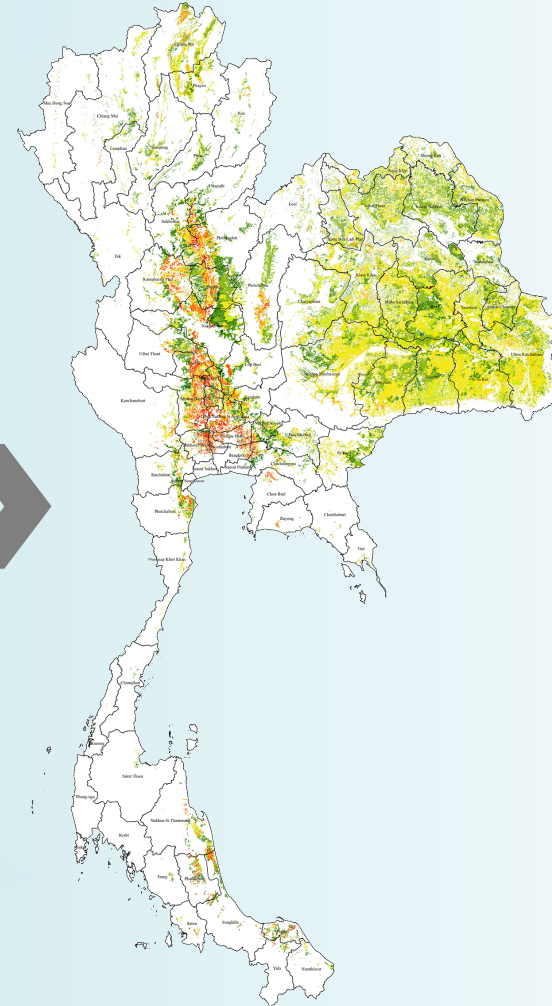


Image Classification

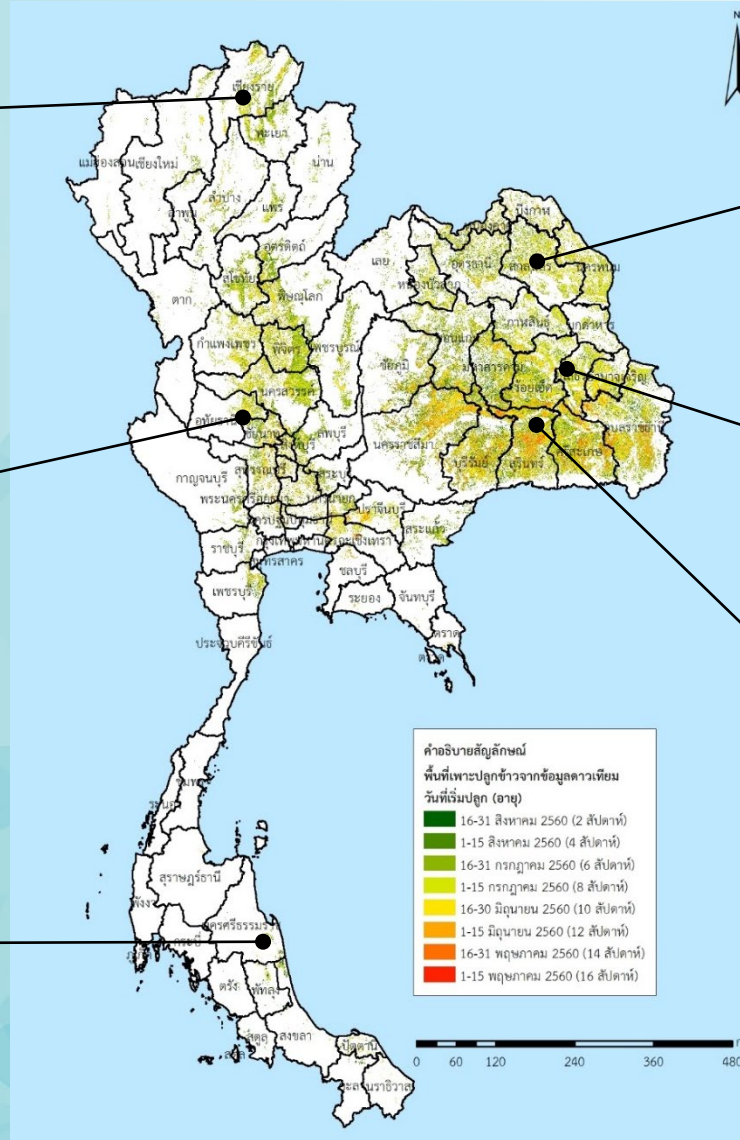


Crops area map

- Rice, Maize, Cassava and Sugarcane (2 weeks - monthly)
- Para rubber and Oil palm (yearly)
- Accuracy ~80–90%
- Partners & Users: Rice Department, Irrigation Department, Office of Agricultural economics, Department of Agricultural Extension, Department of Rainmaking and so on
- Crop area, crop stage, crop production, crop water requirement



# Field work and Data Validation

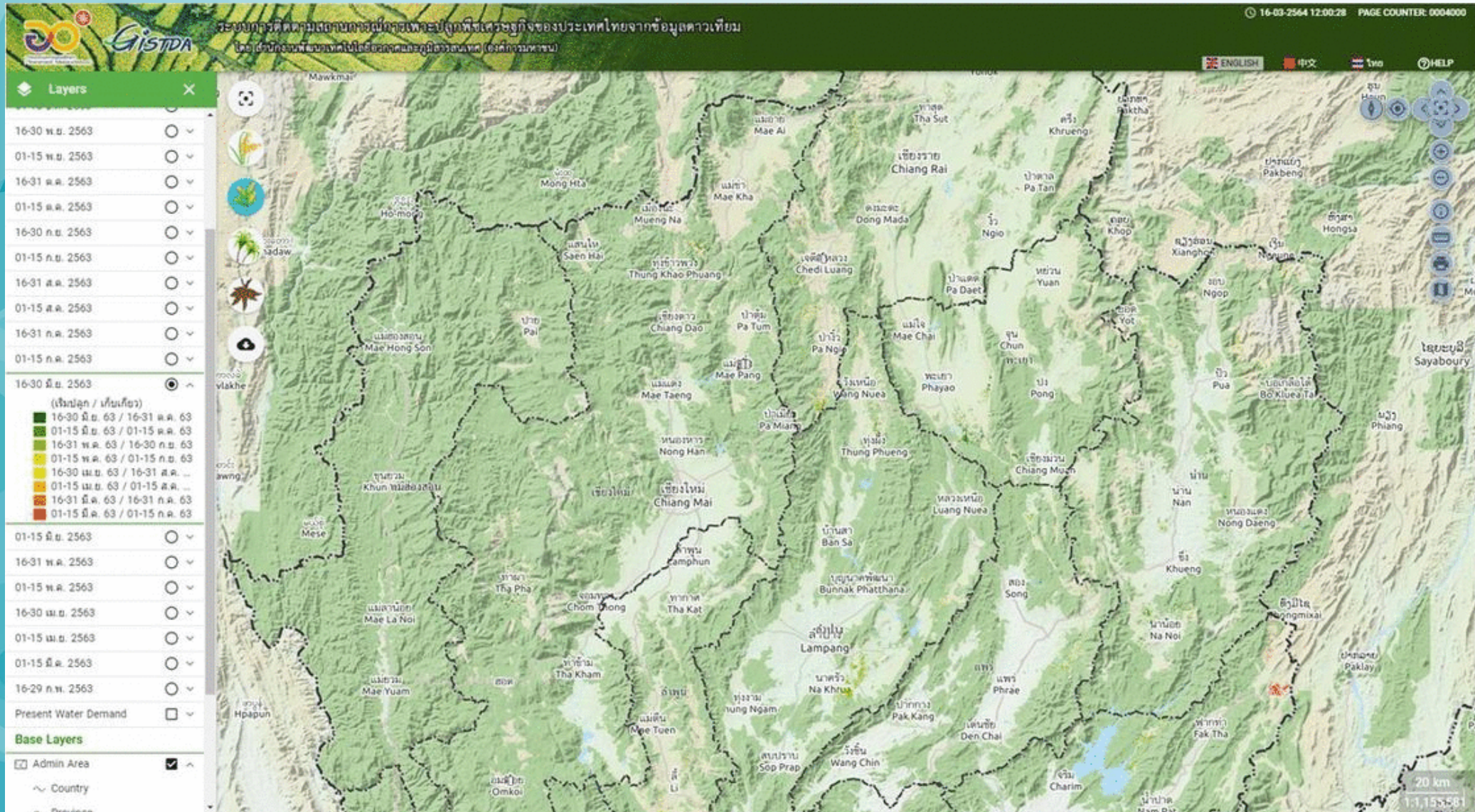






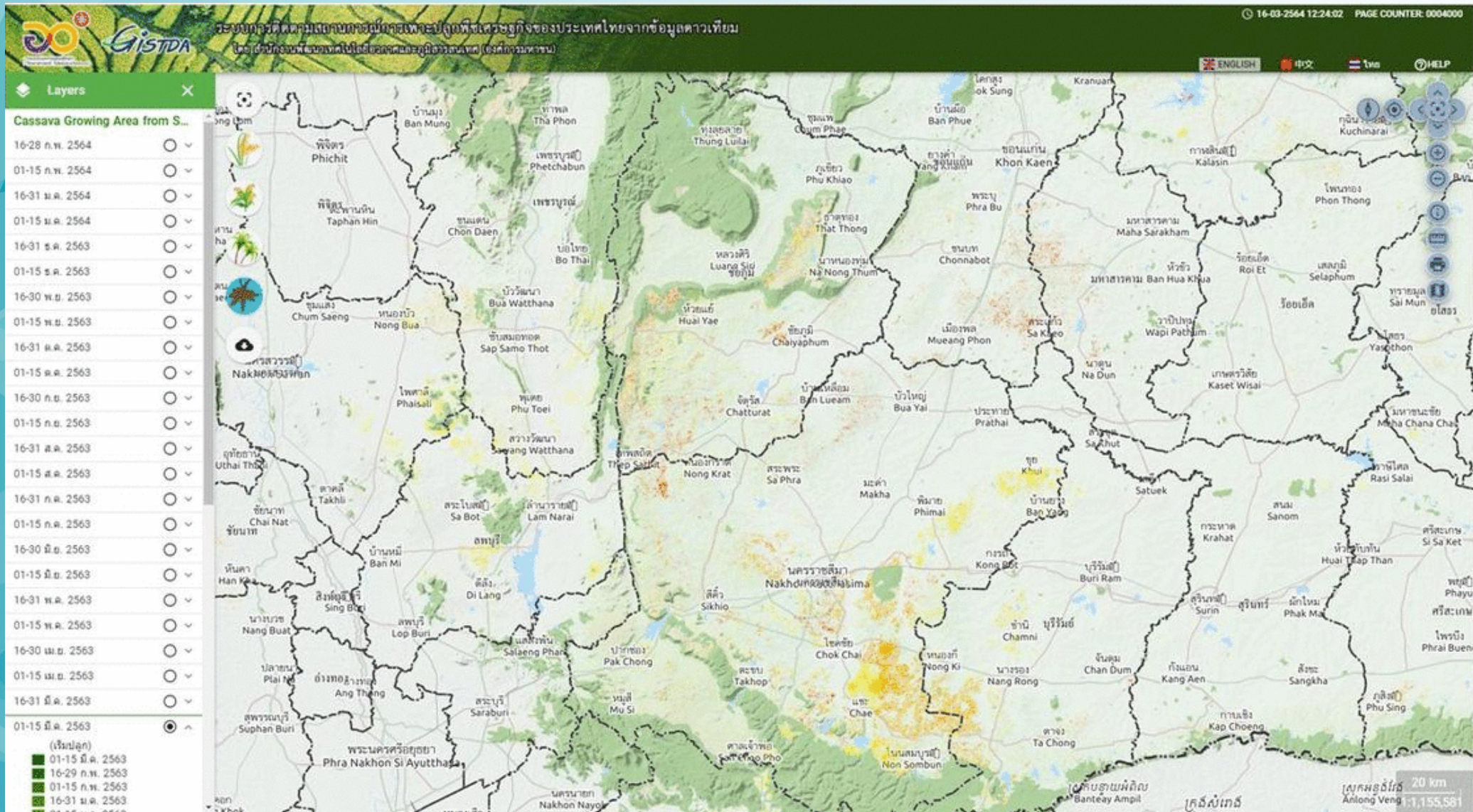


# Maize Monitoring at Country Level



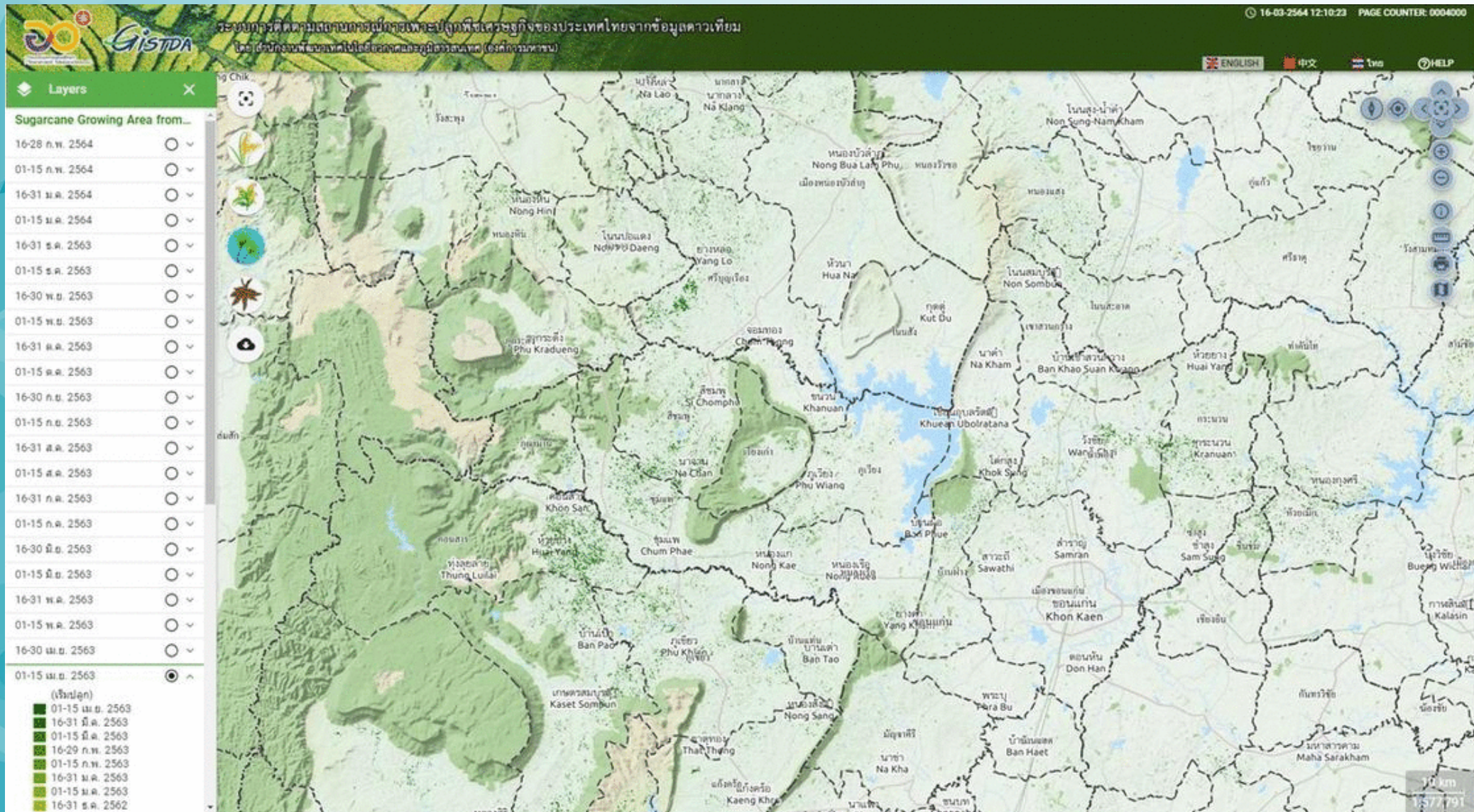


# Cassava Monitoring at Country Level





# Sugarcane Monitoring at Country Level





# Rubber Tree and Oil Palm Monitoring at country level (yearly update)

## Rubber Tree



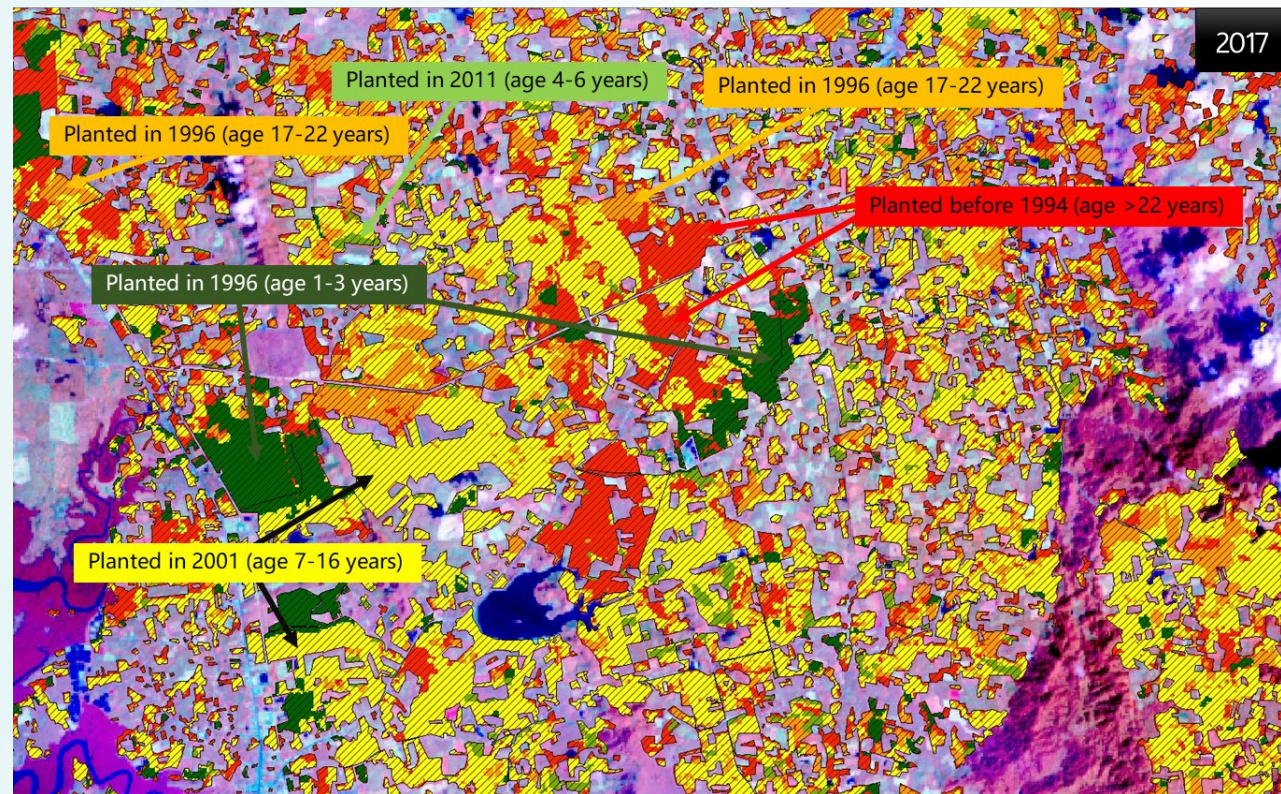
43,000 Km<sup>2</sup>  
In 2021

## Oil Palm



11,000 Km<sup>2</sup>  
In 2021

## Oil palm age classification for production estimate

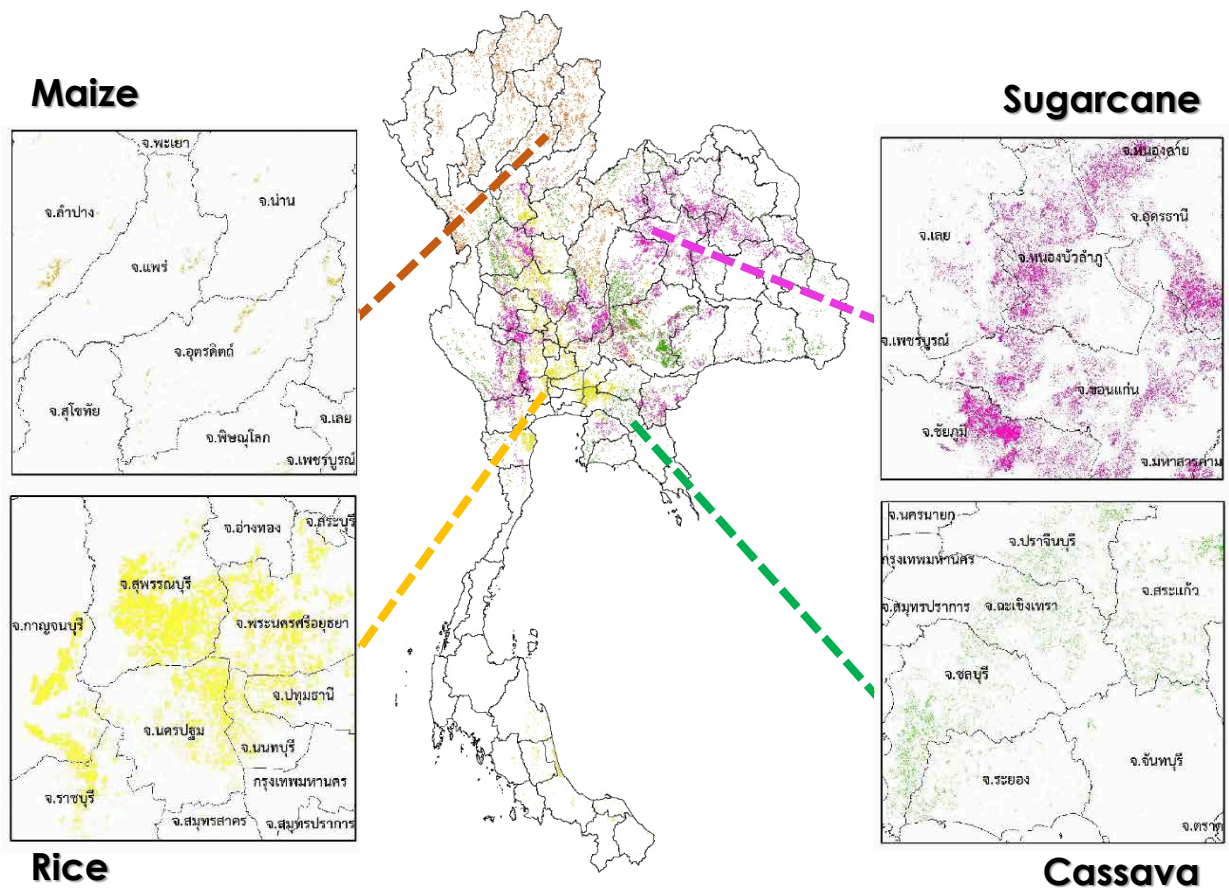




# Harvesting time and production estimation

Using the starting date from crop monitoring and crop cycle to **estimate the harvesting period**

**Crops production estimation** was obtained base on crop cultivation area from satellite data and the **average yield per area** provided by Office of Agricultural Economics (OAE)



## Harvesting and production estimation at July 2022

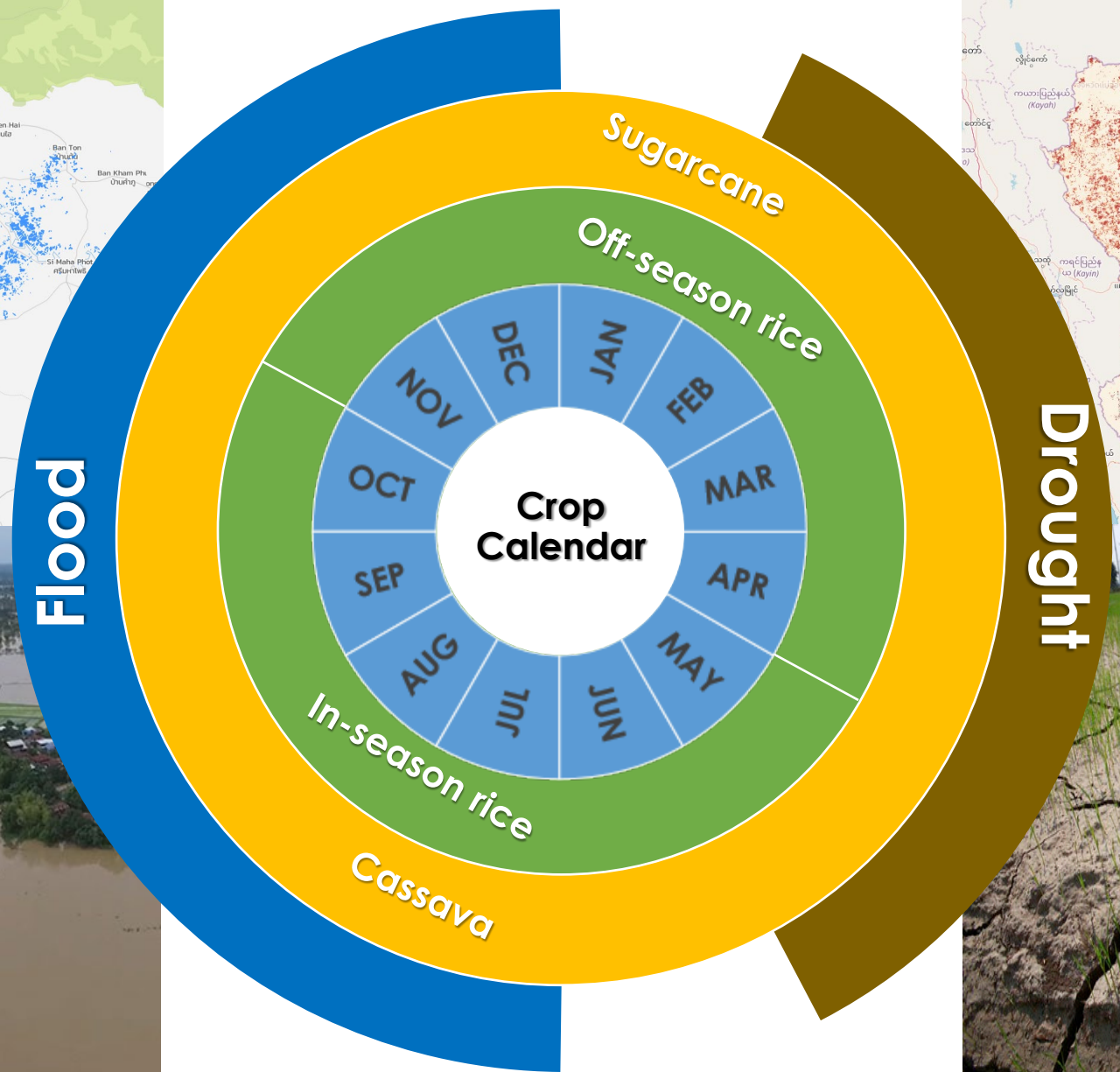
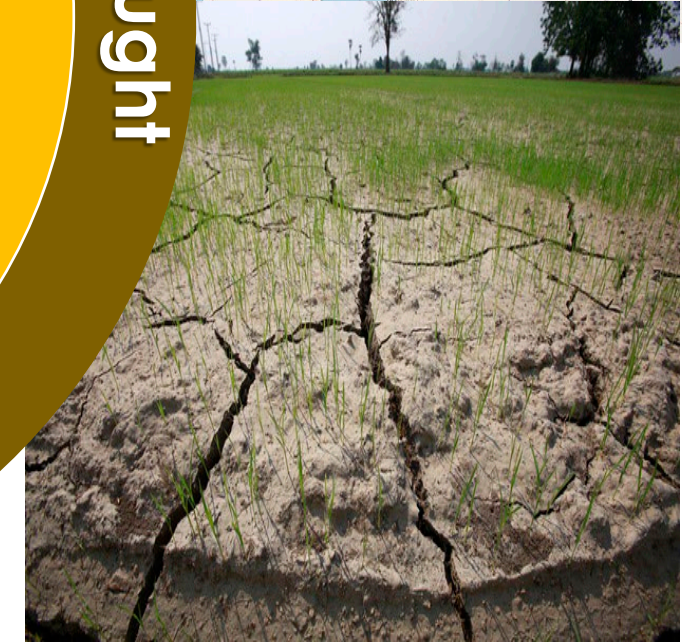
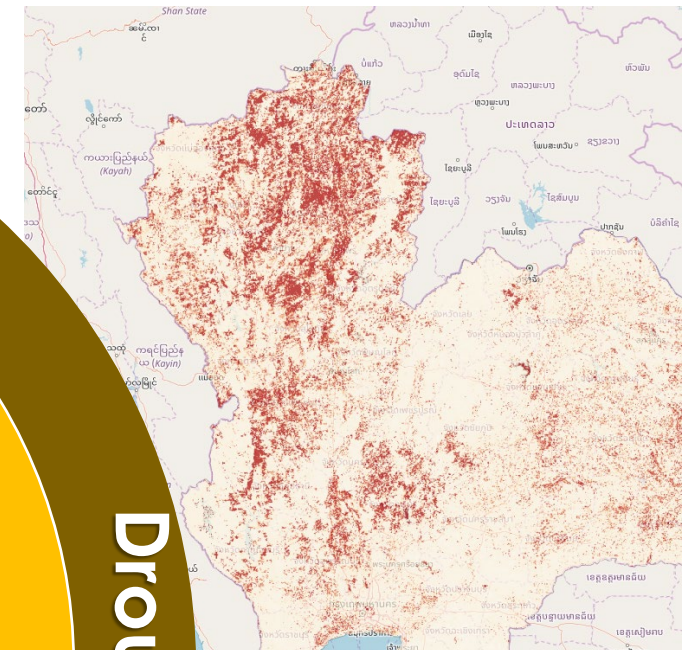
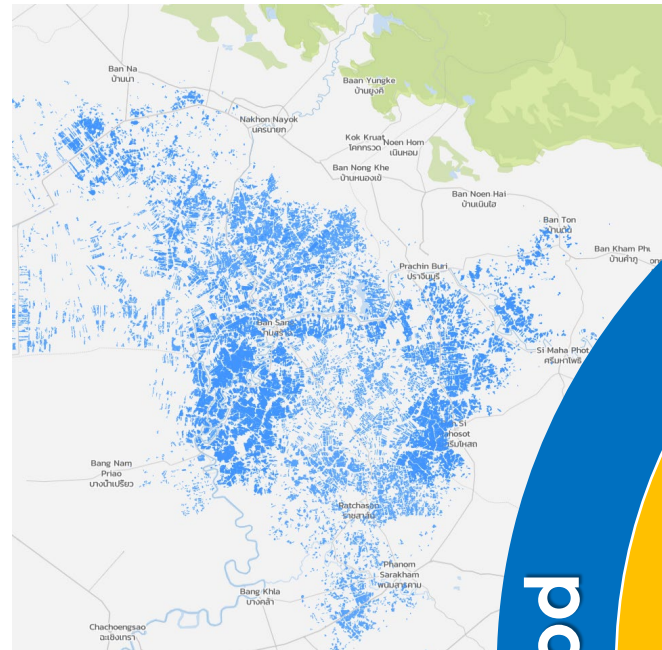
Crop type	Area (Km <sup>2</sup> )	Production Estimation (Million Tons)										
		2022					2023					Total
		Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr		
Rice	<b>38,094</b>	0.71	2.93	2.82	4.54	0	0	0	0	0	<b>11.00</b>	
Maize	<b>5,097</b>	0.21	0.39	0.54	1.13	0	0	0	0	0	<b>2.27</b>	
Cassava	<b>8,365</b>	3.75	2.24	2.75	1.14	3.63	1.95	0	0	0	<b>18.31</b>	
Sugarcane	<b>14,744</b>	0	0	0	0	34.73	67.41	0	0	0	<b>102.14</b>	



# Utilization of crops monitoring?

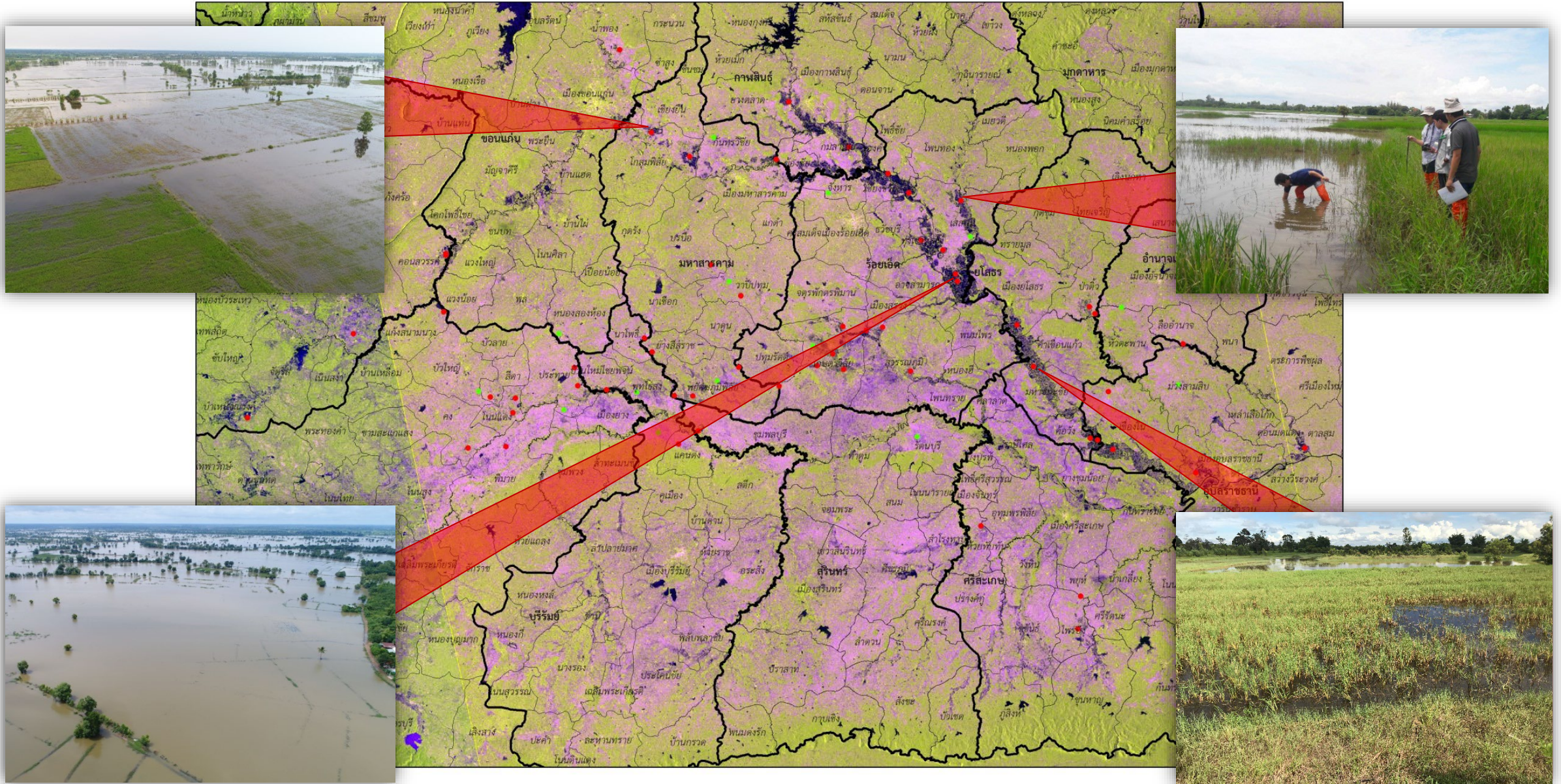
- Estimation of agricultural areas affected by disaster events.
- Rice cropping intensity for water management.

# Thailand crop cultivation is probably to be affected by disaster





# Flood damage to rice area in Northeast of Thailand





# Estimation of rice areas affected by flood

**Data from satellite** : Rice area, rice stage, flood area and duration.

Region	Rice area from Satellite (Ha)			Rice area affected by floods (Ha)		
	Growing Stage	Maturity Stage	Total	Growing Stage	Maturity Stage	Total
Upper North	576,727	2,820	<b>579,547</b>	0	0	<b>0</b>
Lower North	864,786	50,308	<b>915,094</b>	0	0	<b>0</b>
Center	351,177	27,483	<b>378,660</b>	0	0	<b>0</b>
North East	4,393,930	1,143,704	<b>5,537,635</b>	22,436	15,266	<b>37,702</b>
East	206,875	6,962	<b>213,836</b>	14,844	254	<b>15,098</b>
West	97,543	7,142	<b>104,685</b>	0	0	<b>0</b>
South	49,226	947	<b>50,173</b>	0	0	<b>0</b>
<b>Total</b>	<b>6,540,264</b>	<b>1,239,366</b>	<b>7,779,630</b>	<b>37,280</b>	<b>15,520</b>	<b>52,799</b>



# Rice Cropping Intensity for Water Management

Annual rice cultivation area (in-season rice and dry-season rice) from 2015 to 2022 were analyzed to map a rice cropping intensity

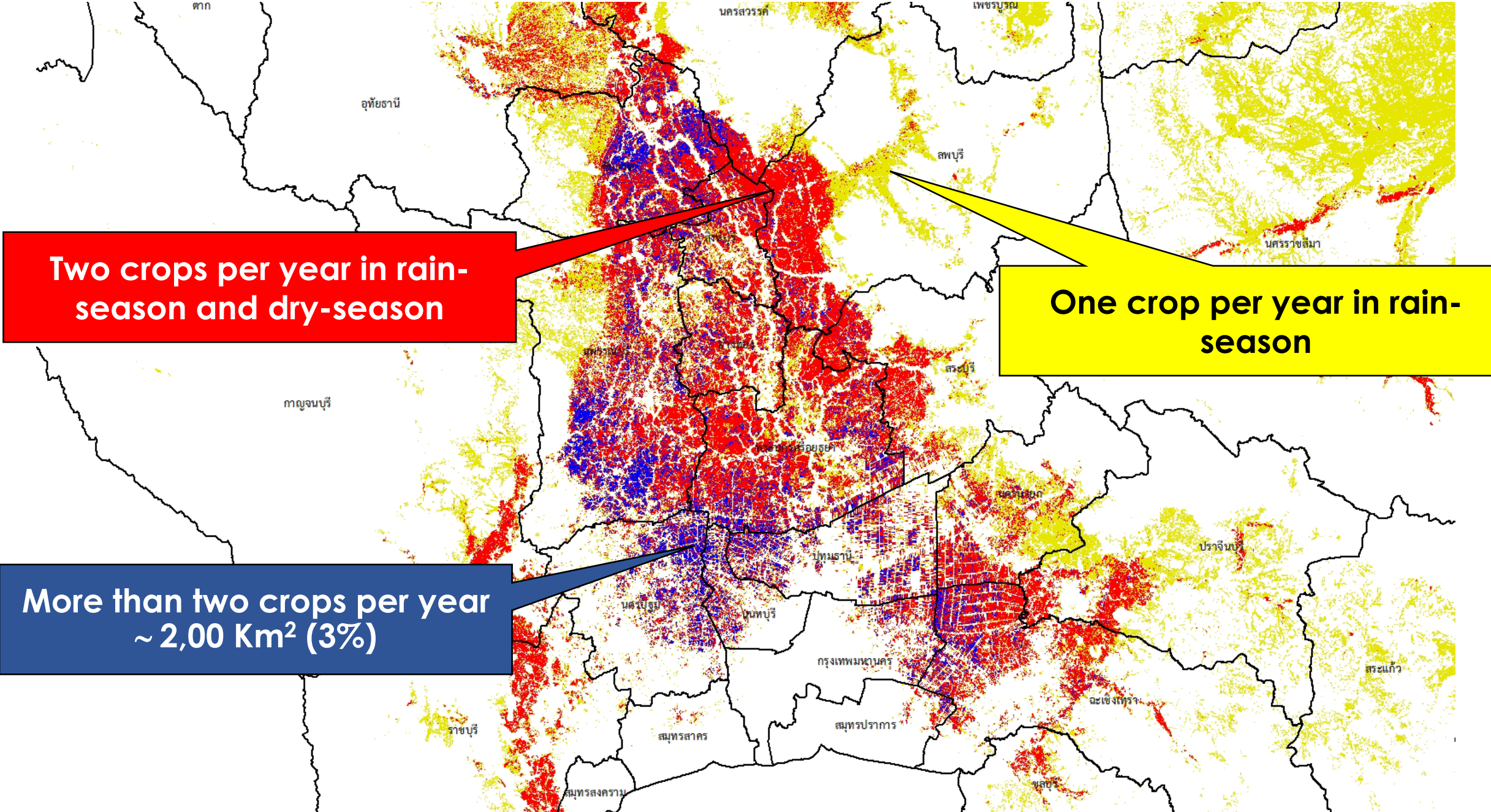


**Two crops per year in rain-season and dry-season  
~ 19,00 Km<sup>2</sup> (20%)**

**One crop per year in rain-season ~ 75,00 Km<sup>2</sup> (77%)**



# Rice Cropping Intensity in the lower Chao Phraya delta



Two crops per year in rain-season and dry-season

One crop per year in rain-season

More than two crops per year  
~ 2,00 Km<sup>2</sup> (3%)



# Lancang-Mekong Cooperation Special Fund Project

**Project Title :** Geospatial information applications for rice monitoring in CLM (Cambodia, Lao PDR and Myanmar) countries

**Implementing Agency :** Geo-Informatics and Space Technology Development Agency (Public Organisation)/ GISTDA

**Implementing Partner:** the United Nations Economic and Social Commission for Asia and the Pacific (ESCAP)

**Participating LMC Countries:** Cambodia, Lao People's Democratic Republic, Myanmar

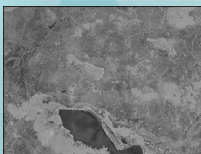
**Project Duration:** 2 years (until December 2023)



## 1. Data preparation

### SAR Image

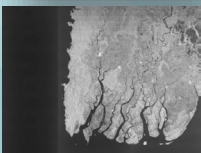
Cambodia



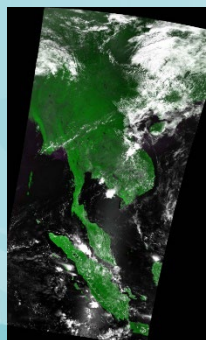
Lao PDR



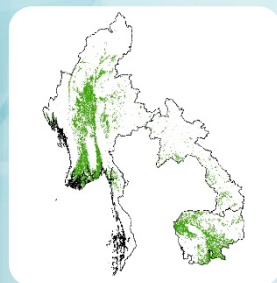
Myanmar



### Optical Image

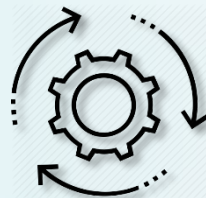


### GIS Data

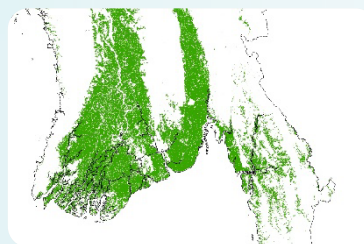


- Administrative Boundary
- Landuse of rice

## 2. Rice area monitoring



Rice Classification Tools



Present rice plantation map

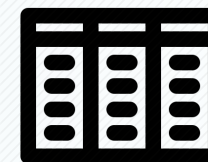
## 3. Field data collection



- Location (Lat/Long)
- Stage of rice
- Health
- Photos
- .....

Validation

## 5. Productivity Estimation



Statistics yield data

1. Monthly updated of rice area mapping for each country
2. Seasonal rice status and health mapping
3. Rice productivity estimation for each country

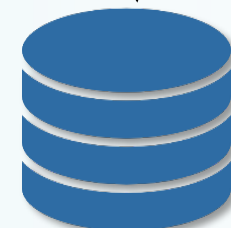
## 4. Rice crop health analysis



Multispectral indices and biophysical parameters analysis



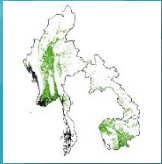
Rice status and health



Geo-Spatial Database



## Geo-Spatial Database



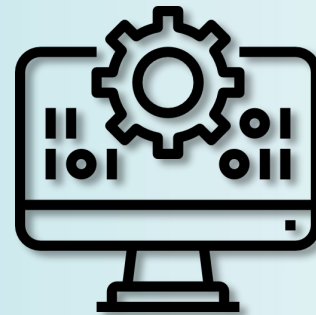
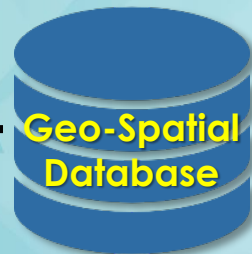
Monthly updated of rice area mapping for each country



Seasonal rice status and health mapping

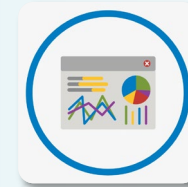


Rice productivity estimation for each country

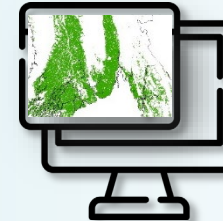


Portal

## System for rice monitoring and productivity estimation



Dashboard



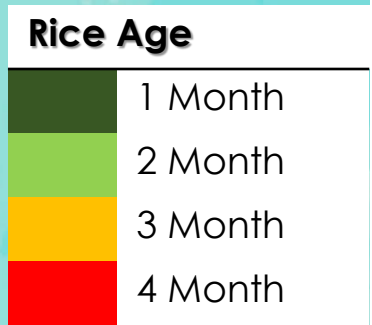
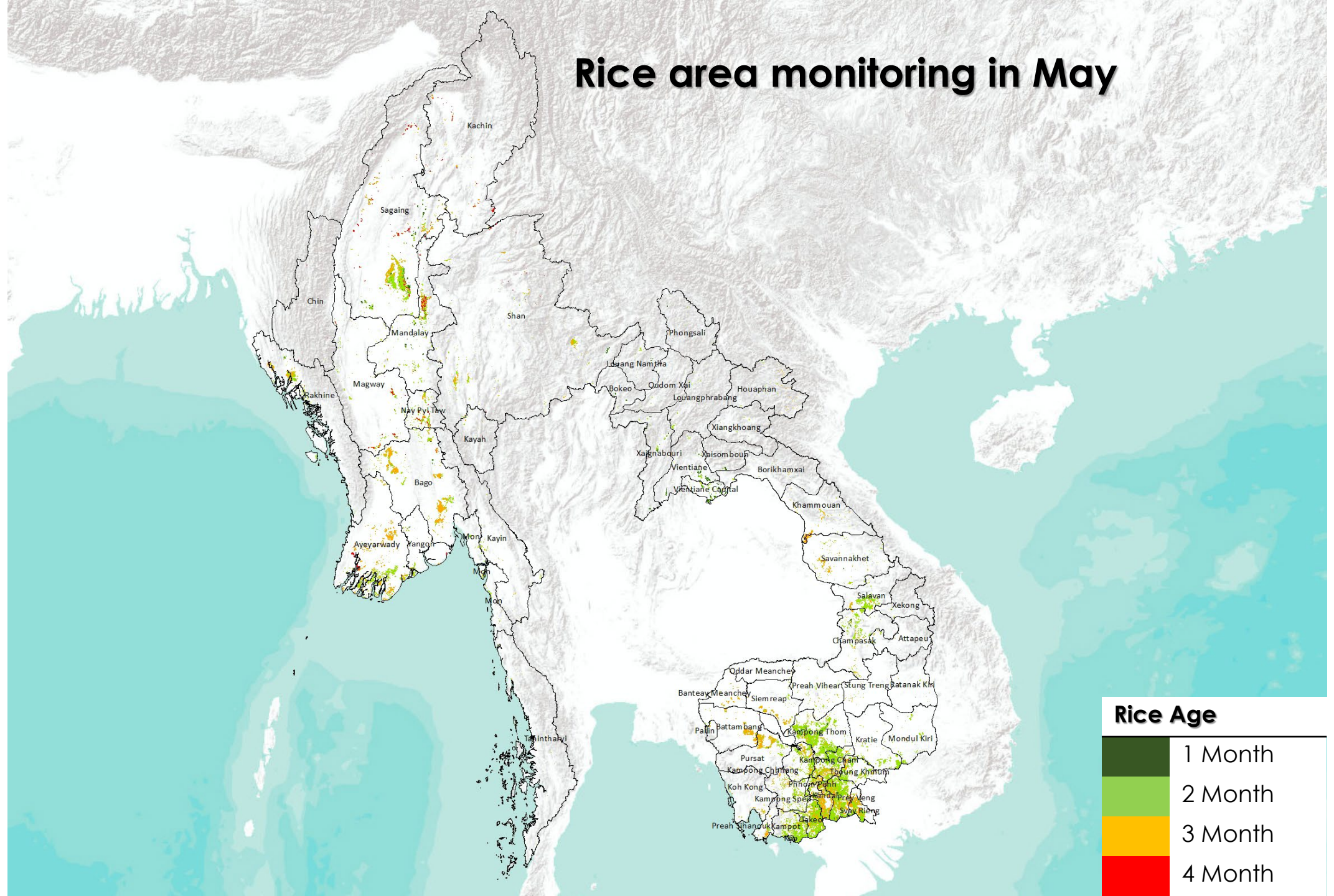
Web application



Mobile application

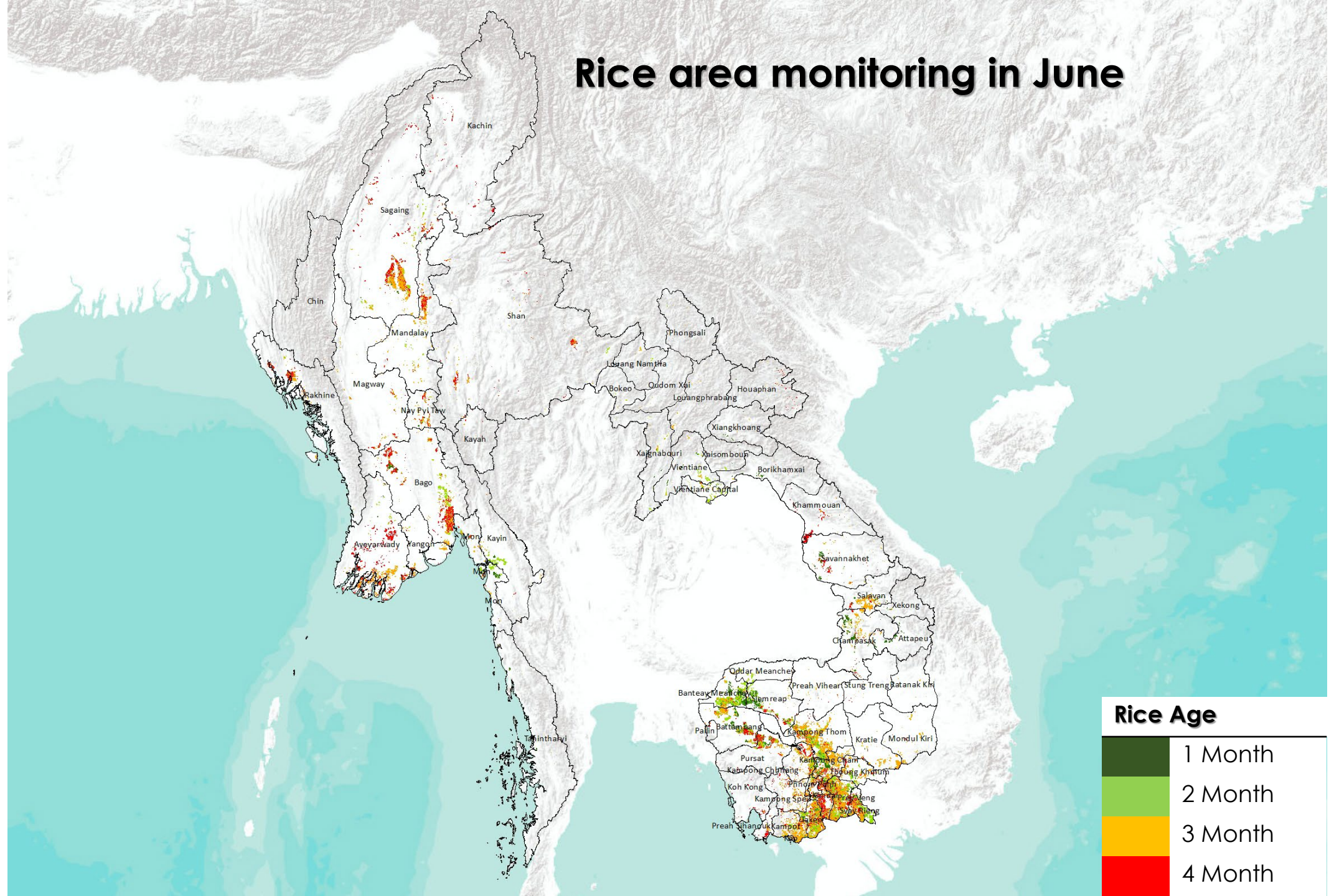


# Rice area monitoring in May



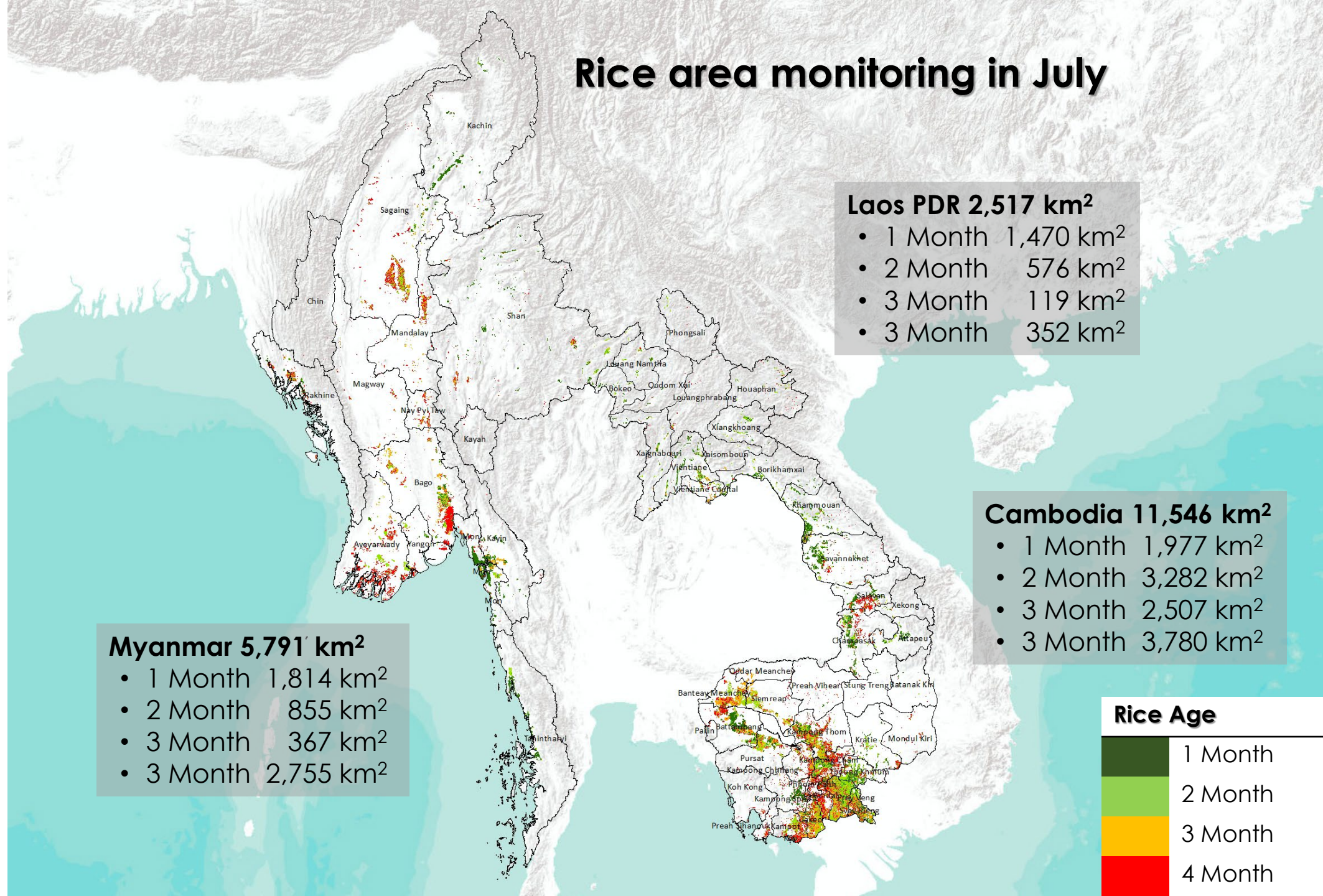


# Rice area monitoring in June





# Rice area monitoring in July



**Laos PDR 2,517 km<sup>2</sup>**

- 1 Month 1,470 km<sup>2</sup>
- 2 Month 576 km<sup>2</sup>
- 3 Month 119 km<sup>2</sup>
- 3 Month 352 km<sup>2</sup>

**Cambodia 11,546 km<sup>2</sup>**

- 1 Month 1,977 km<sup>2</sup>
- 2 Month 3,282 km<sup>2</sup>
- 3 Month 2,507 km<sup>2</sup>
- 3 Month 3,780 km<sup>2</sup>

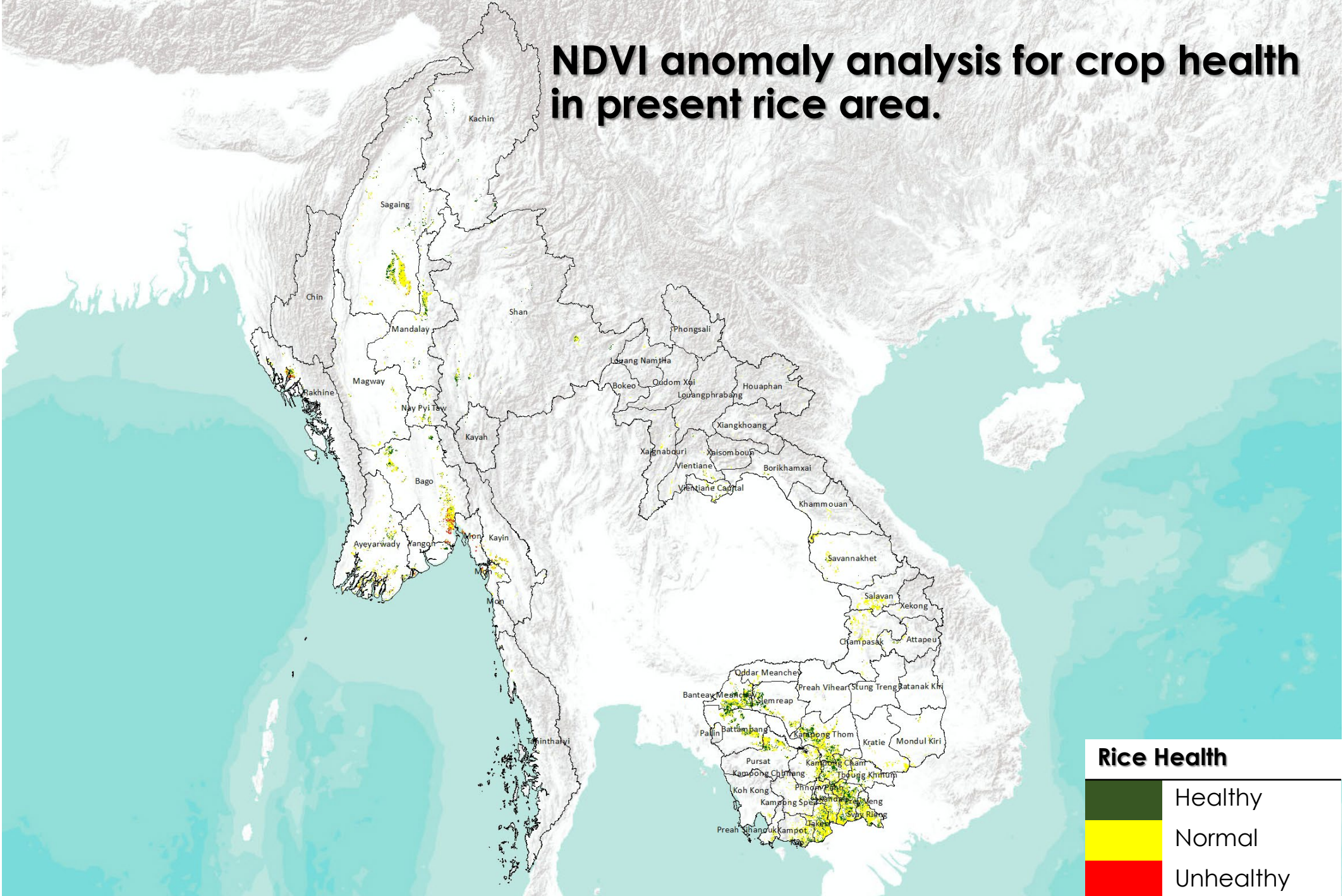
**Myanmar 5,791 km<sup>2</sup>**




- 1 Month 1,814 km<sup>2</sup>
- 2 Month 855 km<sup>2</sup>
- 3 Month 367 km<sup>2</sup>
- 3 Month 2,755 km<sup>2</sup>

Rice Age	
Dark Green	1 Month
Light Green	2 Month
Yellow	3 Month
Red	4 Month



# NDVI anomaly analysis for crop health in present rice area.



Rice Health	
	Healthy
	Normal
	Unhealthy



# CONCLUSIONS

- Using geo-informatics technology and satellite data can deliver the near-real time information to support the government private sectors and local organizations for agricultural management.
- Crop monitoring and production estimation system is useful for several applications such as :
  - Water management
  - Crop insurance and disaster
  - Logistics (agricultural product & machinery)



# THANK YOU

**International Workshop On Land Cover/Land Use Changes, Forestry, and Agriculture in South/Southeast Asia,  
Phnom Penh, Cambodia, August 8-10<sup>th</sup> 2022.**