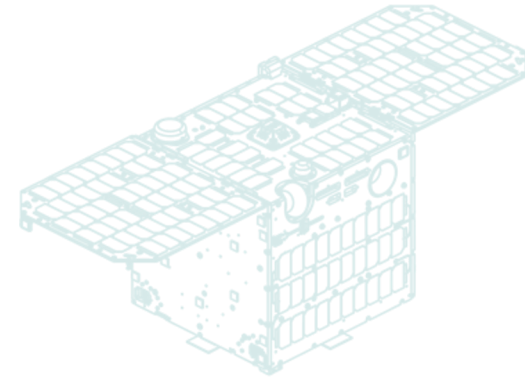
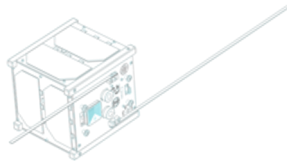


NASA LCLUC Virtual Science Team Meeting  
19 – 21 October 2020



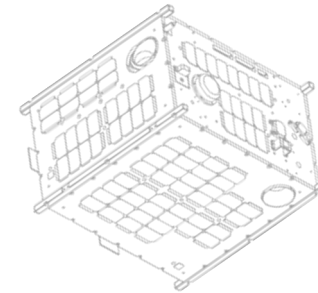
# Philippine Space Agency LCLUC Activities



**GAY JANE PEREZ**

*Associate Professor*

Institute of Environmental Science and Meteorology  
University of the Philippines Diliman



# The Philippine Space Agency

Philippine Republic Act 11363 enacted on 08 August 2019, *“An Act Establishing the Philippine Space Development and Utilization Policy and Creating the Philippine Space Agency, and for other Purposes”*

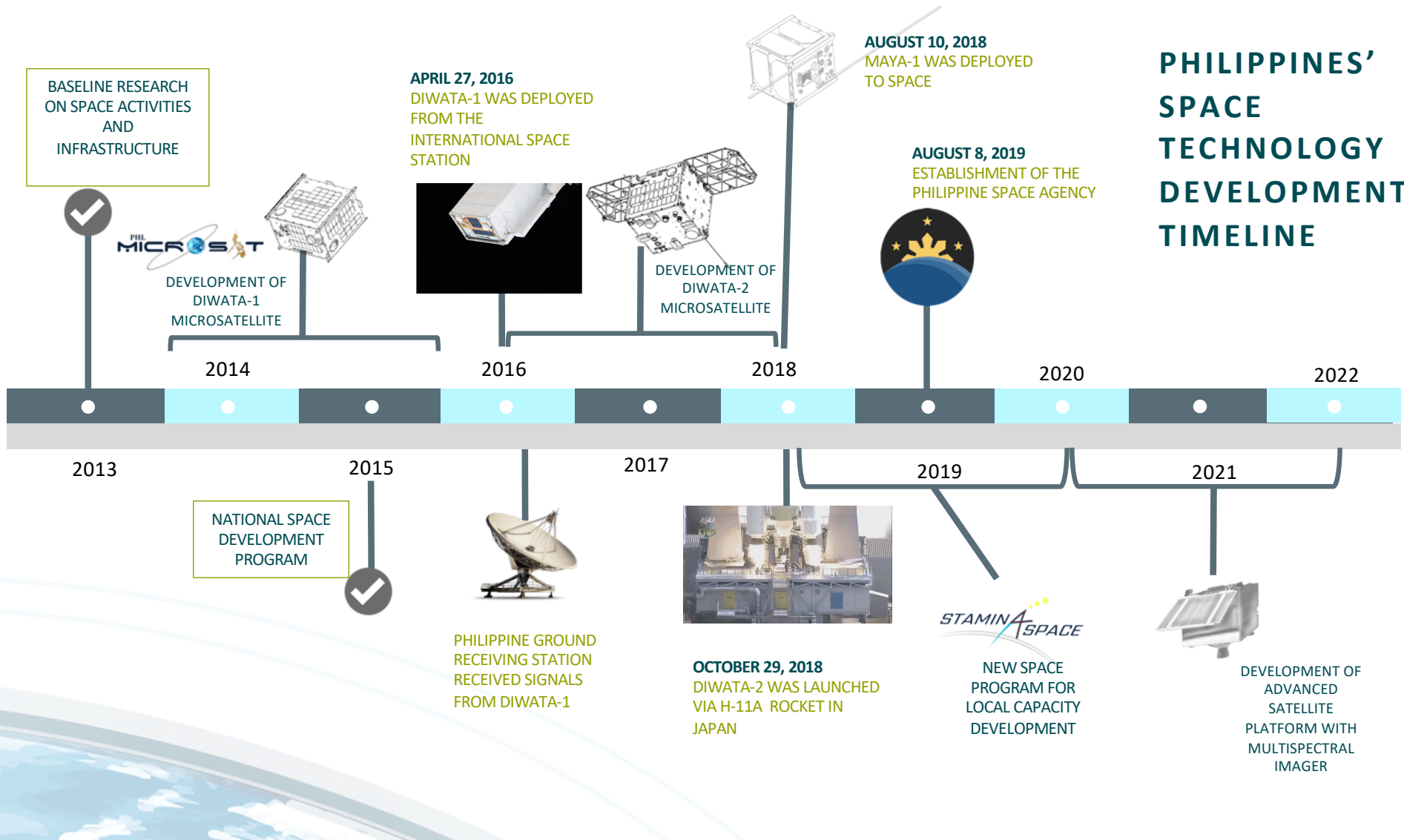
## Mandate

The PhilSA shall be the primary policy, planning, coordinating, implementing, and administrative entity of the Executive Branch of the government that will plan, develop, and promote the national space program in line with the Philippine Space Policy.

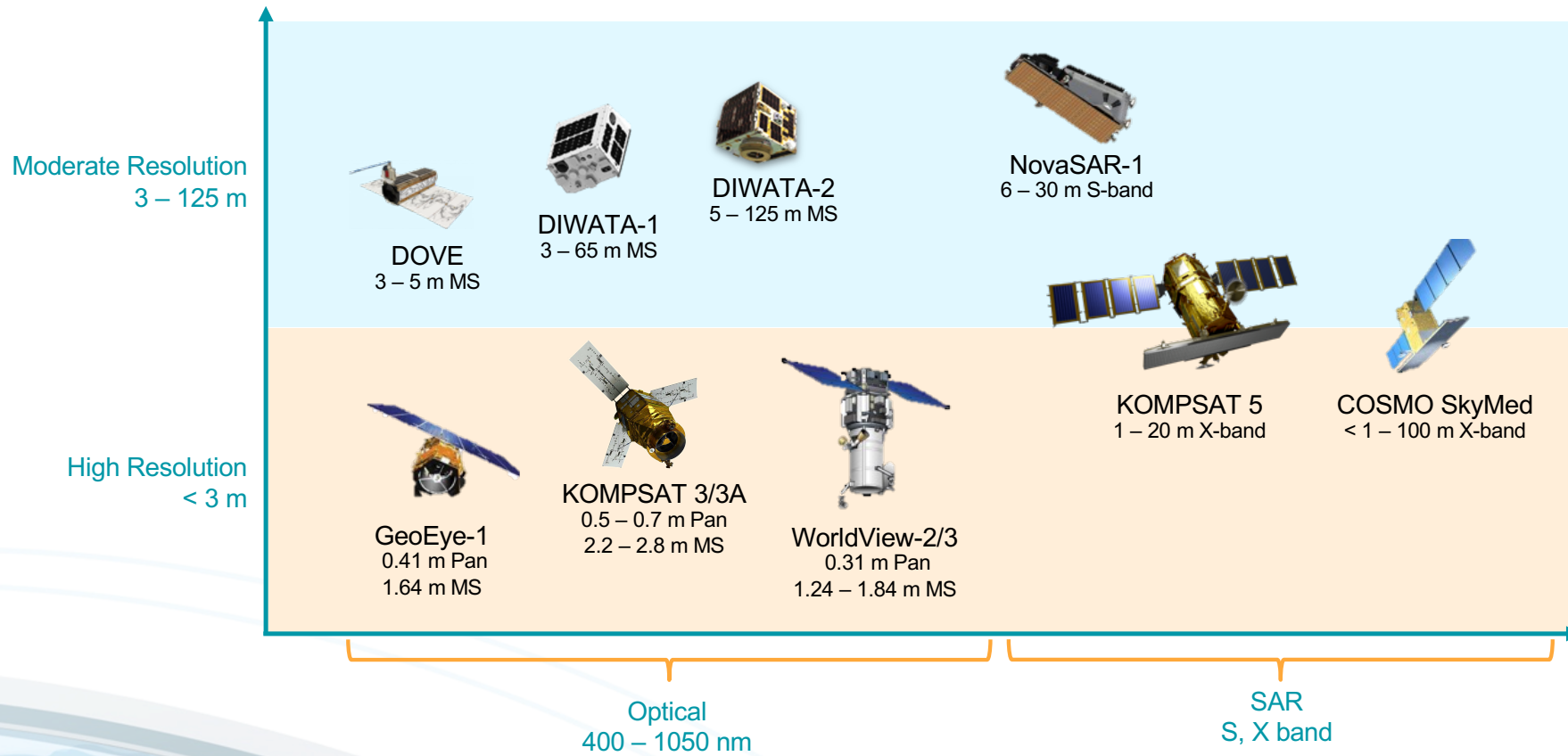
### Key Development Areas

 <p>National Security &amp; Development</p>	 <p>Hazard Management and Climate Studies</p>
 <p>Space Research and Development</p>	 <p>Space Industry Capacity Building</p>
 <p>Education and Awareness</p>	 <p>International Cooperation</p>

# PHILIPPINES' SPACE TECHNOLOGY DEVELOPMENT TIMELINE



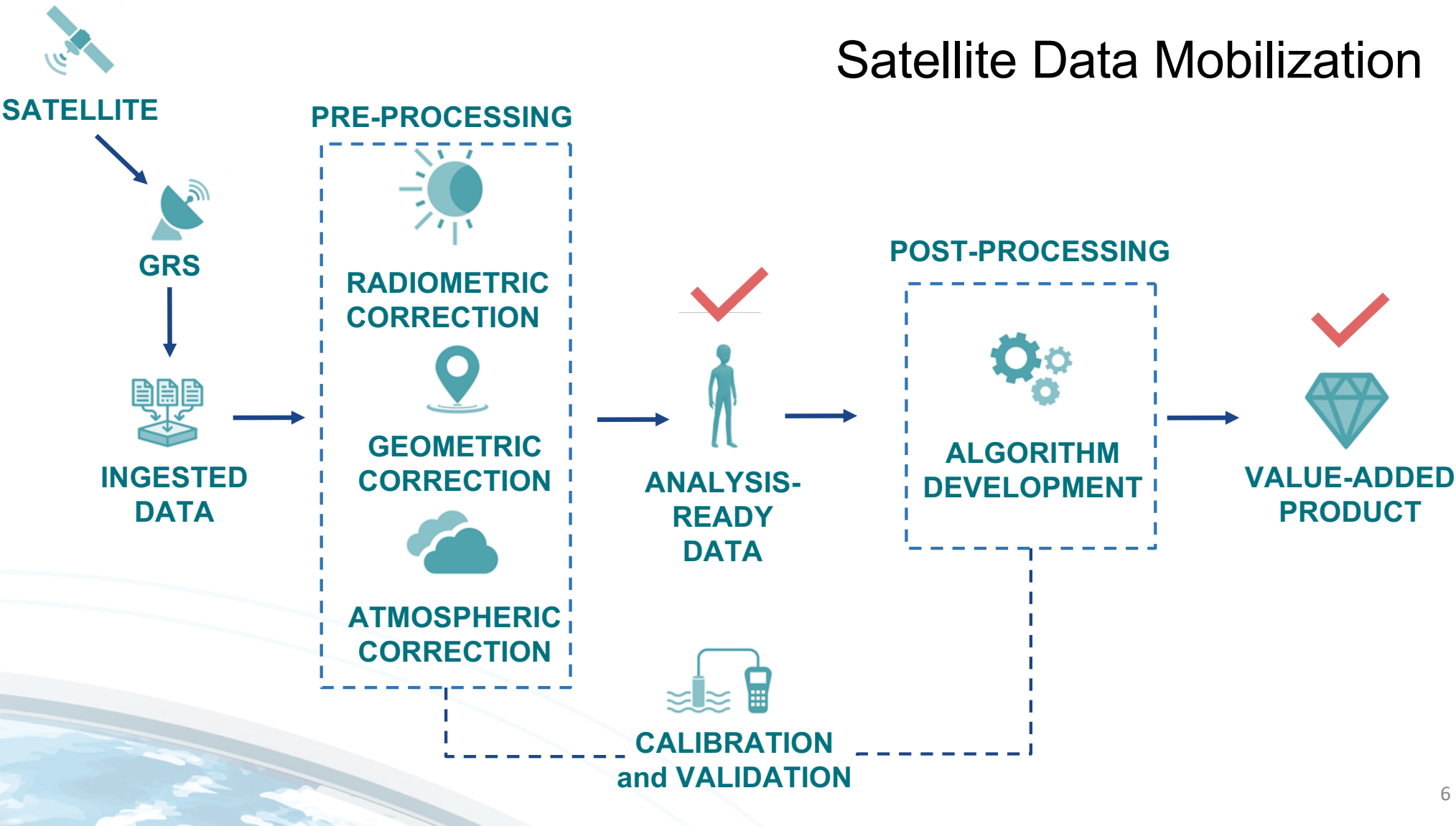
# Earth Observation Satellites: Data Provision



# PhilSA Flagship Initiatives

- *Mobilizing Satellite Images and Spaceborne Data* for National Security and Inclusive Development, Hazard Management, and a Digital Government and Economy
- *Building Satellites* as Vital Component of National Information Infrastructure

# Satellite Data Mobilization



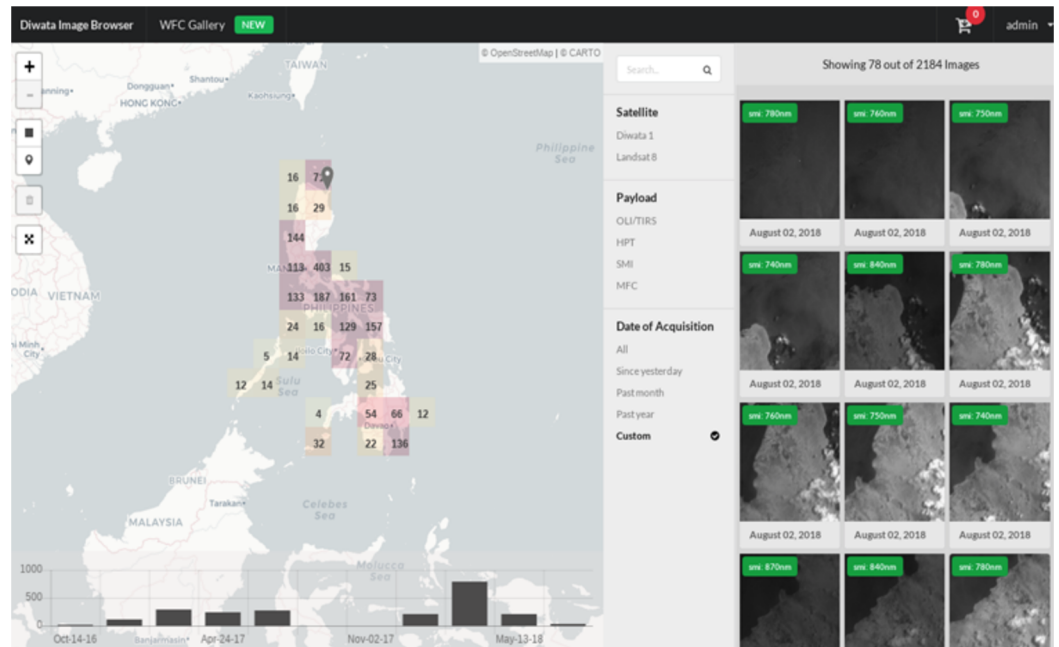
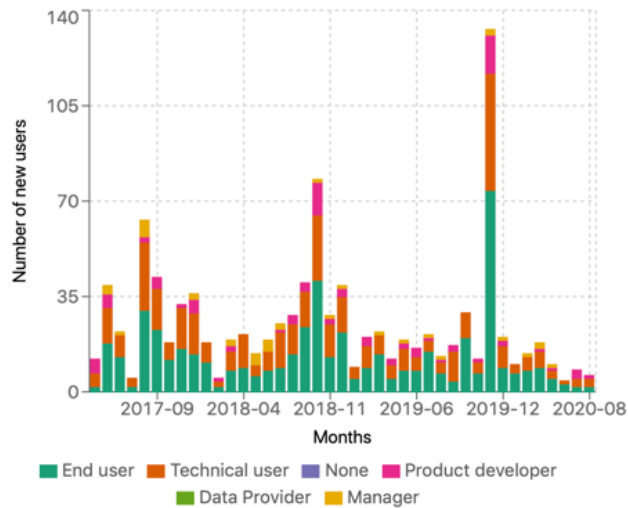
# Analysis Ready Data



## Satellite Data Products

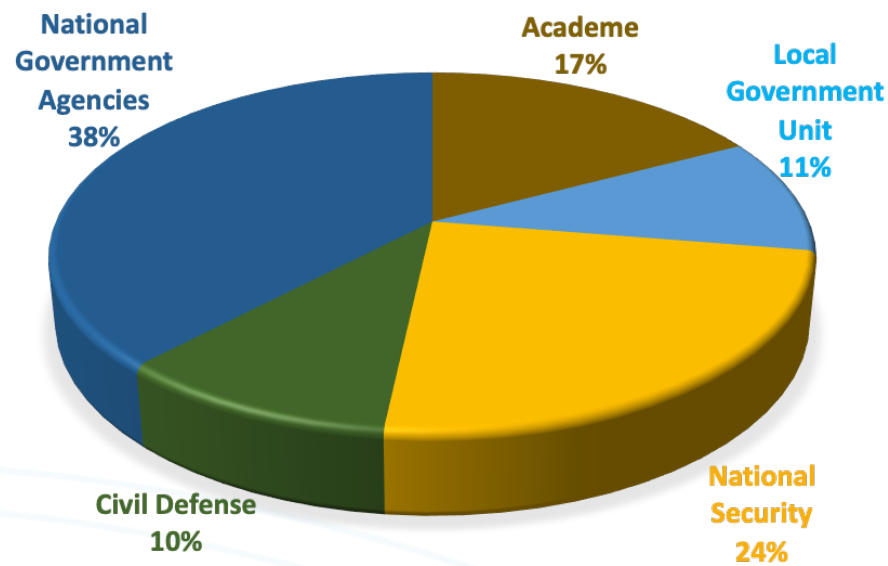
- Access to archived data: DIWATA-1/2
- Target imaging request from DIWATA-2

NEW USERS BY USER TYPE

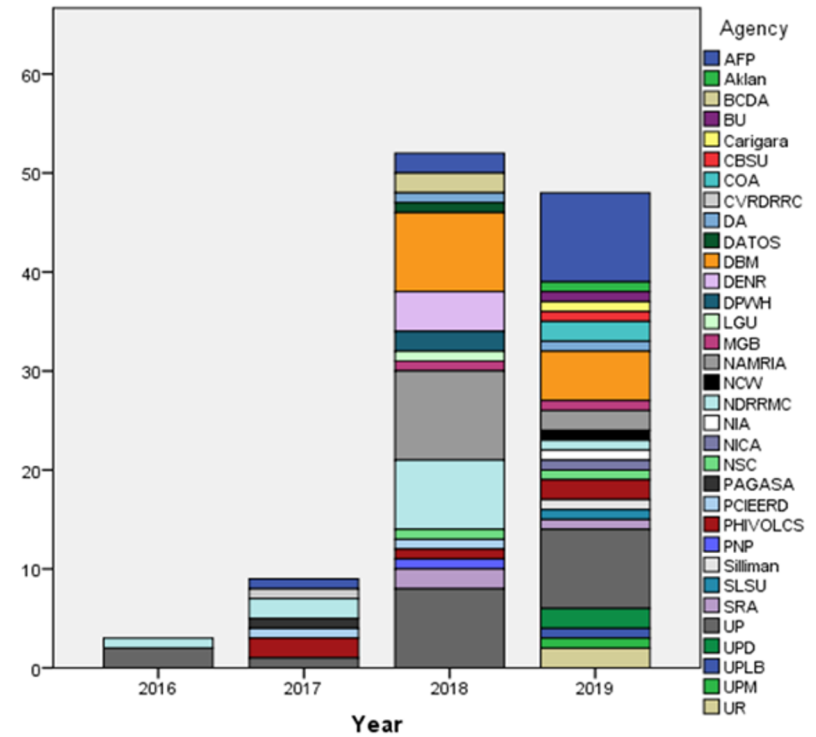


<https://staging.stamina4space.upd.edu.ph>

# Analysis Ready Data: VHR



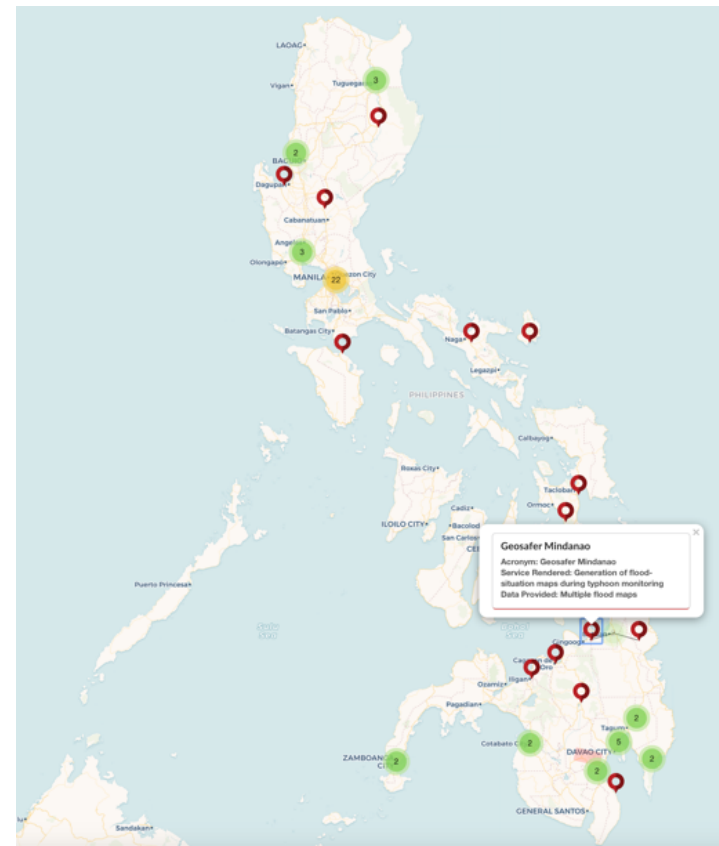
**26,000** satellite images consuming roughly **12.55 TB** worth of data





# Value-Added Products

- Flood-situation maps during typhoon monitoring
- Maps of drought-affected areas
- Earthquake damages and landslide extent
- Forest fire and urban fire extent
- Maps of fruit trees: mango, pili, and coconut
- Maps of major crops: rice, corn, and sugarcane
- Maps of fishponds, fish pens and fish cages



<http://space.gov.ph/spacedata/project/datos>

# Detecting Built-up Areas

- Built infrastructures such as houses and buildings are identified using high-resolution images
- Models using Artificial Intelligence (AI) can project future urban extent
- Provides valuable information for Comprehensive Land Use Plan (CLUP) at Local Government Units

Source: Our Place in Space, 2020



## LEGEND

■ Built-up Areas

## Cartographic Information

Coordinate System: WGS 84/UTM

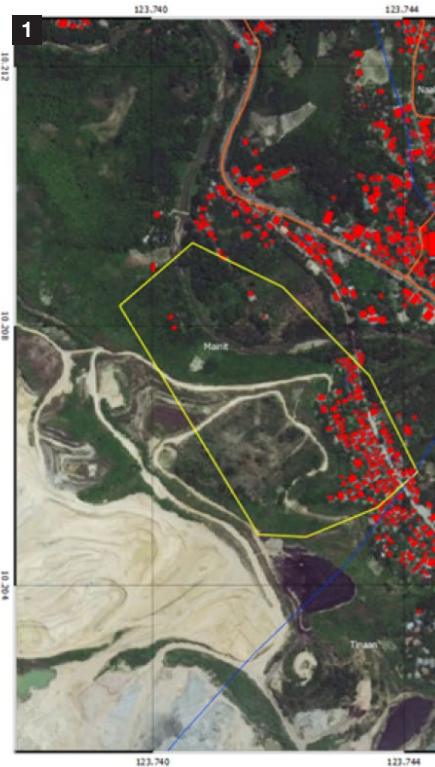
0 0.45 0.9 1.35 1.8 km

**1** **Satellite:** Planet Dove  
**Accessed via:** DOST-ASTI  
**Payload:** Optical  
**Capture dates:** 22 December 2016, 11 May 2017, and 23 June 2018  
**Resolution:** 3m  
**Basemap:** OpenStreetMap (inset)

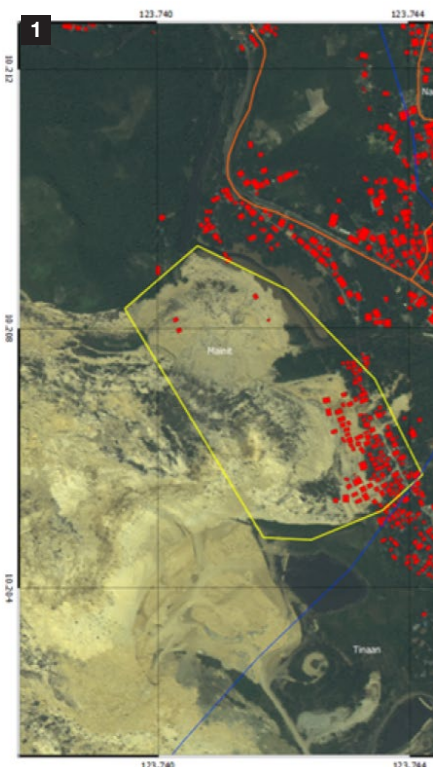
# Rapid Disaster Response

- Database of building footprints generated using AI and high-resolution images
- Overlaid image shows the extent of landslide that engulfed houses
- Critical information are produced in a timely manner

Source: Our Place in Space, 2020



Before



After Landslide

## LEGEND

- Barangays
- Roads
- Building Footprint
- Landslide Affected Area

1

**Satellite:** KOMPSAT-3  
**Accessed via:** DOST-ASTI

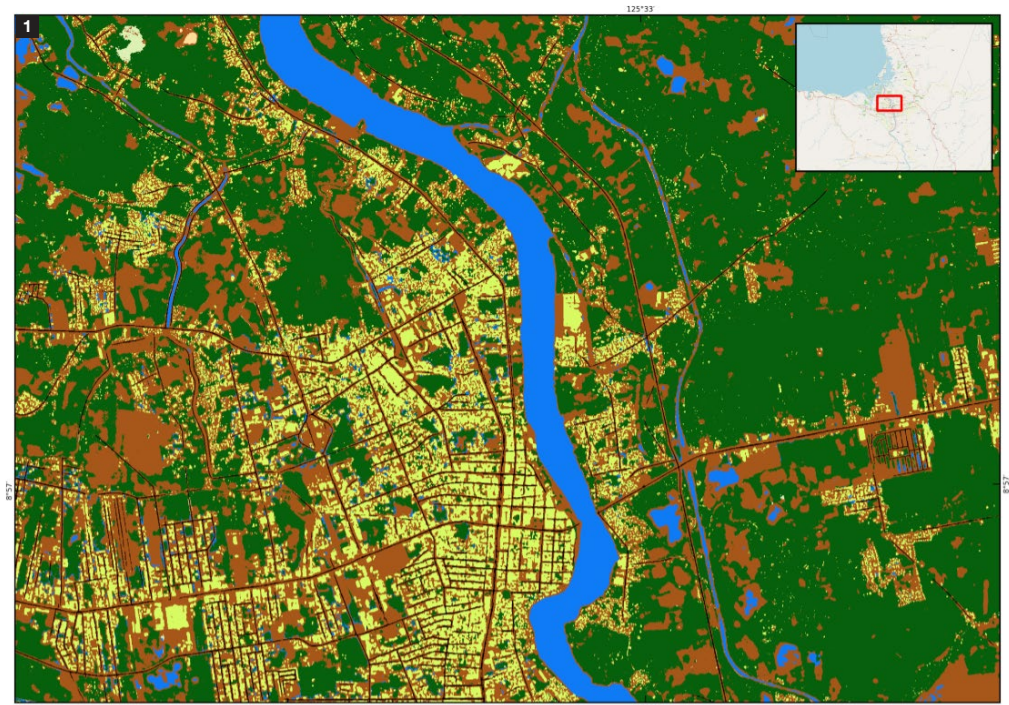
**Capture date:** 21 September 2018  
**Payload:** Optical  
**Resolution:** 0.5 m  
**Basemap:** ESRI (Pre-landslide)

# Updating Land Cover Maps

- Deep learning methods and automated systems are developed for land cover classifications
- In partnership with NAMRIA\*, different models were created for each class and were later merged to create a land cover map

\*NAMRIA – National Mapping and Resource Information Authority

Source: Our Place in Space, 2020



## LEGEND

- |             |              |
|-------------|--------------|
| ■ Roads     | ■ Built-up   |
| ■ Bare soil | ■ Vegetation |
| ■ Water     |              |

## Cartographic Information

Coordinate System: WGS 84/UTM  
0 0.35 0.7 1.05 1.4 km

1

**Satellite:** Planetscope Image  
**Accessed via:** DOST-ASTI  
**Capture date:** August 25, 2017  
**Payload:** Optical  
**Resolution:** 3m  
**Basemap:** OpenStreetMap

# Identification of Fruit Trees



## LEGEND

■ Coconut trees

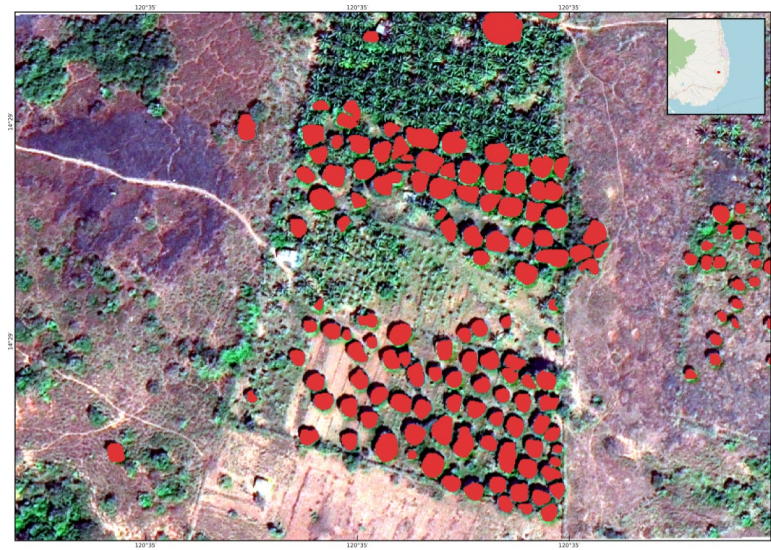
## Cartographic Information

Coordinate System: WGS 84/UTM  
0 0.01 0.02 0.03 0.04 km

1

Satellite: Digital Globe  
Accessed via: DOST-ASTI  
Capture date: May 2018  
Payload: Optical  
Resolution: 0.5 m  
Basemap: OpenStreetMap (inset)

Coconut



## LEGEND

■ Mango trees

## Cartographic Information

Coordinate System: WGS 84/UTM  
0 0.02 0.04 0.06 0.08 km

1 VHR Imagery

Satellite: Digital Globe  
Accessed via: DOST-ASTI  
Capture date: May 2018  
Payload: Optical  
Resolution: 0.5m  
Basemap: OpenStreetMap (inset)

Mango

Source: Our Place in Space, 2020

# Regional Analysis: Urban Sprawl



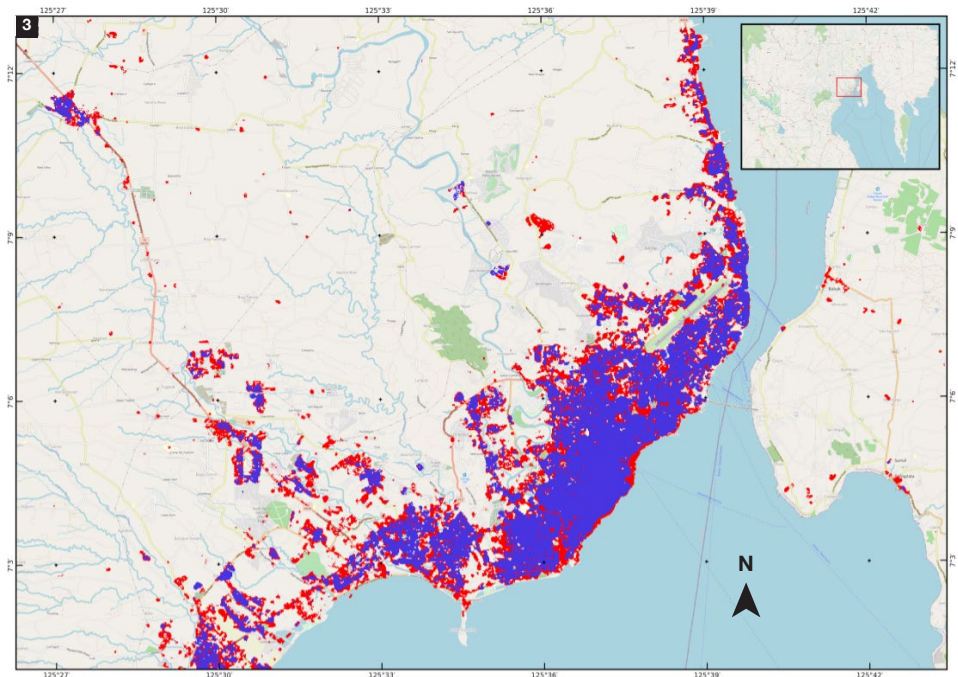
■ 56.78% Vegetated Areas  
■ 40.10% Built-up Areas

**1**  
**Satellite:** Rapid Eye  
**Accessed via:** DOST-ASTI  
**Capture date:** 10 February 2013  
**Payload:** Optical  
**Resolution:** 5 m  
**Basemap:** PhilGIS, Google Earth



■ 35.27% Vegetated Areas  
■ 57.65% Built-up Areas

**2**  
**Satellite:** Rapid Eye  
**Accessed via:** DOST-ASTI  
**Capture date:** 10 February 2017  
**Payload:** Optical  
**Resolution:** 5 m  
**Basemap:** PhilGIS, Google Earth



**LEGEND**  
 Land Area  
■ 2013 Built-up Areas  
■ 2016 Built-up Areas

**3 Multi-temporal Optical Imagery**  
**Satellite:** Landsat 8  
**Capture date:** Whole year predictions (2013 and 2016)  
**Accessed via:** DOST-ASTI

Source: Our Place in Space, 2020

# Regional Analysis: Mapping of Major Crops

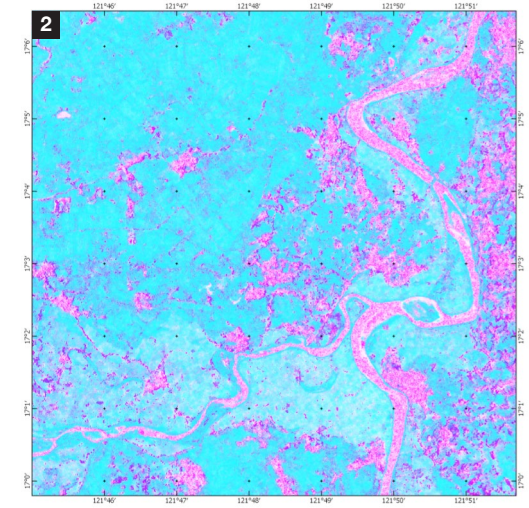
- Crops are identified by monitoring its growth stages using time series analysis of images
- Inventory, monitoring, and yield projection of high-value crops such as rice, corn, and sugarcane are of utmost importance in the Philippines



## 1 Multi-temporal SAR Imagery

**Satellite:** Sentinel-1A, 1B  
**Location:** Tarlac Mill District  
**Accessed via:** DOST-ASTI  
**Capture period:** 01 November 2016 to 08 March 2018  
**Payload:** SAR  
**Resolution:** 15 m  
**Basemap:** OpenStreetMap (inset)

 Sugarcane



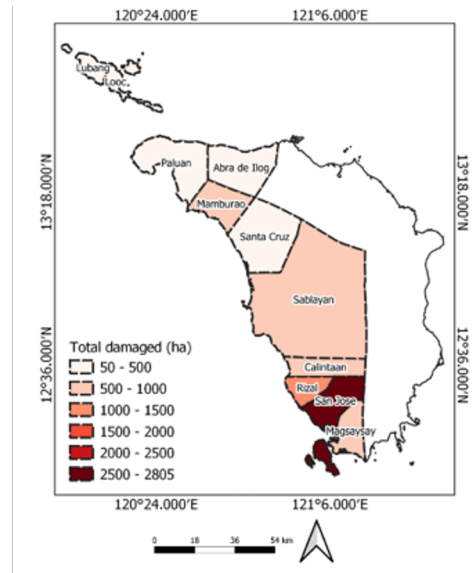
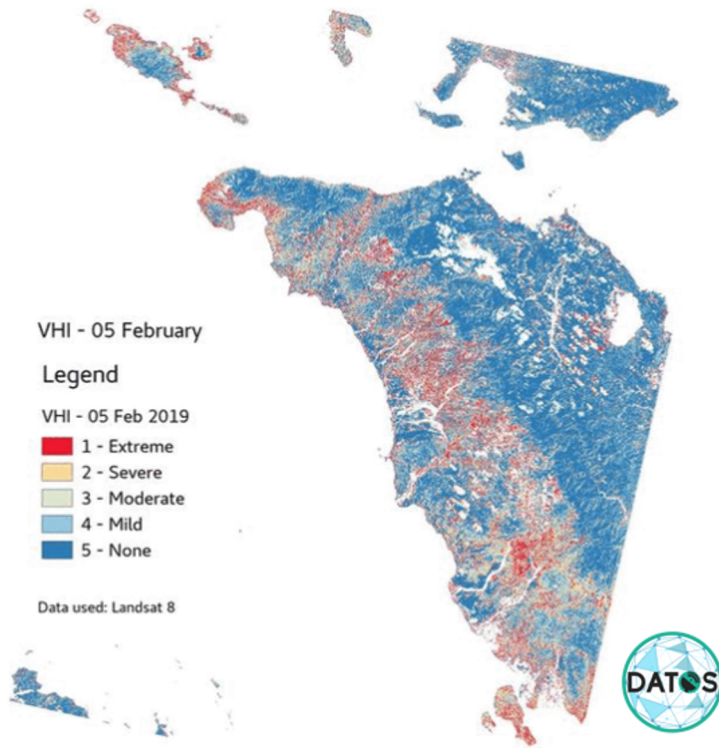
## 2 Multi-temporal SAR Imagery

**Location:** Isabela  
**Satellite:** Sentinel-1A, 1B  
**Accessed via:** DOST-ASTI  
**Capture period:** 06 April 2017 to 12 June 2018  
**Payload:** SAR  
**Resolution:** 15 m  
**Basemap:** OpenStreetMap (inset)

 Rice

Source: Our Place in Space, 2020

# Agricultural Drought Monitoring

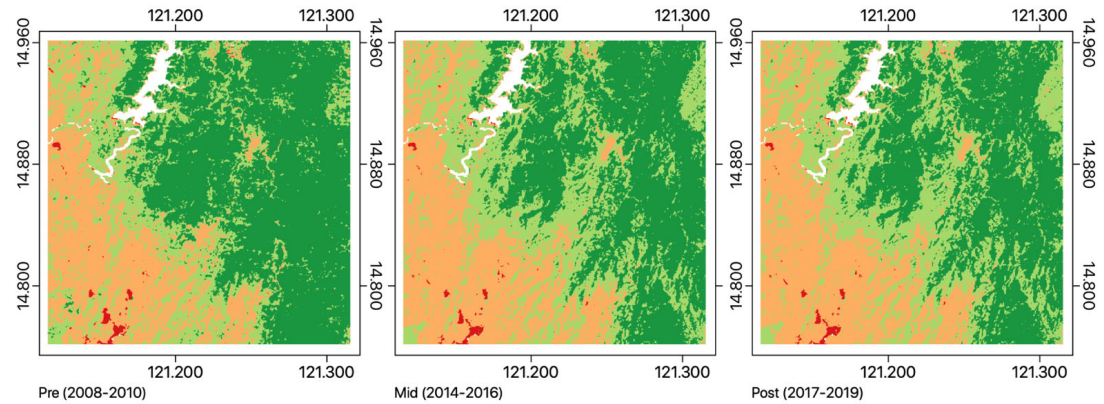
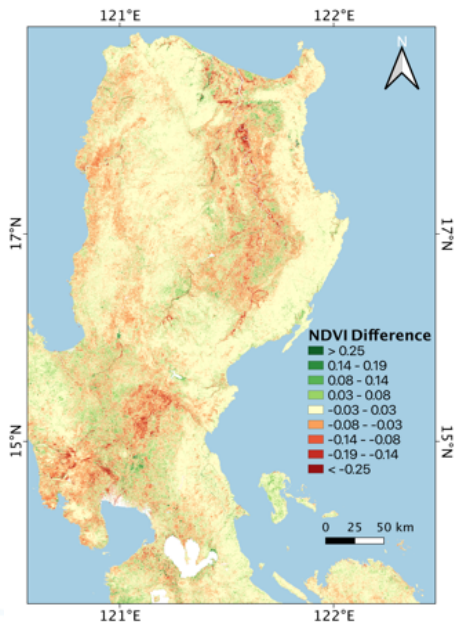


Actual drought damages in Occidental Mindoro

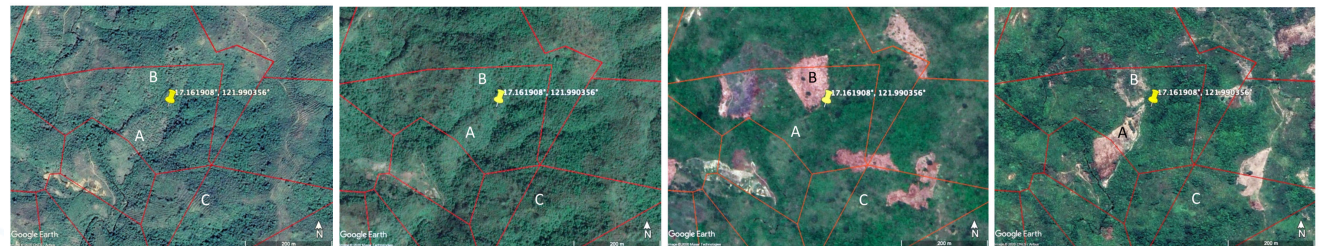




# Reforestation and Deforestation



■ Closed Forest    ■ Sparse Vegetation  
■ Open Forest    ■ Non-Vegetation



2 March 2014

15 January 2016

5 April 2016

11 July 2019

Source: Perez, et al. Forests, 2020



# PhilSA Flagship Initiatives

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- *Building Satellites* as Vital Component of National Information Infrastructure

# Advanced Satellite Platform with Multispectral Imager

- **Multiple imaging bands** to generate key geophysical parameters for **agricultural monitoring and assessment**
- Imaging in **Aerosol/Coastal band** for **coastal environment monitoring**
- **Wide swath coverage at high resolution** for **disaster response and other land applications**

 **9**  
Spectral Bands

**120km**  
  
Wide Swath

**5m**   
Resolution



# Concluding Remarks

- While the **Philippine Space Agency** is only recently established and is building from ground up, it **is not starting from scratch**.
- A number of space science and technology applications (SSTA) activities have been pursued as project-based initiatives leading up to the establishment of the PhilSA, which produced emergent technological capabilities and infrastructure for the PhilSA to build on.
- **LCLUC activities** focused on developing operational workflows for applications that **cater to the needs of various government agencies** through the use of AI and VHR images for local analysis and time series of optical and SAR imagery for regional analysis.
- PhilSA's succeeding programs aim to institutionalize, operationalize and sustain these activities.

# Acknowledgement



**Philippine  
Space  
Agency**

The PhilSA envisions a Filipino nation ***bridged, uplifted, and empowered*** through the peaceful uses of outer space.

We will promote and sustain a robust Philippine space ecosystem that ***adds and creates value*** in space ***for and from Filipinos and for the world.***



Space Technology and Applications  
Mastery, Innovation and Advancement



Philippine Earth Data  
Resource & Observation



Remote Sensing and Data  
Science Help Desk



Drought and Crop Assessment  
and Forecasting

## References:

- [1] Space Data Mobilization, Our Place in Space: Space S&T and Applications in the Philippines, Vol. 1, 2020
- [2] Perez, et al., Reforestation and Deforestation in Northern Luzon, Philippines: Critical Issues as Observed from Space, Forests, 2020

## Thank you very much!

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