

# Leveraging Space Technology: Solutions and Applications Using Planet Satellite Data in India



Partha Ghosh, Presales Head – India , Planet

**RASHTRAPATI BHAVAN** · New Delhi, India · October 21, 2021



## PLANET'S MISSION

To image the whole world every day and make global change **visible, accessible,** and **actionable.**

## Our Public Benefit Corporation (PBC)

### Purpose:

To accelerate humanity toward a more sustainable, secure, and prosperous world by illuminating environmental and social change.





## CURRENT CONSTELLATIONS

### SuperDove

#### Always-on Monitoring

- ~200 satellites
- Up to 300 million km<sup>2</sup>/ day
- 8-band
- Unique scanning

### SkySat

#### High-Resolution Tasking

- 21 satellites
- 50cm resolution
- RGB, NIR, and Pan bands
- Sub-daily tasking

## PLANNED FUTURE CONSTELLATIONS

### Tanager

#### Hyperspectral Tasking

- 400 - 2500 nm
- ~400 5nm bands
- Technical demo planned to launch late 2023

### Pelican

#### Very High Resolution Tasking

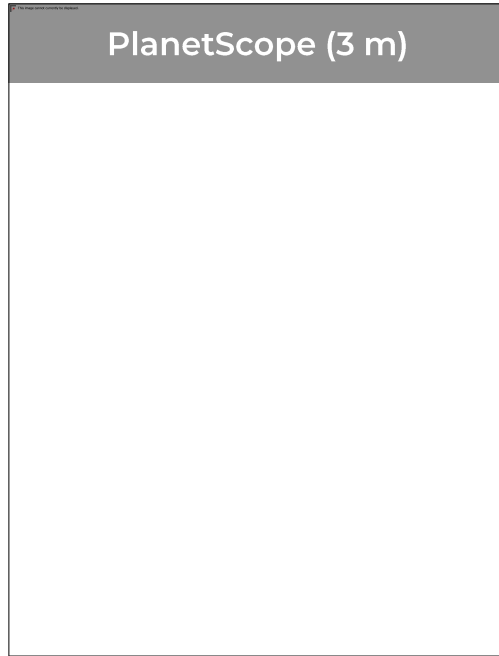
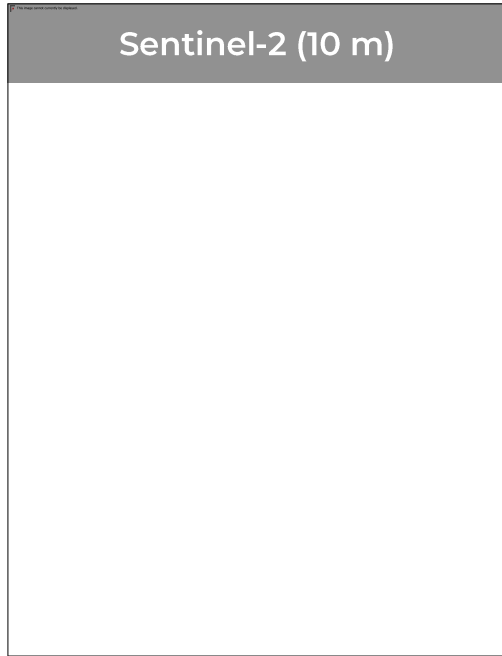
- Initial fleet of up to 30 satellites<sup>1</sup>
- 30cm resolution
- Pan + 6 RGB+NIR bands
- Up to 30 revisits/day

<sup>1</sup> Does not include initial 2 demonstration satellites planned for FY'24.

# VISIBLE Agile Space Missions



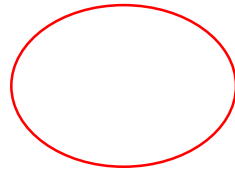
# More Spatial Resolution Means Better Spatial Accuracy with Planet Imagery

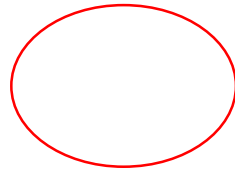






- Morbi







- Morbi







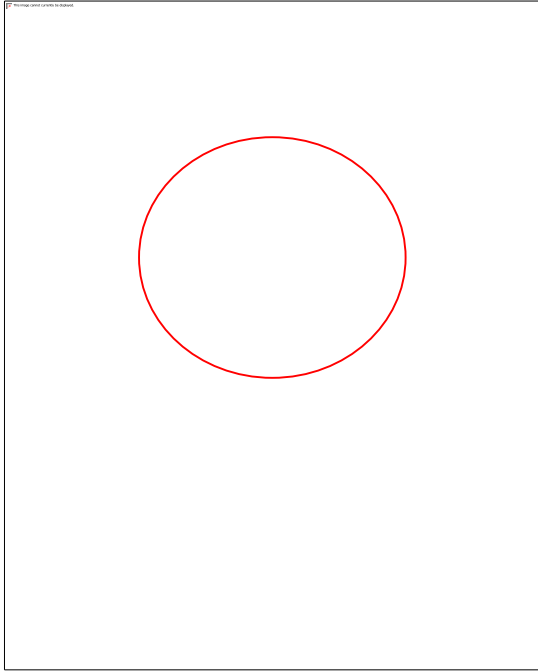
- Morbi



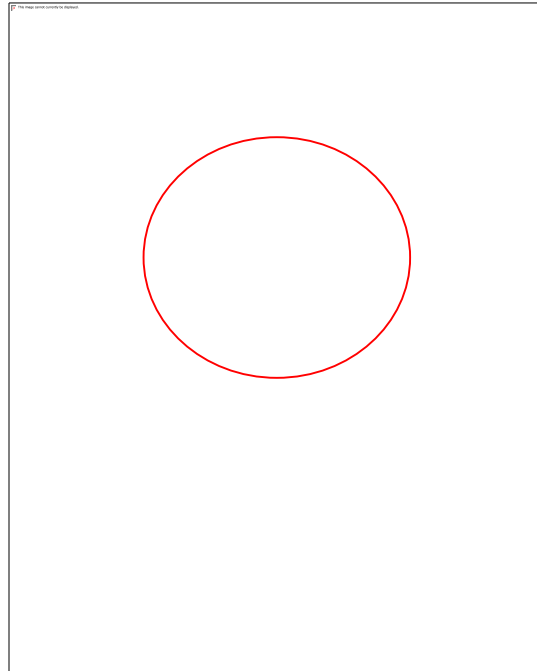




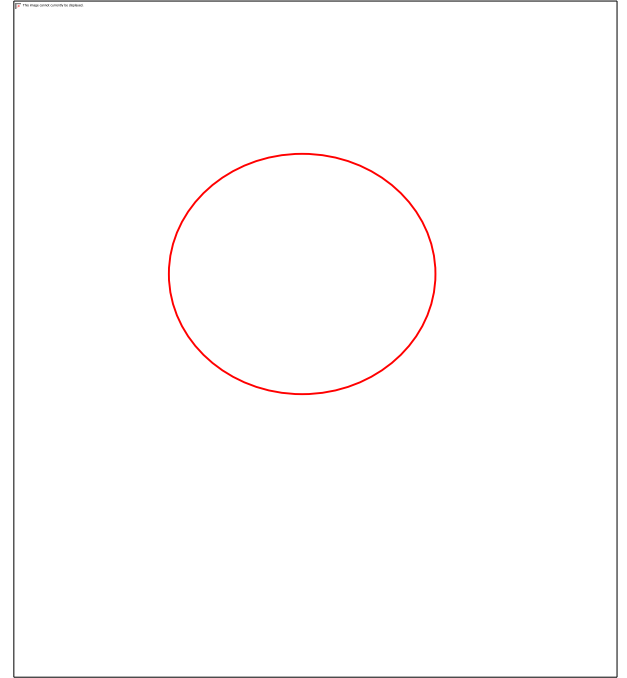
# Daily Change Monitoring in Gurgaon



PlanetScope (3m) 6-Sept-2022



PlanetScope (3m) 7-Sep-2022

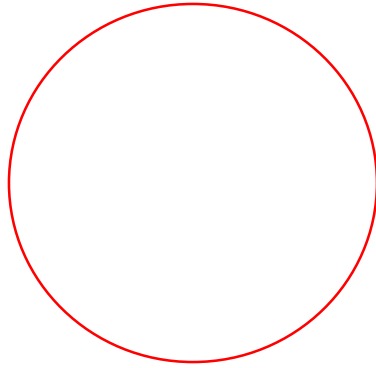


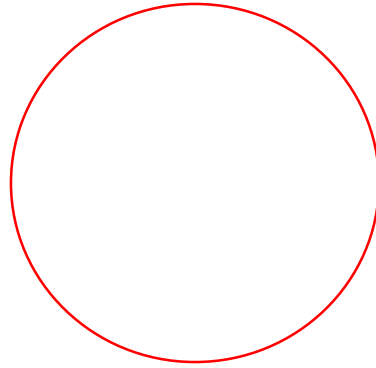
SkySat (50cm) 7-Sept-2022





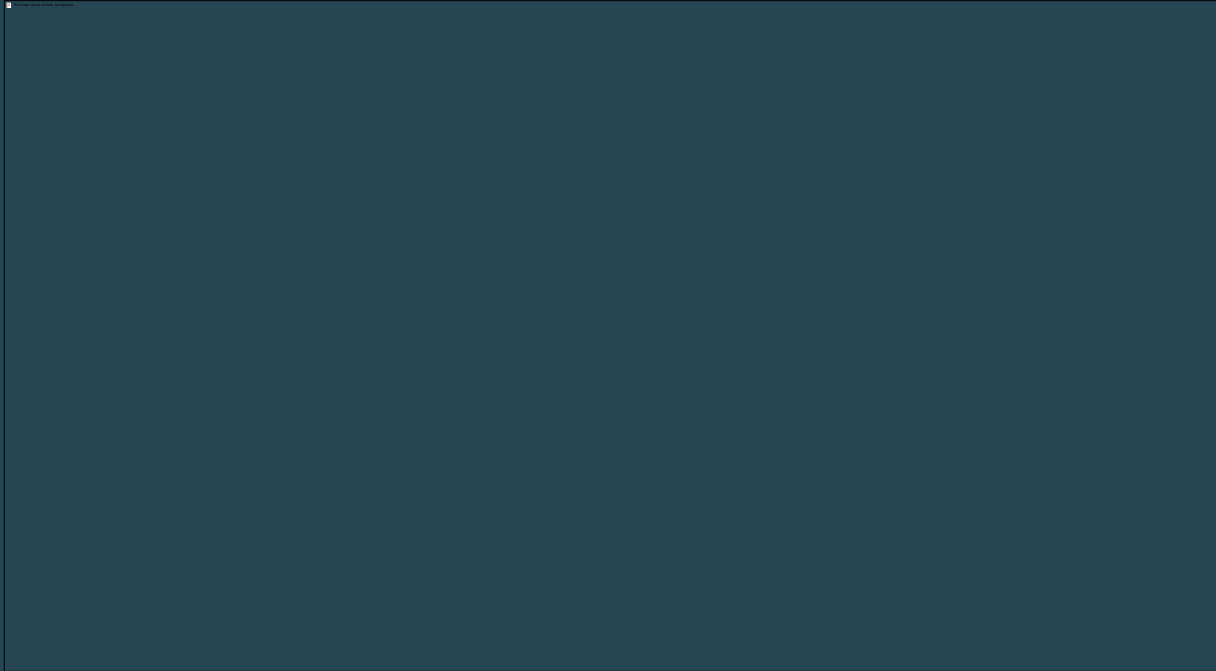








# PlanetScope 8 Band Spectral Response



## **SuperDove (PSB.SD)** **Relative Spectral** **Response**

Coastal Blue 431-452 nm

Blue: 465-515 nm

Green I: 513. - 549 nm

Green: 547. - 583 nm

Yellow: 600-620 nm

Red: 650 - 680 nm

Red-Edge: 697 - 713 nm

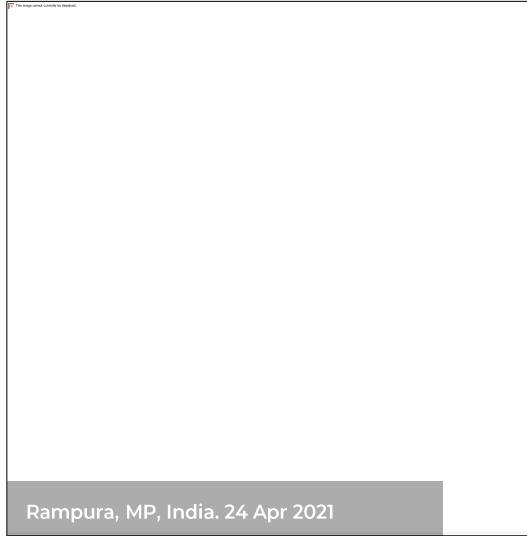
NIR: 845 - 885 nm







# NDVI, RENDVI & PRI



**Normalized Difference  
Vegetation Index (NDVI)**



**Red Edge NDVI  
(RENDVI)**



**Photochemical  
Reflectance Index (PRI)**



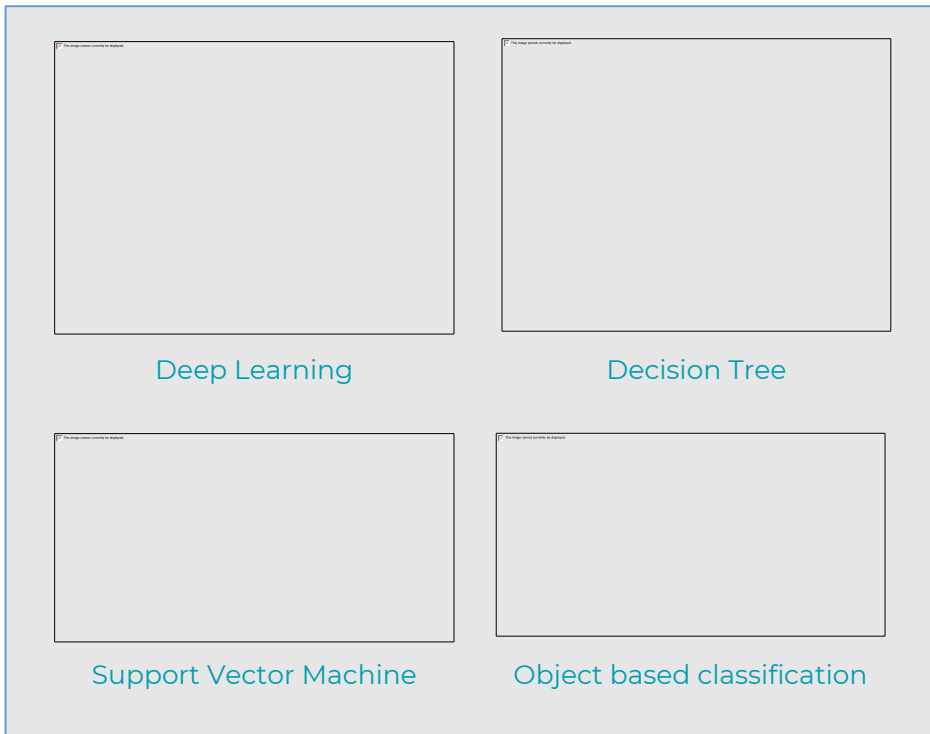
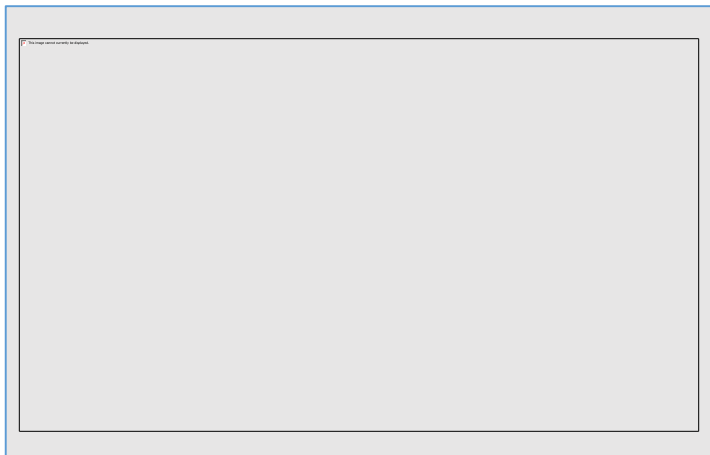
# Change Detection





# Analytics, AI, ML in Remote Sensing

## Object detection and classification



- Algorithms are decades old in all Standard COTS
- Challenges:
  - Training imagery/ Label
  - Processing power of hardware

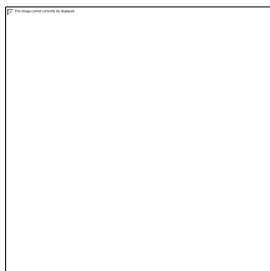




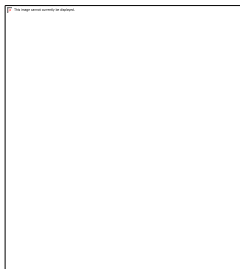
# Road & Building Change Detection

## A Technological Assist

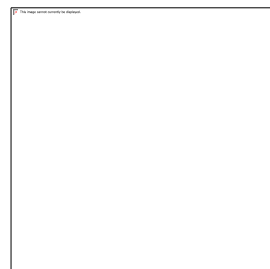
Monitoring country-wide areas to help users narrow their attention to where development is taking place for next level review



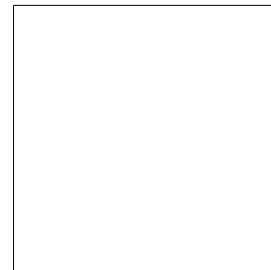
Civil Government



Defense &  
Intelligence



Mapping



NGOs





# How do Analytic Feeds work?

1

## Develop a model

Models trained to recognize features in imagery

2

## Create a Feed

A feed is the blueprint for what processing is required to create Analytic outputs

3

## Create a subscription

A set of conditions for when imagery is processed by feed (ie, AOI and TOI)

4

## Grant user access to subscription

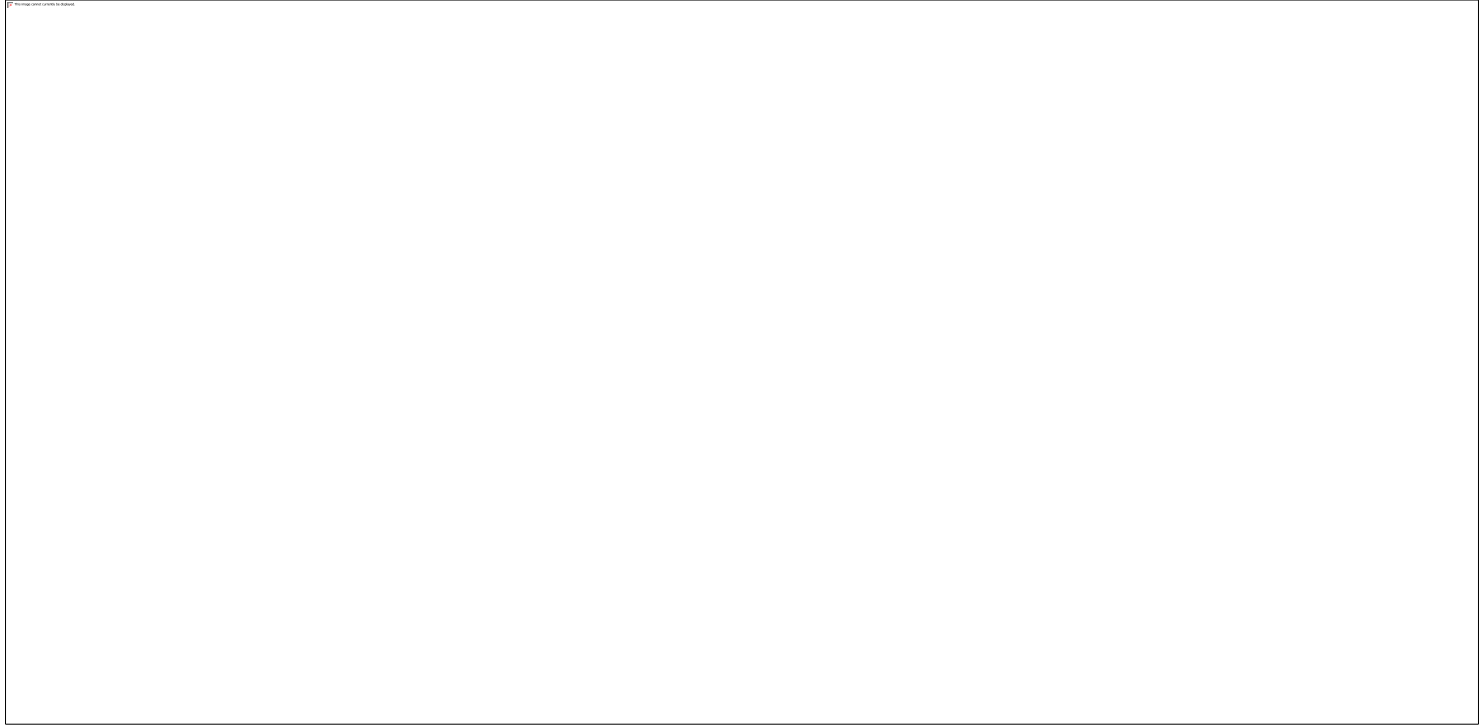
Allow people to get the Analytic outputs





# Planet Analytic Feed Viewer

Efficiently view your detections on the web



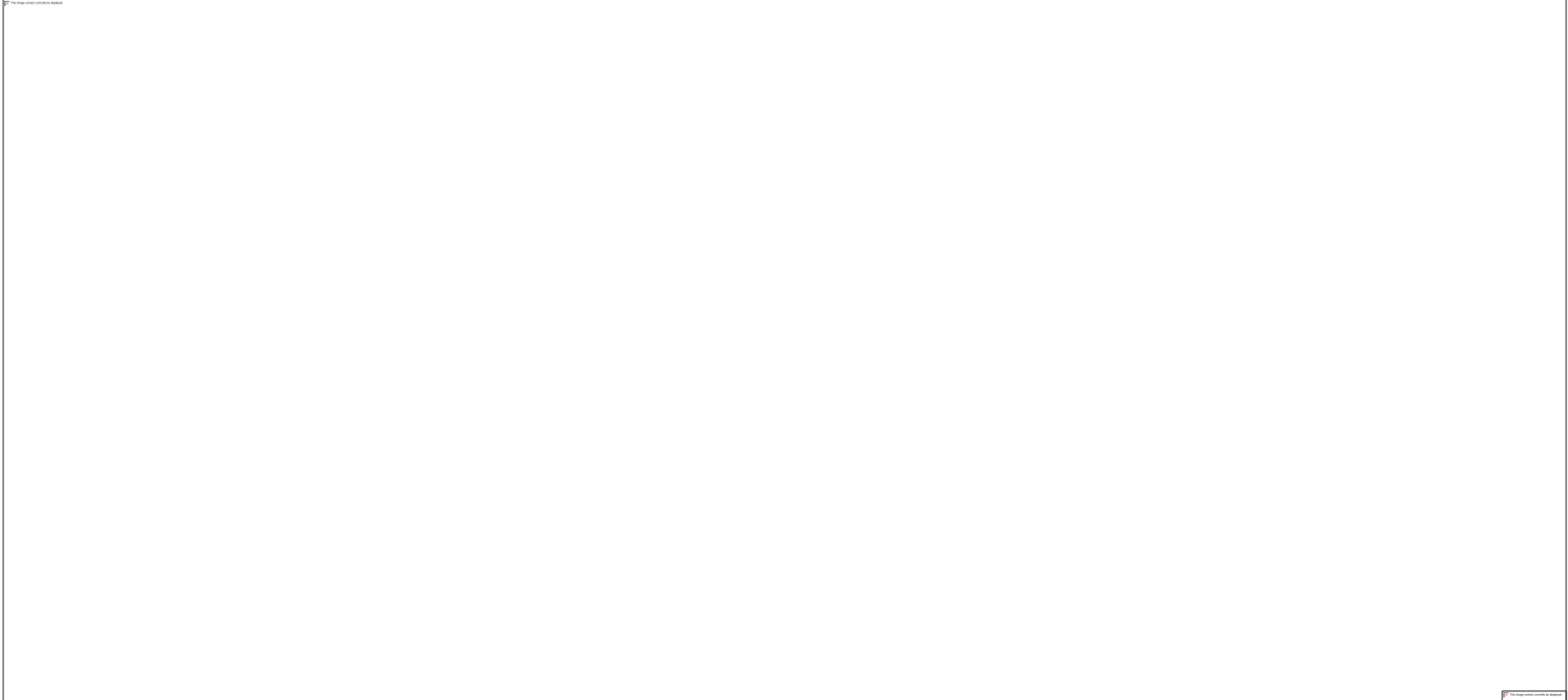


# Planet Analytic Feed Viewer





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# Planet Analytic Feed Viewer





# Planet Analytic Feed Viewer

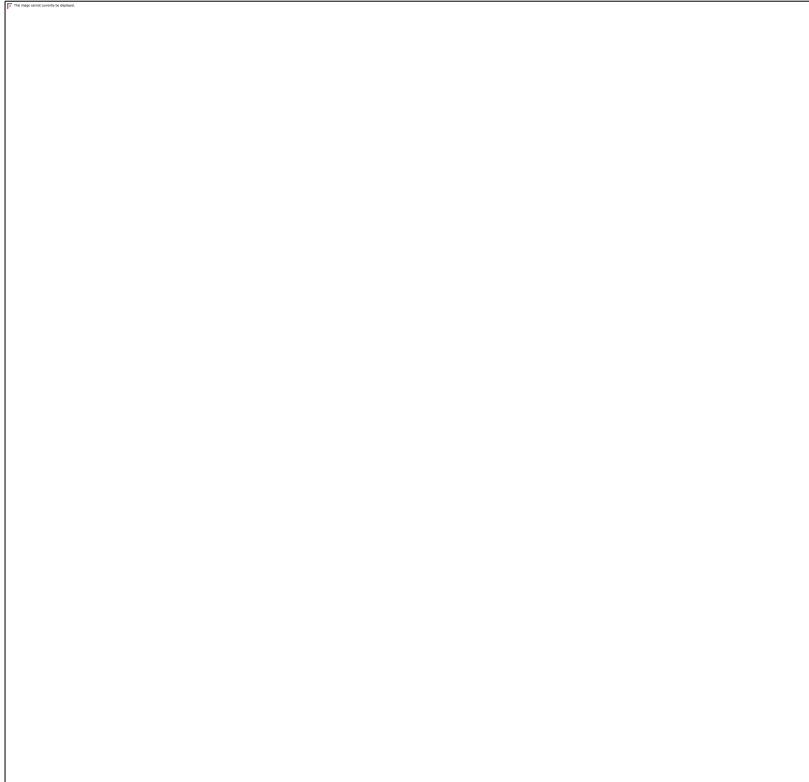


# Classification of Land





# Land Classification using Planet Imagery



Planet data, can increased accuracy results:

**67% Accuracy**  **87% Accuracy**

*“This research demonstrated the Object-based approaches’ applicability in Google Earth Engine, even in vast study areas and using high-resolution imagery. Although additional applications are necessary, the proposed methodology appears to be very promising for properly exploiting the potential of Planet Labs data in Google Earth Engine,” wrote Vizzari.*

Comparison of LULC classification approaches in a representative region of the study area. Location of the area (blue arrow and rectangle) within the study area (red rectangle) (a), Google aerial view (b), 1\_PB\_S2 (c), 2\_PB\_S2S1 (d), 3\_PB\_PL (e), 4\_PB\_S2S1PL (f), 5\_OB\_S2 (g), 6\_OB\_S2S1 (h), 7\_OB\_S2S1T (i), 8\_OB\_PL (j), 9\_OB\_S2S1PL (k), 10\_OB\_PL\_S2S1 (l). PB: pixel-based, OB: object-based, S2: Sentinel 2, S1: Sentinel 1, PL: PlanetScope.





# Land Classification using Planet Imagery



Planet data, can increased accuracy results:

67% Accuracy



87% Accuracy



LULC from Sentinel-2 Imagery

LULC from PlanetScope Imagery

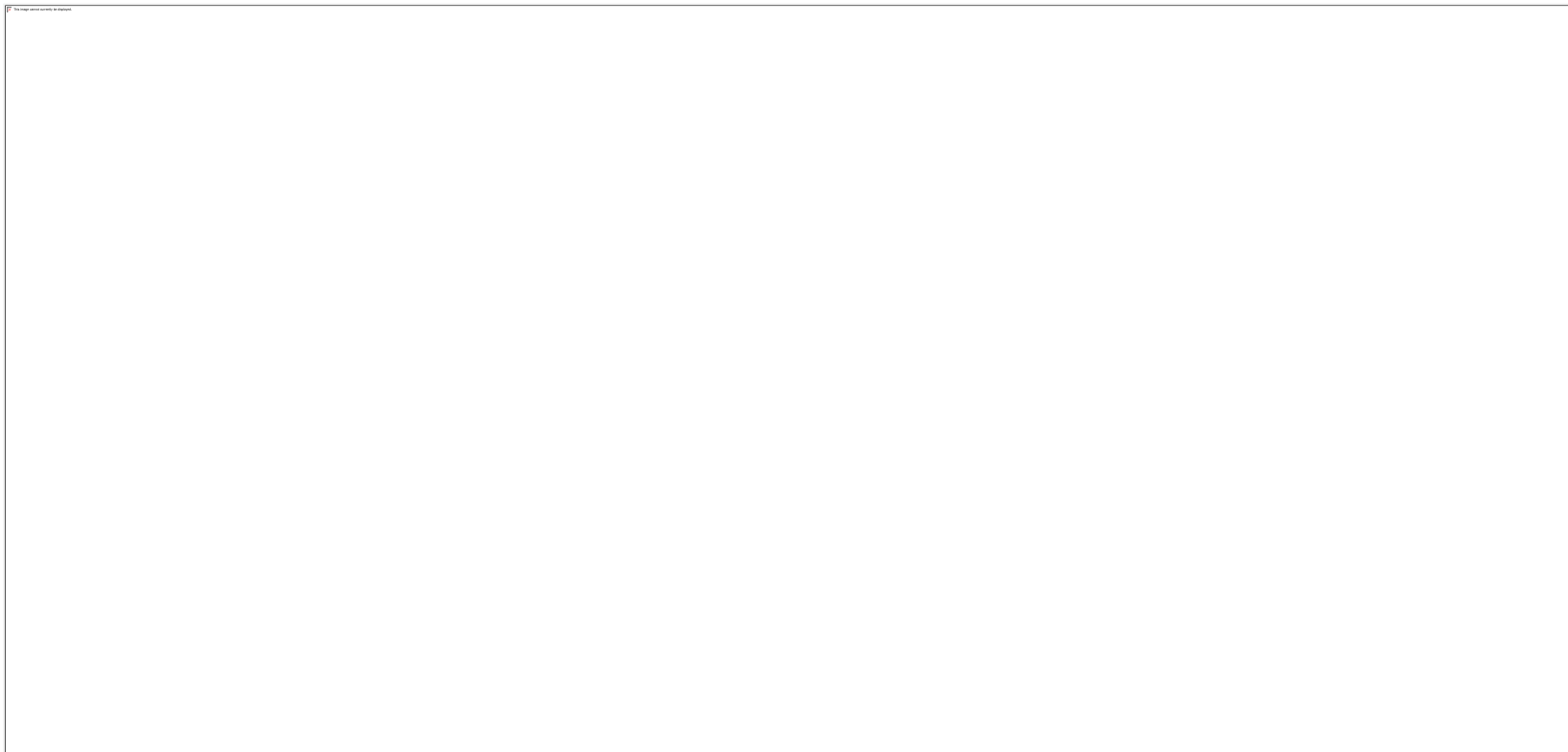


# Land use Change Monitoring



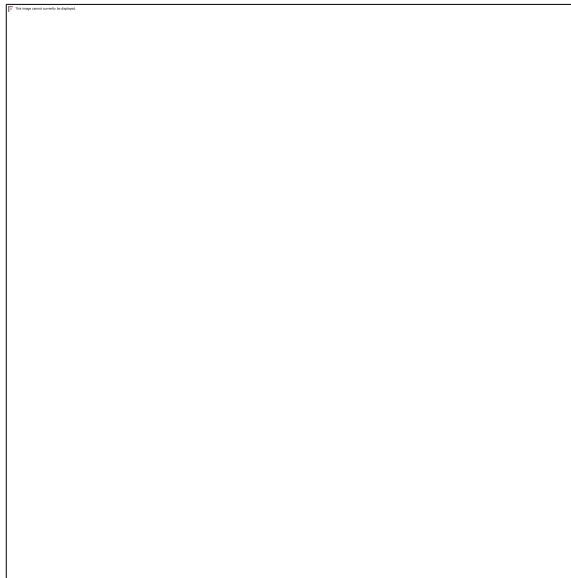


# Desertification Control Project, Ningxia, China

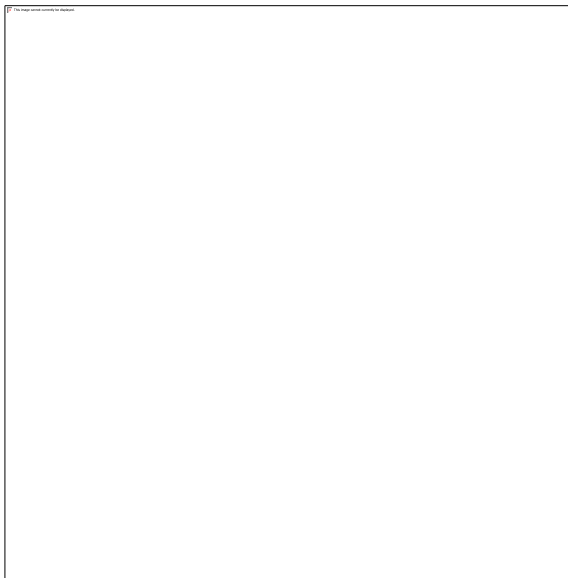




# Desertification Control Project, Ningxia, China



RapidEye, 18 Aug 2014



RapidEye, 9 Aug 2017



PlanetScope, 26 Aug 2020





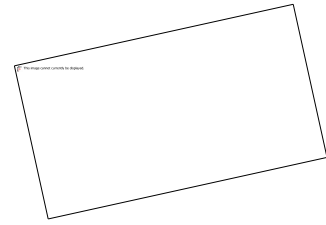
# Cadastral Change and Land Revenue





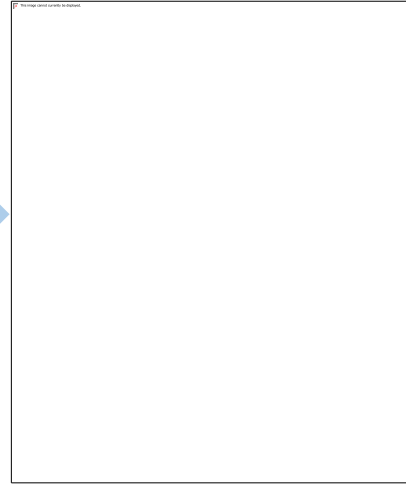
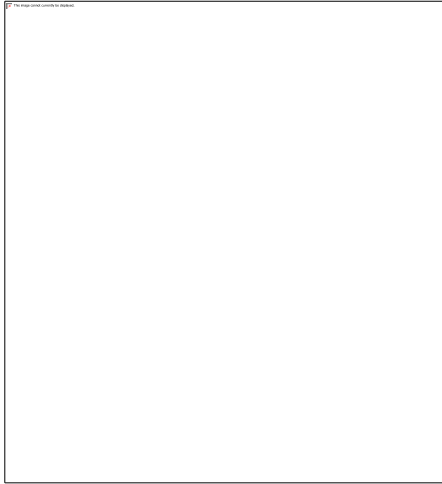
# Tax Department, City of Wroclaw, Poland

Visuals courtesy of SatRevolution



## STEP 2

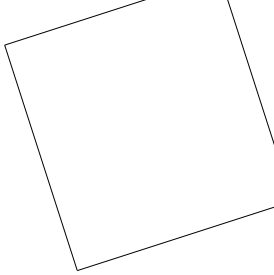
Use Planet's monthly 3-5 m **automatic building change detection** analytics





# How is this done?

Visuals courtesy of SatRevolution



## STEP 3

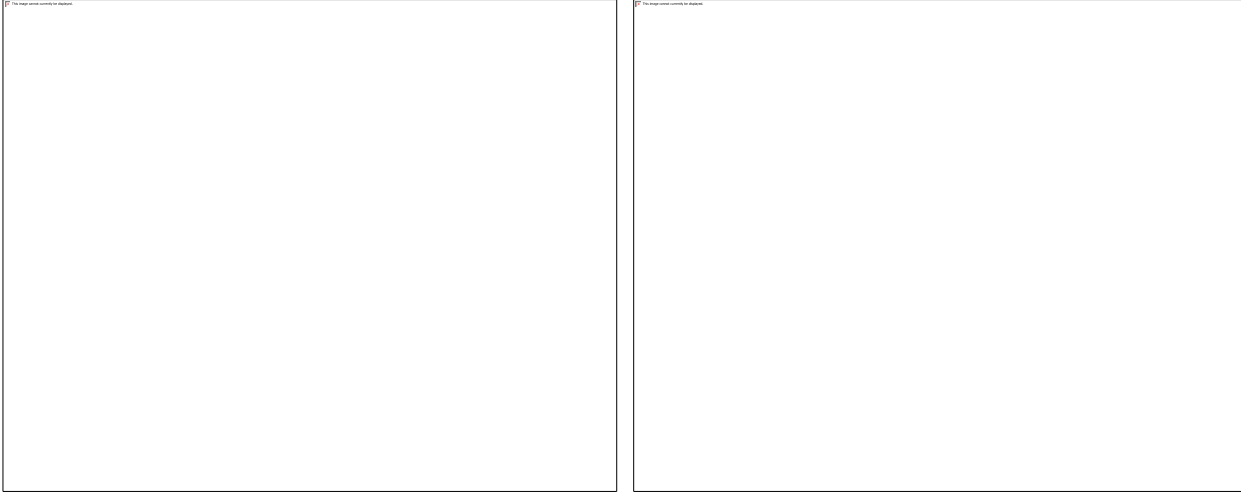
Obtain a **closer look** of the development with high (0.5m) resolution tasking





# How is this done?

Visuals courtesy of SatRevolution



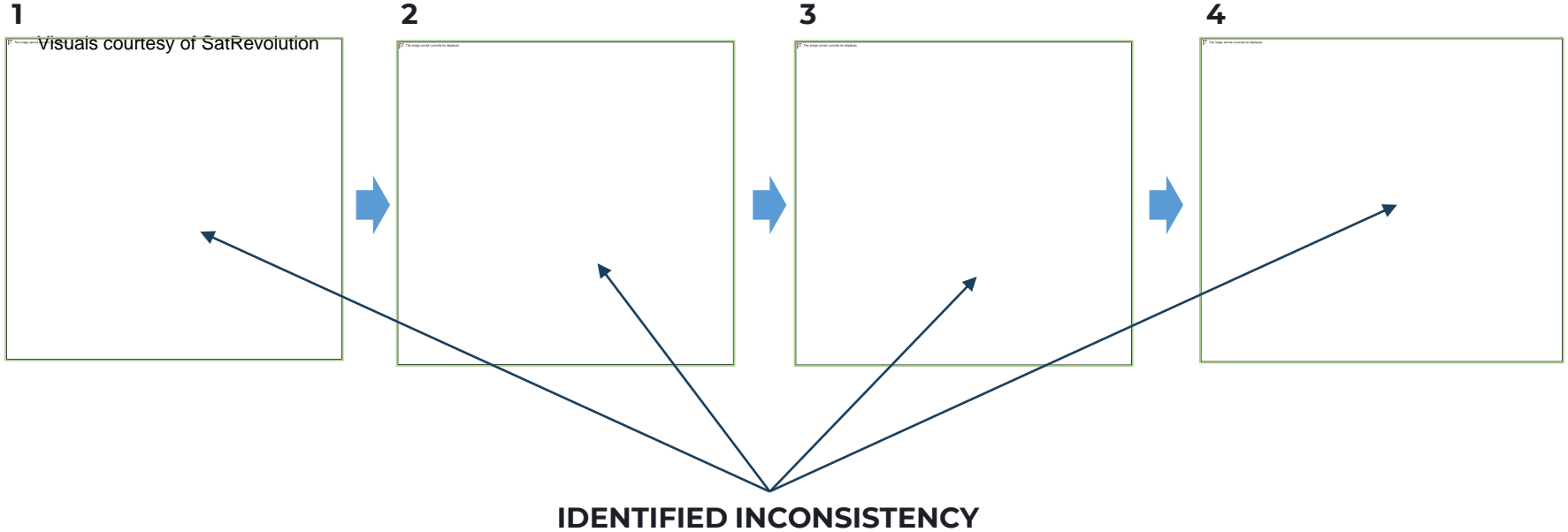
## STEP 4

Alerts with mismatches between detected construction and cadastral information automatically generated





# Let's have a closer look

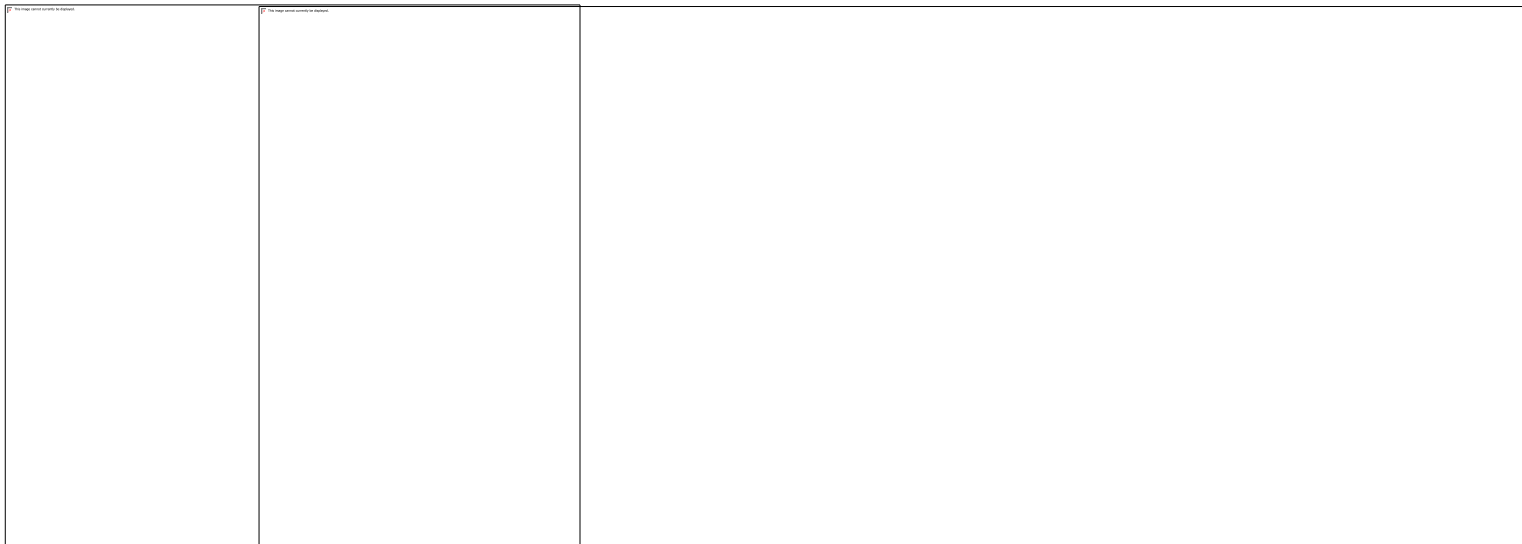


# Soil Moisture

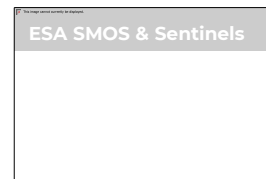
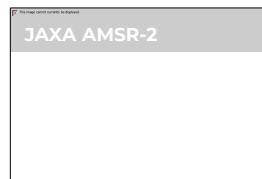
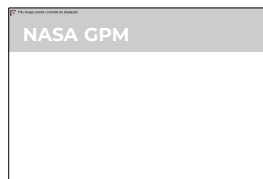
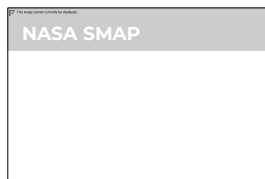




# Planetary variables



Public Satellite  
constellation





# Planetary variables

Soil water content [ $\text{m}^3/\text{m}^3$ ]



100 x 100 m  
Near Real Time  
20 years archive  
Global

Land surface temperature [K]



100 x 100 m  
Near Real Time  
20 years archive  
Global

Biomass proxy [-]



10 x 10 m  
Near Real Time  
4 years archive  
Global







# Start on an exciting journey with Planet... *... and there's more to come along the way!*



## PlanetScope

Always-on Monitoring

- 200+ satellites
- 3m resolution
- 8-band
- No tasking required



## SkySat

High-Resolution Tasking

- 21 satellites
- 50cm resolution
- RGB, NIR, and Pan bands
- Sub-daily tasking

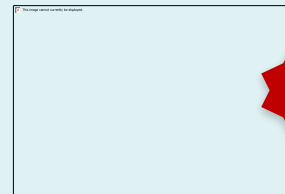


2023

## Pelican (2023)

Very High Resolution Tasking

- Up to 32 satellites
- **30cm resolution**
- Pan + 6 RGB+NIR bands
- **Up to 30 revisits/day**



2023

## Hyperspectral (2023)

Hyperspectral Tasking

- Planned late 2023 launch
- 2 satellites to start
- 30m resolution
- **~400 bands**



VISIBLE

# High Revisit, High Res Data

Meet Pelican

Planet's next-generation satellite constellation for delivering high-resolution, rapid revisit information – anywhere on the globe.

RESPONSIVE • RAPID REVISIT • HIGHLY PRECISE • INTEROPERABLE

EXPANSIVE  
COVERAGE

UP TO

30

satellites<sup>1</sup>

GREATER  
PRECISION

30

cm  
resolution

MORE  
CAPTURES

UP TO

30

captures  
per day

HIGHER DAILY  
REVISITS

Approximately

30

minute  
revisit time





VISIBLE

# High Precision Hyperspectral Data Brought to you by Tanager



Hyperspectral imaging captures the unseen, revealing valuable information that enables improved modeling, reduced uncertainty, and better, more efficient decision making.

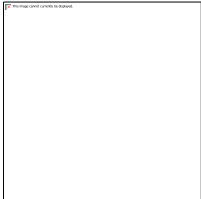


- CROP DIFFERENTIATION • BIODIVERSITY TRACKING
- METHANE MONITORING • MATERIALS IDENTIFICATION
- ENVIRONMENTAL SITE ASSESSMENT
- SOIL CHARACTERISTICS • AND MANY MORE





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# Partha Pratim Ghosh

