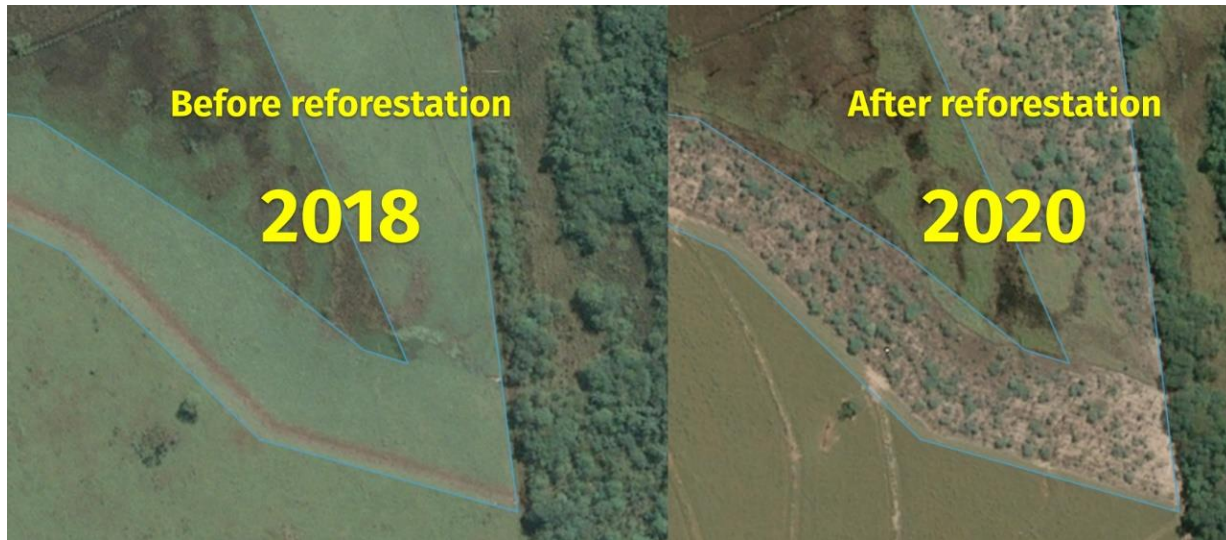## Monitoring Reforestation and Deforestation Activities

Comparison of Pléiades imagery of 0.5-meter of a forest restoration site in 2018 and 2020 (Source: blog.explorer.land).

Product Category

■ Land Use	☐ Natural Disaster	☐ Coast Management	☐ Earth's Surface Motion
☐ Land Cover	☐ Climate Change	☐ Marine	

Financial Domain(s)

☐ **Investment management**	■ **Risk analysis**	☐ **Insurance management**	■ **Green finance**

User requirements

UN27: Need to assess historical trends and baseline of natural assets.

UN28: Need to classify the types of crops being grown in order to assess the sustainability and environmental impact of agricultural investments.

UN30: Need for monitoring with accurate measurements of the growth and health of trees.

UN39: Need to assess the potential impact of business activities or investments on ecosystems and biodiversity.

Description

Earth Observation helps establish baseline data by providing detailed information about the current state of forests and land cover. It enables the identification of areas suitable for reforestation and helps estimate the extent of deforestation or degradation that has taken place. Optical and SAR sensors allow for the continuous monitoring of reforestation efforts. It enables the assessment of tree planting activities, including the extent, density, and spatial distribution of newly planted trees. Satellite imagery can be used to estimate tree survival rates, monitor the growth and health of planted trees, and track changes in vegetation cover over time. Also, earth observation helps in detecting and monitoring instances of deforestation or illegal logging within reforested areas. Satellite imagery can identify changes in land cover and detect signs of forest clearance or encroachment. Early detection of deforestation enables prompt action to protect reforested areas and implement mitigation measures.

Spatial Coverage Target

Forests

Data Throughput

Rapid tasking	☐ High	■ Low
Data availability	■ High	☐ Low

Product specifications	
Main processing steps	Medium resolution or VHR optical/SAR satellite imagery can be used to monitor reforestation and deforestation activities. The selection of the appropriate resolution is based on different factors such as area to monitor, cost, and level of accuracy required. The procedure commences with determining the study's timeframe, followed by the selection of base line data serving as a reference for detecting reforestation or deforestation activities. Forest areas within the images can be identified by either land cover data or employing vegetation indices. By comparing each image within the designated timeframe with the reference image using change detection techniques, regions attributed to reforestation or deforestation activities can be distinguished. Moreover, incorporating supplementary data such as tree height, diameter at breast height, and species types can provide further understanding of the implications of deforestation actions.
Input data sources	Optical: Sentinel-2, VHR based on the availability like Pleiades 1A/1B & NEO, WorldView2&3, and SPOT6/7 Radar: Sentinel-1, VHR images from different sources like ICEYE, Capella space, Umbra, and TerraSAR-X Supporting data: land cover data, in-situ data like height, diameter at breast height, species types
Accessibility	Sentinel-1&2: freely and publicly available from ESA. VHR imagery: commercially available on demand from EO service providers.
Spatial resolution	Sentinel-2: 10 m Optical VHR: ≤ 1 m Sentinel-1: 10 m SAR VHR: ≤ 3 m
Frequency (Temporal resolution)	Sentinel-2:6 days Optical VHR: Daily Sentinel-1:6 days SAR VHR: Daily
Latency	≤ 1 day
Geographical scale coverage	Globally
Delivery/ output format	Data type: Raster File format: GeoTIFF
Accuracies	Thematic accuracy: 80-90% Spatial accuracy: 1.5-2 pixels of input data
Constraints and limitations	■ Cloud presence ■ By using medium resolution imagery for large forests, distinguishing reforestation, or deforestation activities from other land uses, such as agriculture or natural disturbances, can be challenging due to similar visual characteristics. ■ The accuracy of land cover data used for classification can impact the precision of change detection results. ■ Availability of historical satellite imagery may be limited. ■ Changes in vegetation cover due to natural seasonal cycles can impact the accuracy of change detection, potentially leading to false positives or negatives.
User's level of knowledge and skills to extract information and perform further analysis on the EO products.	Skills: Essential Knowledge: Essential