# Sentinel 2 : Land use/land cover mapping

**The Copernicus Sentinel-2 mission,** operated by the European Space Agency (**ESA**), consists of a constellation of polar-orbiting satellites designed for **high-resolution** Earth observation. The constellation initially included Sentinel-2A (launched in June 2015) and Sentinel-2B (launched in March 2017), flying in the **same sun-synchronous orbit** at an **altitude of 786 km**, with a **phase difference of 180°.** In September 2024, Sentinel-2C was launched to replace Sentinel-2A, ensuring mission continuity.

**Key Sensor Specifications:**

- **Sensor model:** Multispectral Imager (MSI)
- **Swath width:** 290 km
- **Spectral coverage:** 13 bands ranging from 443 nm to 2190 nm
- **Revisit time:** 5 days from two-satellite constellation (at equator)
- **Nominal mission lifetime:** Minimum 7 years

Each Sentinel-2 satellite is equipped with an advanced Multispectral Imager (MSI) that captures data in 13 spectral bands. This sensor enables detailed monitoring of land surfaces, vegetation, inland and coastal waters, and atmospheric properties.


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**References :**

- **https://dataspace.copernicus.eu/data-collections/copernicus-sentinel-data/sentinel-2**
- **https://www.esa.int/Applications/Observing_the_Earth/Copernicus/Sentinel-2**
- **https://www.esa.int/Applications/Observing_the_Earth/Copernicus/Sentinel-2/Facts_**
- **https://fr.wikipedia.org/wiki/Sentinel-2**
- **https://www.esa.int/Applications/Observing_the_Earth/Copernicus/Sentinel-2/Instrument**


**Main application : Global land monitoring**

**How ?** (Fig. 2)

- **Visible bands:** B2 (Blue), B3 (Green), B4 (Red) provides true color images (RGB) which is essential for land cover classification and vegetation mapping. Red band is critical for vegetation indices like NDVI (Normalized difference vegetation index).
- **Near-Infrared (NIR) bands:** B8 (NIR, 842 nm), B8A (Narrow NIR, 865 nm) High reflectance in vegetation → used in vegetation health, biomass, and canopy density monitoring.
- **Red-edge bands** (B5, B6, B7) Specifically included in Sentinel-2 for vegetation stress detection and chlorophyll estimation. More precise than NDVI in dense vegetation.
- **Short-Wave Infrared (SWIR) bands:** B11 (1610 nm), B12 (2190 nm) Sensitive to water content in vegetation and soil. Used in burned area mapping, drought monitoring, and distinguishing snow from clouds.
- **Atmospheric correction bands:** B1 (443 nm), B9 (945 nm) , B10 (1375 nm). Not used directly for land monitoring, but essential for correcting atmospheric effects so surface reflectance values are accurate.

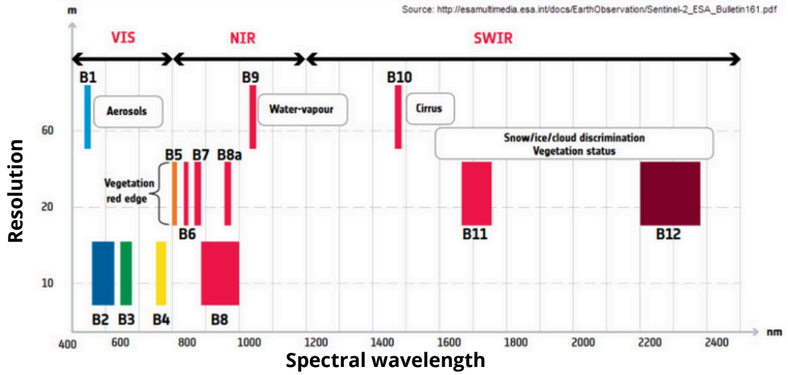


Fig. 2 : Wavelength diagram of the Sentinel 2

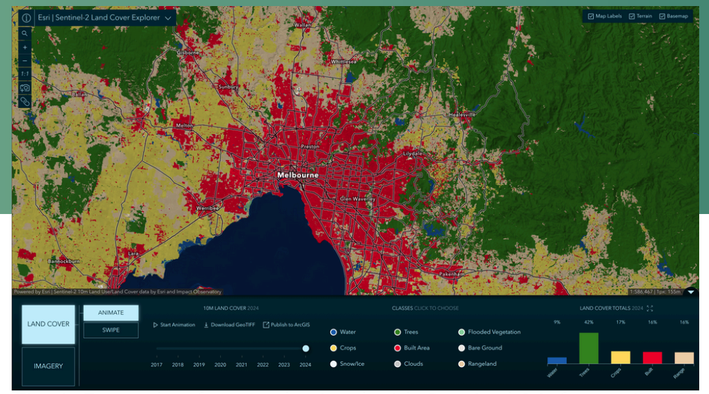


Fig. 1: Example of map obtained with Sentinel 2 information

**Land use / Land cover (LULC) mapping**

Sentinel-2's multi-spectral imagery enables detailed mapping of the Earth's surface, allowing the distinction of forests, croplands, urban areas, water bodies and more. By classifying these land use and land cover categories, researchers and decision-makers can **track environmental change**, monitor **urban growth**, and **assess agricultural resources** with high accuracy.

Organizations such as **Esri** use this data to produce accessible global 10-meter LULC maps (available in the ArcGIS Living Atla) supporting applications from deforestation monitoring to sustainable urban planning.

Sentinel-2 data are freely available and updated every 5 days, they provide a reliable foundation for both scientific research and real-world decision-making in land and resource management.

Fig. 3: Photography of Sentinel 2