LEVERAGING SPACE TECHNOLOGY FOR AGRICULTURAL DEVELOPMENT AND FOOD SECURITY

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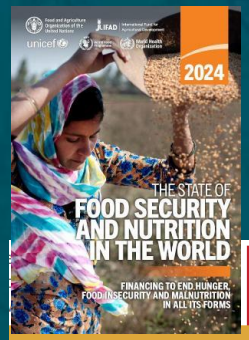
Urgent action needed for achieving SDGs



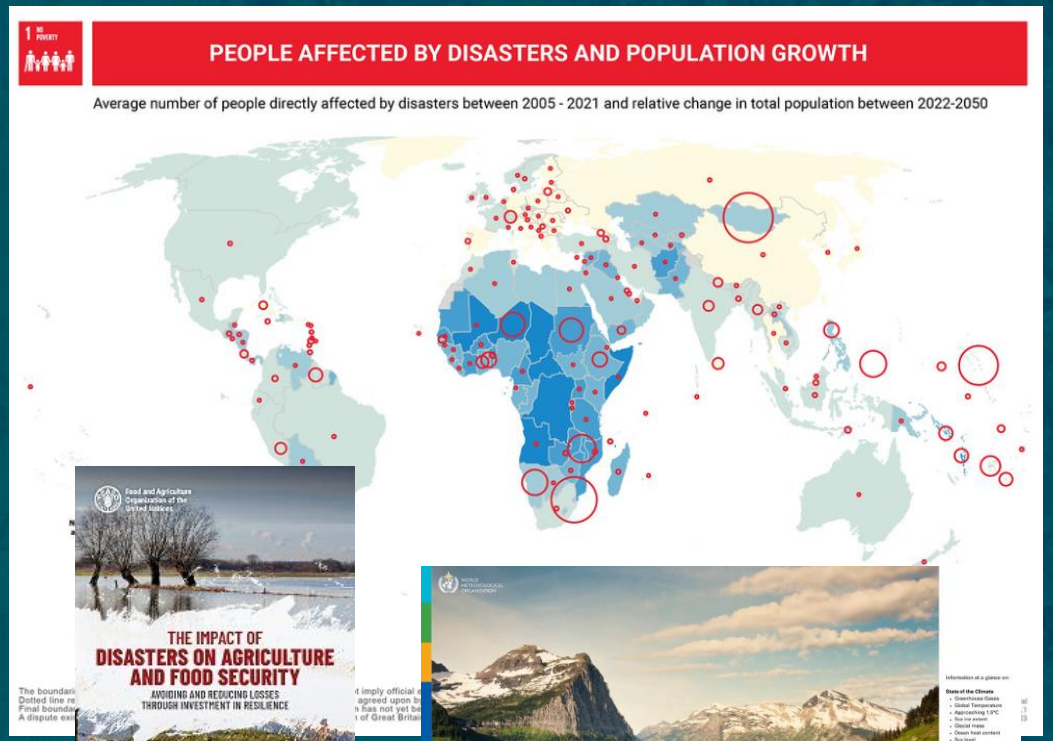
The State of Food Security and Nutrition in the World 2024

FAO and the SDGs

Around 733 million people faced hunger in 2023 and nearly one-third (28.9%) of the global population was food insecure (FAO, 2024).

The world is not on track to achieve the SDG global nutrition targets by 2030.

Increasing vulnerability to shocks and crises



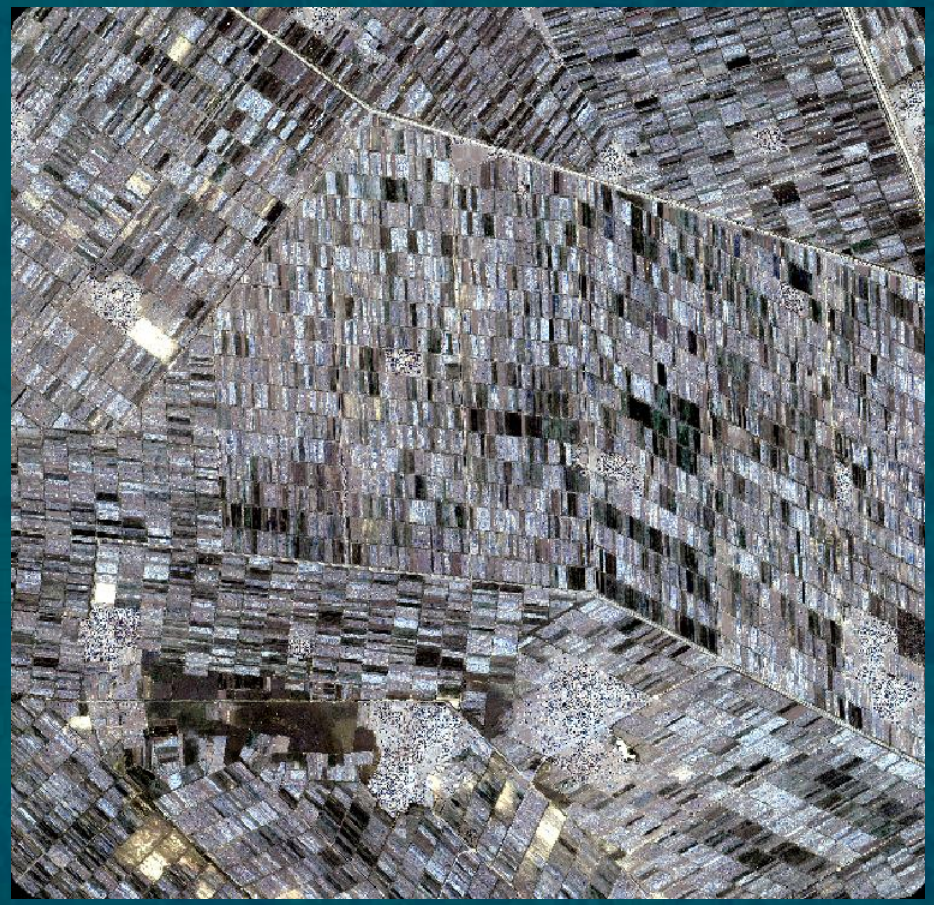
Shocks and crises have become more frequent (UN, 2024).

2024 is warmest year on record at about 1.55°C above pre-industrial level (WMO, 2024).

Disasters, weather and climate extremes are aggravating factors to food insecurity (FAO, 2023).

https://library.wmo.int/records/item/69075-state-of-the-climate-2024
The Impact of Disasters on Agriculture and Food Security 2023
https://www.fao.org/interactive/disasters-in-agriculture/en/

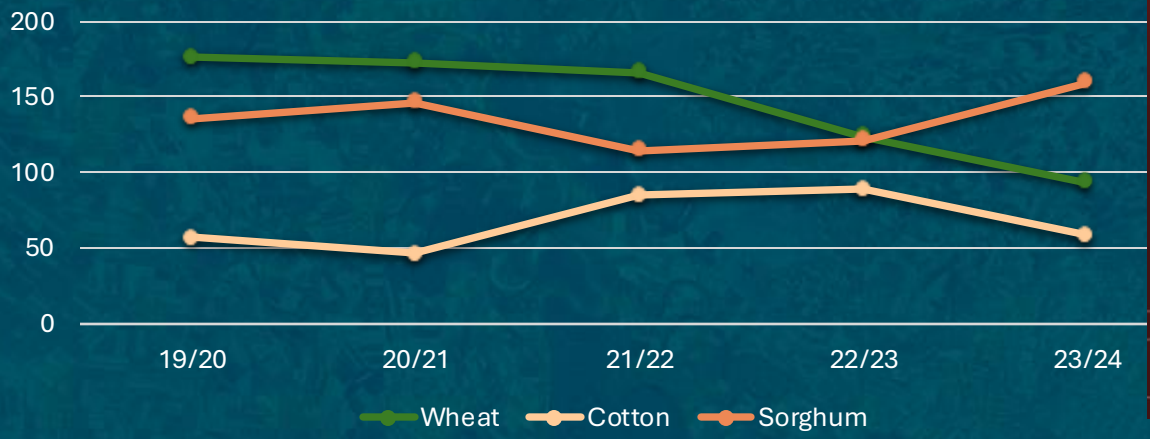
Geospatial applications for food security - production

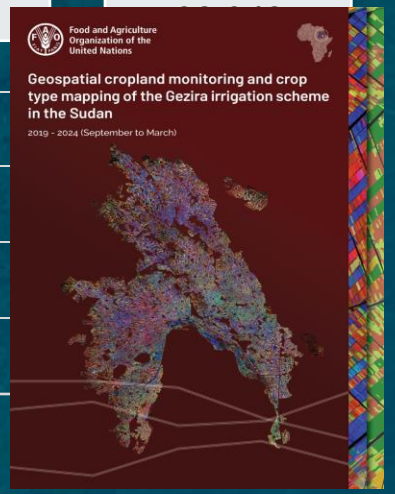


Geizira irrigation scheme, March 2024, Source: Pléiades @ CNES 2024, Distribution Airbus DS.
https://www.fao.org/geospatial/resources/detail/en/c/1698177/

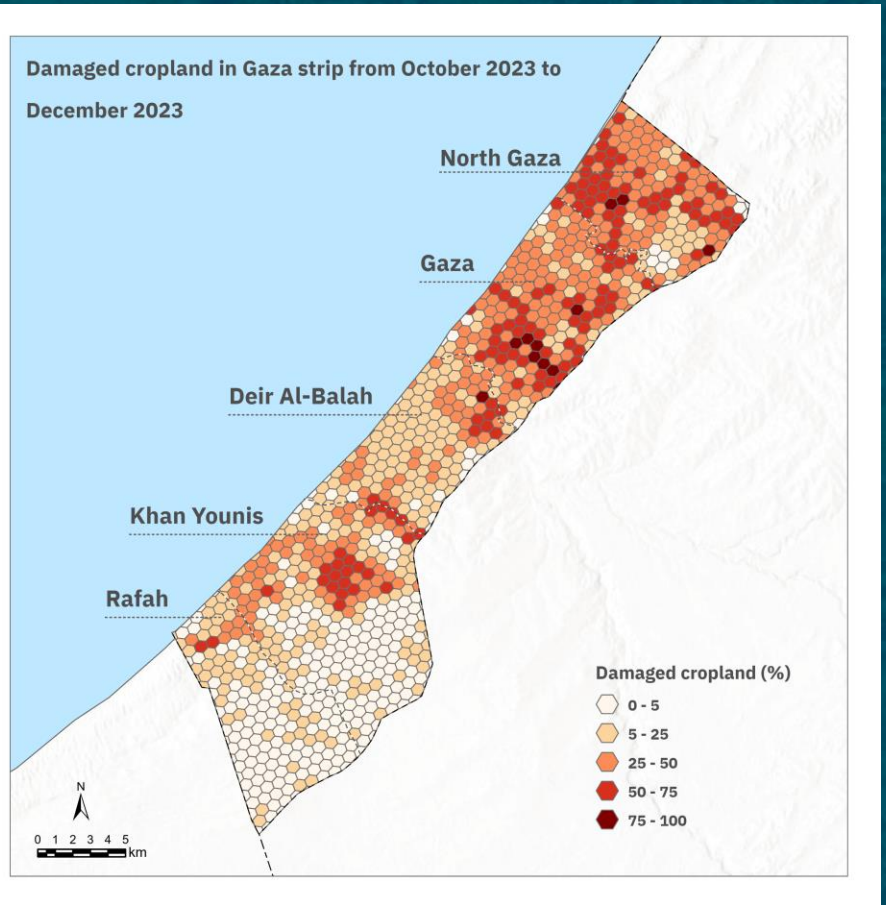
Monitoring agricultural production in Gezira irrigation scheme in Sudan

2019 - 2020	2020 - 2021	2021 - 2022	2022 - 2023	2023 - 2024
175,607	172,760	166,152	123,499	





Geospatial applications for food security - shocks

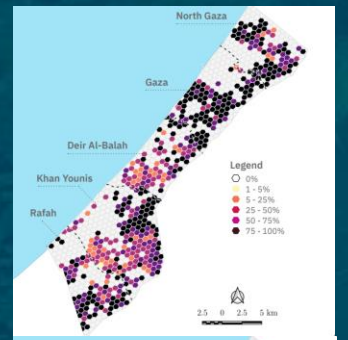


https://www.fao.org/in-focus/gaza/en
https://www.fao.org/geospatial/resources/detail/en/c/1676810/

Monitoring impacted agriculture in the Gaza strip (dec 2024)

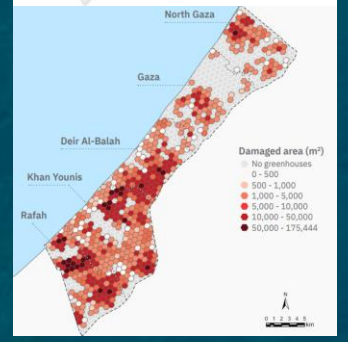
August 2023 December 2023

Infrastructures



Wells

Greenhouses



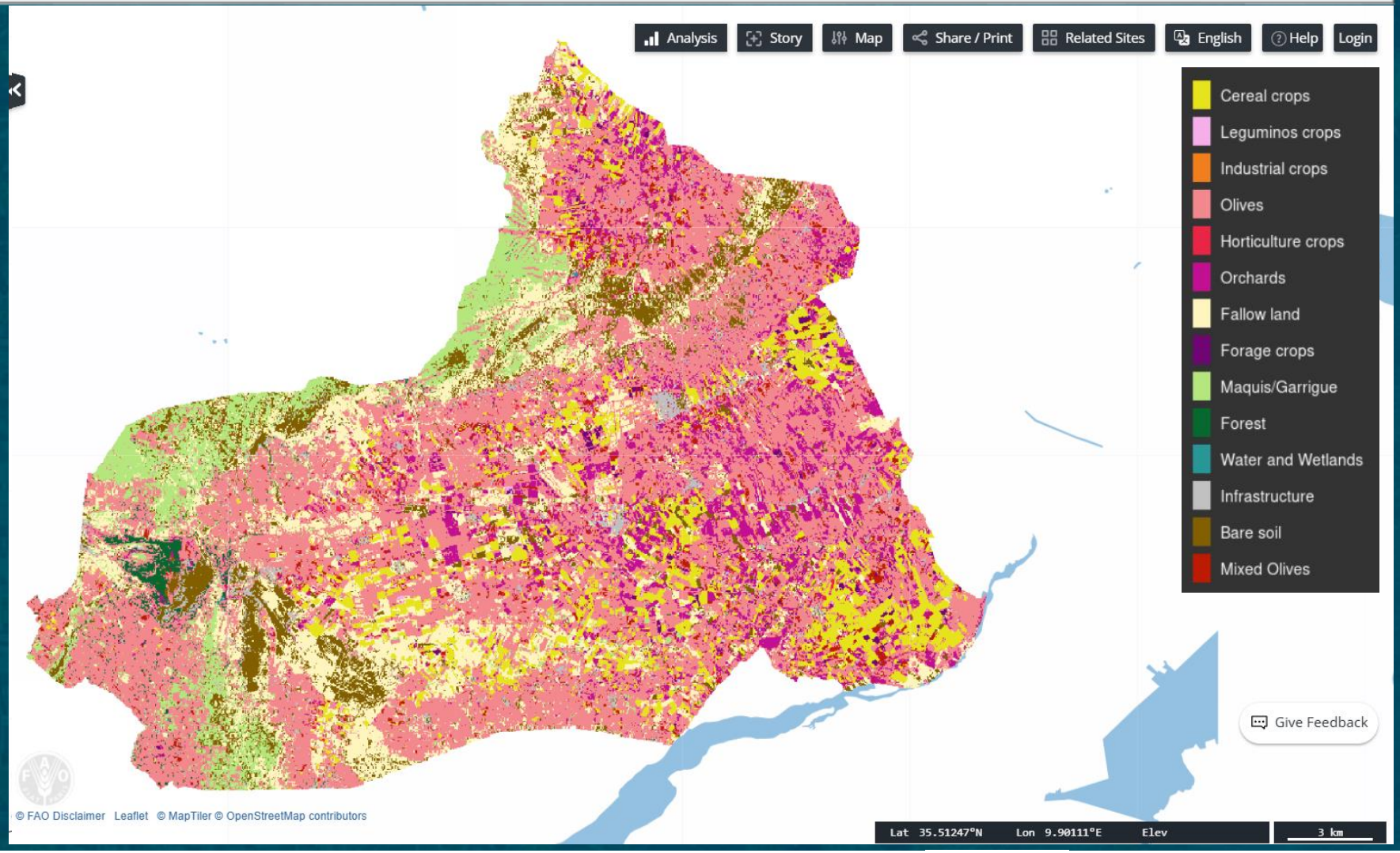
Geospatial applications for food security - land cover

Land cover mapping and crop-type mapping

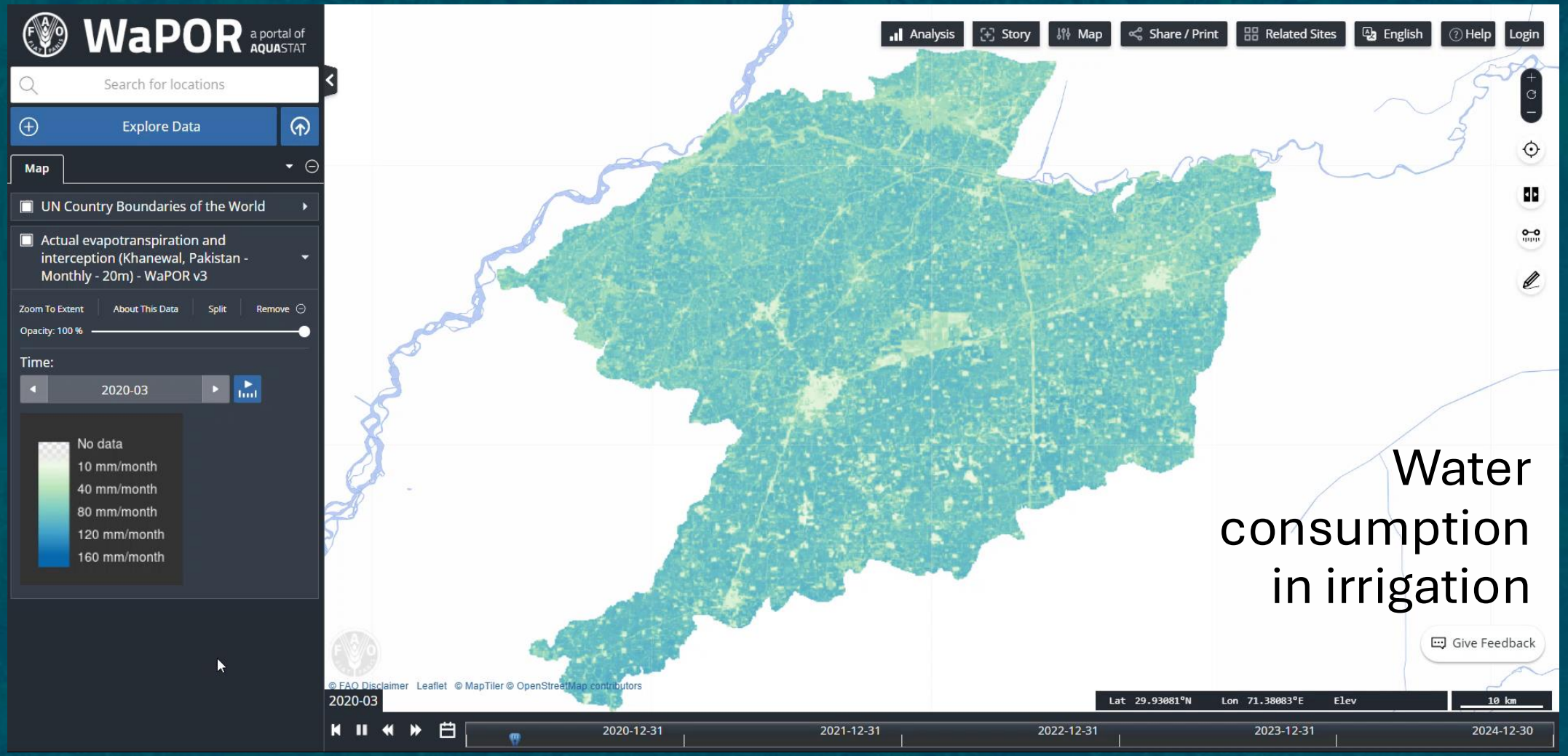
*Examples in Zambia and Tunisia (Kairouan), accessed via the **FAO agro-informatics platform***

1. Zambia

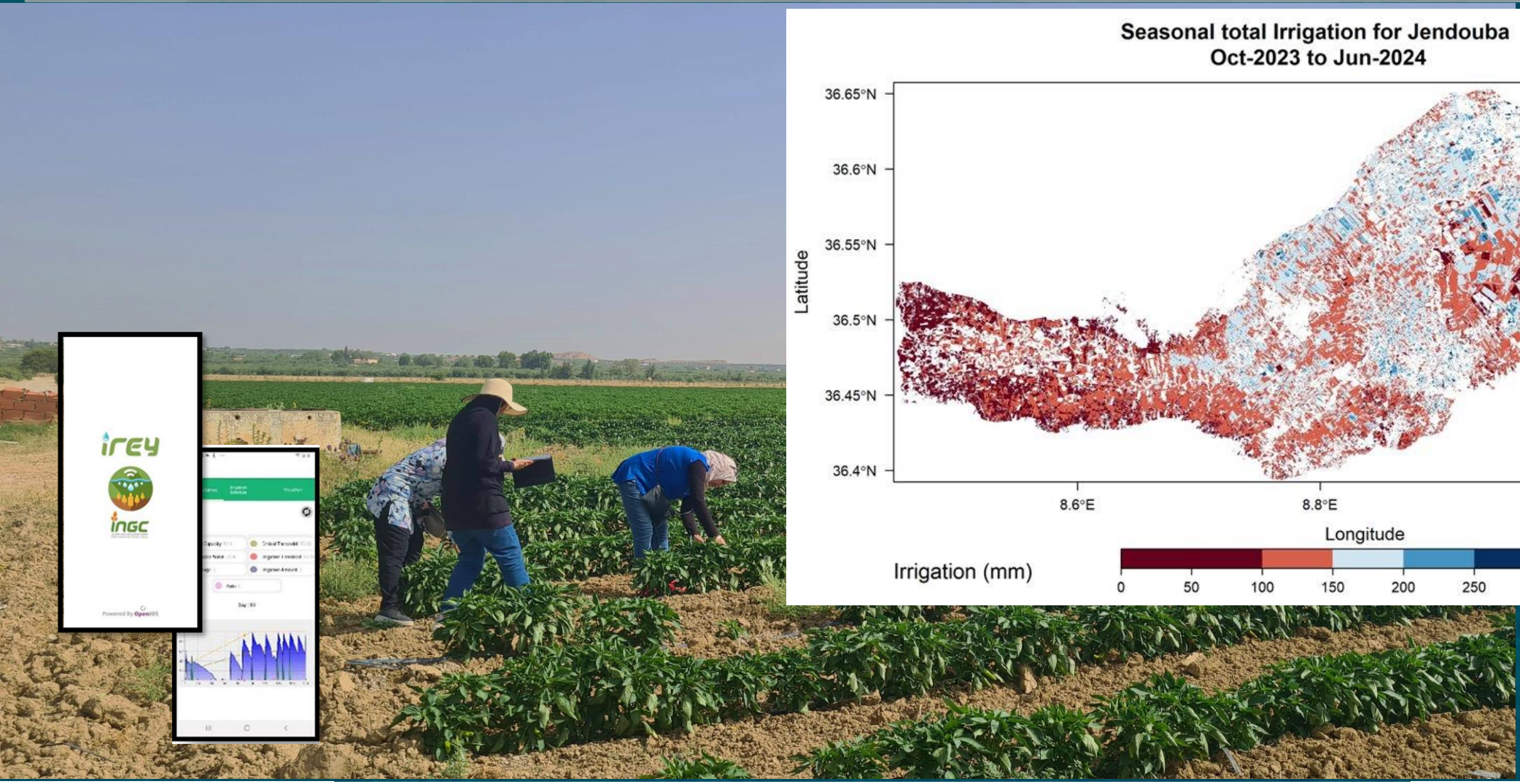
2. Tunisia (Kairouan)



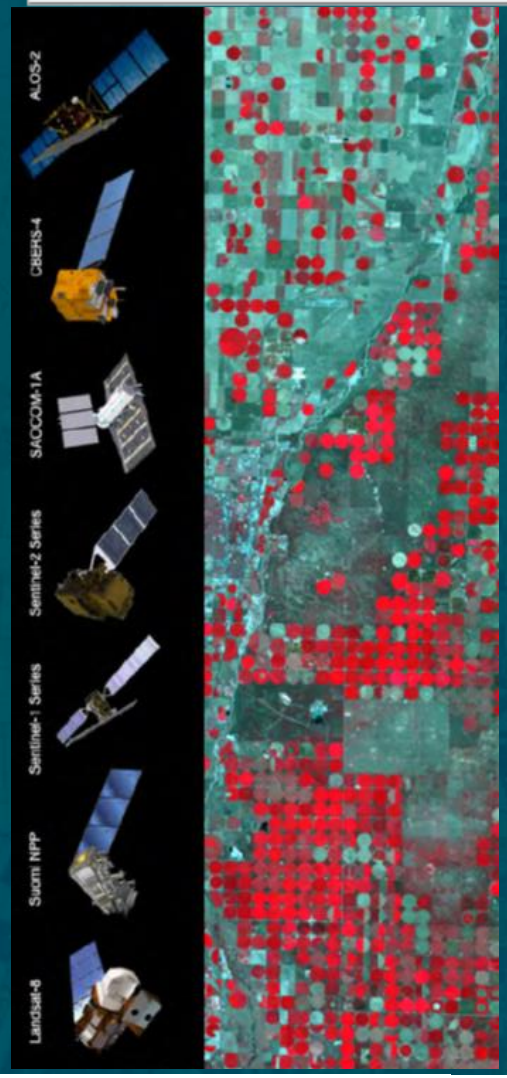
Geospatial applications for food security – water use



Geospatial applications for food security – irrigation

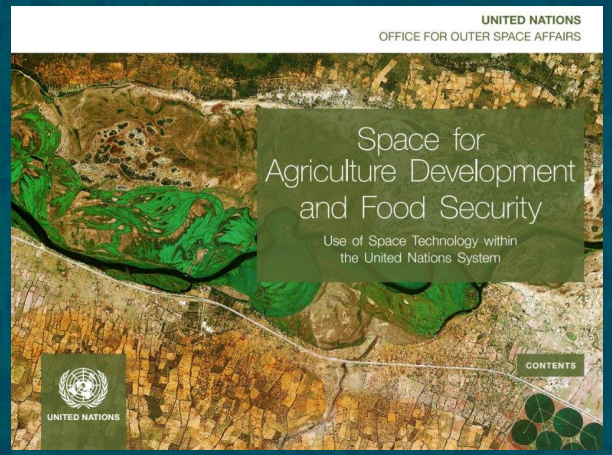


Powerful tools underexploited



- Improve collaboration in the space value chain to maximize better use of emerging space technologies, GNSS, and remote sensing.
- Strengthen technical capabilities for agricultural applications of space technologies.
- Promote international standards while considering national specificities.

2015

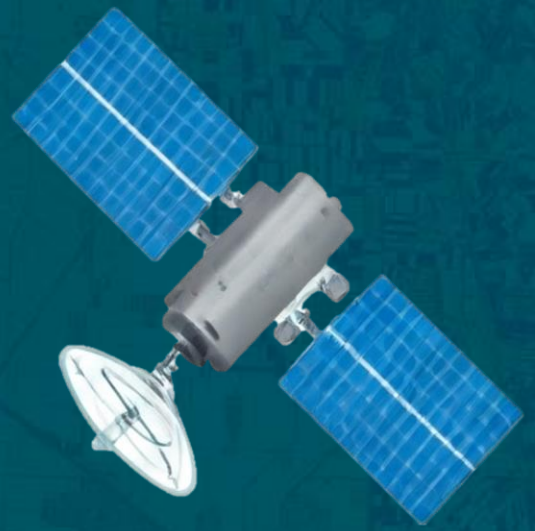


2025

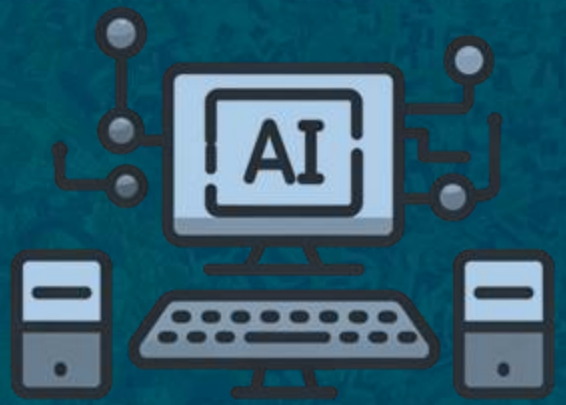
Structure of the publication

1. *Introduction on the role of space technology for agriculture and food security*
2. *The space technology value chain for agriculture and food security (upstream, midstream, downstream segments)*
3. *Challenges and opportunities for enhanced space-related capabilities for agriculture and food security*
4. *Outlook and innovation in space technology for agriculture*
5. *Conclusions*

Role of space technology for agriculture and food security



- *Remote sensing (RS)*
- *Global navigation satellite systems (GNSS)*



- *Cloud computing*
- *Geospatial analysis*
- *Machine learning*
- *Field data*

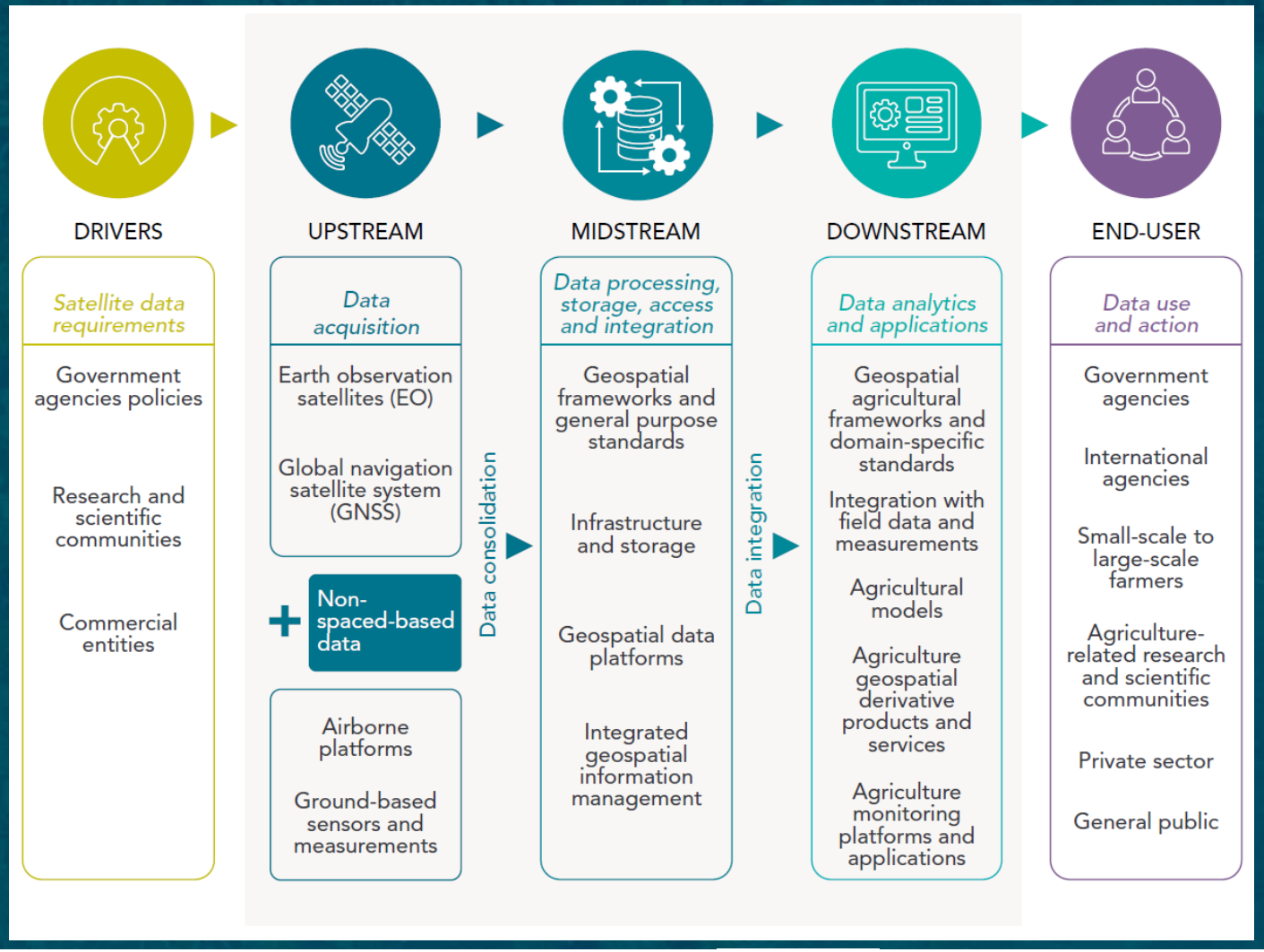
- *Support to agriculture*
- *Food security policies*

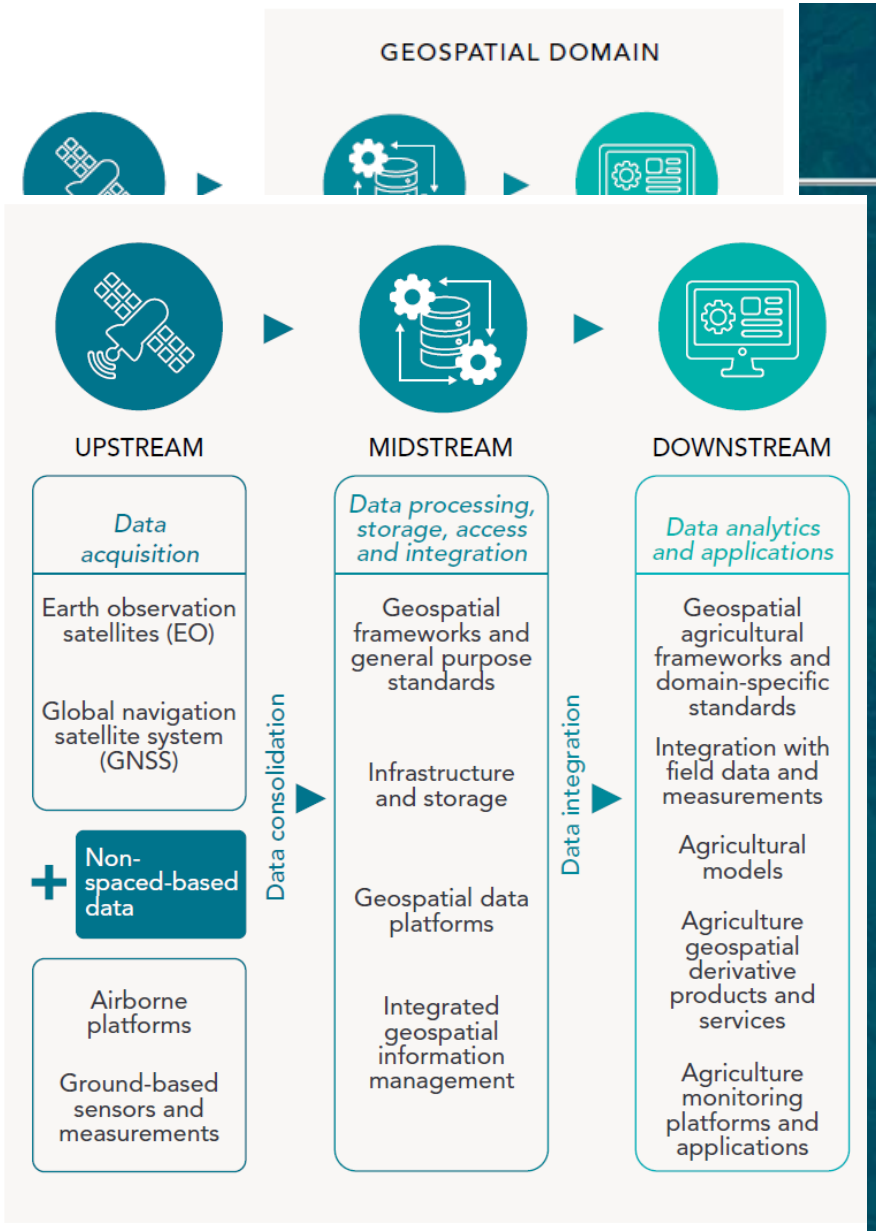
Space segments and relations with agriculture

UPSTREAM SEGMENT

MIDSTREAM SEGMENT

DOWNSTREAM SEGMENT





Geospatial domain

Space Value Chain is part of the Geospatial Domain

which includes hydrographic, statistical, geological data, among others.

Ensure harmonization through Data Consistency:

For example, standards provided by international organizations including the International Standards Organization (ISO), the Open Geospatial Consortium (OGC), and the United Nations Committee of Experts on Global Geospatial Information Management (UN-GGIM).

Frameworks for Agricultural Information Formulation

Data need to inform end users, but also be relevant for key framework agreements and reporting mechanisms, including:

- 2030 Agenda for Sustainable Development
- Rio conventions and COP (biodiversity, climate change and desertification)
- Essential agricultural variables (GEOGLAM)
- UN-GGIM

Challenges And Opportunities - Upstream Segment

	Challenges	Opportunities
DEVELOPMENT CAPACITY	Dependency on other countries	Empowering all nations through global collaboration in satellite development with initiative as the *UNOOSA Access to Space for All*
		Leveraging public-private partnerships for countries in the initial stages of the space technology development
MISSION PLANNING	Information gaps and stagnation in remote-sensing innovation	Mission planning should not only focus on expanding coverage but also on studying new sensors.
		Unlocking opportunities for multi-stakeholder collaboration in satellite development
	Enhance satellite design to boost data usability for agricultural applications	Enhancing satellite missions' development through standardized agriculture-specific requirements
		Strengthening satellite missions through regulated end-user and stakeholder feedback

Challenges And Opportunities - Midstream Segment

	Challenges	Opportunities
DATA ACCESS	Limited access to high-resolution Earth observation and global navigation satellite systems data	Advancing agriculture and food security through enhanced multi-sector partnerships
		Enhancing data accessibility through open data initiatives
STANDARDIZATION AND ADOPTION	Standardizing and adopting Earth observation and global navigation satellite systems data	Global coordination in data standardization and capacity-building
MULTIPLE PLATFORMS	Overlapping platforms for data access	Strengthening global data access through collaborative platforms

Challenges And Opportunities - Downstream Segment

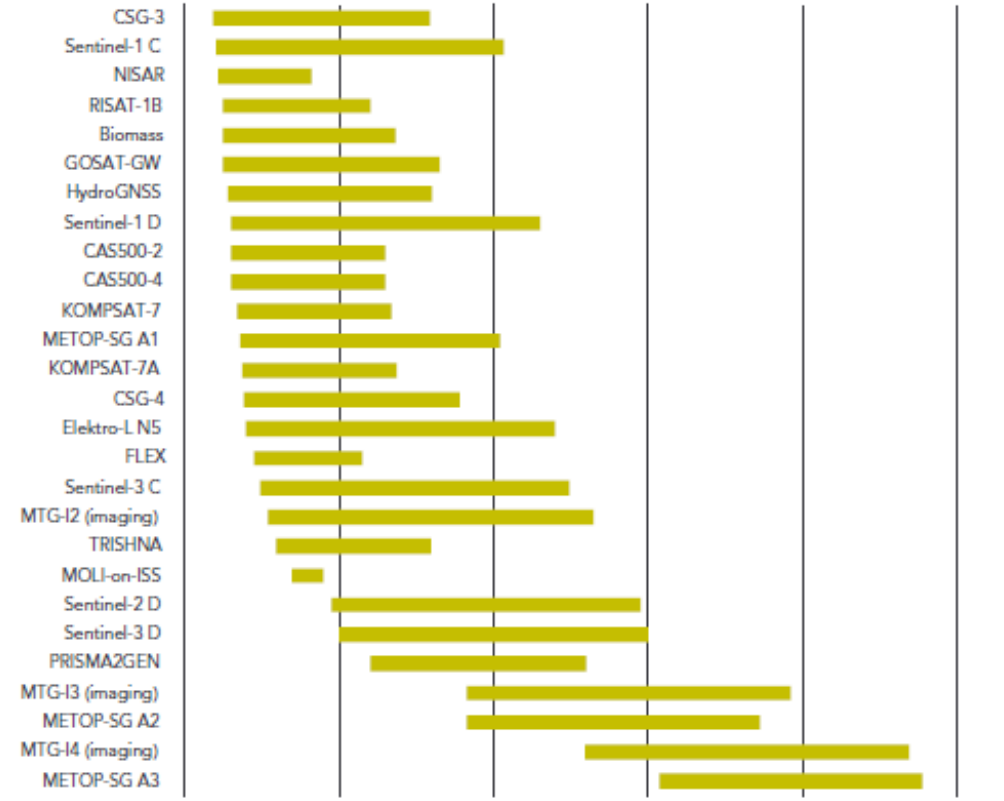
	Challenges	Opportunities
AGRI-INFORMATION GAPS	Information gap in global agricultural monitoring platforms	Advancing agricultural monitoring through innovative monitoring platforms and collaborative data-sharing
IN SITU DATA	Difficulties in accessing high-quality in situ data for agricultural use	Global coordination for enhancing in situ data open access and collaboration

Future Space Missions

According to the CEOS database of future Earth observation missions, there are 27 future missions approved for vegetation and 12 for soil moisture[1].

Both types of mission can be utilized for agriculture technology development to achieve food security development goals.

[1]CEOS database consulted on 2 December 2024 for approved missions under those categories



Source: Modified from CEOS. 2023. The CEOS Database: Timelines - Measurement: Aerosols, cited 9 October 2024. https://database.eohandbook.com/timeline/timeline.aspx

Conclusion

Through continuous **investment** in space technology, international **partnerships** and sustainable practices, the agriculture sector can be better equipped to tackle the mounting pressures of population growth, resource constraints and climate change. This transformation is essential for meeting global food security goals and **transforming agri-food systems.**

Together, let us commit to this vision and work to create a future where technology and agriculture unite to nourish our fast-evolving world

THANK YOU!

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https://openknowledge.fao.org/handle/20.500.14283/cd3989en