We are not on track to limit warming to 1.5 °C.
Background

Environmental change: climate crisis is here and now (IPCC, 2022): monitoring & forecasting land (cover/use) has become crucial more than ever to

Global scale: variety of data/data sources

National scale: global data used nationally or national data for different (international) reporting frameworks

FAO in collaboration with ESA, academia and other partners have developed tools to assist countries in measurement, reporting, and verification (MRV)
Mitigation: REDD+ reporting to the UNFCCC

Reference level submissions to the UNFCCC

Brazil
Colombia
Ecuador
Guyana
Malaysia
Mexico
Chile
Congo
Costa Rica
Ethiopia
Indonesia
Paraguay
Peru
Viet Nam
Zambia
Brazil
Cambodia
Côte d’Ivoire
Ghana
Honduras
Madagascar
PNG
Sri Lanka
Uganda
Tanzania
Brazil
DRC
India
Lao PDR
Madagascar
Malaysia
Mongolia
Mozambique
Myanmar
Nigeria
Panama
Suriname
Argentina
Bangladesh
Guinea-Bissau
Malaysia
Nicaragua
Nigeria
Solomon Islands
Belize
Bhutan
Burkina Faso
Colombia
Dominican Republic
Ecuador
Equatorial Guinea
Honduras
Kenya
Liberia
Malawi
Mexico
Namibia
Pakistan
Papua New Guinea
Philippines
Togo

UNFCCC REDD+ results:
11.5 billion t CO₂
Methods AD

Reference levels

UNFCCC (n=56)  
GCF RBP (n=12)  
FCPF CF (n=15)

Results reported UNFCCC
Most countries have NFI or inventory data suitable for deforestation EF.

Challenges:
- NFI data for degradation EF
- NFI data for A/R
- Take advantage of multiple cycles
The complicated landscape of carbon finance opportunities

- Results-based payments
- Compliance markets
- Voluntary carbon markets

Logos:
- GREEN CLIMATE FUND
- FOREST CARBON PARTNERSHIP
- JCM (Joint Crediting Mechanism)
- ART (Architecture for REDD+ Transactions)
- CORSIA
- VERRA
Monitoring and policy needs (here and now)

- Better data, better decisions? e.g. 10 y UN-REDD
- Need for (better) integration of measurable (hyperspectral) field, airborne and space borne RS parameters with practical (monitoring) solutions and policy implementation
- Support research needed in the domains of agriculture, food security, raw materials, soils, biodiversity, environmental degradation and hazards, inland and coastal waters, and forestry
- Mitigation efforts versus adaptation: new monitoring field to be explored, f. e. agricultural practices/management through Chl, N in soils, first attempt TOPC-CEOS indicators
FAO Applications and Resources

A short overview
Open Foris initiative

Free and open source tools and methods for data collection, analysis and reporting

- **Arena**: Online platform for survey design, data management, utilization and processing
- **Collect**: Easy and flexible survey design and data management
- **Collect Mobile**: Intuitive data collection and validation in the field
- **Calc**: Efficient and collaborative data analysis and results dissemination
- **Collect Earth**: Easy and flexible survey design and data management
- **Collect Earth Online**: Online Land Monitoring tool for crowd-sourcing of augmented visually interpreted data
- **Earth Map**: The power of Google Earth Engine without coding. A user friendly tool for complex land monitoring
- **SEPAL**: System for earth observation, data access, processing, analysis for land monitoring
Key principles

- **FAO-led initiative**
- **Free and open source:** approx. 30,000 downloads since 2016; source codes are available in [GitHub](https://github.com).
- **Software development:** new and improved versions of the tools are released periodically.
- **Collaboration:** FAO [Hand-in-Hand](https://www.fao.org/hand-in-hand) Initiative; private and public partners (e.g. Google, NASA-Servir); academic institutions; projects.
- **Country testing:** OF tools have been used in more than 130 countries.
- **Capacity building:** training sessions on all OF tools in all regions of the world.
- **Implementation:** more than 44 countries have integrated OF tools in their forest monitoring systems.
SEPAL: Earth Observation and cloud computing

- SEPAL is a cloud based platform for accessing, processing and analysing geospatial data for land monitoring

- SEPAL is free and open: anyone can register for access to its features: https://sepal.io

- All you need is an Internet connection to access the SEPAL website
SEPAL

System for earth observations, data access, processing & analysis for land monitoring.

Signup  Launch
SEPAL https://sepal.io

SEPAL provides many capabilities:

- Search and process satellites imagery
- Mobile and tablet compatibility
- Store and access data
- Access super computers
- Analyze data using predefined processing chains
SEPAL -module example

Stratified Random Sampling for Accuracy Assessment
Link to Collect Earth and Collect Earth Online

Collect Earth can be used with Sepal to produce training data.

Follow our tutorials for more information.
Collect Earth

Visual interpretation tool for land use/cover classification and change detection with access to high and very high resolution satellite imagery
Augmented Visual Interpretation

Data Collection tool integrated in Google Earth.
Free access to Very High Resolution imagery.
Multitemporal imagery thanks to Google Earth, Bing Maps and High Resolution
Collect Earth Online

Visual interpretation tool for land use/cover classification and change detection with access to high and very high resolution satellite imagery

Used globally
Developed in collaboration with NASA-SERVIR and FAO. Online application for crowdsourcing and centralized assessments. Multiple users can simultaneously collect information.
Fusion Optical and radar data

**ALOS**

**LANDSAT 8**

**ALOS + LANDSAT 8**


Pan-tropical, high-resolution data offer amazing opportunities

(Slides courtesy of R. D'Annunzio)
Land phenology
NRT Validation / Verification
Site-specific, high-resolution interpretation
Tree crown classification
LandTrendr summary

Example: What you’ll learn about mapping forest disturbance

- Use a graphical user interface
- Control algorithm behavior
- Interpret time-series data
- Make maps of disturbance
ECOCROP: Database of Crop Constraints and Characteristics integrated in the Global Agricultural Ecological zoning (GAEZ) platform

User would have access to existing data used under different international and national frameworks (depending on accessibility)

Area of Interest
- GADM/GAUL
- Upload your AOI
- Design your AOI

Layers by ecosystem components
- Soil
- Water
- Vegetation

Layers by climatic zone
- Subtropical
- Temperate
- Dry
- Tropical

Prepare your indices
- Link to modules in SEPAL
  - Download (.shp, .tif, .kml, .xls, etc.)
A FERM Platform for monitoring terrestrial ecosystem restoration

Layers by ecosystem components
- Soil
- Water
- Vegetation

Layers by climatic zone
- Subtropical
- Temperate
- Dry
- Tropical

Prepare your indices
- Link to modules in SEPAL
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Area of Interest
- GADM/GAUL
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User would have access to existing data used under different international and national reporting frameworks (depending on accessibility)
Integrating different platforms, data and tools

Layers by ecosystem components
- Soil
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- Vegetation

Layers by climatic zone
- Subtropical
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- Dry
- Tropical

Preparation of indices
- Link to modules in SEPAL

Data are mapped considering the different indicators, criteria and frameworks.
One dataset e.g. Land Cover can be used for various frameworks.
Different frameworks, similar indicators, same data?

We map frameworks related to ecosystem restoration and develop a database which contains the data, indicators, criteria, targets, etc.
TAKE HOME MESSAGES and link with EO

-Agriculture, forestry and other land use can not only provide large-scale GHG emissions reductions, but also absorb and store CO2 at scale. Well-designed measures can benefit biodiversity, help us adapt to climate change, secure livelihoods, improve food security and wood supplies. Agroforestry, reforestation, avoiding deforestation, managing soils and sustainable livestock management can enhance productivity, improve livelihoods and provide renewable energy.

-Positive impacts of certain international and climate policies on reducing emissions have been shown as for example deforestation, it argues that it is too early to say whether zero-deforestation pledges from the public and private sectors can be effective.

-- Achieving ambitious climate goals relies on international cooperation. Transnational partnerships are playing a growing role as technology, knowledge and experience are shared.

-Earth Observation with long data records and data over remote places can help in
- Validation of (climate and other) models
- Monitoring and early warning: imaging spectroscopy!
- Process understanding
- Importance of free and open EO data
Earth Observation: our wish list from policy side to ESA and the Scientific community

- Support in mapping changes in land cover/land use and sustainable agricultural practices: ADAPTATION monitoring
- Detect soil properties for action on improving soil health
- Support agriculture and forest management and assessments on biodiversity, ecosystem sustainability and environmental degradation, and to monitor lake and coastal ecosystems including water quality.

- New products asked from end users and services in the domain of agriculture, food security, raw materials, soils, biodiversity, environmental degradation and hazards, inland and coastal waters, and forestry: distinction private and public end users
Way forward interlinking end users and Earth Observation scientific community

Taking into account user requirements in the domains of agricultural services, forestry and sustainable agricultural and forest management

- **User inclusion** from the concrete (project) start with implementing actors/agencies

- **Data ownership** for end users: creating spatially aggregated products for countries need ‘endorsement’ at least

- **Important policy frameworks**, among others

UN SDGs [(Sustainable Development Goals], SDGs 2, 12 and 15], the EU Common Agricultural Policy (CAP), the EU Raw Materials Initiative, the UN Convention for Combating Desertification and Land Degradation, the Soil Thematic Strategy and the Soil Framework Directive, the EU Water Framework Directive and the UN Convention on Biodiversity (Aichi Targets).
The evidence is clear:
The time for action is now
Thanks for your attention!

More info on www.fao.org

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@FAOClimatetechchange

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