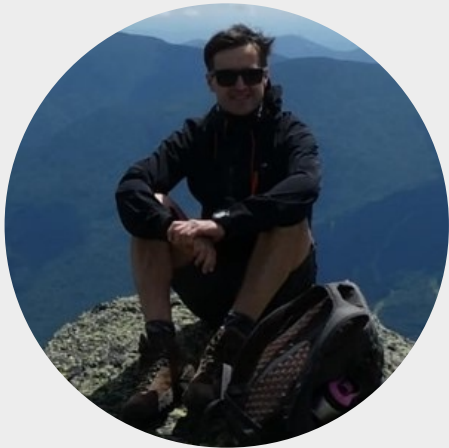# INNOVATIVE MRV SYSTEMS AND TRANSACTION REGISTRIES: KEY PARTNERS FOR UNLOCKING FINANCE AND SUPPORTING SUSTAINABLE PRODUCTION SYSTEMS



**ANDRÉS ESPEJO**

*Senior Carbon Finance Specialist*
World Bank Group

**JULIAN GONZALO JIMÉNEZ**

*Senior Carbon Finance Specialist*
World Bank Group

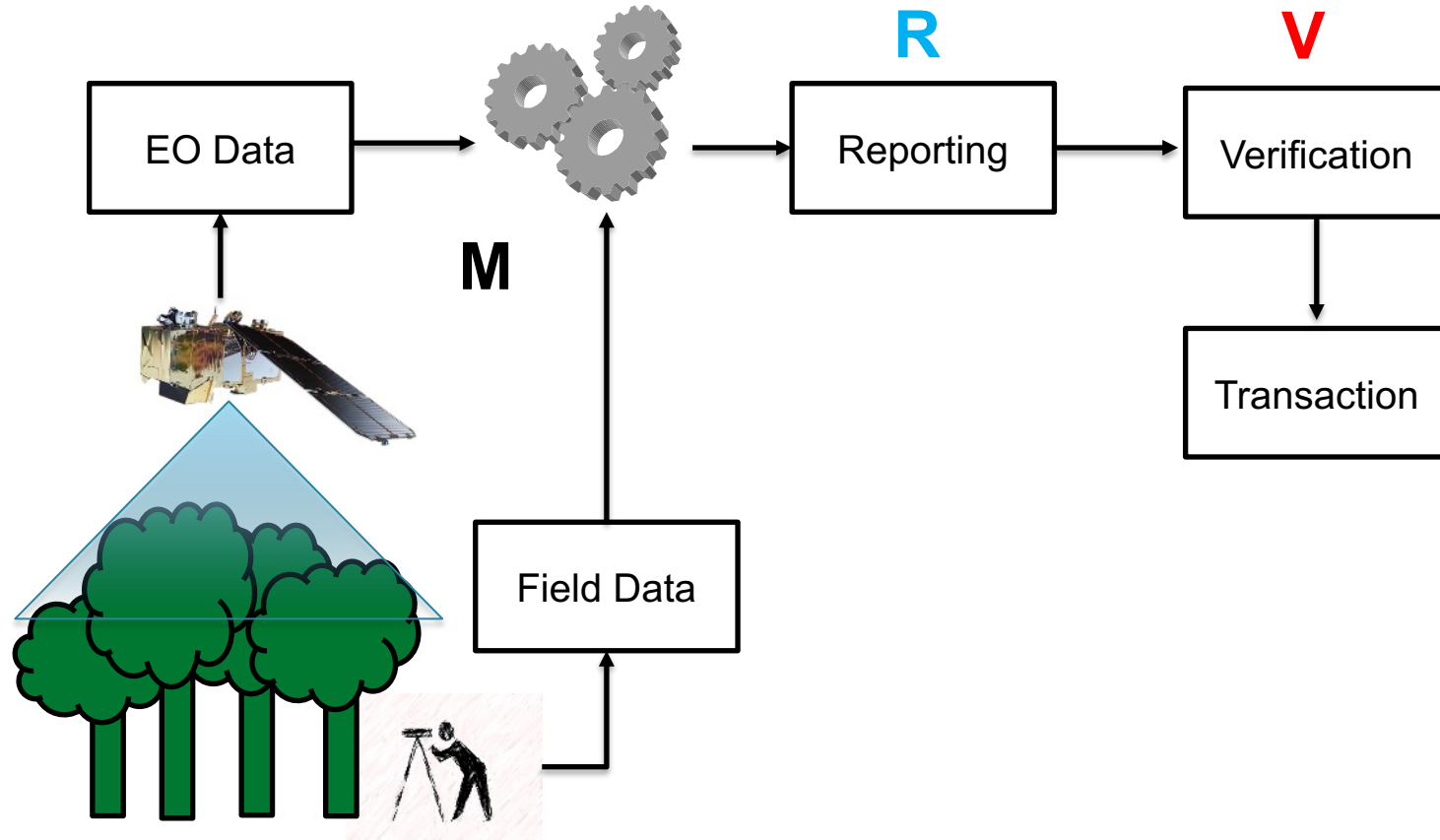**ANA SEBASTIÁN LÓPEZ**

*Business Development Manager*
GMV

# Innovative MRV Systems and Transaction Registries: Key Partners for Unlocking Finance and supporting sustainable production systems

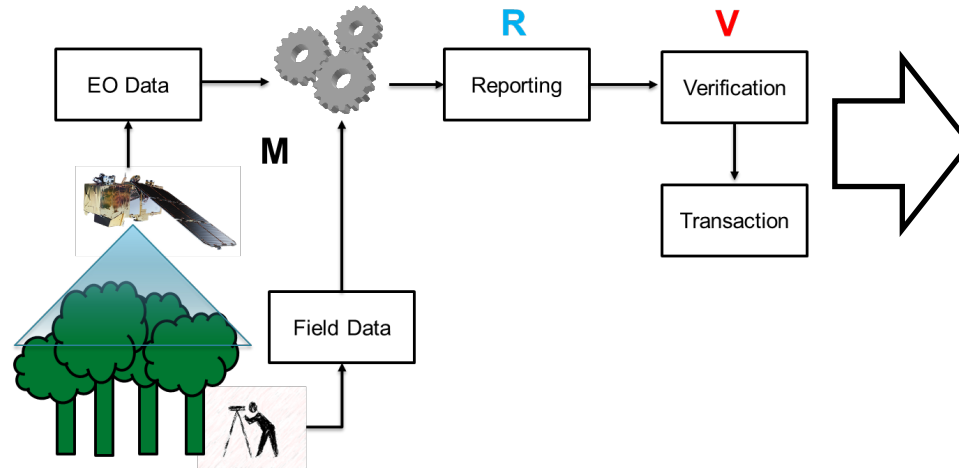**Andrés Espejo** – Senior Carbon Finance Specialist

**Julián Gonzalo** – Senior Carbon Finance Specialist
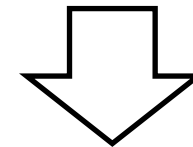
# MRV + TRANSACTION

**MRV** = Measurement, Reporting and Verification

# MRV + TRANSACTION – CURRENT SYSTEMS



- Manually operated
- High uncertainties and biases
- High costs (0.2 -1.6 €/credit)
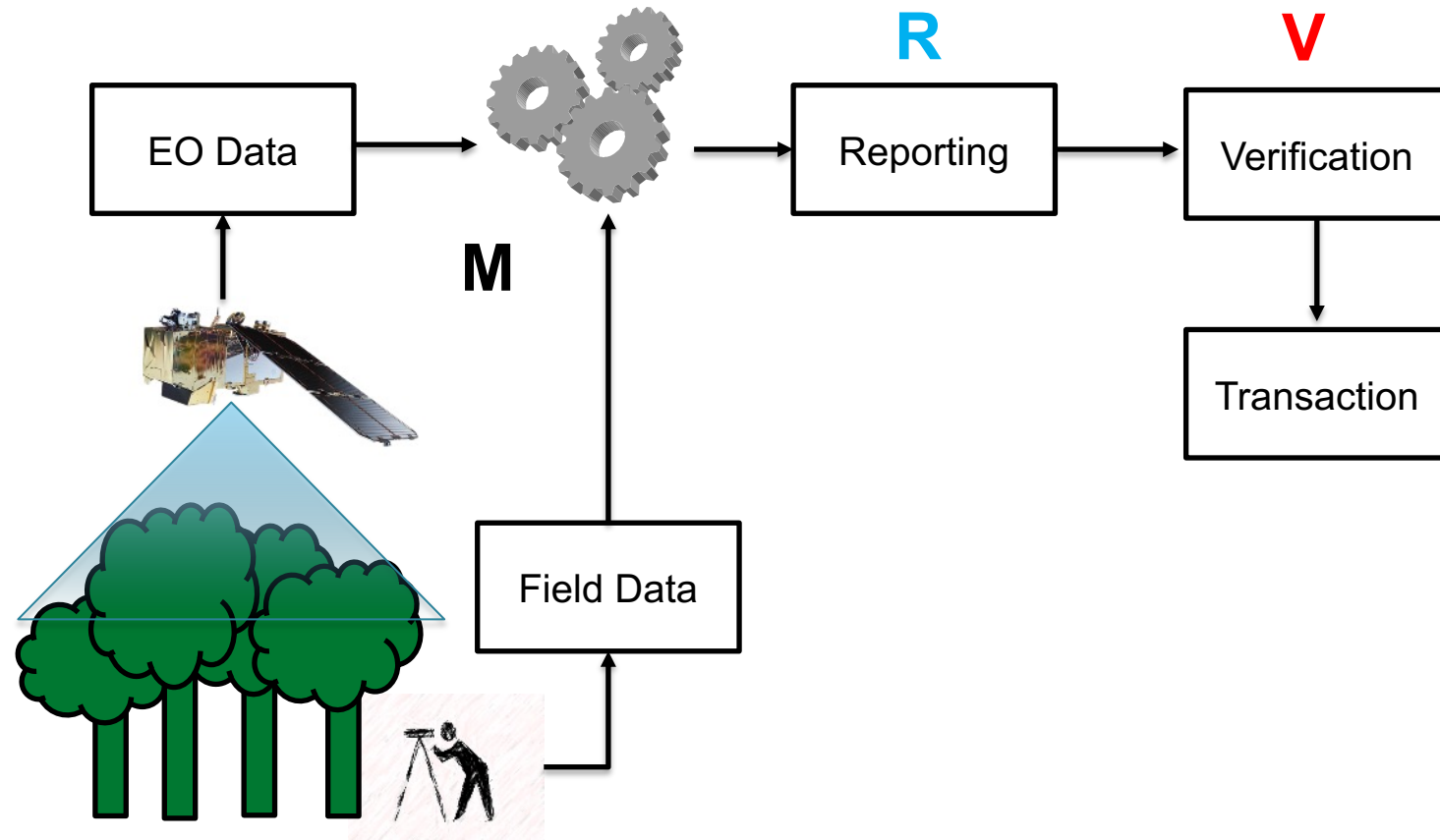- Slow (12-24 months per cycle)
- Non-integrated transaction logs
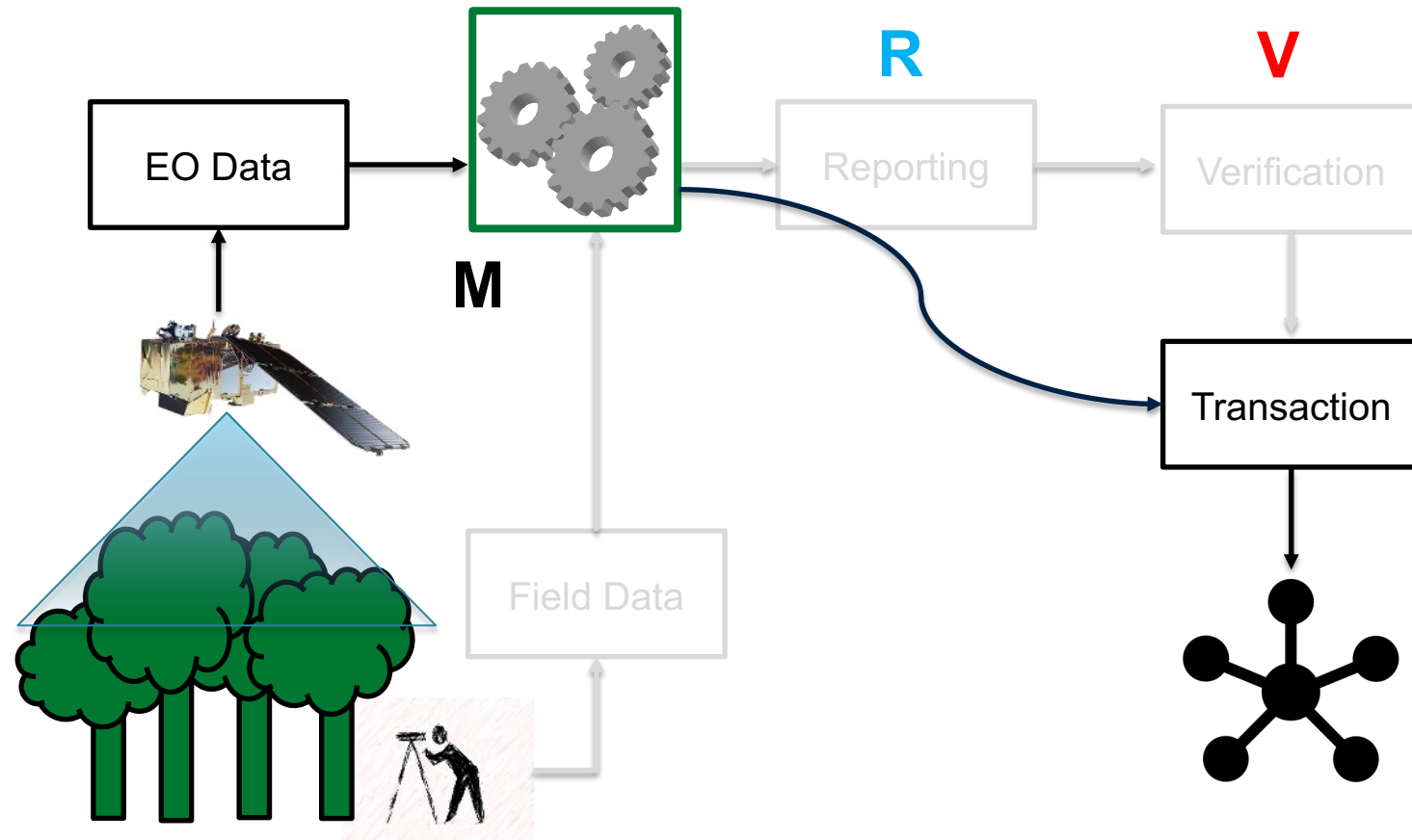
- Limiting factor for market development and access to carbon/climate finance

# MRV + TRANSACTION – NEW GENERATION

# MRV + TRANSACTION – NEW GENERATION

# MRV + TRANSACTION – NEW GENERATION

# MRV + Transaction – New generation – WB work



MRV 2.0

EO Data

Reporting

Verification

Field Data

CATS
Carbon Assets
Tracking System

Climate Warehouse

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Climate Change

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# MRV + TRANSACTION – NEW GENERATION – WB WORK

MRV 2.0

EO Data

Reporting

Verification

Field Data

CATS
Carbon Assets Tracking System

Climate Warehouse

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# NEW PARADIGM IN FOREST MONITORING
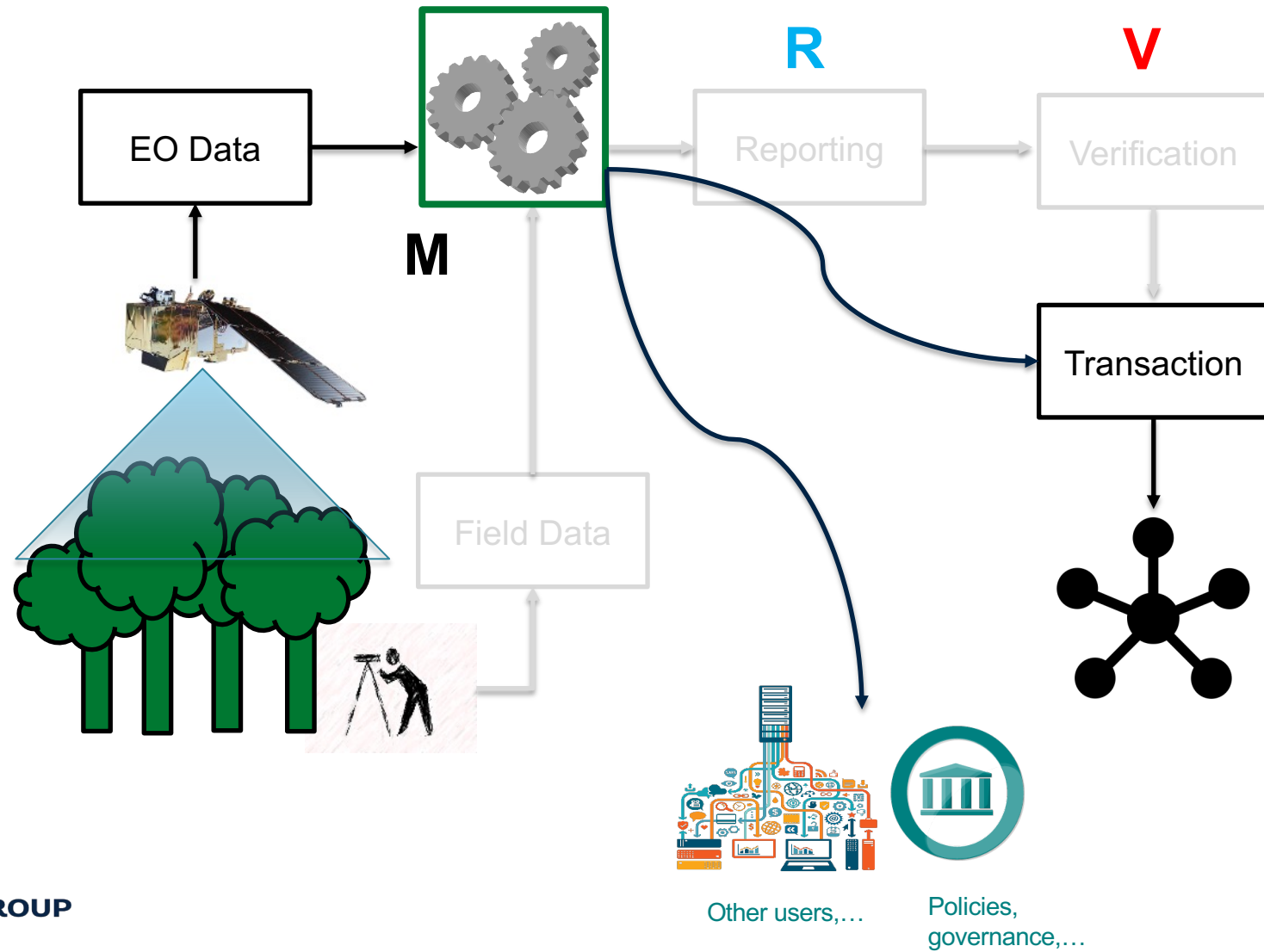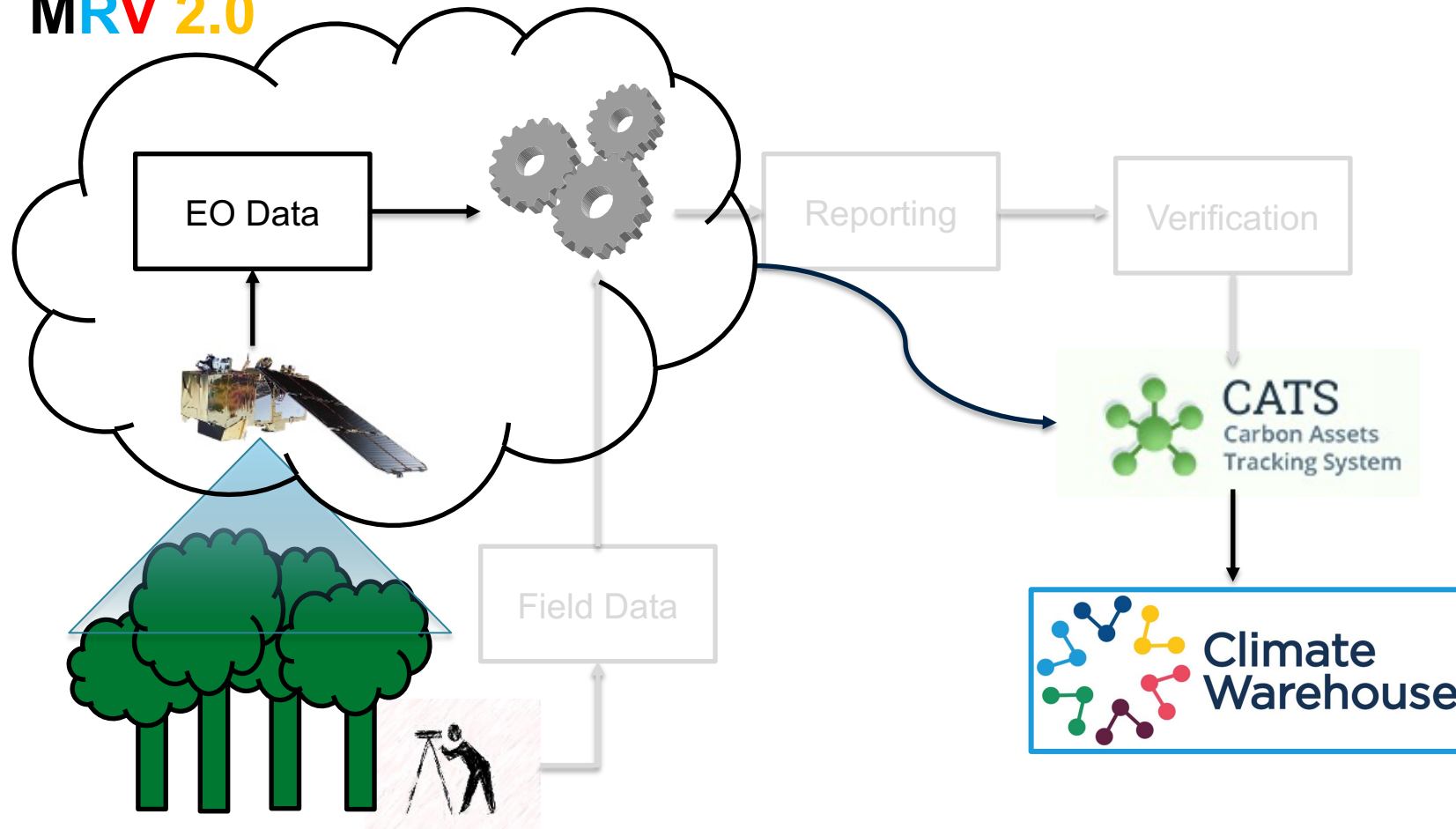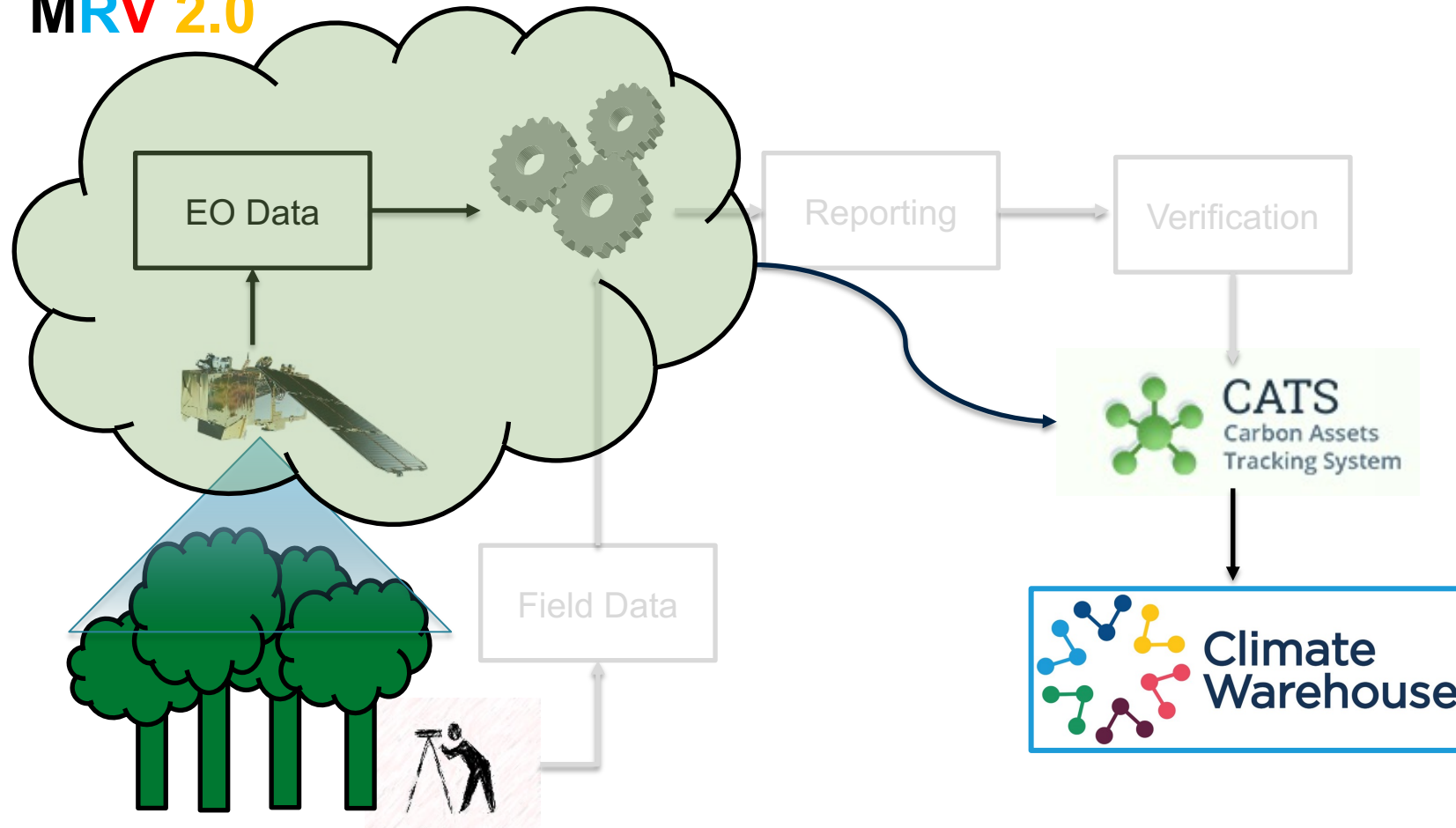
4. Processing and production of carbon maps

3. EO Data Collection (RADAR L-Band)

2. Aerial Laser Scanning Sampling (Aerial LiDAR)

1. Terrestrial Laser Scanning (Terrestrial LiDAR)

By ESA (2020)
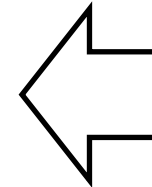
*Possible regular monitoring of carbon stocks by satellite using a combination of LiDAR and RADAR L-Band*

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# 1. TERRESTRIAL LASER SCANNING (TERRESTRIAL LiDAR)



By unknown Author licensed under CC BY-NC
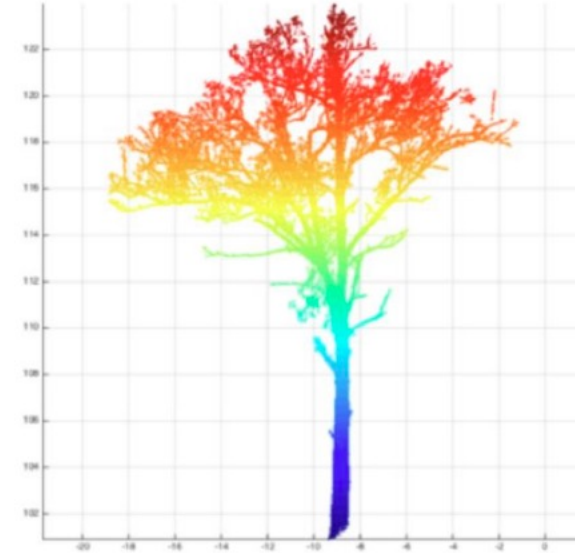


By Duncanson et al. (2021)



By Sylvera (2021)

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# 2. AERIAL LASER SCANNING SAMPLING (AERIAL LiDAR)



By Sylvera (2021)



By Saatchi (2016)



Terra Firme Forest

Swamp Forest

By Saatchi (2016)



GNC system

Vertical camera mount

Inspection camera

LIDAR
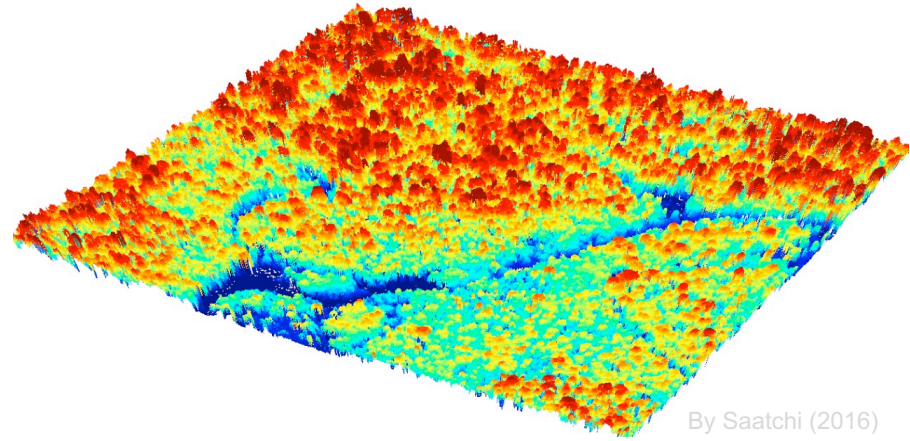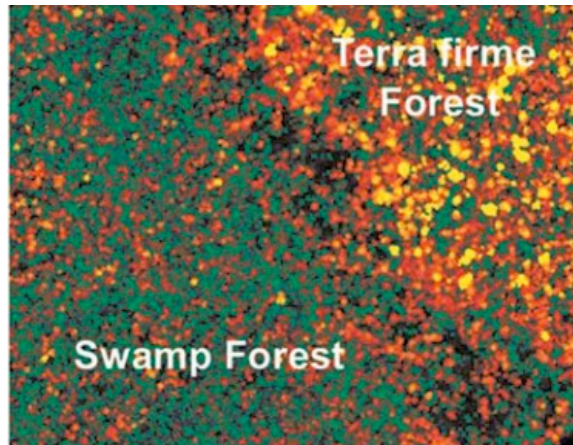
By Merz and Chapman (2012)

# 3. EO Data Collection (RADAR L-Band)

- Unprecedented data availability

- RADAR Band – L critical for carbon mapping

- Only SAOCOM (Argentina) and ALOS-2 (Japan)    competitive advantage Argentina

- New sensors for 2023 (ALOS-4, NISAR, BIOMASS)

-
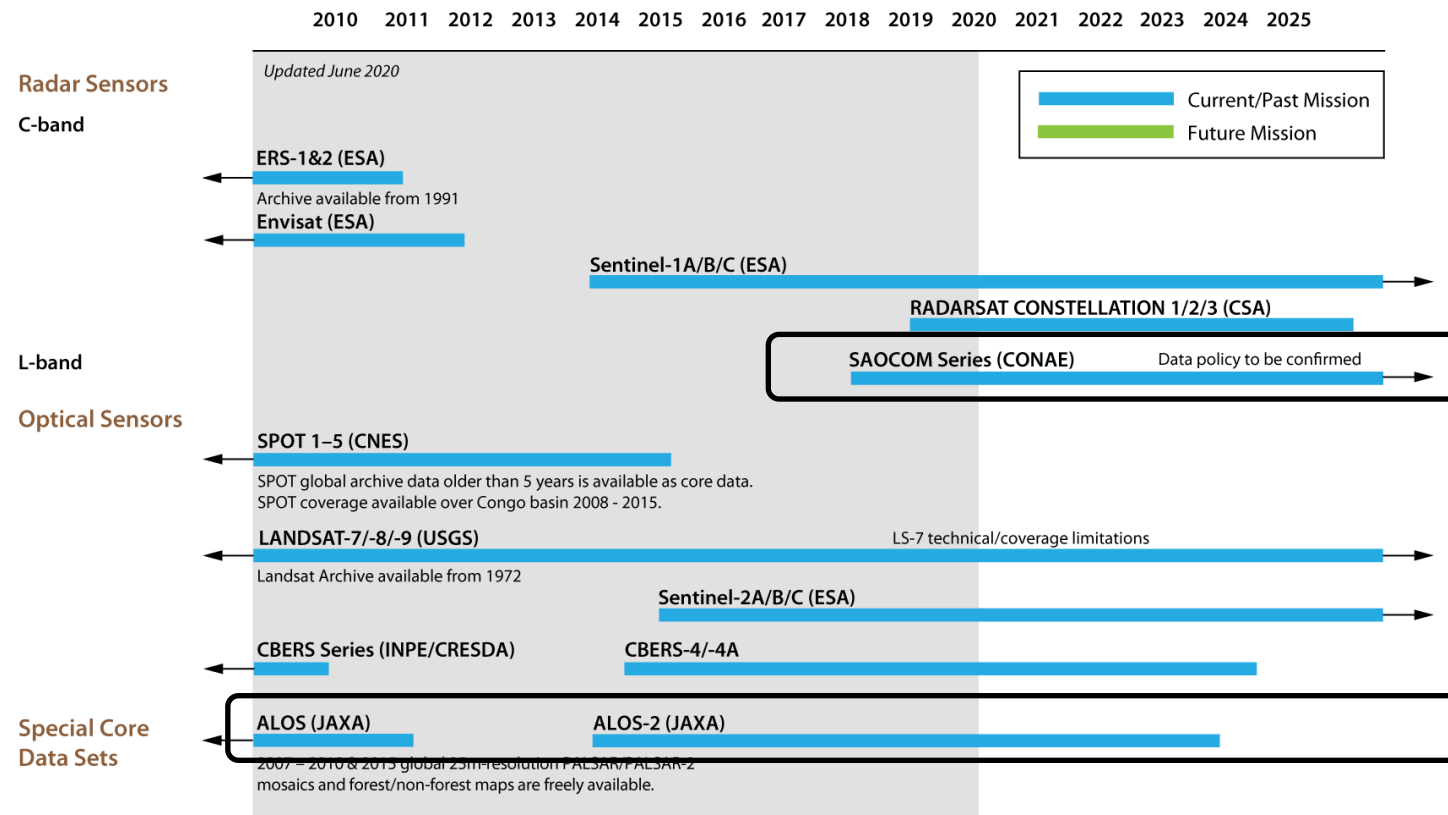
# 4. PROCESSING AND PRODUCTION OF CARBON MAPS

- Very high computational demand and complex algorithms
- Cloud computing in an elevated state of maturation
- Advances in Artificial Intelligence allow predictions with high accuracy
- Encryption methods allow the use of data without taking privacy risks or sensitive data
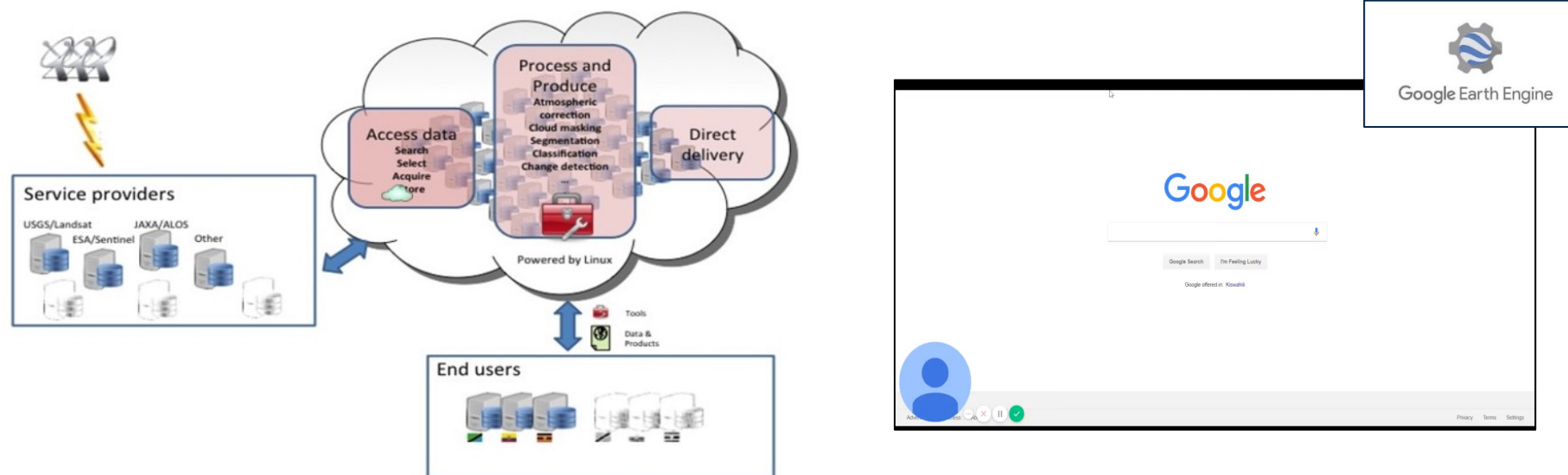


By FAO (2019)

- BM has launched the development of a proof of concept (POC) for a next generation MRV system to report to the WB-managed GHG Programs (FCPF and BioCF ISFL)

- This POC will be carried out in Mozambique and Colombia

- Prototype is expected to be concluded by May 2023



By Sylvera (2021)

# MRV + Transaction – New generation – WB work

# CARBON ASSETS TRACKING SYSTEM

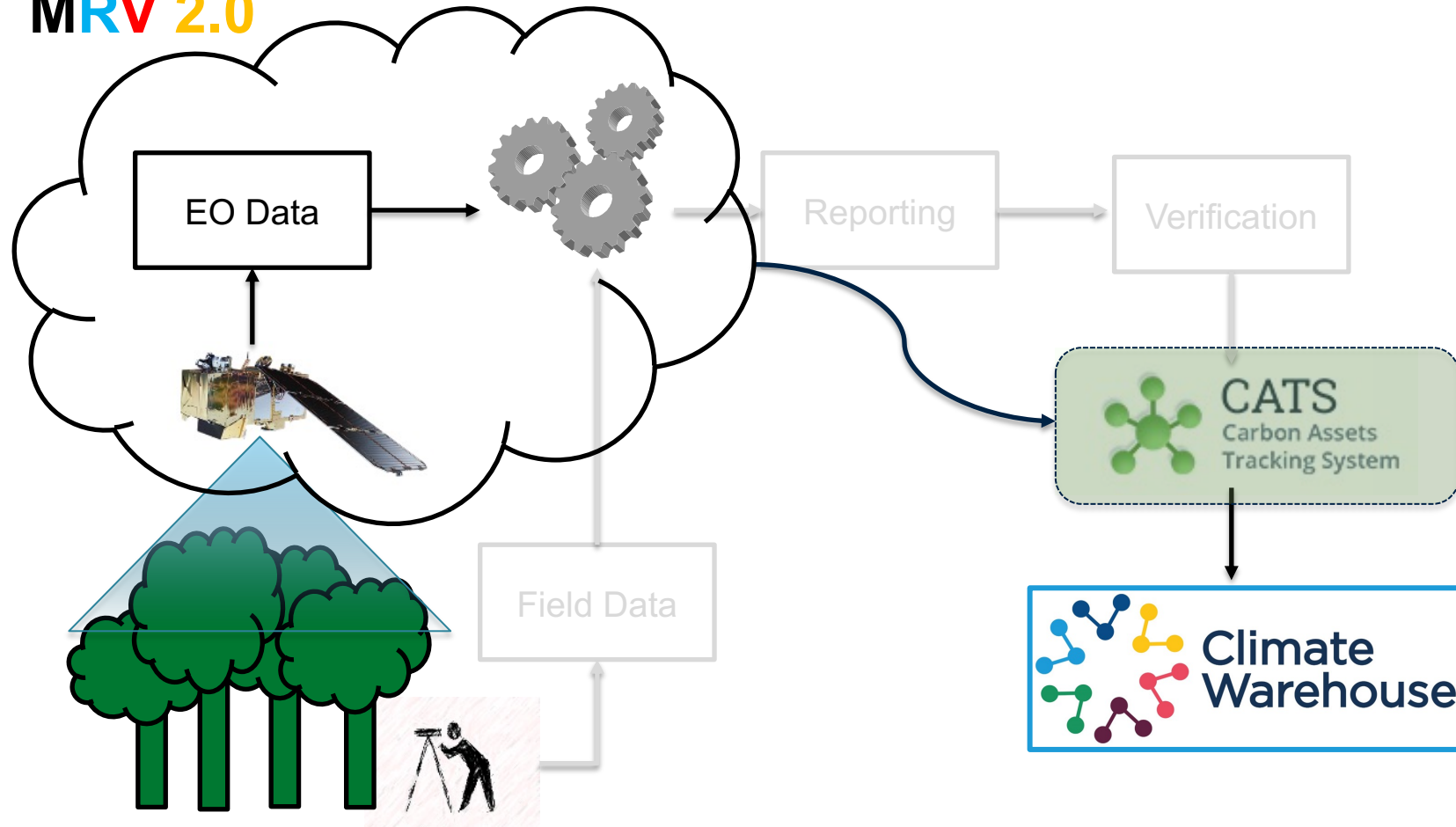- An ER Transaction Registry is a key piece to **safeguard environmental integrity** by **mitigating the risks of double counting, double selling and double claiming.**

- The WB ER Transaction Registry **CATS – Carbon Assets Tracking System** serves as a central platform to support the operations under the FCPF CF and the BioCF ISFL ER Programs.

- The **WB issues ER units on behalf of the host countries (ERP) due to their current lack of capacity** (none of the host countries have proven to have an operational transaction platform so far).

- The **WB is not competing with other issuing parties** to the extent that host countries are part of the governance system of the registry and the WB will issue and transact the ER units on behalf of the host countries, with their consent and approval.

- The World Bank -as the trustee of trust funds supporting these results-based climate finance programs- provides a **secure and transparent transactional platform minimizing risks.**

# CARBON ASSETS TRACKING SYSTEM



**https://cats.worldbank.org/**

# CARBON ASSETS TRACKING SYSTEM

- Scale



Mexico

Dominican Republic

Nepal

Lao PDR

Vietnam

Guatemala

Ethiopia

Indonesia

Cote d'Ivoire

Costa Rica

Ghana

Mozambique

Colombia

Madagascar

Fiji

Republic of Congo

Zambia

Chile

DRC

- **20 ER Programs** (19 Countries; Indonesia host both programs )
- 15 FCPF CF ERP
- 5 BioCF ISFL ERP

- Core Structure

- Accounts chart

# CARBON ASSETS TRACKING SYSTEM

- **Next steps CATS Phase II)**: **(under discussion)**

  - **Accommodation of existing WB programs and projects** generating carbon credits and new mechanisms adapted to the new accounting and market framework designed under the Paris Agreement (MO/ITMOS/CA).

  - **Incorporation of a MRV data integration interface** to enable a digital MRV (starting with a geodatabase with information by GHG category)

  - **Communication with other third-party and national registries**; to connect CATS to the **Climate Warehouse (Meta Registry)** prototype and **Climate Portal (Tokenization Platform)**

  - **To provide support and capacity building to host-countries on transaction registries:** knowledge, multitenant portal, customized software.

# MRV + TRANSACTION − NEW GENERATION − WB WORK
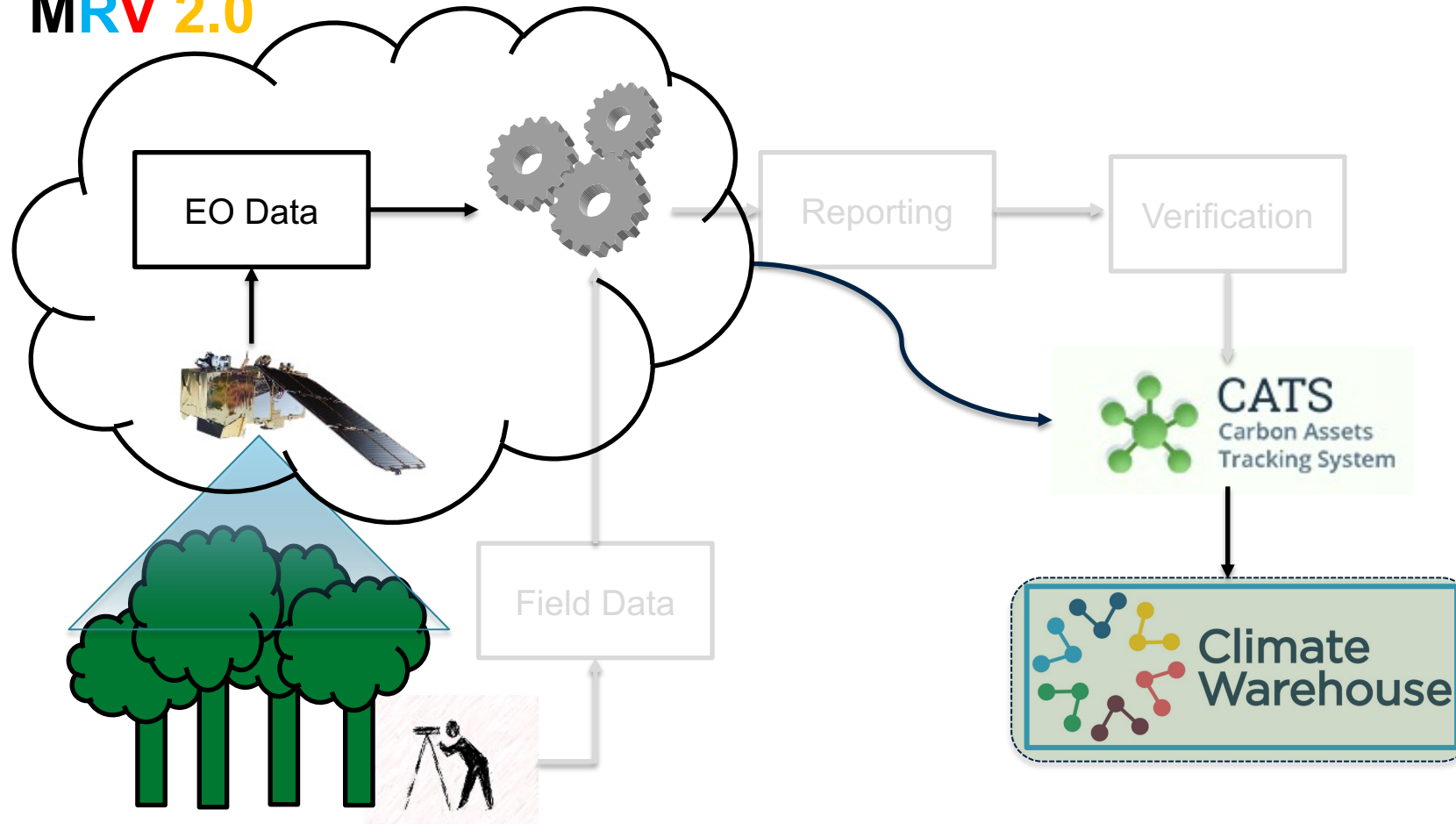
# CLIMATE WAREHOUSE INITIATIVE

- Climate Warehouse (CW) Initiative is a decentralized IT approach to connect climate markets: a shared open metadata repository of registries.

  - To facilitate a peer-to-peer connection and communication among decentralized registries to track mitigation outcomes,
  - To provide visibility into corresponding adjustment (CA) procedures and the lifecycle of carbon offsets from issuances to retirement (safeguard against double counting and ease reporting requirements).
  - Surface publicly-available information on MOs and record status changes to provide information on how MOs are used (CW doesn't hold assets)
  - Enhance transparency and trust among market participants and enable tracking of MOs and reduce double counting risk.

- Prototype is open source, low cost (no hosted services or commercial software licenses) with easy local install/ cloud deployment.
- Uses Global Public Blockchain (Chia), secure Nakamoto consensus, low energy consumption, low transaction fees, compliant with US security laws.
- Integration points with existing registry systems, available user interface for direct access.
- Self-sovereign, participants fully own data.
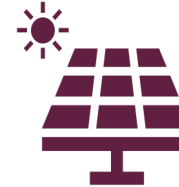
# CLIMATE WAREHOUSE CHARACTERISTICS

Climate Warehouse

**1** **Country-Level or Institutional Databases** Reflect pipeline of potential projects

Emission reductions from identified projects across countries are quantified, MRV'd, and independently assessed

Forestry project in Country A

Solar PV project in Country B

Energy efficiency project in Country C

**2** **Country or International Standards Registries** Include issued MOs

Mitigation Outcomes are issued in a country or institutional registry and may move to a different registry

| Country A | Country B | Country C |
|---|---|---|
| Registry 1 (e.g. Ministry of the Environment) | Registry 2 (e.g. Independent Standard) | Registry 3 (e.g. Centralized UN Registry) |

**3** **Warehouse**

Connects systems to reflect information on all MOs

- Establishes a peer-to-peer communication protocol to connect decentralized systems and mirror public information from existing registries,
- Offers a user interface to allow users to filter MOs by features (e.g., location, scale, tCO2e, etc.),
- Records status changes of MOs (e.g., use, retirement, transfer),

Climate Warehouse

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Climate Change

# ESTRUCTURA DEL CLIMATE WAREHOUSE

**Climate Warehouse**

**Transaction layer**

• Designed as an open shared infrastructure layer

**Registry layer**

• Common taxonomy of data facilitates communication between entities

**Metadata layer**

• Registry service providers and countries share data to the Warehouse

**Services layer**

• Public and private sector market players can host a node and build out the service layer

Exchange A — Exchange B — Inner-Registry Trades

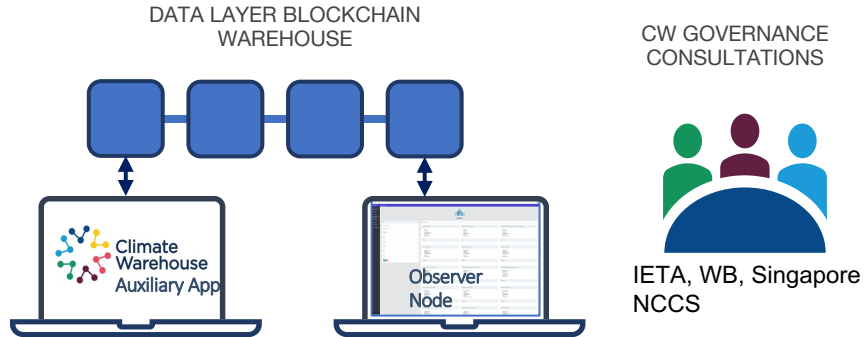Country Registry A — Country Registry B — Indep. Standard Registry — Regional Registry

Climate Warehouse

Compliance Reporting — Benchmarking — Due Diligences Checks — Certifications

Forecasting — Ratings — Conflict Resolution

**WORLD BANK GROUP** Climate Change

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# CURRENT STATUS AND NEXT STEPS

DATA LAYER BLOCKCHAIN
WAREHOUSE

CW GOVERNANCE
CONSULTATIONS

Climate
Warehouse
Auxiliary App

Observer
Node

IETA, WB, Singapore
NCCS

**16 registry nodes:**

Chile
Costa Rica
Japan
Mexico
Singapore
Switzerland
American Carbon Registry
Carbon Action Reserve
Global Carbon Council
Gold Standard Foundation
Verra
Kengen
Energy Efficiency Services
Limited (EESL)
EcoRegistry
Global Green Growth Institute

**Observer node
access:**

Over 20 organizations:
UNFCCC
MDBs
Academics
Country Ministries
Industry Partners

**Governance
consultation with
private, public and
non-profit ecosystem
partners:**

Goals:
Determine the
appropriate governance
and operating model for
the Climate Warehouse
as a public good.
Explore different funding
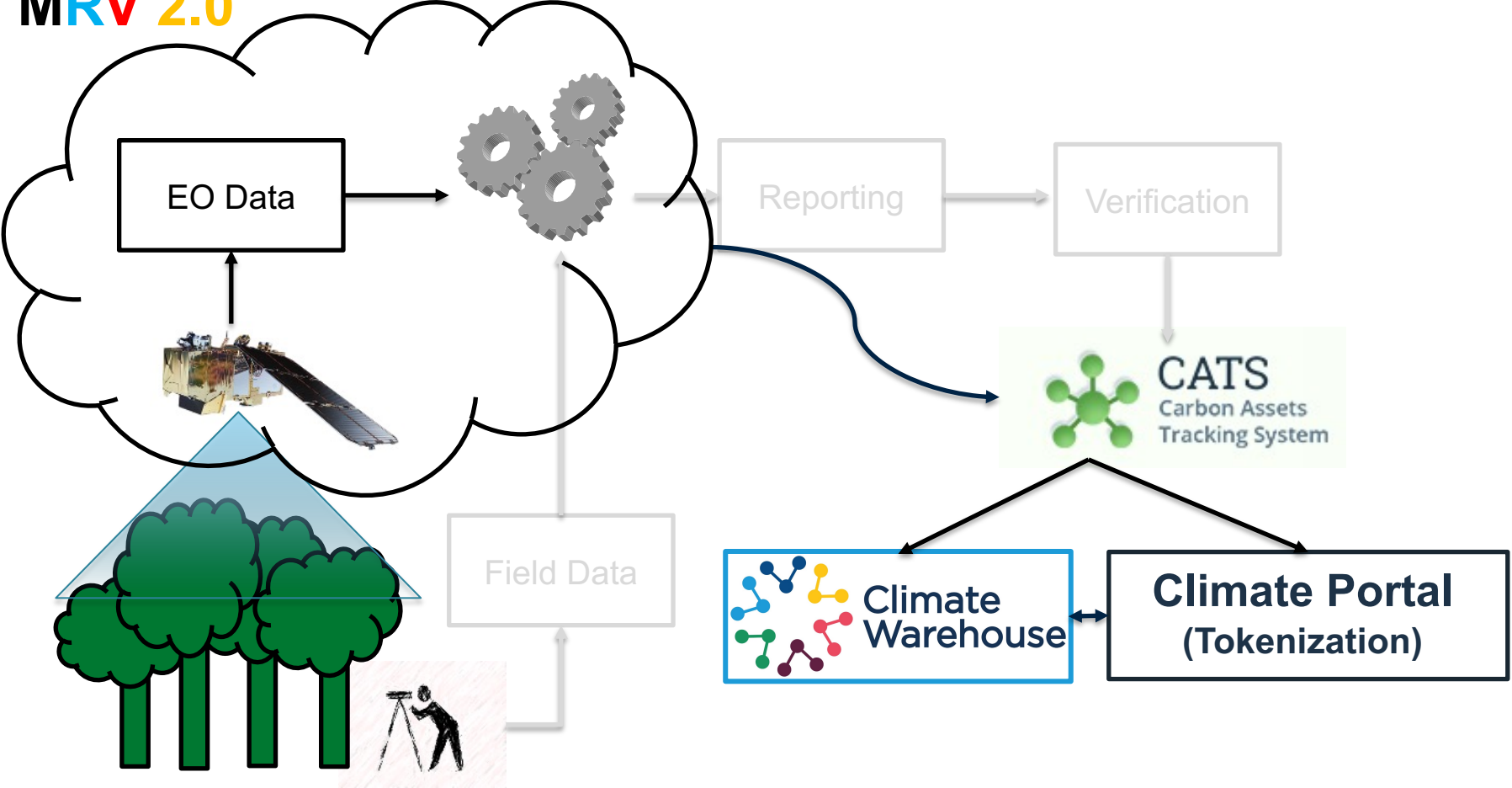models for the
operations
and maintenance of the
infrastructure

- Phase 2 of prototype development completed
- Developed 3rd version of prototype with Chia blockchain (February 2022)

Next Steps:

- Launch of phase III - testing and simulation of prototype (August 2022)
- Completion of Governance Consultations with IETA and the Government of Singapore (August 2022)

**WORLD BANK GROUP**
Climate Change

# MRV + Transaction – New generation – WB work



MRV 2.0

EO Data

Reporting

Verification

Field Data

CATS
Carbon Assets
Tracking System

Climate Warehouse

**Climate Portal**
**(Tokenization)**

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# CLIMATE PORTAL (TOKENIZATION PLATFORM)

WB is conceptualizing a tokenization platform (**Climate Portal**) that delivers tokenization capabilities to independent and sovereign carbon registries so they may digitize new and previously issued offset credits into **Native Carbon Tokens** with the same legal status.

- **Integrity Maintained by Registries:** Registries remain in control so they can continue to safeguard environmental credibility, ensure KYC/AML, and earn tokenization fees to support their expanding operations.

- **The Portal will support:** Tokenization of VERs into Native Project Tokens, Retirement of tokens results in retirement of VERs (retired via issuing registry which may require permission) and ability to revert Tokens to VERs.

- **Easy Registry integration**: Straightforward implementation as the Portal can utilize the data collection systems and structure built for the Climate Warehouse.

- **Secure & Low-risk:** Utilizing an industry-wide tokenization standard process on a shared public good infrastructure will reduce liability for all parties, reduces errors and assure transparency

- **Low Cost:** The Climate Portal will be developed open source for a public good facility

- **Interoperable:** Tokenization modules easily added to extend to any blockchain qualified as sustainable, secure and legal

# CLIMATE PORTAL (TOKENIZATION PLATFORM)

Native tokens issued by Climate Portal can be pooled in Native Token Pool Facility
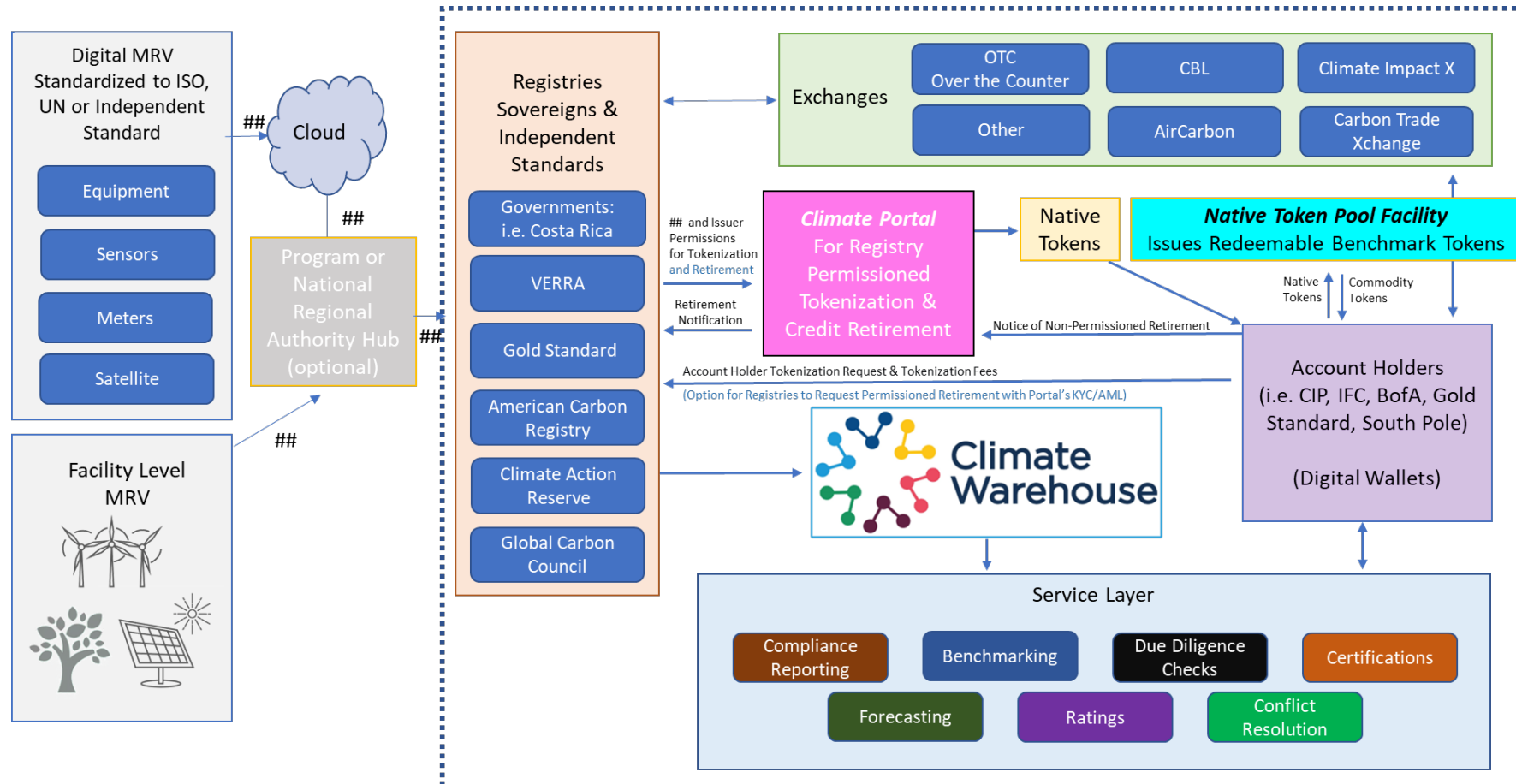
# TOKENIZATION PILOT – CATS + IFC FACILITY + CP+ CW

- WB is developing a tokenization pilot together with IFC to deal with the third-party transfers (external sales of ERs).

- The units created in CATS are sold to the IFC facility (with account open in CATS), which tokenizes them in the Chia Blockchain (CP). Tokens are homogenized in pools to improve fungibility and sale in high liquidity markets.
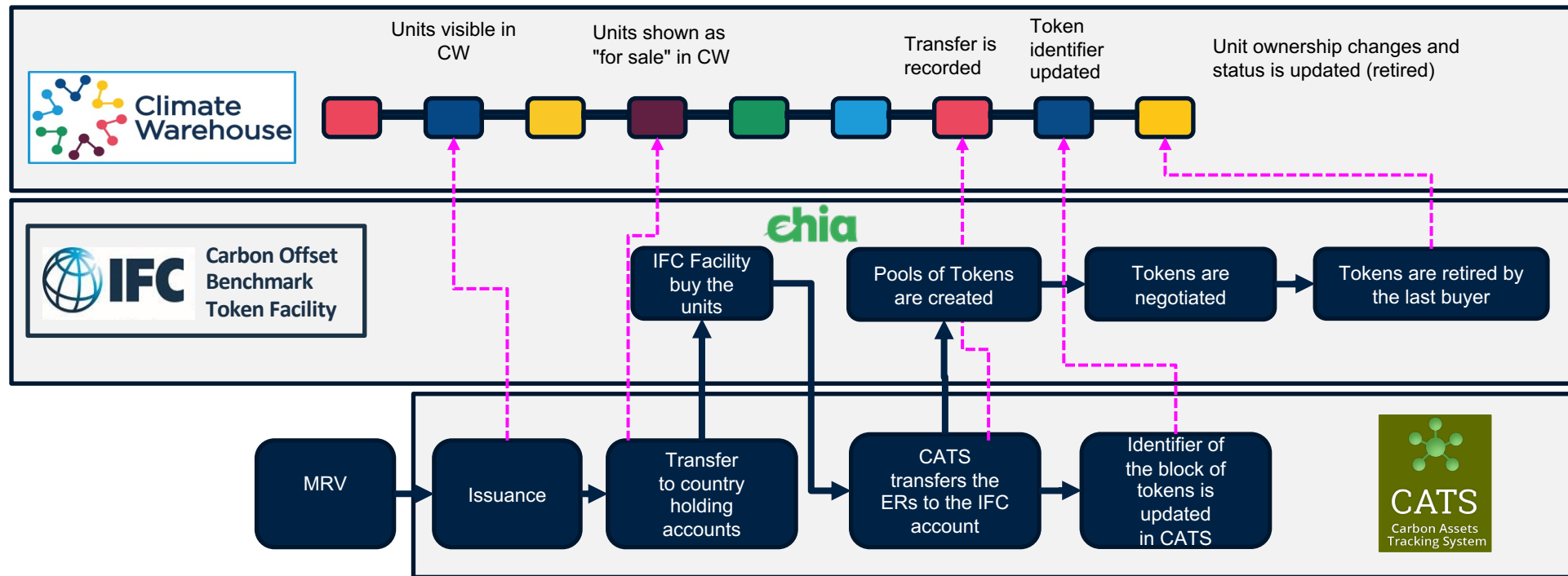
Thanks!

- MRV for Commodities
- Pilot project in the Dominican Republic

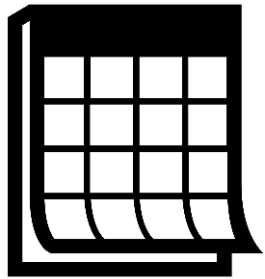Dr. Ana Sebastián
BD Manager
EO applications specialist
**GMV**

**Workshop on Accelerating Climate Action: Unlocking Private Sector Finance for Sustainable Landscape**

# Pilot MRV for commodities in the Dom. Republic

## Duration
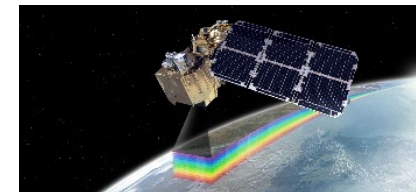
**1** year

## Budget

**150k euro**

Funded by the **European Space Agency** (ESA)
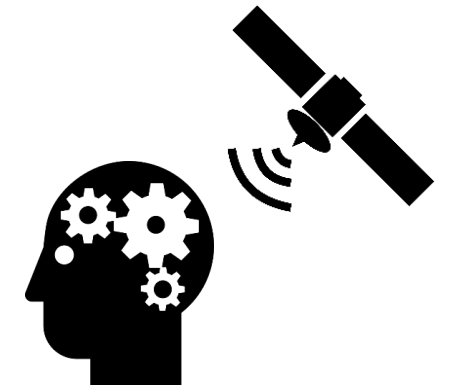
## Sensors used

**3 satellites**

Open source o**ptical** and **radar** data from ESA (Sentinel), and commercial radar data (ALOS) from JAXA.

## Technologies

**2 techs**

**Sat-EO, AI, GNSS**

---

**Stakeholders**

GOBIERNO DE LA REPÚBLICA DOMINICANA — MEDIO AMBIENTE

GOBIERNO DE LA REPÚBLICA DOMINICANA — AGRICULTURA

DR Cocoa Foundation

WORLD BANK GROUP

dd/mm/yyyy

gmv NSL

# Vision

**Satellite-based tool to support the country's MRV strategy, boost the cocoa-based economy and value chains:**

| | Project contribution: |
|---|---|
| M & M | Locating, measuring, monitoring changes |
| Reporting | Periodic, consistent and objective satellite measurements |
| Verification | Supported by quantifiable and consistent actionable evidence |
| Modernize and boost the value chain | Underpin decision-making, modernize the cocoa value chain and attract investors. |
| | Meet the current new Green Deal market regulations affecting cocoa (e.g.: EU and UK) |
| | Contribute to demonstrate the role of agroforestry cocoa in fighting climate change. |

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# Technical Objectives:

| | |
|---|---|
| Identify | the most suitable land to grow cocoa, considering natural protected areas. |
| Monitor | deforestation and drought, with focus the cocoa areas |
| Quantify | estimate AGB and C stock to conclude about their role in the ER |
| Generate | actionable evidence for cocoa farm management and market strategy planning. |
| Demonstrate | the advantages of EO virtual platforms |

| | |
|---|---|
| Raise awareness | .. about the role of agroforestry systems in fighting climate change and their socio-economic benefits to all stakeholders |

dd/mm/yyyy

# Scope

**1**

MRV4C pilot country

**MRV4C**

**45**

Number of ML models trained for cocoa classification

**260**

Total number of Sentinel-1/2 imagery used
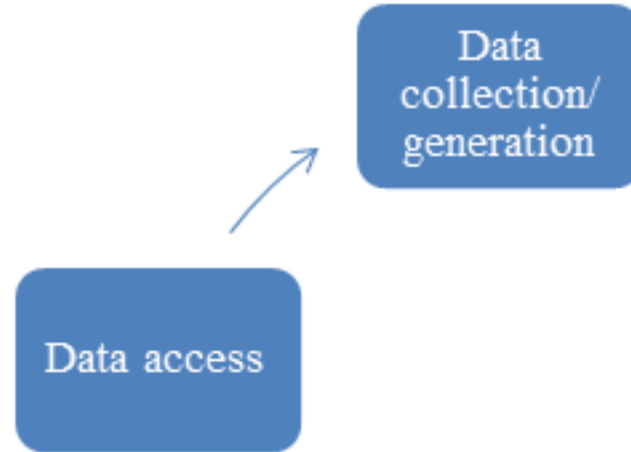
**0.2 TB**
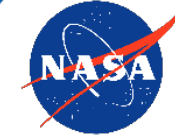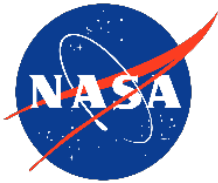
Storage required for processed Sentinel-1/2 imagery

**2,586**

Number of labelled polygon used for the cocoa classification
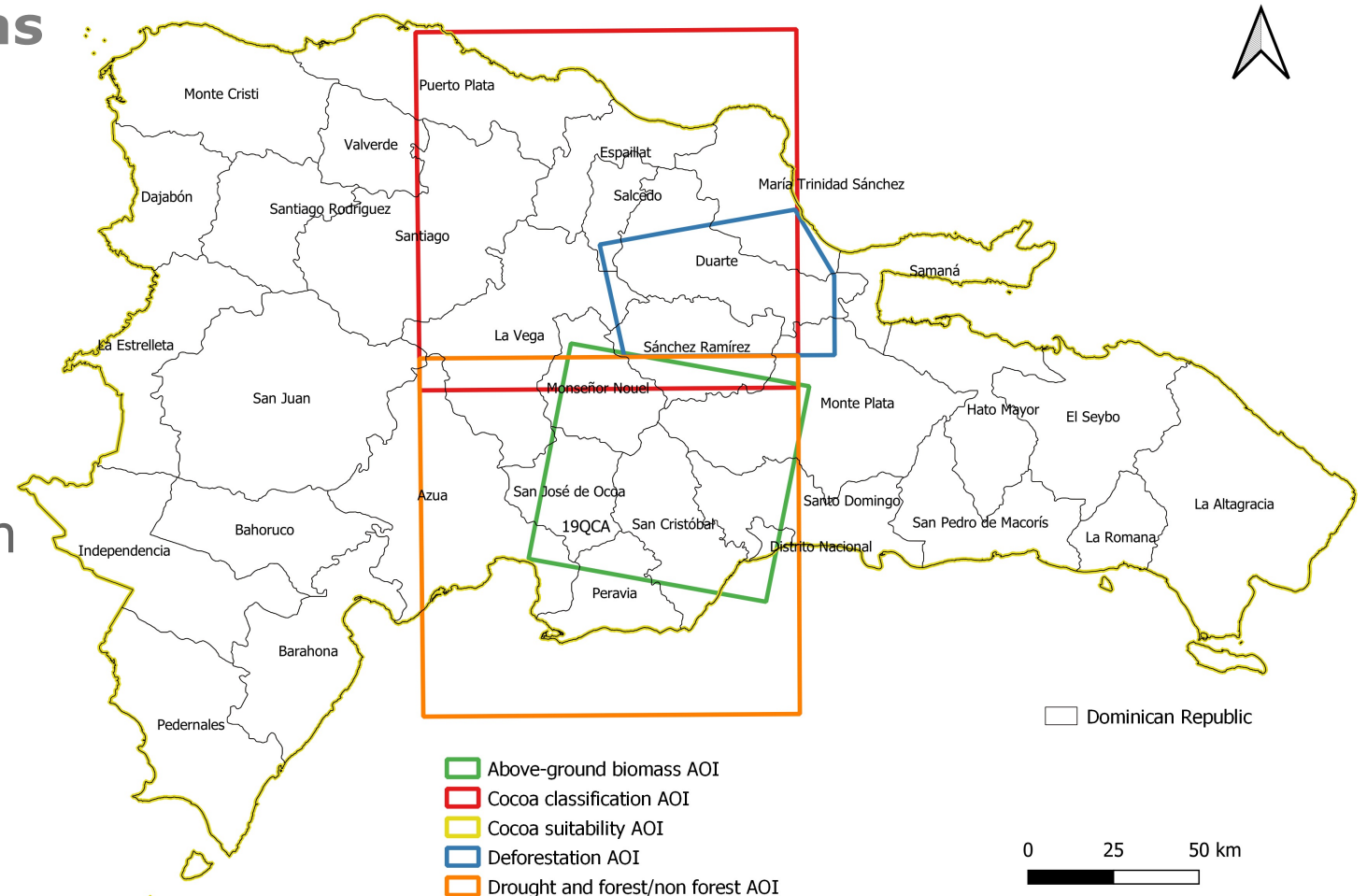
dd/mm/yyyy

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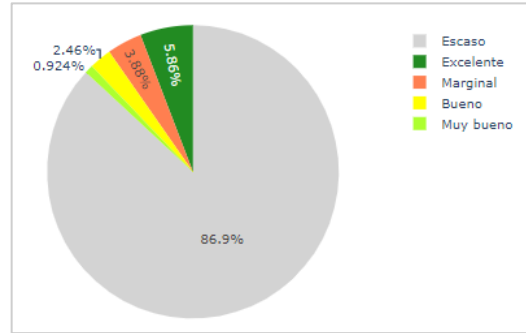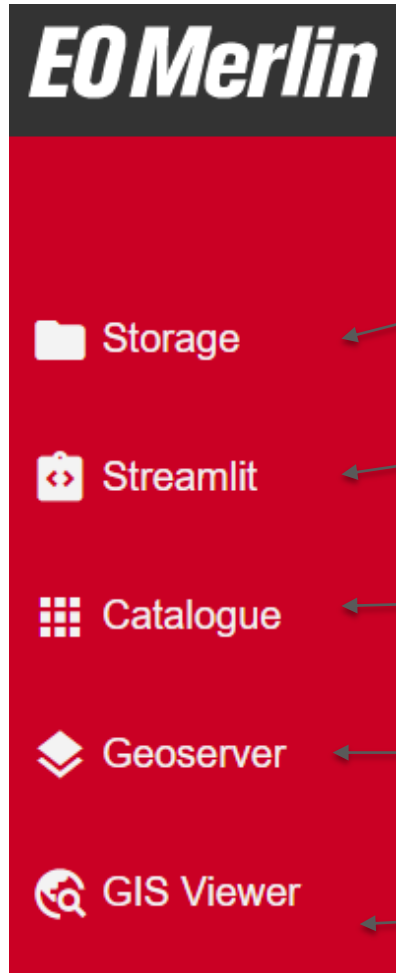# Data Management and tools

dd/mm/yyyy
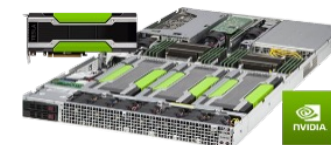
# Results

## Satellite products in pilot areas

1. Cocoa land vocation
2. Forest/non-forest mask
3. ML cocoa farms classification
4. Deforestation monitoring
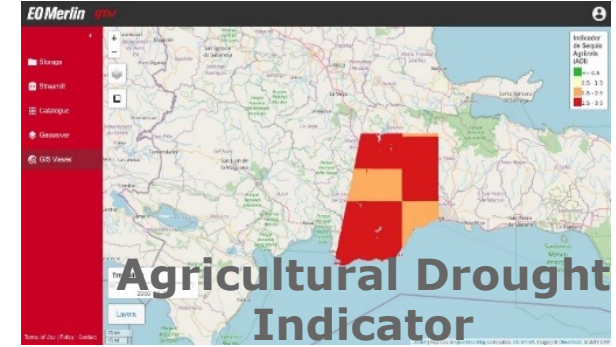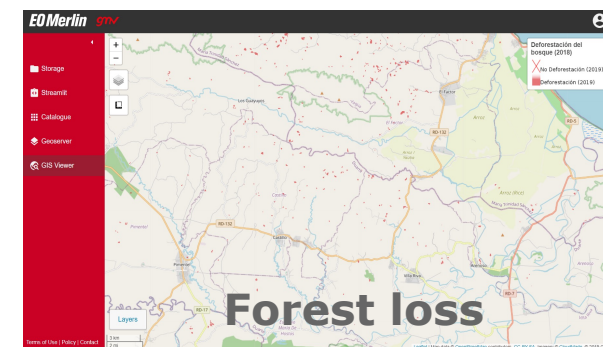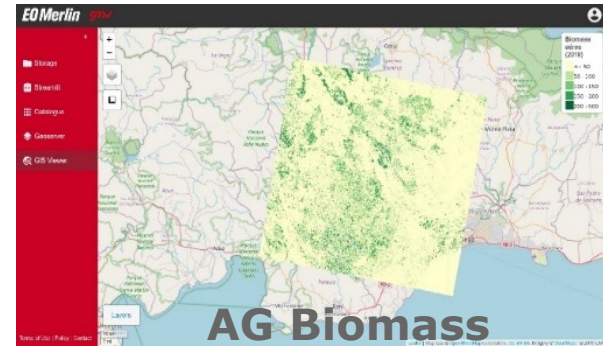5. Above-ground biomass/carbon stocks
6. Drought indicator



Legend:
- Above-ground biomass AOI
- Cocoa classification AOI
- Cocoa suitability AOI
- Deforestation AOI
- Drought and forest/non forest AOI
- Dominican Republic

dd/mm/yyyy

# Results

## Prototype tool


EO Merlin


Pie chart: Escaso 86.9%, Excelente, Marginal 3.88%, Bueno 0.924%, Muy bueno 5.86%, 2.46%

- **Escaso**
- **Excelente**
- **Marginal**
- **Bueno**
- **Muy bueno**

Storage → Product download and storage

Streamlit → Online generation of Stats & infographics

Catalogue → Product search

Geoserver → Onlide Data access

GIS Viewer → Product visualization & query


**Forest/Non-Forest**


**Cocoa suitability**


**AG Biomass**


**Cocoa classification**


**Forest loss**


**Agricultural Drought Indicator**

dd/mm/yyyy

gmv NSL

# INTEREST FOR AN MRV4C (1/3)

## 1- Support MRV2.0

1. Generate satellite products at the **national scale**

2. **Periodic monitoring** and analysis of **changes**

3. **Quantify carbon credits** during the monitoring period in accordance with the concrete methodological standard (by comparing current emissions with a baseline)

4. **Support the Verification/Certification LEADING TO**

5. **Issuing credits** in the market through the transaction platform of the chosen carbon standard

dd/mm/yyyy

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# INTEREST FOR AN MRV4C (2/3)

## 2 – Feed Sustainability Due Diligence statements

Proposal 2021/0366 for a **Regulation of the EU** on the making available on the Union market as well as export from the Union of certain commodities and products associated with deforestation and forest degradation

*ESG regulations - Game changer for governments and private operators:*

Commodities or products linked to deforestation or degradation after Dec 2020 will be **prohibited** in the EU market. Obligations:

1. **Country benchmarking** requesting periodic proof of the risk profile
2. **Information System (Registry)** requesting Due Diligence statement contain:
   ✓ Geolocation **coordinates** of production land plots
   ✓ Date or time range of **production**
   ✓ Adequate and verifiable information that the production has been conducted in accordance to the national legislation
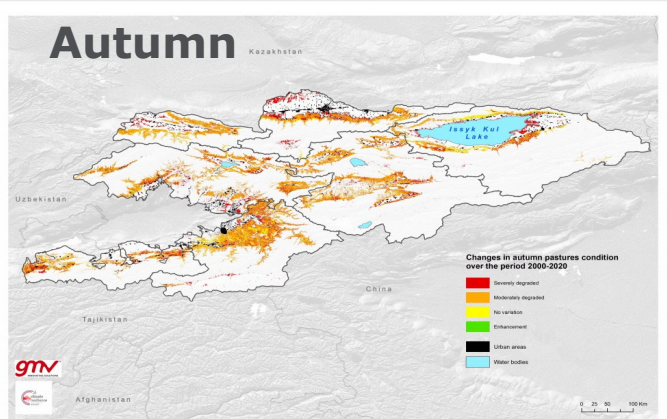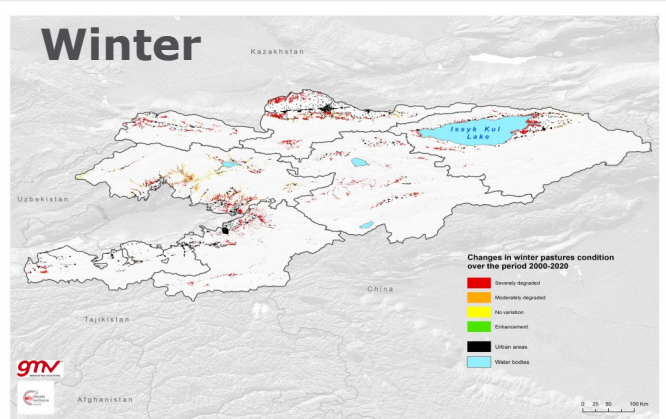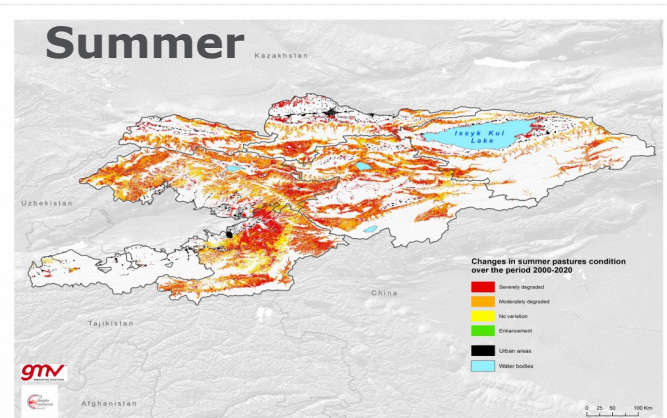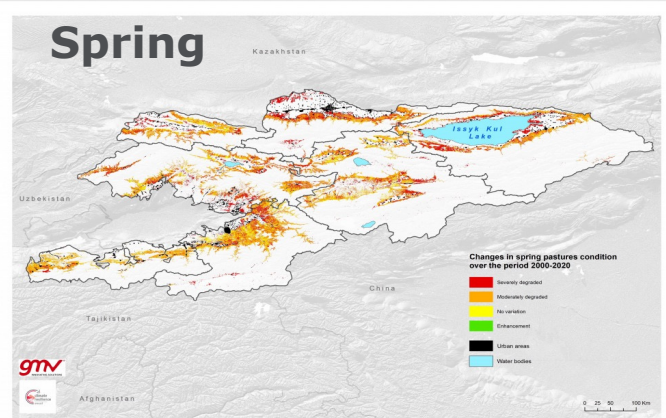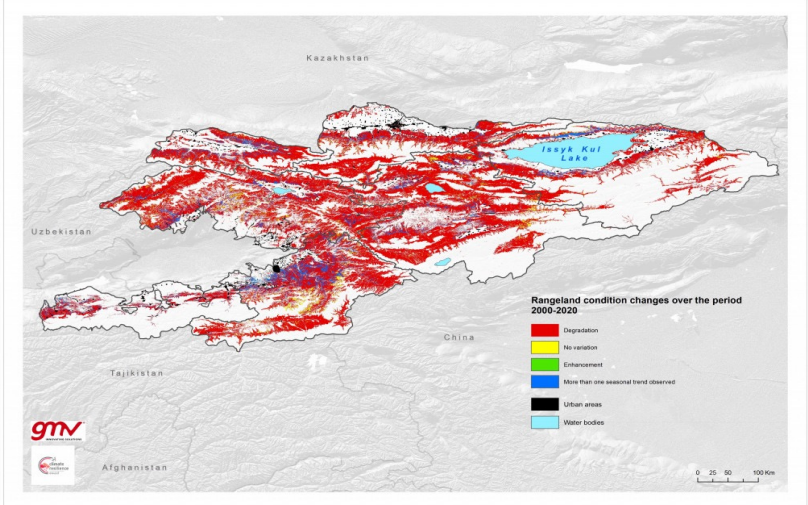
dd/mm/yyyy

**gmv** NSL

# INTEREST FOR AN MRV4C (3/3)

## 3- Extend MRV4C to other relevant commodities:

EU regulation concerns: cocoa, cattle, coffee, oil palm, soya and timber

**Grassland Conditions monitoring  2000- 2020:**

# MRV4C USE

**1- National public sector:**

a) Prove compliance with ER commitments,

b) Facilitate conversations / information exchange with int. orgs. and regulatory authorities.

c) Inform country's risk profile (simplify Due Diligence process)

d) Results-based financing (RBF) compliance (Art. 6, NDC…) and voluntary markets

**2- National private sector:**

a) Improve management and market strategies,

b) Facilitate generation ESG due diligence statements. Satellite products over their farms

c) Connect (digitally) their farms to the ER project / payment-for ecosystem services or any other schemes providing revenues

dd/mm/yyyy

**gmv** NSL

# TAKE WAY MESSAGES

## RELEVANT MESSAGES

1. Synergies among the Emission Reductions MRV and MRV for Commodities (MRC4C), and the interest of connecting them

2. Relevance of satellite earth observation data to feed the MRV4C

3. The multiple uses /frames of a MRV4C platform

4. The posibility of building the MRV4C in an scalable way (like in e.g. begin with cocoa, follow with livestock, palm oil..etc)

dd/mm/yyyy

# GMV EXPERIENCE
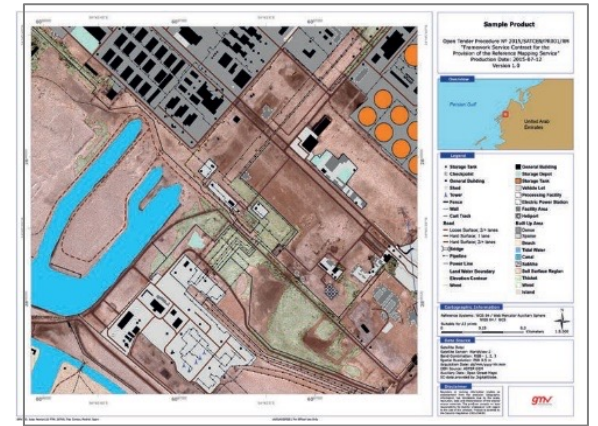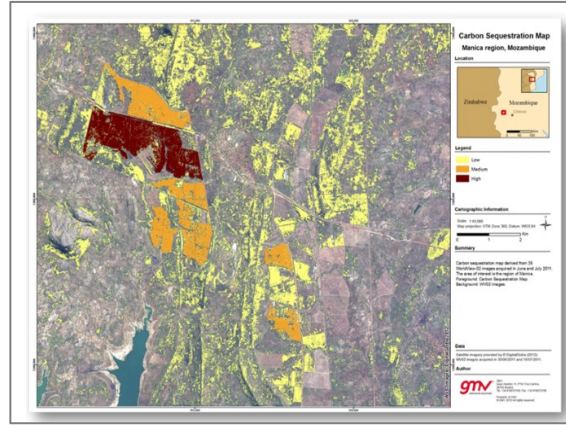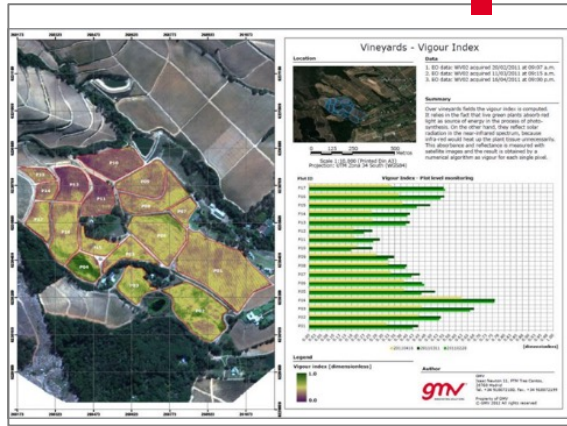


**Agriculture and Rangelands**   **Sustainable Forest Mngt.**   **Climate change**   **Emergency & Humanitarian**

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# Thank you

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