

Peer learning session

Remote sensing and thermal intelligence for Carbon Farming MRV

SESSION CONTEXT

Peer learning session led by [Constellr](#) and held the 16th of March 2026 in Padova, Italy, during the Smart Carbon Farming Consortium meeting.

The session convened project partners, researchers, technology providers and farmers organizations to explore how satellite-based Earth Observation (EO) and thermal intelligence can support carbon farming practices, monitoring and verification processes. The goal was to simplify abstract remote sensing concepts and demonstrate practical applications for monitoring soil health, crop stress, and carbon sequestration.

ADVANCED MONITORING THROUGH EARTH OBSERVATION BY SATELLITE

OBJECTIVES

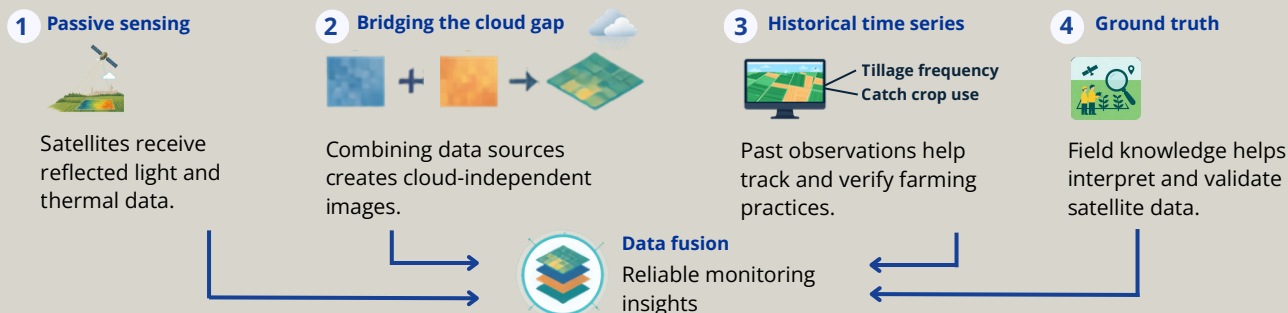
The core objective of the session was to demonstrate how high-resolution thermal and multispectral data can provide scalable solutions for Monitoring, Reporting, and Verification (MRV) in carbon farming. By leveraging Land Surface Temperature (LST) and vegetation indices, the project aims to help farmers optimize land management, reduce input costs, and accurately quantify carbon sequestration.

KEY PARAMETERS

In carbon farming, remote sensing and thermal intelligence act as a "new sense," allowing us to measure what the human eye cannot. The three most critical parameters used are:

- **Land Surface Temperature (LST):** This measures the heat radiated from the soil and crop canopy. It is a proxy for soil moisture and plant health, as thirsty plants tend to heat up before they show physical signs of wilting.
- **Normalized Difference Vegetation Index (NDVI):** This is the industry standard for measuring biomass and "greenness". It helps advisors estimate how much carbon is being sequestered by the growing crop or cover crops.
- **Normalized Difference Moisture Index (NDMI):** This index focuses on the water content within the plants themselves, providing a more detailed look at drought stress than biomass alone.

METHODOLOGY



EXPECTED RESULTS: BETTER MANAGEMENT AND NEW INCOMES

By using these advanced tools, farmers can expect three main benefits:

- **Precision Field Zoning:** Instead of treating an entire field the same, remote sensing creates "zoning maps". These maps identify exactly where the most productive areas are and where soil sampling should be targeted, which can significantly reduce the costs of laboratory testing.
- **Variable Rate Application (VRA):** Farmers can use these insights to create digital maps for their machinery. This allows for localized irrigation and fertilization, applying water and nutrients only where they are needed. This reduces waste, saves money, and helps comply with environmental regulations for reducing chemical use.
- **Early Warning Systems:** Thermal sensors can detect "decoupling," a phenomenon where a crop begins to heat up internally because it is stressed by drought or pests (like aphid outbreaks) long before it turns yellow or wilts. This allows you to intervene days earlier than traditional methods.

FARMER SPOTLIGHT: KEY INSIGHTS & HIGHLIGHTS OF THE EIKENHORST FARM



Drought and Stress Identification:

Thermal sensors can detect "decoupling," where high-biomass crops show heat stress before physical wilting is visible to the human eye or optical sensors. This provides an early warning system for drought or pest infestations, such as aphid outbreaks, which cause distinct temperature drops in the crop canopy.



Soil Moisture Proxies:

By measuring Land Surface Temperature (LST), remote sensing acts as a proxy for soil moisture content. Analysis of the "Gaffey" parcels in Ireland showed that different soil properties (e.g., peat vs. mineral soil) result in distinct thermal signatures, which are crucial for establishing baselines in carbon farming.



Management Verification:

Retrospective time-series analysis allows project managers to verify historical farming practices, such as the use of catch crops or tillage frequency, which are essential for carbon credit certification.



Zoning for Sampling:

Instead of homogeneous field sampling, remote sensing creates "zoning maps" based on productivity and thermal variance. This allows farmers to target soil sampling in areas with the highest or lowest carbon potential, significantly reducing lab testing cost.



Targeted Carbon Retrieval:

By combining the thermal signatures with Growing Degree Days (GDD) and phenology markers (the timing of crop growth stages), the technology can be used to model soil carbon content retrieval. On the ILVO and Teagasc parcels, this allowed researchers to identify specific zones where carbon content might be higher—such as in clover-rich areas—which helps in quantifying the total carbon sequestered by the farm.

KEY TAKEAWAYS FOR OTHER CARBON FARMING PROJECTS & ADVISORS



Thermal Intelligence as a "New Sense"

Thermal data provides critical information that traditional optical sensors miss. It detects nighttime activity and photosynthesis health because thermal sensors do not require solar illumination, capturing emitted heat instead of reflected light.



Need for Ground-Truth

While remote sensing identifies "where" and "when" anomalies occur, "agronomists and soil scientists" remain essential to determine "why". A prime example is the phenomenon of "decoupling," where high-biomass crops begin to heat up internally due to drought or aphid outbreaks before any physical wilting is visible. Field experts are required to interpret these thermal signals and distinguish biological stress from specific management actions.



Scalability via Data Fusion

Commercial constellations offer daily revisit times at 30m resolution, but when fused with public Sentinel or Landsat data, they provide a continuous, high-temporal monitoring stream that is "cloud-independent."



Precision Management Equals Sustainability

Utilizing Variable Rate Application (VRA) maps for localized chemical, fertilizer, and water delivery is a financial win-win that directly reduces a farm's carbon footprint. These "zoning maps" allow farmers to treat different areas of a field according to their specific productivity levels, which can also target soil sampling to areas with the highest carbon potential, significantly reducing expensive laboratory testing cost.



Verification for Carbon Markets

Long-term, retrospective time-series data is the most reliable method for providing the "proof of practice" required by carbon markets. This historical analysis allows auditors to verify past management habits which is a mandatory requirement for the official certification and sale of carbon credits.



CONTRIBUTORS

Multitel
INNOVATION CENTRE

ver de terre
PRODUCTION

Teagasc
AGRICULTURE AND FOOD DEVELOPMENT AUTHORITY

@tgo AG
THE GOOD ONES

GR!
Green
Restoration
IRELAND

constellr

ZLTO

Kompetenzzentrum
Niedersachsen - Netzwerk
Nachwachsende Rohstoffe
und Bioökonomie e.V. **3N**

oost.nl

ILVO
Flanders Research Institute for
Agriculture, Fisheries and Food

**BOEREN
BOND**

Together with:
bax

CONTACT US:



<https://smartcarbonfarming.nweurope.eu/>



Cottin Alexandre
alexandre.cottin@verdeterreprod.fr



Duval Matthieu
duval@multitel.be

MORE INFO:

<https://www.constellr.com/resources>

<https://constellr.github.io/product-list/our-technology/>



Co-funded by
the European Union

Publication Date: 11/2025