" Food Security & Nature Credits" Session MoM's

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<tr><td>Meeting Date</td><td>04.12.2025</td><td rowspan="2">Location</td><td rowspan="2">Prague</td></tr>
<tr><td>Meeting Called By</td><td>EUSPA</td></tr>
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Gunter Zeug, Riscognition
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<tr><td>Distribution (in addition to attendees)</td><td colspan="3">UCP Plenary session, EUSPA, Public</td></tr>
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Agenda

Agenda Items	Presenter
1. Copernicus for Carbon Removals and Nature Credits	Juric Krajcic, DG CLIMA Joanna Balasis-Levinsen, EEA Michael Hylind, Sylva Jan Jakub Busek, SpaceKnow Jonas Franke, Remote Sensing Solutions **Roundtable** Sotirios Kanellopoulos, DG ENV David Hello, TerraNIS Ariane Kaploun, AXA Climate Mila Luleva, Rabobank Ed Mitchard, Space Intelligence
2. Copernicus for CAP Eco-schemes	Dáire Boyle, Evenflow Luboš Kučera , GISAT **Roundtable** Lucie Šavelková, SZIF Kemal Moetz, ZKF Bernadett Csonka, EOX Henk Janssen, NEO
3. GNSS: HAS for Precision Farming and Autonomous Machinery Evolution	Daniel Corbacho, GSC F. Javier De Blas, EUSPA Christophe Aubé, AgreenCulture Julián Rioja, AGControl **Roundtable** Christophe Aubé, AgreenCulture Julián Rioja, AGControl Oliver Teeken, CLAAS Bram Veldhuisen, Wageningen University
4. Threats in Forestry and Agriculture (Health, Extreme Weather Events)	Cristina Ananasso, ECMWF Quentin d'Huart, Timbtrack Antoine Lefebvre, Kermap Sandra Dotzler, VISTA **Rountable** Jorge del Rio Vera, United Nations Office for Outer Space Affairs (UNOOSA) Dario Spiller, Food and Agriculture Organization (FAO) Gunter Zeug, Riscognition Torsten Bondo, DHI David Hello, TerraNIS

SUMMARY

1. Copernicus for Carbon Removals and Nature Credits

The presentations identified several data needs, gaps, and technical challenges that hinder the effective scaling of carbon removal projects and nature finance.

- **The "Data Trap":** Using **global EO datasets for local action** has been called a "data trap." While global data is accurate overall, it often lacks the necessary local precision and certainty to meet the strict requirements of small-scale carbon projects.
- **Need for Agricultural Parcel-Level Data:** Accurate carbon quantification is required at the **farm or forest holding level** (parcel-dependent) to incentivize the high-quality removal market. The current level of accuracy, while high for some KPIs (like 98% for deforestation checks), is often insufficient to prevent the **uncertainty buffer pool** from becoming too large and ruining a project's economic viability.
- **3D Structure Data:** There is a significant gap for new, free, and open high-resolution data that better explains the **three-dimensional structure of vegetation globally**. The need for improved (**space-borne) LiDAR** data was mentioned.
- **Carbon Sink Indicators:** The Copernicus HR-VPP product is being revamped to include **Gross Primary Productivity (GPP) Estimation**, a core indicator for quantitative CO2 uptake, to better measure biospheric carbon sink strength.
- **Reliable Data Cube:** A reliable, standardized **data cube built specifically for carbon and nature** that could rival the massive catalogue from platforms like Google Earth Engine would be very useful. Automated tools face fragility and harmonization problems when ingesting data from multiple sources.
- **Resource Constraints:** The main constraint on delivering data, particularly annual products like the Urban Atlas, is **resources**, which prevents quicker delivery and involves trade-offs between speed and quality.
- **Making Tools Usable:** Soil Mission's research data must be made "available and attractive" to key users (farmers, foresters) and require **minimal post-processing** to ensure widespread uptake across the EU.

In essence, the speakers agreed that the technology to **see** the environmental impact exists, but to create a real, trustworthy **impact**, the industry needs standardized, high-precision, locally-relevant data delivered through robust and easy-to-use infrastructure:

- **Lack of Biomass Calculation Benchmarks:** No perfect EO solution exists for calculating biomass, particularly for complex scenarios like cover crops with infinite seed combinations. There is a lack of **official, free-of-charge benchmark datasets** to check the accuracy and correct significant biases in EO-estimated biomass.
- **Technical Complexity in Biomass Calculation:** Calculating the change in biomass for various agricultural practices (like cover crops) is technically challenging due to the inherent complexity and variability of seed combinations and growing conditions.
- The panel discussion featured participants from the European Commission, private EO companies, an insurance firm, and a bank, who addressed the roles of their services in the Digital Monitoring, Reporting, and Verification (DMRV) value chain, as well as the key challenges they encountered.

- **Confidentiality vs. Transparency Trade-off:** While digitalization aims for transparency, it creates a challenge in balancing this need with the requirement to protect **sensitive commercial data** from land stewards and farmers, necessitating targeted transparency for verifiers and buyers.
- **Need for Digital Identification:** A fundamental gap exists in guaranteeing **digital identification** for all actors involved in the Digital MRV (DMRV) process, which is necessary to fully streamline and secure the system. Tokenization was proposed to achieve complete, end-to-end transparency, from a company's ESG report back to the restoration project. Tokenization could also help manage market risks through innovative instruments. A key DMRV challenge, however, remained how to simplify complex information for a token owner or downstream market participant to understand what was happening. EO is a pillar of MRV, and data provenance was key, requiring all information (including verifier data and securely geotagged in-situ data) to be transparent to allow scrutiny by civil society and NGOs.
- A major need related to nature-based solutions is to build connection, trust, and integrity to enable large-scale finance to flow for forest protection and restoration. EO is only one part of the puzzle. EO services are necessary to convert the data into intelligence for investment. The technology to produce Above Ground Biomass and land cover map products is available, albeit with its challenges, but the need is for these products to become trustworthy and integrated into the wider value chain.
- **Operationalizing Research:** Moving DMRV tools and solutions from **research and development (R&D) projects** into **operational status** is a significant challenge requiring vast, gathered expertise and pre-commercial financing.
- **Lack of Methodology for Smallholders:** Existing methodologies for carbon credits were insufficient to support the viable business case for **smallholder farmers** transitioning to sustainable agroforestry, requiring the development of custom, in-house solutions.
- **Proprietary Data Challenges:** The intellectual property (IP) protection on vendor products makes it difficult to ensure the **transparency and comparability** of remote sensing data and products.
- **Converting Quality to Trust:** The major challenge is not the quality of EO data itself, but the downstream inability to translate this high technical quality into a **convincing narrative** to secure large-scale finance and overcome buyer scepticism due to past market failures.

2. Copernicus for CAP Eco-schemes

- The presentations on using Copernicus data for monitoring Common Agricultural Policy (CAP) eco-schemes highlighted several gaps and further improvements that could be addressed: **Spatial Resolution Limitations for Small Features:** Standard Copernicus resolution makes it very difficult to detect **small and narrow parcels** (anything less than 0.2 hectares) and **small landscape features** such as individual isolated trees or hedges. **Boundary detection** is problematic, particularly near forest edges.
- **Temporal Resolution and Continuity: Cloud cover** and **snow** are pervasive issues that interrupt the continuous monitoring of vegetation curves, especially critical for verifying practices with **very short compliance periods** (e.g., short catch crop periods).

- **Signal Complexity and Differentiation: Mixed cropping** generates complex spectral signals, making crop differentiation and accurate monitoring difficult.
- **Lack of Ready-to-Use Solutions/Mixed Success:** Paying Agencies reported having **mixed results** with their currently tested EO solutions, indicating a gap in readily available, proven, and effective operational tools.
- **Need for Customized and Combined Datasets:** Monitoring is complex due to the **diverse conditions and national specificities** of eco-schemes across Member States. Solutions cannot be one-size-fits-all but must be **customized** and based on a **combination of multiple datasets** (e.g., optical data, SAR coherence, thermal imagery) and integrated with existing Area Monitoring Systems (AMS).**Technical Complexity in Challenging Use Cases: Fallow land monitoring** is the most challenging use case due to highly complex, nationally defined management rules (type, timing of activity, prohibited practices), requiring sophisticated analysis of multi-temporal profiles (NDVI/SAR coherence) to reflect compliance.

The panel discussion on monitoring CAP eco-schemes highlighted that while the use of EO is now necessary, numerous data and technical gaps complicate cost-effective implementation:

- **Financial Limitations on Data Resolution:** There is a strong prioritization of **free Copernicus data** (Sentinel-1 and Sentinel-2) driven by cost efficiency. This creates a reliance on medium (MR) and high resolution (HR) data and a gap in accessible very-high resolution (VHR) data that could improve accuracy for complex or small features. Due to the complexity of IACS and the strict attitude of risk avoidance, managing the paradigm shift of AMS is difficult for the Member States. To implement the basic idea of AMS in relation to the fact that geometry is given by a VHR orthophoto and/or a satellite image while the event monitoring is implemented by systematically processed medium-high resolution images throughout the entire vegetation year seems a complex issue still. Advanced image processing should be widely spread in the IACS community to understand the real potential of the medium / high-resolution images, including the use of all spectral bands, not only an NDVI index. The progress is visible, but there is a lot more to invest.
- **Resolution and Geometry Deficiencies: Small field parcels, thin geometries** (like flower strips or narrow habitats), and features near **boundaries** (e.g., forest edges) are difficult to monitor with the standard resolution, forcing some countries to invest in costly commercial Very High Resolution (VHR) data (e.g., Planet data) to fill this gap. Paying Agencies need more clarity what requirements the EC has regarding the small parcels and non-conclusive AMS cases. Technical limitations of EO are less accepted, as by historical reasons national administrations still require very accurate and trustable (high probability) AMS checks.
- Need for **Integrated Scientific Knowledge**: Successfully integrating Synthetic Aperture Radar (Sentinel-1) and Optical (Sentinel-2) data—essential for many land phenomena (e.g., grassland mowing)—requires strong scientific capabilities that are slow to disseminate across the industry and public sector.
- More time, integrated knowledge, and sharing experiences are needed to reliably **validate algorithms** and decision flows for complex parcel-level decisions (e.g., error spread mathematics).

- **Gaps in Non-EO Data Fusion:** The number of mowing events throughout a vegetation year on a grassland parcel is well detectable and quite widely applied by AMS contractors, while some specific, highly detailed eco-scheme requirements (e.g., height of cut by the machine, the amount of straw returned to the soil) cannot be distinguished by satellite data alone. This necessitates the integration of non-EO inputs like geotagged photos (requiring automatic processing and modelling flows), drone footage and machine data (location-based services) to complete the verification chain. Member states are slowly realizing that the EO technological shift of AMS with its implementation capabilities influences the definition of scheme eligibility conditions (ElCos). This leads to implementers taking various directions - some adjusting the ElCo rules to the capability of EO, while others searching for other (non-EO) solutions that might be more expensive and which create complexity for managing IACS. AMS implementers are far from using the full potential of EO image processing. Open science and data sharing are supporting this well, but to reach the latest level of EO knowledge by the tech-sci implementers and the decision makers, there is still a lot to do. Next level of AMS implementation would be if EO modelling would support the CAP Strategic Plan with scenario analyses and predictions.
- **Knowledge and Standardization Gap**: The primary gap is identified as a knowledge gap within Ministries of Agriculture, responsible for the CAP-Strategic Plans and Paying Agencies, as AMS implementers, leading to communication breakdowns and the creation of unmonitorable eligibility conditions (e.g., complex biodiversity requirements). The potential of EO data onboarded for AMS is not used in creating CAP performance indicators. The value of multi-annual full-county scale data processing and modelling is not used operationally yet.
- There is a major need for a knowledge hub or a platform for agencies to share multiple times a year various AMS-related information, present possible solutions, and establish benchmarks or baselines for comparison, which are currently lacking due to the shift away from centralized technical guidance.

3. GNSS: HAS for Precision Farming and Autonomous Machinery Evolution

The presentations on the Galileo High Accuracy Service (HAS) in agriculture, the broader program update and other presentations related to precision farming revealed two main types of gaps: limitations in the current services, and gaps in trust, adoption, and specialized application support.

Gaps in HAS Service Performance and Features:

- **Vertical Accuracy and Land Levelling:** The current Galileo HAS, even with better-than-expected short-term horizontal accuracy (around 1-2 cm pass-to-pass), lacks the necessary **vertical accuracy** for critical applications like **land levelling**. This application still requires traditional RTK performance.
- **Lack of Safety Certified High Accuracy Positioning:** Autonomous and safety-critical system developers require High Accuracy positioning services with defined integrity performance, safety assurance frameworks, and certification readiness aligned with European regulatory requirements. The absence of such service-level guarantees forces many actors to develop costly in-house safety layers, slowing adoption.

Gaps in Adoption, Trust, and Market Support:

- **Specific Application Limits:** As demonstrated by various companies, HAS proves highly effective for a wide range of agricultural applications (such as spraying or broad-acre tillage). However, for high-precision tasks like row crop seeding (e.g., corn), the current decimetre-level accuracy is not yet sufficient, meaning traditional RTK solutions remain necessary for these specific operations.
- **Trust in Positioning:** Trust in the **positioning of GNSS** remains a concern for agencies dealing with payments and manufacturers of autonomous machinery/robotics, though features like the Open Service Navigation Message Authentication (OSNMA) and future Signal Authentication Service (SAS) are designed to bridge the trust gap regarding **spoofing attacks**, navigation message and signal origin.
- **Market Awareness:** There is a gap in **general advertising and awareness** regarding Galileo's services, leading to a wish for more promotional efforts to enhance customer satisfaction and drive adoption.
- **GNSS Integration and Useability:** Companies need continuous **support and resources** (like the planned release of HAS reference algorithm) to bridge the gap - e.g. SMEs lacking the capability to develop ''from scratch and fully-fledged'' HAS-based solutions

The roundtable discussion highlighted several critical gaps in achieving high-accuracy, reliable, and safe autonomous farming solutions:

- **Reliable Connectivity (important gap):** The primary gap is the **lack of permanent internet access** across many farming regions ("white spots"), which is essential for modern "factories on wheels-tractors" to transfer harvested data, telematics and maintain RTK corrections. This situation opens the door to the adoption of alternative technologies like **SATCOM**, with promising European options like IRIS^2 in the future. -
- **High-Accuracy Requirement for Repeatability:** While Galileo HAS aims for global baseline accuracy, it does not substitute commercial RTK, which is necessary for precise cm accuracy (often 2 – 3 cm) required for **perennial crops** (vineyards) and **year-to-year repeatability** (e.g., targeting weeds detected the previous year or Controlled Traffic Farming).
- **Latency and Convergence Time:** Autonomous systems require **immediate accuracy** with **low-latency algorithms**; they cannot wait for the standard convergence time of minutes for the solution to reach high accuracy.
- **Implement-Level Intelligence and Standardization:** A significant practical gap exists because the **implements** (e.g., plows, seeders) are still "not-intelligent" and lack the **sensing and monitoring capabilities** (e.g., detecting clogs or locks) that a human driver provides. **Standardization bodies (ISO)** are still developing the necessary protocols to integrate safety levels into the communication between the autonomous system and the implement.
- **Closing the Soil Health/Data Loop:** While the digital platforms are ready to receive soil data, the historical focus on heavy, above-ground machinery created a **soil compaction problem**. The issue could be partially addressed by **using multiple light-weight robots** for better soil management, regeneration and control traffic management in general.

- **Customer Trust and Education:** A business constraint is the need to **educate and convince farmers** and end-customers that autonomous technology is trustworthy and risk-free.

4. Threats in Forestry and Agriculture (Health, Extreme Weather Events)

The presentations and discussion on Copernicus products for agriculture and forestry highlighted several data and technical needs, along with significant gaps in user capability and market structure:

- Both agriculture and forestry are impacted **by climate change for which C3S (implemented by ECMWF)** provide valuable data and services about **past, present and future climate** as well as the dedicated dataset **AgERA5** tailored for agriculture, which can support the following questions:
    - Is the current growing season warmer than normal?
    - How many frost days can I expect on average?
    - Are the conditions favourable for development of crop diseases?
- **Cloud Cover and Data Continuity:** A gap persists due to **cloud cover** affecting the continuous monitoring required for workflows like crop monitoring. Companies are developing methods to create seamless, **cloud-free basemaps** and use **crop growth models** to bridge data gaps.
- **Need for Higher Frequency and Spatial resolution: Higher frequency** of satellite data would be valuable, as longer cloudy phases lead to higher uncertainties in model outputs. While current 10-meter resolution is usable for alerts, **higher spatial resolution** would be welcome for more detailed forest analysis.
- **GNSS Performance in Complex Environments:** The **forest environment** poses a gap for accurate GNSS (Galileo) use in the field, as the signal struggles with tree cover, challenging ground-truth collection and validation.
- **Missing In-Situ Data and Validation:** A significant gap is the **lack of reliable ground truth (in-situ) data** (e.g., geo-located crop type, land cover) for validating EO products, particularly in regions outside of Europe. **Market Sustainability and Regulatory Driver:** Agriculture is often **not a sustainable market** for many EO companies. The biggest gap is the **lack of a regulatory driver** (an obligation) forcing the use of EO services; clients often will not pay unless they are obliged.
- **Capacity and Knowledge Gap:** A significant gap exists in **user awareness and expertise** in how to effectively utilize space data. Users (farmers, ministries, institutions like the World Bank) in both emerging and established countries are often not prepared or lack the knowledge to integrate space capabilities into their workflows.
- **Technical Complexity for End-Users:** Copernicus data remains **complex for non-specialists**. Processing raw Synthetic Aperture Radar (SAR) data is still difficult, and inconsistencies between data streams (e.g., Sentinel-2 tiles vs. Sentinel-1 strips) add to the complexity.
- **Data Standardization for Algorithms:** A recurring technical challenge is that every time a new algorithm or model is introduced, the required **data standardization changes**, forcing users to repeatedly recollect and re-verify ground truth data.

The roundtable discussion involving experts from UNOOSA, FAO, and the geospatial industry highlighted that while space data (specifically Copernicus and EGNSS) offers transformative potential, significant structural and technical barriers remain:

- **The transition from satellite imagery to actionable intelligence** is hindered by a lack of "ground-truth" context. EO requires reliable, geo-located ground data (e.g., specific crop types, soil moisture) to calibrate models. This is a severe gap in Africa and Middle Asia, making satellite analysis less accurate.
- **Fragmentation & Standardization:** There is a requirement for global standardization in data description and categories, information products, and reporting formats to ensure cross-border compatibility.
- **Market Sustainability:** Defence remains the primary market for EO. Agriculture is often not a self-sustaining market because users (like farmers) frequently prioritize physical equipment over data services.
- **The "Last Mile" Problem:** There is a disconnect between high-quality data services and the actual delivery of usable solutions to the end-user on the ground.
- **Conservative Ecosystems:** While technical staff may be convinced of the data's value, high-level decision-makers in conservative industries (like insurance and banking) are often slow to adopt space-based risk assessments.
- **Capacity Building:** There is a major need for training, especially in emerging economies. Users—from smallholder farmers to national ministries—often do not know that space data is available or how to integrate it into agricultural workflows.
- **Translating Complexity:** Experts noted the difficulty in explaining the value of Copernicus data to non-technical institutions like the World Bank or local cooperatives. **User Awareness:** Bridging the gap between what space systems can do and what end-users need requires a systematic effort to map user requirements through global surveys.
- **Regulatory Obligation:** In sectors where EO is not mandatory, adoption is low. Legislation like the EU Deforestation Regulation (EUDR) and the Common Agricultural Policy (CAP) creates a requirement for satellite monitoring, forcing the market to mature.