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New imaging technologies for agricultural monitoring

August 2019

Member State agencies paying out EU agricultural aid carry out detailed checks on around 5 % of area aid scheme applicants because certain requirements, such as the actual crop type grown, cannot be checked retrospectively. Over the years, classic on-the-spot inspections have been largely replaced with remote sensing checks; however, these remote checks still require significant human interaction to interpret the satellite images.

Since March 2017, the EU's Copernicus Sentinel satellite programme has provided free, high-resolution images, which are significantly better than those already freely available in terms of spatial resolution, frequency and long-term availability.

The use of new technologies for monitoring should increase the effectiveness of environmental and climate measures. The new technologies also have the potential to reduce the costs of controls in Member States, while checking more beneficiaries.

This audit aims to identify the use of these new imaging technologies so far, the support provided by the Commission, best practices identified in the Member States already using them, and challenges hindering the faster and wider deployment of the new technologies to monitor the Common Agriculture Policy (CAP). The audit could have a timely impact on the CAP monitoring requirements for the post-2020 CAP.

If you wish to contact the audit team, you may do so at the following email address:

ECA-agri-monitoring-audit@eca.europa.eu

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Introduction – New imaging technologies to monitor the CAP

Paying agencies (PA) in Member States administer most spending under the Common Agricultural Policy (CAP). For each support scheme financed by the European Agricultural Guarantee Fund or European Agricultural Fund for Rural Development, the paying agencies apply a system of exhaustive administrative controls (100 % of aid applications) and on-the-spot checks (mostly on a sample basis) prior to any payment. The Commission reports that around 900 000 on-the-spot checks are carried out by paying agencies each year¹.

On-the-spot checks of area-aid transactions consist of verification by PA inspectors that the applicant has complied with the set of eligibility requirements. They include a visit to the applicant's premises or a review of recent satellite images of land parcels (also referred to as "Checks with Remote Sensing"). These kinds of checks are usually applied to 5 % of beneficiaries of the Basic Payment Scheme, the single area payment scheme and most rural development area-based measures. According to the European Commission's Joint Research Centre (JRC), 80 % of these checks in the EU are now performed using remote sensing in the EU overall, but the percentage varies within Member States.

Since March 2017, the EU-owned Sentinel satellite constellation of the Copernicus programme has been providing freely available high-resolution images which are significantly more advanced than those freely available from the existing systems, mainly for the following reasons:

- high spatial resolution (10 m compared to 30 m for Landsat, the US satellite earth observation programme);
- high frequency (5-day repeat cycle under the same viewing conditions, compared to 16 days for Landsat);
- long time series, reliable, high quality (calibration) and long-term commitment from the EU to supply the images;
- the large datasets can be processed using big-data analysis techniques.

The availability of these images provides an opportunity to monitor the CAP in a different, more comprehensive, cost-efficient and effective way. For example, the following eligibility requirements can be checked using the Copernicus Sentinel data:

• agricultural activity taking place on the parcel (presence of vegetation, harvest, ploughing, mowing, etc.);

- crop classification, important for crop diversification and checks on some ecological focus areas (catch crops, winter crops);
- o grubbing up of old vineyards.

While the area cannot be measured, Copernicus Sentinel data can provide a good indication of areas which may not be eligible for aid (e.g. construction sites).

As the EU's Earth Observation programme, Copernicus combines satellite observation data with data from sensor networks on the Earth's surface to build a comprehensive picture of our planet and its environment. *Figure 1* describes the Copernicus components. Currently, there are seven satellites (Sentinels) in orbit, and three more satellites are due to be launched by 2021.

Figure 1 – Copernicus components



Source: DG GROW

At present, the Copernicus land service does not provide any downstream products that can be used for monitoring agricultural crops during the growing season. Users can develop their own products based on the freely available Sentinel satellite data. Some Member States have their own platform for downloading the data, while other users can download them via the European Space Agency or via one of the Data and Information Access Services (DIAS) providing online computation services.

Since June 2018, five different consortia have launched DIAS platforms offering cloudbased services. DIAS must provide the Copernicus data free of charge, but can charge for extras (such as processing, storage of data, combining Copernicus data with other datasets). According to the Copernicus market report of 2016², agriculture is the most promising market in terms of the impact of Copernicus.

Drones

Agriculture is one of the sectors expected to see a significant uptake of drone technology in the near future. A Commission document of January 2018³ lists the following applications for drones in agriculture: soil and field analysis, crop monitoring, health assessment, irrigation, crop spraying and aerial planting. Paying agencies may also use drones for checking crop presence⁴ if satellite images are not available or if their resolution is not sufficiently high. Drones can check large areas more efficiently than inspectors, especially areas which are difficult to access.

While there is a potential in using drones, there are still several obstacles to using them more widely, such as price, battery capacity, data quality and the need to further develop the legal framework.

Geo-tagged photos

Geo-tagging refers to the process of adding and embedding geographical information into a file. For pictures, this is usually the location and time of acquisition obtained through the Global Navigation Satellite System (GNSS) antenna of the camera or smartphone. Geo-tagged photos can be used⁵ as an input to:

- document on-the-spot checks;
- o update parcel information in the Land Parcel Identification System;
- complement the evidence for any element not monitored with imagery or as a follow-up method to address inconclusive monitoring⁶.

It is important that the integrity of the geographical information is guaranteed when images are used as evidence. Some geotagging solutions are already commercially available. The Commission, in cooperation with the European GNSS Agency, is working to build an open-source application which will help to improve the positioning accuracy and increase the robustness of geo-tagged photos for the post-2020 CAP⁷.

Research and innovation

The Commission funds a large number of research and innovation projects supporting land monitoring, agriculture and the development of Copernicus services under various programmes. The most common use of new imaging technology in these projects is for crop or land cover classification, to help to meet cross-compliance and crop diversification requirements, and to check the accuracy of farmers' declarations. Other applications include monitoring mowing and harvest dates.

The legal and policy framework

In May 2018, the Commission introduced the possibility for Member States to carry out "checks by monitoring" on 100 % of their beneficiaries for all eligibility requirements, using the Copernicus Sentinel satellite data, instead of checking 5 % on the spot⁸. The amended Regulation also allows new technologies such as drones and geo-tagged photographs or data captured by the Copernicus Sentinels satellites to be used as additional evidence for checking compliance under the CAP.

In 2018, only Italy (AGEA) used the new technology for its checks in a small region in Puglia (Foggia). *Table 1* shows paying agencies in five Member States which have informed the Commission of their intention to use the technology for their checks in 2019. These checks could be implemented at scheme level, and do not have to cover all beneficiaries (regions) in the first year of implementation.

Member State (Region)	Basic Payment Scheme	Greening	Other
Belgium (Flanders)	Yes	Partly	Young farmer scheme
Denmark	Yes	Partly	Areas with natural constrains
Italy (AGEA)	Yes	Partly	Small farmers scheme
Malta	No	No	Voluntary coupled support (VCS) for tomatoes
Spain (Castilla y León)	Yes	Yes	Small farmers scheme; Young farmer scheme; VCS for protein crops and oilseeds + nut and carob bean + legumes + sugar beat
Spain (another 9 regions ⁹)	Yes	Mostly No	Small farmers scheme and some VCS

Table 1 – Paying agencies in Member States using checks by monitoring in 2019

Source: DG AGRI

In September 2018, with the entry into force of the revised European Aviation Safety Agency Basic Regulation¹⁰, responsibility for regulating the use of drones was transferred to the European Union. The Commission, through the Single European Sky Air Traffic Management Research Joint Undertaking, has been developing procedures for the safe, efficient and secure use of airspace by large numbers of drones¹¹.

Regulation No 377/2014 established the Copernicus programme¹², the European Union's Earth observation and monitoring programme. The main objective of the programme is to deliver near-real-time data on a global level based on satellite and in situ (non-space) observations.

In its proposal for the post-2020 CAP¹³, the Commission introduced the concept of an "area monitoring system", defined as "a procedure of regular and systematic observation, tracking and assessment of agricultural activities and practices on agricultural areas by Copernicus Sentinel satellite data or other data with at least equivalent value". This area monitoring system will be part of the Integrated Administrative Control System in Member States, alongside the existing Land Parcel Identification System and Geospatial Aid Application. The area monitoring system will help to improve monitoring of the CAP's performance.

Roles and responsibilities

European Commission

Within the European Commission, the Directorate-General for Internal Market, Industry, Entrepreneurship and SMEs manages and coordinates the Copernicus programme. The Commission implements it in partnership with the Member States, the European Space Agency, the European Organisation for the Exploitation of Meteorological Satellites, the European Centre for Medium-Range Weather Forecasts, EU Agencies and Mercator Ocean.

The Copernicus Committee is composed of representatives of the EU Member States and supports the European Commission in ensuring coordination of contributions to Copernicus by the European Union, the Member States and the inter-governmental organisations involved in the programme. There is also a user forum, made up of representatives of Member States and the main user organisations, which ensures that the users are continuously involved in the definition and validation of service requirements.

The Commission departments involved in deploying new monitoring technologies for agriculture are the Directorate-General for Agriculture and Rural Development and the Joint Research Centre. As the monitoring approach can increase the effectiveness of the environmental and climate measures, we also included the Directorate-General for Environment and the Directorate-General for Climate Action in our audit.

Member States

Paying agencies are responsible for administering the aid applications, carrying out checks on applicants, making payments and monitoring the use of funding. Most Member States have just one Paying Agency for the whole country while some (Germany, Italy, Spain and the UK) have several, usually one per region. The Commission collaborates with the 71 paying agencies managing area-related measures¹⁴.

Financing

Funding for the four main CAP area payment schemes (Basic Payment Scheme, Single Area Payment Scheme, greening and redistributive payment), for which the new imaging technologies could be used, amounted to €35 billion in 2018, representing almost 62 % of the EU's expenditure for the Common Agricultural Policy (€56.8 billion)¹⁵. The CAP also finances other area aid schemes through Pillar I (part of the voluntary coupled payment schemes amounting to €4 billion euro annually) and Pillar II (e.g. agrienvironment climate measures or payments to areas facing natural or other specific constraints).

Focus of the audit

We aim to find out whether the Commission and Member States have taken steps to unlock the potential of new imaging technologies for CAP monitoring. Within that, the audit will focus specifically on whether:

- the Commission identified the potential use of new imaging technologies for CAP monitoring and encouraged widespread use of those technologies;
- Member States assessed the potential use of new imaging technologies for CAP monitoring and took action to deploy those technologies after assessment.

While many sectors, such as forestry, urban monitoring, insurance and ocean monitoring, could make use of new imaging technologies, the audit will focus on agriculture, and in particular on monitoring compliance and performance in the framework of the CAP.

Our work in selected Member States (Belgium, Denmark, Italy and Spain) will focus on the use of new imaging technologies to monitor compliance with the eligibility and cross-compliance requirements intended to mitigate environmental issues and climate change. In order to understand the progress, obstacles and challenges of using new imaging technologies faced by paying agencies in the remaining Member States, we have sent a survey to all of them. At Commission level, we will also examine the use of new imaging technologies for CAP performance monitoring.

Since these focus areas are identified before the audit work is complete, they should not be regarded as audit observations, conclusions or recommendations.

ABOUT ECA SPECIAL REPORTS AND AUDIT PREVIEWS

The ECA's special reports set out the results of its audits of EU policies and programmes or management topics related to specific budgetary areas.

Audit previews provide information in relation to an ongoing audit task. They are based on preparatory work undertaken before the start of the audit and are intended as a source of information for those interested in the policy and/or programme being audited.

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ECA-agri-monitoring-audit@eca.europa.eu

- ¹ Annexes to DG AGRI 2017 Annual Activity Report, page 46.
- ² Copernicus Market report. Issue 1, November 2016. Prepared by PwC.
- ³ Digital Transformation Monitor. Drones in Agriculture. January 2018.
- ⁴ Presentation "Testing UAV for field controls in working processes of the Croatian Paying Agency" given on the 24th MARS conference in November 2018.
- ⁵ Presentation "Survey on the use of geotagged photos in 2018 (Catalonia, ES)" given at the 24th MARS conference in November 2018 by the Paying Agency of Catalonia.
- ⁶ Presentation "Geotagged images for capturing additional evidence" given at the 23rd MARS conference in November 2017 by the JRC.
- ⁷ Presentation "CAP related activities at GSA: EGNOS and the geo-tagged photo applications" given at the 24th MARS Conference in November 2018 by the GSA.
- ⁸ Article 1(10) of Commission Implementing Regulation (EU) 2018/746 of 18 May 2018 amending Implementing Regulation (EU) No 809/2014 as regards modification of single applications and payment claims and checks, C/2018/2976 and article 40(a) of Commission Implementing Regulation (EU) No 809/2014 of 17 July 2014 laying down rules for the application of Regulation (EU) No 1306/2013 of the European Parliament and of the Council with regard to the integrated administration and control system, rural development measures and cross compliance.
- ⁹ Andalucía, Aragón, Cataluña, Comunidad Valenciana, Extremadura, Galicia, Madrid, Murcia, and Navarra.
- ¹⁰ Regulation (EU) 2018/1139 of the European Parliament and of the Council of 4 July 2018 on common rules in the field of civil aviation and establishing a European Union Aviation Safety Agency, and amending Regulations (EC) No 2111/2005, (EC) No 1008/2008, (EU) No 996/2010, (EU) No 376/2014 and Directives 2014/30/EU and 2014/53/EU of the European Parliament and of the Council, and repealing Regulations (EC) No 552/2004 and (EC) No 216/2008 of the European Parliament and of the Council and Council Regulation (EEC) No 3922/91.
- ¹¹ U-Space Blueprint. SESAR Joint Undertaking, 2017.
- ¹² The precursor of Copernicus was called Global Monitoring for Environment and Security (GMES).
- ¹³ Proposal for a regulation of the European Parliament and of the Council on the financing, management and monitoring of the common agricultural policy and repealing Regulation (EU) No 1306/2013, COM(2018) 393 final.

- ¹⁴ There were 76 operating PAs at the end of 2018. Five of them do not manage area-based schemes (DE01, DE02, FR20, ES18 and IT02). Source: Annexes to DG AGRI 2018 annual activity report, pages 74-80.
- ¹⁵ Annexes to DG AGRI 2018 Annual Activity Report, page 134.

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