



Integrated Administration and Control System (IACS) implementation and LUCAS data integration feasibility in the Western Balkans

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Abstract

From the perspective of the Western Balkan agricultural sector, the Common Agricultural Policy (CAP) represents the benchmark for setting their future agricultural policy. The necessary CAP administrative structures include administrative, financial, control, and information structures, such as setting up paying agencies, integrated administration control systems (IACS), land parcel identification systems (LPIS) and geospatial aid-applications (GSA). This report aligned with JRC Project 32263 Environment and Climate in Enlargement, presents a comprehensive review of IACS and LPIS, focusing on the potential for integrating these systems with soil quality data. The primary objective is to explore how such integration can support the implementation of environmental legislation in the Western Balkans, enhancing agricultural policy and sustainability. Furthermore, the report contributes to the Western Balkans Agenda on Innovation, Research, Education, Culture, Youth, and Sports by enhancing regional capacity in environmental management and supporting sustainable agricultural practices through improved data integration and system capabilities.

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1 Introduction

Accession of Western Balkan¹ countries to the European Union (EU) has gained increasing political attention in recent years, although different countries are at various stages of integration. The Stabilisation and Association Process (SAP) is the EU's policy towards the Western Balkans, established with the aim of eventual EU membership. Western Balkan countries are involved in a progressive partnership with a view of stabilising the region and establishing a free-trade area. The SAP sets out common political and economic goals although progress evaluation is based on countries' own merits.

Agriculture is one of the most complex, sensitive and critical issues in the enlargement process due to its significant size (share of Gross Domestic Product (GDP) and the high proportion of the population active in agriculture) and its structural deficiencies (subsistence and semi-subsistence farming).

Accession negotiations in agriculture focus on the procedures for future direct payments, support for rural development and the need for transitional measures to allow for integration into the EU, taking into account the specific circumstances of the agricultural sector in each country. A large number of binding rules and their effective enforcement by an efficient public administration are essential for the functioning of the CAP. This includes the laws governing management systems, such as a paying agency and the **integrated administration and control system (IACS)**, and the capacity to implement rural development actions.

IACS is the most important complex system for implementing and controlling payments made to farmers by the Member States in the implementation of the CAP. It provides a uniform basis for control, including the systematic administrative control of submitted applications and systematic monitoring of all agricultural areas, as well as a sample-based on-the-spot control. The whole system (data and procedures) shall be supported by an adequate and robust IT system². The accredited Paying Agency uses the IACS in its work. This system covers procedures for all support schemes of direct payments, certain rural development interventions (agri-climate-environmental interventions), and procedures for conditionality requirements checks.

IACS consists of a series of linked electronic databases and geographic information systems that shall be used for receiving and processing applications, comprising³:

- a single identification system for all agricultural areas/parcels - Land Parcel Identification System (LPIS);
- a geo-spatial application system (GSA) and an animal-based application system ;
- an area monitoring system (AMS);
- a system for the identification of beneficiaries of the interventions and measures (Farm Registry);
- a control and penalty system; and
- a system for the identification and registration of animals;

IACS is pivotal to the EU's CAP, overseeing agricultural subsidies and payments.

¹ This report uses the term "Western Balkans" to encompass countries/territories of the region: Albania, Bosnia and Herzegovina, Kosovo*, North Macedonia, Montenegro and the Republic of Serbia.

² Article 66(3) of Regulation (EU) 2021/2116

³ Article 66(1) of Regulation (EU) 2021/2116

This report presents a review study on IACS in the Western Balkans, with a focus on evaluating the potential for combining IACS data with soil quality data. The primary objective is to assess how such integration could support the implementation of environmental legislation in the region.

The review aims to identify current capabilities, limitations, and opportunities for enhancing environmental monitoring and policy enforcement through improved data integration. This is a preliminary step to inform future JRC activities, which may involve integrating IACS data with LUCAS (Land Use/Cover Area Frame Statistical Survey) data to enhance knowledge of soil health in Western Balkan countries.

2 Integrated administration and control system in Western Balkan countries

2.1 Albania

The Integrated Administration and Control System (IACS) has yet to be fully implemented, but certain elements of it – such as a farmer register and an animal register – have been developed. Considered one of the key issues for the design and development of comprehensive agricultural policies for family farms, in the promotion of rural development, the increase of rural welfare and the preservation of heritage, work has begun on the design of the programme for the Farm Accounting Data Network (FADN). Albania's support in this process comes within the framework of the "EU Integration and Policy Support in Agriculture and Rural Development" project, funded by The Food and Agriculture Organization of the United Nations (FAO), and focuses on comprehensive policies towards family farms, with the objective of promoting rural businesses and increasing well-being in the rural and family economy.

According to the latest report from the European Commission (EC, 2023a) Albania has some level of preparation in agriculture and rural development. Some progress was achieved regarding the developing administrative capacity to prepare the instrument for pre-accession assistance for rural development (IPARD III) programme and adopting an implementation plan for the setting up of the farm accountancy data network (FADN).

A farm register was put in place and should be improved to fully align with EU acquis. Registration of farms is required and performed by the advisory services, both under national schemes and under relevant IPARD measures. The farm register is an important first part of the future IACS and it will support the implementation of IPARD III programme. **There was no progress in establishing a land parcel identification system (LPIS).** An implementation plan, with specific details of the timeline and resource allocation to set up the FADN was adopted in April 2023, and the necessary administrative capacity now needs to be deployed. Direct payments to farmers are coupled to production and not subject to cross-compliance rules. All support measures need to be brought in line with the EU acquis.

2.2 Bosnia and Herzegovina

The Ministry of Foreign Trade and Economic Relations of Bosnia and Herzegovina (MOFTRBIH) carries out tasks and duties within Bosnia and Herzegovina's areas of competence related to policy definition, basic principles, coordination of activities and alignment of the plans of its entity authorities and institutions in the field of agriculture at the international level. The MOFTRBIH administrative body is the Office for Harmonization and Coordination of the Payment Systems in Agriculture and the Food and Rural Development of Bosnia and Herzegovina.

The federation of Bosnia and Herzegovina has faced several challenges in establishing the necessary structures and institutions required for accessing IPARD funds from the EU. The necessary administrative structures required for the CAP in Bosnia and Herzegovina, including a paying agency, were not established and there was **no progress in developing elements of an integrated administration and control system (IACS)** or a farm accountancy data network (FADN) (EC, 2023b). The IPARD structure, including the Payment Agency, IACS, **LPIS, and Geoportal Aid Application (GSA), has not been established in Bosnia and Herzegovina.** Bosnia and Herzegovina need to improve sector coordination and strengthen administrative capacity at all levels of government. For the country to benefit from IPARD, the authorities need to set up the necessary institutional structures. Direct

payments still need to be aligned with the EU acquis. Bosnia and Herzegovina need to develop farm advisory services.

Agriculture-related competencies in Bosnia and Herzegovina are divided between different entities, such as the Republika Srpska and the Federation of Bosnia and Herzegovina. The lack of agreement at the state level has hindered the establishment of a unified structure for IPARD implementation.

Efforts were made in the near past to include projects funded through the Instrument for Pre-accession Assistance (IPA) and technical assistance from experts, aimed at establishing the IPARD structures in Bosnia and Herzegovina. However, these efforts faced challenges, and the EU Delegation in Sarajevo discontinued the project initiated in 2012 due to the lack of progress and agreement among stakeholders.

The establishment of an agricultural information system in Bosnia and Herzegovina is a critical step towards modernizing the agricultural sector and aligning with EU standards. The key components and processes involved are:

- Legal Basis: The Law on Agriculture, Food, and Rural Development of Bosnia and Herzegovina provides the legal framework for the establishment of sub-components of the agricultural information system. This includes the coordination of development efforts through the Committee for Coordination of Information in Agriculture, in consultation with relevant authorities at the state, entity, and Brčko District levels.
- Several sub-components of the agricultural information system are in the process of establishment and development in the country. These include:
 - Register of agricultural holdings and register of clients
 - Animal identification and registration system
 - Phyto-register
 - Census of agriculture
 - Farm Accounting Data Network (FADN)
 - GIS framework for the research area based on the sample.

Bosnia and Herzegovina has obligations under the Agreement on Stabilization and Association with the EU to gradually adopt regulations and policies related to agriculture, food, and rural development, in line with the EU's *acquis communautaire*. This includes ensuring the harmonization of sub-components of the Agricultural Information System and facilitating automated data delivery while maintaining traceability, accuracy, and verifiability.

The Ministry of Agriculture, Forestry and Water Management of the Republic of Srpska is an independent administrative body that performs administrative and other tasks in several administrative areas and is directly subordinated to the Government. The republic's administrative organization within the Ministry is the Agrarian Payment Agency.

LPIS, integral to the Integrated Administration and Control System (IACS), and the Geospatial Application (GSA) haven't been established in the Republic of Srpska. Nonetheless, the Republic of

Srpska boasts other information systems contributing to efficient land management despite the absence of LPIS and GSA.

In 2021, the Ministry introduced the innovative ETFAR (Enhancement of the Federation's Agricultural Record) system, a comprehensive platform designed to revolutionize the management of agricultural data and enhance the efficiency of agricultural practices across the region. Comprising several integral components, the ETFAR system represents a significant milestone in modernizing agricultural administration and ensuring sustainable agricultural development.

Central to the ETFAR system is the Land Information System (ZIS), a sophisticated database that provides insights into land ownership and utilization. Leveraging data sourced from the Republic Administration for Geodetic and Property Legal Affairs, ZIS offers both alphanumeric and graphical representations of land parcels owned by the Republic of Srpska. Through its Geographic Information System (GIS) capabilities, ZIS facilitates seamless tracking and monitoring of land-related activities, enabling authorities to make informed decisions regarding land management and resource allocation. Since 2014, the Ministry has been conducting control of agricultural land fertility. The data collected from these controls are stored in a GIS database managed by the "Agriculture Institute Republic of Srpska", Banja Luka.

The ETFAR system, along with its components, aims to enhance the management of agricultural data in the Republic of Srpska by leveraging various information systems and databases, improving efficiency and accuracy in agricultural land management and monitoring.

In tandem with these initiatives, efforts are underway to establish a comprehensive Register of Agricultural Holdings scheduled for completion in 2024.

Drawing upon the rich repository of data provided by RUGIPP, this register will furnish alphanumeric and geo-spatial information for all registered parcels. By consolidating disparate datasets into a unified platform, the Register of Agricultural Holdings aims to streamline administrative processes, improve data accuracy, and foster greater transparency in land management practices. The Register of Agricultural Holdings will soon contain data on all parcels, akin to the LPIS.

2.3 Kosovo*⁴

The Payment Agency was established in 2012 with the Law on Agriculture and Rural Development as an Executive Agency within the Ministry of Agriculture, Forestry, and Rural Development in Kosovo. Its purpose is to administer subsidies for farmers financed from the national budget.

Kosovo* is still in the process of establishing agricultural system which include IACS, a farm accountancy data network (FADN) and agricultural market information system (EC, 2023c).

The Simple Land Parcel Identification System (sLPIS) was set up in 2012, and it functions to systematically digitize agricultural plots and assign attribute data to each farmer. This system enables the creation of a geo-database for all agricultural plots in Kosovo and facilitates the application, changes, and controls of subsidies for farmers. The sLPIS in Kosovo* is a simplified version of the more

⁴ *This designation is without prejudice to positions on the status and is in line with UNSCR 1244 and the ICJ Opinion on the Kosovo* declaration of independence

comprehensive LPIS used in the European Union. While both systems aim to digitize agricultural land and support subsidy management, sLPIS is tailored to the specific needs and context of Kosovo*. It includes essential functionalities for plot digitization and subsidy management but lack some of the advanced features and integration capabilities present in the EU's LPIS. The LPIS includes more complex layers of data integration and control mechanisms to meet the broader requirements of CAP implementation across the EU.

The Kosovo* Cadastre Agency's development of the Geoportal represents a significant step towards enhancing access to geographic data and information in Kosovo*. The Geoportal (<https://geoportal.rks-gov.net/sr/search>) serves as an internet portal designed to provide users with access to geographic data from various sources. It offers a centralized platform for accessing, viewing, analysing, and downloading geographic information related to land parcels, boundaries, infrastructure, and other spatial features.

Users can access a wide range of geographic data layers through the Geoportal, including cadastral information, topographic maps, administrative boundaries, land use classifications, and environmental datasets. These datasets are sourced from multiple sources and are presented in a standardized and easily accessible format.

2.4 North Macedonia

The Ministry of Agriculture, Forestry, and Water Economy (MAFWE) is responsible for the establishment and maintenance of the Farm Registry as well as the establishment and maintenance of the Integrated Administration and Control System (IACS), and its related registries. **It operates a central LPIS unit with three full-time employees and oversees 90 local offices distributed across 33 cities, staffed with 200 personnel dedicated to the maintenance of LPIS (IPA, 2021).**

On 11 June 2007, the Parliament of the Republic of North Macedonia adopted the Law on the establishment of the Agency for Financial Support in Agriculture and Rural Development (Agency), with the objective of more successful implementation of the agricultural policy and the rural development policy in North Macedonia. Competencies of the Agency are the implementation of measures for direct payments in agriculture, interventions in the agriculture products market, implementation of the production quotas, implementation of the rural development measures, realization of the funds from the European Union Pre-accession Assistance for Rural Development, implementation of agriculture state aid measures. This enables efficient management of the financial resources both from the Budget and the funds from the European Union Pre-Accession Assistance for Rural Development.

As of 2007, MAFWE has introduced elements of the IACS, including the Single Registry of Agricultural Holdings (referred to as Farm registry) and the LPIS. The aerial survey of June 2009 and the initial production of digitalised data for agricultural land purposes have resulted in information about arable agricultural land and the real graphic ortho-photo map of the territory. In 2012, due to the organised campaign MAFWE, all the registered agriculture holdings have recorded their land production capacities and as of 2013 for the purpose of subsidies payments 31 “per ha”, the LPIS records are used as a control mechanism of the reference parcel, which at this point is the Cadastre parcel.

With the financial support by the EU Instrument for Pre-Accession TAIB 2012 program, from January 2017 until October 2018, MAFWE implemented the project: "Production of orthophoto maps and digitization of agricultural land use and IT software development for Farm registry and FADN system and LPIS software upgrade". Within the project scope, several outputs were delivered: Aerial images, Orthophoto maps, Digital Terrain Model, Digitisation of agricultural land and upgrade of the LPIS

system with a new tools, modules, and functionalities. Based on the new 2017-orthophoto maps, MAFWE has updated the data related to cultivated agricultural land including permanent pastures.

The Main Features of LPIS include a multifunctional reference system used for administration and control of area-related subsidies, encompassing cross-compliance, permanent crops, and organic farming. It involves reference parcels, often referred to as farmer blocks, with computer-assisted photo interpretation, conducted on-screen for digitization using digital orthophoto maps. The link between photo-interpreted agricultural land and farmers is established during direct consultations. The LPIS reference parcel layer contains essential information such as parcel geometry, unique ID, area, perimeter, land use category, farmer ID, administrative unit ID, and terrain characteristics.

The latest European Commission report confirms that **all components of the integrated administration and control system (IACS) are operational and compliant with the EU regulations** (EC, 2023e). However, data transfers and the inter-operability of the various elements need to be improved. In particular, it should ensure the transfer of the farm register and the LPIS to the paying agency. The area-based payments continue to be determined based on the LPIS. The legislative framework for transferring the farmers' register and LPIS to the Paying Agency is still pending. On the farm accountancy data network (FADN), a new plan for selecting representative agricultural holdings has been prepared ensuring the expansion of the sample for data collection. Additional human and financial resources are essential to ensure the sustainability of the FADN system. Efforts are underway to develop the farm advisory services in line with the EU acquis.

2.5 Montenegro

The Ministry of Agriculture, Forestry, and Water Management (MAFWM) is the key institution in designing and implementing of agricultural policy. The key units of MAFWM are the Directorate for Rural Development; the Directorate for Agriculture (since 2019, the Advisory/Extension Service has been functioning within it) and the Directorate for Payments. These directorates are responsible for creating policies, drafting primary and secondary legislation proposals, and overseeing the implementation of adopted policies and laws (MAFWM, 2023).

In 2015 the system for the unique identification of farmers (Farm Register) was developed. Software and hardware components for this system were funded by the Montenegro Institutional Development and Agriculture Strengthening Project (MIDAS). Another important aspect of the institutional capacity-building supported by MIDAS Project included the development, upgrading, and updating of an information, monitoring, and control system that adhered to EU requirements and served as a precondition to starting negotiations with the EU: **the Integrated Administration and Control System (IACS), which includes a farm register with an integrated animal identification and registration system, a land parcel identification system (LPIS) and cadastre maps of vineyards, olive and fruit orchards, and other digital and interconnected databases.** Since 2016, all primary producers, beneficiaries of the Agro budget, have been required to register in the Farm Register. The number of agricultural holdings in the farm register had increased from 130 in 2014 to 13,986 by March 2021 (an increase of approximately 2,000 registered holdings per year since 2016). This is a positive development, but the majority of the approximately 43,000 agricultural holdings in Montenegro are still not registered and hence are ineligible to access government and IPARD support, so the benefits are not yet as broadly distributed as they could be (World Bank, 2021).

The Land Parcel Identification System (LPIS) was established with funding from the EU IPA 2013. This initiative covered technical assistance, procurement of orthophoto maps, software, and hardware for

LPIS application, concluding in June 2018. Additionally, non-IACS systems, such as the Reference Price Database and IPARD Accountancy software, were developed to meet IPARD needs and were funded by the MIDAS project. These systems were installed on hardware infrastructure shared with the Farm Register.

All activities aimed at establishing the IACS and associated systems have been meticulously coordinated among the MIDAS and IPARD-like projects, alongside the EU Delegation IPA and EU facilities project, overseen by the Ministry of Agriculture, Forestry, and Water Management (MAFWM), specifically the Directorate for Payments. These efforts are synergistic, with each project contributing distinct components towards the common goal of achieving functional systems and a fully operational Paying Agency.

The process of the initial digitalization of the LPIS layer and vectorization of permanent borders of agricultural land was finished in November 2018. The technical specification for this activity was prepared within the EU IPA project, and the final implementation was carried out via the World Bank project (MIDAS). In 2018 and 2019, the geospatial identification of agricultural parcels in the System for the Identification of Land Parcels was mandatory for all farms which apply through the measure of support for organic production and the measure of support for direct payments for all perennial crops.

During the digitalization in 2019, the initial layer was first used as assistance in the operator's work. In 2021, arable land was included in the LPIS for the first time. By the end of that year, a total of 16,491 plots and 4,309 farms with a combined area of 9,612.2 hectares were eligible for support. This accounted for 62.2% of the total arable area designated for crop production.

According to the Spatial Development Plan of Montenegro (2007-2020), the available agricultural land spans 514,501 hectares. This figure represents an increase of 114,000 hectares compared to the initial establishment of the LPIS. Such changes suggest a shift in methodology, as well as potential land conversion or abandonment. This information underscores the need for a more detailed analysis of agricultural land management and a proactive approach to addressing land conversion issues. Such efforts are crucial for achieving coordinated spatial planning and effective implementation of agricultural policies. The inclusion of pastures and meadows in the LPIS is currently underway, aiming to allocate support for these areas within the agricultural budget starting in 2023. The development of FADN is being supported by FAO. While the FADN pilot was completed in fall 2021, results are not yet available (MAFWM, 2023).

The Strategy for the development of agriculture and rural areas 2023- 2028 was adopted in June 2023. One of the key needs outlined in the Strategy is the enhancement of statistical quality and other information necessary for the management of agriculture and rural development. The agricultural census in Montenegro has not been conducted since 2010, and there are no economic accounts for agriculture. The survey of farm structures was last conducted in 2016. The integration of several essential operational databases such as the Register of Agricultural Holdings, LPIS, and the Unified Register of Applications is planned to facilitate statistical reporting and regular annual reporting to the Ministry of Agriculture, Forestry, and Water Management. It is imperative to strengthen the evidence-based statistical system to provide robust information for sector analysis, planning, and measurable monitoring of achieved results.

The latest European Commission report emphasizes that the **further implementation of LPIS in Montenegro requires substantial support, which entails not only the advancement of the software solution but also a dedicated focus on capacity building and the collection of additional data** (EC, 2023d). Montenegro still needs to bring its support measures fully in line with EU acquis. Progress in

setting up the integrated administration and control system (IACS) remained slow. The land parcel identification system (LPIS) has yet to be rolled out across the whole territory. Preparations are ongoing to secure new orthophotographs to update the system. Efforts to further develop the FADN need to continue. Farm advisory services have yet to be strengthened.

2.6 Republic of Serbia

The Ministry of Agriculture, Forestry, and Water Management (MAFWM), Sector for Coordination, International Cooperation and IACS, Directorate for Agrarian Payments in the Republic of Serbia is responsible for establishing and maintaining the Integrated Administration and Control System (IACS), which is currently in the intensive setting-up process stage. There are some IACS elements established already, however, they are still not completely in line with the rules stipulated by the acquis. There are certain elements of system described below:

IACS procedures will comprise:

- Farm registration (for the first time) will be conducted in an online form or, eventually, in the regional offices. Online access will be given to the farmers to be able to see the data in the register. Any changes will be reported, by the farmer, online or, eventually, to the regional office where they will be entered into the register;
- LPIS data will be established through the online form procedure or throughout the farmer's consultations in the regional offices. Online access will be given to the farmers to be able to see the data in the register. Any changes will be reported, by the farmer, online or eventually, to the regional office where they will be entered into the register;
- The register of animals is systematically improved in accordance with the IACS requirements (both in legal and technical terms) and remains within the competence of the Veterinary Administration;
- Integration of all registers in the system will be conducted in the central office;
- Receipt of single applications online or in the regional offices (geo-spatial for area-based schemes);
- Administrative and cross-check control of all applications will be done in the central database;
- Risk Analysis will be conducted at the central level;
- Control with remote sensing will be carried out by the central office and classical on-the-spot control will be performed locally;
- The Payments approval procedure will be performed by the central level of the Paying Agency.

In the Republic of Serbia, a **GIS Land Parcel Identification System as stipulated by the EU acquis has not yet been established entirely**. Control of agricultural area, for which a payment request is made (as from the claim year 2023, via eAgrar – eSubsidies/ePodsticaji), is based on an alphanumeric data of used agricultural land (no GIS data), which is an integral part also of a new version the Farm Register. This database is based on data from the real estate cadastre managed by the Republic Geodetic Authority (RGA) (EC, 2023f).

On the other hand, **the process for setting up EU CAP compliant LPIS is well on track**. In 2019, the Technical Assistance Project (under the IPA 2013 unallocated funds) "Introducing and Maintenance of functioning Land Parcel Identification System in pilot municipalities in the Republic of Serbia" was launched. The Project's main objective was to assist the beneficiary (the MAFWM and the DAP) by

providing expertise on GIS LPIS as one of the integrated system's core elements. Within the project, which concluded in 2019, the pilot test of four different reference parcel types on the pilot municipalities was implemented, the methodology for LPIS establishment was elaborated, technical specifications for LPIS software were developed, as well as specifications for Land Cover layer (an initial LPIS layer), photo-interpretation manual drafted and training of a group of operators was organized.

The next phase in the LPIS development is foreseen to be implemented in the period from November 2023 to September 2024. For this purpose, ortho-photo images are provided for the whole Serbia. In addition to this, several other layers as essential components of the LPIS were acquired, for example topographical map, digital cadastre, water channels network and hydrographic network, ecological network (i.e., equivalent to the NATURA2000 layer) etc.

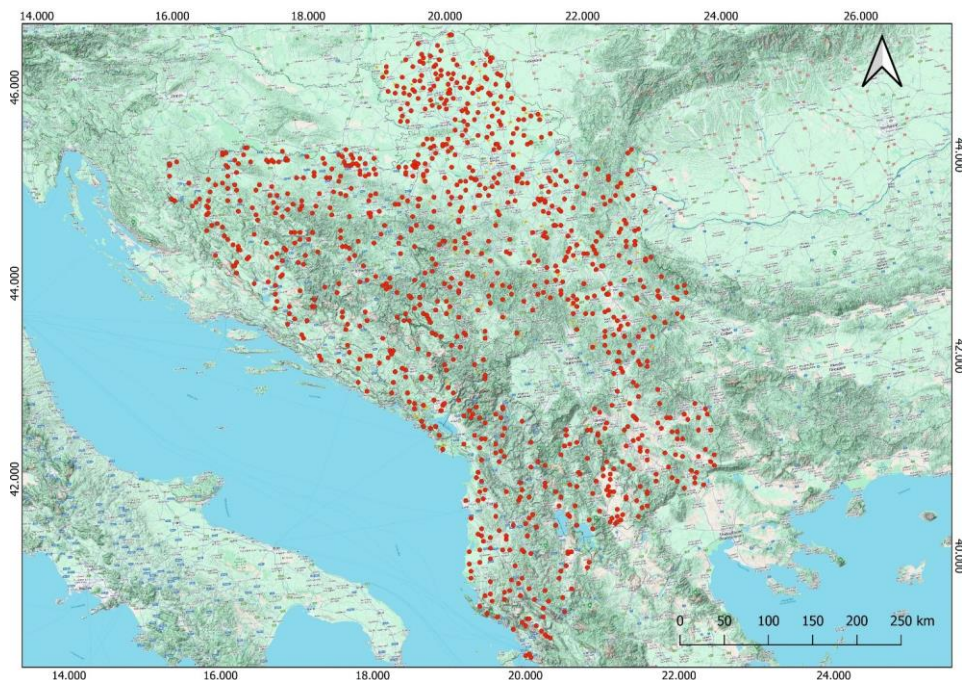
The Paying Agency is fully responsible for the establishment and maintenance of the LPIS (updates and upgrades). The Republic Geodetic Authority (RGA) has provided orthophoto and other images/data as well as other institutions provided other indispensable data used within the LPIS. All data (geospatial and alphanumeric) essential for the LPIS setup and management are available to the DAP free of charge if owned by public bodies. LPIS establishment on the entire territory of the Republic of Serbia is expected in Q4 2025. Following IACS principles, GSA will be integrated with the registers and will be therefore available as a specific GSA module (as well as other modules of the single application) to help farmers with the application process. Farmers will be able to enter single aid applications either online by themselves or with the assistance of the operator in the regional office or other qualified and competent institutions. The establishment of GSA for the territory of the entire Republic of Serbia, including GSA quality assessment, is planned for the period Q1 2026 – Q4 2026, financed by IPA funds.

3 Integration of IACS and Soil Data: Potential in the region

Integrating IACS agricultural parcel data with the Land Use and Coverage Area frame Survey (LUCAS) soil data in the Western Balkans holds significant potential benefits for advancing environmental and climate research. This integration would allow for a comprehensive understanding of soil health across diverse agricultural landscapes, as demonstrated for the EU (Schillaci *et al.*, 2023; Vieira *et al.*, 2023). By combining detailed parcel-level agricultural data with soil quality data, scientists and policymakers can develop and refine sophisticated models that more accurately predict environmental and climate outcomes. These models can assess the impact of agricultural practices on soil health, identify areas at risk of degradation, and propose targeted interventions to improve sustainability. Such integrative efforts would facilitate the creation of robust, evidence-based strategies to enhance agricultural productivity while preserving soil health and mitigating climate change impacts.

Data to characterize the overall state of pressures on soils in the Western Balkan region are largely lacking, making it difficult to quantify the geographical extent of the pressures or to establish quantitative trend assessments of overall soil health. In 2015, the European Commission took an outstanding decision to sample for the first-time soil samples in the Western Balkans countries (Albania, Bosnia and Herzegovina, North Macedonia, Montenegro, and Serbia) under the leadership of the Joint Research Centre's (JRC) Enlargement and Integration Programme in the context of the LUCAS. 1,015 soil samples were collected in the five countries of Western Balkan (Figure 1).

Figure 1 Distribution of LUCAS 2015 soil points in Western Balkan



The JRC intends to publish an assessment of soil characteristics based on the analysis of samples collected during the LUCAS 2015 Survey. The combination of IACS data with LUCAS 2015 ancillary data (Arias-Navarro *et al.*, 2024), supplemented by laboratory data when available, will be highly relevant. This integrated approach will provide a comprehensive understanding of soil characteristics by incorporating detailed environmental information such as climate, topography, land cover, and soil regions, along with precise laboratory analyses. Such a robust dataset will significantly enhance

agricultural management practices, support environmental compliance, and inform policy decisions in the Western Balkans.

In the Western Balkans, the implementation of LPIS varies significantly across countries (Annex 1. Summary of the implementation of IACS across the countries and territories of the Western Balkans):

- In Albania, IACS has yet to be fully implemented, and there has been no progress in establishing LPIS.
- Bosnia and Herzegovina has not established LPIS or Geospatial Support Activities (GSA) but is gradually adopting EU regulations and policies related to agriculture, food, and rural development. The Republic of Srpska, a region within Bosnia and Herzegovina, utilizes other information systems for efficient land management despite the absence of LPIS and GSA.
- Kosovo is still in the process of setting up its agricultural system, including IACS, and has implemented the Simple Land Parcel Identification System (sLPIS) to digitize agricultural plots and assign data to each farmer.
- In Montenegro, LPIS was established with EU funding in 2013, but it has yet to be rolled out across the entire territory. Further implementation requires substantial support, including software advancements and additional data collection.
- North Macedonia stands out with all components of IACS operational and compliant with EU regulations. However, improvements are needed in data transfers and the interoperability of system elements, particularly in transferring the farm register and LPIS to the paying agency. The Main Features of LPIS include a multifunctional reference system used for administration and control of area-related subsidies, encompassing cross-compliance, permanent crops, and organic farming.
- The Republic of Serbia has established some IACS elements, though they are not fully compliant with EU rules. The country is on track to set up an EU CAP-compliant LPIS and should expedite the transition from manual to electronic processing of aid applications.

North Macedonia could serve as a test country in the Western Balkans to develop a methodology for calculating soil health indicators at the parcel level using IACS and LUCAS data. This data integration offers significant potential benefits, such as supporting the development and application of scientific models relevant for environmental and climate performance measurements and assessments, as well as evaluating the soil health status of agricultural parcels. By demonstrating the potential to apply soil information to an eventual LPIS for the Western Balkans, this initiative could provide a robust framework for enhancing agricultural sustainability and environmental monitoring across the region. Combining these operational IACS components with LUCAS soil data in North Macedonia would thus not only advance soil health monitoring but also strengthen the overall efficiency and effectiveness of agricultural and environmental management in the Western Balkans.

4 Conclusions

The implementation of the Integrated Administration and Control System (IACS) across the countries and territories of the Western Balkans is at various stages, reflecting the diverse progress and challenges encountered within the region. Despite these variances, North Macedonia stands out as a promising candidate for pioneering a methodology to calculate soil health indicators at the parcel level by integrating IACS data with the LUCAS 2015 data, encompassing 120 sampling points. This initiative could serve as a crucial pilot project, demonstrating the feasibility and benefits of such data integration.

Potential benefits from integrating IACS and LUCAS data are manifold. Firstly, it would enable the development and application of advanced scientific models that are essential for accurate environmental and climate performance measurements and assessments. These models would provide detailed insights into the soil health status of agricultural parcels, highlighting areas that require intervention and those that are performing well. Such detailed soil health assessments are critical for sustainable land management and for implementing practices that enhance soil quality, thus ensuring long-term agricultural productivity.

Moreover, the integration of these datasets would support more precise monitoring of soil carbon sequestration, nutrient cycling, and erosion patterns, which are vital for understanding and mitigating climate change impacts. This approach would help in tailoring agricultural practices to specific parcel needs, promoting more efficient use of resources and reducing the environmental footprint of farming activities. Ultimately, the methodology developed in North Macedonia could serve as a model for other countries in the region, fostering a more unified and effective approach to agricultural and environmental management across the Western Balkans.

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List of abbreviations and definitions

Abbreviations	Definitions
IACS	Integrated Administration Control Systems
CAP	Common Agricultural Policy
ETFAR	Enhancement of the Federation's Agricultural Record
EU	European Union
FADN	Farm Accounting Data Network
FAO	The Food and Agriculture Organization of the United Nations
GDP	Gross Domestic Product
GIS	Geographic Information System
GSA	Geospatial aid-application
IPA	Instrument for Pre-accession Assistance
IPARD	Instrument for pre-accession assistance for rural development
JRC	Joint Research Centre
LPIS	Land Parcel Identification Systems
MAFWE	Ministry of Agriculture, Forestry, and Water Economy
MAFWM	Ministry of Agriculture, Forestry, and Water Management
MIDAS	Montenegro Institutional Development and Agriculture Strengthening Project
MOFTRBIH	Ministry of Foreign Trade and Economic Relations of Bosnia and Herzegovina
SAP	Stabilisation and Association Process
sLPIS	Simple Land Parcel Identification System

Abbreviations**Definitions**

ZIS

Land Information System (Republic of Srpska)

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Annexes

Annex 1. Summary of the implementation of IACS across the countries and territories of the Western Balkans.

Country	Status	Outlook	References
Albania	IACS has yet to be fully implemented	Progress needs to be made in establishing LPIS	European Commission, SWD(2023) 690 final, Albania 2023 Report, Accompanying the document "Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions 2023 Communication on EU Enlargement policy", 2023. https://neighbourhood-enlargement.ec.europa.eu/albania-report-2023_en
Bosnia and Herzegovina	LPIS and GSA have not been established yet. The Republic of Srpska boasts other information systems contributing to efficient land management despite the absence of LPIS and GSA.	Ensure the harmonization of sub-components of the Agricultural Information System and facilitating automated data delivery while maintaining traceability, accuracy, and verifiability.	European Commission, SWD(2023) 691 final, Bosnia and Herzegovina 2023 Report, Accompanying the document "Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions, 2023 Communication on EU Enlargement policy", 2023. https://neighbourhood-enlargement.ec.europa.eu/bosnia-and-herzegovina-report-2023_en Ministry of Agriculture, Forestry and Water Management of the Republic of Srpska, Department for agricultural land, Official information, January 2024
Kosovo*	Still in the process of establishing IACS	The Simple Land Parcel Identification System (sLPIS) was set up in 2012, and it functions to systematically digitize agricultural plots and assign attribute data to each farmer.	European Commission, SWD(2023) 692 final, Kosovo* 2023 Report, Accompanying the document "Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions, 2023 Communication on EU Enlargement policy", 2023. https://neighbourhood-enlargement.ec.europa.eu/kosovo-report-2023_en
North Macedonia	All components of IACS are operational and compliant with the EU regulations	Data transfers and the inter-operability of the various elements need to be improved. In particular, it should	PA Rural Development Programme 2021-2027, THE REPUBLIC OF NORTH MACEDONIA https://ipard.gov.mk/wp-content/uploads/2023/04/IPARD-PROGRAMME-2021-2027-eng.pdf

Country	Status	Outlook	References
		ensure the transfer of the farm register and the LPIS to the paying agency.	European Commission, SWD(2023) 693 final, North Macedonia 2023 Report, Accompanying the document "Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions, 2023 Communication on EU Enlargement policy", 2023. https://neighbourhood-enlargement.ec.europa.eu/north-macedonia-report-2023_en
Montenegro	LPIS was established with funding from the EU IPA 2013. LPIS has yet to be rolled out across the whole territory.	Further implementation of LPIS in Montenegro requires substantial support, which entails not only the advancement of the software solution but also a dedicated focus on capacity building and the collection of additional data	Montenegro institutional development and agriculture strengthening, MIDAS Project, FINAL ASSESSMENT, Contract No.: MNE-MIDAS AF-8643-ME-IC-CS-18-2 Strategy for the development of agriculture and rural areas 2023-2028, Ministry of Agriculture, Forestry and Water Management, 2023. https://www.gov.me/dokumenta/1e9c16c3-8814-49ab-ba89-de4f60f796af European Commission, SWD(2023) 694 final, Montenegro 2023 Report, Accompanying the document "Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions, 2023 Communication on EU Enlargement policy", 2023. https://neighbourhood-enlargement.ec.europa.eu/montenegro-report-2023_en
Republic of Serbia	There are some IACS elements established already, however, they are still not completely in line with the rules stipulated by the acquis.	The process for setting up EU CAP compliant LPIS is on track. LPIS establishment on the entire territory of the Republic of Serbia is expected in Q4 2025. The establishment of GSA for the territory of the entire Republic of Serbia, including GSA quality assessment, is	Ministry of Agriculture, Forestry and Water Management, Sector for Coordination, International Cooperation and IACS, Directorate for Agrarian Payments, Official information, December 2023 European Commission, SWD(2023) 695 final, Republic of Serbia 2023 Report, Accompanying the document "Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions, 2023 Communication on EU Enlargement policy", 2023. https://neighbourhood-enlargement.ec.europa.eu/serbia-report-2023_en

Country	Status	Outlook	References
		planned for the period Q1 2026 – Q4 2026.	

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