Using the Integrated Administration and Control System's plot-level data: A proposed scoping review and pilot analysis

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***Abstract* - In recent years, data from the EU's Integrated Administration and Control System (IACS) containing farmed plots' location and cultivation have become increasingly available for research purposes. While researchers from a broad range of disciplines rely on this data for their work, there is no complete and structured overview of use cases. To address this gap, we plan to conduct a systematic scoping review for identifying and analysing publications using plot-level IACS data from Austria, Czechia, France, Germany, and Sweden. To illustrate our intentions, we conduct a pilot analysis of 12 selected academic publications and present the results here. The pilot analysis demonstrates that IACS data serve to address a variety of research questions from disciplines including economics, ecology, and remote sensing. The analysed publications derive and apply 26 different indicators from IACS data to indicate landscape or farm configuration, composition, and management outcomes. We find a lack of a common terminology in the analysed papers and an apparent lack of data (access) harmonization between countries. Nevertheless, the results suggest that IACS plot-level data provide reliable, comprehensive and highly disaggregated information that facilitates scientific work.**

Introduction

To administer and control subsidies to farmers under the Common Agricultural Policy, European Union (EU) member states operate an Integrated Administration and Control System (IACS). IACS contains a land parcel identification system in which authorities provide georeferenced information on the agricultural plots eligible for subsidies and collect information on the crops grown on each plot (European Commission, n.d.). Since most farmers in the EU apply for subsidies and declare their farmed land and cultivated crops to IACS each year, the final dataset covers the vast majority of farmland in most EU countries.

Recently, authorities increasingly provide IACS data for scientific use. Researchers from various disciplines use the data, but there is little exchange of ideas, data handling strategies, or solutions to common problems between data users. We are also unaware of efforts to systematically collect and analyse published uses of IACS data.

To address this lack of knowledge collection and sharing, we plan to conduct a systematic scoping review (Munn et al., 2018) of scientific work that uses plot-level IACS data from five selected countries: Austria, Czechia, France, Germany, and Sweden. In this conference paper we present a pilot analysis to explain our research aims and planned analysis.

We address the following research questions (RQs) in both the planned review and the pilot analysis: (1) Who has used IACS plot-level data, in which disciplines and time periods? (2) What research questions have been answered by using the data? (3) For which purposes have IACS data been used? (4) What information from IACS data has been used at which spatial and temporal levels? (5) What indicators have been derived from the data and for what purposes? (6) What other datasets have been linked to IACS data and how? (7) What critical evaluations and suggestions for using and improving the IACS datasets have been made?

The pilot analysis

To guide our proposed scoping review, we rely on the methodology suggested by James et al. (2016) and follow a pre-registered protocol (in preparation) that details the 5 stages of the review process: (1) Searching publications, (2) Screening and selecting publications, (3) Extracting information, (4) Analysing and synthesizing information, and (5) Reporting.

To test stages (3)-(5) of the review protocol, we conduct a pilot analysis of 12 selected publications that cover different disciplines, journals, publishers, and all countries included in the review. From each of these publications we extract information needed to address RQ2 – RQ7, and analyse this information, e.g., by means of creating wordclouds, coding and grouping content, etc. The following sections present and discuss selected results of the pilot analysis.

Results

Figure 1 presents a wordcloud of the sample papers' abstracts, illustrating the *research topics* (RQ2) addressed in the papers. Note that land (use) and farming feature prominently, next to fragmentation. We identify and group the *methodological purposes* (RQ3) of IACS data use into indicator derivation, use as metric(s), site selection and grouping, typology creation, and reference data for remote sensing applications. We identify and group *content-related purposes* (also RQ3) into describing landscape and farm structure in terms of configuration and composition, describing farmer management activities, and conceptual discussions of IACS data.

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Figure 1. Wordcloud of sample paper abstracts.

In the 12 sample papers, we identify 26 *indicators derived* from IACS data (RQ5) that measure 9 different indicanda (phenomena of interest measured by indicators): crop diversity, land management intensity, land use change, land use fragmentation, land use type, landscape complexity, landscape diversity, landscape structure, and soil conservation behaviour.

To construct indicators and metrics, plot geometry, location, and crop type are the most commonly used IACS raw data components (RQ4). Other information collected by IACS such as farm IDs, data on organic farming, or AES appears to be available for research purposes only in some countries. The most common spatial units of analysis (RQ4) are the farm and plot levels. However, there is a lack of common terminology for plots and blocks (consisting of several plots). The twelve sample papers combine a host of different datasets (RQ6) with IACS data (including weather data, species sampling data, open streetmap data, and farm accountancy data (FADN)), in most cases by spatial matching.

Last, we collect discussion points (RQ7) on the benefits and limitations of IACS data uses that sample papers mention. The sample papers consider IACS data as comprehensive, precise, detailed, and spatially and temporally highly disaggregated; providing a "cost-free" information source that is theoretically available and comparable EU-wide. However, not all farms and lands are registered in IACS (only those that farmers use to claim subsidies), and data privacy concerns restrict the use of some types of data. It is difficult to trace plots over time, and there is a lack of data access harmonization and standardization across EU countries and federal states. Dataset contents also differ between the datasets available as open data (e.g., on the EU's INSPIRE Geoportal) and those available upon request, and between countries. The authors of several sample papers suggest adding new data to IACS, or ask authorities to enable merging with other farm-level datasets.

Discussion and Conclusions

While the results of the pilot analysis demonstrate the potentials of IACS data (e.g., for indicator derivation), they also reveal differences in data contents, challenges to data use, a lack of common terminology, and inconsistencies and gaps in the analysed papers.

Several authors use information on AES and organic farming, while open IACS data on the INSPIRE Geoportal do not provide this information. Some authors use farm IDs; others note that IDs are not provided to them. Such differences hinder cross-country data use. Data-providing authorities should harmonize how they construe data privacy protection regulations for scientific use, and researchers should be transparent about data access and contents.

The smallest data unit (plots or blocks) in IACS also differs between countries, which likely originates from different IACS setups. The analysed papers do not always clearly define this unit. Other challenges (missing land, traceability of plots over time) cannot be avoided easily as they arise from the nature of IACS data gathering, but should be addressed or discussed by researchers. We do not find any attempts to validate IACS data or derived indicators using alternative datasets among our sample papers either. Agricultural Structure Survey data or FADN data could be used for validation, and could provide additional information (e.g., farm management practices) that some authors suggest adding to IACS.

The pilot analysis reveals a lack of a common terminology; e.g., an inconsistent use of names for the smallest spatial unit (plot, parcel, patch, field), and the interchangeable use of landscape structure, complexity, patterns, diversity, and fragmentation without proper definitions. We also find that authors who derived indicators from the data are not always clear about their indicators' indicanda and the theoretical or causal link between them.

While the results of the pilot analysis presented here are limited by the number and choice of sample papers, we hope that this first glimpse into IACS data use sparks interest in our future review and analysis that we expect to span more disciplines and provide more comprehensive insights.

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