EU CAP NETWORK

Rough estimate of the soil protection potential of the CAP Strategic Plans over the 2023-2027 period

Executive summary
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Additional information about the activities of the European Evaluation Helpdesk for the CAP is available on the Internet through the Europa server https://eu-cap-network.ec.europa.eu/support/evaluation.

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Acknowledgements

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Questions and suggestions regarding the content of the publication can be addressed to the European Evaluation Helpdesk for the CAP at evaluation@eucapnetwork.eu.

1. Introduction and method

Soil health plays a vital role in the long-term viability of agricultural systems. However, according to the Soil Degradation Dashboard of the European Union (EU) Soil Observatory, 62% of EU soils are not in a healthy condition, i.e. likely to be affected by one or more soil degradation processes or by soil sealing based on 19 indicators [1]. The situation is even worse in agricultural soils. The 2023-2027 Common Agricultural Policy (CAP) is a key instrument for achieving the goals set by the EU to protect and improve soil health. The CAP Strategic Plan Regulation [2] directly addresses soil protection, both through mandatory requirements of the good agricultural and environmental conditions (GAECs) and through various types of interventions (voluntary commitments). In this context, the study contributes to the development of methodologies for a detailed analysis and an improved quantification of the potential contribution of CAP Strategic Plans (CSPs) to sustainable soil management. It proposes a quantification assessment tool for the Managing Authorities and other interested parties.

The methodology developed by the European Evaluation Helpdesk for the CAP establishes the link between CSP instruments and their potential to improve soil health. The methodology is applied to 13 CSPs [3], selected to represent the diversity of the EU pedoclimatic zones and to look at CSPs where soil protection is identified as a priority. It relies on programming data extracted from the CSPs as approved by the European Commission at the time of the study and on average effect coefficients of farm practices representing their potential quantitative impact on selected soil health indicators [4].

The methodology is based on the following key steps:

1. Identification of the CAP interventions and GAECs that have the potential to contribute to the soil health at CSP level.
2. Association of each intervention and GAEC with relevant farm practices.
3. Estimation of the area covered by the farm practices supported by the CSPs.
4. Estimation of the potential contribution of CAP interventions and the potential added value of GAECs, by multiplying the estimated area of each farm practice by its quantitative effect and summing it up to the CSP level.

The methodology employed is based on a **series of assumptions and simplifications necessary at various stages of the analysis**. It is crucial to consider these assumptions and the data gaps when interpreting the final estimates.

The study focuses on the following **types of interventions**: schemes aimed at promoting climate, environmental, and animal welfare objectives (eco-schemes); coupled income support (CIS) targeting protein crops; environmental, climate-related and other management commitments (ENVCLIM); and investment support (INVEST). The scope of the study also includes the following **GAECs**: GAEC 1 – Maintenance of permanent grassland based on a ratio of permanent grassland in relation to agricultural area at national, regional, subregional, group of holdings or holding level in comparison to the reference year 2018; GAEC 2 – Protection of wetland and peatland; GAEC 4 – Establishment of buffer strips along water courses; GAEC 5 – Tillage management, reducing the risk of soil degradation and erosion, including consideration of the slope gradient; GAEC 6 – Minimum soil cover to avoid bare soil in periods that are most sensitive; and GAEC 7 – Crop rotation in arable land, except for crops growing under water.

Six indicators to report on soil health

In the context of the study, the assessment of soil health builds on the following six indicators, each corresponding to one soil characteristic:

- **Soil organic carbon content**: increase in organic carbon stock at the top 30 cm (tonnes of carbon/hectare/year).
- **Soil nitrogen**: increase in nitrogen stock at the top 20 cm (tonnes of nitrogen/hectare/year).
- **Soil water retention capacity**: increase in water stock at field capacity at the top 20 cm (tonnes of water/hectare/year).
- **Soil packing density**: reduction in packing density at the top 20 cm (tonnes of soil loss at constant soil volume/hectare/year – top 20 cm).
- **Nitrogen leaching and runoff**: reduction in mass of nitrogen loss from leaching and runoff per hectare (tonnes of nitrogen/hectare/year).
- **Soil erosion by water**: reduction in mass of eroded soil through runoff per hectare (tonnes of soil/hectare/year).

These soil indicators were selected based on available data in the European Commission Joint Research Centre (JRC) Farming Practices Evidence Library [5]. Certain indicators could not be included in this exercise because of data gaps or the heterogeneity of their units of measurement. For example, soil biodiversity is not included, which is an important gap in the assessment given its importance in the impact of farming on soil health.

1 https://esdac.jrc.ec.europa.eu/esdacviewer/euso-dashboard/.
2 Regulation (EU) 2021/2115.
3 Czechia, Germany, Denmark, Greece, Spain, Italy, Latvia, Luxembourg, Hungary, the Netherlands, Poland, Romania and Finland.
4 Coefficients from the JRC Farming Practice Evidence Library: https://joint-research-centre.ec.europa.eu/jrc-news-and-updates/farming-practices-evidence-library-tool-agricultural-sustainability-2025-02-21_en.
5 https://joint-research-centre.ec.europa.eu/jrc-news-and-updates/farming-practices-evidence-library-tool-agricultural-sustainability-2025-02-21_en.

Coefficient database: assigning coefficients to the farm practices to assess their potential effect on the different characteristics of soil health

As a first step, coefficients from the JRC Farming Practices Evidence Library are used to estimate the annual effect of each farm practice relative to its equivalent conventional practice as a percentage [6]. For example, the farm practice S232 (winter cover crop) is estimated to reduce soil erosion by water by 50%, compared to no winter cover. These coefficients, expressed as relative change (%), are common to all Member States.

As a second step, these relative effects are translated into absolute values by applying them to national soil condition baselines, representing the initial state of the soil at national level in relation to each of the six indicators covered. These baselines may vary significantly across Member States. This means that the same practice can have different impacts depending on the national context, e.g. a 50% reduction in erosion equates to 0.15 tonnes per hectare in the Netherlands and 5.38 tonnes in Italy due to differing baseline erosion levels.

Focusing on the CSPs' positive potential contribution

The approach focuses on potential positive effects of the farm practices supported through CAP interventions and GAECs on soil health. Farm practices supported by CAP instruments can also have negative effects on one or several soil characteristics, but these are not assessed in this study as the scope of the JRC Farming Practices Evidence Library focuses mainly on agri-environmental farm practices generally associated with positive environmental effects.

2. Main results

For CSP interventions, the study compares the effect of the supported farm practices to conventional farm practices. In this case, the estimated potential contribution encompasses all the areas where supported farming practices are expected to be implemented through the different types of intervention covered. Therefore, **results represent the maximum potential contribution** of all the areas targeted for support from the CSP.

The following table shows the relative improvement of the studied soil characteristics at Member State level resulting from CSP interventions. It shows that soil organic carbon content in utilised agriculture area (UAA) is estimated to potentially increase from 0.21% in Luxembourg to 1.59% in Romania on an annual basis with the implementation of different CSP interventions. The annual estimates for soil nitrogen range from 0.38% increase in Denmark to 4.81% in Romania. Soil water retention capacity is estimated to increase from close to 0.00% in Czechia to 3.04% in Finland, annually. The decrease in soil packing density is estimated to be null for Denmark and Luxembourg due to the lack of farm practices with an expected effect on this soil characteristic, but it reaches an annual value of 1.58% in Finland. Annual nitrogen leaching and runoff are estimated to decrease from 3.91% in Spain to 33.67% in Finland. Finally, the estimated decrease in annual soil erosion by water ranges from 1.07% in Germany to 38.69% in Greece. All these results must be carefully interpreted, considering notably that the study only focuses on potential positive effects of the CAP.

Table 1. Relative estimated potential improvement of each of the soil characteristics covered

CSP	Increase in soil organic carbon content	Increase in soil nitrogen	Increase in soil water retention capacity	Decrease in soil packing density	Decrease in nitrogen leaching and runoff	Decrease in soil erosion by water
CZ	0.6%	1.9%	0.0%*	0.0%*	6.5%	34.5%
DE	0.9%	0.4%	0.2%	0.0%*	11.0%	1.1%
DK	0.5%	0.4%	0.0%*	0.0%*	11.5%	3.9%
EL	0.8%	1.0%	0.9%	0.0%	31.4%	38.7%
ES	0.7%	1.3%	1.4%	0.4%	3.9%	7.1%
FI	1.5%	3.6%	3.0%	1.6%	33.7%	33.4%
HU	1.3%	2.7%	1.1%	0.3%	12.6%	14.4%
IT	1.2%	3.3%	1.8%	0.1%	9.6%	6.3%

6 A few exceptions for soil organic carbon content that have some of their coefficients directly expressed in absolute values.

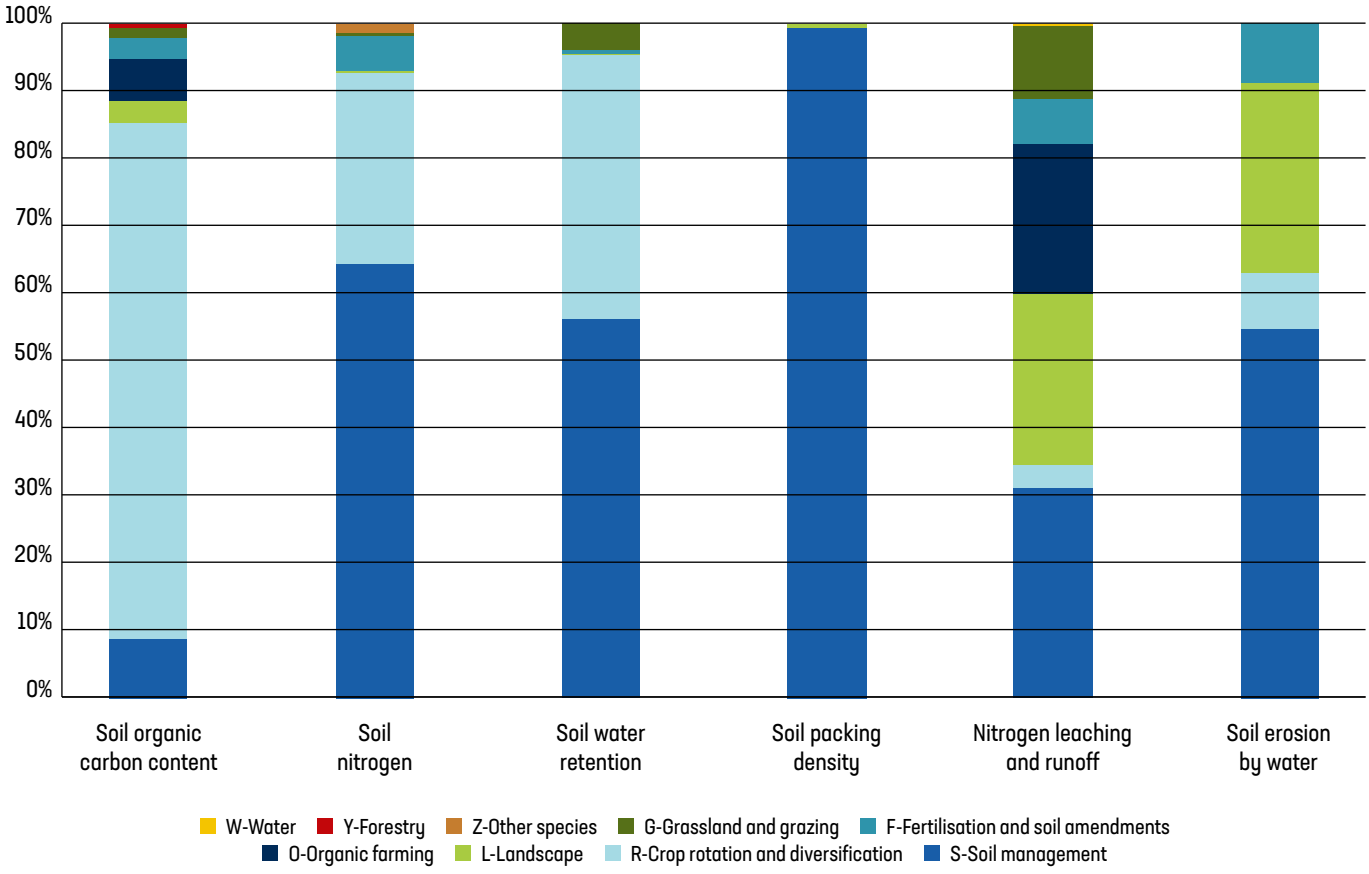
CSP	Increase in soil organic carbon content	Increase in soil nitrogen	Increase in soil water retention capacity	Decrease in soil packing density	Decrease in nitrogen leaching and runoff	Decrease in soil erosion by water
LU	0.2%	0.5%	0.8%	0.0%	28.4%	19.7%
LV	0.4%	1.9%	0.7%	0.2%	18.9%	12.1%
NL	0.3%	3.2%	0.1%	0.0%*	20.4%	17.8%
PL	0.6%	3.4%	1.1%	0.3%	4.9%	3.6%
RO	1.6%	4.8%	2.1%	0.7%	0.0%	21.1%

Source: EU CAP Network supported by the European Evaluation Helpdesk for the CAP (2025)

*non-zero value rounded to 0.0%. Results in absolute value are divided by the baseline at the scale of the total UAA to obtain relative values. The colour scale highlights the highest values in dark green and the lowest values in white/light green.

Results are also broken down by farm practices [7].

Figure 1. Distribution of the CSP interventions' estimates by category of farm practices



Source: EU CAP Network supported by the European Evaluation Helpdesk for the CAP (2025)

7 For the purpose of the study, farm practices are labelled following the classification scheme developed by the JRC: Angileri, V., Guerrero, I. and Weiss, F., *A classification scheme based on farming practices*, Publications Office of the European Union, Luxembourg, 2024, doi:10.2760/33560, JRC133862 https://publications.jrc.ec.europa.eu/repository/handle/JRC133862.

Results show that supports in favour of soil management farm practices (**category S**) account for most of the estimated potential contribution of the CSPs' interventions for several soil characteristics. This category includes practices that limit tillage or ensure soil cover. In particular, the farm practice S22 (crop residues left on soil, leaving stubbles on the fields) is a key farm practice, because it is supported by CSPs interventions on large areas and it is associated with a coefficient on all soil characteristics studied. Farm practices related to crop rotation and diversification (**category R**) account for most of the estimated potential increase in SOC content and contribute significantly to increases in soil nitrogen and soil water retention. Farm practices related to landscape (**category L**), such as the installation of hedgerows or different types of field margins or patches, account for a significant part of the estimated reductions in nitrogen leaching and runoff and soil erosion by water. Organic farming (**category O**) also significantly contributes to the estimated reduction of nitrogen leaching and runoff. The contribution of other categories of farm practices is relatively limited. Further detail at the farm practice level per CSP shows the variability across the 13 CSPs covered, indicating the presence of differences in strategies to address soil-related issues.

For GAECs, **the study focuses on estimating the added value of 2023-2027 GAECs compared to the previous programming period**. This approach aims at calculating the additional areas covered by the current GAEC requirements compared to those covered by the GAEC requirements during the previous programming period, as well as areas where the practices are already adopted by farmers, even without the GAECs of the 2023-2027 programming period. Therefore, results for GAECs quantify the added value of the current programming period.

Based on this approach, it is considered that all GAECs studied only bring added value in some of the CSPs studied (from 4/13 CSPs for GAEC 4 to 8/13 CSPs for GAEC 6). An exception is GAEC 7, considered to bring added value in all CSPs studied. When GAECs are considered to bring an added value, the results show very high heterogeneities from one CSP to another. The order of magnitude of the estimates assessed for GAECs is comparable to the ones assessed for CSP interventions. Results show that GAEC 5 and, above all, GAEC 6 are expected to play a significant role in the improvement of soil health based on the soil characteristics covered.

3. Conclusions

The results show how quantified rough estimates can support both the evaluation of the current CAP's estimated contribution to environmental and soil health objectives and assist in the design of future CAP green architecture. By identifying the GAECs and CSP interventions with the highest potential to generate positive environmental outcomes, the analysis provides a basis for more targeted and effective policy decisions.

Moreover, the study underscores the importance of maintaining and further developing robust scientific databases, such as the JRC's Farming Practices Evidence Library and the EU Soil Observatory (EUSO), to underpin policy design and evaluation with sound scientific evidence. This aligns with broader strategic initiatives, such as the EU Mission Soil, which is expected to contribute to filling some of the gaps identified in the study, such as indicators and farm practices' effects for soil biodiversity or quantification of the impact of combined farm practices adapted to local conditions. The present analysis should thus be viewed as an initial step toward more refined and comprehensive assessments. Future improvements should aim to:

- Incorporate more accurate and context-specific coefficients and baselines, tailored to local pedoclimatic conditions and agricultural practices.
- Integrate data on the actual uptake of CSP interventions.
- Distinguish between newly covered areas and those where practices were implemented in the past to better estimate the impacts of the 2023-2027 CAP programming period.

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