

ClieNFarms Policy Brief #4: Methodological Challenges in Assessing the Integral Sustainability of Farms and Climate Solutions

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Introduction

Achieving sustainable agriculture means preserving natural resources for current and future generations by reducing agriculture's negative impacts. As outlined in the first policy brief produced by ClieNFarms, climate solutions should be based on a holistic approach that looks at all the elements and connections within and around farming systems, with a strong focus on ecosystem resilienceⁱ. Ecosystem resilience benefits not only the planet but also the agricultural sector itself. Nature and its ecosystem services underpin two thirds of the EU's added economic value. The European Commission emphasises nature's potential for providing cost-effective solutions to climate mitigation, adaptation and resilience, stressing the need to reward them, in the 2025 Vision for Agriculture, the Nature Restoration Law (NRL) and the Food and the Water Resilience Strategyⁱⁱ.

Enabling the transition of European agriculture toward a more sustainable production can be supported by monitoring and reporting of sustainability performance of farms. During the last years, several global frameworks, protocols, and guidelines for carrying out sustainability assessments have been introduced. These tools, models and frameworks provide structured approaches to assess the environmental, economic and social aspects of agricultural sustainability. While a wide range of indicators has been developed to evaluate these aspects at farm level, their extensive data demands complicate the monitoring process. Consequently, existing sustainability assessment tools tend to focus only on a limited set of indicators. Therefore, carrying out these assessments requires different tools to be combined, but there are no clear agreed methodologies for how to do so.

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The content of this policy brief is based on the research carried out within the EU Horizon 2020 project ClieNFarms. ClieNFarms analysed the methods for farm-level multicriteria sustainability assessments available in the European agricultural context. This analysis covered, on the one hand, a literature review of sustainability challenges and relevant policy frameworks, and on the other hand, a practical analysis of the effectiveness of tools applied in demonstration case-studies involved in the project. These case studies are called Innovative Systemic Solutions Spaces (ISS) and consist of farms where solutions have been tested, developed and implemented throughout the project duration.

Aim of the policy brief

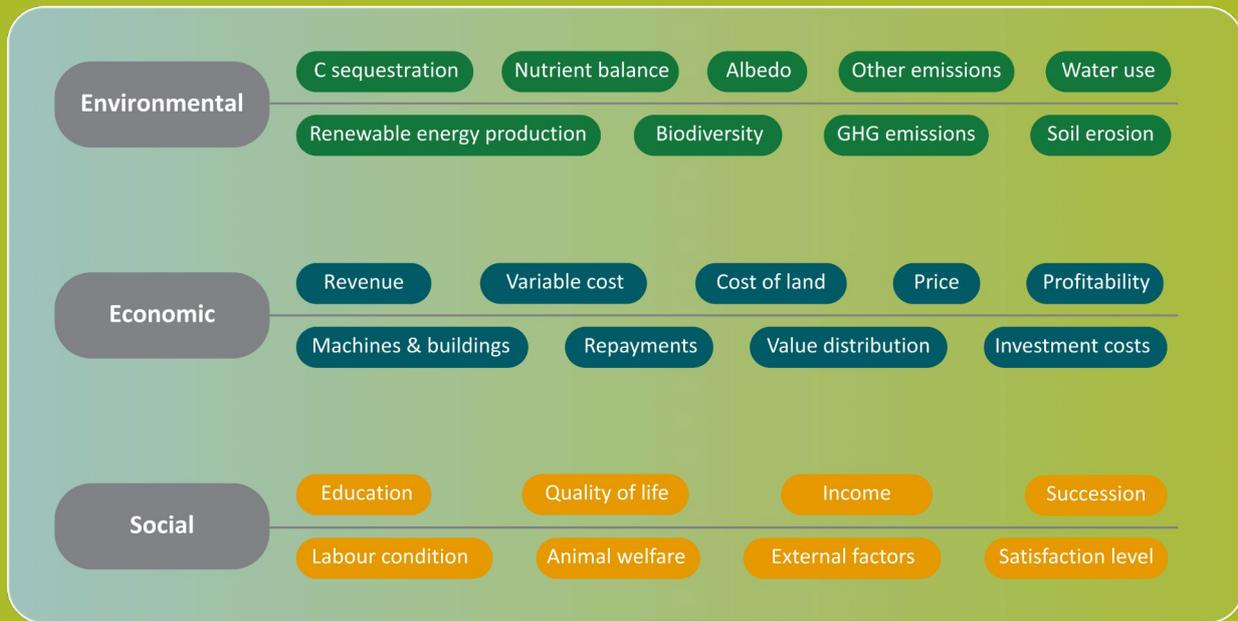
This policy brief dives deeper in the topic of assessing the environmental and socio-economic impacts of farms that aim to contribute to the EU target of becoming a climate neutral continent by 2050. Its purpose is to propose an approach to guide policy makers in the process of selecting the right tools and tackling the challenges of carrying out an integral (used also as "integrated" and "multicriteria") sustainability assessment.





Key findings

Key finding 1: Assessing a farm's integral sustainability requires defining and monitoring a list of indicators that cover the following sustainability aspects:



The methodology used by ClieNFarms was the integral sustainability assessment (ISA), a holistic method aimed at evaluating the sustainability level of farms or applied practices in farms, considering environmental, economic and social dimensions. ISA tools and frameworks often apply hierarchical structures to organize components: pillars, principles, aspects, themes, sub-themes, criteria and indicators, being indicator or criterion the lowest level. ISAs can be performed using a combination of:

- i) a single integral sustainability assessment tool (e.g. SAFA, RISE and TAPE) which quantitatively or qualitatively assesses several sustainability indicators,
- ii) a tool/model (e.g. KLV , DECiDE, CAP2ER , Cool Farm Tool) which partially assess a limited number of important indicators,
- iii) a tool/model (e.g. RothC) which assesses one specific indicator among the available indicators.

The outcomes of the literature review carried out by ClieNFarms included a unified list of indicators for ISA tailored to different production systems in the EU: dairy, beef, sheep, pig, arable and horticultural crops. The definition of aspects to monitor and indicators is based on their relevance to the SDGs, the Farm to Fork Strategy, the Biodiversity Strategy for 2030 and other integral sustainability frameworks and guidelines. Table 1 shows some of the indicators that were monitored in 135 arable farms as an example. Same approach was used for various production systems.

Table 1 - Aspects and indicators used for integral sustainability assessment (ISA) of arable systems.

Aspect	Indicator	Functional Unit
GHG emissions	GHG	kg CO2eq/kg fresh crop





	GHG	kg CO ₂ eq/farm
Carbon sequestration	C-sequestration	kg CO ₂ eq/ha
Nutrient balance	Whole farm Nitrogen (N) surplus	kg N/kg fresh crop
	Whole farm N surplus	kg N/farm
	Soil N surplus	kg N/ha
Water	Water consumption	m ³ /kg fresh crop
	Water consumption	m ³ /ha
Soil erosion	Share of land with moderate and severe soil erosion	%/farm land
Biodiversity	Soil N surplus	kg N/ha
	Ammonia (NH ₃) emissions	kg NH ₃ /ha
	Greenhouse Gas GHG emissions	kg CO ₂ eq/kg fresh crop
	Soil organic matter (SOM) balance	kg SOM/ha
	Share of cover crops (the cover crop area divided by total land used area)	%
	Share of area with reduced tillage (reduced tillage area divided by total crop land)	%
	Pesticide use	kg active/ha
	Percentage of land used entirely for managing meadow birds and other birds (the area divided by total land used area)	%
	Percentage of line-shaped elements (e.g. shelter belts or hedgerows) (the area divided by total land used area)	%
	Percentage of point elements (e.g. ponds or solitary trees) (the area divided by total land used area)	%

Key finding 2: Results highlighted that multicriteria sustainability assessments applied to assess the sustainability of farms often lack consideration of certain indicators, which leads to trade-offs between different integral sustainability aspects and to co-benefits not being accounted for.

Some of the most commonly used assessment tools in the EU, namely **ANCA tool**, **DECiDE**, **CAP2ER**, **Cool Farm Tool**, **Means in Out**, **Systerre**, and **RISE** were used for the evaluation of integral sustainability of EU farms and to find out to what extent these tools can contribute to ISAs of agricultural production systems. We found that some indicators are more represented than others in the tools. For example, pesticide use is not monitored in I3S farms.

Annual Nutrient Cycling Assessment (ANCA) tool: mandatory for nearly all Dutch dairy farms. Used for farm-specific assessment of nutrient cycles and emissions to air, water and soil. However, some of the other indicators such as the amount of renewable energy production, water consumption, soil erosion, biodiversity, social and economic indicators are not among its outputs.



Key finding 3: Several challenges hinder the development of an integral sustainability assessment in the EU:

Underrepresentation of social and economic dimensions in country-specific tools

Differences in monitoring or calculation methods for well-know indicators

Limited comparability of results across regions and countries, due to the regional nature of many sustainability indicators

Divergence in indicator priorities between countries (e.g., ammonia in the Netherlands, water use elsewhere)



A survey was conducted to understand which indicators were monitored in the farms involved in the project. Its results, in addition to the previously conducted literature review, helped elucidate the challenges that hinder the development of a common integral sustainability framework at EU level.

Policy recommendations

- ClieNFarms proposes a list of actions to be taken before an ISA of a farm:
 1. Selection of appropriate tools/models and sustainability indicators for that specific farm. Existing tools can cover most of the important indicators. In the absence of country-specific models for addressing specific indicators, the available options are:
 - a. Using a generic model or tool;
 - b. Using a common or simple calculation method;
 - c. Doing field measurements.

Besides, defining the scope and use of different functional units (see table 1) is important for further benchmarking and evaluation.
 2. Integration of multiple tools for a comprehensive assessment so that all indicators are represented.
 3. Choice between quantitative, qualitative or mixed approaches
 4. Development of methodologies for indicators lacking standardization.

ClieNFarms has included an integral sustainability and climate performance assessment of farming practices in its catalogue of climate solutionsⁱⁱⁱ.

- Policy should integrate multiple methods to assess all the relevant sustainability indicators covering the three pillars of sustainability in farms. Many indicators are not covered by the most used tools, such as the LCA-based tools and the Joint Research Center (JRC)'s product environmental footprint (PEF), which results in some aspects, such as water use and biodiversity, not being monitored, calculated or weighed properly. Consequently, undesirable trade-offs may occur when a climate farming solution is implemented.
- The EU needs to establish a clear framework or strategy to ensure coherence and comparability in sustainability assessments across member states. This strategy can include:
 - More funding for research projects that improve currently available tools, such as the SYSTERRE tool, which is being improved by H2020 projects DiverIMPACTS and SmartAgriHubs.
 - The development of the EU sustainability compass^{iv} for the agrifood sector by adding the indicators suggested by ClieNFarms.

Key references

ⁱClieNFarms (2025). *ClieNFarms Policy Brief #1: How can EU farms contribute to Climate Neutrality?* Available at: <https://cliefarms.eu/library/policy-briefs/>

ⁱⁱEuropean Commission (2025). *Communication from the commission to the European Parliament, the council, the European economic and social Committee and the committee of the regions. European Water Resilience Strategy.* COM (2025) 280 final

ⁱⁱⁱClieNFarms (2025). Catalogue of climate solutions. Available at: www.ClieNFarms.eu/solutions

^{iv}European Commission (2025). Agri Sustainability Compass. Available at: <https://agridata.ec.europa.eu/extensions/compass/compass.html>