



Report presenting sustainability indicator calculations and a simplified sustainability assessment tool for use by Advanced Farmer Clusters.

.....

Deliverable Work Package Number (Deliverable Number): D7.1

Lead Author and Institution: Rachel Nichols (GWCT)

Date of Submission: September, 23rd 2025



Deliverable Description & Contributors

- **Due date:** September 30th, 2025
 - **Actual submission date:** September 23rd, 2025
 - **Project start date:** 1st October 2020
 - **Duration:** 60 months
 - **Work package:** Systems analysis and synthesis (WP7)
 - **Work package leader:** LIST
 - **Deliverable Title:** Report presenting sustainability indicator calculations and a simplified sustainability assessment tool for use by Advanced Farmer Clusters.
 - **Nature of deliverable:** Other
 - **Dissemination level:** Public
-
- **Deliverable description:** Report comparing the impact of landscape-scale interventions compared to farm-based on biodiversity using data from the pilot Farmer Cluster network
-
- **Contributors**
 - Graham Begg, Simone Martino, Trinity Ndlovu (HUTTON)
 - Alastair Simmons (TAL)
 - Niamh McHugh (GWCT)
 - Claudio Petucco (LIST)

Contents

Deliverable Description & Contributors	2
1. Background to the FRAMEwork project	5
1.1 FRAMEwork Project Executive Summary (<i>abbreviated</i>)	5
1.2 Project Partners	6
1.3 Purpose of the Deliverable	6
2. Executive Summary	7
3. Sustainability assessments	8
4. Developing a detailed sustainability assessment tool	9
4.1 The overarching sustainability indicators	9
4.2 Creating the detailed sustainability tool	12
4.3 Conducting the sustainability assessment	17
4.3.1 Collecting the data	17
4.3.2 The control values	17
4.3.3 Data analysis	20
4.3.4 Results	20
5. Developing a streamlined sustainability assessment tool	23
5.1 The methods	23
5.2 The driving factors	23
5.2.1 Due diligence	23
5.2.2 Stakeholder dialogue	24
5.2.3 Water Quality	24
5.2.4 Land degradation	25
5.2.5 Ecosystem diversity	25
5.2.6 Land under AES	26
5.2.7 Material Use	26
5.2.8 Energy Use	27
5.2.9 Profitability	27
5.2.10 Dependence	27
5.2.11 Local Value Creation	28
5.2.12 Quality of life	28
5.3 The final streamlined tool	28

5.4 Testing the streamlined tool and preliminary results of the FRAMEwork Farmer Clusters	31
6. Conclusion	34
7. References	35
8. Disclaimer	37
9. Copyright	37
10. Citation	37
Appendix	38
Appendix I.....	38
Appendix II.....	43

1. Background to the FRAMEwork project

1.1 FRAMEwork Project Executive Summary (*abbreviated*)

Biodiversity is essential for agroecosystem resilience, sustainability, and long-term food security. Traditionally, management for short-term economic returns has taken priority over management for the environment. Current mechanisms for compensating and encouraging farmers to apply biodiversity sensitive management strategies are often inefficient, being applied at individual farm rather than landscape level, and tend to be generic solutions, imposed from the top down at an EU or national level. Monitoring is rarely carried out and there is therefore little scope for evaluating the success of strategies in achieving improvements to farmland biodiversity.

The FRAMEwork project has been designed and develop a novel alternative to this called the **FRAMEwork System for Biodiversity Sensitive Farming** to enable the transition of EU farming systems to a position where they can conserve biodiversity and benefit from the enhancement of ecosystem services, while mitigating agronomic or economic risks. The FRAMEwork System combines the following elements:

- **Advanced Farmer Clusters** – local farmer groups working as a collective to deliver landscape scale management, supported by a Cluster Facilitator with expertise in agriculture and the environment, and linked to a local Cluster Stakeholder Group to inform and promote policy and practice, organised into regional, national, and international networks.
- **Technical Resource** – technical specialists associated with the regional, national, international networks to provide technical information, methods, and tools to support agrobiodiversity monitoring, management and policy including the dedicated DSTs – FRAMEselect and FRAMEtest.
- **Scientific Innovation** – researchers associated with regional, national, international networks to provide knowledge on the ecology, sociology and economics that underpins the functioning of sustainable agricultural systems.
- **Citizen Observatory and Information Hub** – an open access platform to support FRAMEwork networks, sharing activities, information, data and resources between farmers, scientists, policy makers, and citizens.

The FRAMEwork project will design, build, test, and deploy a prototype of the FRAMEwork System for Biodiversity Sensitive Farming and will work with 3 concepts important to the success and delivery of the project: (i) promoting collective landscape management; (ii) applying the approach across a diversity of European farming systems; and (iii) understanding and supporting the social and ecological change associated with a transition to biodiversity sensitive farming.

1.2 Project Partners

No	Participant organisation name	Type	Country
1*	The James Hutton Institute (HUTTON)	Research Inst	UK
2	Game and Wildlife Conservation Trust (GWCT)	Non-profit	UK
3	Groupe de Recherche en Agriculture Biologique (GRAB)	Non-profit	FR
4	Universitaet fuer Bodenkultur Wien (BOKU)	University	AT
5	Eesti Maaulikool (EMU)	University	EE
6	Hoehere Bundeslehr- und Forschungsanstalt fuer Landwirtschaft Raumberg-Gumpenstein (AREC)	Research Inst	AT
7	Fundacion Artemisan (ARTEMISAN)	Non-profit	ES
8	Scuola Superiore di Studi Universitari e di Perfezionamento Sant'anna (SSSA)	University	IT
9	The University of Hertfordshire Higher Education Corporation (UNI OF HERTS)	University	UK
10	Centro de Investigacion Ecologica Yaplicaciones Forestales Consorcio (CREAF)	University	ES
11	Institut National de la Recherche Agronomique (INRAE)	Research Inst	FR
12	Internationales Institut fuer Angewandte Systemanalyse (IIASA)	Research Inst	AT
13	Universiteit van Amsterdam (UvA)	University	NL
14	Luxembourg Institute of Science and Technology (LIST)	Research Inst	LU
15	Universitaet Osnabrueck (UOS)	University	DE
16	Taskscape Associates Limited (TAL)	SME	UK
17	Ceska Zemedelska Univerzita v Praze (CULS)	University	CZ
18	Nordisk Fond for Miljo og Udvikling (NORDECO)	SME	DK

*Coordinating institution

1.3 Purpose of the Deliverable

The purpose of this deliverable is to present the methods used to calculate the overall sustainability of a subset of the Farmer Clusters in the FRAMEwork project. The report provides detailed explanations of each sustainability indicator used and their calculation methods, along with the formal analysis conducted to identify key indicators impacting overall sustainability. It also includes the methods to translate the results into a simplified, more streamlined sustainability assessment tool, and presents the results of the Farmer Clusters' sustainability assessment using a preliminary version of this tool.

2. Executive Summary

The FRAMEwork project sought to develop a practical and reliable way to assess farm sustainability in line with the EU's evolving agricultural priorities, including biodiversity restoration and sustainable food systems. Although numerous assessment tools exist, project partners identified a need for a streamlined, farmer-friendly tool tailored to the needs of Farmer Clusters and capable of offering clear guidance for improvement rather than only scientific metrics.

The project began by reviewing existing sustainability frameworks and compiling a wide range of potential sustainability indicators. Indicators were evaluated based on relevance, ease of understanding, data availability, sensitivity to change, and applicability across farming systems. A detailed assessment tool was constructed with a questionnaire and calculation spreadsheet covering over 30 indicators across topics such as land use, pesticides, water quality, energy, economics, worker wellbeing, and stakeholder relations.

Despite collecting usable data from 12 farmers in the English Farmer Cluster, low uptake across other Farmer Clusters prevented broader application of this detailed tool. Control values for the indicators were derived from literature, national statistics, and EU data to allow comparison between the English Farmer Cluster results and typical or expected farm performance. Statistical analyses identified 11 indicators significantly above or below their controls and 8 additional indicators linked to biodiversity outcomes.

Given limited engagement with the detailed tool, the project pivoted to create a simplified sustainability assessment tool that could be deployed more widely. This involved identifying the specific “driving factors” behind each significant indicator—i.e., the particular behaviours, practices, or landscape features most responsible for sustainability outcomes. These drivers were transformed into clear, action-oriented statements that farmers could easily evaluate.

Each indicator was turned into a four-level statement system (red, amber, green, dark green), making results intuitive and solutions-focused. The resulting tool allows farmers to self-assess, track progress over time, and identify areas where sustainability is declining or improving, while facilitators can quickly identify Cluster-level trends.

The final version of the streamlined assessment tool was produced as a spreadsheet with three components: an information page, the questionnaire, and automated results with colour-coded sustainability scores. The tool was then tested across several European Farmer Clusters to assess clarity, cultural relevance, and robustness across arable and mixed farming systems. Feedback from the English, Austrian, Scottish, and Czech Farmer Clusters informed final refinements, ensuring broader applicability across European contexts.

3. Sustainability assessments

As the Common Agricultural Policy (CAP) shifts its focus from maximising production to supporting sustainable food production and increasing farmland biodiversity (Nature Restoration Regulation, Farm to Fork Strategy etc.), there is a need to easily assess the varying aspects of a farm's sustainability, to ensure all sustainability pillars (Figure 1) remain stable, and the system, as a whole, is moving in a sustainable direction.

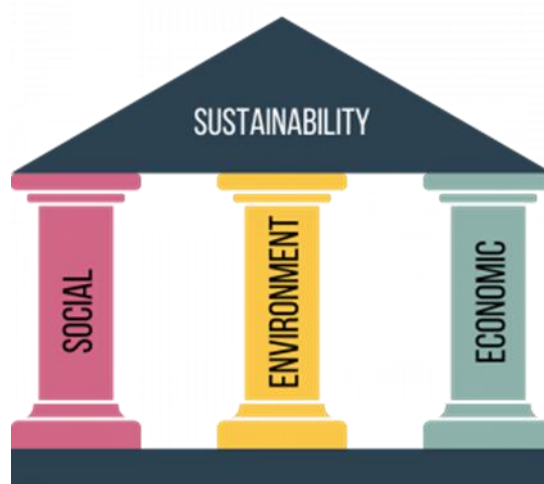


Figure 1. Pillars of sustainability. Overall sustainability is formed through multiple pillars, typically social, environmental, and economic pillars (Munro, 2023).

There are numerous sustainability assessment tools already available (SOSTARE, TAPE, SAFA etc. Paracchini et al., 2015; Mottet et al., 2020; FAO, 2013), however, an assessment was required that captured factors both experts and stakeholders within the FRAMEwork project considered to be of importance, and that were relevant to the Farmer Clusters within the project.

The initial aim was to identify suitable sustainability indicators and conduct a detailed sustainability assessment of the FRAMEwork Farmer Clusters. During the project, the focus shifted, and we instead aimed to produce a streamlined sustainability assessment tool that could be used by current and future Farmer Clusters. There are few simple, practitioner-friendly sustainability assessment tools available that not only capture the sustainability level of a farm, but that also provide steps a farmer could take should they wish to improve their sustainability within a specific area.

Therefore, the final aim was to produce a streamlined sustainability assessment tool that would allow farmers to monitor their sustainability on a regular basis and aid Farmer Cluster facilitators in identifying certain areas that were moving in the wrong direction within the Cluster and provide them with basic guidelines to help the farmers move in the right direction.

4. Developing a detailed sustainability assessment tool

4.1 The overarching sustainability indicators

The first stage was the collation of potential sustainability indicators. Multiple sustainability assessment frameworks for farming were reviewed and the indicators and their calculation methods recorded. The indicators had to be relevant, easy to understand, accessible to non-experts, easy to monitor, sensitive to changes in time, non-subjective, already acknowledged in the study of farming systems, controllable by the farmer, internationally applied in programmes, and have a data collection protocol available.

This list of potential indicators was i) cross-checked against a list of key sub-topics that followed the SAFA guidelines (FAO, 2013), which were identified through stakeholder and expert consultations, and ii) further assessed for practicality of calculation and data collection. For example, crop diversity could simply be considered as the number of crops per hectare for each farm (no. crops per ha per year). This clarified the data requirement, i.e. farmers would need to be asked how many different crops were grown within a 12-month period, and the size in hectares of their agricultural land via a questionnaire. This approach enabled the selection of indicators that were both significant to FRAMEwork stakeholders and feasible to calculate and collect data for. Indicators deemed less relevant or too complex to assess were excluded (Table 1). Over the course of the task, slight adjustments were made to this overarching list of sustainability indicators. Some were added that had previously been excluded or not considered, others were removed despite being considered and equations formulated for their calculation, and others were simply adjusted to meet the available control being used for comparison.

Table 1. Overarching list of sustainability indicators within their topics and dimensions. Potential indicators were collated and aligned with their corresponding subtopic (“N/A” indicates that no sustainability indicator was considered or identified from the overarching list). Subtopics or indicators marked with an Asterix (*) were not in the original list of sub-topics/indicators. All overarching indicators were included in the questionnaire. Indicators in **bold** were analysed against a control.

Dimension	Topics	Subtopics	Sustainability Indicators
Governance	Ethics	Due Diligence	Corporate ethics
			Sustainability protocol presence
	Participation	Stakeholder Dialogue	Stakeholder dialogue
Environmental	Atmosphere	Greenhouse gases	Total GHGe emissions
			CO2 sequestered
			CO2 released
		Air Quality	N/A
	Water	Water Use & Withdrawal	Total water use
			Water use from alternative sources
			Mass of produce per unit of water
			Total water use for top produce
		Water Quality	Area of SNH within 10m buffer of water bodies
	Land	Soil Quality	NPK stock of the soil
		Land Degradation	Area receiving low soil tillage
			Area permanent vegetation
	Biodiversity	Ecosystem Diversity	Area with woody vegetation
			Length of hedgerows
			Crop diversity
			Land under AES
		Species Diversity	N/A
	Materials & Energy	Material Use	Fertiliser use efficiency
			Nitrogen farmgate balance
			Pesticide use
			Average no. of spray rounds
			Insecticide application (proportion of crops)
			Glyphosate desiccant (proportion of crops)

Dimension	Topics	Subtopics	Sustainability Indicators
Economic		Energy Use	Total electricity use
			Amount energy produced (renewables) as % of energy used
		Waste reduction & disposal	N/A
	Investment	Internal Investment	Enrolment in a public or private scheme
		Profitability	Profit per ha per year
	Vulnerability	Dependence*	Income from subsidies
			Income from other avenues
		Stability of supply	N/A
		Stability of market	N/A
		Risk Management	N/A
	Production Quality and Information	Food Quality	N/A
		Product Information	N/A
	Local Economy	Local Value Creation	Local economy enhancement
		Local Procurement	N/A
Social	Decent livelihood	Quality of life	Wellbeing*
		Capacity development	Quality of work life
	Fair trading practices	Responsible buyers	N/A
		Rights of suppliers	N/A
	Equity	Gender equity (inclusivity)	Women in work
	Cultural diversity	Food Sovereignty	N/A


4.2 Creating the detailed sustainability tool

The tool is made up of two parts, a questionnaire (Figure 2) and an indicator calculation spreadsheet (Figure 3 - Figure 5), and was initially based on assessing the sustainability of an arable/mixed system. We started with the calculations required for each sustainability indicator that we wanted to consider (Table 1), as well as any additional Natural Assets Profiling calculations ([D7.4](#)). The equations needed for each indicator were entered into the spreadsheet, allowing us to work out what data we would need directly from the farmers, from maps of the land, and extracted from published maps of the area. The questionnaire was then constructed around gathering the specific data needed for the calculations. The questionnaire was also adapted to capture data from the orchards, and from the grassland system.

The questionnaire first provides information about the project followed by instructions for completion. It then asks for basic farm information, such as size of the farm (in ha), type of farming produce, and the dates (12-month period) that they are reporting the data from. It then goes through five sections asking for information about their farming business: agricultural produce, income and capitals, resource usage, farming practices, and business policies. The data entered in the questionnaire can then be transferred directly into the spreadsheet.

The calculation spreadsheet was designed to complement the questionnaire. The first sheet titled “About,” explains the purpose of the project and provides guidance on how to use the spreadsheet (Figure 3). The second sheet “Farm info,” covers the basic farm information requested at the beginning of the questionnaire (Figure 3). Then each sheet covers one of the questionnaire sections, with corresponding numbered questions (Figure 4). Once the data are entered, the calculations are made automatically using the embedded equations (Figure 4). The final sheet of indicator results can then be exported to conduct further data analysis (Figure 5).

Although we collected data for over 30 sustainability indicators, we couldn’t progress with all of them. For example, some had highly complex calculations (e.g. Total GHGe emissions), and when looking at the published controls, many either failed to be explicit in their calculation methods, or we didn’t have all of the data required to fully match the method that had been used in the control. In other cases, it was not possible to find a relevant published control (see section 3.3.2 for details on the calculation of control values). As a result, not all the indicators were carried forward to the data analysis stage.




Tell us about your farm business income and capitals.

4. Please tell us about the **farm business personnel**. During the 12-month reporting period, how many people worked at the farm, and how many person-hours did they do across the year? Please include family members/shareholders as well as employees and contractors that do any work for the farm business directly.

Personnel	Role	No. of people	Avg. person-hours per week	Avg. no. weeks per year
Internal/family members				
External/hired personnel				

5. Please tell us about the main **farm machinery** (maximum of 5) you use for your farm business (e.g., tractor, harvester), their age, and rough value if they were brand new?

Farm machinery	No. of units	Age (years)	Approximate value if brand new (£)



6. Please tell us about the main **farm buildings** (maximum of 5) you use for your farm business (e.g., storage barn, animal shed), their age if known, and rough value if they were built brand new?


Building	No. of units	Age (years)	Approximate value if brand new (£)

7. Please tell us about any **subsidies** you receive. Please give us an estimate of your overall income (turnover) from subsidies as percentages:

Percentage of overall income from all subsidies	%
Percentage of overall income from the basic payment	%
Percentage of overall income from agri-environment scheme payments	%

8. If you receive any **subsidies for agri-environment schemes** (public or private), please could you provide us with details about the schemes and area of land involved (if known). Details only needed for schemes covering the largest areas of land (maximum of 5).

Public or private	Overall scheme name (e.g., CS Mid-tier)	Specify the environmental option/activity (e.g., wildflower margin)	Total area under option/activity (ha)	Amount money received per ha (£)



9. Do you undertake any **other business ventures** on your land that provide a percentage of your overall income (turnover), but that aren't directly linked to farming activities (e.g., B&B, studio space, **agri-tourism**, production of renewable energy, game shoot)? If so, please provide the details below.

Business venture	% of income created

Tell us about your farm business resource usage.

Please tell us about the farm's resource usage during the 12-month reporting period. Please supply an **exact figure** wherever possible. If you cannot find the details to provide the exact figure, then please provide an **estimate** based on your prior knowledge.

Fuel

10. Please provide **fuel usage for your farm machinery**. How much **diesel** purchased?

Fuel usage (12 months)	
Diesel	litres/gallons

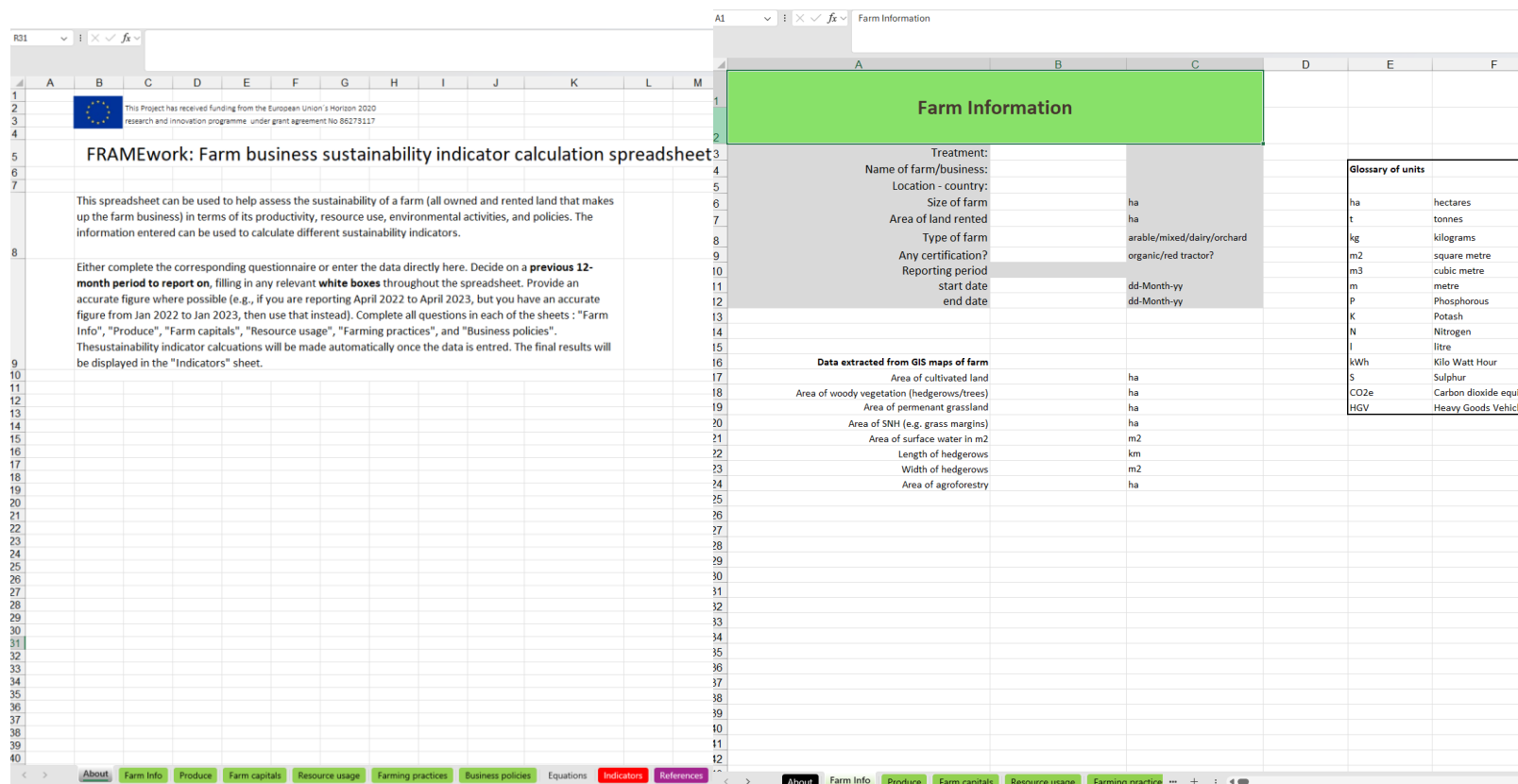
11. How much fuel used for your main **road** vehicle(s) used to get around the farm?

Fuel usage (12 months)	
Diesel	litres/gallons or miles/km
Petrol	litres/gallons or miles/km

12. Did you purchase any **additional fuel** for equipment on the farm (e.g., generators, leaf blowers)?

Fuel usage (12 months)	
Diesel	litres/gallons
Petrol	litres/gallons
Lubricating oil	litres/gallons

Figure 2. Farmer questionnaire to capture sustainability indicator and natural assets profiling data.



The screenshot displays two views of the FRAMEWORK spreadsheet. The left view shows the 'About' page, which includes a title 'FRAMEWORK: Farm business sustainability indicator calculation spreadsheet', a description of the spreadsheet's purpose, and instructions for users. The right view shows the 'Farm Info' tab, which is a form for entering farm information. This form includes sections for 'Farm Information' (with fields for Name, Location, Size, Area, Type, Certification, and Reporting period), 'Data extracted from GIS maps of farm' (with fields for various land areas and lengths), and a 'Glossary of units' table.

Glossary of units	
ha	hectares
t	tonnes
kg	kilograms
m ²	square metre
m ³	cubic metre
m	metre
P	Phosphorous
K	Potash
N	Nitrogen
l	litre
kWh	Kilo Watt Hour
S	Sulphur
CO ₂ e	Carbon dioxide equiv
HGV	Heavy Goods Vehicle

Figure 3. Sustainability indicator calculation spreadsheet. The “About” page explaining how to use the spreadsheet (left). The “Farm Info” tab that requires additional farm mapping data to be input (right).

N46

<

Figure 4. Sustainability indicator calculation example. Corresponding questions from the questionnaire (blue boxes), white boxes to be filled in with information from the questionnaire or options from the drop-down menu selected. Data is extracted and calculations made (in the green boxes).

	F	G	H	I	J	M	N
1	Dimension	Topic	Sub_topic	Indicator	Result		
2	Governance	Ethics	Due_diligence	Corporate_ethics_%	100.00		
3	Governance	Ethics	Due_diligence	Sustainability_protocol_presence_%	25.00		
4	Governance	Participation	Stakeholder_dialogue	Stakeholder_dialogue_%	62.50		
5	Environmental	Atmosphere	Greenhouse_gases	Total_GHG_emissions_tCO2e/year	321.64		
6	Environmental	Atmosphere	Greenhouse_gases	Carbon_sequestered_tCO2/ha/year	0.46		
7	Environmental	Atmosphere	Greenhouse_gases	Carbon_released_tCO2/ha/year	0.05		
8	Environmental	Materials_and_Energy	Energy_Use	Total_electricity_use_kWh	70000.00		
9	Environmental	Materials_and_Energy	Energy_Use	%_from_renewable_source_%	0.00		
10	Environmental	Materials_and_Energy	Energy_Use	Amount_energy_produced_kWh	50000.00		
11	Environmental	Materials_and_Energy	Material_use	Fertiliser_use_efficiency_t_fertiliser/t_p	27.00		
12	Environmental	Materials_and_Energy	Material_use	Nitrogen_farmgate_balance_kgN/ha	NA		
13	Environmental	Materials_and_Energy	Material_use	Pesticide_use_%	10.00		
14	Environmental	Water	Water_use_and_with	Total_water_use_m3	7000.00		
15	Environmental	Water	Water_use_and_with	Water_from_alternative_sources_%	0.00		
16	Environmental	Water	Water_use_and_with	Avg_mass_of_produce_per_unit_of_w	19.20		
17	Environmental	Water	Water_use_and_with	Total_water_use_for_top_produce_m	540.00		
18	Environmental	Water	Water_quality	Buffer	0.00		
19	Environmental	Land	Soil_quality	Risk_of_soil_compaction_low/med/hig	1.00		
20	Environmental	Land	Land_degradation	Area_receiving_low_soil_tillage_%	85.71		
21	Environmental	Land	Land_degradation	Permenant_vegetation_%	30.85		
22	Environmental	Land	Land_degradation	Risk_of_soil_loss_due_to_erosion	0.00		
23	Environmental	Biodiversity	Ecosystem_diversity	Area_land_with_woody_veg_%	28.52		
24	Environmental	Biodiversity	Ecosystem_diversity	Area_of_hedgerows_km	0.54		
25	Environmental	Biodiversity	Ecosystem_diversity	Crop_diversity_no_crops/year	8.00		
26	Environmental	Biodiversity	Ecosystem_diversity	Land_under_AES_%	3.78		
27	Economic	Investment	Profitability	Profit_per_ha_£/year	238.00		
28	Economic	Vulnerability	Dependence	Income_from_subsidies_%	15.00		
29	Economic	Vulnerability	Dependence	Income_from_other_avenues_%	2.00		
30	Economic	Local Economy	Local_value_creation	Local_economy_enhancement_%	87.50		
31	Social	Quality_of_life	Quality_of_work_and	Wellbeing_%	75.00		
32	Social	Equity	Gender_equity	Women_in_work_%	25.00		

Figure 5. Final sustainability indicator results for a single farm. Boxes highlighted in red relate to the calculations made in Figure 4.

4.3 Conducting the sustainability assessment

4.3.1 Collecting the data

The original aim was to determine the sustainability status of as many of the FRAMEwork Farmer Clusters as possible, collecting data from both the farmers in the Clusters and the farmers in the control sites using our questionnaire, and then comparing the indicator results. We began by sending the questionnaire to the Cranborne Chase, England, Farmer Cluster, in January 2024. Twelve of the 23 farmers replied within one month and had completed questionnaires to a standard that we could calculate the sustainability indicators for the Farmer Cluster. It soon became apparent that no other Farmer Clusters were willing to answer the sustainability questionnaire, likely due to a mixture of time constraints and questionnaire fatigue. Therefore, we focused on the English Farmer Cluster initially and aimed to conduct a thorough sustainability status analysis of the Cluster.

4.3.2 The control values

The aim was to compare each indicator result to a reference value that could be considered a control. This would allow us to identify indicators that were performing above or below this reference farm in terms of their sustainability. These would therefore, be “driving” the sustainability (either up or down) and likely impact the overall sustainability direction more quickly than those of an “average” status. In the case of the English Farmer Cluster, control or average expected values were sourced from the literature and published government documents due to the lack of suitable control, i.e. non-cluster, farms in the area. Where possible, European values were sourced so that the results would be comparative across European farms and Farmer Clusters, but in a lot of cases, English or UK values had to be used. This also resulted in some indicators being edited or removed due to the lack of available data with which to calculate a control value. Here we illustrate the derivation of control values by describing the indicator controls for the English Farmer Cluster.

Corporate ethics, sustainability protocol presence, stakeholder dialogue, local economy enhancement, wellbeing, and women in work.

Some indicators were considered on a qualitative categorical scale: 1 = not in place because not considered relevant; 2 = considered but not implemented yet (due to economic or technical constraints); 3 = in the process of implementation; 4 = achieved/implemented. To fit in a percentage category, 1 would equal 25%, and 4 would equal 100%. It was expected that a control farm at most would have "considered but not yet implemented" a sustainable approach in these areas. Therefore, the expected control value was set at 50% for these indicators.

Area of semi-natural habitat (SNH) within a 10m buffer of water bodies (water buffer)

This measurement was used as an indicator of water quality in the Cluster. Cole et al.'s review of the literature (2020) found that the mitigation of pollution was positively related to buffer width (Zhang et al., 2010), as the greater the width, the more vegetation is present to stop pollution particles and the further the water source is from in-field activities. Lin et al. (2011) found that increasing buffer strip width from 4 to 8 m reduced loadings of glyphosate. Overall, the first 10 m of buffer strip width provided the biggest benefit in terms of sediment trapping before effectiveness levelled off (Dorioz et al., 2006; Liu et al., 2008). We were unable to find a reliable average water buffer width for UK or European farms reported in the literature. Therefore, based on the literature, we selected a 10 m

buffer as an optimum width to improve water quality. The 10 m buffer of each water source for the 12 farms were mapped and categorised into percentages of different land uses. In total, their 10 m buffers contained 4.94% artificial land (roads, buildings etc.). If the presence of artificial land cannot be easily changed, we assume that at least 95% of the buffer should be non-artificial. Therefore, we set the expected proportion of SNH to be 0.95.

Area receiving minimum-to-no soil tillage (Low soil tillage)

Alskaf et al. (2020) estimated from 371 English farms that in 2016, nearly 48% of arable land by area was cultivated using reduced tillage, but the adoption of no-tillage remained very low at 7%. Therefore, we used 55% as our expected average control value (combining 48% reduced till and 7% no-till = 55%).

Area permanent vegetation

Eurostat (2023) indicates that in 2020, the EU's UAA was made up of 30.5% permanent grassland/meadows, and 7.1% permanent crops. Although each country's % varied, we therefore expected the UK's to fall roughly within this value and put an expected value of 37% permanent vegetation.

Area woody vegetation

In 2018, 5% of EU agricultural land held woody vegetation. With the EU directive to have 10% by 2030 (EEA, 2024), this would suggest an estimated increase of 0.42% each year between 2018 and 2030. Therefore, for data collected between 2022-2023, we'd expect the woody % to be at 6.88 %.

Area of hedgerows (Hedgerow length)

The current length of woody linear features in the UK equates to approximately 4.2 km/km² of hedgerows (Staley et al., 2022).

Land under agri-environment scheme

In 2022 in England, farms with higher-level or targeted agri-environment agreements accounted for 26% of area on agricultural holdings (2.3 million hectares; JNCC, 2024).

Fertiliser use efficiency

Using the published average figures for tonnes of produce per ha (GOV.UK, 2024), the expected average for the Cluster based on the crops they reported growing that year was estimated. The Cranborne Chase Cluster would have produced an average of 5.85 tons/ha.

The European Commission published the fertiliser input estimates in farms (EC, 2021), giving an average fertiliser use of 100-150 Euros per ha in the UK between 2014 and 2018, giving a median of 125 Euros/ha. From 2018 to 2022, there was an average price increase of 200% (AHDB, 2025), putting the median price up to €250 or £212. Therefore, £212 fertiliser per ha / 5.85 ton produce / ha = £36.24 fertiliser per ton produced.

Nitrogen farmgate balance

In the UK, the Nitrogen farmgate balance sat at 82.9 kg/ha in 2023, and 79.1 kg/ha in 2022 (GOV.UK, 2024a). Therefore, a mean of 81.0 kg/ha of Nitrogen should be the expected/average value for a British farm.

Pesticide use: number of spray rounds per crop (Pesticide use: spray rounds)

Table 4a in the pesticide usage survey report (Ridley et al., 2022) was used to get the average number of spray rounds for each of the crops grown in the Cluster. This was then used to calculate the supposed average number of spray rounds for the Cluster: 5.29 spray rounds of pesticides per crop per year.

Insecticide use

Insecticides are commonly used throughout the year, and we expect typical farms to use insecticides on 100% of their crops at some point during the year, resulting in a proportion 1.0 crops treated with insecticides.

Pesticide use: pre-harvest glyphosate application (Glyphosate use)

Glyphosate is commonly used as a crop desiccant (O'Donovan et al., 2024). Therefore, we expect farmers to apply it to their crops, resulting in an average proportion of 1.0 crops treated with glyphosate as a desiccant.

Total electricity use per ha

A recent review indicates that the annual energy use in EU open-field agriculture is at least 1431 PJ, with findings suggesting that almost 8% of open-field agriculture is powered by electricity, which is used mainly for irrigation, storage and drying activities (Paris et al., 2022). Therefore 8% of 1435 PJ is 114.64 PJ energy use. If the EU agricultural land is 157m ha, and 98.1m ha is arable land, and 11.1m is permanent crops (Eurostat (2023), this gives a total of 109.2m ha of open-field agricultural land. $114.64 \text{ PJ energy} / 109.2 \text{ m ha of land} = 1.05 \text{ PJ per million ha of land}$. Converted to kWh per ha is 291.67 kWh per ha.

Amount of energy produced as a % of energy used (Renewables produced)

In the UK, the average electricity unit rate during 2022–2023 varied significantly due to the energy crisis, but it is estimated that the rate averaged out at around 30p per kWh, so £0.30/kWh. This rate was used to convert any electricity costs into amount of electricity used during the calculation process (some farmers answered this question in amount of electricity used, some in amount spent on electricity). This ensured we had an amount of electricity used for each farm to then calculate the percentage that should have come from renewables.

In both 2022 and 2023, renewable energy sources generated approximately 135 terawatt-hours (TWh) of electricity in the UK. This equates to about 135 billion kilowatt-hours (kWh) each year. In 2022, the UK consumed approximately 317.1 terawatt-hours (TWh) of electricity, while in 2023, consumption decreased to about 309.98 TWh. Therefore, roughly 43% of the electricity used in the UK was

produced by renewable energy (National Grid, 2025). Therefore, this was used as the expected value for the Cranborne Chase farms.

Profit per ha per year

In England, the total farm business profit was £3.6bn, with 105,200 holdings and 9m ha of UAA (DEFRA, 2022). That equates to £34.2k per holding profit, or £400 per ha profit.

Income from subsidies

For cereal farms, the total received for subsidies averaged at 11.08% of income, and for mixed farms it was 10.01% (GOV.UK, 2024b). Therefore, an average of 10.5% from subsidies (AES and basic payments combined).

Income from other avenues (Diversification)

Diversification is calculated at 9.37% for cereal farms and 8.06% for mixed farms (GOV.UK, 2024b).

4.3.3 Data analysis

The indicator results from each farm were compared against their respective controls using a Wilcoxon Rank Sum test, and any found to be significantly greater or less than their controls were considered to either be driving or pulling down the sustainability, and therefore important to look at in greater detail (V; Table 2). Additionally, as the FRAMEwork project's focus was on improving overall farmland biodiversity, we thought it important capture any sustainability indicators that might also have a significant relationship with biodiversity. Therefore, for those indicators that were not found to be significantly different from the controls, their potential association with biodiversity was assessed. Generalised Linear Mixed Effects Models (GLMM) were built using a biodiversity indicator as the response variable (bumblebee and butterfly transect abundance, species richness and Shannon's diversity index; farmland bird transect abundance, species richness, and Shannon's diversity index; Filippi-Codaccioni et al., 2010), against the sustainability indicator as the explanatory variable, with farm, survey round and transect location all as individual random effects (Table 3).

4.3.4 Results

Of the initial 33 overarching sustainability indicators identified, data from the English Farmer Cluster allowed us to test 23 against their control values, of which, eleven were found to be significantly different (Table 2): corporate ethics, stakeholder dialogue, water buffers, area of permanent vegetation, area with woody vegetation, nitrogen farmgate balance, insecticide use, glyphosate use, profit, local economy enhancement, and wellbeing. The twelve indicators not found to be significantly different to the controls were tested for relationships with multiple biodiversity indicators, and eight of these were significant (Table 3): sustainability protocol, hedgerow length, land under AES, fertiliser use efficiency, pesticide use: spray rounds, renewables produced, income from subsidies, and diversification.

Table 2. Sustainability indicator statistical analysis results. Indicators with their units, the average results of the Farmer Cluster, the expected (control) value, and result of Wilcoxon Rank Sum test (V) with significant results in bold.

Dimension	Indicators	Unit	Mean	Median	SE	Expected	V	P-value
Governance	Corporate ethics	%	79.86	91.67	6.60	50.00	53.5	0.009
	Sustainability protocol presence	%	45.83	25.00	8.61	50.00	23.5	0.705
	Stakeholder dialogue	%	75.00	81.25	6.71	50.00	61.5	0.012
Environment	Water buffers	prop	0.86	0.91	0.04	0.95	9275.0	<0.001
	Low soil tillage	%	56.77	69.05	12.47	55.00	39.0	1.000
	Area permanent vegetation	%	3.41	3.22	0.38	37.00	0.0	<0.001
	Area with woody vegetation	%	1.86	1.65	0.19	6.88	0.0	<0.001
	Hedgerow length	km/km ²	4.11	4.08	0.63	4.20	34.0	0.733
	Land under AES	%	35.54	14.43	11.84	26.00	33.0	1.000
	Fertiliser use efficiency	£ / ton	27.21	34.34	5.44	36.24	14.0	0.185
	Nitrogen farmgate balance	kg N / ha	0.08	24.00	23.09	81.00	4523	0.024
	Pesticide use: spray rounds	mean #	4.14	4.14	0.89	5.29	16.0	0.262
	Insecticide use	prop	0.04	0.00	0.03	1.00	0.0	0.004
	Glyphosate use	prop	0.19	0.20	0.06	1.00	0.0	0.035
	Total electricity use per ha	kWh / ha	235.81	106.19	75.09	291.67	24.0	0.465
	Renewables produced	%	43.39	0.00	18.94	43.00	34.0	0.718
Economic	Profit	£ / ha	1397.04	1039.32	557.55	400.00	64.0	0.052
	Income from subsidies	%	22.92	15.00	7.65	10.5	61.5	0.084
	Diversification	%	14.58	2.50	5.80	9.37	46.0	0.609
	Local economy enhancement	%	81.25	87.50	5.86	50.00	50.0	0.005
Social	Wellbeing	%	72.92	75.00	7.97	50.00	58.00	0.027
	Capacity development	%	64.58	75.00	9.46	50.00	50.00	0.129
	Women in work	%	48.96	50.00	6.43	50.00	14.0	0.618

Table 3. Results of the sustainability indicators and biodiversity metrics analysis. Results of GLMM models testing each sustainability indicator against abundance, species richness, and diversity (Shannon's diversity index) of insect pollinators (bumblebees and butterflies transect walk data) and farmland birds. The abundance of just farmland bird specialists was also tested. Models that failed to converge or had poor model fits are marked as "-". Significance is recorded as: *: $p = 0.05$; **: $p = 0.01$; ***: $p = 0.001$; NS = not significant.

Indicators	Pollinators			Farmland birds			Specialist Farmland birds
	Abundance	Richness	Shannon diversity	Abundance	Richness	Shannon diversity	Abundance
Sustainability protocol presence	NS	NS	NS	NS	-	-	***
Low soil tillage	NS	-	-	NS	NS	NS	-
Hedgerow length	NS	NS	-	NS	NS	NS	**
Land under AES	NS	NS	NS	NS	**	-	NS
Fertiliser use efficiency	*	NS	NS	NS	-	-	NS
Pesticide use: spray rounds	**	NS	NS	NS	***	-	NS
Total electricity use per ha	NS	NS	NS	NS	NS	NS	NS
Renewables produced	NS	NS	NS	NS	***	NS	**
Income from subsidies	NS	NS	*	*	**	-	-
Diversification	NS	NS	*	NS	-	NS	NS
Capacity development	NS	-	NS	NS	-	NS	NS
Women in work	NS	NS	NS	NS	-	NS	NS

5. Developing a streamlined sustainability assessment tool

5.1 The methods

Although we had developed the above tool to collect and assess detailed sustainability data, our work on this halted due to the lack of data we acquired from other Farmer Clusters in the FRAMEwork project. It would not be possible to conduct an overall assessment of the FRAMEwork Farmer Clusters with such a detailed questionnaire and assessment due to lack of uptake. Instead, we needed something simpler and more streamlined, that was quicker and easier to complete, and that provided farmers with feedback and guidance, rather than data for a scientific analysis alone. We therefore shifted focus to developing a streamlined questionnaire for a sustainability assessment.

The objective was to advance beyond the approach employed in the SOSTARE method (Paracchini et al., 2015), which primarily assesses whether an indicator exceeds or falls below a reference control value. In our study, we aimed to conduct a more comprehensive analysis by examining the underlying data components contributing to each indicator described above with the aim of identifying specific variables that may be driving statistically significant outcomes for use as streamlined indicators - although the overall results for each indicator are presented (Table 2), our aim was to break down the data behind those results into their individual components (described below 4.2 The driving factors). Identification of these specific variables would enable a streamlined questionnaire to be developed, that would only require data or a response relating to the driving factor of each indicator. This would mean, in part, that any sustainability assessment conducted with the final tool would be in comparison to the direction of an English Farmer Cluster. However, it doesn't assume that the English Farmer Cluster represented the peak or standard, as indicators have been selected that were moving in both positive and negative directions. This process of identifying each driving factor is described below for the English Cluster data, as well as the final statements for each indicator that were considered to set the threshold for current sustainability.

5.2 The driving factors

5.2.1 Due diligence

Corporate ethics

This indicator was calculated from answers to three categorical questions in the questionnaire, all relating to risk assessments and safety policies. In response to these questions, we found that 75% of farmers gave a sustainable score to one question (are risk assessments in place for the safety and good working conditions of all employees and yourself?), and 67% of farmers gave a sustainable answer to the other two questions (are risk assessments in place for how farming activity might have external impacts to stakeholders and the local environment? and do you have a policy to ensure all employee training is up to date regarding health and safety standards e.g., machinery, handling chemicals?), all similar scores. However, 25% of farms considered that a policy to ensure employee training is up to date, was not relevant for their farm business. It was the only question to receive any "1" scores in the corporate ethics section. Agriculture remains one of the most dangerous industries in Britain, with

27 people killed during 2022-2023 (HSE, 2023). Therefore, health and safety remain important as part of due diligence and corporate ethics. All three questions were considered as driving the results and important to bring into the streamlined questionnaire.

We have combined all 3 questions into one sustainability statement to capture the positive responses overall for corporate ethics: “A policy has been implemented to ensure employee training is up to date regarding health and safety standards; risk assessments are in place for the safety and good working conditions of all employees and yourself; and for how farming activity might have external impacts to stakeholders and the local environment.”

Sustainability protocol

This indicator was based on one categorical question in the questionnaire (do you implement any of the environmental ISO 14000 standards in your business e.g., for irrigation, fertiliser, water treatment, waste removal, product labelling, GHG emissions?). Three of the farmers entered “NA” and one farmer a “question mark” instead of giving a score. This suggests 33% of the farmers are not aware of the ISO protocol standards, with only 25% of the farmers giving a sustainable score here. It might be that farmers are already conducting their businesses to meet these standards but are not aware of the ISO guidance. However, even though it received a significant relationship with specialist farmland bird abundances, due to the farmers’ lack of familiarity with the ISO protocols, this question was excluded from further consideration.

5.2.2 Stakeholder dialogue

Stakeholder dialogue

This indicator consisted of two categorical questions in the questionnaire, 83% of the farmers answered sustainably to one (do you encourage communication between yourself and stakeholders in your supply chains?), and just 50% of farmers answered sustainably to the second (Do you facilitate regular meetings between staff and stakeholders on matters of mutual concern?). Seven of the 12 farmers already encourage communication between themselves and stakeholders in their supply chains, with only 1 farmer not considering it relevant. Overall, both questions scored averages over 50% (control; 83.3 % and 66.7 % respectively), so both have been included moving forward.

We have combined both questions into one sustainable statement: “You encourage communication between yourself and stakeholders in your supply chains; and you facilitate regular meetings between yourself/staff and stakeholders on matters of mutual concern.”

5.2.3 Water Quality

Water buffers

Of the 12 farms we received questionnaire data for, all 12 had some form of water source present. The habitat types mapped in a 10m buffer around the water sources was analysed. Across all 12 farms, their 10m buffers contained 91.46% herbaceous and woody land cover, just over 1% of the land was not categorised into a habitat, and 2.93% of the land within the buffers was arable crops. When looking in more detail at the mapped areas where crops were found within the 10m buffers, it would

simply mean reducing the cropped areas by 4-5m to allow for a full 10m water buffer of semi-natural habitat.

Therefore, the sustainable statement is: “you have measured and can confirm that no crop is grown within a 10m buffer around any water bodies on your land.”

5.2.4 Land degradation

Area of permanent vegetation

As the values reported were much lower than the expected value, we examined the landscape composition as detailed in the cluster land use map. Hedgerows are the largest area of permanent vegetation across the Farmer Cluster (9.9% total), with pastureland (8.6%) and woodland (8.3%) close behind. There were small amounts of other permanent vegetation, and a notable lack of perennial crops (fruit trees/orchards/olive groves) and agroforestry/silvopasture within the Farmer Cluster. Therefore, to address this, a greater overall level of permanent vegetation would be required to become more sustainable, including more diversification in the vegetation type, with the inclusion of permanent crops and agroforestry. This gave rise to the selection of the following,

- 1) the sustainable statement: “You have over 25% of land under permanent vegetation (e.g. semi-natural habitats, perennial crops, grasslands)”, and;
- 2) the statement to capture further increase to sustainability: “You continue to create a diverse range of land under permanent vegetation, and/or have started/considered integrating permanent crops or agroforestry wherever possible.”

5.2.5 Ecosystem diversity

Area with woody vegetation

Woody vegetation was well-below the expected, and when we look at the breakdown of wood features, hedgerows are the highest, with 9.9% of land, followed by 8.3% of woodland, then just 2.8% of tree lines and 1.1% of transitional woodland/shrub. As it is the lack of a diversity of woody features that appears to be pulling this indicator down, we have focused on firstly achieving the expected 6% area of woody features, and then expect the diversity of woody features to continually improve as follows.

The sustainable statement is: “Over 6% of your land is covered in woody vegetation.”

The continuing to improve your sustainability statement is: “You continue to diversify the woody vegetation on your land, planting trees and allowing areas to transition to scrub and woodland wherever possible.”

Length of hedgerows

As the hedgerow lengths were not significantly different to the expected control length and only showed a relationship with specialist farmland bird abundance, we focused on meeting the expected control.

The sustainable statement is: “You have at least 4.0-4.5 km per km² of hedgerow on your land.”

5.2.6 Land under AES

Land under AES

Over 3000 ha of land were designated to multiple AES that weren't specified in the questionnaires, and another almost 1000 ha were specified with scheme details. These can roughly be broken down into categories: schemes that aid pollinators, birds, both birds and pollinators as well as other animals, and the general environment (soil, water etc.). Schemes that helped the general environment covered the biggest area of land (665 ha), as these typically were whole field areas and conversions or grassland or organic. The largest contribution here was a 430 ha area of organic rotational crop. The next biggest was a low input cereal field on one farm (220 ha) that benefited multiple species (birds, pollinators, other mammals etc.). The smallest areas were for pollinators (27.2 ha) such as pollen and nectar or wildflower plots and strips, as these would typically be confined to field margins or corners.

As the significant result is therefore being driven by the larger, whole-field farming practices, this is what the focus of the sustainable statement will be: "You have AES that cover whole-field practices such as low-input cereals and grassland, or organic farming."

5.2.7 Material Use

Fertiliser use efficiency

As we didn't collect data on how much fertiliser per crop the farmers used, only the amount spent on fertilisers, it is difficult to determine if any crops were receiving above or below the average amounts. Therefore, instead we focused our sustainability statement on an overall reduction of fertilisers, in particular, nitrogen fertilisers.

Sustainable statement: You have reduced the amount (on average) or already use very low levels of synthetic nitrogen fertiliser, per ha.

Nitrogen farmgate balance

As nitrogen use was already very low on the farms, we decided to capture this in the above statement (fertiliser use efficiency).

Pesticide use: spray rounds

If we focus on the crops that were grown on >1 farm and covered the greatest area of land (wheat, barley, peas, OSR, and maize) and look at the average number of spray rounds applied to these crops, they received average spray round of 6.11, 5.22, 4.00, 4.67, and 2.00, respectively. We decided therefore to focus on the spray rounds associated with wheat and barely crops. Rather than expecting a sustainable farmer to be arbitrarily reducing spray rounds, we suggest that sustainable farmers will use technology that helps guide them in where to spray, how much to spray, and even to help calculate if they even need to spray a certain treatment.

Sustainable statement: You have used technology or pest monitoring methods to assess if plant protection product use is required (e.g. T-sum to determine BYDV aphid pressure for barley), avoiding insecticide use during the spring-summer months across all crops, and/or have reduced the average number of spray rounds compared to previously.

Pesticide use: insecticide use

Insecticide use was much lower than expected, only used during the spring-summer months on peas and beans (2 instances across the 12 farms and 41 crops being grown). We have used insecticide treatments through the above spray-rounds indicator.

Pesticide use: glyphosate use

Glyphosate use as a pre-harvest desiccant was relatively low across the farms, with 1 each instance of beans, herbage seed and peas receiving treatment, but 5 out of the 6 farms where OSR was grown received glyphosate application. With concerns over glyphosate-based products entering the human food-chain directly (Torretta et al., 2018), we focused the statements on this.

The sustainable statement: You do not/have stopped using a glyphosate-based product as a crop desiccant (pre-harvest spray) on all crops (including oil seed rape).

The statement resulting in a decline in sustainability: You used a glyphosate-based product as a crop desiccant (pre-harvest spray), using more than the previous year, and/or this produce entered the human food chain directly.

5.2.8 Energy Use

Renewables produced

As we gained no additional information relating to the form of renewable energy produced, we focused on the expected value for our sustainability statement: You produce at least 40% of your annual electricity consumption through renewables means on your land.

5.2.9 Profitability

Profit per ha per year

When looking at the breakdown of farm business incoming and expenditures, there was no clear element that was driving this result. Therefore, the sustainability statement simply focuses on whether the farmer found the business to be profitable: Your overall business profit has provided your household with a sufficient income.

5.2.10 Dependence

Income from subsidies

The average or expected percentage of income from subsidies is at 10.5% per year (with AES and basic payments combined). However, the FC was reaching an average of 11.4% income purely from basic payments, with an additional average of 9.2% income from AES. Therefore, as it is the environmental subsidies that are pushing this result, we have focused the multiple-choice question on these, especially as Basic Payments are reduced in the UK and this questionnaire needs to be relevant across all of Europe. By pushing for a 10%+ income from subsidies this increases financial stability.

The sustainable statement is: You have applied for environmental subsidies, and these provide on average, over 10% of your total income.

Diversification

To prevent another question based around the same topic of profit and avenues of income, it was decided instead that “diversification” would be used as the “green+” statement for the profit indicator to capture those businesses that were profitable and continually expanding their businesses with other ventures:

You continue to diversify your farm business income with additional ventures and subsidies.

5.2.11 Local Value Creation

Local economy enhancement

This indicator consisted of two categorical questions (1. Do you have a policy to procure through local suppliers wherever possible?; 2. Do you have a policy to hire regional people wherever possible?). Two farmers deemed question 2 to be irrelevant, leaving 67% of farmers to answer the question sustainably, whilst 75% of farmers answered question 1 sustainably. Therefore, both questions appear to be driving the significant result.

We have combined both questions into one sustainable statement: You have a policy to procure through local suppliers; and to hire regional people, wherever possible.

5.2.12 Quality of life

Wellbeing

This indicator consisted of two categorical questions (1. Do you have a system in place to discuss periodically the physical burden and mental health of yourself or your employees?; 2. Do you have a policy to ensure employees have a sustainable work-life balance (e.g., offering flexible working, 4 day working week, weekends off)? One farm entered “NA” for both questions, and another considered all 3 questions to be irrelevant. 75% of farmers replied sustainably to question 1, and 67% of farmers replied sustainably to question 2. Therefore, these were both clearly driving the significant result and were selected for the streamlined questionnaire.

We have combined both questions into one sustainable statement: You have both a system in place to discuss periodically the physical burden and mental health of yourself or your employees; and a policy to ensure employees have a sustainable work-life balance (e.g., offering flexible working during quieter periods).

5.3 The final streamlined tool

Once each of the sustainable statements had been identified, the alternative options needed to be defined, and adjustments made so that a 4-tiered traffic light system could be created. Red represents sustainability declining (25%), amber is no different to a control or average farm (50%), green is optimum sustainability (75%), and dark green is constantly improving the sustainability level (100%). The conversion to percentages makes it as easy as possible to calculate scores for combined indicators, and average across multiple farms within the Cluster. The full set of indicator questions and multiple-choice options can be found in Appendix I.

The streamlined sustainability assessment tool was created in the form of a spreadsheet questionnaire and is freely available on Zenodo (Nichols, 2025). The “Info page” describes the purpose of the tool and explains how to use the tool (Figure 6A). The “Sustainability Assessment Tool” tab (Figure 6B) contains the questionnaire. Each indicator has a choice of four statements to choose from, and the farmer selects the statement that most fits their current activity, or activity since the last assessment. There are numbers (1-4) above the statements, and the farmer selects the number from the drop-down menu that links to the statement they have chosen. Finally, the “Results” tab (Figure 6C) shows the farmer the results of their assessment with percentage scores and a colour to aid in identifying quickly which indicators are doing well and which require some work. Those in light or dark green are sustainable and aiding in the overall sustainability of the farm, and those in amber or red require some changes to be made to prevent the sustainability of farm decreasing over time.

A

FRAMEWORK

Practitioner Sustainability Assessment Tool
Please read through all the text on this "Info page" carefully before beginning your assessment.

This sustainability assessment tool has been developed as part of the FRAMEWORK project, a Horizon 2020 EU funded project that looked at biodiversity across Europe within Farmer Clusters. This tool was developed to determine the overall sustainability levels and directions that the arable/mixed Farmer Clusters were moving in an easy and practical way. This assessment should be completed as an individual arable/mixed farm business, even if part of a Farmer Cluster.

This spreadsheet consists of three tabs. The "Info page" describes the tool and how to use it. The "Sustainability Assessment Tool" tab contains all the sustainability indicators that you need to answer. The "Results" tab will show your results once you've completed the assessment tool tab.

Instructions for the assessment:

- Go to the "Sustainability Assessment Tool" tab
- There are 16 indicators, separated into their "dimensions" and "sub-topics".
- Each indicator has 4 statements in its row (columns D-G). For each indicator, read through statements 1-4 in order to determine which category you fall (most closely) into.
- Statements in column 4 begin with "3 +", because statement 4 requires you to have already achieved statement 3, plus the additional work that is present in column 4.
- Check if there are any "notes" for each indicator in the "notes" column (columns I-L).
- In the "Your answer" column (H), from the drop-down menu, select the number (row 2) that aligns with the statement that fits your circumstances.
- In some cases it might be appropriate to select "NA" (see notes column).
- Once you've given each indicator an answer, go to the "Results" tab.

B

Dimension	Sub-topic	Indicator	1	2	3	4	Your answer	Notes
Governance	Due diligence	Corporate ethics	Policy is not present among employee training is up to date regarding health and safety standards, and risk assessments are in place for the safety and good working conditions of all employees and yourself, and a risk assessment for how farming activity might have external impacts to stakeholders and the local environment.	Policy is present among employee training is up to date regarding health and safety standards, and risk assessments are in place for the safety and good working conditions of all employees and yourself, and a risk assessment for how farming activity might have external impacts to stakeholders and the local environment.	Policy is present among employee training is up to date regarding health and safety standards, and risk assessments are in place for the safety and good working conditions of all employees and yourself, and a risk assessment for how farming activity might have external impacts to stakeholders and the local environment.	3+ Your policies and risk assessments are routinely checked and updated.	2	
	Stakeholder dialogue	Stakeholder dialogue	There is very little to no communication between yourself and stakeholders in your supply chain.	You encourage communication between yourself and stakeholders in your supply chain, and you facilitate regular meetings between yourself and stakeholders on matters of mutual concern.	You encourage communication between yourself and stakeholders in your supply chain, and you facilitate regular meetings between yourself and stakeholders on matters of mutual concern.	3+ Communications and meetings with stakeholders are becoming more regular and relationships are forming well between the business and stakeholders.	3	
Land degradation	Water quality	Water buffers	You have not measured and/or it is likely that crops in green within a 10m buffer around any water bodies on your land.	You have measured and can confirm that crops in green within a 10m buffer around any water bodies on your land.	You have measured and can confirm that no crops in green within a 10m buffer around any water bodies on your land.	3+ You continue to enhance the semi-natural habitat areas to buffer with diverse plants.	4	here crop refers to an annual, double-cropland (e.g. rapeseed), select "NA" if you have no water bodies on your land.
	Land degradation	Area of permanent vegetation	You have under 20% of land under permanent vegetation (e.g. semi-natural habitats, permanent crops, grasslands).	You have about 20% of land under permanent vegetation (e.g. semi-natural habitats, permanent crops, grasslands).	You have over 20% of land under permanent vegetation (e.g. semi-natural habitats, permanent crops, grasslands).	3+ You continue to create a diverse range of land under permanent vegetation, and are integrating permanent crops or agroforestry/afforestation where possible.	1	
Ecosystem diversity	Biodiversity	Biodiversity	Formal biodiversity monitoring has not been conducted on your land, neither by yourself, nor with the assistance of expert farmers/volunteers, the use of an App, or by contributing to a formal national monitoring scheme.	Ad hoc or opportunistic biodiversity monitoring has been conducted on your land either by yourself, or with the assistance of expert farmers/volunteers, the use of an App, or by contributing to a formal national monitoring scheme.	Formal biodiversity monitoring has been conducted on your land either by yourself, or with the assistance of expert farmers/volunteers, the use of an App, or by contributing to a formal national monitoring scheme.	3+ You will continue to monitor on a regular (1-5 years) basis, documenting either as a farm and/or submitting records to national monitoring schemes.	4	
	Area with woody vegetation	Area with woody vegetation	Less than 5% of your land is covered in woody vegetation.	Between 5-4% of your land is covered in woody vegetation.	Over 5% of your land is covered in woody vegetation.	3+ You continue to diversify the woody vegetation on your land, planting trees and allowing areas to transition to scrub and woodland where possible.	3	
Environment	Land under AES	Land under AES	You have no paid for AESs or self-funded environmental habitat management areas on your land.	You have paid for AESs or self-funded environmental habitat management areas on your land, but none that cover whole field practices such as low input cereals and grassland, or organic farming.	You have paid for AESs or self-funded environmental habitat management areas that cover whole field practices such as low input cereals and grassland, or organic farming.	3+ You continue to diversify the different environmental habitat managements on your land through both funded AESs and self-funded environmental habitat management areas.	2	
	Length of hedgerows	Length of hedgerows	You have no hedgerows on your land.	You have less than 4.0 km per ha ² of hedgerows on your land.	You have at least 4.0-4.5 km per ha ² of hedgerows on your land.	3+ You have also completed a hedgerow condition assessment and continue to increase the width and/or diversity of your hedgerows.	2	
Fertiliser use efficiency	Fertiliser use efficiency	Fertiliser use efficiency	You have increased the amount (on average) or already use very high levels of synthetic nitrogen fertiliser, per ha.	You have maintained the amount (on average) or only use average levels of synthetic nitrogen fertiliser, per ha.	You have reduced the amount (on average) or already use very low levels of synthetic nitrogen fertiliser, per ha.	3+ You continue to use the knowledge to calculate the amount of nitrogen application needed, making the amount applied otherwise possible.	2	

C

Dimension	Sub-topic	Indicator	Results per indicator (%)	Code	Description
Governance	Due diligence	Corporate ethics	50	Low priority	continue current activities in this area
	Stakeholder dialogue	Stakeholder dialogue	75	Low priority	continue current activities in this area and look for minor improvements
Land degradation	Water quality	Water buffers	100	Medium priority	look to improve activities in this area
	Land degradation	Area of permanent vegetation	25	High priority	look to improve activities in this area
Ecosystem diversity	Biodiversity	Biodiversity	100		
	Area with woody vegetation	Area with woody vegetation	75		
Environment	Land under AES	Land under AES	75		
	Length of hedgerows	Length of hedgerows	75		
Fertiliser use efficiency	Fertiliser use efficiency	Fertiliser use efficiency	50		
	Pesticide use: spray rounds	Pesticide use: spray rounds	50		
Material Use	Pesticide use: glyphosate	Pesticide use: glyphosate	75		
	Renewables produced	Renewables produced	25		
Economic	Profitability	Profit	100		
	Dependence	Income from subsidies	50		
Social	Local Value creation	Local economy enhancement	100		
	Quality of life	Wellbeing	75		

Figure 6. Streamlined sustainability assessment tool. A) the "info page" tab; B) the "sustainability assessment tool" tab as a questionnaire in multiple choice format; C) the "results" tab. Example data entered to illustrate how the results will display.

5.4 Testing the streamlined tool and preliminary results of the FRAMEwork Farmer Clusters

Due to basing the tool on data collected through only the English Farmer Cluster, it was important to test the tool on European Farmer Clusters to ensure that the statements were representative of farming norms throughout Europe. Testing the tool on the other arable/mixed FRAMEwork Farmer Clusters would allow us to identify any flaws in the statements and their relative “sustainability scores”. It would also allow us to assess the Farmer Clusters to determine if they were indeed making progress towards a sustainable system since joining the FRAMEwork project.

The FRAMEwork arable/mixed Farmer Clusters present a range of norms. For example, the Velké Hostěrádky and Kanepi kihlkund Farm Clusters had very large field sizes, and Velké Hostěrádky also had very little semi-natural habitat. Different countries have different water buffer size requirements. On-site processing levels will vary country-to-country, with more being done on the farm in some countries, and more done off-site at specialist factories in others, and so we can expect electricity use and reliance on renewables to vary across the Farmer Clusters. Different countries will also have different attitudes and expectations of policies relating to employment and business. Therefore, it was important to test the tool to identify any flaws that could be amended before publishing the final version, and we could see if any statements and their scores required shifting to align more closely with other European farms.

A preliminary version of the streamlined sustainability tool (in a word document format – Appendix II) went out to all the arable/mixed Farmer Clusters in the FRAMEwork project (after translation) in January 2025, and we received useable feedback by the end of February 2025 from four of the Clusters ([Cranborne Chase](#), England; [Burgenland](#), Austria; [Buchan](#), Scotland; and [Velké Hostěrádky](#), Czech Republic). This version was based on initial analysis (described above). However, when writing up the methods, many of the control sources were re-checked and consequently, results were re-analysed. Therefore, some indicators that are identified (Table 2 - Table 3) were not in the preliminary version. Hence, the results described below should only be considered as indicative of the sustainability levels and directions of the Farmer Clusters, although still providing an idea of their progress and what future assessments would be likely to divulge.

The completed preliminary questionnaires were carefully considered, and results edited as described below, where necessary:

1. Blank response (no boxes ticked at all for a question):

If no comment given to explain a blank response, then left as “N/A” for analysis.

Some respondents left the use of pesticides and glyphosate blank or answer “B”, with a comment indicating the whole system was organic and therefore these chemicals had never been used. We had not incorporated this option into the possible answers, and so in these instances, it was deemed that as the system was sustainable before starting FRAMEwork, and had remained at that sustainable level,

they were given a “D” score as this was deemed the most sustainable option possible. The final version published will have the wording altered so that this is captured in any future surveys.

Other answers left blank with no clear comment as to why were also labelled as N/A.

2. Two contradicting answers given:

The multiple-choice options were A-C. However, if someone answered A, they were also given the opportunity to read an additional statement (D) and select that as well. However, some individuals selected answers B or C, and D. In other words, they were saying that had not managed to improve their sustainability directly in the manner we described, but felt they had made advances elsewhere. In these instances, we took their initial answer (B or C) for analysis, but made a note of the D response for inclusion in the more qualitative analysis.

3. Comments indicated adjustment needed:

This mostly occurred for semi-natural habitat indicators. The wording meant that at no point could a farmer select that they had no hedges/permanent vegetation/woody vegetation. They were mostly selecting B, indicating that the level of vegetation had not changed. However, to truly capture the sustainability, the wording should have included the option under C to have none to begin with. Therefore, these were adjusted to reflect this.

Once these adjustments were made, the final results were averaged across the farms within each Cluster and are presented as a spider diagram (Figure 7).

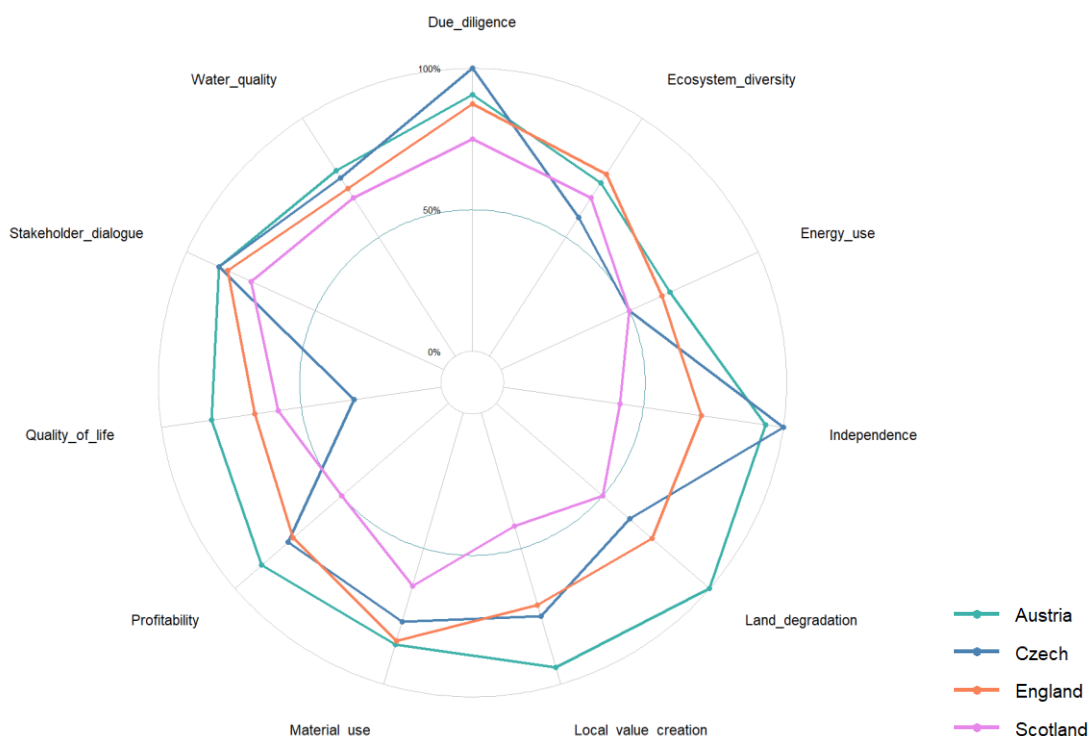


Figure 7. Preliminary sustainability indicator results. Results obtained from a preliminary version of the sustainability assessment tool and averaged across the farms within each Farmer Cluster.

The overall sustainability scores would place both the Austrian and English Farmer Clusters in a very positive direction, and both the Czech and Scottish Farmer Clusters with overall sustainable scores (Table 4). The Scottish Cluster is the closest to falling into a control or average farm category, and might require some work in a few areas (local value creation, and independence fall below the 50% mark; Figure7), to improve certain indicator scores and raise its overall sustainability score.

Table 4. Sustainability scores. Sustainability scores averaged across all indicators for each of the Farmer Clusters.

Farmer Cluster (Country)	Sustainability score
Burgenland (Austria)	83.6 %
Cranborne Chase (England)	76.0 %
Velké Hostěrádky (Czech Republic)	70.8 %
Buchan (Scotland)	59.3 %

Both due diligence and stakeholder dialogue received the highest scores across the four Farmer Clusters, averaging at 89.4% and 85.0% respectively. As these sub-topics cover the governance dimension, this is a positive sign of accountability and good decision-making within the agriculture industry within these Farmer Clusters.

Energy use as a sub-topic received the lowest average score across the Farmer Clusters (60.2%), however, when we looked at the explanations provided in the questionnaire feedback, 25.9% of farmers described already low electricity use (e.g. “very little electricity used in our farming”, “low already”, “difficult to improve on the small amount of electricity use here...”), suggesting a potential re-phrasing of the multiple-choice statements is needed that captures below average use already.

The lowest indicator score overall was hedgerow length, with an average of just 58.3 % across the four Farmer Clusters. When we broke it down by country, we found that England had a score of 72.9%, almost into the top sustainability band. However, the Velké Hostěrádky Farm Cluster, Czech Republic, only scored 25.0%, and when we looked at the feedback in the questionnaires, we saw that this was due to the lack of hedgerows (and any permanent vegetation) on their farms (e.g. “hedges are not found in the cluster”, “we don't have an area with permanent vegetation”). This highlights a need for improvement in forms of semi-natural habitat found in this Farmer Cluster to ensure it continues to move in a sustainable direction in all dimensions.

6. Conclusion

The streamlined questionnaire should be considered a starting point for any farm or Farmer Cluster to begin assessing multiple aspects of their overall sustainability. By identifying areas that are moving in the right direction, we acknowledge the hard work and progress of the farmer. By highlighting areas that need improvement, we are not criticising the farmer but suggesting small steps they could make to start moving in a more sustainable direction that will ultimately provide the farmer with a sustainable farming business. Where multiple farms within a Farmer Cluster are all taking these steps to become more sustainable, the landscape and people in it can flourish.

7. References

Alskaf, K., Sparkes, D.L., Mooney, S.J., Sjögersten, S. and Wilson, P., 2020. The uptake of different tillage practices in England. *Soil Use and Management*, 36(1), pp.27-44.

Cole, L.J., Stockan, J. and Helliwell, R., 2020. Managing riparian buffer strips to optimise ecosystem services: A review. *Agriculture, ecosystems & environment*, 296, p.106891.

DEFRA (2022). Agriculture in the UK Evidence Pack. September 2022 update. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1106562/AUK_Evidence_Pack_2021_Sept22.pdf#:~:text=This%20represents%20just%20under,2.1%25%20of%20UK%20arable%20land (Accessed: 21 July 2025)

Dorioz, J.M., Wang, D., Poulenard, J. and Trevisan, D., 2006. The effect of grass buffer strips on phosphorus dynamics—a critical review and synthesis as a basis for application in agricultural landscapes in France. *Agriculture, Ecosystems & Environment*, 117(1), pp.4-21.

European Environment Agency (EEA) (2024) Woody landscape features on agricultural land in Europe. Available at: <https://www.eea.europa.eu/en/analysis/indicators/woody-landscape-features-on-agricultural-land> (Accessed: 09 April 2025).

Eurostat (2023) Agri-environmental indicator - cropping patterns. Available at: [Agri-environmental indicator - cropping patterns - Statistics Explained - Eurostat](#) (Accessed: 09 April 2025).

Eurostat (2024) Renewable energy statistics. Available at: https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Renewable_energy_statistics (Accessed: 11 April 2025).

Filippi-Codaccioni, O., Devictor, V., Bas, Y., conservation, R. J.-B. (2010). Toward more concern for specialisation and less for species diversity in conserving farmland biodiversity. Elsevier. <https://www.sciencedirect.com/science/article/pii/S0006320710001205?via%3Dihub>

Food and Agriculture Organization of the United Nations (FAO). (2013). Sustainability Assessment of Food and Agriculture Systems: SAFA Guidelines, Version 3.0; Food and Agriculture Organization of the United Nations: Rome, Italy; Available at: [https://www.fao.org/fileadmin/templates/nr/sustainability_pathways/docs/SAFA_Guidelines_Version_3.0%20\(Accessed:%2001%20January%202023\)](https://www.fao.org/fileadmin/templates/nr/sustainability_pathways/docs/SAFA_Guidelines_Version_3.0%20(Accessed:%2001%20January%202023)).

Gallizzi, B. (2023) UK renewable energy statistics 2024, Uswitch. Available at: <https://www.uswitch.com/gas-electricity/studies/renewable-statistics/?msocid=38ed62dc12bc6a4e3f50710113846b99> (Accessed: 11 April 2025).

GOV.UK (2024) Chapter 7: Crops. Available at: <https://www.gov.uk/government/statistics/agriculture-in-the-united-kingdom-2023/chapter-7-crops> (Accessed: 08 April 2025).

GOV.UK (2024a) Soil nutrient balances UK, 2023 - statistics notice. Available at: <https://www.gov.uk/government/statistics/uk-and-england-soil-nutrient-balances-2023/soil-nutrient-balances-uk-2023-statistics-notice#uk-nitrogen-balance> (Accessed: 11 April 2025).

GOV.UK (2024b) Farm accounts in England data sets. Table 5: Business Outputs, Input Costs and Incomes. Available at: <https://www.gov.uk/government/statistics/farm-accounts-in-england-data-sets> (Accessed: 21 July 2025).

HSE (2023). Fatal injuries in agriculture, forestry and fishing in Great Britain. 1 April 2022 to 31 March 2023. Available at: <https://www.hse.gov.uk/agriculture/assets/docs/agriculture-fatal-injuries-2023.pdf> (Accessed: 21 July 2025).

JNCC (2024) Area of land in Agri-Environment Schemes. Available at: <https://jncc.gov.uk/our-work/ukbi-agri-environment-schemes/> (Accessed: 11 April 2025).

EC (2021), Fertiliser input estimates in farms, An overview of costs and quantities of the three main fertilizer, July 2021. European Commission, DG Agriculture and Rural Development, Brussels

AHDB (2025) GB fertiliser prices. Available at: <https://ahdb.org.uk/GB-fertiliser-prices> (Accessed: 08 April 2025).

Lin, C.H., Lerch, R.N., Goyne, K.W. and Garrett, H.E., 2011. Reducing herbicides and veterinary antibiotics losses from agroecosystems using vegetative buffers. *Journal of environmental quality*, 40(3), pp.791-799.

Liu, X., Zhang, X. and Zhang, M., 2008. Major factors influencing the efficacy of vegetated buffers on sediment trapping: A review and analysis. *Journal of Environmental Quality*, 37(5), pp.1667-1674.

Mottet, A., Bicksler, A., Lucantoni, D., De Rosa, F., Scherf, B., Scopel, E., ... & Tittonell, P. (2020). Assessing transitions to sustainable agricultural and food systems: a tool for agroecology performance evaluation (TAPE). *Frontiers in Sustainable Food Systems*, 4, 579154.

Munro, T. (2023). Introduction to Sustainability. MacEwan Open Books. <https://doi.org/10.31542/b.gm.4>

National Grid (2025). How much of the UK's energy is renewable? Available at: <https://www.nationalgrid.com/stories/energy-explained/how-much-uks-energy-renewable> (Accessed: 21 July 2025).

Nichols, R. (2025). Practitioner Sustainability Assessment Tool. Zenodo. <https://doi.org/10.5281/zenodo.17083854>.

O'Donovan, J.T., Kubota, H., Harker, K.N., Turkington, T.K., May, W., Johnson, E.N., Beres, B., Izydorczyk, M., Oatway, L., de Gooijer, H. and Mulenga, A., 2024. The effects of pre-harvest glyphosate rate and timing on yield and pre-malt quality of malting barley. *Canadian Journal of Plant Science*, 104(5), pp.431-440.

Paracchini, M. L., Bulgheroni, C., Borreani, G., Tabacco, E., Banterle, A., Bertoni, D., ... & De Paola, C. (2015). A diagnostic system to assess sustainability at a farm level: The SOSTARE model. *Agricultural Systems*, 133, 35-53.

Paris, B., Vadorou, F., Balafoutis, A.T., Vaiopoulos, K., Kyriakarakos, G., Manolakis, D. and Papadakis, G., 2022. Energy use in open-field agriculture in the EU: A critical review recommending energy efficiency measures and renewable energy sources adoption. *Renewable and Sustainable Energy Reviews*, 158, p.112098.

Ridley, L., Parrish, G., Chantry, T., Richmond, A., MacArthur, R. & Garthwaite, D. (2022) Pesticide Usage Survey Report 309 - Arable Crops in the United Kingdom, 2022. York: Fera

Staley, J.T., Wolton, R. and Norton, L.R., 2023. Improving and expanding hedgerows—Recommendations for a semi-natural habitat in agricultural landscapes. *Ecological Solutions and Evidence*, 4(1), p.e12209.

Zhang, X., Liu, X., Zhang, M., Dahlgren, R.A. and Eitzel, M., 2010. A review of vegetated buffers and a meta-analysis of their mitigation efficacy in reducing nonpoint source pollution. *Journal of environmental quality*, 39(1), pp.76-84.

8. Disclaimer

The information presented here has been thoroughly researched and is believed to be accurate and correct. However, the authors cannot be held legally responsible for any errors. There are no warranties, expressed or implied, made with respect to the information provided. The authors will not be liable for any direct, indirect, special, incidental, or consequential damages arising out of the use or inability to use the content of this publication.

9. Copyright

© All rights reserved. Reproduction and dissemination of material presented here for research, educational or other non-commercial purposes are authorised without any prior written permission from the copyright holders provided the source is fully acknowledged. Reproduction of material for sale or other commercial purposes is prohibited.

10. Citation

Nichols, R. N. (2025). D7.1 Report presenting sustainability indicator calculations and a simplified sustainability assessment tool for use by Advanced Farmer Clusters. For the EU-H2020 funded project FRAMEwork under Grant Agreement Number 862731. DOI: 10.5281/zenodo.16608438.

Appendix

Appendix I

Indicator	Statements			
	Red (1)	Amber (2)	Green (3)	Dark green (4)
Corporate ethics	Policy is not present ensuring employee training is up to date regarding health and safety standards; neither are there risk assessments in place for the safety and good working conditions of all employees and yourself; nor a risk assessment for how farming activity might have external impacts to stakeholders and the local environment.	Either policy is present ensuring employee training is up to date regarding health and safety standards; or risk assessments are in place for the safety and good working conditions of all employees and yourself; or a risk assessment for how farming activity might have external impacts to stakeholders and the local environment.	Policy is present ensuring employee training is up to date regarding health and safety standards; and risk assessments are in place for both the safety and good working conditions of all employees and yourself; and a risk assessment for how farming activity might have external impacts to stakeholders and the local environment.	3 + Your policies and risk assessments are routinely checked and updated.
Stakeholder dialogue	There is very little to no communication between yourself and stakeholders in your supply chains.	You encourage communication between yourself and stakeholders in your supply chains; or you facilitate regular meetings between yourself/staff and stakeholders on matters of mutual concern.	You encourage communication between yourself and stakeholders in your supply chains; and you facilitate regular meetings between yourself/staff and stakeholders on matters of mutual concern.	3 + Communications and meetings with stakeholders are becoming more regular and relationships are forming well between the business and stakeholders.
Water buffers	You have not measured and/or it is likely that crop is grown within a 10m buffer around any water bodies on your land.	You have measured and can confirm that crop is grown within a 10m buffer around any water bodies on your land.	You have measured and can confirm that no crop is grown within a 10m buffer around any water bodies on your land.	3 + You continue to enhance the semi-natural habitat water buffers with diverse plants.

Indicator	Statements			
	Red (1)	Amber (2)	Green (3)	Dark green (4)
Area of permanent vegetation	You have under 25% of land under permanent vegetation (e.g. semi-natural habitats, perennial crops, grasslands).	You have about 25% of land under permanent vegetation (e.g. semi-natural habitats, perennial crops, grasslands).	You have over 25% of land under permanent vegetation (e.g. semi-natural habitats, perennial crops, grasslands).	3 + You continue to create a diverse range of land under permanent vegetation, and are integrating permanent crops or agroforestry/silvopasture wherever possible.
Biodiversity	Formal biodiversity monitoring has not been conducted on your land, neither by yourself, nor with the assistance of expert surveyors/volunteers, the use of an App, or by contributing to a formal national monitoring scheme.	Ad hoc or opportunist biodiversity monitoring has been conducted on your land, either by yourself, or with the assistance of expert surveyors/volunteers, the use of an App, or by contributing to a formal national monitoring scheme.	Formal biodiversity monitoring has been conducted on your land, either by yourself, or with the assistance of expert surveyors/volunteers, the use of an App, or by contributing to a formal national monitoring scheme.	3 + You will continue to monitor on a regular (1-5 yearly) basis, documenting either as a farm and/or submitting records to national monitoring schemes
Area with woody vegetation	Under 6% of your land is covered in woody vegetation.	About 6% of your land is covered in woody vegetation.	Over 6% of your land is covered in woody vegetation.	3 + You continue to diversify the woody vegetation on your land, planting trees and allowing areas to transition to scrub and woodland wherever possible.
Land under AES	You have no paid-for or self-funded AES on your land.	You have paid-for or self-funded AES on your land, but none that cover whole-field practices such as low-input cereals and grassland, or organic farming.	You have paid-for or self-funded AES that cover whole-field practices such as low-input cereals and grassland, or organic farming.	3+ You continue to apply for funded AES, diversifying the environmental schemes on your land

Indicator	Statements			
	Red (1)	Amber (2)	Green (3)	Dark green (4)
Length of hedgerows	You have no hedgerows on your land.	You have hedgerows on your land.	You have at least 4.0-4.5 km/km² of hedgerow on your land.	3 + You have also completed a hedgerow condition assessment and continue to increase the width and/or diversity of your hedgerows
Fertiliser use efficiency	You have increased the amount (on average) or already use very high levels of synthetic nitrogen fertiliser, per ha.	You have maintained the amount (on average) or only use average levels of synthetic nitrogen fertiliser, per ha.	You have reduced the amount (on average) or already use very low levels of synthetic nitrogen fertiliser, per ha.	3 + You continue to use technology to calculate the amount of fertiliser application needed, reducing the amounts applied wherever possible.
Pesticide use: spray rounds	You do not use technology or pest monitoring methods to assess if plant protection product use is required (e.g. T-sum to determine BYDV aphid pressure for barley), and/or spray insecticides during the spring-summer months across crops, and/or have increased the average number of spray rounds compared to previously.	You have considered or will shortly implement technology or pest monitoring methods to assess if plant protection product use is required (e.g. T-sum to determine BYDV aphid pressure for barley), and/or avoid insecticide use during the spring-summer months across most crops, and/or have maintained the average number of spray rounds compared to previously.	You use technology or pest monitoring methods to assess if plant protection product use is required (e.g. T-sum to determine BYDV aphid pressure for barley), and/or avoid insecticide use during the spring-summer months across all crops, and/or have reduced the average number of spray rounds compared to previously.	3 + You continue to integrate technology into your plant protection programme, reducing further the number of applications where applicable.
Pesticide use: glyphosate	You used a glyphosate-based product as a crop desiccant (pre-harvest spray), in greater amounts than the previous year and/or the	You used a glyphosate-based product as a crop desiccant (pre-harvest spray), in the same amount as the previous year and/or the	You do not use a glyphosate-based product as a crop desiccant (pre-harvest spray) on any crops (including oil seed rape).	3 + You continue to avoid and/or reduce the use of glyphosate-based products on all crops at all times of year.

Indicator	Statements			
	Red (1)	Amber (2)	Green (3)	Dark green (4)
	treated produce entered the human food chain directly.	treated produce did not enter the human food chain directly.		
Renewables produced	You do not produce renewable electricity on your land and have not reduced your overall energy consumption.	You produce less than 40% of your annual electricity consumption through renewable means on your land and/or have achieved only limited reductions in overall energy use.	You produce at least 40% of your annual electricity consumption through renewable means on your land and/or have achieved significant reductions in overall energy use.	3 + You continue to increase your share of renewable energy and/or further reduce your energy consumption, either by expanding renewable production or by lowering total energy demand.
Profit	Your overall business profit has provided your household with an insufficient income.	Your overall business profit has provided your household with an almost sufficient income.	Your overall business profit has provided your household with a sufficient income.	3 + You continue to diversify your farm business income with additional ventures and subsidies.
Income from subsidies	You have not applied for environmental subsidies, or if you did apply, these provide less than 10% of your total income.	You are in the process of applying for environmental subsidies, or you have already applied and they provide at least 10% of your total income.	You have applied for environmental subsidies, and these provide on average, over 10% of your total income	3 + You will continue to apply for new rounds of environmental subsidies with the aim of maintaining over 10% income from this avenue of income.
Local economy enhancement	You have neither a policy to procure through local suppliers; nor to hire regional people, wherever possible.	You have either a policy to procure through local suppliers; or to hire regional people, wherever possible.	You have a policy to procure through local suppliers; and to hire regional people, wherever possible.	3 + You routinely check and update your supplier list for more local options.
Wellbeing	You have neither a system in place to discuss periodically the physical burden and mental health of yourself or your employees; nor a policy to ensure employees have a sustainable work-life balance (e.g.,	You have either a system in place to discuss periodically the physical burden and mental health of yourself or your employees; or a policy to ensure employees have a sustainable work-life balance (e.g.,	You have both a system in place to discuss periodically the physical burden and mental health of yourself or your employees; and a policy to ensure employees have a sustainable work-life balance (e.g., offering	3 + You are encouraging these discussions to happen more regularly , and leading by example if you have employees.

Indicator	Statements			
	Red (1)	Amber (2)	Green (3)	Dark green (4)
	offering flexible working during quieter periods).	offering flexible working during quieter periods).	flexible working during quieter periods).	

Appendix II

Farm sustainability assessment questionnaire

Below is a list of **15 sustainability indicators** that are designed to assess if your farming business practices are moving in a sustainable direction *since joining the FRAMEwork project*. They encompass a wide range of topics. For each indicator, please select either statement **A, B, or C**, depending on which one fits your farming practices/business most closely now that the FRAMEwork project is coming to an end. If you selected **statement A**, there is an additional statement at the end of each indicator for you to read and select if true. If you selected **statement B or C**, then we would be grateful if you could please add an explanation as to **why** in the box.

Consent:

I confirm that I understand the purpose of this study and that I have had the opportunity to ask questions, and these have been answered fully and explicitly. I understand that by completing this survey, the data will be used to summarise the sustainability of the Farmer Cluster, and that my participation is voluntary, and that I am free to withdraw at any time, without providing any reason and without my legal rights being affected. I understand that anonymised data (i.e., data that do not identify me personally) cannot be withdrawn once they have been included in the study. I understand that any data provided by me will be anonymised. I understand that confidentiality will be maintained at all times, and it will not be possible to connect any choices, statements or opinions to me and my farm in any publications/outputs unless I have given my permission for this. I understand that the outputs of this research can be circulated in the form of reports, scientific papers, briefings, podcast, blog posts and other content for the FRAMEwork website.

Please tick this box to confirm you have given consent to the above (including verbally).

☐

1. Corporate ethics

☐ A) Risk assessments are now in place for the safety and good working conditions of all employees and yourself; **and** for how farming activity might have external impacts to stakeholders and the local environment.

☐ B) Risk assessments are now in place for the safety and good working conditions of all employees and yourself; **or** for how farming activity might have external impacts to stakeholders and the local environment .

- ☐ C) **No** risk assessments are in place for the safety and good working conditions of all employees and yourself; or for how farming activity might have external impacts to stakeholders and the local environment.

If you ticked B or C, please explain why:

If you answered **A** above, please check if the following statement is **also** true:

- ☐ These risk assessments are now/will be routinely checked and updated.

2. Stakeholder dialogue

- ☐ A) You now encourage communication between yourself and stakeholders in your supply chains; **and** you now facilitate regular meetings between yourself/staff and stakeholders on matters of mutual concern.

- ☐ B) You now encourage communication between yourself and stakeholders in your supply chains; **or** you now facilitate regular meetings between yourself/staff and stakeholders on matters of mutual concern.

- ☐ C) There is no communication between yourself/staff and stakeholders in your supply chains.

If you ticked B or C, please explain why:

If you answered **A** above, please check if the following statement is **also** true:

- ☐ These communications and meetings are/will be becoming more regular and relationships are forming well between the business and stakeholders.

3. Semi-natural habitat water buffers

- ☐ A) During the FRAMEwork project (or previous to it), you **have measured** and can confirm that **no crop** is grown within a 10m buffer around any water bodies on your land.

- ☐ B) During the FRAMEwork project (or previous to it), you **have measured** and have found that **crop is grown** within a 10m buffer around any water bodies on your land.

- ☐ C) You have **not measured** and/or it is likely that that **crop is grown** within a 10m buffer around any water bodies on your land.

If you ticked B or C, please explain why:

If you answered **A** above, please check if the following statement is **also** true:

☐ You are currently or will continue to enhance the semi-natural habitat water buffers with diverse plants.

4. Permanent vegetation on your land

☐ A) You have **increased** the area of land under permanent vegetation during the FRAMEwork project.

☐ B) You have **maintained** the area of land under permanent vegetation during the FRAMEwork project.

☐ C) You have **decreased** the area of land under permanent vegetation during the FRAMEwork project.

If you ticked B or C, please explain why:

If you answered **A** above, please tick the box below if the following statement is **also** true:

☐ You continue to create a **diverse** range of land under permanent vegetation, and/or have started/considered integrating **agroforestry** wherever possible.

5. Woody vegetation on your land

☐ A) During the FRAMEwork project (or previous to it), you **have checked** and can confirm you have woody features making up over 5% total area of land, and/or you **have integrated** silvopasture into your practices.

☐ B) During the FRAMEwork project (or previous to it), you **have checked** and/or **intend to increase** your percentage of woody features to over 5% total area of land, and/or you **have considered** integrating silvopasture into your practices.

☐ C) You have either **not checked**, or you have checked but **will not be increasing** your percentage of woody features to over 5% total area of land, and you **won't be** integrating silvopasture into your practices.

If you ticked B or C, please explain why:

If you answered **A** above, please check if the following statement is **also** true:

- ☐ You continue to **diversify** the woody features on your land.

6. Hedgerow length

- ☐ A) You have **increased** the overall lengths of hedgerow the on your land during the FRAMEwork project, and/or have reached a maximum hedgerow length on your land.
- ☐ B) You have **maintained** the overall lengths of hedgerow on your land during the FRAMEwork project.
- ☐ C) You have **decreased** the overall lengths of hedgerow on your land during the FRAMEwork project.

If you ticked B or C, please explain why:

If you answered **A** above, please tick the box below if the following statement is **also** true:

- ☐ You have also completed a **hedgerow condition assessment** and continue to increase the **width and/or diversity** of your hedgerows.

7. Fertiliser use

- ☐ You have **reduced** (on average) the amount of fertiliser used per ha during the FRAMEwork project.
- ☐ B) You have **maintained** (on average) the amount of fertiliser used per ha during the FRAMEwork project.
- ☐ C) You have **increased** (on average) the amount of fertiliser used per ha during the FRAMEwork project.

If you ticked B or C, please explain why:

If you answered **A** above, please tick the box below if the following statement is **also** true:

- ☐ You continue to **use technology** to calculate amount of fertiliser application needed, **reducing** the amounts applied wherever possible.

8. Pesticide use – threshold levels and decision support tools

- ☐ A) During the FRAMEwork project you have **used** technology or pest monitoring methods to assess if plant protection product use is required (e.g. T-sum to determine BYDV aphid pressure for barley), and/or have **reduced** the average number of spray rounds compared to previously.
- ☐ B) During the FRAMEwork project you have **considered using/will shortly implement** technology or pest monitoring methods to assess if plant protection product use is required (e.g. T-sum to determine BYDV aphid pressure for barley), and/or have **maintained** the number of product applications as previously.
- ☐ C) During the FRAMEwork project you have **not** used technology or pest monitoring methods to assess if plant protection product use is required (e.g. T-sum to determine BYDV aphid pressure for barley), and/or have **increased** the number of product applications compared to previously.

If you ticked B or C, please explain why:

If you answered **A** above, please tick the box below if the following statement is **also** true:

- ☐ You continue to **integrate technology** into your plant protection programme, **reducing** further the number of applications where applicable.

9. Pesticide use - Pre-harvest glyphosate application

- ☐ A) During the FRAMEwork project you **stopped using** a glyphosate-based product as a crop desiccant (pre-harvest spray) on all crops.
- ☐ B) During the FRAMEwork project, if you used a glyphosate-based product as a crop desiccant (pre-harvest spray), you used **less or the same** amount as the previous year, and/or this produce did **not** enter the human food chain directly.
- ☐ C) During the FRAMEwork project, if you used a glyphosate-based product as a crop desiccant (pre-harvest spray), you used **more** than the previous year, and/or this produce entered the human food chain directly.

If you ticked B or C, please explain why:

If you answered **A** above, please tick the box below if the following statement is **also** true:

☐ You continue to avoid and/or reduce the use of glyphosate-based products on all crops at **all times of year**.

10. Electricity use

☐ A) Your average yearly energy consumption has **decreased** since the start of the FRAMEwork project.

☐ B) Your average yearly energy consumption has remained **the same** since the start of the FRAMEwork project.

☐ C) Your average yearly energy consumption has **increased** since the start of the FRAMEwork project.

If you ticked B or C, please explain why:

If you answered **A** above, please tick the box below if the following statement is **also** true:

☐ You continue to find ways of decreasing your energy consumption alongside producing renewable energy on your land.

11. Profitability

☐ A) During the FRAMEwork project, your overall profit has provided your household with a **sufficient** income.

☐ B) During the FRAMEwork project, your overall profit has provided your household with an **almost sufficient** income.

- ☐ C) During the FRAMEwork project, your overall profit has **not** provided your household with a sufficient income

If you ticked B or C, please explain why:

If you answered **A** above, please tick the box below if the following statement is **also** true:

- ☐ You continue to **diversify your farm business income** with additional ventures and subsidies.

12. Income from environmental subsidies (including organic status)

- ☐ A) During the FRAMEwork project, you **have applied** for environmental subsidies, with these providing **over 10%** of your total income.

- ☐ B) During the FRAMEwork project, you have **considered** or **have applied** for environmental subsidies, with these providing at **least 10%** of your total income.

- ☐ C) During the FRAMEwork project, you have **not** applied for environmental subsidies, or if you **did apply**, these provided **less than 10%** of your total income.

If you ticked B or C, please explain why:

If you answered **A** above, please tick the box below if the following statement is **also** true:

- ☐ You will continue to apply for new rounds of environmental subsidies with the aim of maintaining over 10% income from this avenue of income.

13. Local economy enhancement

- ☐ A) You now have a policy to procure through local suppliers; **and** to hire regional people, wherever possible.

- ☐ B) You now have **either** a policy to procure through local suppliers; **or** to hire regional people, wherever possible.

- ☐ C) You have **neither** a policy to procure through local suppliers; **nor** to hire regional people, wherever possible.

If you ticked B or C, please explain why:

If you answered **A** above, please tick the box below if the following statement is **also** true:

- ☐ You routinely **check and update your supplier list** for more local options.

14. Wellbeing

- ☐ A) You now have **both** a system in place to discuss periodically the physical burden and mental health of yourself or your employees; **and** a policy to ensure employees have a sustainable work-life balance (e.g., offering flexible working during quieter periods).
- ☐ B) You now have **either** a system in place to discuss periodically the physical burden and mental health of yourself or your employees; **or** a policy to ensure employees have a sustainable work-life balance (e.g., offering flexible working during quieter periods).
- ☐ C) You have **neither** a system in place to discuss periodically the physical burden and mental health of yourself or your employees; **nor** a policy to ensure employees have a sustainable work-life balance (e.g., offering flexible working during quieter periods).

If you ticked B or C, please explain why:

If you answered **A** above, please tick the box below if the following statement is **also** true:

- ☐ You are encouraging these discussions to happen **more regularly**, and leading by example if you have employees.

15. Biodiversity

- ☐ A) During the FRAMEwork project, you **have conducted** biodiversity monitoring on your land, either yourself, or with the assistance of expert surveyors/volunteers, the use of an App, or by contributing to a formal national monitoring scheme.
- ☐ B) During the FRAMEwork project you have **considered** conducting biodiversity monitoring on your land, either yourself, or with the assistance of expert surveyors/volunteers, the use of an App, or contributing to a formal national monitoring scheme.

☐ C) During the FRAMEwork project you **have not** conducted biodiversity monitoring on your land, either yourself, nor with the assistance of expert surveyors/volunteers, the use of an App, nor contributing to a formal national monitoring scheme.

If you ticked B or C, please explain why:

If you answered **A** above, please tick the box below if the following statement is **also** true:

☐ You will **continue to monitor** on a regular basis, documenting either as a farm and/or submitting records to national monitoring schemes.

Your say

If there are any other practices you undertake that you believe are sustainable that you would like to tell us about, please add them in the box below: