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Deliverable 5.6

A farm-level decision support tool

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Dissemination Level

PU	Public	**X**
PP	Restricted to other programme participants (including the Commission Services)	
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1 Introduction

The SUPER-*G* project aims to co-develop sustainable Permanent Grassland (PG) systems and policies with farmers and policy makers to effectively optimise productivity whist supporting biodiversity and delivering other Ecosystem Services (ES). This will be achieved through the completion of a series of Work Packages (WP). Work Package 5 aimed to aid decision making through deliverables (D) including the assessment of current decision support tools (DSTs) and development of new DSTs. This document describes the development of a farmer DST and builds on the D5.4 report ("First version Farm level DST"). The DST aimed to provide the farmer (user) with an overview of the environmental impact and ES provided by their PG, with the objective of developing a scoring system for ES and providing guidance to the user as to how they can improve their ES score. The development of the DST was supported by the other WP from the project, including the PG typology (task 2.1) and the review of ES provided by PG (task 2.3).

2 Information gathering and evaluation

The initial information gathering was undertaken in task 2.3 covering six ES that would be included in the tool: Food wool and biomass production; Climate regulation; Biodiversity; Landscape aesthetics, Flood Erosion and Control; and Water Quality. Each ES has several indicators which could be used to judge the impact of the ES. The proposed report used simple additive weighting, where each ES indicator is assigned a percentage weighting with increasing percentage indicating increasing importance. The user would answer a series of questions to calculate a score for each ES indicator (see Appendix). The ES indicator score would be normalized to a score between 0 and 1 and multiplied by the ES indicator weighting to give a user score. The normalised score would also be presented on a chart to allow the user to benchmark against expected values. An ES score (%) would be calculated by summing the user scores. This proposal was evaluated by a farmers' working group, where a draft of different questions and a draft

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report was discussed by the group. The proposed report would present the user with an intuitive traffic light system and advice on how the user could improve their ES score. The end user group also provided feedback on the proposed report (Table 1). Feedback was positive and the SUPER-*G* consortium agreed to proceed with this approach.

Table 1: End user feedback on the proposed report generated by a custom designed ecosystem services decision support tool

	Yes (% (n))[1]	No (% (n))[1]	Unsure (% (n))[1]
Is the overall ecosystem service score helpful?	73 (22)	0 (0)	27 (8)
Is the traffic light system for each indicator helpful?	76 (22)	0 (0)	24 (7)
Is the benchmarking chart intuitive?	79 (22)	0 (0)	21 (6)
Would you be happy to anonymously share your answers to develop future benchmarking scales?	89 (24)	0 (0)	11 (3)

1 *Denotes the proportion (%) of respondents who selected that answer and the number, n, in brackets*

3 Tool Overview and development

3.1 Ecosystem Services and their respective parameters

Several workshops with experts from task 2.3 were held to discuss if the questions required to gather the relevant information and how this could be used to calculate user scores for each ES parameter. During the co-development workshops, it was agreed that some parameters were not suitable as they were difficult to measure consistently (e.g. earthworm counts), required additional cost or analysis (e.g. soil sampling), or they were beyond the scope of the tool (e.g. CO_2 equivalent emission per unit area). It was found that many questions linked to multiple ES and they could be grouped into six themes (Figure 1), which are discussed in the following paragraphs.

3.1.1 Nitrogen (N) input

The amount and type of both organic and manufactured fertiliser applied is recorded. The user can enter each type of fertiliser applied and its composition, from which the total tonnes of N applied can be calculated. This information is used to monitor the farm efficiency, the risk of pollutants in water ways and the application of manufactured N

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fertiliser to permanent grassland. The method and date of application is also recorded as this will affect the leaching potential of the fertiliser.

3.3.2 Stocking rate

Stocking rate requires the entry of the number of animals on farm and the farm area. The farm area is entered in hectares (ha) and is broken down into “Permanent Grass (ha) - Land which has been grassland for five years or more” (PG area), “Temporary Grass (ha) - Land which has been grassland for less than five years” (TG area), “Other crops (ha)” (O area) and “Building yards and roadways (ha)”. Total grassland is calculated as the sum of ‘PG area’ and ‘TG area’; total useable agricultural area (UAA) is the sum of ‘PG area’, ‘TG area’ and ‘O area’.

The number of animals on farm and the land area are important indicators of farm efficiency. The initial animal entry page offers the options of “Cattle”, “Equidae”, “Pigs”, “Sheep”, “Goats”, “Deer”, or “Poultry”. It was decided that as an affordance to the user, they should be able to select an animal type and then subsequent animal count questions would be restricted to animals held on the user’s farm. The number of animals is converted to Livestock units (Europa.eu). There are two metrics applied for Stocking density, the stocking density at grass and the stocking density on farm.

3.3.3 Grassland management

These questions explore the plant species the user has in their grass sward, their reseeding decisions, and the grass cover throughout the grazing season.

3.3.4 GHG Emissions

The GHG emissions indicator was ultimately removed from the tool. It was a parameter for climate regulation. The additional data required to give an estimate of the CO_2 equivalent emission per unit area.

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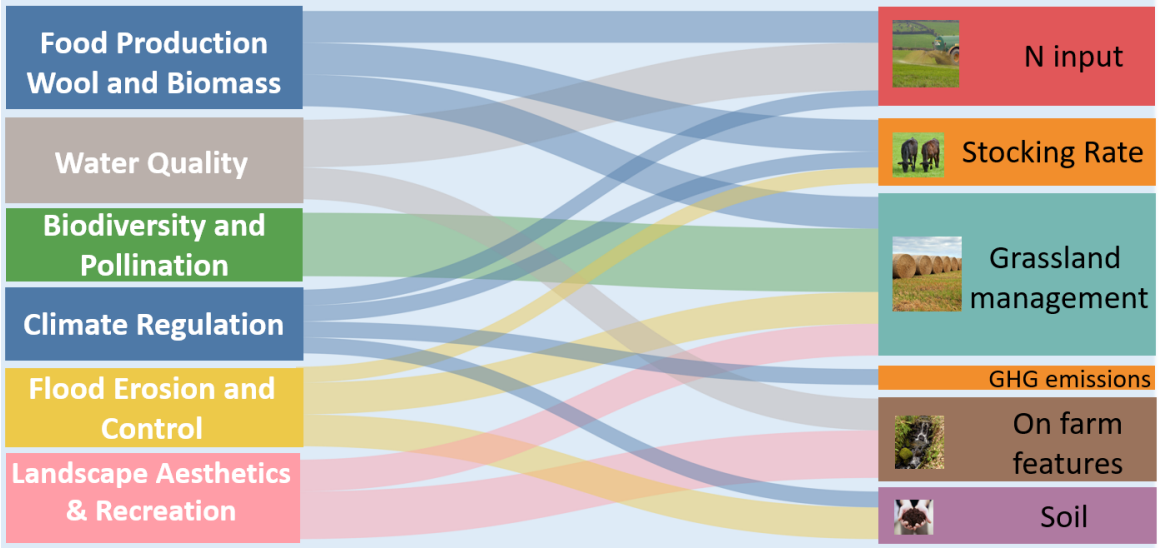

Figure 1: A Sankey diagram which demonstrates how the Ecosystem services and their indicators are linked.

3.3.5 On farm Features

On farm features can refer to natural features and their management, for example rivers and/ or trees; or man-made features such as nature trails or bridle ways.

3.3.6 Soil

These questions ask the user about soil condition and signs of erosion, asking the user to assess this visually. It was agreed that since there is no European standard soil sampling report, it would not be possible to accurately incorporate this into the DST. Future iterations of the tool may link to the harmonised world soil database (FAO, 2024). However, this would only be possible if a more detailed mapping system was available. This would be possible in future iterations of the DST at a more localised level.

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3.2 Calculations

The tool uses simple additive weighting to calculate an ES score. This is a three-step process:

- Parameters within ecosystem service are ranked then given a % weighting score *(weighting)*
- Each ecosystem service parameter is normalised to a value between 0 and 1 *(normalised score)*
- ∑(normalised score * weighting) = ecosystem service score

The ecosystem service score is presented to the user as a percentage(%) as this was an intuitive measure, with percentages being recognised universally as a score out of 100. In this current iteration of the tool, the co-innovation group were asked to rank the parameters by importance, with the highest ranked given a higher weighting.

3.3 The online tool

3.3.1 Technical specification

The platform adopts a multi-layered architecture with a decoupled design. The backend, developed using *.NET 6.0*, handles the application logic exposed by a web Application Programming Interface (API), while the frontend is built with *React* and *TypeScript*, with *Redux* managing the state. It interacts with an *Azure* SQL (Structured query language) database via a secure login. The deployment of the application is handled through independent Docker containers for both the Backend and Frontend. This set up is managed by *Kubernetes* which designates pods that run the docker containers on a virtual machine hosted on the ADAS *Azure* tenancy. A subdomain of the www.super-g.eu website is linked to these services.

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3.3.2 Front end of the DST

Users set up a user account where their data is saved so they can modify reports and generate multiple reports for different areas of their farm and/ or different time periods. This allows the user to model the ES delivered from their PG if they change their management and helps them to both learn the impact of changing specific management practices and decide which changes to employ. The user can download reports generated as a pdf for their records.

The tool has been designed to gather the maximum information with the minimum input from the end user. There are a range of controls for the user (Demonstrated in Figure 2) which are designed to ensure that information is accurate and can easily be added. Where appropriate, photographs are included as a visual prompt to help the user choose an option.

3.3.3 The Report

The report generated by the DST gives a summary of the ES selected, the calculated ES score, the individual parameter performance and, if appropriate, management advice to improve the parameter score (Figure 3). Each parameter is given on a scaled bar, with a colour range from red to green, where red is worst and green is best. It was agreed that traffic light scales are ubiquitous across Europe and would be understood by users. The user can easily access the questions relevant to each parameter beside the colour scale. This means that not only can the user easily model change and assess the impacts of changing their management, but it also gives the user an opportunity to learn about each parameter and the management practices related to it. If the user does not score well, tailored advice is offered to help the user decide whether they want to implement change on farm. The advice not only tells the user how to improve their score but describes any trade-offs and how a change in management may affect other ES or parameters.

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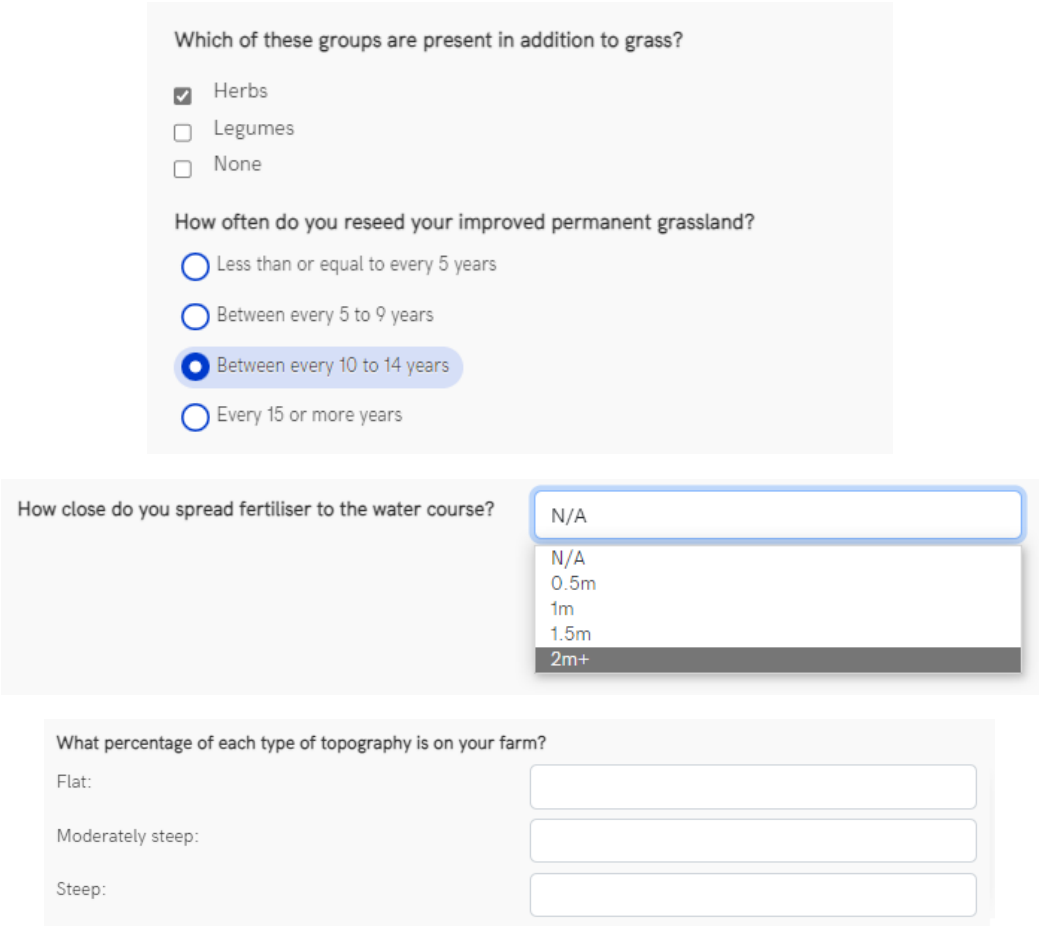

Figure 2: The tool incorporates a range of user controls, including check boxes and radio buttons (Top), drop down lists (Middle) and input boxes with validation (bottom).

3.3.4 Road testing

Farmer feedback was received on the questions at a SUPER-*G* event held in County Down, Northern Ireland in November 2023. A hard copy of the questions was distributed to 29 farmers and they were asked to complete it and feedback was received on any questions they did not understand. This resulted in the term "Rill" being defined in the tool as some farmers did not understand the term. Three farmers were observed using a prototype of the tool, and notes were taken. This led to the addition of 'Tool tips' to aid users in which a description of the function that a control performs is shown when the user hovers over it with their mouse.

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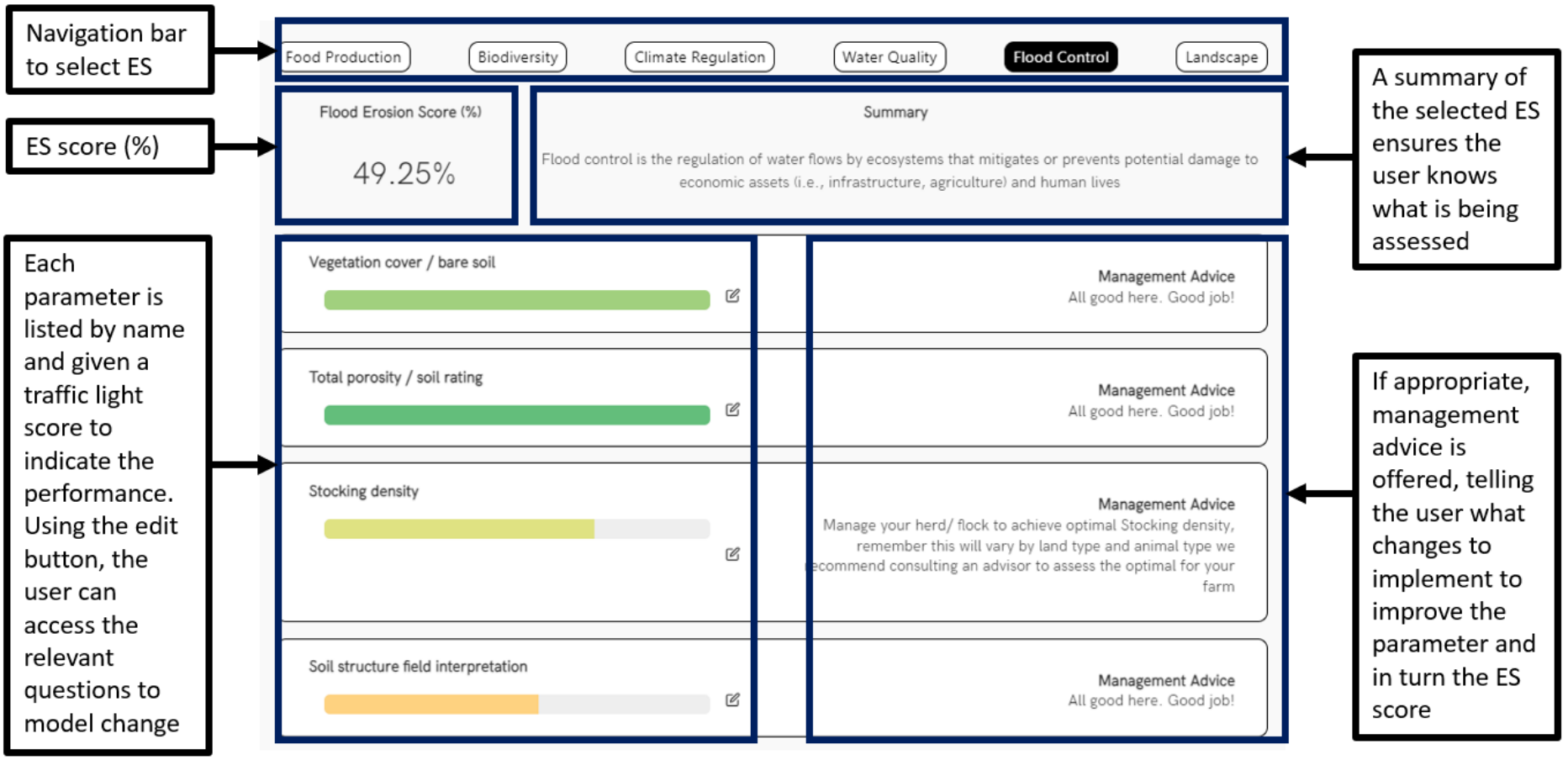

Figure 3: An example of the report generated with a description of each component of the report.

The title of a report was also changed to include the farm name, date, and location. User acceptance testing was carried out once the changes had been deployed, and users found the tool easier to use and understand.

The tool was also tested with local policy makers in Northern Ireland. Their feedback was positive, and included some changes which would have been specific to laws and environmental conditions in Northern Ireland. These changes were not introduced to the current version of the tool but demonstrate the appetite for the tool and the potential to adapt it to more localised areas.

4 Launch and legacy

The tool will be launched at the end of February 2023 and hosted for a period of 24 months post project. In this time, the tool will be available free of charge to end users. The tool in its current form can be considered a proof of concept and fulfils the aim of giving users an indication of the ES delivery from their PG, but it has been built to be agile, where the calculations can be updated or adapted to be more suited to a specific pedoclimatic area or policy region.

5 References

ADHB (2019), Healthy grassland soils, https://projectblue.blob.core.windows.net/media/Default/Beef%20&%20Lamb/HealthyGrasslandSoils2735_190430_WEB.pdf , Accessed 26 Feb 2024

Eurostat, (2023), Glossary: Livestock Unit (LSU), https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Glossary:Livestock_unit_(LSU) , Accessed 26 Feb 2024

FAO, (2024) Harmonized World Soil Database v 1.2,

https://www.fao.org/soils-portal/data-hub/soil-maps-and-databases/harmonized-world-soil-database-v12/en/ , Accessed 26 Feb 2024

Palmer, R. C., and R. P. Smith. "Soil structural degradation in SW England and its impact on surface-water runoff generation." Soil Use and Management 29.4 (2013): 567-575.

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6 Appendix: Calculations used in the DST

6.1 Biodiversity

6.1.1 Botanical composition

Question	Options	User control	Score
Please state the proportion (%) of grassland at each species richness level (3 extensive, 1 intensive)	High biodiversity, more than 15 plant species/m^2	Input box, percentage	0.3 for each percentage point
	Moderate Biodiversity, between 8 and 15 plant species/m^2		0.2 for each percentage point
	Low Biodiversity, up to 8 plant species/m^2		0.1 for each percentage point

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6.1.2 Wildlife friendly grassland management

Measure taken	Options	User control	Score
Part of the sward left uncut (an insect refuge)	Yes	Radio button	1
	No		0.1
Mowing of the grassland from the centre of the field to the outside (allowing animals to escape to neighbouring habitats)	Yes	Radio button	1
	No		0.1
Reduced management intensity of field margins (2-5 m of field margin)	Yes	Radio button	1
	No		0.1
Protection patches for ground nesting birds	Yes	Radio button	1
	No		0.1

6.1.3 Presence of a threatened species associated with grassland

Question	Options	User control	Score
Are you aware of any threatened species associated with the permanent grassland? This includes any plant growing in the PG or animal which functionally uses the PG, for example ground nesting birds or animals which use the area to forage.	Yes	Radio button	1
	No		0.1

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6.1.4 Presence of insect pollinated crops on farm

Question	Options	User control	Score
This includes any plant growing in the PG or animal which functionally uses the PG, for example ground nesting birds or animals which use the area to forage.	Yes	Radio button	1
	No		0.1

6.2 Climate regulation

6.2.1 Stocking density

Average LSU animals per month / UAA (Usable Agricultural Area, ha)

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6.1.2 Soil degradation

Question	Options	User control	Score
Please enter the proportion of your farm area in the following degradation class (soil degradation class adapted from Palmer and Smith 2013)	Severe	Input box, percentage	If the user has ≥ 20% in the Moderate or High degradation class, advice is given
	High		
	Moderate		
	Low		

6.1.3 Mineral N application level

Sum of N (t) applied as manufactured fertiliser on PG divided by area (ha) of PG

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6.2 Water quality

6.2.1 Risk of pollutants in surface water

Topography score + (Distance manure/ fertiliser spread from waterway) + (Tonnes applied per season/ Area application)+ fenced waterways + riparian strips

	Options	**User control**	**Score**
Topography score	Flat	Numeric, Min 0, Max 100 Units= %	0.3 for each percent
	Moderately sloped		0.2 for each percent
	Steep		0.1 for each percent
Distance manure spread from waterway	n/a		0
	1 m to 10 m+ (in increments of 1)	Drop down menu	1 for each metre distance
Distance manufactured fertiliser spread from waterway	n/a		0
	1 m to 10 m+ (in increments of 1)	Drop down menu	1 for each metre distance
Are waterways fenced?	Yes	Radio button	1
	No	Radio button	0

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Are there riparian strips on farm?	Yes	Radio button	1
	No	Radio button	0
Tonnes manure applied per season	Spring	Numeric input box, Units= tonnes	Input
	Summer		Input
	Autumn		Input*1.1
	Winter		Input*1.1
Area (ha) slurry applied to		Numeric input box, Units= ha	

6.2.2 Quantities of manure applied

Sum of all manures applied to each farm grassland type/ area each grassland type

6.2.3 N input rate (manufactured fertiliser N rate plus effective (fertiliser equiv.) manure N rate)

Sum of N (t) applied as manure and N (t) applied as manufactured fertiliser.

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6.2.4 Waterway protection

(Approximate proportion of watercourse protected by riparian strip * thickness riparian strip) + (Distance (m) slurry/ manure spread from watercourse + distance (m) manufactured fertiliser spread from watercourse)

Question	Options	User control	Score
How close do you spread slurry/ manure to the water course?	0 m to 10 m+ (in increments of 1)	Drop down menu	1 for each 0.5 metre distance
How close do you spread fertiliser to the water course?	0 m to 2 m+ (in increments of 0.5)	Drop down menu	1 for each 0.5 metre distance
Are watercourses fenced to prevent livestock access?	Yes	Radio button	1
	No		0.1
If used, how wide are riparian/buffer strips? (m)	2 m to 20 m+ (in increments of 2)	Drop down	1 for each metre distance
Approximate proportion of watercourse protected by riparian strip (%)	Proportion, 1-100%	Free form	1 for each %

6.3 Food production

6.3.1 Stocking density

Average LSU animals per month / UAA (Usable Agricultural Area, ha)

6.3.2 Stocking density at grass

[LSU per m/ time at grass per year] / Area grassland (ha)

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6.3.3 Nitrogen use efficiency

Sum of: Nitrogen management plan + Fertiliser analysis + Fertiliser timing + Fertiliser application

	Options	User Control	Score
Do you follow a nitrogen management plan?	Yes	Radio button	1
	No		0
Is fertiliser/ manure analysed?	Yes	Radio button	1
	No		0
When is fertiliser/ manure applied?		Numeric, Units tonnes	Sum (amount spread spring& summer)/ total spread
Method of application	Broadcast	Numeric, Min 0, Max 100, Units%	[Input]* 0
	Band spread		[Input]* 0.5
	Liquid		[Input]* 0.5
	Injection		[Input]* 1

6.3.4 Nitrogen use efficiency (livestock production)

Calculation = Output/ sum (N inputs)

Output = sum of outputs from animals (kg liveweight /milk/ products sold)

N input from fertilisers and N input from concentrate feed

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6.3.5 Grass clover dry matter productivity

Question	Options	User Control	Score
What is the share of legumes in the sward?	0-100%	Input box, numeric, Min 0, Max 100, Units%	0.1 for each percent
Which of these groups are present in addition to grass?	Herb	Check box	1
	Legume	Check box	1
Are legumes included in reseed?	Yes / No	Radio button	Yes = 1 No = 0
How often do you reseed?	Less than 5 years	Radio button	0
	5 to 9 years		1
	10-15 years		0
	More than 15 years		0
Why do you reseed?	Standard management/ routine reseeding	Check box	0
	Compaction of soil	check box	0.5
	Improve sward cover	Check box	0.5
	Reintroduction of species/ increase sward diversity	check box	1 OR 2

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6.3.6 Forage efficiency

Forage efficiency = ((energy required by animals) - (energy from non-grass feed)) / (energy required by animals)

6.4 Landscape aesthetics

6.4.1 Area conserved for nature (%), including buffer strips, trees, hedges-specific non-agricultural use on the grassland

	Options	User control	Score
How much of the permanent grassland area is conserved for nature (this includes buffer strips, trees, hedges- specific non-agricultural use on the grassland)	0-100%	Numeric, Min 0, Max 100, Units%	1 point for each percentage point

6.4.2 Natural heritage, sacred objects

Are there natural heritage or sacred objects on farm? (Y = 1, No = 0.1)

6.4.3 Nature trails, public footpaths and bridleways

Are there nature trails, public footpaths and bridleways on your farm? (Y = 1, No = 0.1)

6.4.4 Farm appeal

This is a score that was developed by the co-innovation group which considers the aesthetic appeal of the farm and its contribution to the enjoyment of people who may be passing by and using the countryside recreationally. This considers the field

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boundaries, the application of organic manure (which contributes to an unappealing smell), grazing animals and flowering plants.

Field boundaries on farm:

Field boundary type	**Yes**	**Approximate percentage of farm which is this boundary type?**	**Score**
Hedgerows	1	(0-100%)	(Score if yes)*(proportion)
Traditional (e.g. drystone wall)	1	(0-100%)	(Score if yes)*(proportion)
Sheep wire	0.5	(0-100%)	(Score if yes)*(proportion)
Ditches	0.5	(0-100%)	(Score if yes)*(proportion)
Other	0.5	(0-100%)	(Score if yes)*(proportion)

Total Organic manure spread- <100 N kg/ha 1 point, >= 100kg N kg/ha 0.5points

Grazing animals on farm- Y/N: Y = 1 (derived from animal inputs)

Flowering plants on farm- Y/N: Y = 1

Hedgerow quality Tall and thick- 1 point

Trimmed monoculture - 0.75

Sparse - 0

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6.5 Flood erosion

6.5.1 Stocking density

Average LSU animals per month / UAA (Usable Agricultural Area, ha)

6.5.2 Housing potential

Do you have sufficient housing for all animals throughout the winter? (Y = 1, No = 0.1)

6.5.3 Total porosity/ soil rating

Adapted from the "Healthy grassland soils" document (AHDB, 2019)

Score	**Description**
1	Good soil structure; Highly porous; Numerous, well-distributed roots; Sweet, earthy smell; Small, rounded aggregates
2	Good soil structure; Porous; Earthy smell; Some indication of larger aggregates; Good root distribution
3	Adequate soil structure; Larger aggregates, some angular; Moderate root distribution; no strong smell; Less visible pores
4	Large, angular aggregates (>5 cm across) with low pore numbers; Some red/orange mottling may be present (sign of poor drainage); Roots clustered in large pores, worm channels and cracks between aggregates; May have sulphur smell (i.e. bad eggs)
5	Very large, angular aggregates (>10 cm), with very few pores; Any roots seen mainly at the surface or clustered down large pores or cracks; May have grey colour with red/orange mottling (sign of poor drainage); May have strong sulphur smell (i.e. bad eggs)

6.5.4 Signs of erosion and run off risk

Sign of erosion	**Points if <u>not</u> present**
Rills (channels made by water flow on the surface of the soil)	1
Poaching	1, if severe 2
Paths created by livestock	1
Exposed soil	1
Surface capping	1
Wheeling	If "very few" 1; if "occasional" 2
Poor sward quality	1

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6.5.5 Vegetation cover/ bare soil in field

During the grazing season, what proportion of total farm PG has <90% grass cover?

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