Interreg North-West Europe
FABulous Farmers
European Regional Development Fund

MAKING FARM POLICY FIT FOR AN AGRO-ECOLOGICAL FUTURE IN ENGLAND.

Soil Association

About this publication

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About FAB Farmers.

FABulous Farmers is a European project designed to support farmers in the transition to more agro-ecological practices on their farms. The project aims to reduce the reliance on external inputs, like chemical fertilisers and plant protection products, by encouraging the use of methods and interventions that increase the farm's Functional AgroBiodiversity (FAB). These are targeted measures of biodiversity in and around the field to improve pollination, pest management, soil and water quality on farmland.

FABulous Farmers aims to accelerate the implementation of FAB by farmers and other land managers in NWE, by collecting, deepening and sharing knowledge and practical experiences about FAB between farmers, scientists, citizens and policy makers in 14 pilot regions in NWE over 6 countries (FR, NL, UK, BE, LUX and DE). 10 FAB solutions are developed in a region-oriented manner, tested and demonstrated across 415 farms and evaluated for ecological performance and economic profitability, with the aim of reducing the dependence on external inputs by an average of 30%.

In each pilot region, a FAB learning network is set up in which farmers exchange knowledge and experiences and draw up a FAB action plan. In addition, we collaborate with local actors, citizens, policy makers and value chain partners to embed FAB more widely in society, policy and market, through the design and implementation of FAB landscape integration plans and the rollout of citizen science tools; development of policy papers (at EU and national / regional level), and 12 business cases for valorisation of FAB via the market. Finally, a long-term development plan is drawn up for the continuation and expansion of the FAB learning networks after the end of the project.

Executive Summary

This policy paper from the UK FABulous Farmers (FAB) partners is intended to assist Defra deliver on its commitments to deliver Public Goods under the 25year Environment Plan. The specific focus is on the Agricultural Transition Plan (ATP), with particular reference to the Environmental Land management Scheme (ELM). ELM is the new way for government to pay farmers and land managers public money to produce public goods; payments will be made for the delivery by land managers of **land management actions** that contribute to:

- Clean and plentiful water
- Clean air
- Protection from and mitigation of environmental hazards
- Thriving plants and wildlife
- Reduction of and adaptation to climate change
- Beauty, heritage and engagement with the environment

Defra has been receptive to the concept of co-design for the components of ELMs, which comprise the Sustainable Farming Incentive (SFI), the Local Nature Recovery (LNR) and the Landscape Recovery (LR).
Key learnings from the FAB project are directly relevant to what is known to date about ELMs and are therefore of value to Defra.

Through this paper and its Annexes, the UK FAB partners are offering their support to Defra and its associated delivery bodies. They can do this through drawing attention to the learnings from multiple research papers and practical project work in England, and North-Western Europe, much of which is ongoing.

Practical FAB solutions to on-farm public goods delivery

In order to achieve a successful transition to sustainable farming, several things need to happen. Farmers will not jump into adopting new practices without careful consideration, taking into account the need for advice, and having regard for financial incentives. The FAB project partners recognised the importance of the following factors in assisting farmers in making the decision to change their farming practices:

Clear, well evidenced actions, all already being successfully practised by progressive farmers, which, when taken together deliver significant, and well evidenced public goods outcomes. (FAB Practices)
Auditing of on-farm public goods outputs, deriving from their current farming business – through use of a Public Goods Tool
FABulous Farmers Learning Networks; Peer to peer learning and easy access to advice and demonstration farms
Farm Landscape Integration Plans. Promoting the benefits of collaboration at landscape scale, including marketing

Practical FAB solutions to benchmark, monitor and evaluate on-farm Public Goods Delivery.

The FAB project partners also recognised that in order to secure government interest in, and support for, recognising and rewarding land managers transitioning to more agro-ecological farming practices, that the following would be required:

Meta- analysis of the evidence for public goods delivery from FAB Practices

Auditing of on-farm Public Goods delivery through use of Public Goods Tool

Practical metrics and methods to evaluate and measure Public Goods Delivery

Key Recommendations

Rather than simply reporting on the seven highlighted solutions above, this paper will demonstrate their relevance to the ATP and overall ELMs scheme design. The results of our analysis lead us to make the following Key Recommendations to Defra:

1. All ten FAB practices should be incorporated in the SFI standards. There is a pressing need to encourage the growth in Agroforestry. This can be achieved through developing a specific standard in the SFI

2. All ten FAB practices should be tested through the National Pilot. The current SFI Standards will deliver even more public goods if they have 'add on' options to reward less (and no) use of Plant Protection Products, and inorganic fertilisers

3. The Agricultural Transition Plan (ATP) should facilitate FAB-style Learning Networks to ensure that farmers can deliver the changes which provide public goods. These networks should adopt best practice on interactive innovation in agriculture to support effective learning

4. The ATP and specifically ELMs should make Public Goods Tools available to farmers and their advisers, to enable them to understand how best to deliver public goods whilst retaining financial resilience

5. Commission/fund more research to assist with developing metrics for monitoring and evaluating delivery of Public Goods through on farm practices

The basis for our recommendations

Recommendation 1:

All ten FAB practices should be incorporated in the SFI standards There is a pressing need to encourage the growth in Agroforestry. This can be achieved through developing a specific standard in the SFI.

At its heart, the FAB farmer project highlights the work that progressive farmers and researchers have been engaged in to develop effective farming practices that work with natural systems rather than against them. Functional agro-biodiversity (FAB) practices target biodiversity 'gains' in and around the field which improve pollination, pest management, soil and water quality; and also have positive impacts for Public goods delivery for society as a whole. The FABulous Farmers project has identified 10 practices which can be adopted by farmers that enable them to farm profitably, whilst simultaneously delivering these environmental 'public goods.' These practices are:

- Reduced tillage techniques (reduced soil disturbance and compaction).
- Mixed crops/crop rotations.
- Cover/catchcrops (incl. legumes).
- Organic matter input (plant residuals, wood chips, biochar).
- Modify manure quality and diversity (fresh manure, limit use of fertiliser).
- Agroforestry.
- Hedgerow management.
- Field margin management.
- Reduction in the use of plant protection products.
- Semi natural landscape elements (provide habitat).

The FABulous Farmer project has collated research and conducted practical field studies over the past 2 years in northern Europe, putting these practices to the test, and has published its findings here, in its EU Policy paper.

The following summary chart of 'public goods' delivery clearly demonstrates the effectiveness of the FAB practices, and consequently their relevance to Defra's Sustainable Farming Incentive (SFI).

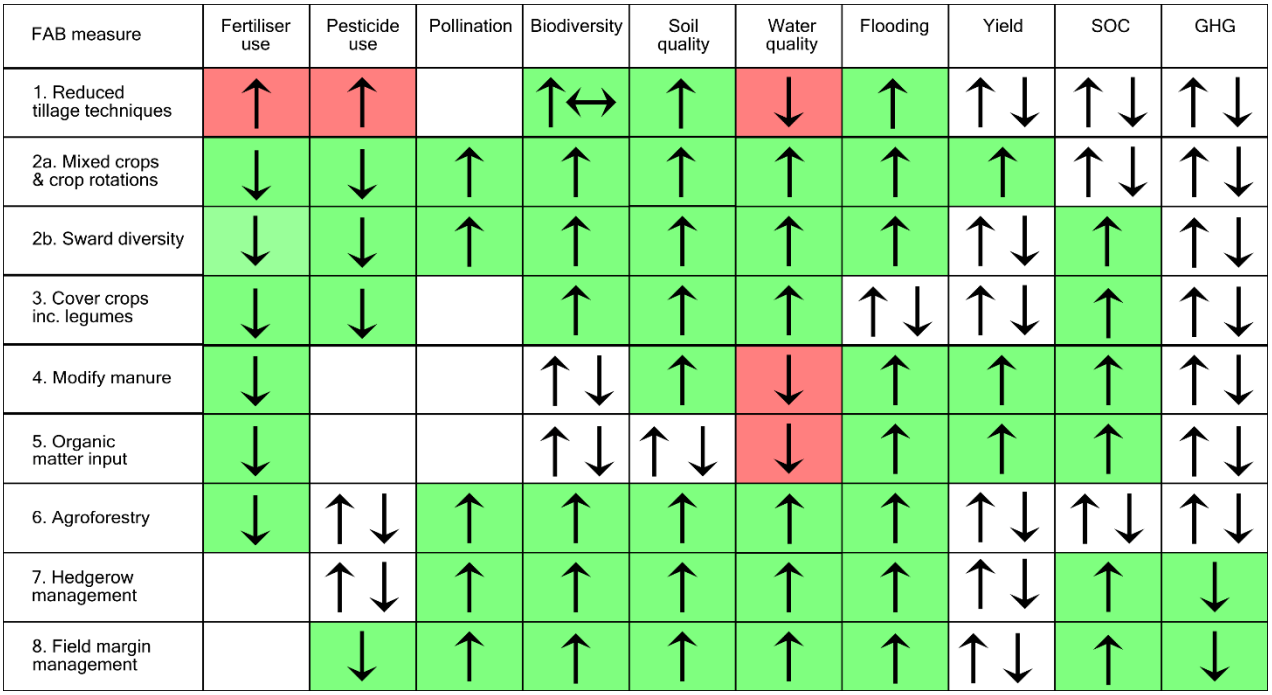

Figure 1: 8 FAB measures. Note: green represents positive effects, red represents negative effects. Upward and downward arrow = mixed effects. Horizontal arrow = no effect. SOC stands for soil organic content and GHG for greenhouse gasses. Adapted from: L Maskell, L Norton, J Alison, S Reinsch & DA Robinson, 'Review of current methods and approaches for simple on farm environmental monitoring of FAB solutions'

In March 2021 Defra published outline Standards for the SFI which clearly integrate most of the FAB practices, as our analysis in Annex 1 demonstrates.

There is one FAB practice which is missing: agroforestry. This is a significant omission**,** only partially compensated for through the Hedgerow and Farm Woodland standards. The Public Goods benefits of Agro-forestry are well evidenced, with full details contained in the FAB report *'Review of Current Methods and Approaches for simple on farm environmental monitoring of FAB solutions'*.

Carbon sequestration can be a benefit associated with agroforestry. Globally, deforestation is a major threat to forests and planetary climate with great impact on terrestrial C losses to the atmosphere and their feedback to climate change. Nair (2007) states "assuming that one hectare of agroforestry could save five hectares from deforestation" Carbon emission from deforestation can be greatly reduced by implementing agroforestry systems. Depending on the type of woodland restored, there may be other co-benefits such as recreation and timber production (Alison et al. 2019), coppicing or fruit production (Smith et al. 2017).
Silvopastoral and silvoarable agroforestry can provide shelter and shade for livestock and crops, improve nutrient cycling, improve air quality through pollutant capture, provide habitat for pollinators and other wildlife and improve water retention (Jose 2009, Smith 2010). Depending on the crops, silvoarable agroforestry can also increase total yields and profitability, but sometimes does not (Torralba et al. 2016). The foliage from the trees may

represent a significant feed resource depending on tree species, in particular in terms of energy, protein and micronutrients for cattle for instance, white mulberry (*Morus alba*) and common ash (*Fraxinus excelsior*) (Hermansen et al. 2017).
Some socio-economic co-benefits include co-benefits of diversified income from trees, including high value tree and fruit or nut crops in agroforestry systems and improved biosecurity from hedgerows reducing transmission between stock in adjacent fields. However, wide hedgerows can also provide habitat for alleged secondary vectors (badgers) (Keenleyside et al. 2019).
Silvoarable systems require fewer N inputs, both because the area of crop is reduced and because the greater litter input and more extensive root systems fix N in the soil (Keenleyside et al. 2019). Notable trade-offs include a reduction in agricultural productivity although there is mixed evidence on whether yield and productivity is better or worse in an agroforestry system (see above).
In some agroforestry systems land can be "locked up" for forestry for decades. This is less of an issue for hedgerows, and shelterbelts trees along ditches. There may be conflict between two competing land uses e.g., mixing stock with fruit production creates issues around biosecurity and use of chemicals (Hermansen et al. 2017).

Recommendation 2:

All ten FAB practices should be tested through the National Pilot. The current SFI Standards will deliver even more public goods if they have 'add on' options to reward less (and no) use of Plant Protection Products, and inorganic fertilisers

FAB partners welcome the approach taken by Defra to 'pilot' the SFI standards, as well as the Local Nature Recovery and Landscape Recovery components of ELMs. We recommend that FAB demonstration farms, learning networks, public goods audits, and all 10 practices should be examined by Defra, either in the National Pilots, or in the Test and Trials, and integrated into ELM when it rolls out.

There is a good fit between most FAB practices and the 8 Draft SFI Standards (see Annex1). **However, the Standards could go considerably further to encourage use of manures and composts, and reduce, or even eliminate use of inorganic fertilisers**. Manures and composts can reduce reliance on N fertiliser, leading to lower GHG emissions from fertiliser manufactures (Smith et al. 2011). The positive impacts of manure application on SOC exceeds the impacts of inorganic fertilisers because C is added to the soil with liquid or solid manure, but not with mineral fertilisers. Indeed, when Jones et al. (2006) applied a variety of manures, slurries and mineral fertilisers to cut grasslands in southern Scotland, they found that all manure treatments increased topsoil C concentration, while mineral fertilisers did not. In addition**, Inorganic fertiliser use contributes 18% of Ammonia emissions from agriculture**. Defra has legally binding targets to reduce ammonia emissions under the Clean Air Strategy, making this option all the more necessary. Through both the FABulous Farmers and Farm Net Zero projects farmers are actively exploring the benefits of composting and maximizing manure applications as part of their strategy to achieve Net Zero.

The Standards could go further to reduce or even eliminate use of Plant Protection Products, chiefly to reverse declining biodiversity on farmland and to attain cleaner water.

Integrated pest management which aims to reduce or minimise the effects of plant protection products to human health and the environment became compulsory in the EU in 2014. However, integrated pest management does not necessarily lead to reduced pesticide use (Keulemans et al. 2019). Organic farming (minimal use of pesticides) was found to promote 30% higher species richness on average and a 50% higher abundance of organisms (Bengtsson et al. 2005). Organic farming is reported to increase diversity of carabid beetles (Bengtsson et al. 2005, Kromp 1989), vascular plants (Hyvönen and Salonen 2002, 2003) and birds (Freemark and Kirk 2001). Geiger et al. (2010) found that in particular the use of insecticides and fungicides had consistent negative effects on the species diversity of plants, carabids and ground-nesting farmland birds. In a study for Defra (SCARAB-2000) there were differences in arthropod abundance between a reduced pesticide input approach and current farm practice with current practise having long-term adverse effects. Pesticides reduce pest invertebrate species but may also reduce other non-pest beneficial predator species. There have been widespread concerns that neonicotinoid insecticides contribute to bee declines (Steinhauer 2018) - see section on pollination. Reduced use of pesticides can encourage soil biota, in particular allowing for increased earthworm numbers (Pelosi et al. 2014, Zwart et al. 1994). Herbicides reduce the abundance of weeds, and in doing so they also reduce species dependent on them e.g. invertebrates and birds (Chiverton and Sotherton 1991).

Case Study; A demonstration of the economic and environmental benefits of adopting FAB practices through whole farm system planning at a National Trust farm in Cambridgeshire.

Summary (full details in Annex 2). The FAB practices all lead to beneficial public goods outcomes in their own right. However, when applied together under a whole farm system, the benefits are enhanced. This is evidenced by statistics from Wimpole Hall, an estate owned and managed by FAB partner the National Trust. Their full report is at Annex 2. The 589 hectare (1,419 acre) mixed livestock and arable organic farm, which is the only lowland farm run in-hand by the conservation charity, conducted in-depth surveys over two years into farmland birds, invertebrates and soil health.

Key results included:

• the doubling in numbers of breeding pairs of rare skylarks and linnets in six years which are good indicators of a healthy ecosystem
• a 38 per cent increase in invertebrate numbers over 13 years to include the recording of 95 rare and protected species, vital for pollinating crops and preying on pests
• a total carbon balance of -2,260 tonnes of CO_2 per year achieved through the amount of organic matter in the soil which soaks up carbon, the number of trees and grown out hedges As a business, the farm is also returning a healthy profit.

Recommendation 3:

The Agricultural Transition Plan (ATP) should facilitate FAB-style Learning Networks to ensure that farmers can deliver the changes which provide public goods. These networks should adopt best practice on interactive innovation in agriculture to support effective learning

The FABulous Farmers project explores the benefits to farmers of having access to researchers and experts through use of 'demonstration farms' and learning events linked to Learning Networks. This is of particular importance where 'new' practices are being reviewed, which have perceived 'barriers to entry'; a good example being Agroforestry.

Major barriers to implementation of agroforestry are expertise, knowledge, technical skills and time to manage woodland, and possibly unwillingness to invest capital in non-agricultural land management, particularly as this is a decision for the long term (Keenleyside et al. 2019). Farmers are not generally aware of the positive benefits of trees on farms, and culturally there is a perception amongst some farmers that trees get in the way of farming and concerns about the extent of competition with pasture/crop species (Keenleyside et al. 2019). Smaller areas of land providing wood chip and/or shelter may be of greater interest or creation of hedgerows (Alison et al. 2019).
Agroforestry can have significant costs at establishment particularly in pastoral systems, due to the need for protective fencing and loss of crop area (Hernandez Morcillo 2018). Many arable agricultural practices are adapted to large fields and the use of large machinery and it would be challenging to reintroduce field boundaries and consequently smaller fields. However, alley cropping has been successfully applied in some European countries and an initial focus on planting shelterbelts along existing field boundaries might also be a successful approach (Kanzler et al. 2017).
The policy framework may also be a barrier; currently agroforestry falls in the gap between forestry, environmental stewardship and agriculture and funding options are unclear. Other barriers are the limitations on long-term business planning and capital investment imposed by short-term tenancies. Investment and management support could enable farmers to restore existing agroforestry systems (e.g. hedgerow trees, shelter systems) and to develop new combinations of tree crops with existing arable and pasture systems, which may involve restructuring the farm business model. Targeted public support would ensure that these are designed (in terms of choice of species and systems) and located in the farmed landscape to maximise the long-term delivery of environmental public goods and climate adaptation benefits for the sector (Keenleyside et al. 2019).

Extensive research through LIAISON[1] https://liaison2020.eu/ has identified best practice for learning networks which can be adopted by future learning networks to promote effective outcomes. This research has developed a set of "How to Guides" as well as a series of tools for multi-actor partnerships and facilitators to use which support interactive innovation excellence from project initiation through to conclusion.

[1] H2020 project to identify and promote best practice for interactive innovation

Another good example of how FAB Learning Networks which utilise a combination of Demonstration Farms, Peer to Peer Learning sessions, as well as provision of expert advice is the Herbal Leys Learning Network in South West England. The following is a short summary, more detailed information can be found in Annex 3.

Case Study; knowledge exchange through Learning Networks

The Herbal Leys Learning Network provides a successful example of how working, learning and sharing as an extended group can build confidence and expertise rapidly in agroecological practices. The Network is a mix of farmers, advisors, researchers and other industry bodies (e.g. seed companies). Led by FAB partner the Soil Association; the Network includes individual farmer support and advice as needed delivered by expert advisors and farm walks and events hosted on network member farms who are implementing herbal leys at variable scales. There have been practical webinars learning direct from farmers and also updates of relevant research and active dissemination of research in digestible forms through blogs and via social media. It has also brought together a wider herbal leys stakeholder group to consider boundaries to implementation at a landscape scale and actions to overcome these. This combined approach and having a practical organisation to take the lead has ensured we have built momentum and confidence in the uptake of such a valuable agroecological practice.

Recommendation 4:

The ATP and specifically ELMs should make Public Goods Tools available to farmers and their advisers, to enable them to understand how best to deliver public goods, and to retain financial resilience

Summary.

Unless there is a common platform through which land managers can audit, measure and evaluate their ability to deliver public goods through their farming operations, policy outcomes will be very difficult to audit. At present, knowledge in this area is still highly fragmented and insufficiently embedded in agricultural practice to guarantee delivery through financial incentives alone. Although progressive farmers and their advisors are delivering public goods and Functional Agrobiodiversity within their farming operations, they are in the minority, and it would be a mistake to assume that all land managers can evolve their practices without first applying an advisor led audit of their land management, followed by advice on progression. Such an audit presents the opportunity for the land manager to understand what is already working well, what will need to change, and, crucially, understand the impact of making those changes on the financial resilience of the business. An audit conducted on a common platform also allows for a national baseline to be determined against which progress towards achieving policy goals can be measured. Without the ability to measure progress Defra may not be able to present credible

evidence of public goods delivery through the ATP to third party auditors from the Treasury.

Integrated Sustainability Assessment Tools (ISATs).

The FABulous Farmers programme included research which is of direct relevance for Defra and the ATP. Recognising the importance of having a common platform for all of the above reasons, the project partners conducted a review of all the platforms available, with a view to picking the 'best' one. That 'winning' platform would then be tested and evaluated within the 12 regions of the FABfarmers project. The work is contained in the Report DT 1.2.4, **'***Review of current metrics, indicators and tools for monitoring the environmental and socio-economic performance of FAB solutions***'** and can be viewed here.

The project partners first identified user friendly tools and methods that could measure the environmental and socio-economic performance of the FAB solutions. They recognised the need to balance the need for on-farm efficiency with the need for scientific robustness to record baselines, measure change, and to provide aids for on farm assessment.
The following is an excerpt from the ILVO led their report.

> The management dimension of the framework reflects the steps in the farmer's decision-making process in sustainability management. We looked at the number of steps an ISAT incorporates or supports.
> **step 1:** the actual use of an assessment tool;
> **step 2:** interpretation of the results and gaining insights into the sustainability of multiple farm aspects;
> **step 3:** finding options, i.e., developing improvement strategies;
> **step 4:** implementing the new strategies on the own farm;
> **step 5:** monitoring and benchmarking, i.e., follow-up of and reflection on the outcomes.

The tool should be capable of capturing key performance indicators (economic and ecological), as well as providing support for farmers' learning processes. The results should establish indicator sets that provide insight into overall farm sustainability; and also an evidence base to underpin claims for targeted publicly funded support (either from Defra, or devolved administrations). These indicator sets could be based on Targets, Practices, and Performance (results).

The project partners looked at all relevant tools that were 'on the market' and prepared a summary chart (see below). Of most relevance to the UK were the Organic research Centre's Public Goods Tool, and the LEAF audit.

Theme	DEXiPM	LEAF-SFR	PG Tool	SustainFARM PG Tool	SAFA-App	SMART Farm Tool
Yield	++	no	++	no	no	++
Cost/benefit	cost	no	sales price	no	no	sales price
Profitability	++	no	farm business resilience	farm business resilience	+	++
Pesticides	+++	insufficient	+	insufficient	+	+++
Fertilisers	+++	++	+++	+++	++	+++
Water quality	+	water use	+	water use	+	+++
Soil quality	+++	++	++	++	++	+++
Biodiverity	++	++	++	++	++	++

Figure 2: Summary of ISATs (Integrated sustainability assessment tools) coverage of FABulous Farmers themes

The project partners analysis confirmed that the more basic tools were good for getting all farmers engaged with the process, but that they were not suited for baseline and performance measurement. For this reason, they did not take up, amongst others, the LEAF model. **Consequently, they chose the Organic Research Centre (ORC) Public Goods (PG) Tool and used it throughout the Interreg regions for the FAB project**.
The PG Tool has been adapted and modified in the UK by ORC through a Defra funded Test and Trial (068), and by the Sustainable Food Trust, where it is now known as the Global Farm Metric. The Test and Trial has been operational since 2020 and is due to Report in September 2021. There is raw data available for Defra policy makers to review if required before that time.

Recommendation 5:

Commission/fund more research is needed to assist with developing metrics for monitoring and evaluating delivery of Public Goods through on farm practices

The SFI standards, and other components of the ATP will have to be assessed for effectiveness in delivering Government objectives. Consequently, there will need to be mechanisms for carrying out these assessments. This appears to be an area where more work, and especially practical evidence gathering, needs to be done.
The FAB project partners have considerable experience in this area, and the Report '*Review of Current Methods and Approaches for simple on farm environmental monitoring of FAB solutions*' contains a thorough analysis of the evidence base for the benefits of the FAB

practices. Alongside this, is a detailed review as to how the evidence can be gathered and monitored, so as to evaluate performance, and to monitor progress.

An example from the Report, from the section on Diverse Leys, gives an indication of the challenge:

Metrics and verification

Biodiversity

Diversification of the sward should increase above and below ground biodiversity and this should be measured within fields and on adjacent land to understand the effects. Plant species diversity should increase and can be monitored using quadrats (Halbritter et al. 2019). The sward structure: height, management and fine-scaled topography should also be measured as this will impact upon other species. Invertebrates should benefit from increases in sward diversity and these can be measured using similar methods to pollinators. It has been suggested that earthworms would not necessarily increase with sward diversity and it would be useful to measure earthworms and other soil invertebrates (Halbritter et al. 2019). Invertebrate abundance and diversity will also influence bird species abundance and diversity, and this should be measured using standardised repeatable methods.

Pollination

Nectar plants should increase in abundance and diversity within fields and the floral density of nectar plants should be measured alongside monitoring of the abundance and diversity of pollinators such as pollinator transects (Carvell et al. 2015), sweep nets and pit fall traps. This should be within fields and in areas surrounding the fields to understand the spatial extent of the effect.

Soil quality and conservation

Increases in legumes could increase soil nutrient status and this should be measured. There should be an improvement in soil structure, so soil compaction and soil erosion should be measured.

C sequestration and Greenhouse Gas (GHG) emissions

Diverse swards may sequester C, particularly when moving from poor to optimal management or on previously degraded soils, but it may not be possible to sequester C at these rates in the longer term so measurements of soil organic C should be taken over an extended time period e.g. in 5 year intervals. Deeper rooted plant species and increases in net primary productivity may increase soil organic matter and move it at depth, so SOC should be measured in top soil and subsoil (Ward et al. 2016).

Where the addition of legumes is effective in reducing manufactured N fertiliser use and in optimal soil and agro-climatic conditions, direct and indirect N_20 emissions could be reduced. However, where legumes are added to swards that did not previously receive manufactured N fertiliser, the additional fixed N can result in a net emission of nitrous oxide so if possible N_2O emissions should be measured.

Water quality

Increases in legumes should lead to a reduction in nitrate leaching, this should be verified through testing of water quality. However, as mentioned, it Is difficult to attribute changes on individual farms or fields to changes in water quality. It may be better to focus on the level of pollutants in the soil which can be easily measured by each individual farmer.

Water conservation/ flooding

Deeper rooting herbs should improve infiltration and it would be useful to measure soil moisture, soil infiltration and incorporate these into catchment modelling.

Yield

There is mixed evidence on the relationship between sward diversity, productivity and yield, further evidence is required. It can be measured as dry matter yield of cut hay.
Evidence also shows potential for improvements in sward quality with diversity, for instance, digestibility, metabolisable energy and crude protein, mineral content, micro and macro nutrients. Some of the plant species in a diverse sward may have medicinal properties and some measure of health/disease in livestock would be useful.

Annex 1: Analysis of how FAB practices fit within the SFI Standards published in March 2021.

Defra's launch of the SFI standards in March 2021 clearly placed the standards within a wider policy framework:

The SFI standards have been created to *help farmers to create greener landscapes and improve biodiversity. They will promote cleaner air and water, and guard against environmental risks such as climate change and flooding. This marks a further important step towards achieving our (DEFRA) 25 Year Environment Plan ambitions and our carbon net zero goals*.

The compatibility of FAB practices with the Standards is clear; two of them directly overlap with FAB practices; the **Hedgerow Standard**, and the **Waterbody Buffering Standard**. A third, **On-farm Woodland**, may link with Agroforestry, but there is a need for more detail. Taking the others in turn;

Arable and Horticultural Standards (key areas highlighted in red):

Introductory level (£28 per hectare)	Intermediate level (£54 per hectare) All actions in the introductory level plus	Advanced level (£74 per hectare) All actions in the introductory and intermediate levels plus
Provide year-round resources for farmland birds and insects	Improve nutrient use efficiency and reduce loses to the environment by carrying out a nutrient budget	Provide nesting and shelter for wildlife by having areas of tall vegetation and scrub
Better meet your soil requirements by following a nutrient management plan	Increase habitat for farm and aquatic wildlife through rotational ditch management	Benefit from crop pest predators by locating their habitats next to cropped areas
Minimise emissions of ammonia through rapid incorporation of organic manures and slurry on ploughed land	Better target your nutrient application by carrying out soil mapping	Use efficient precision application equipment for fertilisers and organic manures

Arable and Horticultural Soils Standard (key areas highlighted in red):

Introductory level (£30 per hectare)	Intermediate level (£47 per hectare) All actions in the introductory level plus	Advanced level (£59/ha) All actions in the introductory and intermediate levels plus
Identify the priority areas for soil management on your farm by carrying out a soil assessment	Further improve soil structure and biology by providing minimum inputs of organic matter over more of your arable and horticultural land	Further improve soil structure and biology by providing minimum inputs of organic matter over more of your arable and horticultural land
	Maintain soil organic matter and support soil biology by reducing tillage depths on some of your arable and horticultural land	Reduce flooding and improve soil structure, soil carbon and soil biology by producing a soil management plan
Protect your soil from runoff, erosion and flooding and help increase crop yields by taking measures to maintain soil structure and avoid or alleviate soil compaction	Reduce the risk of soil erosion and maintain soil organic matter by reducing tillage on fields identified as high and very high risk of surface run-off or soil erosion	Reduce soil damage by limiting the area of the field that is travelled on
Improve the soil structure and biology by inputting organic matter on some of your arable and horticultural land		
Reduce the risk of soil erosion by cultivating and drilling across slopes where appropriate		
Protect the soil from soil erosion and run-off by maintaining minimum soil cover over winter, where appropriate		

Improved Grassland Standard (key areas highlighted in red):

Introductory level (£27 per hectare)	Intermediate level (£62 per hectare) All actions in the introductory level plus	Advanced level (£97 per hectare) All actions in the introductory and intermediate levels plus
Increase above and below ground biodiversity by grazing to retain a minimum sward height	Increase biodiversity and provide habitat for breeding birds by altering the timing of your silage cuts	Increase biodiversity and habitats for wildlife by managing grazing or cutting to provide a higher sward height over a larger area
Increase habitats for insects and small mammals by leaving uncut margins to produce flowers and seeds	Increase habitat for farm and aquatic wildlife through rotational ditch management	Improve soil structure and biology and provide increased pollinator resource with legume and herb-rich swards
Protect your areas of historic interest by maintaining permanent grassland cover on them	Improve nutrient use efficiency and reduce losses to the environment with a nutrient budget	Increase the food available for birds in winter by leaving some ryegrass to bear seed
Protect soils and reduce loses to the environment by following a nutrient management plan	Use slurry more efficiently by testing content, managing application rates and using low emission technologies	Better target your nutrient application by carrying out soil mapping
Provide more habitats for wildlife by taking small areas out of cutting and grazing management	Improve your soil structure and biology, provide pollinator resource and reduce fertiliser application, with clover and legumes	Use efficient precision application equipment for fertilisers and organic manures

Improved Grassland Soils Standard (key areas highlighted in red):

Introductory level (£6 per hectare)	Intermediate level (£6 per hectare) All actions in the introductory level plus	Advanced level (£8 per hectare) All actions in the introductory and intermediate levels plus
Identify the priority areas for soil management on your farm by carrying out a soil assessment	Protect fields from soil erosion, maintain soil carbon and support soil biological activity by reducing tillage on temporary grassland identified as high and very high risk of surface run-off or soil erosion	To improve soil structure, soil carbon and soil biology and reduce flooding, produce a soil management plan
Protect your soil from run-off and flooding, and increase yields, by taking measures to maintain soil structure		Reduce soil compaction by limiting the area of the field that is travelled on

and avoid or alleviate soil compaction and poaching		
When reseeding temporary grassland at high or very risk of surface run-off, soil erosion or flooding, establish grass to achieve good ground cover before winter		

Low and No input grassland standard (key areas highlighted in red):

Introductory level (£22 per hectare)	Intermediate level (£89 per hectare) All actions in the introductory level plus	Advanced level (£110 per hectare) All actions in the introductory and intermediate levels plus
Manage weeds and invasive and competitive species in ways that reduce herbicide impacts	Further increase botanical diversity by managing pasture without fertiliser, and only farmyard manure on meadows	Increase biodiversity by making field-dried hay or haylage on a greater proportion of meadows
Buffer your in-field trees to protect them and provide a habitat for wildlife	Improve habitat for breeding waders by managing rush, where present	
Increase botanical diversity by limiting application rates of inorganic fertiliser and manure	Increase available nesting, shelter and food resources by managing tall vegetation, ponds and scrub	
Provide more habitats for wildlife by leaving some uncut margins to produce flowers and seed	Increase botanical biodiversity by making field-dried hay or haylage in meadows	
Minimise the impacts of supplementary feeding on grasslands, water courses and wildlife		
Increase habitat for farm and aquatic wildlife through rotational ditch management		
Increase biodiversity by managing grazing to leave a minimum sward height		

Further Analysis Required.

Defra have indicated that there is a lot more detail within the proposed standards that is not currently publicly available (March 2021). FAB partners have been presented with these more detailed Standards and are able to 'audit' the actions contained within them against public goods delivery. Some actions deliver greater numbers of public goods than others; and some can deliver greater synergistic benefits when adopted through whole farm systems. The 10 FAB practices were carefully selected by the FAB partners for the reason that they were the most effective when taken together. The FAB partners can conduct a 'gap analysis' of the detailed standards to highlight where the SFI may fall short, and where it could be improved upon.

Annex 2: Demonstrate the economic and environmental benefits of adopting FAB practices through whole farm system planning using a case study of National Trust farm in Cambridgeshire

Nature and soil health are flourishing at the National Trust's Wimpole Home Farm near Cambridge according to the results of a full 'health-check' into its biodiversity, carbon levels and levels of public accessibility.

The results, announced as the landmark Agriculture Bill starts its next crucial stage in the House of Lords tomorrow, show increases in the numbers of breeding pairs of rare farmland birds, invertebrates and how the land is a significant sequester of carbon.

The organic farm has been focusing on nature friendly, sustainable farming methods for the past 12 years to reflect the conservation charity's goals for farming models which are good for nature, deliver public benefit and which are profitable.
Nationally, numbers of farmland birds have declined by 54 per cent since 1970, the distribution of bees and hoverflies declined by 31 per cent between 2009 and 2014 and it is estimated that soil degradation in England and Wales costs the economy £1.2 billion a year.
The 589 hectare (1,419 acre) mixed livestock and arable farm, which is the only lowland farm run in-hand by the conservation charity, conducted in-depth surveys over two years into farmland birds, invertebrates and soil health.

Key results included:
• the doubling in numbers of breeding pairs of rare skylarks and linnets in six years which are good indicators of a healthy ecosystem
• a 38 per cent increase in invertebrate numbers over 13 years to include the recording

of 95 rare and protected species, vital for pollinating crops and preying on pests
• a total carbon balance of -2,260 tonnes of CO2 per year achieved through the amount of organic matter in the soil which soaks up carbon, the number of trees and grown out hedges

As for public goods, in terms of access for the public, Wimpole also has over 40km of public rights of way and permissive paths which are enjoyed by over 350,000 visitors a year.
As a business, the farm is also returning a healthy profit.
Last year, production levels across 369 hectares (912 acres) of the arable farm reached impressive levels for an organic farming system with last year's harvests resulting in 142 tonnes of wheat - enough to make 200,000 loaves of bread, or over four million scones - 123 tonnes of organic barley – equivalent to what's needed to make nearly 1.5million pints of beer and 126 tonnes of organic oats - equivalent to over 2.5 million bowls of porridge.
For 2019, this resulted in £294,617 income, £117,588 profit for the farm (including subsidy payments).
Callum Weir farm manager at Wimpole said: "Many of the increases we recorded in the surveys are down to the combination of organic farming methods in the fields and the mosaic of margins, hedges and habitats that surround each field.

"That is not to say that organic farming is the only way to farm with nature. There are great examples of farmers across the UK who aren't organic but are still delivering massive benefits to the environment. Like many farmers, we dedicate areas of Wimpole to help biodiversity. For example, we sow a variety of plants including phacelia which has purpley blue flowers, clover and sainfoin, with its bright pink flowers which flower from early April right through to October. These attract and support pollinators and insects which have a vital role in the ecosystem.

"The survey results are vital to understanding how our holistic approach to farming at Wimpole is working. We want to farm sustainably at the same time as being a truly viable business and it's fantastic to see how nature friendly farming and a profitable farm business, can go hand in hand."

Professor Dave Goulson, invertebrate expert at Sussex University said: "The intensification of farming practises over the last 100 years, with the move to ever-larger fields, fewer crops, and lots of chemical inputs, has been a major driver of biodiversity loss. It is hugely heartening to see that farming doesn't need to be this way; Wimpole shows that it is possible to have a highly productive, profitable farm without pesticides, and to simultaneously encourage biodiversity and capture carbon. The new Agriculture Bill could learn from this."

Mark Harold, Director of Land and Nature at the National Trust said: "Sustainable, productive and profitable farming is underpinned by a healthy environment.

"Coronavirus has shown how important it is to have a resilient food and farming system. We know that climate change and sustainability pose the greatest threats to food security, as this year's flooding and now drought have shown.

“The Agriculture Bill – and the principle of public money for public goods at its heart – is an opportunity to deliver this.

“At the Trust we are working to demonstrate that sustainable farming does work and that it is profitable.

“We have taken the risks, experimented and want to share our learnings with others. At Wimpole we’ve had to overcome particular challenges such as soil degradation, decreasing returns from farming and declines in farmland wildlife.

“With a focus on sustainable land management, wildlife and soil health can recover quicker than we might think.

“The story at Wimpole paints one of hope and optimism – and the Government’s forthcoming ‘environmental land management scheme’ will be crucial to replicating this across the farming industry, as will the new Agriculture Bill in prioritising government support for this scheme.

Together, these two mechanisms will ensure all farms have a sustainable future which will be good for the environment, good for farm businesses and good for people.

“Tomorrow, the Agriculture Bill starts its next stage in the House of Lords. It’s vital that its ambition and key public goods principles aren’t weakened. We also mustn’t see progress at home on sustainability undermined by food imports that don’t meet our standards: the Bill should therefore be amended to provide safeguards against this.”

Survey results in detail:
To fully understand the impact of 12 years of organic farming on the environment, the team carried out surveys into rare farmland birds, invertebrates and conducted an in-depth study into carbon sequestration.

Key findings from the farmland bird survey conducted across half the farm revealed that since 2013:
- Numbers of rare skylarks have increased by 75 per cent, from 12 to 21 pairs
- Number of rare linnets have doubled from three to seven pairs
- Wimpole is one of the most important populations of the rare corn bunting in Cambridgeshire with between five and eight pairs breeding each year
- The farm provides winter feeding habitat for at least nine rare bird species - grey partridge, lapwing, linnet, skylark, starling, yellowhammer, woodcock, hen harrier, fieldfare

A total of 1,145 species were recorded in the invertebrates’ survey, equating to an increase of 38 per cent in the number of species between 2003 and 2019.

This included 95 rare species with formal conservation status including Bombus Ruderatus – the large garden bumblebee and Tyria Jacobaeae - the cinnabar moth. 75 species of bee, 49 species of wasps, 46 species of hoverflies and 22 types of butterflies

were recorded. Other key results from last year included:
- A 150 per cent increase in Hymonptera (wasps, bees, ants)
- A 190 per cent increase in the number of rare invertebrate species including the nationally scarce (NS) Tumbling Flower Beeting (Mordellistena variegate), the small heath butterfly (high on the Butterfly Conservation Priority List) and the (NS) Slender-horned Leatherback
- A 30 per cent increase in the number of butterfly species including the silver washed fritillary and marbled white.
- The organic field margins support on average 30 per cent more invertebrates then conventional field margins.

Callum continued: “We were so pleased by the results of the study. It was great to see that our margins, so rich in wildlife, bordering productive farmland. This gave me real hope that with the right support, farmers can help address biodiversity losses and play our part with tackling the climate crisis.”

The team used the Farm Carbon Cutting Toolkit, a recognised carbon measure by the farming industry, to conduct a full carbon analysis across the whole estate to include the farmland, parkland and woodland.
Thanks to the team’s holistic approach to farming on the estate, incorporating soil management, habitats and tree planting/woodland management, the land is a significant sequester of carbon, with a total carbon balance of -2,260 tonnes of CO2 per year.
Callum explains: “When you think that an economy class return flight from London to New York emits an estimated 0.67 tonnes of CO2 per passenger, this is really significant.”

Over the last 12 years, by far the biggest sequester of carbon is the increase in soil organic matter (SOM).
This has been achieved by applying agroecological principles to the arable farmland which includes reducing cultivation, cover cropping, integrating livestock, utilising habitats and stewardship and embracing technology.

“Trees were a significant sequester or carbon on the estate, however the main belts and blocks of woodlands on the estate are reaching maturity and will soon stop sequestering carbon (but these old trees remain very valuable to biodiversity). However, we’ve addressed this by planting 1,000 parkland trees over the past 10 years which will help with carbon capture and biodiversity.

“We recognise that our livestock are a large emitter of carbon. But, they are the perfect tool to manage our Grade 1 listed parkland and the traditional hay meadows.

“If we were to plough up the parkland and convert it to arable, this would release 50,000 tonnes of CO2e from this carbon sink – equivalent to 100,000 return flights to New York City (for individual people or 416 full 747 aeroplanes). This demonstrates the value of livestock in the carbon cycle, and the benefits of grass-fed meat. If meat is produced in the right way and consumed in the right amounts, it can be sustainable.”

Annex 3: Demonstrate the benefits to farmers of having access to researchers and experts through use of FAB 'demonstration farms' giving an example in Devon of the Herbal Leys Learning Network.

FAB partner Soil Association is conducting a Test and Trial for Defra in Devon. It has submitted an Action Plan for landscape scale change, which includes surveys of farmers' attitudes to changing their practices in order to deliver more public goods. A copy of the Action Plan can be found attached. The two FAB practices that farmers were likely to adopt first were herbal leys and agroforestry.

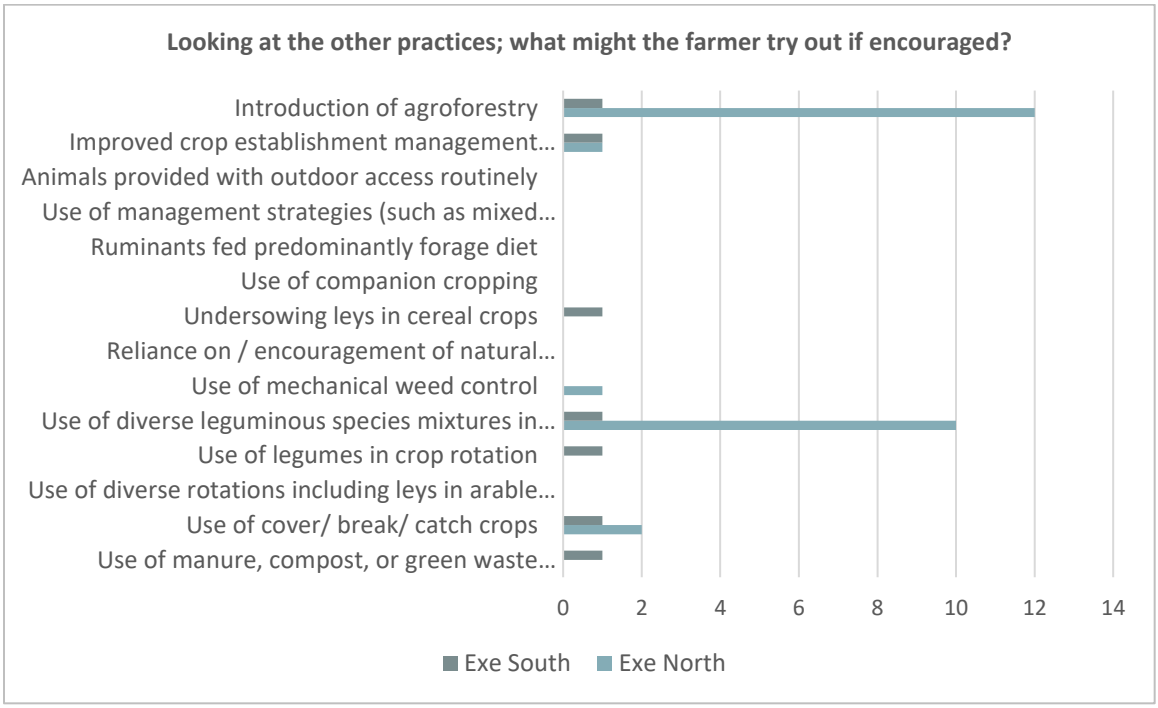

Figure 3: Bar chart from Action Plan.

FAB Learning Networks have been established to help farmers to change their practices. The Herbal Leys Learning Network provides a successful example of how working, learning and sharing as an extended group can build confidence and expertise rapidly in agroecological practices. The Network is a mix of farmers, advisors, researchers and other industry bodies (e.g. seed companies). Led by the Soil Association the Network has included individual farmer support and advice as need delivered by expert advisors, farm walks and events hosted on network member farms who are implementing herbal leys at variable scales. There have been practical webinars learning direct from farmers and also updates of relevant research and active dissemination of research in digestible forms through blogs and via social media. We have also brought together a wider herbal leys stakeholder group to consider boundaries to implementation at a landscape scale and

actions to overcome these. This combined approach and having a practical organisation to take the lead has ensured we have built momentum and confidence in the uptake of such a valuable agroecological practice.

Three Learning Networks have been developed to date. These Networks have focused on either the implementation of two specific FAB measures: agroforestry and diverse herbal leys as part of mixed cropping. Plus an additional third network has established and led by Farm Carbon Toolkit (FCT) and this network includes farmers working together to reduce their carbon footprint by implementing FAB measures.
The farms within the **herbal leys network** are predominantly organic and non-organic dairy farmers who are looking to adopt or expand the area of diverse herbal leys on their grazing platform. Additionally, there are beef and sheep farmers and arable/mixed farmers looking to implement herbal leys as part of their rotation. A large proportion of the arable cropping in the SW is on mixed farms where crops are grown directly for livestock feed either to be harvested as grain or whole crop. Therefore, there is good scope to utilise fertility building diverse leys in the rotation. The learning network provides an ideal opportunity for non-organic farmers who have yet to implement diverse leys to learn from the experience, knowledge and confidence of those that have already embraced the approach. Utilising these diverse swards to reduce nitrogen inputs, improve soil organic matter and health, improve livestock health and forage resilience against drought and increase habitat for pollinators.

Herbal leys learning network:
The main challenges when implementing herbal leys measures are:

- Loosing species diversity over life of the crop
- How to maximise forage production without overgrazing.
- Establish which species to grow on their soils.
- Guidance on how and when to establish mixes
- Concern of later growth spirt of diverse mixes – where Rye grass ley responds well early season
- Reliance on contactors to carry out establishment work – making sure they do a good job – establish at the right time

The main knowledge gaps are areas of support the farmers what the network to address in the adoption of herbal leys are:

- Overcome longevity issues with herbal leys. How to maintain species diversity over a long period.
- How to maximise forage production without overgrazing.
- Establish which species to grow on their soils.
- Establishment guidance and grazing guidelines

Herbal leys learning network
Four of the FAB demonstration farmers that are implementing and expanding the areas of diverse mixed ley are part of an Innovative Farmers trial. The trial is focused on "*Optimising the length of herbal leys - considering grazing intensity and species mixes sown for lasting*

diverse species composition and optimal nutritional feed value". The farmers in this trial are becoming very knowledgeable in managing these swards.
There is considerable knowledge within the Herbal leys learning network. Cotswold Seeds have huge experience in formulating mixes in these diverse leys and advising on establishment and ongoing management.
Clyde Jones, a member of the network, formally dairy farming had converted his whole grazing platform into diverse herbal mixes he is now advising other farmers looking to adopt this approach.
Farming and Wildlife Advisory Group are part of this herbal leys network. They have a number of trials and projects collecting information that can feed knowledge into the network. They are running an Innovative Farmers Field lab looking at incorporating herbal leys into the arable rotation to improve soil health. Additionally, they are looking at the use of herbal leys within intensive dairy farms and their ability to protect water courses, improving soil structure and infiltration.

What activity?	When?	Who will be involved?
Knowledge related activities		
Demonstration event on herbal leys at North Wyke – bringing in learning from The Toolbox of Multi-species Swards project (TOMS); Achieving Sustainable Agricultural Systems project (ASSIST); Cell Grazing, the precision grazing project	*March 2020 – postponed due to COVID 19. Webinars delivered in May/June 2020*	*Farmers from networks, experts and researchers*

Annex 4: Highlight the importance of baseline audits for farms and recommend a Public Goods assessment tool.

FABfarmers partners have also been trialling baseline audits for farmers using a Public Goods Tool.
If policy makers are to expect land managers to want to participate in landscape scale change to improve delivery of public goods, it is necessary to help them to understand what these public goods are. Then to assess what they are already (either knowingly or otherwise) providing. The Public Goods Tool that we used has been developed by the Organic Research Centre and has been in use for some years by organic advisers. We adapted it to ensure convergence with Defra's 6 Public Goods, and the suite of agroecological practices that we identified as most suitable. Once an audit is complete a land manager is given a visual representation of public goods delivery, which highlights areas of strength and weakness.

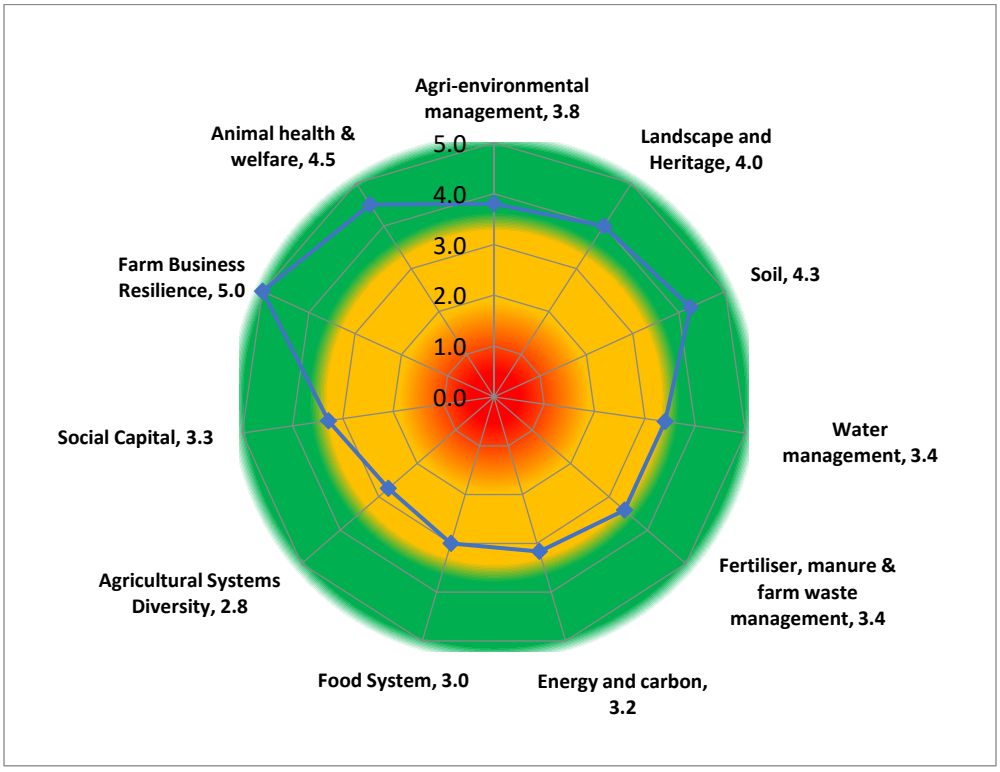

Figure 4: Results from a participating farmer's PG Tool in the Exe valley – visual representation of public goods delivery.

Although some farmers were able to use the PG Tool themselves to help them to decide what changes they might be best placed to make, the majority were not able to do this, and did need some advice and support. Originally the PG Tool was designed as an advisory tool yet it has successfully been used independently by a number of innovative farmers interested in understanding their public goods delivery on farm.