Final Report

Identification of farming regulations and wider legislation critical to protecting and improving the natural environment

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Executive summary

Background

The Office for Environmental Protection (OEP) commissioned ICF and ADAS to assess how effectively farming regulations and wider legislation in England protect and improve the natural environment. The work supports OEP's duties in England to monitor and critically assess on governments' progress in improving the natural environment in line with the Environmental Improvement Plan (EIP), goals and targets.

Methods

The project used a three-stage approach, consisting of:

1. Baseline risk assessment: expert scoring of 89 farming and land management activities for their baseline environmental risk, using a source–pathway–receptor (SPR) model. The assessment assumed a "worst-case, in the absence of compliance" baseline counterfactual to compare regulatory effects, it does not imply that all farms operate without compliance in practice. The scoring scale ranged from -3 (high degradation) to +3 (high improvement), with negative values indicating increasing levels of environmental harm and positive values indicating environmental benefit.
2. Regulatory effectiveness mapping and scoring: experts scored 75 regulations, categorising and mapping them to farm types and farming activities and scoring them on their coverage and control of risks under compliance. Coverage, for the purpose of this assessment, refers to whether regulatory requirements apply to the relevant source–pathway–receptor link for an activity (i.e., was the baseline risk within regulatory scope). Control refers to how strongly those requirements, including mitigating rules, reduce the baseline risk if complied with. For example, a rule may "cover" nutrient spreading nationally, but "control" may be weaker if requirements are ambiguous or enforcement/follow-up is limited. Note: high coverage can coexist with weak control (broad but vague rules), and high control can coexist with limited coverage (strong rules that apply only to some farm types/areas). The scoring scale ranged from 0 (no discernible coverage or control) to 3 (high coverage or control), with higher values indicating greater effectiveness in reducing, avoiding, or compensating for environmental pressures or pollutants.
3. Regulatory monitoring regime analysis: the team analysed the monitoring and enforcement regimes of key regulators (Environment Agency, Rural Payments Agency, Natural England, Health and Safety Executive, Local Authorities), focusing on real-world implementation, systemic gaps, compliance rates and the effectiveness of monitoring and enforcement strategies.

The three-stage approach was supported by spatial analysis, statistical testing, a review of publicly available evidence and the development of an interactive dashboard to visualise findings at national and regional scales. The findings were validated through workshops with regulators, government officials and sector stakeholders.

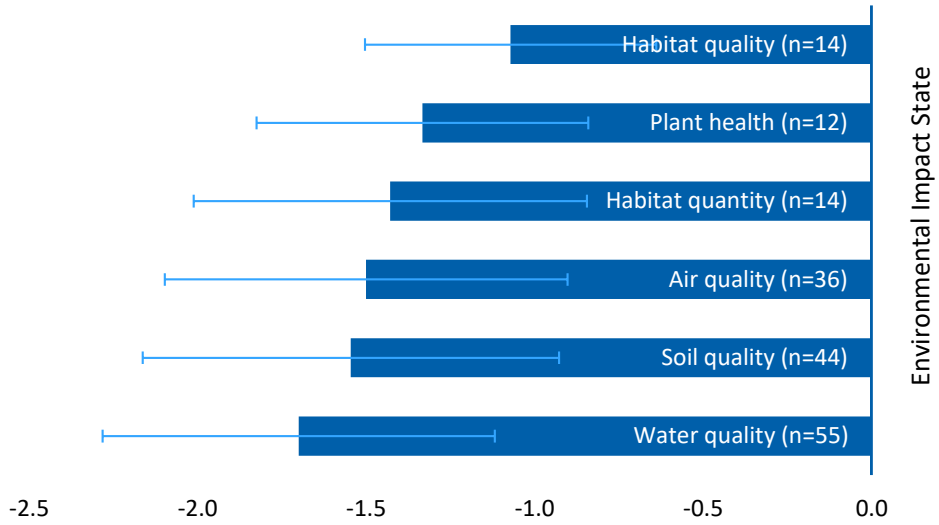
Baseline environmental risks

The analysis of baseline environmental risks associated with farming activities revealed substantial variation in impact severity across farm types, environmental impacted states (EIS), pollutant categories, and regions. Activities such as nutrient application (e.g., organic manures such as slurry/manure/digestate and manufactured fertilisers), pose moderate to high risks to soil, water, and air quality under baseline conditions where the absence of regulatory mitigations are assumed. These practices are also major contributors to ammonia and nitrous oxide emissions and increase the likelihood of nutrient runoff, highlighting the need for targeted interventions such as improved nutrient management and incorporation techniques.

Waste management practices, particularly pesticide disposal and silage effluent handling, were identified as major contributors to contamination risks. Combustion and burning activities were found to exacerbate air quality degradation and wildlife health impacts. These findings indicate that without regulatory enforcement, diffuse pollution and habitat disruption remain persistent threats.

Pollutant-specific analysis highlighted nitrates, phosphorus, ammonia, and methane as the most environmentally impactful substances. These were closely linked to fertiliser use and livestock emissions. Conversely, pollutants such as particulate matter (PM2.5 and PM10) and carbon monoxide exhibited lower, but still notable, risks. At the farm level (see Table 1Figure 1 below), cropping systems, particularly horticulture and cereals, showed the highest baseline environmental risks, while mixed and grazing systems faced lower baseline pressures. At the national scale, cereals contributed the largest share of overall impact as they occupy a substantial proportion of farmland, even though the risk profile of a typical cereal farm is similar to other arable systems. Across outcomes, soil and water quality were the most vulnerable EIS, indicating moderate to high baseline risks relative to other EIS.

Figure 1 Assessed baseline risks of impacts from farming activities on EIS.

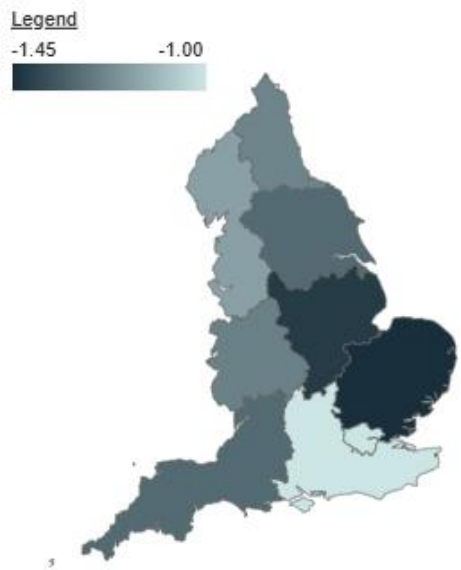


Scoring scale ranged from -3 (high degradation) to +3 (high improvement).

Note: Whiskers represent standard deviation for each EIS. Note: Water quantity/availability and wildlife heath are not shown as their small sample size (n=8) limits generalisation of statistical findings.

Regional analysis (see Figure 2 below) showed that baseline risks potentially vary substantially across England, driven by differences in farming structure and land use intensity. Weighted baseline environmental risks were highest in regions with greater land area under cereal cropping systems and intensive grazing nutrient loading. These observations highlight the importance of spatially targeted interventions and region-specific strategies, particularly in areas dominated by cereals and mixed cropping systems.

Figure 2 Baseline impact of farming activities in regions of England.



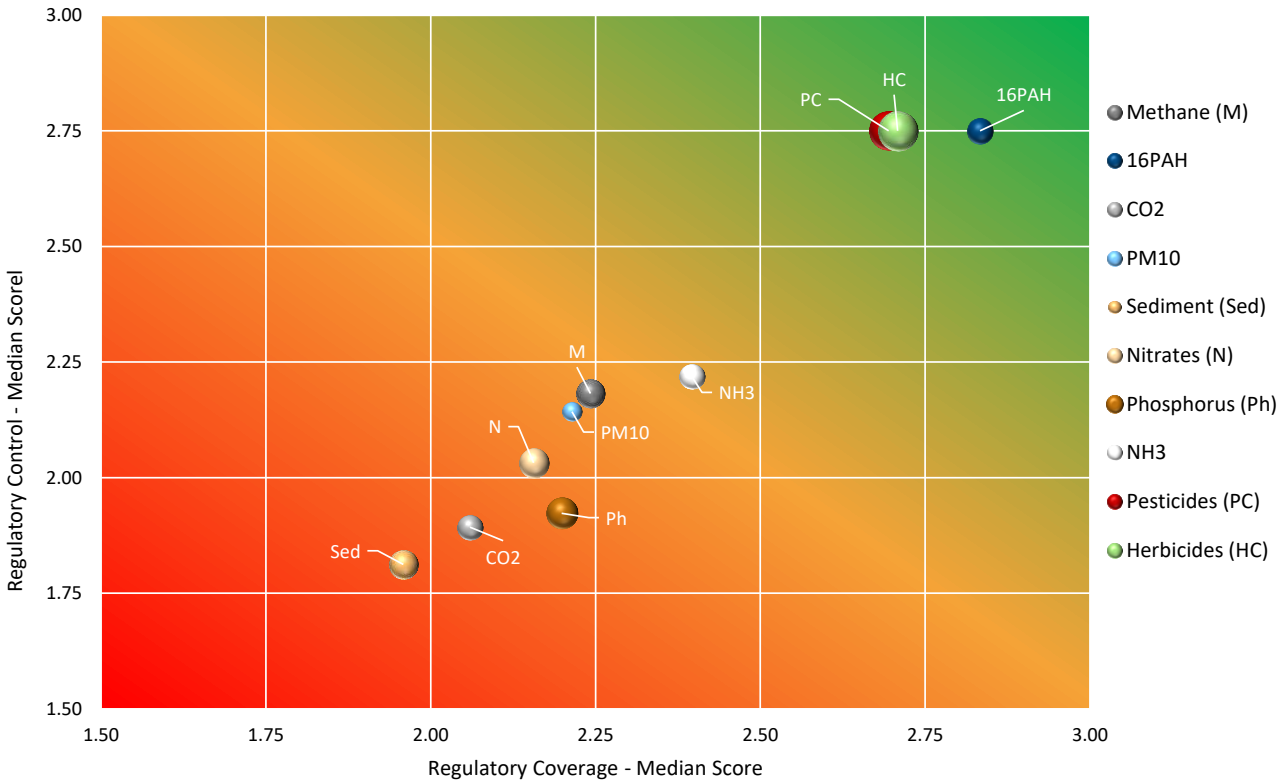
Scoring ranged from -1.45 to -1.0 (the higher score / darker colour representing a higher risk identified) out of a full range of -3 (high degradation) to +3 (high improvement).

Source: OEP 006 - INS305-03 - Dashboard, Annex 9

Regulatory effectiveness

The assessment of regulatory effectiveness indicated that current frameworks are only partially effective and uneven in controlling baseline risks. Certain pollutants, such as pesticides and herbicides, benefit from strong regulatory coverage and control. Others, particularly diffuse pollutants (e.g., nutrient, sediment) and atmospheric pollutants (e.g., PM2.5 and carbon monoxide), remain subject to weaker/less agriculture-specific controls. PM emissions, for example, are mainly addressed indirectly through general permitting rather than dedicated on-farm standards (see Figure 3 below). Soil and water quality were seen as being relatively well-covered by regulations, but control measures were highlighted as being weak.

Figure 3 Risk matrix of regulatory coverage and control median scores, highlighting overall regulatory effectiveness across assessed pollutants.



Vertical axis shows regulatory control scores on a (1.5 to 3) scale. Horizontal axis shows regulatory coverage scores on a (1.5 to 3) scoring scale.

At national and regional scales, regulatory control and coverage are broadly uniform, but pollutant-specific gaps persist, particularly for emissions and cumulative impacts. Farming rules and mitigations tend to prioritise single-holding compliance, not total catchment or local air-quality load. Many small, compliant increments (e.g., manure and fertiliser applications, yard/runoff losses, pesticide pulses, ammonia) accumulate across soils, surface and groundwaters, and local air pathways over time, affecting WFD water bodies, AQMAs and protected sites. Thresholds, permitting silos and compliance-focused monitoring often miss hotspots, while legacy phosphorus, nitrate lags, and secondary PM2.5 compound underestimation of cumulative impacts. This indicates that while regulations provide a

foundation for environmental protection, they do not fully address the spectrum of risks posed by farming and land management activities.

Overall, the findings point to a regulatory landscape that is uneven and misaligned with the full range of environmental pressures.

Regulatory monitoring regimes

The analysis of monitoring and enforcement regimes reveals a system that is predominantly risk-based and reactive. Regulatory inspections and enforcement actions are concentrated on high-risk holdings (risk defined by farm type, geography and history of compliance), meaning that a significant proportion of farms (especially smaller, low-input, or mixed enterprises) receive little or no oversight. Persistent non-compliance is a notable challenge: nearly half of farms inspected under the Farming Rules for Water failed at least one requirement, and one-third of non-compliances are not rectified, likely indicating that enforcement mechanisms are not always effective at securing environmental outcomes. Additionally, the complexity of regulations may mean that some land managers struggle to clearly understand the requirements prior to receiving advice.

Data gaps are a major barrier to effective oversight and accountability. For 30 out of 70 regulations examined, there was limited or no information on the responsible authority or on compliance levels received within this study. For example, no responsible authority or data was identified for the Mobile Sheep Dipping Code of Practice 2023, the Animal Feed (Hygiene, Sampling etc. and Enforcement) (England) Regulations 2015 or the Veterinary Medicines Regulations 2013. This lack of transparency undermines the ability to assess regulatory effectiveness and target interventions where they are most needed.

The Environment Agency's risk-based inspection approach broadly aligns with the geographic and sectoral patterns of environmental risk identified in this study, particularly for dairy, poultry and lowland grazing livestock farms in high impact regions such as the South West, West Midlands and North West. However, gaps remain where lower risk areas rely on complaints, mixed farming coverage is inconsistent, and the lack of farm type data in EA inspection records shared with the study team limited the ability to fully assess whether all high risk sectors, such as specialist pigs and cereals, are being adequately monitored.

The removal of the cross-compliance mechanism (previously linked to CAP payments) at the end of 2023 may have created a gap in monitoring and enforcement for core environmental regulations. The system now relies more heavily on the capacity and coordination of statutory regulators, but roles and responsibilities appear unclear for some regulations, and there is a risk that they are no longer systematically monitored. For example, the RPA was the only responsible authority identified for the Ancient Monuments and Archaeological Areas Act 1979 and the Animals and Animal Products (Examination for Residues and Maximum Residue Limits) (England and Scotland) Regulations 2015, but it was unclear from the data in this study how these regulations are currently being monitored and enforced.

There are signs of innovation: the introduction of remote sensing by the Environment Agency in 2024 increased detection of non-compliance by 15–20%, particularly for issues such as slurry storage capacity and soil erosion. However, these tools are not yet systematically integrated into compliance statistics or enforcement strategies, and their use remains uneven across regions and regulatory domains.

Enforcement actions are largely advisory, with most breaches resolved through guidance or warnings. However, persistent offenders remain, especially in relation to nutrient management and manure storage. Smaller, non-permitted farms and non-designated habitats are less systematically monitored, and proactive monitoring is limited, particularly for non-designated species and emerging risks such as zoonotic diseases and climate change impacts. This patchwork approach leaves important environmental risks unaddressed and highlights the need for a more integrated, transparent, and proactive compliance and enforcement regime. Conversely, the analysis highlights significant regulatory overlap in water and soil quality, as well as nutrient management. This complexity arises from multiple regulations sharing similar environmental goals, especially in pollution control, soils, waste management, and water protection.

Conclusions and recommendations

This assessment demonstrates that England's regulatory system for farming and environmental protection is most effective where risks are direct, measurable, and linked to robust enforcement. However, persistent gaps, overlaps, and ambiguities limit its effectiveness and leave significant environmental risks unaddressed.

Key conclusions:

Greatest baseline risks are concentrated in high input mixed cropping and horticulture systems, with water and soil quality as the most affected environmental states. These risks are highest in the East Midlands, East of England, and South West, where intensive systems dominate. Regulatory effectiveness is uneven. Regulations for pesticides, herbicides, and plant health are well established and when implemented appropriately can be effective, but soil and water quality controls are weaker, particularly for erosion, compaction, and diffuse pollution. Air quality and cumulative impacts from smaller or mixed farms remain under-regulated although this may be proportionate to their impact.

A lack of detailed and accessible monitoring data held by most regulators makes assessing compliance and enforcement difficult. The EA appears to have the most comprehensive datasets available.

Recent policy changes, notably the removal of cross-compliance, may have created further gaps in monitoring and enforcement, especially for core environmental regulations. While remote sensing has improved detection of non-compliance, it is not yet systematically integrated into enforcement.

Recommendations:

To inform regulatory reform, Defra and delivery bodies should:

1. Rationalise and clarify the regulatory framework. Streamline existing regulations, remove unnecessary duplication, and ensure each regulation has a clearly assigned enforcement body. All rules should be explicitly aligned with all Environmental Improvement Plan (EIP) targets, including biodiversity and climate targets, with outcome indicators for all major regulatory areas.
2. Prioritise regulatory improvement and enforcement for mixed, low-input, and diversified farms in lowland and higher-risk regions. These farming systems were found to have notable evidence gaps, particularly in regions where baseline environmental risks were found to be higher. While permitting drives an inspection focus on pigs/poultry, our baseline assessment suggests cumulatively significant pressures can also arise from widespread arable systems; this supports periodic review of spatial targeting criteria. Expansion of regulatory requirements for upland extensive grazing or Less Favourable Area (LFA) systems is a lower priority, as they consistently show the lowest baseline risks. In addition, the EA should review its risk-based approach to ensure sufficient coverage and enforcement of all farm types posing a risk to water quality.
3. Improve data standardisation and transparency. Develop unified, accessible data platforms across all regulators to support robust monitoring, reporting, and adaptive management. This will enable better tracking of compliance rates, environmental outcomes, and enforcement actions.

To support long-term implementation and compliment regulatory compliance, Defra and delivery bodies should:

4. Undertake proactive, not just reactive, compliance. Expand risk-informed and integrated monitoring, increase use of digital tools and remote sensing, and improve follow-up and rectification rates, especially for persistent non-compliance in high-risk sectors.
5. Strengthen guidance and communication for land managers. Invest in clearer, more accessible guidance, especially for complex or overlapping requirements such as hedgerow and nutrient management, to support compliance and reduce confusion.
6. Continue to support voluntary and incentive-based schemes to complement regulation. Where direct enforcement is challenging (e.g., soil health, small-scale horticulture), voluntary schemes and financial incentives should be developed and promoted to encourage best practice and go beyond minimum regulatory standards.

1 Introduction

This is the final report of the research project INS305-03: Identification of farming regulations and wider legislation critical to protecting and improving the natural environment. It presents the process undertaken, summarises main findings and provides recommendations for further scrutiny.

1.1 Background

The Office for Environmental Protection (OEP) is an independent public body established under the Environment Act 2021. Its mission is to protect and improve the natural environment by holding government and other public authorities to account. The OEP monitors, critically assesses and reports on governments' progress in improving the natural environment in line with their Environmental Improvement Plans (EIPs), goals and targets. This remit encompasses both England and Northern Ireland.

To support these duties, the OEP commissioned ICF and ADAS to assess the effectiveness of farming regulations and wider legislation in England in protecting and improving the natural environment.

This work also supports the OEPs wider function to scrutinise environmental law.

1.2 About the project

The project assessed the extent to which farming regulations and wider legislation mitigate the environmental impact of farming and land management activities (hereafter ‘farming activities’). The outputs will inform future progress reporting and further scrutiny.

The objectives of the project were to:

Categorise the baseline risks of impact from farming activities on the natural environment, in the absence of regulatory compliance or implementation of mitigation measures on farms (Task A).

Categorise the scale of effect of farming regulations and wider legislation in mitigating the baseline risks of impact from farming activities (Task B).

Summarise the implementation of farming regulations and wider legislation critical to achieving biodiversity targets and environmental commitments (Task C).

The project synthesises findings from the analysis and provides recommendations to support future scrutiny of the regulatory landscape and its effectiveness in reducing the baseline risks of impact from farming activities. It also provides an interactive tool to further support OEP appraisal activities, which is hosted on Power BI.

1.3 Structure of this report

The structure of the report is as follows:

- Chapter 2 describes the three-stage methodology, including the source-pathway-receptor approach and methods for data collection, scoring, validation and analysis.
- Chapter 3 presents findings on the baseline risks of impact associated with different farming activities and systems, highlighting variations by environmental impacted state, pollutant, farm type and region.
- Chapter 4 presents findings on the extent to which current regulations and wider legislation mitigate the baseline risks of impact from farming activities, identifying the strengths, gaps and variability in regulatory coverage and control across environmental impacted states.
- Chapter 5 presents findings on the current state of compliance and enforcement for a selection of regulations critical to biodiversity targets and commitments, by regulatory body and regulation.
- Chapter 6 synthesises the main findings, evaluates the strengths and weaknesses of the regulatory landscape and provides targeted recommendations for future scrutiny.

The annexes provide supporting materials including:

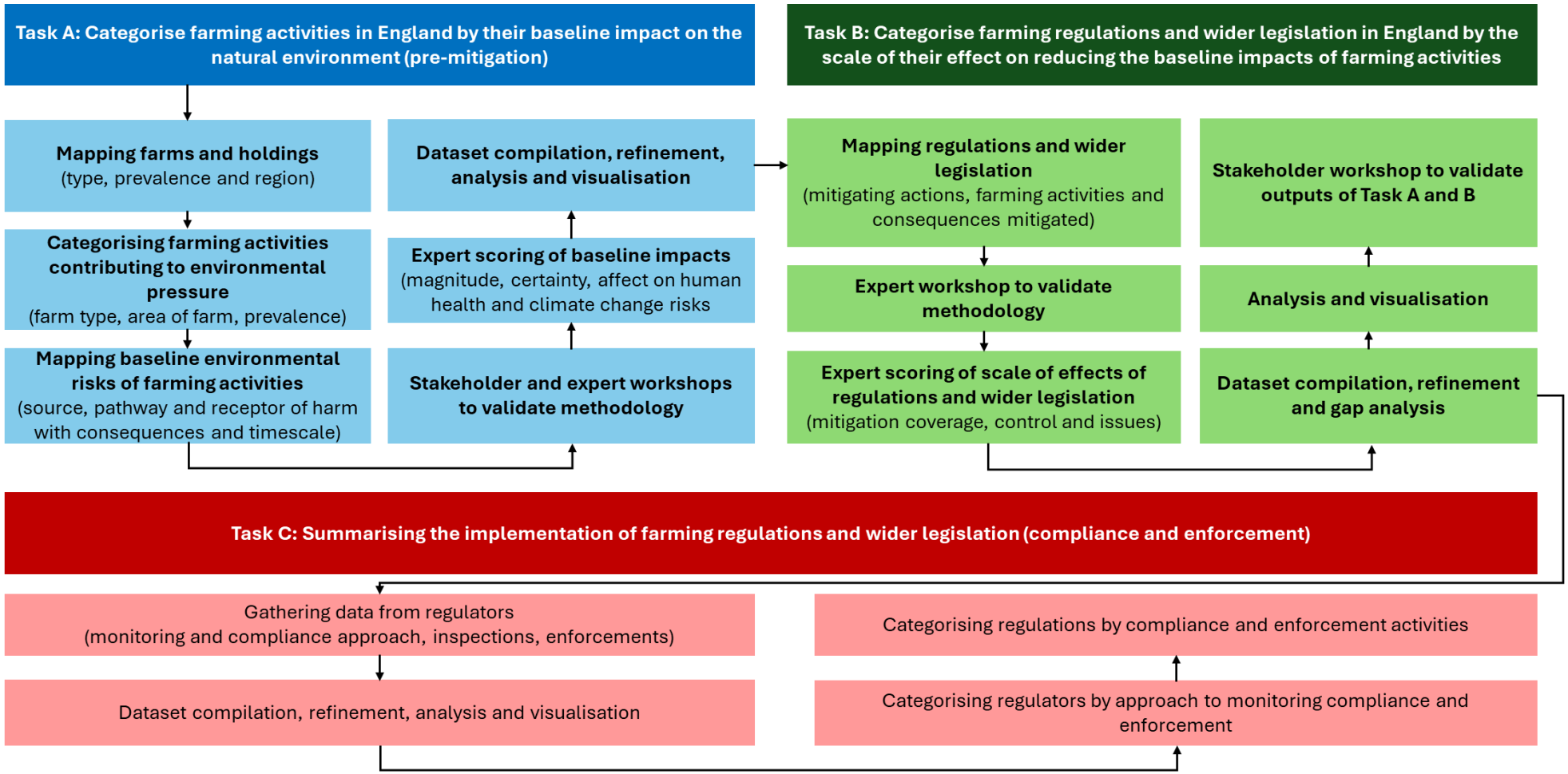
- a list of references, glossary of terms and technical categories used in the study;
- the scoring methodologies for assessing baseline risks of impact and regulatory effectiveness;
- detailed results from the analysis of baseline risks of impact and regulatory effectiveness;
- a list and classification of regulations assessed in this study; and
- a summary of regulatory compliance and enforcement.

2 Methodology

The research employed a three-stage approach to assess the extent to which farming regulations and wider legislation reduce the impact of farming activities on the natural environment. The approach was grounded in robust scientific principles, specifically the source–pathway–receptor framework, which informed the mapping of environmental risks associated with farming activities.

The research design combined a review of publicly available evidence with structured scoring. The approach relied primarily on the judgment of technical experts, due to the breadth and complexity of the study. Eight scorers with expertise covering domain areas of agronomy, hydrology, soil science, livestock grazing, ecology and environmental regulation contributed to the research. The methodology was supported by a set of definitions and assumptions, as detailed in Annex 2 and Annex 3. Figure 4 provides an overview of the research design and process followed for this research.

Figure 4 Research design



2.1 Categorising the baseline risks of impact from farming activities on the natural environment

This study evaluated the environmental impacts associated with farming activities. Its purpose was to identify the risks from farming in the absence of regulatory compliance and no implementation of mitigation measures. An assessment of the likelihood and scale of risks at national and regional levels was also undertaken. The following were taken into consideration:

- farm types and farming activities identified as having a high risk when scaled up;
- farm types and farming activities shown to pose a common risk to key statutory and associated interim biodiversity targets and commitments (see Annex 6) and related ecosystem services[1];
- a short listing and categorisation of farm types and farming activities (see Annex 3);
- the strength of the link between farming activities and impacts on ecosystems services and those biodiversity targets;
- the degree to which farming activities influence environmental risks;
- the degree to which farming activities impact the quantity, quality and connectivity of habitats; and
- a confidence rating for the linkage, considering uncertainty, the robustness of the link with the biodiversity targets, commitments, and related ecosystem services.

The project team carried out the categorisation and assessment in three stages:

1. Identifying and categorising activities by farm type (including sector, number, enterprise type and location) and by the source, pathway and receptor of environmental baseline risks.
2. Assessing the baseline risks of impacts from farming activities on the natural environment in the absence of regulatory compliance and mitigation actions, with judgment based ordinal scoring by technical experts.
3. Assessing the baseline risks of impact at a regional level, using regional data on farm types to weight impact.

[1] Ecosystem services refer to the benefits that humans obtain from ecosystems, including provisioning services (such as food, water, and raw materials), regulating services (such as climate regulation, water purification, and pollination), cultural services (such as recreation and aesthetic value), and supporting services (such as soil formation and nutrient cycling) that underpin all other services.

2.1.1 Source-pathway-receptor approach

A source-pathway-receptor (SPR) approach was used to identify and assess the baseline risk of impacts from farming activities.

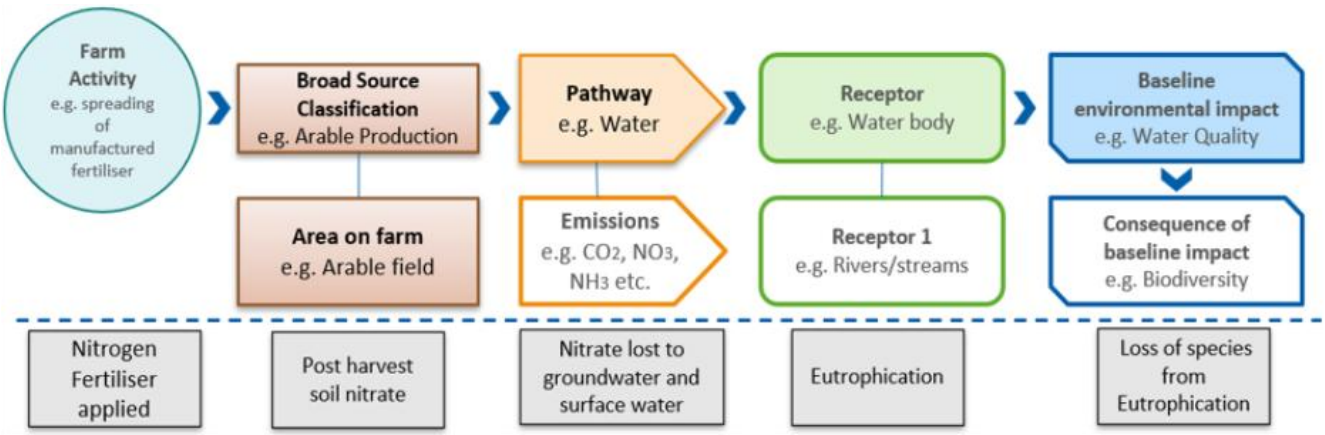
The SPR framework (Ericson et al., 2020[2]; Environment Agency, 2025[3]) provides a structured approach for assessing environmental risks, by tracing how pollutants and pressures lead to impacts on the natural environment. It consists of three principal elements:

- the source describes the origin of potential pollutants or pressures;
- the pathway describes how pollutants move from their source to the environment, either directly (e.g., surface runoff into water bodies or leaching into groundwater) or indirectly (e.g., atmospheric deposition from volatised chemicals); and
- receptors are the environmental components affected, including rivers, lakes, soils, air, plants, and wildlife.

For example, the SPR framework can show how nitrogen from fertilisers (source) moves through runoff or leaching (pathway) to degrade groundwater quality or cause eutrophication in rivers (receptor), harming aquatic ecosystems (Figure 5). Applying the SPR framework enables a clearer understanding of where and how environmental impacts can occur, enabling targeted, effective mitigation strategies for future regulatory interventions.

The SPR approach applied to this research was adapted from Payraudeau and van der Werf (2005)[4] and tailored to the context of this research.

Figure 5 SPR approach applied to this research



Source: Adapted from Payraudeau and van der Werf (2005).

[2] Ericson et al. (2020) available at: Rapid Environmental Assessment (REA) investigator handbook
[3] Environment Agency (2025) available at: LCRM: Stage 1 risk assessment - GOV.UK
[4] Payraudeau and van der Werf (2005) available at: Environmental impact assessment for a farming region: a review of methods - ScienceDirect

2.1.2 Identification and mapping of farming activities

This subtask categorised farm types and farming activities based on their baseline risk of impact on the natural environment. The categorisation considered the characteristics of farms or holdings, the activities carried out in these settings and the scale of their baseline impact on the environment under an assumption of no regulatory mitigations being in place or undertaken on farm.

2.1.2.1 Preliminary review and mapping of farming activities to baseline impacts

A selection of farming activities was drawn up using a range of sources. Supporting information and data were collated and reviewed from publicly available evidence in three stages: (1) categorising farms holdings by type using data from the 2024 Defra Annual June Survey of Agriculture and Horticulture[5] (hereinafter Defra June Survey); (2) categorising farm activities; and (3) mapping the baseline risks of impact by categories of farm type and activity. The mapping process utilised a variation of a source-pathway-receptor model (see Section 2.1.1) to assess the risk that each farming activity might have on the natural environment. The prevalence of farming activities was mapped by the farm types identified in Annex 3, Table 8.

The starting point was the previous research undertaken by ADAS, on behalf of Defra, which assessed the effectiveness of the UK regulatory system in addressing the impacts (severity, extent and whether mitigated or unmitigated) of agriculture and other rural land management activities on primary domains (e.g. air, water, soil etc.).[6] The work, which looked at both general and animal health focused farming activities, helped inform the activities to identify farming/land management activities and relevant regulations for this research. The findings of the work provided an easily accessible base of evidence which supported rapid collation.

The National Atmospheric Emissions Inventory[7] (NAEI) UK emissions data selector was used as an additional preliminary source of information to refine the categorisation of farming activities (see Annex 3), as well as associated environmental pressures. This online tool offers the opportunity to search for data on a variety of pollutants including greenhouse gases, air pollutants, heavy metals and base cations and particulate matter.

2.1.2.2 Mapping farms holdings, by their type, region and prevalence

The project team collated evidence from the Defra June Survey to identify the prevalence of farming activities and their impacts on the natural environment at a regional and national level. Farming activities were categorised by farm type (or sector) at two levels (Table 1).

[5] Defra (2024) available at: Defra Annual June Survey of Agriculture and Horticulture, 2024

[6] Unpublished, internal Defra Report.

[7] National Atmospheric Emissions Inventory (2025) available at: National Atmospheric Emissions Inventory

Table 1 Farm types used for categorisation of farming activities

Level 1	Level 2
Cropping	Cereals
	General cropping
	Horticulture
Grazing livestock	Dairy
	Grazing livestock (LFA)
	Grazing livestock (Lowland)
Other types and mixed	Specialist poultry
	Specialist pigs
	Mixed

Source: Defra (2023) Farm classification in the United Kingdom.

Farming activities were then mapped by their prevalence across the regions in England.[8]

2.1.3 Assessment of baseline risks of impact at the farm level

A primary component of the study was the assessment of baseline risks from farming activities across England on air quality, water quality and quantity, soil quality, habitat quality and quantity, plant health and wildlife health. For this research, these were defined as Environmental Impacted States (EIS). Annex 2 provides a definition for EIS.

By identifying key environmental stressors and regional variations, the baseline assessment provided a foundation from which regulatory mitigations could be mapped, categorised and assessed. The following subsections outline the approaches that were utilised to help inform the assessment of baseline risks of impacts.

2.1.3.1 Literature review of baseline risks of impact from farming activities

There is a considerable body of evidence on the impact of farming activities on the natural environment, both with respect to the activity itself (e.g., spreading of manufactured fertiliser) and with respect to potential impacts caused by the activity (e.g., ground water leaching and infiltration; atmospheric deposition). The relationship between activity and impact, however, can be complex involving several stages, often with spatial and temporal dimensions, feedback loops and interactions.

A high-level review of literature related to the environmental risks associated with farming activities was undertaken to help inform the assessment of baseline risks for this research. The

[8] ITL1 classifications were used with the Southeast and London combined, reflecting the smaller proportion of agricultural land in London.

evidence review assessed publicly available data on farming activities and their prevalence across farm types and holdings to help identify relevant farming activities.

Relevant sources were critically reviewed using a red, amber, green ranking system, with twelve green ranked papers then used to support this research. Key findings and gaps in the reviewed literature were also identified as part of the review.

2.1.3.2 Scoring by technical experts

A scoring system was used to determine the extent of the baseline risks of impacts on the natural environment by each farming or land management activity. The system was developed and refined following feedback from an external workshop to validate the methodology (see Section 2.2.3).

'Baseline risk' was defined as the impact that the farming activity would have on the natural environment in the absence of regulatory compliance or the implementation of mitigation measures on farms. Scorers were instructed to assess baseline risks under assumptions of no regulatory compliance and no mitigating actions or rules being implemented on farm, i.e., in the absence of regulatory compliance and mitigation.

The aim of the scoring approach was to evaluate the baseline level of risk by farm type and farming or land management activity. The categorisation was used to generate:

- groupings of farming activities by category of baseline environmental risk, stratified by farm type and EIS.
- a confidence rating of the strength of evidence (by availability and quality and the linkage with biodiversity targets / commitments and ecosystem services).

In the context of this research, the term 'impact' was assumed to be any significant direct or indirect effect that a farming or land management activity has on all or part of an EIS (e.g., air quality, water quality, soil quality). Eight ADAS specialists with expertise across the range of farming activities undertook the scoring of farming activities as part of the process. During this process, the technical experts were asked to consider and assess the following:

- In addition to what is being carried out, how is the farming activity carried out (e.g., timing, method, location and scale)?
- Are there any interventions undertaken through the farming activity that make a positive contribution (improvement) to the natural environment?
- Baseline risks of impacts at a farm scale, considering which activities pose a high risk to the natural environment when scaled up.
- The degree to which the farming activity impacts the quantity, quality and connectivity of habitats.

- Alignment of baseline risks of impacts with biodiversity targets/commitments and wider ecosystem services.
- The timescale for which the baseline risk of impact from farm activity on EIS occurs (i.e. when the baseline environmental impact is greatest, e.g. short <1 year, medium 5 years, long > 5 years).

The technical experts were asked to list any baseline risk of impacts (effects) that they knew, or could identify, in relation to each farming activity. In addition, they were asked to consider if the baseline impact of one farming activity would exacerbate the impact of other activities either through cumulative, combined or synergistic processes.

The technical experts were provided with instructions and guidance on how to complete the ordinal scoring. Scorers were instructed to work from left to right on the “Task A Database" tab of the scoring spreadsheet and use a defined process to categorise and score the baseline risks of impacts from farming activities based on a scale of -3 (high degradation) to +3 (high improvement). The detailed scoring guidance is provided in Annex 4.

Following a preliminary testing of the scoring process an internal workshop was held with the selected ADAS technical experts, OEP colleagues and the project team to refine the scoring methodology. The experts brought specialist knowledge across the EIS categories, including soil, air, water and biodiversity. Feedback and suggestions from this workshop were incorporated into the scoring process to improve clarity, consistency and usability.

Subsequently, a second round of ordinal scoring was undertaken by the technical experts using the set of pre-determined scoring criteria (Annex 4) that had previously been agreed in consultation with the OEP project team for the first round of scoring. The first-round scoring spreadsheet was refined and expanded to include dropdown menus, which improved the efficiency and time required by scorers to complete the scoring process. Scorers were able to select a score from the dropdown list for each criterion linked to individual farming activities.

The technical assessment and scoring methodology were subject to assurance at multiple stages of development. Oversight was provided by the project’s technical assurance lead, with ongoing input and feedback from the client team to ensure methodological rigour and alignment with project objectives. In addition to the internal workshop to refine the scoring approach, an external validation workshop was also undertaken with regulators and government officials (see Section 2.2.3 for further detail).

2.1.4 Analysis and statistical testing at the farm, regional and national levels

2.1.4.1 Statistical analysis of baseline risks of impact, at the farm level

The statistical analysis of baseline risks from farming activities began with descriptive statistics for each EIS category. These included measures of central tendency (mean and median), dispersion (standard deviation) and distribution shape (skewness and kurtosis).

These metrics provided insight into average baseline impact levels and variability across farming activities. Skewness and kurtosis were used to assess distribution characteristics and identify outliers, offering a deeper understanding of risk patterns. Annex 6 and Annex 7 detail the full results, while Sections 3.1.2 and 3.2.2 summarise key observations. To further investigate differences between farming activities and their associated baseline environmental impacts, an Analysis of Variance (ANOVA) was applied; ANOVA is a statistical method used to compare means across multiple groups to determine if there are significant differences. ANOVA identified whether specific farming practices contributed disproportionately to certain EIS categories, providing insight into which activities pose the greatest environmental risks under baseline assumptions (Supplementary Annex A).

2.1.4.2 Spatial analysis of baseline risks of impact

A spatial analysis was conducted to examine how baseline risks observed at the farm level translate into environmental impacts at regional and national levels. Farming activities differ substantially in the nature and severity of baseline risks; however, overall influence on the natural environment depends on the spatial distribution of farms and the combination of activities carried out. The analysis was based on the hypothesis that farming systems that occupy a larger share of land, combined with a higher baseline risk of impact, are likely to exert a proportionally greater influence on regional and national baseline risk estimates.

First, geographic data on farms in England were collected from the Defra June Survey[9]. The dataset included the number of farms and their farmed area (in hectares), disaggregated by Defra farm type classification and region. These data were used to calculate the proportion of farms and proportion of farmed area attributable to each farm type across England and within each region. To account for variation in the share of agricultural land across regions, data on total land area were integrated from the ONS Open Geography Portal to calculate the proportion of total land occupied by each farm type nationally and in each region.

To integrate the geographic data and scoring dataset, the research team mapped the farming activities and farm types developed in the scoring process to the Level 2 Defra farm type classifications[10].

Impact scores for the farming activities aligned to each Defra classification farm type were aggregated to calculate the median baseline impact score for each farm type. This was then multiplied with the proportion of farmed area that the farm type occupies within each region, to calculate a weighted baseline impact score (based on farmed area). The following calculation was used:

[9] Defra (2024) available at: Defra Annual June Survey of Agriculture and Horticulture, 2024

[10] Defra (2023) Level 2 Defra farm type classifications. available at: fbs-uk-farmclassification-2014-14mar23.pdf

Weighted baseline impact score for farm type, in region = Median impact score for farm type at the farm level x Proportion of farmed area covered by farm type, in region.

The calculation was replicated to produce a weighted baseline score based on the proportion of total land area (including non-agricultural land) covered by farm type, in each region. The weighting approach ensured that the analysis captured both the diversity and spatial distribution of farming systems, and the areas of non-agricultural land, providing a meaningful basis for comparing baseline risks of impact across regions. Aggregate results were calculated using Power BI, as it effectively enables resulting data to be readily integrated into the visualisations.

The spatial analysis provides an indicative tool for understanding how baseline risks at the farm level scale to regional and national contexts. The method does not capture variation between individual farms and does not consider dynamic factors such as local management practices, environmental conditions or landscape features. The approach offers a practical tool for comparing relative risk patterns across regions; it is particularly valuable for identifying broad trends and enabling spatial prioritisation where detailed farm level modelling is not feasible.

2.1.5 Considerations for the baseline assessment around data availability and analysis

2.1.5.1 Considerations and limitations of the SPR approach

While the SPR framework offered a structured and practical method for assessing environmental risks associated with farming activities, it provided generalised conclusions that assumed minimal change and contextual variation. These limitations should be considered when interpreting the results of the baseline assessment and if applied to future regulatory or policy development appraisals. The primary limitations of the SPR approach included:

Simplification of complex systems; the SPR approach applied simplifies environmental interactions into linear chains, which may not fully capture feedback loops, cumulative effects, or interactions between multiple pollutants and pressures.

Static assumptions: the SPR approach applied assumes consistent farming practices and environmental conditions, which may not reflect location, seasonal variability, climate change, or evolving land use and technology.

Reliance on expert interpretation; where data is lacking, the framework depends on expert judgment to define sources, pathways, and receptors, which can introduce subjectivity and inconsistency.

Limited spatial and temporal resolution; the SPR approach applied may not account for localised variations in soil type, topography or weather patterns or long-term lags between pollutant release and environmental impact.

To address these limitations, the research incorporated external validation workshops with regulators and government officials (see Section 2.2.3), internal validation workshops with specialists who had expertise relevant to the EIS (air, water, soil, habitats, plants and wildlife) and peer review.

2.1.5.2 Considerations and limitations of the baseline scoring approach

While the scoring methodology provided a structured means of assessing baseline environmental risks, certain limitations were acknowledged that could influence consistency, accuracy and applicability of the results. These should be considered when interpreting the outputs of the baseline assessment and when applying the framework in future assessments. Importantly, steps were taken to address these limitations throughout the process. The primary limitations of the scoring methodology are listed below.

Dependence on expert judgment. The approach used expert assessments to capture the practical knowledge of specialists familiar with farming practices under varying compliance levels. This process inherently involves interpretation and draws on relevant experience. Structured guidance and validation sessions were implemented to ensure consistency and alignment across scorers.

Assumption of non-compliance. The categorisation of the baseline risks of impact from farming activities on the natural environment, in the absence of regulatory compliance or implementation of mitigation measures on farms adopted a hypothetical scenario where regulatory compliance and on-farm mitigations were absent. This assumption was necessary to establish a clear baseline risk profile. While it does not reflect all real-world conditions, it aligns with observed practices in cases where compliance is incomplete, for example, 50% of farms are not compliant with nutrient regulations. Scorers were able to associate realistic reference points, which were drawn from their own field experience to the hypothetical scenario and in doing so were able to acknowledge that some farming activities were already moderated to a certain extent.

Variability in evidence base. Data availability differed across farming activities, with some areas supported by robust evidence and others less evidenced. To address this, scorers applied confidence ratings alongside risk scores, ensuring transparency about uncertainty and highlighting priorities for future data collection.

Limited technical flexibility. The spreadsheet-based tool was intentionally designed for simplicity and accessibility. While it does not support dynamic modelling or spatial integration, its structured format enabled consistent application across diverse activities. Future iterations could build on this foundation by incorporating GIS layers and scenario modelling capabilities.

2.1.5.3 Considerations and limitations of the statistical analysis for the categorisation of baseline risks.

Sample size and representativeness. The reliability of descriptive statistics depends on the sample size and how representative the data is across the farming activities and EIS. Small or biased samples limit generalisability and interpretation of results should be treated with caution.

Distribution assumptions. Skewness and kurtosis values indicate deviations from normality. Many environmental impact categories show skewed or peaked distributions, suggesting that parametric statistical tests may not be appropriate without transformation.

Variability and outliers. High standard deviations and kurtosis values in categories like habitat quality and water quality suggest the presence of outliers or extreme values, which can disproportionately influence mean scores.

Interpretation of negative scores. The use of negative mean values to indicate environmental degradation requires consistent scoring methodology. Interpretation should consider the context and scale used for scoring.

Lack of inferential analysis. Descriptive statistics provide a snapshot of data characteristics but do not allow for hypothesis testing or causal inference. Further statistical modelling is recommended to assess more robust relationships between farming activities and baseline risks of environmental impacts.

Temporal and spatial factors. The statistics do not account for seasonal variations or geographic differences in farming practices, which would influence baseline risks of impacts on environmental outcomes.

Aggregation effects. Aggregating scores across farming types may mask localised baseline risks of impacts or farm practices that would be more influenced by targeted regulatory rules or mitigations. Disaggregated analysis would provide more nuanced insights.

Several steps were taken to reduce the impact of these limitations. The sample included a broad range of farming and land management practices, with expert validation applied where data was limited. To address non-standard data patterns, skewness and kurtosis checks were performed. For extreme values, diagnostic plots and sensitivity analyses were used to identify outliers, and medians were applied to reduce their influence. Negative scores were defined through a structured scoring protocol to consistently indicate environmental harm, ensuring clarity in interpretation. Future analyses would benefit from the incorporation of temporal and spatial measures to better reflect farm-level seasonal and geographic variability.

2.2 Categorising the scale of effect of farming regulations and wider legislation in mitigating the baseline risks of impact from farming activities

The scale of effect assessment involved an evaluation of the effectiveness of farming regulations and wider legislation in reducing the impact of farming activities on the natural environment. It aimed to identify the regulatory rules that would affect a reduction in the baseline risks of impact with compliance, while also identifying the farm types and farming activities with gaps in regulatory coverage and control. The project team carried out this task by:

- Identifying and categorising a shortlist of farming regulations and wider legislation to the farm types, farming activities and environmental pressures identified in the baseline risks.
- Assessing the impact of farming activities on the natural environment if there was compliance with regulatory rules as identified in each of the regulations included the assessment.

2.2.1 Identification and mapping of farming regulations and wider legislation

The objective of this sub-task was to assess the control and coverage of regulations (including mitigating interventions and rules) in reducing, avoiding, cancelling or compensating baseline risks of impact from farming activities on the natural environment. Supported by the activities within the baseline assessment, this component of the study built in a regulatory framework by identifying the most relevant regulations aligned to farming activities (the source). The same eight expert scorers from the baseline assessment were given a definitive list of farming activities (Annex 3) and asked to consider to what extent the baseline risks of impacts would be mitigated under an assumption of compliance with farming regulations. Further detail on the scoring process is provided in Section 2.2.2.1.

From the previous work undertaken by ADAS on behalf of Defra, the project team identified a list of 85 regulations and matched them to a longer list of 104 farming and wider regulations provided by the OEP. This helped identify a refined list of regulations (Annex 10) most relevant to farming activities at a farm scale for protecting and improving the natural environment.

In addition, the project team used websites such as gov.uk and legislation.gov.uk to identify rules, guidance and mitigation measures linked to the refined list of regulations. The project team then identified rules and mitigation measures relevant to the agreed list of farming activities to enable assessment of regulatory effectiveness.

The project team then quality assured and validated the list in a similar manner as the work done in the baseline assessment (see Annex 10). The same eight technical experts that were tasked with undertaking the scoring components, reviewed both the list of regulations and list of farming activities. They also validated the list in a facilitated workshop with the OEP. The

validation process and recommendations suggested by the technical experts is outlined further in Section 2.2.3.

2.2.2 Assessment of scale of effect of regulations in mitigating baseline risks of impact

Similar to the baseline assessment, a scoring system was used to assess and categorise farming regulations and wider legislation by their likely scale of effectiveness (coverage and control) in reducing the baseline risks of impact from farming activities under an assumption of compliance. Coverage, for the purpose of this assessment, refers to whether regulatory requirements apply to the relevant source–pathway–receptor link for an activity (i.e., was the baseline risk within regulatory scope). While control refers to how strongly those requirements, including mitigating rules, reduce the baseline risk if complied with (i.e., how clear, specific and outcome-effective the rules are in practice). For example, a rule may "cover" nutrient spreading nationally, but "control" may be weaker if requirements are ambiguous or enforcement/follow-up is limited. Note: high coverage can coexist with weak control (broad but vague rules), and high control can co-exist with limited coverage (strong rules that apply only to some farm types/areas).

The coverage and control of farming activities were assessed based on a matched list of regulatory rules for each of the agreed regulations. This list was used to match farm types and farming activities with appropriate regulatory rules to help identify gaps in coverage and control. It should be noted that not all rules and mitigations were able to be included due to project scope and timings. In addition, some rules and mitigations apply to multiple regulations, including regulations with multiple versions and those that have been revised. In practice, scorers focused on reviewing the effectiveness of the mitigation measures and guidance underpinning the agreed list regulations. Each farming activity was assigned to a key regulation for clarity; however, scorers often considered measures drawn from multiple regulations, as it is rare for a single regulation to comprehensively address a single farming activity (e.g., Farming Rules for Water). In some cases, determining the "main" regulation was debatable, but scorers were required to identify the most relevant regulation within the constraints of the project.

2.2.2.1 Scoring by technical experts

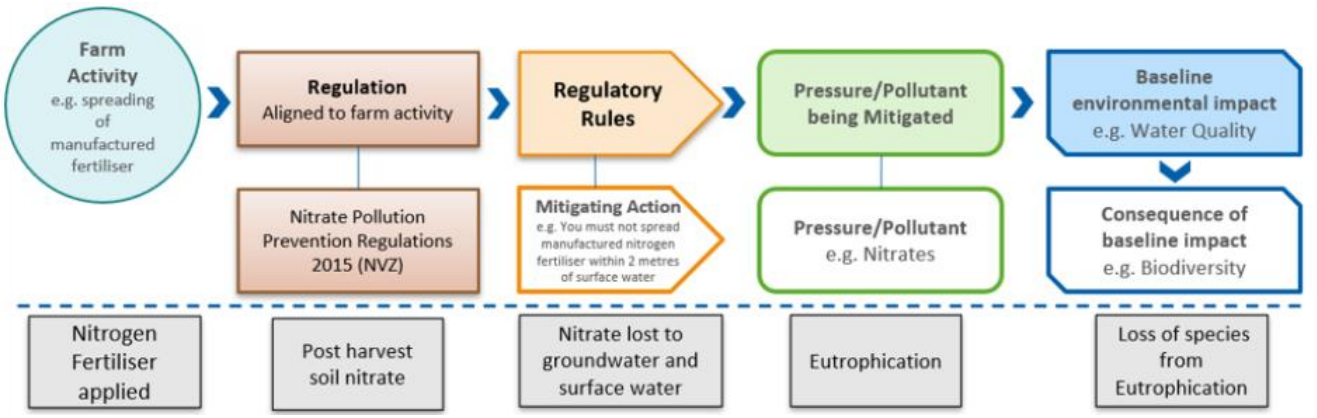
Building on the outputs from the baseline assessment, the coverage and likely outcomes of the shortlisted group of farming regulations and wider legislation were assessed by the same technical experts who assessed the baseline risks of impact. The eight ADAS technical experts, assessed the coverage, control and issues related to mitigation measures identified in each farming regulation or piece of legislation against the categorised farming activities under an assumption of compliance. This included assessing where a regulation might work well or might be insufficient in addressing the identified environmental impacts from farming activities. The aim of this scoring process was to identify potential gaps and overlaps in farming regulations and wider legislation and highlight farming types and activities that are not sufficiently covered.

A spreadsheet-based matrix was compiled to assess and score the mitigation measures against the farming activities and types identified in the baseline assessment. Detailed scoring classifications and definitions were provided to experts prior to undertaking the ordinal scoring. Scoring definition tables from the slide deck instructions are provided in Annex 5.

Scorers were also asked to suggest any changes to prepopulated regulations based on their knowledge of the relevant farming activities and/or regulation. Experts provided comments and justifications for why the prepopulated regulation was changed as required. Several of these comments provided additional evidence to support findings. An example logic chain graphic (Figure 6) was provided to scorers to help them with thinking through farming activity → regulation → consequence links during the scoring process. In addition, scorers were asked to consider the following when thinking through the scoring process:

- the extent to which baseline risks of impact can be reduced through the implementation of farming regulations;
- the application of regulations across different farm types and farming activities. identifying potential gaps and overlaps across the farming landscape;
- the strength of alignment between the regulations, farming types and activities i.e. the degree to which a regulation manages risks from a farm type and activity; and
- impacts on EIS (post mitigations) should be assessed at a farm scale, but please also think about whether regulatory rules will help mitigate harms to the natural environment when scaled up.

Figure 6 Graphical representation of an example logic chain provided to scorers to assist thinking during the regulatory scoring process



Source: Adapted from Payraudeau and van der Werf (2005).

Table 2 sets out additional instructions provided to scorers based on the definitions and score scales provided in the guidance (Annex 5).

Table 2 Regulatory scoring guidance

Column	Category	Description
Columns T V	Mitigation Coverage Score	Rate coverage (on scale of 0 to 3) using dropdown list (refer to definitions on guidance tab) for source, pathway and receptor.
Column W	Mitigation Control Score	Rate mitigation control (on scale of 0 to 3) using dropdown list (refer to definitions on guidance tab).
Columns X AC	Mitigation Issues	Please consider whether there are issues with the regulation and/or mitigation actions and whether they are a major or minor issue. If no issues, leave cell blank (refer to definitions on guidance tab).
Column Q	Notes/comments	Please provide any additional information/references to evidence, or expert opinion that will help us understand the scores that were applied.

2.2.3 External validation of the assessment methodology

A validation workshop was convened to review and refine the assessment methodology for baseline environmental risks of impacts from farming activities and regulatory coverage and control. The purpose of the workshop was to support further refinement of the methodological approach and categorisation framework prior to the scoring by ADAS technical experts. The workshop brought together members of the OEP College of Experts, representatives from public authorities (including Defra, Natural England, the Environment Agency and Health and Safety Executive) and sector groups (including the National Farmers' Union (NFU) and Green Alliance).

The workshop comprised of four sessions to discuss the assessment approach, with two sessions each for scoring component (baseline and regulatory). Participants discussed one of these selected three environmental impacted states in break out groups: (i) air (covering air quality), (ii) water and soil (covering water quality, water quantity/availability and soil quality) and (iii) biodiversity (covering plant health, wildlife health, habitat quantity and habitat quality). Breakout groups were allocated based on expertise to discuss the baseline risks of impacts on the natural environment of five farming activities relevant to their grouping.

For the baseline scoring approach, groups assessed the magnitude, importance, reversibility, and synergies of environmental risks in the absence of regulatory compliance or implementation of mitigation measures. They highlighted the need for greater clarity in the categorisation of sources, pathways, and receptors, and the importance of context and timescale in the baseline risk assessment.

Groups were asked to evaluate each of the activities according to three sets of questions:

1. How does this activity contribute to the baseline risk of impact from the environmental pressure/pollutant selected? Do you agree that this activity is one of the greatest contributors to the environmental pressure/pollutant?
2. How does this activity lead to the pathway selected? Do you agree that this activity poses the greatest baseline risk of impact through this pathway?
3. How does this activity contribute to the baseline risk of impact on the receptor selected? Do you agree that this activity poses the greatest baseline risk of impact for this receptor?

Following each breakout activity, a plenary discussion allowed groups to relay core reflections to the wider workshop group, followed by a final plenary to conclude the workshop. For the regulatory scoring approach, participants reviewed the mapping of regulations to activities, considering the adequacy of regulatory coverage and control and raised issues around the specificity, enforcement, and effectiveness of existing regulations.

The themes below emerged from the workshop discussions, and the project team ensured the methodology and findings reflected these discussions.

Clarity and consistency in categorisation. Across both scoring approaches, participants emphasised the need for clearer definitions and more granular categorisation. Participants highlighted the need for greater clarity in the categorisation of sources, pathways, and receptors, with concern that some categories were too broad (e.g., “all soil” or “native plants”). Doing so would prevent important differences in impact from being obscured. Participants recommended to refine these categories and, where appropriate, introduce additional granularity or groupings to better reflect real world variation.

Context and timescale. Participants repeatedly emphasised the importance of context, such as farm type, scale and local conditions. They noted that the environmental impact of an activity can vary significantly depending on when, where, and how it is undertaken. Timescale was also identified as a complex factor, with impacts often occurring at different rates for different receptors. The group suggested that timescales should be defined more clearly, potentially as ranges (e.g., short to long term), and that definitions should be tightened to ensure consistency.

Addressing methodological gaps. Participants identified several methodological gaps that could affect the robustness of the assessment. They emphasised the need to clearly distinguish between pollutants and pressures, to recognise unintended consequences such as pollution swapping, and to account for activities that may have both positive and negative impacts depending on context. Additionally, the methodology should better capture cumulative and synergistic effects.

Recommendations for further refinement. To address these issues, the workshop recommended several refinements that were implemented by the team: introducing a climate change risk classification; separating baseline risks of impacts to humans from those on the natural environment; focusing on the pathways which pose the greatest baseline risks; and

clarifying the use of certainty scores. Tightening definitions for timescales and impact categories, along with further internal review, were also advised to ensure the robustness and transparency of the methodology.

In addition to the themes relevant to both tasks, stakeholders raised questions about the assessment of regulatory coverage and effectiveness. They also reviewed the mapping of regulations to activities and raised questions about the specificity, enforcement, and effectiveness of existing regulations. There was a consensus that some regulations were highly targeted (e.g., burning regulations), while others were more general or only partially applicable (e.g., Nitrate Pollution Regulations (NVZs), which do not cover all areas). Participants recommended a conservative approach to assigning regulations to activities to avoid overstating regulatory coverage. They also recommended that the methodology should better capture any gaps in regulatory coverage and implementation and clarify use of the mitigation effectiveness (coverage and control) scores. Following the workshop, all recommendations were considered and subsequently incorporated into the second-round scoring process (see Table 1Figure 4 for process).

2.2.4 Analysis and statistical testing at the farm scale

2.2.4.1 Statistical analysis of the scale of effect of regulatory mitigations

As in the baseline assessment, the statistical analysis of the effectiveness of regulatory mitigations began with descriptive statistics for each EIS category. The metrics highlighted the extent to which regulatory measures influence mitigation coverage and control. Skewness and kurtosis were used to assess distribution characteristics and identify outliers, offering a deeper understanding of risk patterns and regulatory performance. ANOVA tests assessed whether regulatory measures (for both regulatory coverage and control) effectively reduce these risks across different sources, pathways, and receptors (see more details on supplementary Annex A. These analyses form the basis for understanding both the drivers of environmental impact and the relative strength of regulatory frameworks in managing baseline risks.

2.2.5 Visualisation of outputs

The categorisations and assessments were used to produce an interactive dashboard (Annex 9). The dashboard provides an interactive tool to explore the findings of this project. Visualisations allow the OEP and the public to appraise the baseline risks of impact from farming activities on the natural environment and the ways in which regulations help to reduce these impacts. It accompanies the final report which explains the methods used, synthesises findings and provides recommendations to support future scrutiny of the regulatory landscape. It is accompanied by a detailed spreadsheet that can be used to explore the categorisations and the project findings in greater detail.

For the baseline assessment, the visualisations show where and how various farming activities pose risks to air, water, soil, habitats, and wildlife. By mapping these risks, users can quickly

identify which activities or regions may need more attention or support. For the regulatory assessment, the visualisations illustrate how current regulations and wider legislation are distributed and how effectively they cover and control different environmental risks. This helps users spot any gaps in regulatory effectiveness and understand where new or improved policies might be needed.

The interactive dashboard was produced in Power BI. The dashboard development process began with reviewing and standardising the data catalogue to ensure consistency and ease of use. The project team then clarified which functions, and visual formats would best support user needs, in consultation with data visualisation specialists and stakeholders. A data model was created using the farm level mapping and regional analyses produced for the baseline risks. The dashboard was iteratively tested and refined, with feedback from validation workshops used to improve its content and functionality before launch.

2.2.6 External validation of the findings and preliminary outputs

A final validation workshop was held to engage regulators and government officials in reviewing the findings and outputs from the baseline and regulatory assessments. The aim was to assess whether the analyses accurately captured the baseline risks of impacts from farming activities on the natural environment and reflected the practical experience of regulators in monitoring and enforcing farming regulations. The workshop, conducted via MS Teams, included participants from the EA, HSE, NE and Defra.

Stakeholders were asked to assess the analytical approach, including statistical methods, stratification of results, and key recommendations or limitations.

Overall, stakeholders acknowledged the process as sensible and robust, with no major concerns raised. For both assessment components, stakeholders found the visualisations logical and potentially useful but emphasised the need to balance detail with context to ensure clarity and accessibility. Specific feedback for the baseline assessment was that there was limited variance in the presented data; a participant suggested that the number of scorers may have influenced this.

For the regulatory assessment, the HSE representative highlighted that while regulations may be comprehensive, their effectiveness depends on operator training, compliance, and equipment maintenance. The analysis was seen as helpful for identifying regulatory gaps and prioritising resources.

2.2.7 Considerations related to categorising the scale of effect of farming regulations and wider legislation in mitigating the baseline risks of impact from farming activities

2.2.7.1 Considerations and limitations for the categorisation of farming regulations

The process of identifying and categorising farming regulations and wider legislation was designed to provide a clear and practical representation of the regulatory landscape at the time

of analysis. While certain challenges were inherent to this approach, they largely reflect conscious methodological choices aimed at ensuring relevance and usability. Principal considerations are listed below.

Reflecting the regulatory landscape that affected farms directly at the time of analysis. The initial regulation list was based on previous ADAS and OEP research, providing a robust and up-to-date foundation. Only one material change, the Hedgerow Regulations 2024, was introduced after the initial mapping and subsequently incorporated. This ensures that the framework closely aligns with current legislative requirements.

Focused expert validation. Validation was undertaken through facilitated workshops and internal reviews to ensure technical accuracy and consistency. While broader stakeholder engagement (e.g., farmers, NGOs) was outside the scope of this phase, the approach prioritised expert insight to identify regulations where compliance is most critical for environmental outcomes.

Assumption of compliance. The scoring assumed full compliance with regulations, which is appropriate for assessing the intended effectiveness of the regulatory framework. This assumption provided scorers with a benchmark for identifying where regulations are designed to deliver the greatest environmental benefit, even though real-world enforcement may vary.

Use of expert judgement and established frameworks. Expert input and pre-existing frameworks were deliberately employed to ensure coherence and efficiency. While this introduces some subjectivity, it reflects best practice in environmental policy analysis and was supported by structured guidance to maintain consistency.

Scope and simplification. Certain farming activities and pressures were simplified or excluded to maintain clarity and focus on mainstream practices. This was a necessary trade-off to produce a usable mapping tool, with future iterations able to expand coverage for mixed or diversified farming systems.

Assumed linear relationships. The categorisation process adopted a linear representation of activity-impact pathways for clarity and comparability. While ecological interactions are complex, this approach provides a practical starting point for identifying priority regulations and could be refined in future research.

2.3 Summarising the implementation of farming regulations and wider legislation critical to achieving biodiversity targets and environmental commitments

The purpose of this task was to systematically assess and summarise the current implementation of farming regulations and wider legislation most critical to biodiversity targets and environmental commitments in England. The primary aim was to evaluate and present compliance and enforcement rates for those regulations identified as most relevant for

mitigating baseline environmental impacts, focusing on the period from the introduction of the Agriculture Act 2020 to the present.

2.3.1 Gathering compliance and enforcement data

The project team obtained data on compliance and enforcement related to the shortlist of regulations developed in Tasks A and B, as well as the regulators' overall approach to environmental compliance and enforcement.

The OEP submitted information requests to government agencies responsible for monitoring and enforcement, including the EA, NE, RPA, HSE and local authorities. Data was shared with the OEP and study team via email. The data request sought detailed information on:

- the agency responsible for each regulation;
- the type and frequency of inspections;
- the number of farm holdings subject to each regulation;
- number and frequency of inspections and repeat inspections;
- levels and severity of compliance and noncompliance;
- actions taken to address noncompliance (advice, guidance, enforcement); and
- monitoring and evaluation processes for each regulation.

2.3.2 Assessment of compliance and enforcement of farming regulations and wider legislation

Once data had been collated, the project team undertook a systematic mapping and analysis process. The process involved compiling and standardising the compliance and enforcement data for each data source, mapped against the relevant regulations. The data was then synthesised for each regulation and the approaches taken by each agency to monitor and enforce compliance where summarised, where relevant. The analysis described whether agencies used risk based, universal, or investigative strategies, and provided an account of the sampling strategies and rationale for targeting specific farm types or regions. Where available, rectification rates (the proportion of noncompliance cases resolved) were analysed to assess the effectiveness of enforcement actions. The project team also assessed the extent to which monitoring and enforcement activities aligned with the environmental risks and regulatory coverage identified in earlier tasks, and identified any gaps, overlaps, or limitations in the current regulatory landscape.

Where information was used to draw key conclusions, the completed excel database was then shared with the regulators who had provided data to allow for validation and comment to ensure that the data was accurate and representative of that shared by the regulators.

2.3.3 Analysis and synthesis

The findings were then synthesised to provide an overall assessment of the implementation landscape, highlighting strengths, weaknesses, and gaps in monitoring, compliance, and enforcement. Recommendations were developed to address identified gaps, improve data integration, clarify regulatory responsibilities, and align regulations with biodiversity and climate targets. Findings were verified with regulators where information was provided.

2.3.4 Considerations related to the data availability and analysis for the assessment of compliance and enforcement of farming regulations and wider legislation

The following limitations are acknowledged when summarising the implementation of farming regulations and wider legislation most critical to biodiversity targets and commitments.

Data gaps and fragmented monitoring: The OEP reached out to regulators and requested data directly from them. Some data gaps remained as not all regulators were able to complete the request for data. In some cases, where data was provided, it was in a summarised and high-level format, making in-depth analysis and comparison between regulations difficult. This limitation led to a high number of gaps within the mapping spreadsheet. Therefore, a definitive assessment of the overall availability of data for monitoring and enforcement cannot be made, as additional relevant data may exist beyond what was examined in this study. Further study would be required to provide a full analysis of the current regulatory landscape.

Recent policy changes: There was a lack of data on the current monitoring and enforcement landscape beyond cross compliance (until its end in December 2023), making it difficult to ascertain approaches to monitoring and current levels of compliance and enforcement in these areas. It should be noted that all analysis and recommendations regarding the RPA as a regulator are based on data from before 2023. Additionally, several regulations were superseded or partially superseded by more recent regulations. This study focused on the measures underpinning each regulation currently in place; therefore, in some places it is possible that an older form of the regulation may be quoted.

3 Analysis: Baseline risks of impact from farming activities on the natural environment

This section presents a synthesis and breakdown of the baseline risks posed by farming activities on the natural environment. Detailed statistical analysis results for the baseline analysis are provided in Annex 6.

3.1 Baseline risks of impact from farming activities, at farm scale

Baseline risks of impacts from farming activities were stratified by EIS and farm types that align to those used in the Defra June Survey[11]. The stratification enabled a clearer understanding of how different types of farms contribute to environmental pressures and potential impacts under baseline conditions, which assume no regulatory mitigations are in place on-farm.

The analysis highlighted variations in baseline environmental risk across agricultural systems but for the purpose of the final analysis, median scores were used to inform the results on activity impact. Additional testing using maximum scores and average scores was also undertaken and included in the scoring and analysis spreadsheet that accompanies this report. The median baseline risk scores, based on a score scale ranging from -3 (high degradation) to +3 (high improvement), offer a comparative measure of potential impact severity, highlighting farming activities which have greater baseline risks of impacting on the natural environment and therefore, may require targeted interventions. Annex 5, Table 17-Table 20, provide additional detail on the scoring scales for both assessments.

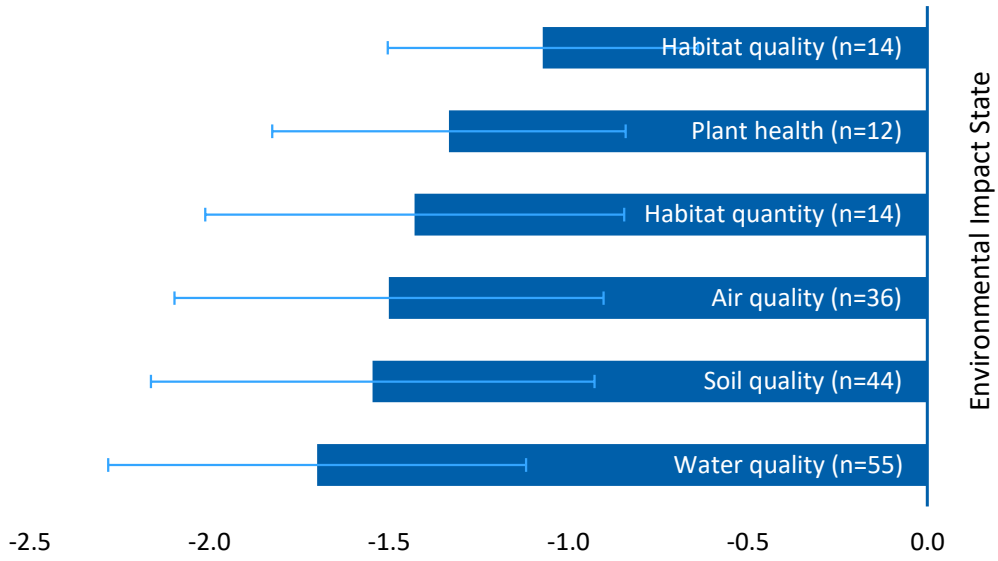
3.1.1 Overview of baseline risks by EIS

The statistical analyses revealed that farming activities (based on median scores) exert different baseline risks of impacts across EIS, environmental receptors, and pollutant categories.

Figure 7 shows that soil and water quality EIS were perceived as being at higher risk of impact. Activities such as slurry spreading, manure storage, and digestate application were perceived as substantially contributing to baseline risks of environmental harm in the absence of regulatory compliance or mitigation measures on farms. Air quality was also seen as being at higher risk of impact, particularly through emissions from combustion and livestock-related farming activities. In contrast, baseline risks of impacts on habitat quality were generally seen as being lower, though still present and notable under the baseline assumptions. It should be noted that while most baseline risks were seen as being direct impacts, indirect pathways will also contribute to baseline risks of impacts on habitats.

[11] Defra (2025) Structure of the agricultural industry in England and the UK at June 2024. Available at: https://www.gov.uk/government/statistical-data-sets/structure-of-the-agricultural-industry-in-england-and-the-uk-at-june

Figure 7 Assessed baseline risks of impacts from farming activities on EIS



Note: Whiskers represent standard deviation for each EIS. Note: Water quantity/availability and wildlife heath are not shown as their small sample size (n=8) limits generalisation of statistical findings.

The ANOVA results for EIS (Annex 6) confirmed that there were statistically significant differences between category means, with the p-value (0.01) being less than the 5% significance level and the F-statistic (2.60) being greater than the F-critical value (2.06). This indicates that the EIS categories differ in their median scores, and these differences are unlikely to be due to chance. In other words, the categories are not impacted at the same level. For example, one category might have a much higher median score, indicating higher risk of impact, while another category could be noticeably lower, suggesting less risk of impact. The ANOVA compares group means, however, for the purpose of the overall analysis medians were used as the primary summary statistic to reduce influence of extreme scores. Sensitivity checks using means and maxima were also undertaken (Annex 6). Figure 8 highlights the distribution of median scores across EIS.

Figure 8 Boxplot illustrating the distribution of median scores (on a scale of 0 to -3) for baseline risks of impacts on the eight environmental impacted states.

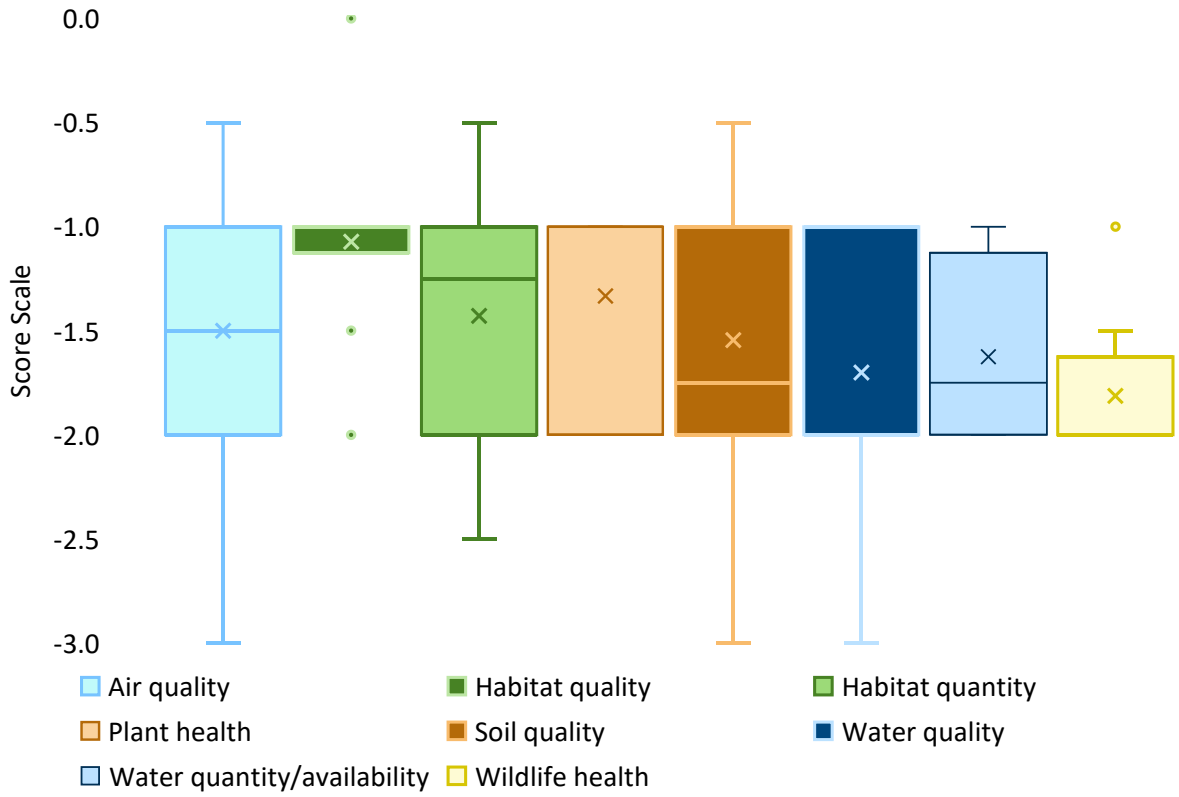


Figure 8 helps identify which EIS are most at risk of being impacted and where variability in baseline risks of impacts from farming activities may suggest improvement through improved regulatory compliance or mitigations. The box plot visualises the distribution of baseline risks of impact scores across the eight EIS. The vertical axis represents the score scale, ranging from -3 (high negative baseline risk of impact) to 0 (no baseline risk of impact)[12]. Lower negative scores indicate higher potential risk.

Each coloured box shows the interquartile range (i.e., the middle 50% of scores) while the vertical lines (whiskers) extend to the minimum and maximum values, excluding outliers. The "X" represents the arithmetic mean score for each EIS, offering a quick reference to the average baseline risk of impact.

The plot reveals that most EIS have median scores between -1 and -2, indicating low to moderate baseline risks of impacts on the natural environment from farming activities in the absence of compliance and mitigation. Soil quality and water quality show low means (as in higher risk of impact) and longer whiskers, suggesting greater risk and variability of impacts across farming activities. In contrast, habitat quality and wildlife health display narrow boxes

[12] Note: Scorers were asked to assess baseline risks on a scale of -3 to +3, however, for the purpose of the analysis, only those farming or land management activities with scores equal to or less than zero were included.

and short whiskers, reflecting less variability in scoring outcomes, indicating that the baseline risks of impact from farming activities on these EIS was perceived as being more consistent. It should be noted, however, that the sample sizes for these EIS were small, so caution should be exercised when interpreting statistical findings.

When grouped by receptor, waterbodies[13] emerged as highly vulnerable, with a high median score (-1.70) and variance (0.34) for baseline risks of impact. All soil systems (median score -1.64) and atmospheric components (-1.52) also showed substantial baseline risks of impacts, while plant and livestock receptors were perceived as having lower baseline risks of impact from farming activities (-1.18 and -1.25, respectively). The results of the receptor analysis suggested that aquatic and soil environments would be the most impacted by farming activities undertaken in the absence of regulatory compliance or implementation of mitigation measures on farms. This is likely due to exacerbation of runoff, erosion, and emissions. The high variability in baseline risk scores within these groups further indicates inconsistent exposure and sensitivity across different farming types and activities.

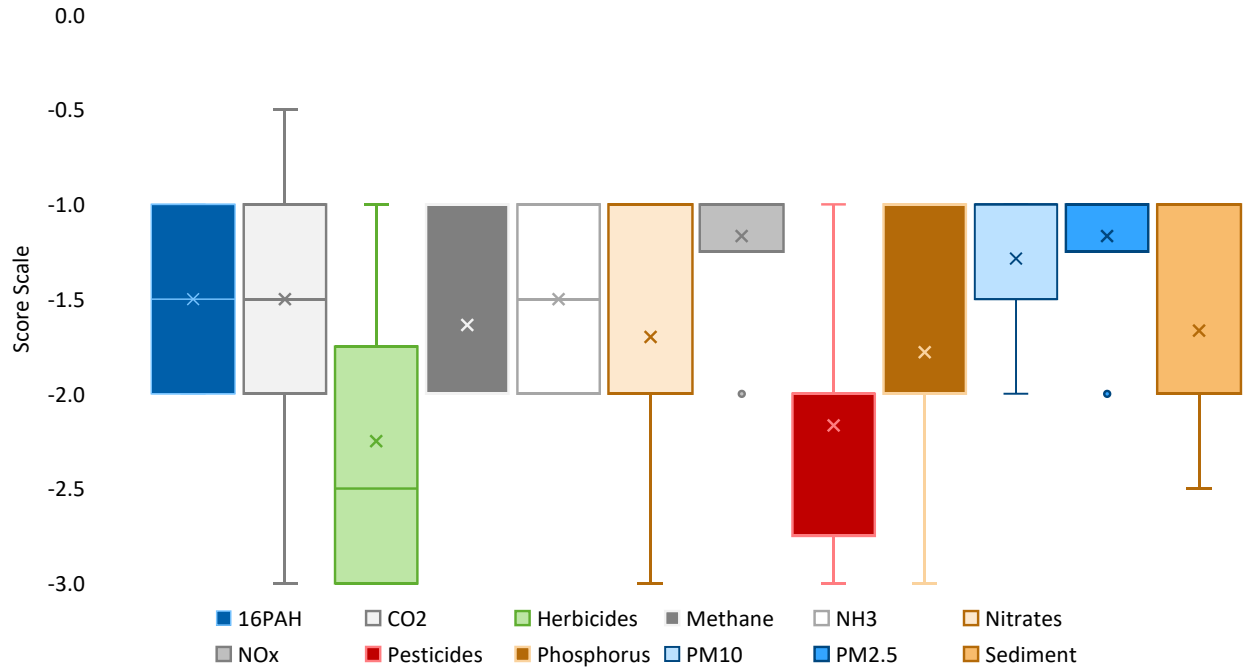
Pollutant-specific analysis highlighted the disproportionate environmental burden posed by nitrates, phosphorus, ammonia, and methane, which were perceived as posing the greatest risks to the natural environment under baseline assumptions, with nitrates showing the highest average negative risk of impact and variability. These pollutants are closely linked to fertiliser use, livestock emissions, and poor waste management. In contrast, pollutants such as NO_x, carbon monoxide and particulate matter (PM2.5 and PM10) exhibited more consistent scores and less negative medians, suggesting lower baseline risks of impacts on the natural environment.

The boxplot shown in Figure 9 highlights differences in central tendency, variability and outlier behaviour across pollutant categories. Medians vary across pollutants, with 16PAH around -1.5 and others closer to zero, suggesting lower levels of risks of impact under baseline assumptions. Spread differs notably, with herbicides and sediment showing the widest interquartile ranges, indicating high variability, while pesticide scores are tightly clustered. Pesticides and herbicides stand out for their consistently low scores, indicating they were perceived by scorers as having higher baseline risks of impact on the natural environment. Pesticides show the lowest median value of all pollutants, while herbicides show a wide interquartile range and a pronounced low outlier (below -2.0). These results suggest that chemical inputs in agriculture were perceived as being highly damaging under baseline assumptions, with potential risks of impacts on biodiversity, soil health, and water quality.

[13] A waterbody is any significant accumulation of water on the Earth's surface or beneath it and includes oceans, seas, lakes, rivers, ponds, and wetlands

The boxplot also shows that variability differs across pollutants. Herbicides and sediment exhibit the widest spreads, while pesticides are tightly clustered, reflecting more uniform perceptions of risk. Sediment is slightly right skewed, meaning most are relatively low but a small number are much higher, and several pollutants show outliers suggesting targeted measures are needed for the highest-risk situations (e.g., runoff/leaching, volatilisation). Pollutants with high variability or skew (e.g., nitrates, sediment) should be prioritised for adaptive land management approaches, while consistently high-risk substances like herbicides and pesticides may require targeted interventions such as integrated pest management or location specific controls.

Figure 9 Boxplot illustrating the distribution of median scores (on a scale of 0 to -3) for baseline risks of impacts on the natural environment from different pollutants.



3.1.2 Main findings at farm scale

Farming activities at the farm scale can exert considerable pressure on environmental systems. This section highlights the main findings from the analysis of baseline risks of impact at a farm scale. Nutrient and waste spreading activities show a moderate to high risk of impact on the environment. Activities such as spreading of slurry, storage of manure, and spreading of digestate consistently showed moderate to high risk of impact across multiple EIS, particularly affecting soil quality, water quality, and air quality. Livestock manure application and its management are a major source of ammonia and nitrous oxide emissions[14]. Digestate,

[14] Cao et al. (2024), available at: https://doi.org/10.1016/j.oneear.2024.02.007

due to its higher pH and ammonium content, can lead to greater nitrogen losses unless mitigated through acidification or rapid incorporation[15,16].

Waste management practices have a significant environmental burden. Farm practices such as waste incineration, disposal of plant protection products, and management of wastewater pose high negative baseline risk scores, especially in relation to soil and water quality, increasing the risks of contamination and environmental degradation in the absence of compliance with regulations or implementation of mitigation measures. Improper pesticide disposal can lead to persistent contamination and ecotoxicological risks[17], impact habitat, and wildlife EIS. Silage effluent is highly polluting, with biochemical oxygen demand far exceeding that of raw sewage, highlighting the need for containment and regulatory compliance.

There is an elevated risk of pesticides and veterinary medicines impacting habitat quality, and plant and wildlife health. Activities such as sheep dipping, disposal of plant protection products and disposal of veterinary waste impact negatively on the environmental pathways. The application and handling of plant protection products also showed consistently higher negative baseline risk scores. These activities pose direct risks to plant and wildlife species and contribute to habitat degradation, particularly through runoff and drift into adjacent semi-natural areas.

Livestock-related operations are likely to contribute to high baseline risks. Activities including housing of intensive poultry, feeding of ruminant livestock and keeping of poultry (free range) were associated with notable negative impact baseline risks of impacts on air and water quality, reflecting a potential risk of pollutants from both intensive and extensive animal farming on the natural environment. Intensive poultry housing contributes significantly to ammonia emissions[15], while free-range systems can cause localised phosphorus accumulation and runoff risks[18].

Intensive livestock systems are likely to contribute disproportionately to environmental pressures. Activities associated with poultry, pigs and dairy cattle, such as housing of non-ruminant livestock, feeding of ruminants, and slurry storage, were consistently linked to elevated baseline risks for water and soil pollution. These operations often involve high nutrient loading and concentrated waste outputs, which can overwhelm local environmental carrying capacities. For example, slurry spreading and storage scored negatively across multiple receptor pathways, indicating diffuse pollution risks to both surface and groundwater.

Land modification and habitat disruption negatively impact habitat quantity and wildlife health. Practices such as tree felling, removal of hedgerows, and cultivation of semi-natural habitat have adverse effects on habitat quantity and wildlife health, highlighting the baseline risk

[15] Nicholson et al. (2017), available at: https://doi.org/10.1016/j.envpol.2017.05.023
[16] Sánchez-Rodríguez et al. (2018), available at: https://doi.org/10.3389/fsufs.2018.00035
[17] Sun et al. (2018), available at: https://doi.org/10.1007/s40726-018-0092-x
[18] Anderson et al. (2020), available at: https://doi.org/10.1002/jeq2.20010

of impacts on biodiversity loss and ecosystem fragmentation. Hedgerow removal and grassland conversion were found to reduce ecological connectivity and soil carbon storage[19].

Combustion and burning activities impact air and wildlife health. Activities like burning of heather and stationary combustion (as defined in Annex 3) are particularly detrimental to air quality and wildlife health. The scoring outcomes suggest environmental risks from open burning and emissions in the absence of regulatory compliance and mitigations would likely be exacerbated. Literature evidence suggests that prescribed burning on peatlands also alters hydrology and reduces aquatic biodiversity[20].

3.2 Baseline risks of impact from farming activities, at regional and national scales

The regional and national scale impacts presented reflect relative differences across farm types. These results are indicative rather than definitive and should not be used in isolation for policy or management decisions without considering underlying methodological constraints and contextual factors.

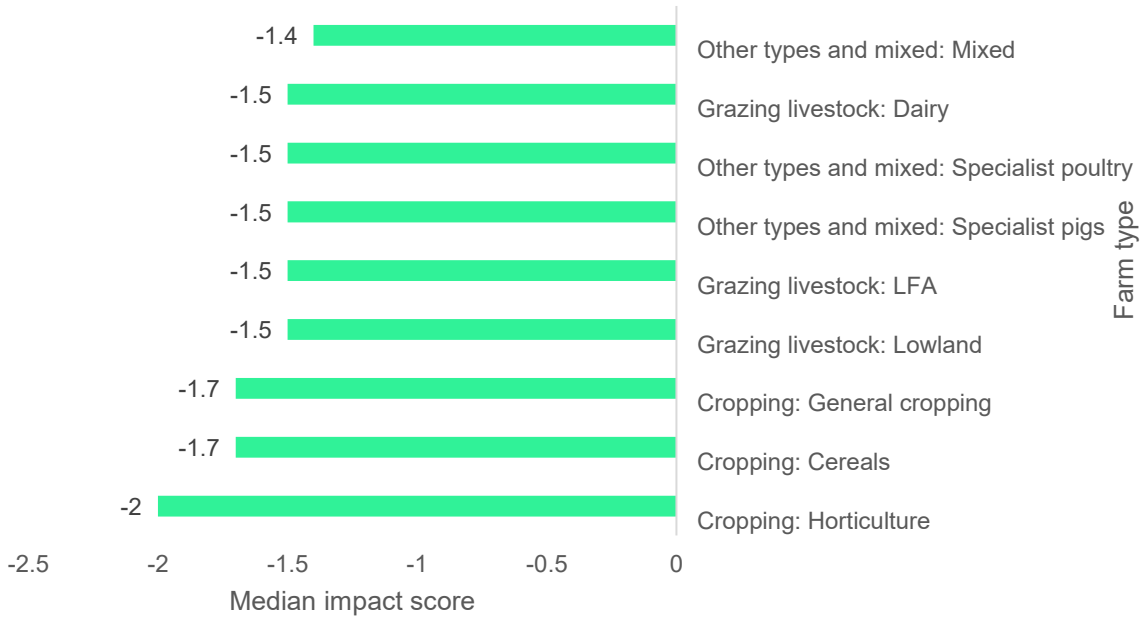
At regional and national scales, baseline environmental risks varied across England: regions with a greater concentration of cropping systems generally showed higher risk scores, while those dominated by grazing systems had lower risks. However, by weighting baseline scores by total land area, these impacts appeared less pronounced in regions where agriculture occupied a smaller share of the landscape and heightened in areas where agriculture was more prevalent.

3.2.1 Overview of baseline risks by farm type

At the farm level, cropping systems had the greatest negative baseline impact scores, with cereals and general cropping registering -1.7 and horticulture -2 (Figure 10) In contrast, Mixed farms showed the least negative score at -1.4, while all grazing livestock, specialist pigs and specialist poultry systems had scores of -1.5.

[19] Bai and Cotrufo (2022), available at: https://doi.org/10.1126/science.abo2380
[20] Brown et al. (2013), available at: https://doi.org/10.1371/journal.pone.0081023

Figure 10 Median baseline impact score by farm type

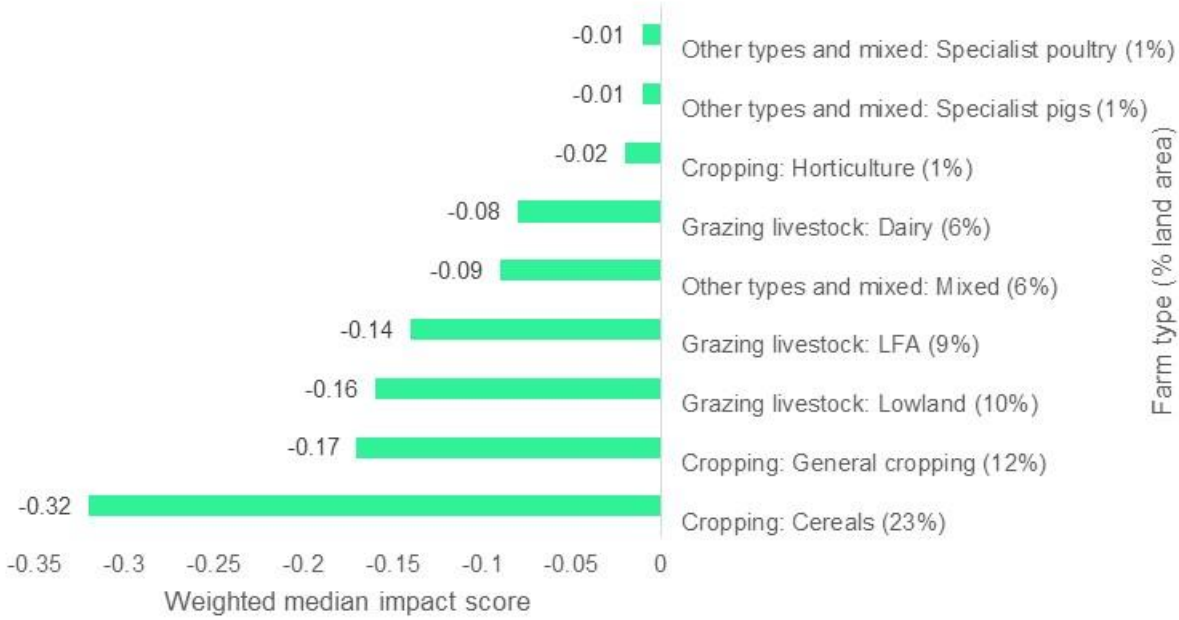


Note: baseline risks were assessed using a scoring ranging from -3 (high impact) to 0 (no discernible impact)

3.2.2 Main findings at regional and national scales

When scaled nationally and weighted by land area, the overall weighted baseline impact score across all farm types was -1.0. Cereals contributed the highest weighted score (-0.32), followed by general cropping (-0.17), lowland grazing (-0.16) and LFA grazing (-0.14). These higher scores reflect their prevalence, ranging from 23% of England's land for cereals to 9% for LFA grazing. Conversely, specialist poultry (-0.01), specialist pigs (-0.01) and horticulture (-0.02) had the lowest weighted scores (Figure 11).

Figure 11 Weighted baseline impact score by farm type, at the national level



The matrix below illustrates how baseline risks varied between farm level and national scales (Table 3). Although horticulture recorded the highest impact at the farm level, its influence at the national scale was minimal because it occupies only 1% of land area. While cereals and general cropping registered the same baseline impact score at the farm level, cereals showed a higher national score due to its substantially larger land coverage.

Table 3 Baseline impact score by farm type, at the farm and national levels

Farm type	Farm-level baseline impact score	Weighted median baseline impact score	% land area in England
Cropping: Cereals	-1.7	-0.32	23
Cropping: General cropping	-1.7	-0.17	12
Grazing livestock: Lowland	-1.5	-0.16	1
Grazing livestock: LFA	-1.5	-0.14	9
Other types and mixed: Mixed	-1.4	-0.09	6
Grazing livestock: Dairy	-1.5	-0.08	6
Cropping: Horticulture	-2	-0.02	1
Other types and mixed: Specialist pigs	-1.5	-0.01	1
Other types and mixed: Specialist poultry	-1.5	-0.01	1

3.2.2.1 Regional scale

At the regional scale, baseline risks were strongly influenced by the proportion of land under agriculture (seen below in Figure 12). Weighted baseline environmental risks were highest in the East of England (-1.43), East Midlands (-1.40), Yorkshire and the Humber (-1.30) and South West (-1.30), reflecting their larger proportion of land area that is farmed (70% to 74% of total land area). The East Midlands and East of England scores were driven by the predominance of cropping systems, with Cereals covering 54% of land in the East of England (weighted impact -0.77) and 52% in the East Midlands (-0.73). In contrast, Yorkshire and the Humber and the South West's risk profile reflected a more diverse mix of farming systems. The first includes LFA grazing (-0.33, 26% of total land area), Cereals (-0.45, 35%), General cropping (-0.23, 18%), and Other (-.018, 14%). South West includes Lowland Grazing (-0.38, 29% of total land area), Dairy (-0.19, 15%), Cereals (-0.30, 23%) and General cropping (-0.18, 14%).

Figure 12 Baseline impact of farming activities in regions of England

Region of England	% Total land area	Magnitude
South East (& London)	54%	-1.02
North West	63%	-1.17
North East	68%	-1.24
West Midlands	69%	-1.25
England (Total)	68%	-1.26
South West	72%	-1.30
Yorkshire and the Humber	70%	-1.30
East Midlands	74%	-1.40
East of England	74%	-1.43

Source: OEP 006 - INS305-03 - Dashboard, Annex 9

Note: The darker the colour the higher the risk identified in the combined score.

Regions with a smaller proportion of farmed land had lower weighted baseline impact scores. Risk was lowest in the South East (& London), with a score of -1.02. This score was influenced by the substantially lower share of land area that is farmed (at 54%), despite a high prevalence of Cereals farms (making up 50% of land area, with a baseline impact score of -0.50). The North West had the same score as the national score of -1.17, reflecting its lower share of land area that was farmed (63%) and prevalence of LFA livestock (44% of land area, -0.52), grazing livestock (-0.18, 15%), and dairy (15%, -0.18).

4 Analysis: Scale of effect of farming regulations and wider legislation in mitigating the baseline risks of impact from farming activities

This section presents an assessment of the scale of effect that farming regulations and wider environmental legislation (Annex 10) would have in reducing the baseline risks of impacts from farming activities with compliance. By examining both the direct regulatory mechanisms and the broader legislative landscape, the analysis evaluates the extent to which regulatory rules and mitigation measures lead to reduced pressures on EIS (e.g., soil health, water quality, air quality, habitat quality). For this analysis the scale of effect was scored on a scale of 0 to 3 (as defined in Annex 5).

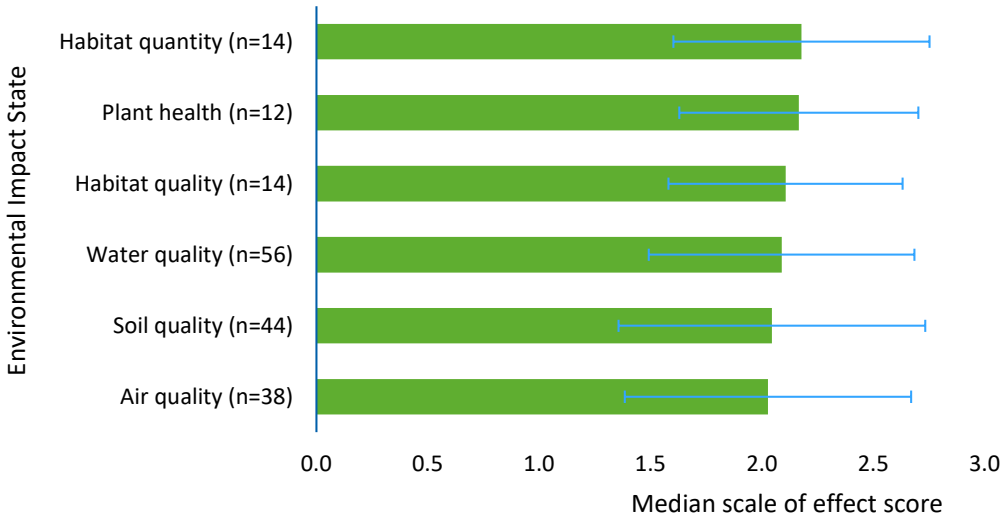
4.1 Scale of effect of farming regulations, at farm scale

4.1.1 Results for regulatory control of farming activities

Descriptive statistics showed that habitat quantity and plant health were perceived by the scorers as being the best controlled EIS through implementation of mitigation rules and regulatory guidance across most farming activities.

The median scores across all EIS were fairly consistent (clustered around 2) (shown below in Figure 13) suggesting scorers perceived control of farm activities as being moderate to high with regulatory control having some impact on reducing, avoiding, cancelling or compensating baseline risks of impacts from environmental pressures/pollutants through compliance and enforcement. It should be noted, however, that the clustering of scores could also indicate that differences were not able to be observed at the EIS level, therefore, additional analysis was required. Detailed analysis results are provided in Annex 5, including analysis broken down by pollutant and receptor.

Figure 13 Assessed effectiveness of Regulations in controlling baseline risks of impacts across EIS (on a scoring of 0 to 3).



Note: Whiskers represent standard deviation for each EIS. Water quantity/availability and wildlife heath are not shown as their small sample sizes (n=8) limit generalisation of statistical findings.

The ANOVA results reinforced these findings by confirming no statistically significant differences in control scores across EIS ($F = 0.26$, $p = 0.97$). The results confirmed that there were no meaningful differences at the EIS level. This implies that there was general agreement that the measures or controls farmers put in place as a result of regulatory compliance would have a similar effect in reducing or offsetting risks from pollutants or environmental pressures, regardless of which EIS was considered.

The slightly lower median score for regulatory control of farm activities impacting on soil quality is supported by research undertaken by ADAS (2024), which concluded that the majority of existing legislation that directly links to sustainable soil management (SSM), focuses on controlling inputs to agricultural soils via non-farm organic materials or manufactured fertilisers, with a specific goal of reducing the risk of soil contamination (e.g. the Sludge (Use in Agriculture) Regulations 1989). There is little focus on other aspects of soil protection such as reducing the threat of soil loss, compaction or erosion. Other legislation (e.g. the Nitrate Pollution Prevention Regulations 2015 and Farming Rules for Water 2018) make reference to a number of SSM measures, but their primary focus is on protecting watercourses with any benefits to soils seen as secondary to water quality improvements.

Similar patterns emerged in the receptor level analysis, where waterbodies and plant receptors were rated more positively by scorers, while soils (especially soil health and soil organisms) received lower recognition for regulatory control. These disparities highlight the need for receptor specific strategies and more equitable distribution of regulatory attention for some farming activities (e.g., cultivation of organic soils, ploughing, spreading of digestate).

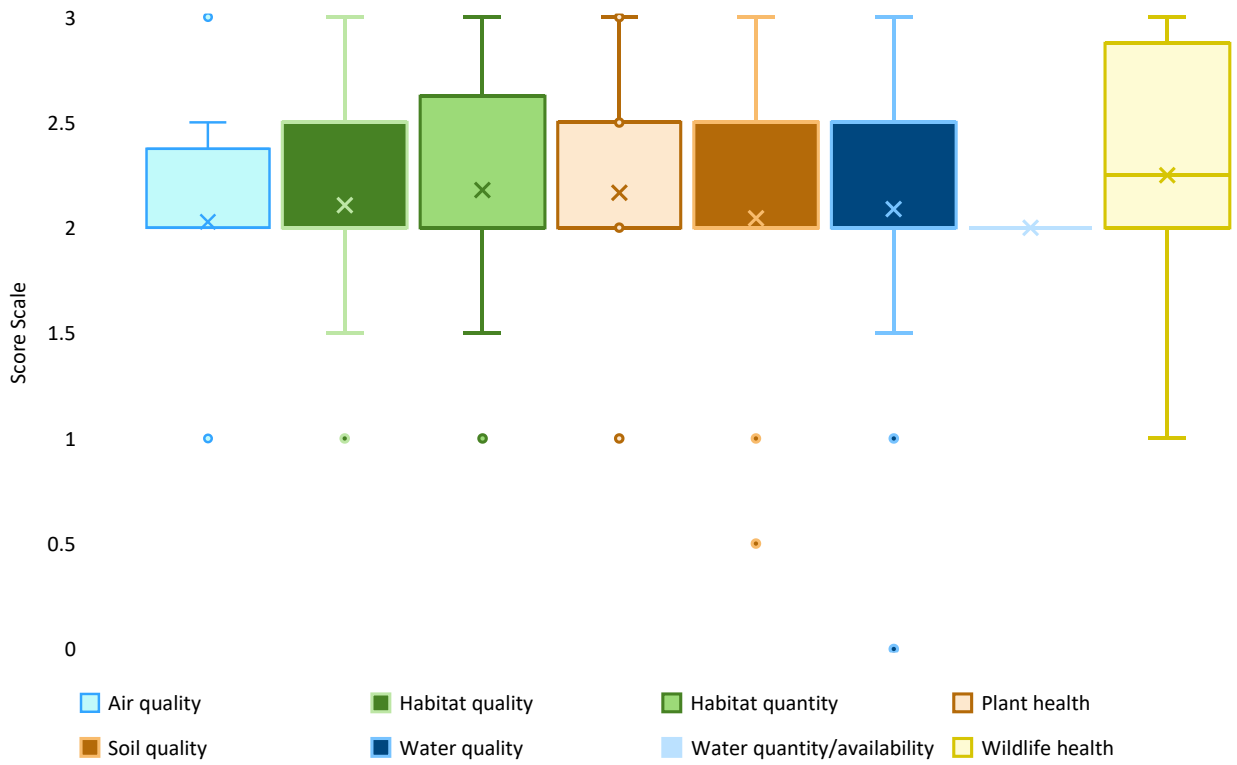
Pollutant specific analysis revealed marginally significant differences in perceived regulatory control ($F = 1.74$, $p = 0.05$). Herbicides and pesticides were rated highest, likely reflecting the maturity of, for example, the Control of Pesticides Regulations 1986 and the Plant Protection Products (Sustainable Use) Regulations 2012 which enforce strict controls on product authorisation, usage, labelling and residue limits. An important point to consider here is that while farming activities may directly impact on food safety and public health (e.g. through pesticide or herbicide run-off and residues), these appear to be sufficiently controlled through regulatory compliance (as perceived by scorers). However, the indirect impacts on the wider environment tend to be more diffuse which could suggest lower regulatory control of baseline risks of impact linked to ecosystem health and function. This is partly supported by the variability in scores at the pollutant level.

In contrast, pollutants such as carbon monoxide and PM2.5 received lower scores, suggesting that some regulations may be less effective in controlling baseline risks of impact from farming activities (e.g., Heather and Grass Burning Regulations 2007, Hazardous Waste (England and Wales) Regulations 2005). The variation in scores across pollutants highlights the importance of pollutant specific monitoring and control strategies, particularly for those farming activities with lower perceived regulatory control. Emissions from farming activities (e.g., machinery use for transportation (on-farm), burning of crop residues, and spreading of manufactured fertiliser) are often addressed indirectly or through general environmental permitting, rather than through dedicated agricultural emission standards. This regulatory gap was identified by scorers as contributing to lower perceived scores for control of these pollutants and highlights the need for more targeted legislation to address specific sources and pathways.

Overall, the statistical evidence points to a regulatory landscape that is only partially effective through regulatory compliance and is uneven, in controlling baseline risks of impacts from farming activities. While certain EIS and pollutants benefit from strong regulatory frameworks, others remain under-addressed. Figure 14 and Figure 15 show boxplots for EIS and pollutants highlighting differences in central tendency, variability and outlier behaviour across the different EIS and pollutant categories in relation to regulatory control.

The boxplot in Figure 14 illustrates how different EIS categories vary under regulatory control. The arithmetic mean, shown by the ‘x’ within each box, indicates the average level of regulatory influence.

Figure 14 Boxplot illustrating the distribution of median scores for regulatory control of farming activities across different EIS.



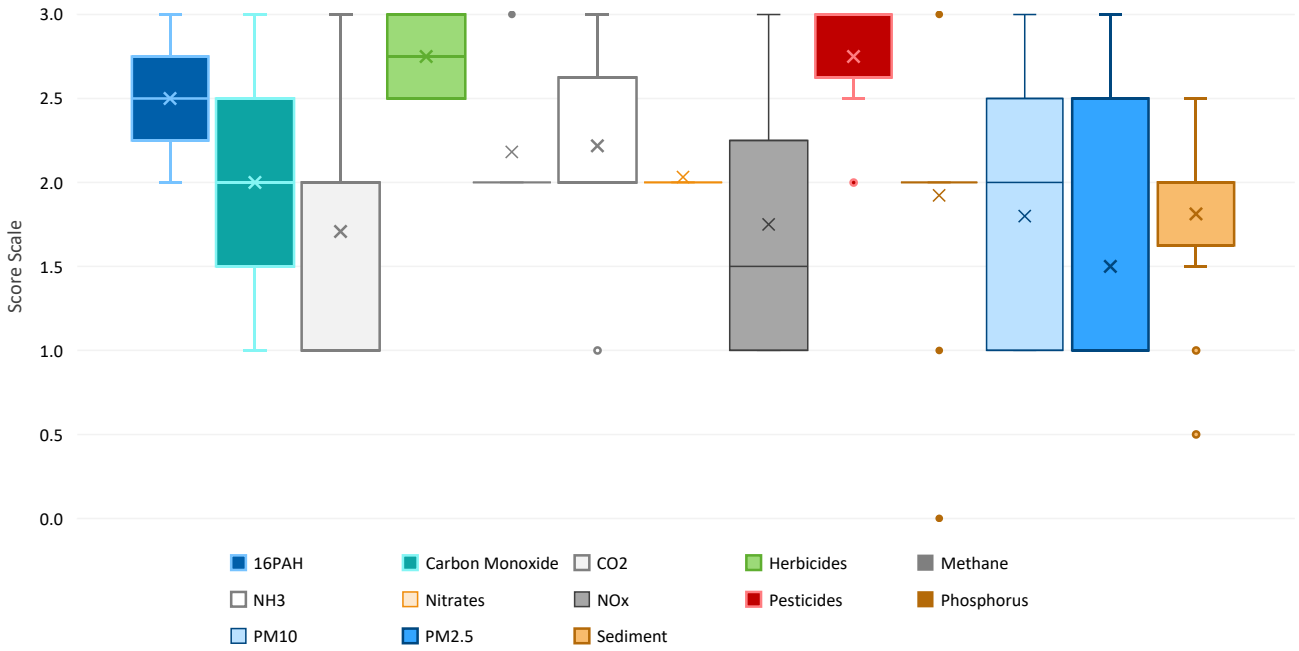
Most EIS categories cluster around higher end scores (above 2), indicated scorers perceived regulatory control of farming activities to be somewhat effective. Water quantity/availability exhibited the lowest score (2), although only marginally lower than other EIS. Variability, represented by the spread of each box and whiskers, reveals the differences in perceived regulatory control of farming activities across EIS: Air and soil quality show relatively tight ranges, implying more uniform control across farming activities, whereas habitat quality, habitat quantity, and wildlife health exhibit wider spreads, highlighting a common perception by scorers of uneven compliance. Outliers (points beyond the whiskers) highlight extreme cases where regulation was perceived as being either very weak or unusually strong. These were most frequent in habitat and water related EIS categories, suggesting localised gaps that could influence overall regulatory effectiveness. Taken together, the patterns confirm that while regulations were generally perceived as helping control risks, their strength and consistency differ across EIS.

The ANOVA results (see Table 32, Annex 7) suggest potential, but not definitive, differentiation in mean scores across pollutants. Scores show a rise from the lowest means for Sediment/CO_2/Phosphorus (~1.8–1.9) to the highest means for PAHs, herbicides and pesticides (2.75). However, the highest-scoring categories (16PAH, Herbicides and Pesticides) are supported by very small sample sizes (n=4–6) and some groups show high dispersion, meaning the apparent ranking may not be stable under repeat sampling. The one-way ANOVA indicates

borderline statistical support for differences in means (F=1.74; p≈0.05; Fcrit=1.75), which, under typical regulatory standards for defensible decisions, should be treated as screening-level evidence rather than a basis for firm compliance or permitting actions. Practically, the appropriate regulatory interpretation is: (1) use the pattern to prioritise verification (targeted additional monitoring and improved representativeness) in the higher-mean categories, especially where n is low; (2) apply variance-robust methods and effect sizes (and/or non-parametric sensitivity checks) to confirm whether differences are real and materially significant; and (3) pair scores with clear decision thresholds, data quality criteria, and corroborating lines of evidence (e.g., exceedance frequency, exposure pathways, receptor sensitivity) so that any escalation is proportionate, transparent, and resilient to challenge given the current uncertainty.

The boxplot in Figure 15 illustrates the distribution of pollutant and chemical concentrations associated with regulatory control of risks.

Figure 15 Boxplot illustrating the distribution of median scores (on a scale of 0 to 3) for regulatory control of farming activities across different pollutant pathways



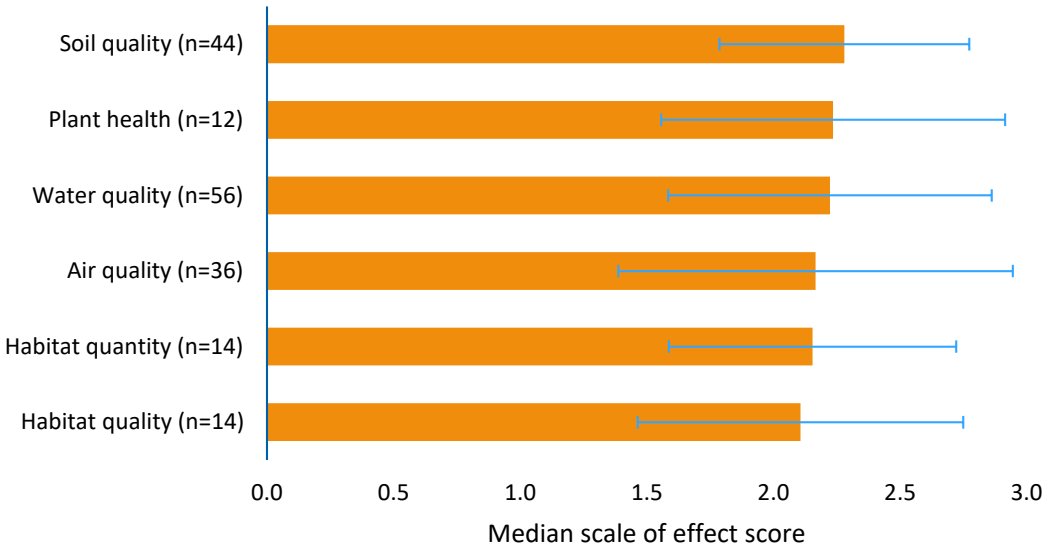
Most pollutants exhibited median scores between 1 and 2, indicating a perception of moderate regulatory effectiveness. Methane and ammonia displayed higher medians and broader interquartile ranges, reflecting variability in emissions from, for example, livestock management and fertiliser application. Herbicides and pesticides presented upper outliers, suggesting variability in regulatory control of, for example, excessive use of plant protection products. Sediment and soil metal concentrations show relatively narrow ranges, pointing to a general perception of consistent regulatory control, whereas particulate matter (PM10 and PM2.5)

shows moderate variability, pointing to a perception of weaker regulatory control, particularly in relation to farming activities linked to soil disturbance or residue burning.

4.1.2 Results for regulatory coverage of farming activities

The statistical analysis of EIS revealed some slight variation in the perceived coverage of farming activities across different regulations. Descriptive statistics showed that soil quality and plant health were perceived as being well covered by regulations. The mean scores for these two EIS (although only slightly higher than other EIS), suggest that baseline risks of impacts from farming activities were perceived as being well covered across the assessed regulations[21]. Figure 16 shows the median scores for each EIS. Additional analysis results are provided in Annex 7.

Figure 16 Assessed scale of effect of regulatory coverage by mitigation rules across sources, pathways, and receptors for baseline risks of impacts on EIS (on scale of 0 to 3). Whiskers represent standard deviation for each EIS.



Note: Water quantity/availability and wildlife health are not shown as their small sample sizes n= 8 limit generalisation of statistical findings.

The ANOVA results for regulatory coverage across EIS categories revealed no statistically significant differences in perceived coverage, with an F-statistic of 0.20 and a p-value of 0.98, well above the conventional threshold of 0.05. This indicates that scorers did not perceive meaningful variation in how different EIS are addressed by regulatory compliance. Despite some variation in mean scores (ranging from 2.11 for habitat quality to 2.35 for water quantity/availability) the differences are likely due to random variation rather than systematic

[21] Note: 18 regulations covered soil quality and 9 covered plant health

differences in regulatory coverage across sources, pathways and receptors. As with regulatory control this could also indicate that differences were not able to be observed at the EIS level.

While the statistical analysis did not confirm significant differences, the descriptive statistics suggested that soil quality (2.28), plant health (2.24) and water quality (2.22), were perceived as relatively well-covered, likely reflecting the presence of established regulations targeting measurable chemical and physical pollutants (e.g., Reduction and Prevention of Agricultural Diffuse Pollution (England) Regulations 2018 (FRW) and Nitrate Pollution Prevention Regulations 2015 (NVZ)). In contrast, habitat quality (2.11), habitat quantity (2.15), and air quality (2.17) received slightly lower scores, hinting at a perception that ecological and atmospheric stressors are less comprehensively addressed. These patterns suggest that mitigation rules may be more focused on quantifiable pollutants, potentially overlooking more complex or diffuse ecological impacts. This highlights the importance of ensuring that regulatory frameworks evolve to better encompass biodiversity and habitat integrity as key components of environmental protection.

The receptor-level analysis ($F = 0.59$, $p = 0.87$) also indicated that there were no statistically significant differences in perceived regulatory coverage across the different receptor groups. Despite this statistical uniformity, the descriptive statistics revealed meaningful variation in how scorers perceive coverage. Receptors such as rivers/streams (mean = 2.67), crops (2.50), and livestock (2.42) received the highest scores, suggesting that these areas are viewed as relatively well-covered across the regulatory landscape. This may reflect the visibility of these receptors in regulatory instruments and their direct links to pollution pathways. In contrast, soil structure (2.03) and all soil (2.02) received lower scores, indicating that soil-related receptors were perceived as moderately covered, with potential gaps in how regulations address their specific vulnerabilities. The relatively lower scores for ecologically specific or spatially discrete receptors, including soil organisms (2.28) and wildlife (2.15), suggest that current regulatory designs may lack the spatial granularity needed to protect biodiversity and sensitive habitats from cumulative or emerging environmental pressures.

At the pollutant level, the ANOVA results ($F = 1.05$, $p = 0.41$) similarly indicated no statistically significant differences between pollutant groups for perceived regulatory coverage. However, the descriptive statistics again pointed to notable variation in perceptions within pollutant groups. 16PAH (2.83), herbicides (2.71), and pesticides (2.69) were scored highest, likely due to the targeted and enforceable nature of UK regulations such as the Plant Protection Products (Sustainable Use) Regulations 2012 and the Control of Pesticides Regulations 1986, which enforce pre-market authorisation, labelling, and usage restrictions. In contrast, pollutants like carbon monoxide (2.00), PM2.5 (2.03), and sediment (1.96) received lower scores, reflecting weaker perceived regulatory coverage. The findings suggest that regulatory attention may be skewed toward pollutants with direct, measurable impacts, while those with diffuse, cumulative, or less visible pathways such as airborne particulates and soil-bound contaminants are not as well covered in the context of regulatory compliance linked to farming activities.

Overall, the findings from the analysis of regulatory coverage again point to a regulatory landscape that is uneven and potentially misaligned with the full spectrum of environmental risks. The coverage of soil and water quality EIS reflects easy to quantify and monitor pollutants and pressures, while the lower scores for ecological health, habitat quantity, and geographically specific receptors indicate that mitigation interventions and regulatory rules are not comprehensive enough to cover all potential environmental risks. To improve environmental governance, future regulatory frameworks should look to incorporate more nuanced consideration of ecological processes, spatial variability, and emerging pollutant pathways. This would support more resilient land management and better safeguard biodiversity, ecosystem services, and long-term sustainability. Figure 17 and Figure 18 show boxplots for EIS and pollutants highlighting central tendency, variability and outlier behaviour across the different EIS and pollutant categories in relation to regulatory coverage.

Figure 17 Boxplot illustrating the distribution of median scores for regulatory coverage of farming activities across different EIS.

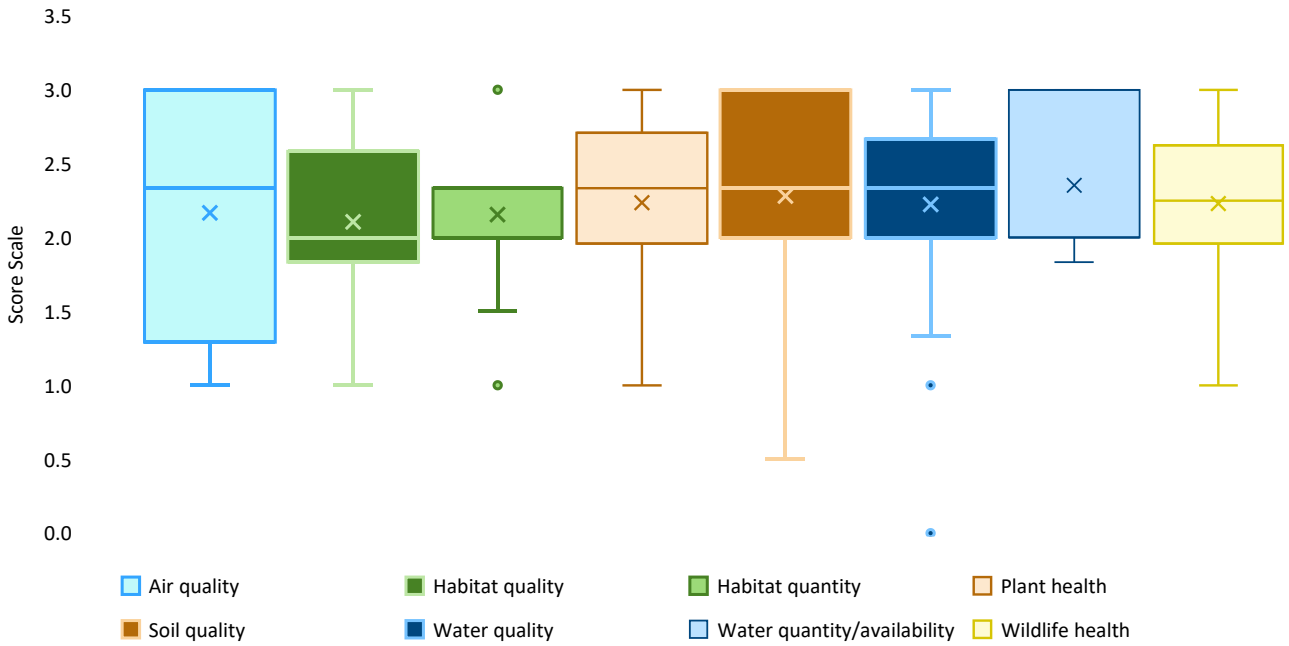
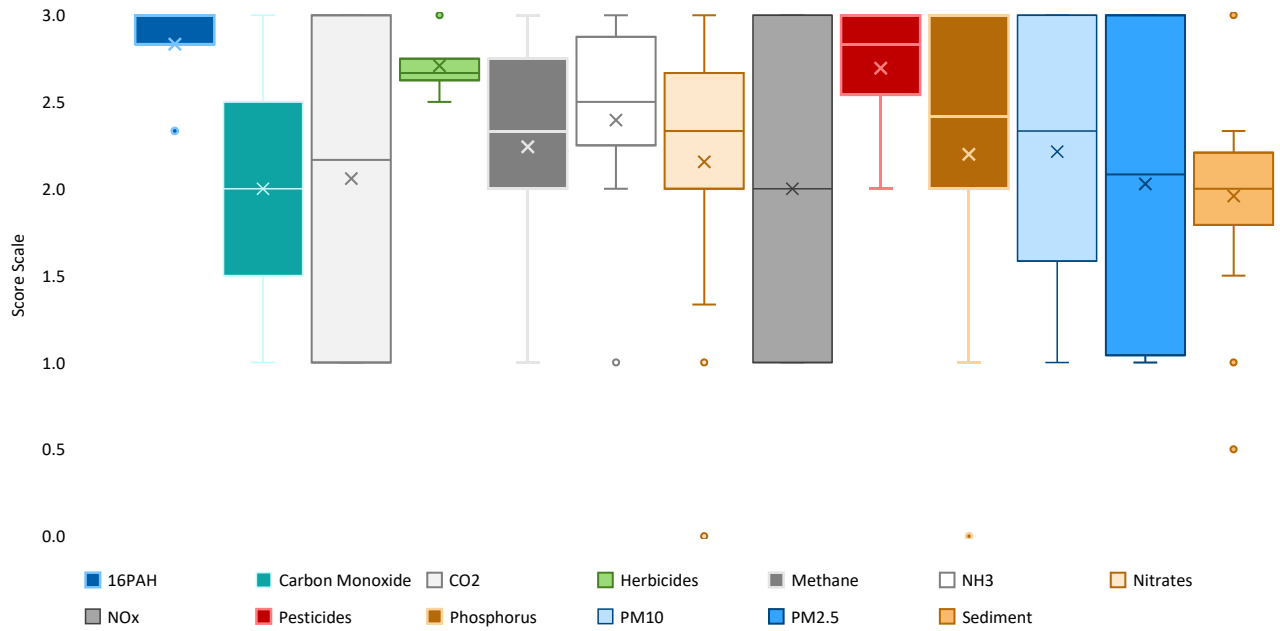


Figure 18 Boxplot illustrating the distribution of median scores for regulatory coverage of farming activities across different pollutant pathways.

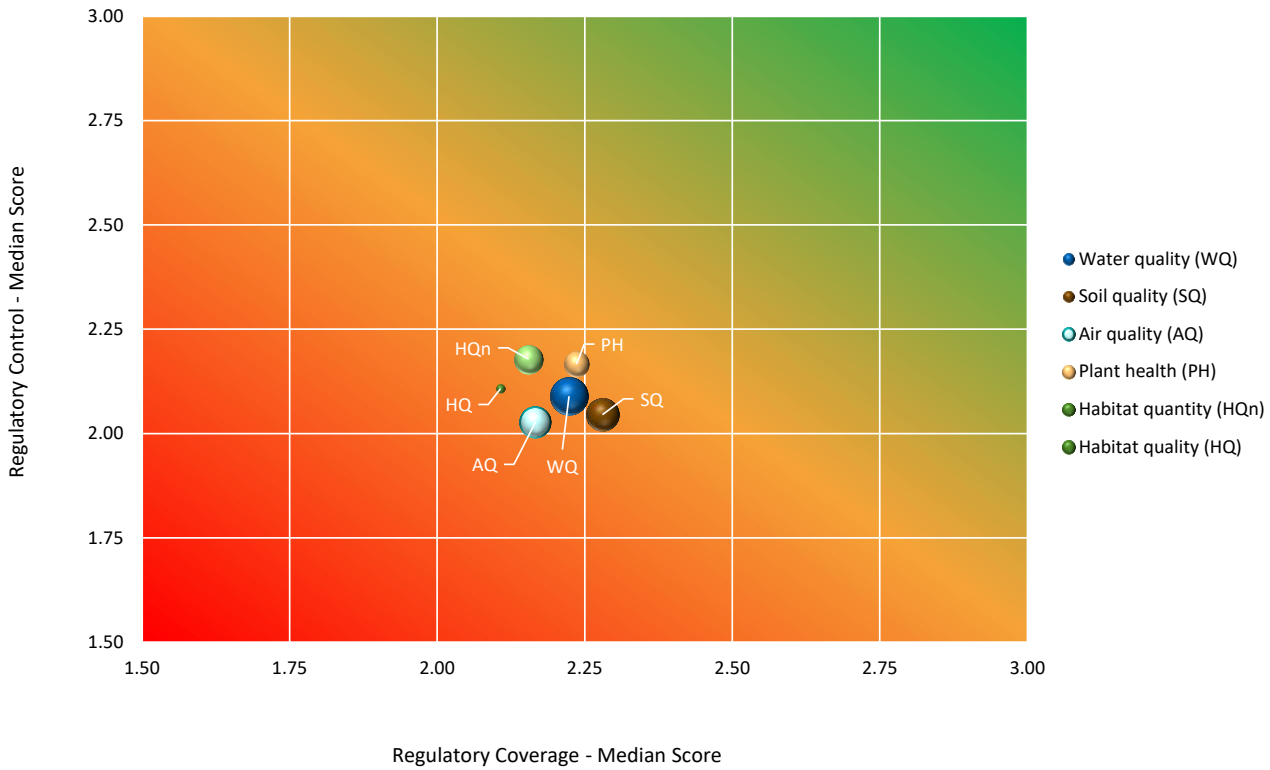


4.1.3 Synthesis of results for regulatory control and coverage

This section synthesises scorer perceptions of how effectively current regulations cover and control baseline environmental risks, using risk matrices to visualise these relationships. Annex 8 provides additional analysis results for overall regulatory effectiveness (coverage and control), baseline risks of impact and certainty scores. Figure 19 provides a visual synthesis of how the various EIS were perceived in terms of both regulatory coverage (x-axis) and regulatory control (y-axis).

Bubble size represents normalised impact score on a scale of 0 to 1, with 1 representing the EIS with the largest magnitude of impact (i.e., greatest baseline risk) and all other EIS scaled proportionally between 0 and 1 based on their magnitude of baseline risk.

Figure 19 Risk matrix of regulatory coverage and control median scores, highlighting overall regulatory effectiveness across assessed EIS.



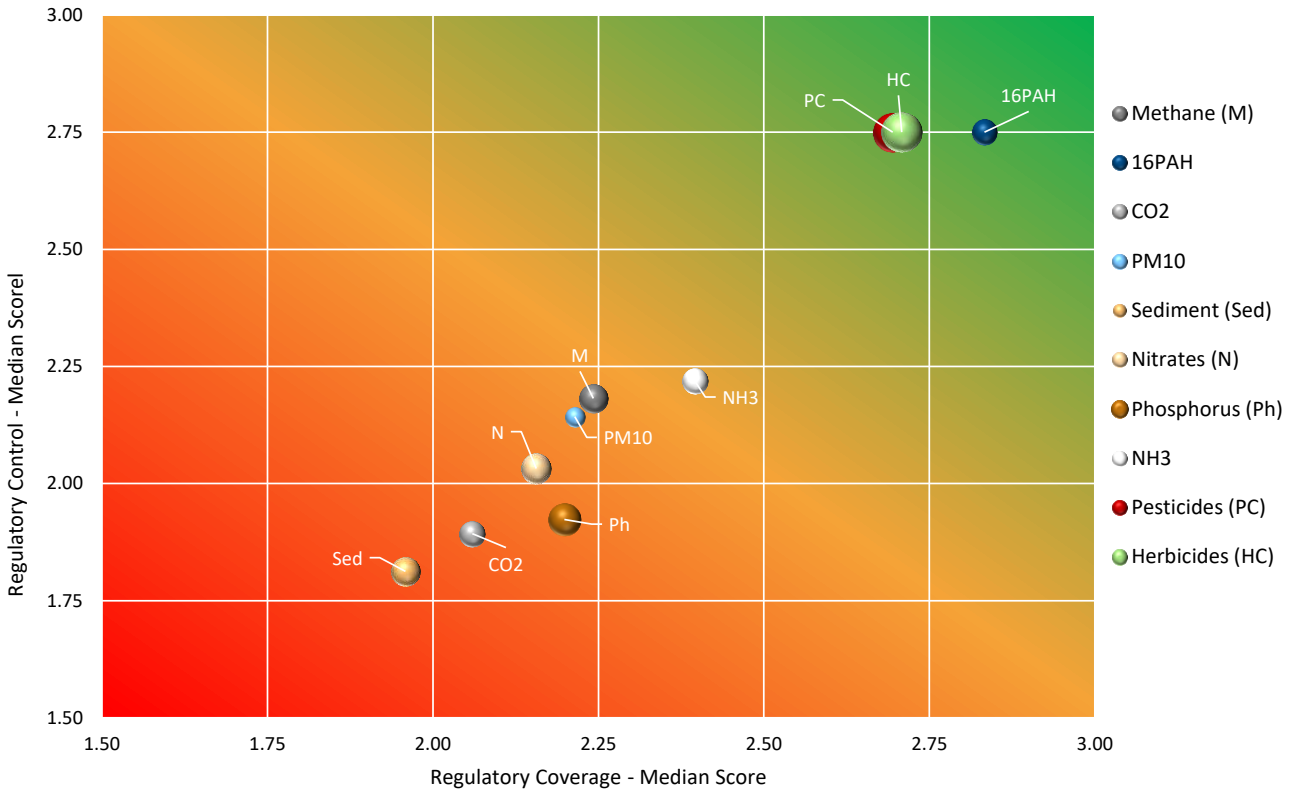
The matrix spans a range from 1.50 to 3.00 on both axes, representing the median score range within which scores for control and coverage fell. A colour gradient background transitioning from red (higher risk of baseline impacts not being covered or controlled) in the bottom-left to green (lower risk) in the top-right provides a visual reference for overall regulatory effectiveness. This gradient, which indicates increasing levels of regulatory effectiveness, implies that EIS positioned closer to the top-right corner would have both high regulatory coverage and control, indicating lower risk of regulatory gaps, while those nearer the bottom-left may be more vulnerable due to weaker coverage and control within the regulatory landscape, especially in the context of regulatory compliance.

Bubble size represents normalised impact, i.e. the relative perceived effectiveness in reducing baseline risks from on-farm mitigation, scaled from 0 (smallest observed impact) to 1 (largest). Water quality appears as the largest bubble (greatest perceived effectiveness), followed by soil quality and air quality, with habitat quantity and plant health showing lower overall regulatory effectiveness, and habitat quality the lowest. Taken together, the chart suggests that coverage and control are perceived as fairly consistent across EIS. Priority for mitigation effort based on perceived effectiveness, however, should focus on targeted improvements to regulatory control as this is likely to unlock additional benefits for the natural environment. Regulatory coverage was generally perceived as being adequate across most EIS.

The pollutant-focused risk matrix shown in Figure 20 provides a comparative visual assessment of how various pollutants were perceived in terms of regulatory coverage (x-axis) and regulatory control (y-axis). Pollutants such as pesticides, herbicides and 16PAH are positioned in the upper-right quadrant, reflecting higher scores for both coverage and control. This suggests that these substances were perceived as benefitting from more targeted and enforceable regulations, likely due to their direct health and environmental risks. In contrast, pollutants like sediment, CO_2, PM2.5, and carbon monoxide are clustered toward the lower-left and lower-central regions of the matrix, indicating lower perceived regulatory coverage and control. These pollutants often have diffuse sources or complex environmental pathways, and their regulation in agriculture tends to be indirect or fragmented. The matrix highlights a potential regulatory gap for pollutants with less visible or cumulative impacts, pointing towards a need for more tailored and enforceable interventions to address their environmental risks more effectively.

The results of this analysis show that while coverage is broadly consistent and perceived as sufficient, regulatory control often lags behind, suggesting enforcement and implementation are key areas for improvement. These insights highlight priority areas for policy refinement, particularly for pollutants and EIS with lower control scores, where targeted interventions could significantly reduce residual environmental risks.

Figure 20 Risk matrix of regulatory coverage and control median scores, highlighting overall regulatory effectiveness across assessed pollutants.



5 Analysis: Implementation of farming regulations and wider legislation critical to mitigating the baseline risks of impact

This section presents a summary of the implementation and enforcement of the regulations based on data provided by the regulators to the OEP following a data request (see Section 2.3). It provides recommendations for further scrutiny of regulations based on environmental risks posed and where gaps were identified in the regulatory landscape. This section is divided into four sections:

- summary of regulatory agencies, their roles and responsibilities;
- summary of the regulations by environmental impacted state (EIS);
- summary of findings on the monitoring, compliance and enforcement regimes for a shortlist of regulations deemed critical due to their relevance for high impact farming activities and low scoring for coverage and control; and
- synthesis of findings and what this tells us about the regulatory landscape overall.

This section is based on data provided by the regulators to the OEP, the EA Chief Regulator's report 2024-2025 and interpretation and expert judgement of the information by the study team.

5.1 Summary of regulator's role in implementing relevant legislation

The effective implementation of farming regulations and wider legislation in England relies on the coordinated actions of several regulatory bodies. Each regulator plays a role in monitoring compliance, enforcing statutory requirements, and supporting the achievement of biodiversity and environmental targets. The following profiles provide an overview of the remit, monitoring and enforcement approaches. The summary section also includes a commentary on data quality considerations for each regulator discussed.

5.1.1 Environment Agency (EA)

The Environment Agency (EA) is the principal environmental regulator for major aspects of farming in England. The EA uses a risk-based approach, with Agriculture Regulatory Inspection Officers (ARIOs) conducting compliance checks. Between 2022 and 2024 the EA ARIOs conducted 10,488 inspections on 9,176 farms (some farms received multiple inspections in this time). Farms are prioritised using combined risk scores from waterbody and agricultural data, with inspections focusing on high-risk catchment areas and holdings with a history of non-compliance. Additionally, the EA responds to reported incidents of source pollution or where there is risk of pollution on farms or caused by farming activities.

Monitoring activities include site inspections and remote sensing (such as drone surveys and aerial photography). Officers systematically record findings and discuss non-compliance and required actions with farm managers after each inspection.

Enforcement actions range from advice and guidance to formal cautions, remediation notices, and prosecution, with the goal of rectifying non-compliance and preventing future harm. Data sharing issues within Defra group have led to occasions where data shared amongst ALBs such as farmer contact details and livestock numbers were out of date[22]. This has impacted the EAs ability to always effectively conduct compliance monitoring. It was noted that this issue is being looked into by Defra. The EA noted that in the data they supplied for this study the remote sensing inspections are excluded from compliance data, as 'they do not accurately represent a site inspection'[23]. The EA's regulatory activities are designed to ensure statutory requirements are met and to support the achievement of environmental targets.

5.1.2 Rural Payments Agency (RPA)

The Rural Payments Agency (RPA) has historically been responsible for enforcing statutory management requirements through the cross-compliance mechanism[24] linked to agricultural payments. The cross-compliance mechanism came to an end on 31st December 2023 when the basic payment scheme (BPS) also ceased to exist and was replaced by delinked payments (which are being phased out) and a focus on new Environmental Land Management Schemes (ELMs)[25]. Based on publicly available evidence, it is currently unclear what the RPA's role in monitoring and enforcing regulations is and how other regulators may have adjusted to the shift in responsibilities. Section 5.3.3 discusses this in more depth.

All RPA data presented within this report shows the period pre-December 2023 when the cross-compliance mechanism was in place. In this period, the RPA operated a reactive, visit-based regime, acting on referrals of potential offences. All referrals were assessed and triaged to ensure a proportionate and fair response, with enforcement focused on meeting statutory management requirements (SMRs) across farm holdings. Monitoring activities included desk-based appraisals, inspections, and review of compliance with specific requirements such as hedgerow management, animal welfare, and food safety. In 2023, the RPA recorded 1754 breaches and gave out 177 advisories and 253 warning letters. The RPA conducted 60 visits in response to serious breaches.

Enforcement actions ranged from advice and guidance to warning letters and reductions in payment entitlements, depending on the severity of non-compliance. The scale of payment reductions decreased with the phasing out of CAP payments. The RPA's data management system was comprehensive, though some limitations existed in the completeness and timeliness of data, particularly where referrals were not followed up due to resource constraints.

[22] Environment Agency (2022) Unpublished document on targeting (DS_C014)
[23] Environment Agency (2024) Unpublished compliance and inspection data (DS_C016)
[24] The Farming Advisory Service (2024) available at: The end of Cross Compliance: What does this mean for Compliance Requirements on Farm? | Farming Advice Service (Table 1 provides detail on how the cross-compliance mechanism (made up of GAEC and SMRs) cover a variety of regulations)
[25] Rural Payment Agency (2024) Cross Compliance Guidance. Available at: https://www.gov.uk/guidance/cross-compliance

5.1.3 Health and Safety Executive (HSE)

The Health and Safety Executive (HSE) regulate health and safety in agriculture, focusing on hazardous substances, machinery, and workplace practices. HSE follows a risk-based, situational approach to compliance monitoring, responding to notifications of concerns or incidents and targeting inspections at farm holdings with the highest risks. Factors such as activity type, sector, and safety record inform the prioritisation of inspections.

Monitoring activities include proactive targeting, site visits, and review of incidents or complaints. Inspectors gather information on hazards and control measures, assess associated risks, and distinguish between actions needed for legal compliance and advice offered to support good practice.

Enforcement actions are selected by HSE based on their assessment of the risk posed and may include advice and guidance, formal improvement notices, enforcement notices, probation notices, and prosecution. HSE works with duty holders to agree reasonable timelines for achieving compliance, aiming to reduce risks and improve safety standards. The number of inspections is limited by available resources, and data on farm-level compliance is not always regulation-specific.

5.1.4 Natural England (NE)

Natural England (NE) is responsible for monitoring compliance with regulations that protect designated habitats, species, and landscape features. NE monitors compliance primarily using an investigative approach, including targeted inspections and by reviewing reports and impact assessments submitted by land managers. Consent for works is only granted if environmental protection requirements are met.

Routine site-based monitoring is rare; instead, NE responds to complaints or missing information by conducting desk-based assessments, which may lead to on-site inspections. For some regulations, compliance may also be identified during separate monitoring activities, such as the Wildlife and Countryside Act 1981 and SSSI checks.

Enforcement actions range from written and verbal warnings to regulatory and enforcement sanctions, monetary penalties, and prosecution in significant cases. Most complaints are investigated through desk-based reviews, typically resulting in written or verbal warnings. The number of complaints and resulting investigations has declined over recent years, and a small proportion of desk-based inspections lead to enforcement. While the severity of breaches is not recorded, typical offences involve activities such as construction, managing trees, vehicle operations, and improper waste disposal. NE uses a phased approach, with disciplinary action escalating according to the offender’s level of cooperation.

5.1.5 Local Authorities

Local Authorities play a key role in enforcing certain farming regulations, particularly those relating to public health, planning, and environmental protection.

Their approach to monitoring compliance is largely reactive, responding to complaints, incidents, or planning applications rather than conducting routine inspections. Activities include desk-based appraisals, site inspections, and review of records. Enforcement actions may involve issuing advisories, warning letters, remediation notices, financial penalties, or prosecution. Local Authorities aim to ensure compliance, rectify breaches, and safeguard community interests.

Data specific to individual farm holdings is limited, making it difficult to assess compliance trends or enforcement outcomes at the farm level. While Local Authorities have conducted a significant number of inspections under relevant legislation, most enforcement actions are triggered by complaints or incidents. The approach is underpinned by statutory obligations to protect public health and uphold local and national legislation, but resource constraints and data limitations present ongoing challenges.

5.1.6 Office for Product Safety and Standards (OPSS)

The Office for Product Safety and Standards (OPSS) is responsible for ensuring that products placed on the market, including those used in agriculture, comply with safety and environmental standards. The OPSS's remit includes oversight of product safety, but its direct involvement in farm-level compliance and enforcement is limited.

The research team did not receive substantive data about the OPSS's monitoring and enforcement approach for farming regulations in the current evidence base.

5.1.7 Overall summary

The regulatory landscape for farming in England is characterised by a diverse set of agencies, each with a distinct remit and approach to compliance and enforcement (see Table 4 below), but with some important areas of crossover.

Table 4 Overview of main regulators

Regulator	Main remit/focus	Monitoring approach	Enforcement tools	Data considerations/notes
EA	Environmental protection	Risk-based, site visits, remote sensing	Advice, cautions, prosecution	Some data gaps due to sharing issues
RPA	Cross-compliance, payments (phasing out)	Referral-based, site visits, desk reviews	Payment reductions, warnings	Some incomplete referral follow-up; future role under review
HSE	Health & safety in agriculture	Risk-based, incident-led	Notices, prosecution	Limited by inspection resources; not always regulation-specific

NE	Biodiversity, habitats, SSSIs	Complaint/investigation -led, desk-based	Warnings, sanctions, prosecution	Limited comprehensive compliance data
Local Authorities	Public health, planning, environment	Reactive, complaint-led	Advisories, penalties, prosecution	Limited farm-level data
OPSS	Product safety	Not substantive for farming	Not substantive for farming	No substantive data for farming

The Environment Agency leads on environmental protection and pollution control, while the Rural Payments Agency has historically provided the backbone for cross-compliance and payment-linked enforcement, though its future role is evolving as direct payments are phased out. Natural England, the Health and Safety Executive, and Local Authorities each play complementary roles, from investigative monitoring of habitats and species to targeted health and safety inspections, and reactive enforcement of public health and planning rules. The Office for Product Safety and Standards (OPSS) has a limited direct role in farm-level enforcement, with little substantive data available on its activities in this sector.

While each agency's remit is distinct, there are areas, such as pollution control, habitat protection, and hazardous substances, where responsibilities and activities overlap. This can provide resilience and flexibility but also introduces complexity for regulated businesses and for the coordination of enforcement. The effectiveness of the system depends on clear allocation of responsibilities, robust and timely data, and ongoing collaboration between regulators.

Persistent data gaps, especially for smaller holdings and non-designated habitats, and the evolving enforcement landscape following the withdrawal of cross-compliance, highlight the need for continued integration, transparency, and adaptation across the regulatory system.

5.2 Summary of key regulations by EIS and their compliance and enforcement levels

The regulations classified for the categorisation of the scale of effect of farming regulations and wider legislation in mitigating the baseline risks of impact from farming activities according to their risk of impact associated with farming activities, were, during this task linked to an EIS. Table 5 shows the list of regulations for each EIS.

Table 5 List of targeted shortlisted regulations per environmental impacted state.

Regulation	Environmental Impacted State					
	Air Quality	Habitat Quality and Quantity	Plant Health	Soil Quality	Water Quality and Quantity	Wildlife Health
Ancient Monuments and Archaeological Areas Act 1979		x				
Animal By-Products (Enforcement) (England) Regulations 2013					x	x
Control of Substances Hazardous to Health Regulations 2002					x	
Crop Residues (Burning) Regulations 1993	x			x		
Environmental Impact Assessment (Forestry) (England and Wales) Regulations 1999[26]		x		x		
Environmental Permitting Regulations (England and Wales) 2010[27]	x	x	x	x		
Environmental Permitting Regulations (England and Wales) 2016	x		x	x	x	
Hazardous Waste (England and Wales) Regulations 2005		x			x	x
Heather and Grass Burning Regulations 2007	x			x		x

[26] Note: Although focused on targeted consent for certain forestry projects, the Regulations sit within a broader assessment framework relevant where farm land use changes involve woodland.

[27] Note: While both Environmental Permitting Regulations (England and Wales) 2010 and 2016 are expansive and consolidate various separate environmental consenting areas (e.g., waste, water, pollution) into one overarching scope and framework, they also include a mix of targeted controls.

Invasive Non-native Species (Amendment etc.) (EU Exit) Regulations 2019						x
Management of Hedgerows (England) Regulations 2024		x			x	
Nitrate Pollution Prevention Regulations 2015 (NVZ)	x		x	x	x	
Plant Protection Products (Sustainable Use) Regulations 2012				x	x	x
Reduction and Prevention of Agricultural Diffuse Pollution (England) Regulations 2018 (FRfW)	x	x	x	x	x	
Sludge (Use in Agriculture) (Amendment) Regulations 1990	x		x	x	x	
The Dairy Products (Hygiene) Regulations 1995					x	
The Groundwater (England and Wales) Regulations 2009					x	
Transport of Animals (Cleansing and Disinfection) (England) (No.3) Order 2003	x			x		
Veterinary Medicines Regulations 2013				x		
Water Resources (Control of Pollution) (Silage, Slurry and Agricultural Fuel Oil) (England) Regulations 2010 (SSAFO)	x		x	x	x	

5.2.1 Air quality

The Environmental Permitting Regulations (EPR) govern air quality regulation for intensive livestock in English agriculture, while the Air Quality (Domestic Solid Fuels Standards) Regulations set standards for domestic solid fuel use.

This study identified that ammonia emissions from livestock and fertiliser use are a primary area of concern, with permitted pig and poultry farms subject to mandatory inspections at least every three years. Whilst pigs and poultry are the focus of inspections, at a national and regional level there are many factors which cumulatively add to air quality issues. The data also reveals that smaller and non-permitted farms are less systematically monitored.

Between January 2022 and September 2024, the Environment Agency (EA) conducted a total of 10,488 inspections, with compliance rates for permitted sites generally high at over 80% for most BAT (Best Available Techniques) requirements. For example, 1,055 permitted farms participate in the Pig and Poultry Assurance Scheme, where high compliance is a condition of membership, and 95% of members passed their most recent inspections. However, remote sensing inspections (e.g., drone surveys) are not included in official compliance statistics. In the Northwest, ammonia exceedances are most common in dairy-intensive catchments, where 22% of inspected holdings failed to cover slurry stores as required. Since the introduction of remote sensing in 2024, 120 additional cases of open manure heaps were identified, highlighting the importance of this tool for identifying non-compliances.

Additionally, the analysis of the data mapping shows that 90% of Crop Residues (burning) breaches were resolved with advice, and only one case led to a fine.

Other key findings from the data analysed are:

- Non-compliance with air quality rules is, from this data, highest in the Northwest and among dairy farms, while permitted poultry operations in the East of England show the highest compliance rates. The non-compliance rates in an area reflect the concentration of the sources of the pollutants, i.e. the higher the concentration of a pollutant (often dictated by farm type) the more likely that non-compliance will be identified.
- Most enforcement is advisory, but persistent offenders remain: 12% of holdings failed two or more inspections in the past two years.
- 60–80% of breaches are resolved with advice or warnings, but 10–20% of holdings are repeat offenders, especially for nutrient management and manure storage.
- Data gaps and inconsistent enforcement for smaller holdings limit sector-wide effectiveness.

5.2.2 Habitat quality/quantity

Habitat protection is governed by the Conservation of Habitats and Species Regulations, the Wildlife and Countryside Act, and the Hedgerow Regulations. These regulations aim to prevent habitat loss, fragmentation, and degradation, with specific protections for designated sites and landscape features.

Enforcement on this area is largely reactive. In 2023, the RPA recorded 1,045 hedgerow referrals (Good Agricultural and Environmental Condition 7a (GAEC 7a)), with a 6% failure rate (62 holdings). Most breaches (77%) were resolved with warning letters (48 issued), but 10% resulted in payment reductions (10 at 1%, 3 at 3%, 12 at 5%, and 2 at over 5%), and two cases led to prosecution for repeated, deliberate removal of ancient hedgerows.

For SSSI protection (GAEC 7d), 101 referrals were recorded, but no failures to comply were identified. This does not consider the high percentage of SSSI area in unfavourable condition (49% in 2024) nor the fact that many indicators of biodiversity are declining in the short and long term.[28][29] Most habitat-related breaches (of agricultural regulations) are detected through desk-based reviews or public complaints, rather than routine field inspections. Proactive monitoring is limited, and under-reporting is likely, especially for non-designated habitats. In upland areas, only 15% of holdings were inspected in the past five years.

Cross-compliance was a key driver of enforcement, but as this mechanism no longer exists due to the phase-out of direct payments, Natural England has anticipated a potential drop in voluntary reporting of minor breaches.

Other key findings from the data analysed are:

- In the East Midlands, repeated minor breaches across multiple holdings have led to measurable declines in hedgerow connectivity.
- Following a 2022 awareness campaign, hedgerow breach referrals dropped by 18% in the following year.
- Farmers in the South West report confusion over hedgerow management rules, suggesting a need for clearer guidance.

5.2.3 Plant health

Plant health is safeguarded through regulations on pesticide use, invasive species, and plant health emergencies. The Plant Protection Products (Sustainable Use) Regulations and related

[28] Defra (2025) available at: https://www.gov.uk/government/statistics/england-biodiversity-indicators/1-extent-and-condition-of-protected-areas--2
[29] Defra (2025) available at: https://www.gov.uk/government/statistics/england-biodiversity-indicators/overview-of-assessment-of-change-for-all-indicators-and-their-component-measures--2

legislation set standards for safe use, storage, and disposal of pesticides, as well as the training and certification of users.

Compliance is generally good among professional users. In 2023, the RPA recorded 814 inspections for SMR 10 (pesticide use), with a 2% failure rate (16 holdings). Most enforcement actions involve advice, guidance, or minor penalties, with only a handful of prosecutions or improvement notices issued. However, 30% of enforcement actions in 2023 related to the storage of obsolete or banned products, particularly on mixed arable-horticultural farms. Invasive species management is a growing concern: 18 new cases of non-native plant outbreaks were recorded in 2024, but only half were followed up with site visits due to resource constraints. HSE inspectors report that awareness of new plant health threats is improving, but small-scale producers remain a blind spot.

Other key findings from the data analysed are:

- The number of invasive species outbreaks has doubled since 2022, with climate change cited as a key driver.
- There is no routine inspection regime for small-scale horticulture, leaving a potential gap in monitoring of biosecurity.
- According to HSE documentation, "*most breaches are due to record-keeping, not deliberate misuse*".

5.2.4 Soil quality

Water-focused regulations primarily aim to reduce pollution and protect aquatic ecosystems, however, they frequently deliver secondary benefits for soil health, particularly through reduced erosion and improved nutrient retention.

In 2023, buffer strip referrals 1 (GAEC 1) had a 4% failure rate (43 of 978 holdings), with most breaches in the South West and on dairy farms (this aligns with the regional data presented in section 3). Erosion hotspots persist in the East of England, despite the lower baseline risk identified by this study for soil quality in this region, 12% of inspected arable holdings failed to meet minimum soil cover requirements. Remote sensing increased detection of bare soil events by 15% in 2024, but data on soil organic matter management and soil compaction is still sparse, especially for holdings under 50 hectares.

Other key findings from the data analysed are:

- A pilot project in Norfolk reduced soil erosion by 20% after introducing cover crops and buffer strips. A Norfolk chalk-catchment demonstration paired winter cover crops with targeted riparian buffers; against baseline, project monitoring showed ~20% fewer erosion indicators on treated fields while remaining within Farming Rules for Water FRfW/NVZ requirements, illustrating how encouraging on-farm practices through non-regulatory schemes can close the risk gaps visible in regulator compliance data.

- Monitoring was heavily reliant on cross-compliance, and more targeted interventions may be needed to address persistent hotspots of erosion and compaction.

5.2.5 Water quality/quantity

Water quality diffuse pollution regulation is the most intensively enforced, with 7,943 FRfW inspections between January 2022 and September 2024. Of these, 47% of holdings failed at least one soil or manure management requirement. Nitrate Vulnerable Zones (NVZ) compliance is slightly higher, with 57% of 4,353 inspected holdings passing, with non-compliances mostly identified due to over-application of nitrogen. The high rates of non-compliance indicate the complexity and ambiguity of the regulations where farmers may not know or understand the rules. This also points to a lack of sanction applied through the enforcement system.

On the other hand, Silage, Slurry and Agricultural Fuel Oil (SSAFO) compliance is highest for oil storage (87%), with 72% compliance for silage and slurry. The data mapping also shows that 66% of enforcement actions for SSAFO result in rectification, but 34% of non-compliance persists beyond the first follow-up.

The main source of data regarding water quantity came from the EA and RPA monitoring of the Environmental Permitting Regulations (England and Wales) 2016, which issues permits for water abstraction. In 2022-2024 the EA reported a compliance rate of 95% (143 inspections) for permitted activities related to groundwater activities.

Other key findings from the data analysed are:

- The average time required to resolve an FRfW breach following the initial inspection is 3.5 months for a holding.
- 12% of holdings failed two or more inspections in the past two years.

5.2.6 Wildlife health

Wildlife health enforcement is mostly complaint-driven, with 180 Wildlife and Countryside Act referrals in 2023. Most breaches (85%) were resolved with warnings, but 10% led to payment reductions. Disease outbreaks linked to livestock-wildlife contact were reported in 12 of the referral cases, but only four resulted in formal investigation.

The cross-compliance mechanism played a role in driving compliance when it was in force, particularly where wildlife health is linked to habitat management or pesticide use. However, proactive monitoring is limited, and the data analysed highlights challenges in addressing emerging risks such as zoonotic diseases and the impacts of climate change.

Other key findings from the data analysed are:

- Reports of wildlife-livestock disease transmission have increased by 30% since 2021.

- Holdings with repeated wildlife breaches are also more likely to have habitat and water quality non-compliance.
- Data on non-designated species is particularly weak, and emerging zoonotic risks are not systematically tracked.

5.2.7 Overall summary

These findings underscore the need for enhanced surveillance and more robust data collection, particularly concerning non-designated species and those habitats currently underrepresented in existing monitoring schemes. Strengthening early warning systems and integrating climate change considerations into enforcement strategies could improve the sector's ability to respond to emerging wildlife and disease threats.

5.3 In depth analysis of the monitoring and enforcement regimes of the most important regulations to the biodiversity targets and commitments in England

This section discusses regulations identified as being most critical for managing environmental risks arising from farming in England. A shortlist of regulations was developed through a structured mapping and scoring process, prioritising regulations that either directly address farming activities identified as high risk for the environment or were scored poorly for their coverage and control (listed in Table 5). The resulting shortlist is a mix of overarching regulations, reflecting their system-wide influence, and more specific and targeted regulations.

For each shortlisted regulation, data collected was analysed to draw out insights on their monitoring, compliance and enforcement activities and overall effectiveness. Key information is summarised in Annex 11.

5.3.1 Overarching regulations

Climate Change Act 2008. The Climate Change Act 2008 provides the legislative framework for the UK's approach to climate mitigation and adaptation, setting legally binding greenhouse gas reduction targets and establishing a system of carbon budgeting. In the context of farming, the Act's influence is indirect, operating through subsequent regulations and sectoral policies.

There is no routine monitoring or enforcement at the farm level, and no farm-level compliance data is available. The Act's effectiveness in the agricultural context is therefore realised through its role in shaping the broader regulatory landscape, rather than through direct compliance mechanisms. Notably, 308 actions were reported against this regulation regarding 'spreading to land' through EA data, with 66% of actions rectified on average across EA inspections. However, these actions are not specific to the Act itself and reflect the broader challenge of attributing compliance outcomes to overarching legislation. Further study would be required to understand the influence of overarching legislation on regulations and associated compliance rates.

As an overarching framework, this Act sets the strategic direction for climate action but does not directly target specific farm types or activities. Its influence is most apparent where subsequent regulations have translated national targets into operational requirements for intensive and high-emission farming systems. However, the lack of farm-level compliance data means its effectiveness in driving improvement at the holding level is indirect, and further scrutiny may be needed to ensure that climate objectives are consistently embedded in sector-specific enforcement.

Common Agricultural Policy (Controls and Enforcement, Cross Compliance, Scrutiny of Transactions and Appeals) Regulations 2014. This regulation has historically been central to environmental compliance in agriculture, leveraging cross-compliance mechanisms to link statutory management requirements to agricultural payments.

The RPA operated a referral-based, visit-driven monitoring regime, supported by desk reviews. In 2023, the RPA recorded 1,754 breaches, issued 177 advisories and 253 warning letters, and applied payment reductions in cases of non-compliance. Of 126 referrals received, 60 were selected for a visit, while the remaining 66 were deemed not appropriate or possible for inspection. The analysis of this data suggests that the enforcement approach was proportionate, with the majority of breaches resolved through advisories and warnings. However, the removal of cross compliance at the end of 2023 due to the phase-out of direct payments introduces uncertainty regarding the current and future effectiveness of this enforcement lever.

This regulation is no longer influential due to the UK leaving the European Union and adopting its own farming policies such as the Environmental Land Management scheme. However, the legislation historically provided the broadest coverage across farm types and activities, particularly through cross-compliance mechanisms linked to payments. Larger and more intensively managed farms were best covered, with measurable improvements in compliance for soil, water, and habitat management. However, as direct payments are phased out, there is a risk that smaller and less intensively regulated holdings may become less visible to enforcement, warranting ongoing review of alternative compliance levers.

Conservation of Habitats and Species Regulations 2017. The Conservation of Habitats and Species Regulations 2017 are central to the protection of designated habitats and species of European importance. NE, the EA, and the RPA shared responsibility for monitoring and enforcement. The approach is predominantly investigative and complaint-led, with desk-based assessments and targeted site visits. In 2023, the RPA recorded 28 referrals under SMR 2 (The Conservation of Wild Birds) and 51 under SMR 3 (Conservation of natural habitats and of wild flora and fauna), with 0% failure to comply. NE data from 2020–2024 show 98 farm investigations following legitimate tip-offs, with approximately 19 offences related to agricultural activities. Most complaints are resolved through written or verbal warnings, and the number of formal investigations triggered by complaints has declined year-on-year. The system has generally been

more effective at securing corrective action, but persistent non-compliance remains a challenge, particularly where monitoring is limited by resource constraints.

The regulation is more effective in protecting designated habitats and species, especially where farming activities intersect with high-value conservation areas. However, the mapping highlights that non-designated habitats and smaller holdings are less systematically monitored, suggesting that further scrutiny is needed to ensure comprehensive biodiversity protection across the farmed landscape.

Environmental Impact Assessment (Agriculture) (England) Regulations 2006. The EIA (Agriculture) Regulations require that certain agricultural projects undergo screening and, where necessary, full assessment to determine their environmental impact. NE is responsible for granting consents and monitoring compliance, primarily through desk-based assessments and, where necessary, site visits.

Since 2018, 60 screening applications were assessed as requiring consent before works could proceed. Once an applicant is notified that they require consent to proceed they should supply Natural England with an environmental statement to set out the expected environmental impact of the works and mitigation measures. However, since 2018 only 6 environmental statements were received. Additionally, in 19 of the 60 cases, evidence of cultivation was observed via aerial imagery despite no consent being issued. Therefore, the regulation is not acting as a suitable deterrent to non-compliant behaviour in a third of cases. The approach is largely investigative, triggered by applications or complaints, with 6.35% of initial desk-based inspections resulting in enforcement activity. The absence of routine monitoring and limited data on overall compliance are notable constraints.

The mapping shows that the EIA regulations are more effective at preventing high-risk land use changes, such as the conversion of semi-natural habitats, on larger or more intensively managed holdings. However, smaller projects and holdings may escape routine scrutiny, and that proactive monitoring could be strengthened to ensure that all environmentally significant changes are captured.

Water Environment (Water Framework Directive) (England and Wales) Regulations 2017. These regulations implement the Water Framework Directive, setting standards for water quality. The EA is responsible for monitoring, but there is no systematic farm-level compliance regime. No specific compliance or enforcement data is available, and the effectiveness of the regulation is realised through its influence on other, more targeted instruments. During the period January 2022 to September 2024, 531 actions were recorded (regulation unspecified, regarding waste), with 74% of actions rectified.

This regulation provides the statutory baseline for water quality, with the greatest improvements observed where it is operationalised through targeted permitting and pollution controls. Nonetheless, the mapping indicates that diffuse pollution from smaller or non-permitted farms

remains a persistent challenge, highlighting the need for more integrated and comprehensive monitoring.

Wildlife and Countryside Act 1981. The Wildlife and Countryside Act provides extensive protections for habitats and species. NE, the EA, and the RPA share responsibility for monitoring and enforcement, which is predominantly complaint-driven and desk-based. Over 2020–2024, NE recorded 98 farm investigations following tip-offs, with 19 offences related to agricultural activities. The RPA recorded 180 referrals under this regulation in 2023, with most breaches resolved through warnings. The system is generally effective at securing corrective action, but data gaps persist, particularly for non-designated species and habitats.

The Act is more effective in safeguarding protected species and habitats, particularly on designated sites and larger holdings. However, the mapping reveals that non-designated areas and smaller farms are less well covered, and that data gaps persist for emerging risks such as climate change and invasive species. Further scrutiny is recommended to ensure that all relevant biodiversity risks are addressed.

5.3.2 Targeted regulations

Environmental Permitting Regulations (England and Wales) 2010/2016. These regulations provide a risk-based, streamlined framework for pollution control, consolidating multiple consenting regimes. The EA leads on monitoring, employing a risk-based approach with routine site visits and remote sensing, prioritising high-risk holdings and those with a history of non-compliance. Permitted farms are subject to mandatory inspections at least every three years, with compliance rates exceeding 80% for most Best Available Techniques (BAT) requirements. Between January 2022 and September 2024, 8,134 actions were reported under these regulations, with 66% of actions rectified. In 2024 98% of inspections under this regulation (1298 permits inspected reflecting 978 inspections) were awarded the highest compliance bands with no or minor environmental effect, showing high rates of compliance with the permits[30]. Where non-compliances were identified 94% were identified as low risk and most enforcement action was advice and guidance (80% advice and guidance and 20% resulting in a warning, formal caution or prosecution).

Enforcement actions range from advice and guidance to formal cautions, remediation notices, and prosecution. The system is robust for permitted sites, but coverage is less systematic for smaller, non-permitted holdings. Mapping evidence indicates that these regulations are more effective for intensive livestock and larger arable operations, where risk-based permitting and regular inspections have led to higher compliance rates and measurable improvements in pollution control. However, smaller and non-permitted holdings remain less well covered,

[30] Environment Agency (November 2025) available at: https://www.gov.uk/government/publications/environment-agency-chief-regulators-report-2024-25/environment-agency-chief-regulators-report-2024-25

suggesting that further scrutiny may be warranted to address gaps in regulatory reach and ensure consistent environmental outcomes across all farm types.

Reduction and Prevention of Agricultural Diffuse Pollution (England) Regulations 2018 (FRfW). The FRfW regulations are designed to reduce and prevent diffuse pollution from agricultural sources. The EA and RPA share monitoring responsibilities, with the EA conducting risk-based inspections and the RPA operating a reactive, referral-based regime. Between January 2022 and September 2024, 7,943 EA inspections were conducted, with a compliance rate of 53% (4,181 holdings compliant, 3,762 non-compliant). The EA's Chief Regulator Report indicates an updated rate of non-compliance of 46% in 2024[31]. The RPA reported 847 referrals under SMR 1, 978 under GAEC 1, and 1,039 under GAEC 5, with failure to comply rates of 5%, 4%, and 0%, respectively. Enforcement is primarily advisory, but formal cautions and prosecutions are used where necessary. A total of 13,713 actions were reported under these regulations by the EA, with 66% of actions rectified.

The FRfW regulations provide strong coverage for high-risk activities such as manure and fertiliser management on larger farms, with compliance data showing significant enforcement activity and rectification rates. Nevertheless, persistent breaches and lower compliance among smaller or less intensively regulated holdings highlight the need for ongoing attention to diffuse pollution risks and the effectiveness of current monitoring strategies.

Nitrate Pollution Prevention Regulations 2015 (NVZ). These regulations impose limits on nitrogen application in designated Nitrate Vulnerable Zones (NVZs). The EA employs a risk-based monitoring strategy, inspecting 5% of derogated farms annually. Between January 2022 and September 2024, 4,353 EA inspections were carried out, with a compliance rate of 57% (2,500 compliant, 1,853 non-compliant). A total of 11,322 actions were reported under these regulations, with 66% of actions rectified. Enforcement actions include advice, cautions, and prosecution, with rectification rates averaging 66%. However, the exclusion of remote sensing data from official compliance statistics and challenges in targeting inspections due to data sharing issues remain a challenge.

These regulations are more effective in areas with intensive livestock and arable farming, where targeted inspections and enforcement have improved nutrient management practices. However, the mapping highlights that smaller farms are less systematically monitored, which may limit the overall environmental benefit and suggests a need for more comprehensive coverage.

Water Resources (Control of Pollution) (Silage, Slurry and Agricultural Fuel Oil) (England) Regulations 2010 (SSAFO). SSAFO regulations set out requirements for the storage of silage, slurry, and fuel oil. The EA adopts a risk-based monitoring approach, with routine site visits every two to four years. Between January 2022 and September 2024, 4,804 slurry, 6,067 silage, and

[31] Environment Agency (November 2025) available at: https://www.gov.uk/government/publications/environment-agency-chief-regulators-report-2024-25/environment-agency-chief-regulators-report-2024-25

6,789 oil inspections were conducted, with compliance rates of 72% for slurry and silage, and 87% for oil. A total of 11,283 actions were reported, with 66% of actions rectified. Enforcement is primarily advisory, with formal cautions and prosecutions reserved for more serious breaches. The system is generally effective, but the reporting of compliance at the store rather than farm level complicates the assessment of overall effectiveness.

SSAFO regulations have driven improvements in storage practices for silage, slurry, and fuel oil, especially on larger, higher-risk farms. Despite this, the mapping reveals that compliance reporting at the store rather than farm level can obscure persistent risks on smaller or less frequently inspected holdings, indicating an area for further regulatory scrutiny.

Hazardous Waste (England and Wales) Regulations 2005. These regulations govern the movement and disposal of hazardous waste. The EA leads on monitoring, using a risk-based approach with site visits. Between January 2022 and September 2024, 9,176 farms were inspected across all regulations, but specific compliance data for hazardous waste is limited. A total of 531 actions were recorded (regulation unspecified, regarding waste), with 74% of actions rectified. Enforcement actions include advice, cautions, and prosecution. While these regulations address acute risks associated with hazardous waste, the mapping shows that coverage is strongest for larger or previously non-compliant farms. Limited data for smaller holdings and the absence of regulation-specific compliance figures suggest that further investigation is needed to ensure all farm types are adequately protected. The lack of regulation-specific compliance data constrains a more granular assessment.

Plant Protection Products (Sustainable Use) Regulations 2012. This regulation sets standards for the safe use, storage, and disposal of pesticides. The EA and HSE share monitoring responsibilities, employing risk-based site visits and, where appropriate, remote monitoring. Between January 2022 and September 2024, 262 actions were reported under these regulations, with 66% rectified. Enforcement includes advice, improvement notices, and prosecution. While compliance is generally good among professional users, gaps remain in the monitoring of small-scale and non-professional users.

The mapping demonstrates that professional users and larger farms are generally well covered by these regulations, with effective enforcement of safe pesticide use and storage. However, gaps remain in the monitoring of small-scale and non-professional users, where risks to both the environment and human health may persist.

The Dairy Products (Hygiene) Regulations 1995. These regulations establish hygiene standards for milk and dairy products. Monitoring is primarily the responsibility of local authorities, with the EA playing a supporting role. There is limited data on compliance and enforcement activities, reflecting the decentralised nature of monitoring and the focus on public health outcomes. A total of 531 actions were recorded (regulation unspecified, regarding waste), with 74% rectified. Enforcement actions include inspections, warnings, and penalties, but the absence of systematic compliance data limits the assessment of effectiveness.

These regulations are more effective in larger dairy operations, where local authority oversight and periodic inspections have maintained high hygiene standards. Smaller producers, however, may not be subject to the same level of scrutiny, and the lack of systematic compliance data points to a potential gap in regulatory effectiveness.

The Groundwater (England and Wales) Regulations 2009. The Groundwater Regulations aim to prevent pollution of groundwater resources. The EA employs a risk-based monitoring approach, with site visits prioritised for high-risk holdings. Between January 2022 and September 2024, 36 actions were recorded (regulation unspecified, regarding fertiliser store - 'manufactured'), with a rectification rate of 53%. Enforcement includes advice, cautions, and prosecution. The limited volume of regulation-specific data constrains a more detailed evaluation. The mapping suggests that these regulations are more effective for high-risk activities on larger farms, particularly where groundwater protection is a priority. However, limited enforcement data and lower coverage of small-scale operations indicate that further scrutiny may be needed to address residual risks.

Heather and Grass Burning Regulations 2007. This regulation controls the burning of heather and grass to prevent environmental harm. NE and the RPA share monitoring responsibilities, with an investigative, complaint-led approach. In 2023, the RPA recorded 786 referrals under GAEC 6, with 0% failure to comply. Enforcement actions include written warnings and payment reductions. The system is more effective at resolving minor breaches, but the reliance on complaints and the absence of routine monitoring limit its reach. These regulations can be effective at controlling burning practices in sensitive upland habitats, particularly where enforcement is triggered by complaints or referrals. Nonetheless, the reliance on reactive monitoring means that some high-risk activities may go undetected, especially on less intensively managed land.

Management of Hedgerows (England) Regulations 2024. This regulation protects hedgerows on agricultural land. The RPA operates a referral-based, desk review and site visit regime. In 2024, 60 holdings were selected for a visit from 126 referrals, with 78 breaches identified. Enforcement actions include advisories, warnings, and payment reductions. The approach is effective for targeted cases, but the absence of routine monitoring and limited data on overall compliance are notable constraints. The mapping shows that these regulations are effective in protecting hedgerows on larger and more intensively managed farms, where referrals and inspections are more common. However, smaller holdings and landscape features outside the main regulatory focus may be less well protected, suggesting a need for more proactive monitoring.

Transport of Animals (Cleansing and Disinfection) (England) (No.3) Order 2003. This regulation requires the cleansing and disinfection of animal transport vehicles. Local authorities are responsible for monitoring and enforcement, but there is no routine farm-level compliance regime. Enforcement actions include inspections, warnings, and penalties, but the lack of systematic compliance data precludes a more detailed assessment. While the regulation is

relevant to disease prevention across all farm types, the lack of systematic compliance data, particularly for smaller or less commercial operations, highlights a potential gap in biosecurity enforcement.

Sludge (Use in Agriculture) (Amendment) Regulations 1990. The Sludge Regulations control the use of sewage sludge on agricultural land. The EA employs a risk-based monitoring approach, with site visits prioritised for high-risk holdings. Between January 2022 and September 2024, 2,644 actions were reported under these regulations, with 66% rectified. Enforcement includes advice, cautions, and prosecution. The absence of a dedicated compliance database for sludge use limits the granularity of the assessment. The mapping indicates that these regulations are most effective for larger farms using sewage sludge, where risk-based inspections are more frequent. However, the absence of a dedicated compliance database and limited oversight of smaller users suggest that further scrutiny may be warranted to ensure consistent environmental protection.

5.3.3 Synthesis

Across the regulators, strategies for inspections focus on high-risk holdings and responding to referrals or complaints, rather than conducting universal, routine inspections. Of the two regulators which noted a risk-based proactive approach, only the EA shared a brief for how they target premises for inspections. The following narrative relates to the EAs targeted operations which are focused on water quality regulations.

Resources (which are often limited) are directed to geographic areas or farm types (such as dairy and livestock farms) which are identified as most at risk for high-impact events because of non-compliance. The heightened risk may be due to their farming activities, the sensitivity of the water catchment or the protected status of surrounding land. Specifically, the EA uses a risk-based scoring system to select which holdings to inspect which takes into consideration a waterbody score which considers any priority protected areas, the ecological status of the waterbody and any current agricultural pollution. This is combined with an agricultural score which looks at the activity of the holding and its history to assess whether it is above a threshold and considered ‘high-risk’.

This risk categorisation aligns well with the findings from this study in section 3.1.2 which notes that nutrient and waste spreading activities show a moderate to high risk of impacting on the environment.

Whilst the EAs approach to targeting does include arable and other farm types on a case by case basis it focuses on livestock farming operations as these are most relevant to the regulations covered by this regulator (e.g. Nitrate Pollution Prevention Regulations 2015 (NVZ) and Water Resources (Control of Pollution) (Silage, Slurry and Agricultural Fuel Oil) (England) Regulations 2010 (SSAFO)). The map (Figure 21) below shows that the EA appear to inspect holdings across England with each of the EA’s areas receiving numerous inspections but with concentrated efforts in areas with particularly high-risk of pollution events. This study would conclude that the

EAs approach to targeting high risk holdings for inspections is in line with this study's regional level findings and as such is an appropriate approach.

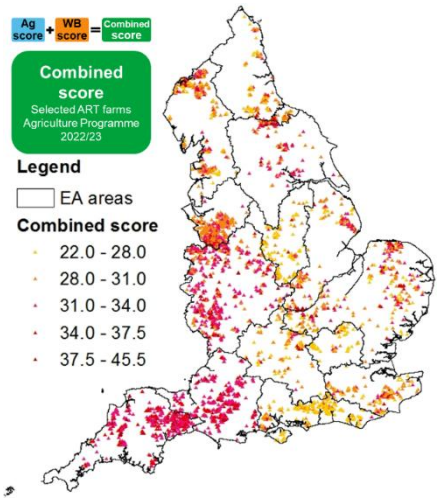
A comparison of the map of farms selected for inspection by EA agriculture regulatory taskforce officers in 2022/23 (Figure 21) against the maps produced by this study (Figure 22 to Figure 27 below) shows the baseline impact of farming activities by farm type, the geographic regions match for the dairy, specialist poultry and lowland grazing livestock sectors. Other high impact areas were identified in the South West, West Midlands and North West which are well covered by the EAs regime.

There is a mixed picture in terms of alignment for the mixed farming sector with some areas matching the impact identified by this study and the EAs inspection targeted areas - such as the South West. It does not match other areas such as the North East. In this case however, the risk level of each premises to each regulation under the EA will vary considerably depending on the makeup of the 'mixed' enterprise.

This study identifies the Less Favourable Area (LFA) grazing livestock sector as relatively low risk to the environment, particularly in terms of water quality (section 3.2.1, Table 3). This is reflected in the EAs assessment as there are less holdings identified in the North East which is where this study identified a larger proportion of LFA grazing livestock holdings.

The EAs map shows lower coverage of areas such as Yorkshire, the Humber and the East Midlands which this study identifies as at high risk from farming activities associated with cereals and specialist pig farming. The lower coverage by the EA likely reflects the lower risks associated with cereals farming for the regulations covered by the EAs regime. They also reflect the low level of specialist pig farms across the country, and it is likely that the EAs regime in these areas does include these higher risk farms. The data provided by the EA does not show the farm types of holdings inspected therefore full conclusions cannot be drawn on their coverage of certain farm types.

Figure 21 EAs map of all farms selected for visiting by ART officers 2022/23



Source (DS_C014 EA Appendix E ART_2022_23_Targeting (2))

Note: The darker the colour the higher the risk identified in the combined score.

Figure 22 Map produced by this study showing areas at highest risk of impact from Grazing Livestock (lowland) farming

Source (Annex 9, Baseline risks of impact)

Note: The darker the colour the higher the risk identified.

Figure 23 Map produced by this study showing areas at highest risk of impact from Mixed farming

Source (Annex 9, Baseline risks of impact)

Note: The darker the colour the higher the risk identified.

Figure 24 Map produced by this study showing areas at highest risk of impact from Specialist Poultry farming

Source (Annex 9, Baseline risks of impact)

Note: The darker the colour the higher the risk identified.

Figure 25 Map produced by this study showing areas at highest risk of impact from Dairy farming

Source (Annex 9, Baseline risks of impact)

Note: The darker the colour the higher the risk identified.

Figure 26 Map produced by this study showing areas at highest risk of impact from Cereals farming

Source (Annex 9, Baseline risks of impact)

Note: The darker the colour the higher the risk identified.

Figure 26 Map produced by this study showing areas at highest risk of impact from Specialist Pigs farming

Source (Annex 9, Baseline risks of impact)

Note: The darker the colour the higher the risk identified.

Figure 27 Map produced by this study showing areas at highest risk of impact from Grazing Livestock (LFA) farming

Source (Annex 9, Baseline risks of impact)

Note: The darker the colour the higher the risk identified.

However, the approach of targeting high-risk holdings can create a gap in monitoring and enforcement with a reliance on complaints and identification of incidents for measuring compliance in other areas classed as lower risk. Further study would be needed to gain an understanding of whether the EA could be conducting more inspections of mixed farming holdings for example, in line with the baseline risk findings for water quality in section 3.

For other regulators identifying and being able to act to rectify non-compliances relies solely on whether a complaint is received. The data collated for this study does not differentiate between inspections in response to a complaint and those that were part of a risk-based approach. It is therefore difficult to draw conclusions from this data regarding responsiveness to complaints.

The data collation exercise highlighted potential evidence gaps around compliance and a lack of easily accessible data. There was good data quality for only 17 regulations of the 70 analysed as part of this analysis. No data was received or regulator easily determined for 30 out of the 70 regulations. An additional 10 regulations had an identified regulator (identified through either documentation received from regulators or through the mapping exercise undertaken in Task B) but the team received no data on monitoring or enforcement activities. Further research, including interviews with the key regulators and desk-based searches may help to identify why there are data gaps for these regulations and whether there are monitoring and enforcement regimes in place.

This study identified two main reasons for the data gaps seen in the analysis. Firstly, some of the regulations included in the study are overarching regulations such as the Agriculture Act 2020 which is used to inform and guide other more direct regulations and agricultural schemes rather than provide regulatory rules of its own. Therefore, while adherence to this by those with authority to create and amend regulations should be monitored, it is not possible or appropriate to monitor compliance with this at a holding level.

Secondly, all data analysed for this task was supplied by regulators. Not all regulators contacted by the OEP supplied data to the study. It is possible that some regulators do not hold compliance data in a readily available format, possibly suggesting that in some cases the data is not readily synthesised by some regulators. Further study and direct discussion with the regulators would be needed to confirm this.

Therefore, the data received may not represent all the data that exists on monitoring and enforcement of regulations. The data likely represents that which is readily available to the regulator (see section 2.3 for further detail of the methodology used to collate the data for this task.) There is potential that some of the data gaps identified in the study point to areas where monitoring and enforcement efforts are not in place and compliance is unmonitored. Further research would help to identify these gaps.

A further 13 regulations (out of the 70) were classified as having limited levels of data available based on the data received from regulators to support the mapping. In these cases, data around compliance or the approach taken to monitor and enforce the regulation were not available.

There are clear data gaps in monitoring and enforcement data which restrict the ability to concretely conclude on the compliance with regulations across the UK and assess the effectiveness of each regulation.

Data around rectification rates is limited. Where available, rectification rates are generally high, but persistent breaches remain in some areas. The EA was the only regulator to provide detailed quantitative data on the rate of rectification, shown through the difference between the number of actions issued and the number of outcomes achieved (when a farmer has sufficiently responded to the action issued). During the 2022-2024 period the average rectification rate for EA regulations was 66%. Some regulations, notably Hazardous Waste (England and Wales) Regulations 2005 and The Dairy Products (Hygiene) Regulations 1995, achieve up to a 74% rectification rate. Whilst other regulations such as The Groundwater (England and Wales) Regulations 2009 achieved a much lower rectification rate of 53%[32]. Therefore, the data shows that the regulator regime is ineffective in approximately one third of cases where non-compliances are found and some areas have lower rectification than others.

Other regulators gave qualitative assessments of their rectification rates making it more difficult to assess how effective their regimes are in practice. For NE, local authorities and HSE, the use of warning letters, verbal warnings and improvements notices is reportedly (in the opinion of regulators) sufficient to rectify non-compliance.

Collating further data around rectification rates would be important for gaining a deeper understanding of the effectiveness of regulators monitoring and enforcement regimes.

New enforcement and compliance techniques such as remote sensing show positive early indications of effectiveness for detecting specific non-compliances. Remote sensing was introduced by the EA in 2024 to support their monitoring and enforcement regime. The tool is used across multiple regulations which focus on water quality and reducing the likelihood of pollution incidents. 2024 data from the EA shows that remote sensing has increased the identification of soil erosion and open manure heaps by 15-20%. This identification then helps the EA to allocate resources to inspect the holdings suspected of non-compliance.

These tools and techniques may be able to assist with monitoring of other regulations such as those for habitat or wildlife protection. Uptake of these opportunities may assist in utilising limited resources and identifying further non-compliances.

The regulatory landscape for farming is complex due to overlap and duplication between regulations and their requirements. Many of the shortlisted regulations (see section 5.3 for full list of shortlisted regulations) share overlapping environmental objectives, particularly in areas

[32] Compliance rate calculated using the mapping of fertiliser storage farming activities to this regulation in Task B and analysis of EA enforcement actions relating to fertiliser storage.

such as pollution control, soils, waste management, and the protection of water resources. Examples of the overlaps and duplication are showcased below:

In the domain of water pollution and nutrient management, four separate regulations aim to reduce nutrient and waste runoff into water bodies: the Nitrate Pollution Prevention Regulations 2015 (NVZ), the Reduction and Prevention of Agricultural Diffuse Pollution Regulations 2018 (FRfW), the Water Resources (Control of Pollution) Regulations 2010 (SSAFO), and the Groundwater Regulations 2009. NVZ focuses on nitrate leaching from fertilizers and manure, FRfW enforces buffer zones and soil management, SSAFO governs the storage of slurry and silage, and the Groundwater Regulations protect aquifers from pollutants like nitrates and pesticides. This overlap leads to duplication, as farmers in NVZ zones must adhere to manure storage rules that are also covered under SSAFO and FRfW, resulting in multiple layers of compliance for similar pollution risks.

Similarly, hazardous substances and waste are regulated by three regulations: the Hazardous Waste Regulations 2005, Environmental Permitting Regulations 2010, and Groundwater Regulations 2009; all of which address the handling and disposal of hazardous materials. A farmer storing pesticides or fuel oil may need to comply with all three, despite the singular environmental risk of soil or water contamination.

In land management and burning, both the Heather and Grass Burning Regulations 2007 and FRfW Regulations 2018 aim to prevent erosion and pollution, requiring farmers to navigate seasonal burning restrictions alongside soil protection mandates.

Hygiene and waste from livestock are governed by the Dairy Products (Hygiene) Regulations 1995, the Transport of Animals (Cleansing and Disinfection) Order 2003, and SSAFO Regulations 2010, each targeting disease and pollution control through different aspects of animal farming.

Lastly, pesticide use and water protection are regulated by the Plant Protection Products (Sustainable Use) Regulations 2012, Groundwater Regulations 2009, and FRfW Regulations 2018, all of which aim to prevent environmental harm from pesticide application. This regulatory overlap means that farmers often face the challenge of interpreting and complying with multiple sets of rules for a single activity, such as storing slurry or spraying pesticides, even though the environmental goals are largely aligned.

The duplication and overlap between regulations create a complex set of rules for land managers to navigate and adhere to. A rationalisation and simplification (removing overlap and streamlining) of the regulations could be beneficial for encouraging compliance. A system where monitoring and enforcement can be done through one inspection rather than multiple by different regulators would allow a better use of resources and possibly better coverage of high-risk and reported issues.

Recent changes to farming schemes and their requirements may have weakened monitoring and enforcement due to the removal of the cross-compliance mechanism and

related inspections. Cross-compliance delivered by the RPA was a key monitoring and enforcement mechanism across several regulations, including those regulating high-impact farming activities such as Reduction and Prevention of Agricultural Diffuse Pollution (England) Regulations 2018 (FRfW), which regulates the causes of agricultural diffuse pollution in watercourses.

The cross-compliance mechanism was introduced alongside the basic payment scheme (BPS), a key pillar in the European Union's Common Agriculture Policy (CAP). The mechanism aimed to ensure that holdings receiving BPS funding were compliant with a core set of regulations. Under the mechanism the RPA had a reactive inspection regime which assessed a range of 'Good Agricultural and Environmental Conditions' and 'Statutory Management Requirements' which covered a range of regulations. Where these were not met, the RPA could utilise a suite of enforcement actions including advisories, warning letters and reductions in agricultural payments on a scale from 1%-15% reduction based on severity of the non-compliance. This risk of reduced agricultural payments was a strong motivator for promoting compliance with the regulations and was unique to the cross-compliance mechanism, although the audit level was low.

The UKs departure from the EU in 2020 started the move away from BPS and CAP. With BPS ending in December 2023 (replaced by delinked payments), cross-compliance also ended. Cross-compliance has not been included as part of the new ELMs scheme requirements.

Currently, the RPA post on gov.uk[33] states that

> *"From 1 January 2024 regulations continue to protect the environment, and animal health and welfare... Compliance is monitored by the existing statutory bodies".*

This likely means that where there are other regulators such as the EA or NE who are responsible for the regulation that was included in cross-compliance, they are now solely responsible for monitoring and enforcing. Where regulations appear to be solely under RPAs responsibility, it is unclear how these are being monitored and enforced. In both of those cases, the data mapping shows that the removal of the cross-compliance potentially leaves a large gap in the monitoring and enforcement of core farming regulations.

The mapping showed six regulations listed as solely regulated by the RPA, it is now unclear how these regulations are being monitored and enforced. Additionally, it showed that 12 other regulations were previously covered under cross-compliance and are now under the sole responsibility of NE, the EA, HSE or local authorities. Whilst many of these regulators have provided data for 2024 showing monitoring and enforcement efforts for these regulations, it is

[33] Rural Payments Agency (2024) Cross Compliance Guidance. Available at: https://www.gov.uk/guidance/cross-compliance

unclear how the regulators have adapted to this rebalancing in responsibility. It would be beneficial to have more scrutiny applied to this area of monitoring and enforcement as it is likely that the discontinuation of the cross-compliance mechanism has left a large gap in enforcement of regulations.

There is evidence that under previous mechanisms there was cross-over in the remit of regulators. However, collaboration between regulators is unclear, indicating an area for further study. There were seven regulations identified where data on compliance and enforcement were received from two regulators.

For the EA and RPA these were:

- Reduction and Prevention of Agricultural Diffuse Pollution (England) Regulations 2018 (FRfW);
- Environmental Permitting Regulations (England and Wales) 2016; and
- Water Resources Act 199.

For HSE and RPA these were:

- Food and Environment Protection Act 1985; and
- Plant Protection Products Regulations 2011.

For NE and RPA these were:

- Environmental Impact Assessment (Agriculture) (England) Regulations 2006; and
- Wildlife and Countryside Act 1981.

This finding demonstrates the cross-over between the RPAs historic cross-compliance regime and the remit of other regulators. Whilst the RPA has focused their monitoring and enforcement activity on specific actions (classed as SMR and GAEC under cross compliance) the other regulators monitoring and enforcement activity is likely to be looking at a larger set of actions, giving a more comprehensive view of the compliance for each regulation.

It is unclear from the data received whether and how regulators worked together (whilst cross compliance was in force) to monitor and enforce the regulations. This overlap adds to the complex landscape of the regulations for farmers.

The findings from this research broadly support the recommendations of the Corry Review[34]. In 2025 an independent evaluation commissioned by the Secretary of State, titled "*Delivering economic growth and nature recovery: An independent review of Defra's regulatory*

[34] Defra (2025) Delivering economic growth and nature recovery: an independent review of Defra's regulatory landscape. Available at: https://www.gov.uk/government/publications/delivering-economic-growth-and-nature-recovery-an-independent-review-of-defras-regulatory-landscape

landscape" also known as the Corry review, was published. The Corry report outlined 29 recommendations pertaining to regulations and Defra oversight, of which eight are identified as aligning with the purpose of this research.

The study supported a more streamlined set of regulations, and suite of responsibilities per regulator, as being beneficial, as the remit and role of each regulator is not always clear. Ensuring regulations are clearly and explicitly linked to statutory targets such as the EIP would improve clarity, as would reducing incidences of regulatory overlap and duplication. Efforts should be made to address gaps in data availability through improved monitoring, which would support enforcement. This study supported harmonising enforcement approaches and enabling proportionate penalties. The relevant Corry Review recommendations are outlined in the Table 6 below:

Table 6 Analysis of study findings against the Corry Review recommendations

No.	Corry Review recommendation	How the recommendation relates to the findings of this study
1	Introduce and publish a refreshed set of outcomes for regulators, linked to the Environmental Improvement Plan, with a clear accountability framework involving measurable outcomes that are monitored regularly by the department and reported on to Ministers and the public.	This study would agree that the regulations and actions of regulators could be more closely linked to the EIP targets.
2	Publish new Strategic Policy Statements for all regulators, starting with the Environment Agency (EA) and Natural England (NE), with the aim of restating the Government's priorities and mandating regulators to use constrained discretion to deliver the desired outcomes, taking account of the place-based dynamics, within the law. These statements should be consistent across all regulators to avoid the current situation where different instructions create confusion and inefficiency. Regulators have indicated that the current lack of uniformity in guidance is counterproductive.	This study would agree that the remit and role of each regulator is not always clear, and policy statements could support increasing clarity.
4	Consolidate the statutory duties, principles and codes of Defra regulators to a core set, reflecting the Government's priorities and helping to provide discretion, e.g. a duty to deliver on/consider climate change/net zero. This will address the increase in regulator-specific and regulator-generic legal obligations and resulting 'regulatory overload' which has emerged over time, resulting in confusion for those who are regulated whilst also weakening accountability. Further work is needed here to scope the legal obligations and to ensure consistency with any wider approaches. Updated duties will need to be consistent with refreshed outcomes and strategic policy statements.	This study would agree that a core consolidated set of regulations around the core environmental impacted states would be beneficial. Greater accountability for regulators regarding their statutory duties is needed, as is clarity as to how regulations are linked to statutory targets and outcomes.
12	Defra should swiftly develop plans to reform slurry application and storage to help address diffuse water pollution from agricultural sources. This is likely to involve changing the Farming Rules for Water and wider regulations relating to slurry application and storage.	This study suggests that slurry application and storage are well controlled by the Farming Rules for Water regulations with a

	This should aim for a single set of regulations which farmers can understand and comply with.	control score of 3 for storage of slurry and a score of 2 for spreading of slurry).
14	The recommended programme of reform for specific regulations should also assess instances of overlap and duplication in the application of regulations, with the aim of streamlining priority areas, for example in the marine environment, where multiple regulators are involved in assessing the same applications for port infrastructure. Both the regulations and the regulatory practices need examining and streamlining.	This study would agree that change is needed to mitigate instances of duplication and overlap.
17	Regulators should commence more frequent risk-based monitoring, using real-time and digital approaches. Clear strategic plans should be produced by each regulator for how they are taking a risk-based approach to monitoring, as well as their approach to making their monitoring information more accessible to the public, using live, up-to-date, data to support holding businesses and regulators to account.	This study supports a shift towards more thorough monitoring and the use of digital technologies such as remote sensing.
18	Defra should review the entire approach to enforcement and sanctions for environmental regulation to bring as much consistency as possible in the approaches taken for different offences. This review should consider where changes to legislation might be needed and aim to create tougher penalties for deliberate non-compliance and persistent offenders, for example in the waste sector, with regulators able to issue speedy fines for minor offences without going through the Court system.	This study supports harmonising enforcement approaches and enabling proportionate penalties.
29	Defra should fast track the sharing of data across regulators and externally, making external commitments to do more. Understanding and interrogating the huge amount of existing data Defra already holds as an organisation should be a high priority in Defra's digital and data transformation strategy, with a much greater presumption on information sharing, and increasing the amount of timely (released as close to real-time as possible), sustained and useful (minimum level of aggregation) data made publicly available. This will build organisational efficiency and an economy of scale, whilst building trust in our regulatory landscape as 'citizen scientists' have increasing access to our data.	This study would support this recommendation as there is a need to fill data gaps around regulation monitoring and enforcement, and some regulators listed data sharing barriers as a limitation to their regimes.

6 Conclusions and recommendations

This section provides overall conclusions on the strengths and weaknesses of the current regulatory landscape for farming and environmental protection in England, drawing on the project's evidence and analysis. It also sets out targeted recommendations for future scrutiny and reform, based on identified environmental risks, implementation gaps, and the evolving policy context.

6.1 Baseline environmental risks: where are they greatest?

The starting point for this assessment is an understanding of where the greatest environmental risks from farming arise, and how these vary by region, farm type, environmental impacted state (EIS), receptor, and pollutant. Analysis indicates that baseline risks are not evenly distributed.

Cropping systems – particularly cereals and horticulture – consistently exhibit the most negative baseline impact scores at the farm level largely due to nutrient and waste spreading (e.g., spreading of treated sewage sludge and spreading of digestate), late harvesting, and intensive soil management. Intensive livestock systems (pigs, poultry, dairy) also present high risks, especially for air and water quality, due to emissions and manure management challenges.

Water and soil quality emerge as the most vulnerable environmental impacted states and receptors with waterbodies and soils as the most impacted receptors. Pollutant-specific analysis highlights nitrates, phosphorus, ammonia, and methane as the most environmentally impactful, closely linked to fertiliser use and livestock emissions.

Regional analysis (see 3.2.2) highlights the East Midlands, East of England, and South West as areas with the highest weighted baseline risks, reflecting the prevalence of intensive cropping and livestock systems. In contrast, regions with less agricultural land, such as the South East and North West, show lower risks.

6.2 Effectiveness of regulation in mitigating risks

The next consideration is the effectiveness of current regulations in mitigating these risks, and where residual risks remain after mitigation. From the analysis, the regulatory landscape is only partially effective and often uneven. Regulations targeting pesticides, herbicides, and plant health are among the most robust, with high coverage and control scores. This reflects the maturity and enforceability of these rules.

However, the picture is less positive for soil and water quality, especially in relation to nutrients. While these are generally well covered in regulatory scope, control measures for soil erosion, compaction, and structural integrity are notably weaker. Air quality pollutants (such as PM2.5, carbon monoxide) and diffuse pollutants (such as sediment) remain under-addressed, with lower regulatory control scores and greater variability.

A key finding is that while some risks are well mitigated, others – especially diffuse and cumulative impacts – remain insufficiently addressed, and regulatory effectiveness is not always aligned with the areas of greatest environmental risk.

6.3 Monitoring and enforcement regimes: Coverage and gaps

Effective regulation depends on robust monitoring and enforcement regimes. This study aimed to understand the monitoring regimes that are in place and their approach to enforcing regulations in England. The analysis found that enforcement is predominantly risk-based and reactive, focusing on high-risk holdings (risk defined by farm type, geography and history of compliance), and responding to complaints. Routine, universal inspections are rare.

The EA's risk-based inspection approach broadly aligns with the geographic and sectoral patterns of environmental risk identified in this study, particularly for dairy, poultry and lowland grazing livestock farms in high impact regions such as the South West, West Midlands and North West. However, there may be gaps in monitoring and enforcement around diffuse pollution, particularly those associated with cropping rather than livestock. Arable enterprises are typically classed as lower risk than intensive livestock enterprises meaning that diffuse pollution from these sites may not be mitigated by monitoring and enforcement regimes. Gaps in monitoring and enforcement remain where lower risk areas rely on complaints, mixed farming coverage is inconsistent, and the lack of farm type data in EA inspection records shared with the study team limited the ability to fully assess whether all high risk sectors, such as specialist pigs and cereals, are being adequately monitored.

Persistent non-compliance is a concern: for example, nearly half of farms inspected under "Farming Rules for Water" failed at least one requirement, and one-third of non-compliances are not rectified. Data gaps are significant, 30 out of 70 regulations examined had limited information on the responsible authority or monitoring and enforcement regimes.

Recent policy changes, such as the removal of cross-compliance, may have increased risks relating to potential gaps in monitoring and enforcement, especially for core environmental regulations. While remote sensing has improved detection of non-compliance (e.g., a 15–20% increase in detection of open manure heaps), it is not yet systematically integrated into compliance statistics.

6.4 Residual risks and regulatory priorities

Bringing together the evidence from the analysis of baseline risk, regulatory effectiveness, and enforcement, it is possible to identify where the greatest residual risks and gaps remain, and whether regulatory priorities are appropriately aligned. It should be noted that these conclusions are based on monitoring and enforcement data provided by responsible authorities only and may not represent all data available for monitoring and enforcement regimes.

Here it is found that diffuse pollution (nutrients, sediment, ammonia) remains a persistent risk, especially in regions with intensive cropping and livestock. Soil erosion, compaction, and

structural integrity are not well addressed by current regulations, with gaps in both coverage and enforcement. Air quality risks from open burning, stationary combustion, and manure management are insufficiently monitored and enforced, particularly for smaller and non-permitted holdings. Wildlife health and non-designated habitats are less systematically monitored and protected, with enforcement largely complaint driven. Across all risks, regulators appear to have less oversight on smaller and non-permitted holdings through monitoring and enforcement activities. Whilst this approach is often proportionate to the risks posed by the holdings it does present a gap.

The EA's risk-based targeting aligns well with the findings regarding base line risks within this study. The data from this study shows that high-risk areas for dairy and lowland grazing livestock in the South West, West Midlands, and North West have high coverage within the EAs inspection regime. However, further consideration could be given to how this approach could increase coverage of other farm types such as cereals to ensure the monitoring and enforcement regime covers the risks posed by diffuse pollution from these farming activities.

Overlap and duplication between regulations create complexity and may dilute enforcement efforts. The analysis shows that regulatory overlap is most pronounced for water quality, soil quality, and nutrient management. These environmental impacted states are subject to multiple, sometimes overlapping, regulations (including NVZs, FRfW, SSAFO, and Groundwater Regulations) meaning pollutants such as nitrates, phosphorus, and ammonia are covered by several instruments. This complexity is less evident for air quality and wildlife health, which are regulated by fewer, more targeted rules. Rationalisation efforts should therefore focus on water and soil quality, where the compliance burden and potential for confusion are greatest.

6.5 Recommendations for further scrutiny and reform

The evidence supports a range of recommendations that could inform regulatory reform (recommendation 1 to 4) as well as longer term implementation and compliance (recommendation 5 to 6). See Table 7 for further details. Defra and delivery bodies should:

1. Rationalise and clarify the regulatory framework

The report identifies persistent issues with regulatory overlap, duplication, and ambiguity in enforcement responsibility. Defra should lead a review to streamline existing regulations, remove unnecessary duplication, and ensure that each regulation has a clearly assigned enforcement body. All rules should be explicitly aligned with all EIP, including biodiversity targets and climate targets, and outcome indicators should be developed for all major regulatory areas to support transparent reporting and accountability.

2. Prioritise regulatory improvement and enforcement for mixed, low-input, and diversified farms in lowland and higher-risk regions

Analysis shows that these systems have significant evidence gaps and are less systematically overseen, particularly where baseline environmental risks are higher. Policymakers should

prioritise research to explore the evidence gaps to understand if whether, in aggregate, these farm types constitute a significant problem. Where found to be necessary, this could stimulate a strengthening of regulatory coverage and monitoring for these farm types and regions. No expansion of regulatory requirements is recommended for upland extensive grazing or LFA systems, as these consistently show the lowest baseline risks. In addition, the EA could review its risk-based approach to ensure sufficient coverage and enforcement of all farm types posing a risk to water quality.

3. **Improve data standardisation and transparency.**

Effective monitoring, reporting, and adaptive management are hampered by fragmented data systems and inconsistent reporting. Defra should coordinate the development of compatible and accessible data platforms that consolidate compliance and enforcement information from all relevant agencies. This will enable more robust tracking of compliance rates, environmental outcomes, and enforcement actions, and support evidence-based policy adjustments.

4. **Undertake proactive, not just reactive, compliance**

Current enforcement is largely reactive and complaint-driven, with higher scales of holdings considered a risk factor. Defra and regulators should shift towards a more proactive approach, using digital tools (such as remote sensing) and regular, risk-informed audits to identify non-compliance before environmental harm occurs. This will enable earlier intervention and more consistent enforcement.

5. **Strengthen guidance and communication for land managers**

Delivery bodies should develop and Defra should publish strengthened guidance for land managers alongside improving communication. Complex or overlapping requirements, such as those for hedgerow management or nutrient management, can create confusion and reduce compliance. Defra should invest in clearer, more accessible guidance and communication strategies, ensuring that land managers understand what is required and why, and have access to practical support for compliance. The benefits of coordination of monitoring across regulations would help farmers understand what they need to do to comply with all relevant regulations and save their time as well as that of the regulators. Common systems for data capture and share are key to this working in practice.

6. **Continue to support voluntary and incentive-based schemes to complement regulation.**

The report notes that direct enforcement is challenging for some issues, such as soil health and small-scale horticulture. Defra should continue to develop and promote voluntary schemes and financial incentives that encourage best practice and go beyond minimum regulatory standards, particularly in areas where regulatory levers are less effective.

Table 7 Summary Table: Key Conclusions and Recommendations for improving the regulatory landscape

Area	What works well	What needs improvement	Recommendation
Farm types/activities audited	Regulatory coverage and enforcement are strongest for arable and intensive livestock systems, particularly in lowland and high-risk regions.	Mixed, low-input, and diversified farms in lowland and high-risk regions show evidence gaps and less systematic oversight.	Prioritise regulatory improvement and monitoring for mixed, low-input, and diversified farms in lowland and high-risk regions (recommendation 1). No expansion of regulatory requirements is recommended for upland extensive grazing or LFA systems.
Regulatory mechanisms	Regulations are most effective where they are clear, specific, and outcome-linked (e.g. pesticides, NVZs, EPR).	Overlap and duplication between regulations, ambiguity in enforcement responsibility, and limited alignment with statutory targets are persistent issues.	Streamline and clarify regulations, assign clear enforcement responsibilities, and ensure all rules are explicitly aligned with statutory biodiversity and climate targets. Develop outcome indicators for all major regulatory areas (recommendations 2 and 3). Continue to support voluntary and incentive-based schemes to complement regulation (recommendation 7).
Monitoring/enforcement	Risk-based and targeted approaches are effective for high-risk sectors and permitted activities. Remote sensing is increasing detection in priority areas.	Monitoring and enforcement are reactive and complaint-driven for low-risk, small, and non-permitted holdings. Persistent non-compliance and limited follow-up are noted in some high-risk sectors.	Expand proactive, risk-informed, and integrated monitoring. Increase use of digital tools and remote sensing. Improve follow-up and rectification rates, especially for persistent non-compliance in high-risk sectors (recommendation 4). Aid compliance by providing clear and accessible guidance to land managers (recommendation 5)

Data and evidence	Data quality is highest for high-risk, payment-linked activities and permitted sites, and for statutory reporting.	Significant gaps exist for air quality, wildlife health, soil health, small farms, and non-designated habitats. Enforcement outcome data are often not regulation-specific or publicly available.	Develop unified, accessible data platforms. Improve transparency and public reporting. Prioritise filling evidence gaps for under-monitored sectors, especially for soil health, air quality, and non-designated habitats (recommendation 6).

6.6 Evidence gaps and next steps

The report acknowledges where the evidence base is weakest and sets out recommendations to increase confidence in future assessments (see the methodological considerations noted in Section 2):

- Small and non-permitted holdings: Compliance and enforcement data are sparse, making it difficult to assess risks and target interventions.
- Non-designated habitats and wildlife health: Monitoring is largely compliance-driven, with limited systematic data.
- Soil health and structure: Outcome indicators are still in development, and regulatory effectiveness is difficult to assess.
- Regulatory overlap and policy change impacts: The effectiveness of regulatory overlap and the impact of recent policy changes (e.g., post-cross-compliance landscape) require further scrutiny.

To address these gaps, the following actions are recommended:

- Conduct targeted audits and field studies in under-monitored sectors and regions.
- Improve data sharing and integration between regulators.
- Pilot new monitoring technologies (e.g., remote sensing) and evaluate their effectiveness.
- Engage with land managers and stakeholders to clarify regulatory requirements and identify barriers to compliance.
- Commission further research on the cumulative impacts of low-intensity and mixed farming systems, and on the effectiveness of voluntary schemes.

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Annex 2 Glossary

Area on farm

As applied in this project, a defined spatial unit within the farm where activities occur or environmental processes take place. Examples include fields, yards, buffer zones, watercourses, or storage areas.

Baseline risk of impact (or 'baseline risk')

As applied in this project, the risk of impact from a farming activity on the natural environment in the absence of regulatory compliance or the implementation of mitigation measures on farms. Baseline risk assumes minimal mitigating actions or rules being implemented on farm.

Best available techniques (BAT)

The available techniques which are best for preventing or minimising emissions and impacts on the environment, as defined in BAT reference documents (BREF) published by the European Commission. Environmental permits in the UK, including for intensive farming, require that BAT or appropriate alternative techniques are used for permitted activities.

Biodiversity

As applied in this project, the variety of life forms within an ecosystem, including species diversity, genetic diversity, and ecosystem diversity, which contribute to the stability and resilience of the environment.

Biodiversity net gain (BNG)

A statutory approach to development in England that requires habitats for wildlife to be left in a measurably better state than they were before the development. BNG is mandatory under Schedule 7A of the Town and Country Planning Act 1990, as inserted by the Environment Act 2021.

Basic Payment Scheme (BPS)

Historic rural payment scheme administered by the RPA until 2023. The scheme provided direct payment to eligible farmers under CAP. The scheme was replaced by delinked payments from 2024 until 2027 for previous BPS recipients.

Certainty score

As applied in this project, a measure of confidence or uncertainty in the judgement provided by the scorer for each impact or mitigation effect.

Climate change risk

As applied in this project, the contribution of the activity or impact to climate change (e.g., greenhouse gas emissions), or vulnerability of the farm or ecosystem to climate-related impacts such as drought, flooding, or temperature rise.

Consequence

As applied in this project, the outcome or impact resulting from the exposure of a receptor to a pollutant or pressure. It can vary in severity, spatial extent and duration, such as eutrophication, biodiversity loss or soil degradation.

Common Agricultural Policy (CAP)

The European Union's overarching policy framework for agriculture, rural development and environmental management. CAP included the BPS and its rules underpinned cross-compliance requirements until the EU Exit. Under the Agriculture Act 2020, a new farm support policy is being rolled out in England to replace previous support under CAP.

Cross compliance

Rules that farmers had to follow to receive full payments under CAP. Cross compliance linked direct payments such as BPS to compliance with statutory requirements and standards for land management. Cross compliance applied in England until CAP schemes ended in 2023.

Department for Environment, Food and Rural Affairs (Defra)

The UK ministerial department responsible for environmental protection, food production and standards, agriculture, fisheries and rural communities. Defra leads on implementing the Environment Act 2021, EIP and agricultural transition schemes and sponsors regulatory agencies including the EA and NE.

Ecosystem services

The benefits that humans obtain from ecosystems. Types of ecosystem services applied in this project are: provisioning (e.g., food, fibre), regulating (e.g., climate regulation, pollination), supporting (e.g., soil formation, biodiversity) and cultural (e.g., heritage landscapes, recreation, amenity).

Ecosystem services impacted

As applied in this project, specific ecosystem services that are negatively (or positively) affected by farming activities or their environmental consequences. For instance, water pollution can reduce water purification services. Types of ecosystem services used in this project are

Effect on human health

As applied in this project, any direct or indirect consequence of farm-derived pollutants or pressures on human health. This can include drinking water contamination, air pollution (e.g., ammonia, PM2.5), or zoonotic disease risk.

Environment Agency (EA)

An executive non-departmental public body sponsored by Defra. EA is the principal environmental regulator in England, responsible for environmental permitting, pollution control, water resources, flood risk management and enforcement under regimes such as Environmental Permitting Regulations and Farming Rules for Water.

Environmental Impact Assessment (EIA)

A statutory process under the Town and Country Planning (Environmental Impact Assessment) Regulations 2017. It ensures that projects likely to have substantial environmental effects are assessed before consent is granted. For agriculture, EIA applies to activities on uncultivated or semi-natural land under separate EIA (Agriculture) Regulations enforced by Natural England.

Environmental Improvement Plan (EIP)

The UK government's statutory plan under the Environment Act 2021 for improving the natural environment in England. The EIP sets out legally binding targets and delivery actions across air, water, biodiversity, waste and climate resilience.

Environmental impacted state (EIS)

The condition of an environmental component (such as air, soil or water) that can be altered by farming activities through exposure to pollutants or pressures, including poor water quality, reduced soil organic matter, or altered habitat structure. EIS used in this project are air quality, habitat quality, habitat quantity, plant health, soil quality and water quality.

Environmental pollutant

A specific chemical or biological substance released by farming that has the potential to degrade the environment. Common pollutants include nitrates, phosphates, ammonia, methane, or sediment.

Environmental pressure

A human-induced factor or farming activity that exerts stress on the environment. Examples include nutrient loading, pesticide use, soil compaction, and greenhouse gas emissions.

Environmental Land Management (ELM)

Schemes introduced by Defra to replace CAP in England, designed to pay farmers, foresters and land managers for delivering environmental climate goods and services. It operates under the Agriculture Act 2020 and supports EIP targets. Its three main components are the Sustainable Farming Incentive, Local Nature Recovery and Landscape Recovery.

Environmental Permitting Regulations (EPR)

The regulatory framework governing permits for activities that could pollute air, water or land in England and Wales. EPR implements requirements for installations, waste operations, water discharge and radioactive substances. Agricultural activities such as intensive pig and poultry farming require permits under EPR.

Farming activity

As used in this study, any land-based operation or practice involved in the cultivation of crops, rearing of livestock, or management of agricultural land, which alters the natural environment to produce food, fibre, fuel or other agricultural products.

Farming Rules for Water (FRfW)

Regulations introduced under the Reduction and Prevention of Agricultural Diffuse Pollution (England) Regulations 2018 and enforced by the EA. The rules aim to protect water quality by requiring farmers to manage nutrients, soils and organic manures responsibly.

Farm type

As used in this study, categories of farm holdings aligned to the 2014 Defra Farm Classification System. The system classifies a farm holding based on the relative contribution of its different enterprises to total standard output (SO). Each farm is grouped according to the enterprise (or group of enterprises) that generates the largest share of its total SO. This allows farms with similar production structures to be grouped consistently for statistical analysis, policy assessment, and comparison across the agricultural sector.

Good Agricultural and Environmental Conditions (GAEC)

Standards that farmers had to meet under cross-compliance rules linked to CAP payments. GAECs covered soil protection, water management, and habitat conservation. Examples include GAEC 1 (establishing buffer strips along watercourses) and GAEC 5 (maintaining soil cover). These standards ceased to apply in England after the end of CAP-linked payments.

Greenhouse gas (GHG)

Atmospheric gases that trap heat and contribute to climate change. Key agricultural GHGs include carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O). The Climate Change Act 2008 sets legally binding targets for reducing UK GHG emissions, and agriculture is a significant source of methane and nitrous oxide.

Health and Safety Executive (HSE)

The national regulator for workplace health and safety in Great Britain. HSE enforces health and safety law across all sectors, including agriculture, and provides guidance on managing risks such as machinery safety, chemical use, and livestock handling.

Herbicide

A type of pesticide formulated to kill or inhibit the growth of unwanted plants (weeds). Herbicides can be selective (targeting specific species) or non-selective. Their use in agriculture is regulated under pesticide legislation and subject to statutory management requirements.

Impact

As applied in this project, any significant direct or indirect effect that a farming or land management activity has on all or part of an EIS, such as air quality, water quality, or soil quality.

Impact magnitude (pre-mitigation)

As applied in this project, the estimated severity or extent of the environmental impact before any regulatory mitigation measures are applied.

Local Nature Recovery Strategy (LNRS)

A statutory spatial planning tool introduced by the Environment Act 2021. LNRSs identify priorities and opportunities for nature recovery at a local level and guide actions to improve biodiversity. They are prepared by responsible authorities and inform land-use decisions and funding under schemes such as Environmental Land Management.

Mitigation issues

Factors that affect how mitigation rules are applied or how effectively they achieve their intended outcomes under a given regulation. These factors can influence the extent to which the regulation provides coverage or control and may have a major, minor, or negligible impact.

Mitigation control

As applied in this project, the extent to which the impacts of farming activities on the natural environment are reduced, avoided, cancelled or compensated when farming regulations and wider legislation are universally complied with. Reflects whether mitigation measures lead to, have some impact on, have minimal impact on, or have no impact on reducing, avoiding, cancelling or compensating the environmental pressure/pollutant.

Mitigation coverage

As applied in this project, the extent to which farming activities and their baseline risks of impact on the natural environment are covered by farming regulations and wider legislation. Reflects whether the regulations and legislation consider the sources, areas and pathways (or geographical area) associated with each activity. Scores are defined as large, small, negligible, or no discernible coverage, depending on how comprehensively the regulations apply.

Mitigation effectiveness

As applied in this project, the degree to which a mitigation measure reduces the environmental pressure or pollutant. Consists of mitigation coverage, mitigation control and mitigation issues.

Natural England (NE)

A non-departmental public body sponsored by Defra. NE is responsible for conserving biodiversity, protecting Sites of Special Scientific Interest (SSSIs), and advising on agri-environment schemes. It also enforces Environmental Impact Assessment (Agriculture) Regulations.

Nitrate Vulnerable Zone (NVZ)

Designated areas where land drains into waters that are vulnerable to nitrate pollution from agricultural sources. NVZs are established under the Nitrates Directive (91/676/EEC) and implemented in England through the Nitrate Pollution Prevention Regulations 2015. Farmers in NVZs must comply with rules on storing and applying nitrogen fertilisers and organic manures to reduce water contamination.

Office for Environmental Protection (OEP)

An independent public body created under the Environment Act 2021. The OEP monitors and reports on government progress against environmental targets, investigates complaints about

public authorities failing to comply with environmental law, and can take enforcement action. It plays a key role in ensuring accountability for environmental governance post-EU Exit.

Office for Product Safety and Standards (OPSS)

A UK government regulator responsible for product safety and standards, including agricultural products and equipment. OPSS enforces compliance with safety legislation, provides guidance to businesses, and supports market surveillance to protect consumers and maintain fair trading.

Pathway

As applied in this project, the route or process through which a pollutant or pressure travels from its source to a receptor. Pathways can include overland flow, leaching through soil, air dispersion, or direct discharge. Types of pathways applied in this project are: hydrological (e.g., runoff, drainage), atmospheric (e.g., volatilisation, wind drift), biological (e.g., pest vectors, animal movement) and direct contact (e.g., livestock access to watercourses).

Particulate Matter (PM2.5 and PM10)

Airborne particles with diameters of 2.5 microns (PM2.5) and 10 microns (PM10). These particulates originate from sources such as combustion, soil dust, and agricultural activities. They are regulated under air quality standards because of their health impacts, including respiratory and cardiovascular disease. Monitoring and reduction of PM emissions are part of the UK's Clean Air Strategy.

Pollutant being mitigated

As applied in this project, the chemical or biological substance targeted for reduction through mitigation, e.g., nitrogen, phosphorus, sediment, methane, or pesticides.

Pesticide

Any substance or mixture intended to prevent, destroy, repel, or control pests, including insects, weeds, fungi, and rodents. Pesticides are regulated under UK pesticide legislation and subject to Statutory Management Requirements (e.g., SMR 10). Their use must comply with safety standards to protect human health and the environment.

Receptor

As applied in this project, the environmental or biological feature that receives and may be affected by a pollutant or pressure. Examples include water bodies, soil, air, biodiversity, crops, or human populations.

Regulation importance

As applied in this project, the relative significance of a rule in mitigating environmental risk, based on technical experts' judgement and supported by reviewed evidence where possible.

Regulations

Binding rules that are required of land managers through law, including primary and secondary legislation. As applied in this project, regulations aligned to farming activities are those legislative or policy instruments that govern specific farm practices or land uses with environmental implications.

Regulatory Enforcement Sanctions (RES)

A set of civil sanctions available to regulators under the Regulatory Enforcement and Sanctions Act 2008. RES includes fixed monetary penalties, variable monetary penalties, compliance notices, and restoration notices. These tools provide alternatives to prosecution for environmental and product safety breaches.

Silage, Slurry and Agricultural Fuel Oil (SSAFO)

Regulations governing the storage of silage, slurry, and fuel oil to prevent water pollution. SSAFO rules require farmers to construct and maintain storage facilities to specified standards and notify the Environment Agency before building new installations.

Site of Special Scientific Interest (SSSI)

Areas designated under the Wildlife and Countryside Act 1981 for their ecological, geological, or physiographical importance. SSSIs are protected by law, and activities that could damage their features require consent from Natural England. They form the foundation of nature conservation in England.

Source

As applied in this project, the origin of a pollutant or environmental pressure on the farm. This can be a farming activity, input, or land use (e.g., manure heap, pesticide application, livestock housing) that generates potential emissions or discharges.

Source-pathway-receptor (SPR)

As applied in this project, a structured framework adapted from Payraudeau and van der Werf (2005) and used to identify and assess baseline risks of impacts from farming activities. The process begins by identifying the source (the origin of potential pollutants or pressures), pathway (the route through which pollutants or pressures travel) and receptor (the environmental or biological feature that may be affected).

Water Framework Directive (WFD)

An EU directive (2000/60/EC) establishing a framework for protecting and improving water quality. In England, WFD objectives are implemented through river basin management plans and underpin measures to achieve “good ecological status” for surface waters and groundwater.

Annex 3 Technical categories used and assumptions

This annex provides categories, definitions and assumptions used in the mapping, scoring, and analysis activities for this project, which were not included in the main glossary.

A3.1 Farm type classifications

Farm classifications from the Defra Farm Business Survey were used to categorise farm holdings by type (see Table 8)

Table 8 Farm classifications from the Defra Farm Business Survey

Type	Main type	Particular type	Definition
Cereal	1 Specialist cereals	1510 Specialist cereals (other than rice), oilseeds and protein crops	Holdings on which cereals, combinable crops and set-aside account for more than two thirds of the total standard output (SO) and (pre-2007) where set-aside alone did not account for more than two thirds of the total SO. (Holdings where set-aside accounted for more than two thirds of total SO were classified as specialist set aside and were included in “other”.) Holdings on which arable crops (including field scale vegetables) account for more than two thirds of the total SO, excluding holdings classified as cereals; holdings on which a mixture of arable and horticultural crops account for more than two thirds of their total SO. Excluding holdings classified as horticulture and holdings on which arable crops account for more than one third of their total SO and no other grouping accounts for more than one third.
General cropping	2 General cropping	1610 Specialist root crops 1620 Cereals, oilseeds, protein crops and root crops combined 1630 Specialist field vegetables 1660 Various filed crops combined	Holdings on which arable crops (including field scale vegetables) account for more than two thirds of the total SO, excluding holdings classified as cereals; holdings on which a mixture of arable and horticultural crops account for more than two thirds of their total SO. Excluding holdings classified as

		6130 Field crops and vineyards combined 6140 Field crops and permanent crops combined 6150 Mixed cropping, mainly field crops	horticulture and holdings on which arable crops account for more than one third of their total SO and no other grouping accounts for more than one third.
Horticulture	3 Specialist fruit 4 Specialist glass 5 Specialist hardy 6 Other horticulture	3610 Specialist fruit (other than citrus, tropical fruit or nuts) 2110 Specialist vegetables indoor 2120 Specialist flowers and ornamentals indoor 2130 Mixed horticulture indoor specialist 2320 Specialist nurseries 2210 Specialist vegetables outdoor 2220 Specialist flowers and ornamentals outdoor 2230 Mixed horticulture outdoor specialist 2310 Specialist mushrooms 2330 Various horticulture 3540 Other vineyards 3800 Various permanent crops 6110 Horticulture and permanent crops combined 6120 Horticulture and field crops combined 6160 Other mixed cropping	Holdings on which fruit (including vine-yards), hardy nursery stock, glasshouse flowers and vegetables, market garden scale vegetables, outdoor bulbs and flowers, and mushrooms account for more than two thirds of their total SO.
Specialist Pigs	7 Specialist pigs	5110 Specialist pig rearing 5120 Specialist pig fattening 5130 Pigs rearing and fattening combined	Holdings on which pigs account for more than two thirds of their total SO.
Specialist Poultry	8 Specialist poultry	5210 Specialist layers 5220 Specialist poultry meat 5230 Layers and poultry meat combined	Holdings on which poultry account for more than two thirds of their total SO.
Dairy	9 Dairy - LFA 10 Dairy - lowland	4500 Specialist dairying 4500 Specialist dairying	Holdings on which dairy cows account for more than two thirds of their total SO.
LFA Grazing Livestock	11 Specialist sheep - SDA 12 Specialist beef - SDA	4810 Specialist sheep 4600 Specialist cattle rearing and fattening 4700 Cattle - dairy, rearing and fattening combined 4820 Sheep and cattle combined	Holdings on which cattle, sheep and other grazing livestock account for more than two thirds of their total SO except holdings classified as dairy. A holding is classified as a Less Favoured Area (LFA) holding if 50 per cent or more of its total

	13 Mixed grazing livestock - SDA 14 Various grazing livestock - DA	4830 Specialist goats 4840 Various grazing livestock 4600 Specialist cattle rearing and fattening 4700 Cattle - dairy, rearing and fattening combined 4810 Specialist sheep 4820 Sheep and cattle combined 4830 Specialist goats 4840 Various grazing livestock	area is in the LFA. Of holdings classified as LFA, those whose LFA land is wholly or mainly (50 per cent or more) in the Severely Disadvantaged Area (SDA) are classified as SDA; those whose LFA land is wholly or mainly (more than 50 per cent) in the Disadvantaged Area (DA) are classified as DA.
Lowland Grazing Livestock	15 Various grazing livestock - lowland	4600 Specialist cattle rearing and fattening 4700 Cattle - dairy, rearing and fattening combined 4810 Specialist sheep 4820 Sheep and cattle combined 4830 Specialist goats 4840 Various grazing livestock	Holdings on which cattle, sheep and other grazing livestock account for more than two thirds of their total SO except holdings classified as dairy. A holding is classified as lowland if less than 50 per cent of its total area is in the LFA.
Mixed	16 Cropping and dairying 17 Cropping, cattle and sheep 18 Cropping, pigs and poultry 19 Cropping and mixed livestock 20 Mixed livestock	8310 Field crops combined with dairying 8320 Dairying combined with field crops 8330 Field crops combined with non-dairy grazing livestock 8340 Non-dairy grazing livestock combined with field crops 8410 Field crops and granivores combined 8420 Permanent crops and grazing livestock combined 8440 Various mixed crops and livestock 5300 Various granivores combined 7310 Mixed livestock, mainly dairying 7320 Mixed livestock, mainly non dairying grazing livestock 7410 Mixed livestock; granivores and dairying combined 7420 Mixed livestock; granivores and non-dairying grazing livestock	Holdings for which none of the above categories accounts for more than 2/3 of total SO. This category includes mixed pigs and poultry farms as well as farms with a mixture of crops and livestock (where neither account for more than 2/3 of SOs).

Other	25 Non classifiable holdings	9000 Non classifiable holdings	Holdings that fit into none of the above categories. Non classifiable holdings are holdings consisting of fallow or buildings and other areas only, for which no SO coefficients are calculated.

Source: Defra (2023) Farm classification in the United Kingdom.

A3.2 Farming activities

Categories of farming activities used in the project are defined in Table 9.

Table 9 Farming activity categories and definitions

Farm Activity	Definition
Anaerobic digestion	A natural process where microorganisms break down organic waste, like food scraps or sewage, in the absence of oxygen, producing biogas (primarily methane) and digestate (a nitrogen-rich fertiliser).
Build boundary features (walls, stone banks and earth banks)	Boundary earthworks are large-scale linear features, like ditches and banks, used to delineate territories or mark significant boundaries around fields or the farm property.
Burning of crop residues	A practice often used to clear fields after harvest or to improve disease and pest control in certain crops.
Burning of grassland	Prescribed burns can be used to stimulate new growth, reduce litter, and control woody encroachment, while also offering benefits for certain plant species and some soil processes.
Burning of heather, rough grass, bracken, gorse or vaccinium	Normally used in upland areas and moorlands to control the listed species because they spread rapidly. It can help maintain different ages of vegetation which can help providing food and shelter for wildlife. It is therefore used to maintaining grouse shooting areas. It can also be used to reduce dead vegetation/fuel build up to reduce the intensity and spread of wildfires.

Clean and dirty water separation	The separation of clean water (uncontaminated rainwater) which has fallen on roofs, clean yards/tracks or land from dirty water. Dirty water includes manure, slurry, silage effluent, chemicals, fertilisers or other wastewater. Examples include collection of rainwater, diversion of clean yard water into soakaways, channelling of dirty water into a dirty water sump or physical barriers (e.g. a kerb) to prevent mixing of clean/dirty water.
Cleaning housing areas	Cleaning farm housing areas involves a multi-step process: removing debris, cleaning surfaces with detergent, pressure washing with hot water, and disinfecting. Waste materials produced include bedding materials and dirty water.
Cleaning milking parlour	Involves a multi-step process that includes pre-rinsing, washing, and sanitising. After each milking, a thorough clean is recommended, including rinsing with lukewarm water followed by a hot wash with detergent, and finally, a cold-water rinse. Weekly cleaning may involve using an acid cleaner to remove milkstone and hard water deposits, followed by disinfection.
Cleaning or washing waste	Cleaning and washing waste involve treating waste materials, like packaging or containers, to remove contaminants for reuse or recycling (this can include application to land). This can include washing, spraying, or coating the waste to make it suitable for its intended purpose.
Cleaning yards	Washing down concrete or other surfaces in farmyards. Waste materials produced include dirty water.
Composting (aerobic)	Decomposing organic matter in the presence of oxygen to produce compost.
Construction of farm buildings, tracks, yards and plant protection product loading areas.	Erecting structures for housing livestock, storing equipment, or other farm operations, therefore removing land from production or semi-natural habitat. This could be either within proximity to existing infrastructure, or a new area of development on a farm. Building new access roads and hard-standing areas on the farm, therefore removing land from production or semi-natural habitat. Creating and maintaining areas for loading and handling plant protection products (PPPs). PPPs are chemical or biological agents to control pests and weeds. This includes insecticides (for insects), fungicides (for fungi), herbicides and rodenticides (for rodents). These areas include

	infrastructure such as impermeable surfaces (spill-proof base), drainage control and waste handling systems. Building and maintaining systems to remove water from farmyards.
Controlled waste	Waste that is subject to regulations due to their potential impact on human health or the environment. This can include plastics, chemicals, oil/fuel, construction waste, slurry, and animal health related waste.
Cultivation around in-field trees	Tilling, ploughing or managing the soil around trees within fields.
Cultivation of organic soils	This refers to the tilling, ploughing, and preparation of soils with a high organic matter content (e.g., peatlands).
Cultivation of semi-natural habitat or uncultivated land	Preparing and planting on land that has not been intensively farmed.
Disposal of dead animals	Also known as fallen stock— this is how livestock carcasses are handled when animals die on a farm other than through slaughterhouses. It can include off-farm incineration of carcasses.
Disposal of plastic wrap	The recycling or disposal of plastic used for wrapping silage or other agricultural products.
Disposal of plant protection products	The safe and legal procedures for getting rid of unwanted or unusable plant protection products (PPPs), including their packaging, to prevent harm to human health and the environment. This includes both professional and non-professional use of PPPs.
Disposal of vet and medicine waste	Safely disposing of veterinary medicines and related waste, this may include incineration.
Domestic sewage treatment (from farm accommodations)	The management and treatment of wastewater (including human waste) generated from domestic sources on the farm. This wastewater typically includes toilet waste, kitchen wastewater, bathroom wastewater, and sometimes laundry water.
Early sown cereals and OSR	Planting cereal crops and oilseed rape earlier in the season.

Feeding of non-ruminant livestock	The nutritional management of animals with a single-compartment stomach, such as swine, poultry, and horses, focusing on providing them with the necessary nutrients for digestion, growth, performance, and overall health.
Feeding of ruminant livestock	The management and provision of food, primarily forage and other plant-based materials, to animals like cows, sheep, and goats that have a specialised digestive system called the rumen. This system allows them to break down and extract nutrients from fibrous plant matter through fermentation by microbes in the rumen.
Grass re-seeding	Planting new grass in a field to improve pasture quality or yield.
Growing late harvested crops (maize, root crops, vegetables)	Cultivating crops that are harvested later in the year.
Harvesting	Gathering mature crops from the field.
Heating intensive livestock housing	Using energy to maintain the temperature in buildings where animals are kept.
Hedgerow cutting	Trimming or cutting back hedgerows. This is important for maintaining field boundaries and keeping rights of way/roads clear. (Time of year should be considered).
Housing of Intensive poultry	The practice of keeping and managing large numbers of farm animals, such as chickens or ducks, in specially designed, enclosed structures.
Housing of non-ruminant livestock	Keeping animals like pigs, which do not have a rumen (have a single chambered stomach), in barns or other structures.
Housing of ruminant livestock	Keeping animals like cattle and sheep, which have a rumen (4 chambered stomach), in barns or other structures.
Impoundment of water	Creating a reservoir or pond to store water. This can be for irrigation, livestock watering, or other purposes.

Incorporation of ash into soil	The process of mixing ash (e.g., from burning biomass) into the soil to improve its physical and chemical properties.
Keeping of non-ruminant livestock outside (grazing)	The general practice of raising animals like pigs outside, which do not have a rumen (have a single chambered stomach). This includes lowland and highland grazed animals.
Keeping of ruminant livestock outside (grazing)	The general practice of raising animals like cattle and sheep outside, which have a rumen (4 chambered stomach). This includes lowland and highland grazed animals.
Keeping of poultry (free range)	The practice of raising poultry, such as chickens, ducks, or turkey, where the birds have regular access to outdoor areas, allowing them to roam freely for at least part of the day, in addition to being housed in shelters for protection and egg-laying.
Land drainage	The process of removing excess water from the soil surface or subsurface to improve the land's suitability for agriculture, construction, or general land use. This requires infrastructure such as ditches or underground pipes.
Large pest control (e.g. shooting, poison, traps)	Managing larger pests which pose a threat to livestock, crops or farm infrastructure. Examples include foxes, deer, rabbits, rats or badgers (insects are not included).
Late harvesting of crops	Harvesting crops later than the typical time. This can affect crop quality and soil conditions.
Late sown cereals	Planting cereal crops later in the season, which can influence yield and disease risk.
Maintaining public rights of way	Keeping footpaths and other public access routes across farmland in good condition.
Management of poultry litter	Handling and storing the manure and bedding material from poultry houses. Includes management in shed and post-clear out.
Management of wastewater	Handling and treating water that has been used and contaminated. This includes runoff from farmyards and water from cleaning processes. (Including direct unconsented discharges).
Milking	Extracting milk from dairy animals.

Minimum or zero till	These are soil cultivation methods which minimise or eliminate mechanical soil disturbance. Minimum till reduces the number of tillage operations, the depth and the area cultivated (such as narrow strips for seedlings) in comparison to traditional ploughing. While zero till involves planting crops directly into undisturbed soil.
Machinery use for transportation (on-farm)	The operation of vehicles and equipment, such as tractors, trailers, quad bikes, and utility vehicles, within the boundaries of a farm for the purpose of moving goods, livestock, feed, tools, or people as part of day-to-day agricultural activities.
Machinery use for transportation (off-farm)	The operation of farm vehicles and equipment, such as tractors with trailers, trucks, or utility vehicles, on public roads or outside the farm boundary for transporting agricultural goods, livestock, machinery, or inputs between farms, markets, suppliers, or processing facilities.
Modification of streams, rivers and ponds	Changing the course, banks, or flow of streams, including clearing of boundary features and debris as done in ditch clearing practices. Changing the course, banks, or flow of rivers, including channel re-alignment and bank enhancements. Altering the size, shape, or structure of ponds. (Does not include removal.)
Movement of animals (within farm)	Moving livestock from one location to another on the farm, either on foot or transported by vehicle. (Vehicular impacts do not need to be considered here as there are included within 'Machinery use for transportation (on farm)'.)
Open access land	Management actions of land owners on land where the public has a right to roam, including all open access areas, for example open hill land, marshland or forest.
Outwintering of stock	Keeping livestock outdoors during the winter months, either on grass or other crop fields.
Plant protection products application and handling	The use of chemical or biological agents to control pests and weeds. This includes insecticides (for insects), fungicides (for fungi), herbicides and rodenticides (for rodents).

Planting non-native trees	Introducing tree species that are not native to the area. Includes hedgerows, shelter belts and small forested areas, large forests are covered within 'planting of monoculture crops'.
Planting of monoculture crops	Growing a single crop species over a large area, including cereal crops, grass and forestry. This does not include more diverse in-field practices such as strip tillage or agroforestry.
Planting native trees	Establishing a mix of native trees, including in forestry, agroforestry, farm woodland areas, hedgerows or other purposes at a field level or within a farm boundary.
Ploughing	A traditional tillage method that involves turning over the top layer of soil with a plough, which is usually towed behind a tractor.
Protection of historic environment or features	Taking steps to preserve archaeological sites, historic buildings, or other heritage features on the farm. Including removal of shrub/grass, fencing or pathway maintenance.
Removal of earth and stone boundaries	Taking out walls, banks, or other boundary features made of earth or stone which have be a longstanding habitat feature.
Removal of hedgerows	Taking out hedgerows (including rooting infrastructure) which were a longstanding habitat feature.
Removal of vegetation	Complete removal of surface vegetation, such as scrub or grass by mechanical means (not chemical).
Separation of slurry	The process of dividing slurry (a mixture of animal excrement and water) into its solid and liquid components. This allows for more targeted use of nutrients, with solids used as fertiliser and liquids irrigated.
Sheep dipping	Immersing sheep in a chemical solution to control parasites.
Spreading of digestate	Applying the solid or liquid material remaining after anaerobic digestion (the breakdown of organic matter by microorganisms in the absence of oxygen) to the land as a fertiliser.

Spreading of manufactured fertiliser	Applying commercially produced fertilisers to the soil to supplement nutrients and enhance crop growth.
Spreading of manure	Distributing animal excrement on the land to improve soil fertility and crop growth.
Spreading of plant matter	Distributing crop residues or other plant material on the land. This can improve soil structure and fertility.
Spreading of poultry litter ash	Using ash from burnt poultry litter as a soil amendment.
Spreading of slurry	Applying a mixture of animal excrement and water to the land as a fertiliser.
Spreading of treated sewage sludge	Applying sewage sludge that has been processed to reduce pathogens and pollutants to agricultural land as a fertiliser.
Stationary combustion	The burning of fuel in fixed or stationary equipment to produce heat, power, or steam, rather than for transportation.
Storage of digestate	Keeping digestate in tanks or lagoons before it is used.
Storage of fuel oil	Keeping fuel for farm machinery and heating.
Storage of manufactured fertiliser	Storing fertiliser in designated areas.
Storage of manure	Keeping animal manure in designated areas.
Storage of plant protection products (PPP)	The keeping of chemical or biological agents to control pests and weeds in designated areas. This includes insecticides (for insects), fungicides (for fungi), herbicides and rodenticides (for rodents).
Storage of silage	Preserving forage crops (e.g., grass, maize) by fermentation and storing it for use as animal feed.
Storage of slurry	Keeping slurry in tanks or lagoons.

Transport of animals (off-farm)	The impacts of moving livestock around the country, to market or other locations. (Vehicular impacts do not need to be considered here as there are included within 'Machinery use for transportation (on farm)'.)
Treatment of waste in a biobed or biofilter	Using biological systems to treat contaminated water, often from PPE use, to break down pollutants.
Tree felling	Cutting down trees for management or timber purposes. This does not include commercial forestry.
Use of waste in construction (on-farm)	Utilising waste materials for building or maintaining farm structures. This can include using rubble for tracks. (May include screening.)
Waste burning in the open (non-plant material)	Burning waste that is not plant-based outdoors.
Waste incineration	Burning waste in a controlled furnace, this method can reduce waste volume.
Water abstraction for irrigation or livestock	Extracting water from sources such as rivers, lakes, or groundwater for the purpose of watering crops or for supplying water for animal drinking needs from natural or stored sources.

A3.3 Biodiversity targets

The Environmental Improvement Plan 2023 (EIP23) for England is a first revision of the 25 Year Environment Plan (25YEP), which set out goals for improving the environment, including statutory Biodiversity Targets and associated interim targets as detailed in Table 11.

Table 10 Biodiversity targets and descriptions

Target	Description
Long-term Habitats	Restore or create more than 500,000 hectares of a range of wildlife-rich habitats outside of protected sites by 2042.

EIP23 Interim Habitats (non-statutory)	Restore or create 140,000 hectares of wildlife rich habitats outside protected sites by 2028, compared to 2022 levels.
Species Abundance	Halt decline in species abundance by 2030 and increase species abundance by 10% by 2042 in comparison to 2030 levels.
Species Extinction	Improve the England level GB Red List Index for species extinction by 2042 compared to 2022 levels.
EIP23 Interim SSSI (non-statutory)	For all sites of special scientific interest (SSSIs) to have an up-to-date condition assessment; and for 50% of SSSIs to have actions on track to achieve favourable condition by 31st January 2028. In addition, Government has set a long-term commitment to have 75% of SSSIs in favourable condition by 2042.

A3.4 Source-pathway-receptor approach

Categories used to carry out mapping and scoring activities using the source-pathway-receptor are defined in Table 11.

Table 11 Categories and definitions used in applying the source-pathway-receptor approach

Category	Specific category	Definition
Source type	Dairy	Adult dairy animals and heifers in calf.
	Beef	Adult beef animals, bulls, young cattle and calves.
	Sheep	Adult sheep and lambs.
	Pigs	All classes of pigs, from weaners through to sows.
	Poultry	All classes of poultry, including chickens, turkeys and ducks.
	Chemical use	Manufactured agro-chemical products applied on the farm (includes any chemicals used to treat farm animals).
	Arable Production	The cultivation of crops on arable fields, such as wheat, barley, and vegetables, for food production. This does not include horticulture or organic production.

	Grass Production	The cultivation of grass on grassland fields for a variety of purposes, including grazing, silage, and turf. This does not include horticulture or organic production.
	Timber Production	The process of growing trees to harvest their wood for use in construction, furniture, and other products.
	All land management	The process of overseeing and making decisions about the use, conservation, and development of land, including agriculture, forestry, wildlife management.
	All ruminant livestock	Refers to all domesticated animals that have a stomach with multiple compartments for digesting plant-based food through fermentation, such as cattle, sheep, goats, and deer.
	All livestock	Refers to all domesticated animals raised for agricultural purposes, including both ruminant and non-ruminant species, such as cattle, pigs, chickens, and sheep.
	Non-ruminant livestock	Domesticated animals that have a single-chambered stomach and do not rely on rumination for digestion, such as pigs, poultry, and horses.
	Infrastructure	The fundamental physical and organisational structures needed for the operation of the farm, including roads, buildings, water supply, electricity, and communication networks.
	Transport	The movement of animals and farm goods from one location to another using various modes such as trucks, trailers etc.
	Public service provision	The delivery of essential services by government or private entities to support society, including water supply, waste management, and emergency services.
	Machinery	Mechanical devices or equipment used in agriculture fields to perform tasks that require force, precision, or automation.
	Invasive species	Non-native organisms that spread rapidly in a new environment, often causing harm to native species, ecosystems, agriculture, or human activities.
Area on farm	Arable field	Fields used for tillage agriculture.

	Grass field	All improved or semi-improved grassland fields (permanent pasture and rotational or ley grassland).
	Rough	Areas of unimproved grassland, heathland or moorland.
	Woodland	All woodland and forestry.
	Boundary	Boundary features separating fields.
	Housing (livestock)	Buildings used for housing livestock.
	Farm buildings	Structures on a farm used for various agricultural purposes, such as barns for storing livestock or crops, silos for grain storage, and sheds for equipment and tools.
	Farm vehicles	Vehicles specifically designed for agricultural work, including tractors, combine harvesters, ploughs, and trucks used for transporting crops, livestock, and equipment.
	Ponds	Small bodies of still water, often artificially created on farms, used for irrigation, watering livestock, fish farming, or as a habitat for wildlife.
	Rivers	Natural flowing water bodies that travel through land, often serving as a source of water for irrigation, livestock, and other agricultural activities.
	Stream	Streams crossed by livestock as they are moved from the steading to grazing areas.
	Field storage	Storage of manure in lagoons (for slurry) or heaps on open field sites (for FYM).
	Steading storage	Storage of manure in steel tanks (for slurry) or heaps on concrete base (for FYM).
	Yards	Open spaces on a farm used for various purposes, such as livestock holding areas, equipment storage, or general farm operations.
	Tracks	Pathways or dirt roads on a farm used for accessing different areas, transporting goods, or moving farm vehicles and machinery.

Pathway broad classification	Air	In a general sense, the mixture of several gases and tiny (invisible) dust particles, which largely present in the lower atmosphere of the earth.
	Soil	Material generated within the soil profile, such as the decomposition of organic material, weathering of minerals.
	Water	In a general sense, any clear liquid that has no colour, taste, or smell, that falls from clouds as rain, forming streams, lakes, and seas, and is used for drinking, washing, irrigation etc.
	Habitat modification	Changes in an area's primary ecological functions and species composition due to human activity and/or non-native species invasion.
Pathway type	Abstraction	The process of extracting water from natural sources (e.g., rivers, lakes, or groundwater) for human use.
	Aerosolisation	The process of converting substances into fine particles or droplets suspended in the air, often linked to pollution.
	Atmospheric deposition	The transfer of pollutants from the air to the Earth's surface through precipitation, dry settling, or other processes.
	Bioaccumulation	The buildup of chemicals in an organism over time, typically through food or environmental exposure.
	Changes in microclimate	Small-scale variations in climate conditions due to environmental or human factors, affecting temperature, humidity, and precipitation.
	Competition from invasive species	The struggle between native and non-native species for resources, where invasive species often outcompete locals.
	Cross contamination	The transfer of pollutants, pathogens, or chemicals from one medium (soil, water, air) to another, leading to environmental or health risks.
	Direct absorption to plants	The uptake of chemicals, nutrients, or pollutants by plants from air, soil, or water.

	Direct contamination of soil	The introduction of pollutants, chemicals, or hazardous substances directly into soil.
	Direct contamination of waterbodies	The introduction of pollutants or hazardous substances directly into lakes, rivers, or other water sources.
	Emissions	The release of gases, particles, or substances into the environment, often from industrial or natural sources.
	Excavation and construction	Human activities involving the removal or disturbance of soil and rock, which can impact ecosystems and pollution levels.
	Groundwater: leaching & infiltration	The process where water moves through soil, carrying contaminants that can reach underground water sources.
	Habitat fragmentation	The breaking up of natural habitats into smaller, isolated patches, reducing biodiversity.
	Ingestion of contaminated animal	The consumption of animals that have accumulated pollutants, leading to bioaccumulation in predators.
	Ingestion of contaminated plant	The consumption of plants that have absorbed pollutants from soil, air, or water.
	Ingestion of water	The act of drinking or absorbing water, which can be a pathway for contaminant exposure.
	Land use change	Alteration of land for different purposes (e.g., agriculture, urbanisation), affecting ecosystems and biodiversity.
	Livestock feed	Food provided to domesticated animals, which can be a source of pollutants or contaminants when sourced improperly.
	Physical disturbance (vegetation or soil)	Any disruption to plants or soil, often due to human activities, leading to erosion or habitat degradation.

	Soil compaction	The compression of soil particles, reducing its ability to absorb water and support plant growth.
	Soil displacement by human activity	The movement of soil due to construction, farming, or deforestation, leading to erosion or habitat loss.
	Soil exposure	The removal of protective vegetation or cover, leaving soil vulnerable to erosion, pollution, or degradation.
	Surface water: runoff & direct discharge	The flow of water over land that can carry pollutants into rivers, lakes, and oceans.
	Volatilisation	The process where chemicals transition from a liquid or solid state into a gas, potentially leading to air pollution.
	Water erosion	The removal of soil particles by water movement, leading to sedimentation and land degradation.
	Wind erosion: dust and particulate matter	The transport of soil and small particles by wind, affecting air quality and soil fertility.
Receptor	Lakes/ponds	Inland, still bodies of water that serve as habitats for aquatic life, sources of drinking water, and recreational areas.
	Rivers/streams	Flowing freshwater bodies that transport nutrients, sediments, and pollutants, supporting ecosystems and human uses.
	Coastal waters	Marine and estuarine environments influenced by freshwater inflows and human activities, supporting diverse marine life and economic activities.
	All waterbodies	Collective term for all aquatic environments, including lakes, rivers, wetlands, oceans, and groundwater.
	Crops	Cultivated plants grown for food, fibre, fuel, or other agricultural purposes.

	Native plants	Plant species that naturally occur in a specific region or ecosystem without human introduction.
	All plants	The entire range of vegetation, including native, cultivated, and invasive species.
	Livestock	Domesticated animals raised for food, fibre, or other agricultural products.
	Wildlife	Non-domesticated animals, including mammals, birds, fish, and insects, that inhabit natural ecosystems.
	All animals	Encompasses both domesticated and wild species across various habitats.
	Soil organisms	Microorganisms, fungi, and invertebrates that contribute to soil fertility, decomposition, and ecosystem health.
	Soil structure	The physical arrangement of soil particles that affects water movement, root growth, and aeration.
	Soil health	The overall condition of soil, including its biological, chemical, and physical properties, supporting plant and ecosystem functions.
	All soil	The entire range of soil types, including agricultural, forest, wetland, and urban soils.
	Atmosphere	The layer of gases surrounding the Earth, essential for climate regulation, weather patterns, and air quality.
	Protected areas	Designated regions such as national parks, wildlife reserves, or conservation areas, preserved for biodiversity, ecosystem services, and cultural significance.
Environmental impacted state	Air quality	A measure of the cleanliness of the air, determined by the presence and concentration of pollutants such as particulate matter, carbon monoxide, sulphur dioxide, nitrogen oxides, and volatile organic compounds.
	Water quality	The physical, chemical, and biological characteristics of water, affecting its suitability for drinking, recreation, agriculture, and ecosystem health.

	Water quantity/availability	The amount of water accessible for human use, agriculture, and ecosystems, influenced by factors such as precipitation, groundwater levels, and water management practices.
	Soil quality	The capacity of soil to support plant growth, regulate water flow, store carbon, and sustain biological activity, determined by factors like nutrient content, texture, structure, and contamination levels.
	Habitat quality	The ability of a habitat to provide food, shelter, and conditions necessary for the survival and reproduction of organisms.
	Habitat quantity	The extent or area of available habitat necessary to support biodiversity and sustain ecosystems.
	Plant health	The overall condition of plants, including their resistance to pests, diseases, and environmental stressors, which affect growth, reproduction, and ecosystem contributions.
	Wildlife health	The overall physical, biological, and ecological condition of wild animals and the ecosystems in which they live.

Annex 4 Scoring guidance for the baseline risks of impacts of farming activities

This annex sets out the guidance provided to scorers for this task.

Objective: Categorise farm types and farming activities based on their baseline risks of impact on the natural environment. The categorisation should consider the characteristics of farms or holdings, the activities carried out in these settings and the scale of their baseline impact when no mitigations are in place.

Identifying farming activities and environmental pressures: A total of 89 farming activities were identified based on previous ADAS research, consultation with the OEP and review of relevant literature. These sit in various source types such as arable production, infrastructure, livestock, etc. and have broken down through:

1. the area in which it occurs on farm

2. the broad pathway and receptor in which the farming activity may cause a baseline impact in, for example, air, soil, water etc.

Table 12 Types of scoring, descriptions and scoring scales

Type of scoring	Description	Scoring scale
Impact score	This score should represent "the impact of the activity as applied at a typical farm scale on a typical farm type as appropriate to that activity"	Provide a score on a scale of -3 to 3, where -3 is the most adversely impactful an activity could be at a baseline level (i.e., high degradation). A score of +3 is the most positively impactful an activity could be at a baseline level (i.e. high improvement).
Certainty score	The score should represent how confident/certain you are in the impact score you have provided for the activity baseline impact on environment.	Provide a score on a scale of 0 to 3, where 1 means low certainty, 2 means moderate certainty and 3 means high certainty. A score of zero is also acceptable where you have no confidence at all. The score should represent how confident/certain you are in the score you have provided for the activity baseline impact on environment.

Temporal	Timescale for which baseline impact from farm activity on environmental state occurs (i.e. when the baseline environmental impact is greatest)	**SHORT** - Baseline impact from farm activity on Environment State occurs over <1 year time period. **MEDIUM** - Baseline impact from farm activity on Environment State occurs between 1 to 5 years. **LONG** - Baseline impact from farm activity on Environment State occurs over >5-year time period. **ALL** - Baseline impact from farm activity on Environment occurs across all time periods

Table 13 Types of degradation/improvement, descriptions and scoring scales

Level of degradation/improvement	Description	Impact Score Scale
No degradation or improvement	The farm/land management activity does not contribute to the environment impact state at all.	0
Low Degradation	The farm/land management activity contributes to the decline in environment impact state in a small way.	-1
Medium Degradation	The farm/land management activity contributes to the decline in environment impact state in a large way.	-2
High Degradation	The farm/land management activity is the main contributor to the decline in environment impact state.	-3
High Improvement	The farm/land management activity is a main contributor to improving the environment impact state	3

Medium Improvement	The farm/land management activity contributes to improving the environment impact state in a large way.	2
Low Improvement	The farm/land management activity contributes to improving the environment impact state in a small way.	1
Not Assessed		NA

Table 14 Certainty definitions and scoring scales

Level of certainty	Description	Certainty Score Scale
No confidence at all	Judgment only.	0
Low confidence in score	Mostly judgment, small knowledge from robust sources.	1
Medium confidence in score	Even judgment and knowledge from robust sources.	2
High confidence in score	Well-known and accepted. Strongly backed in literature.	3
Not Assessed		NA

Table 15 Spreadsheet scoring process

Column	Category	Description
Column A	Farm/Land Management Activity	No action required unless you think an important farm activity has been missed. If so, please add at bottom of current Column A list and score accordingly.
Column B	Source Type	Review pre-populated source and if you disagree use the drop-down to select the source type category you think relates to the activity. Populate empty source cells (up to 5 in total) where appropriate.

Column C	Area of Farm	Using the drop-down select the area on farm category related to the activity and source. Review any pre-populated cells and change if you disagree.
Column D	Pathway Classification	Using the drop-down select an appropriate pathway classification category related to the activity and source. Review any pre-populated cells and change if you disagree.
Column E	Pathway Type	Using the drop-down select the pathway type related to the activity and source. Review any pre-populated cells and change if you disagree.
Column F	Receptor	Using the drop-down select an appropriate Receptor category related to the activity, source and pathway. Review any pre-populated cells and change if you disagree.
Column G	Environmental Pressure	Using the drop-down select the Environmental Pressure category related to the activity, source, pathway and receptor. Review any pre-populated cells and change if you disagree.
Column H	Environmental Pollutant	Using the drop-down select the Environmental Pollutant category related to the activity, source, pathway and receptor. Review any pre-populated cells and change if you disagree.
Column I	Environmental Impacted State	Using the drop-down select the environmental impacted state category related to the activity, source, pathway and receptor.
Column J	Timescale	Using the drop-down select the timescale for which the baseline impact from the farm activity on the environmental state occurs (i.e. when the baseline environmental impact is greatest, e.g. short <1 year, medium 5 years, long > 5 years).

Table 16 Additional task scoring guidance

Column	Description
Column M	Using the scale outlined and the drop down provided choose the appropriate numerical score for the farm activity baseline (pre-mitigation) impact.
Column N	Using the scale outlined and the drop down provided choose the appropriate numerical score for your level of score certainty.

Column O	Please select either yes or no in Column O if you think the Farm Activity will also have an impact on Human Health.
Column P	Please select either yes or no in Column P if you think Climate Change will exacerbate the impacts of the farming activity on the natural environment.
Column Q	Please provide any notes/comments to support your expert opinion.
Column R	Please provide any links to evidence/literature that supports your scores.

Annex 5 Scoring guidance for the scale of effect of farming regulations and wider legislation in mitigating the baseline risks of impact from farming activities

This annex sets out the guidance provided to scorers for this task.

Objective: Assess the extent to which farming regulations and wider legislation mitigate the baseline impact of farming activities on the natural environment. This categorisation will consider the coverage of farming activities by regulatory rules and the impact of the farming activities on the natural environment when the mitigations outlined in the regulatory rules are in place.

Identifying regulations and mitigating interventions: A total of 75 farming and wider pieces of legislation were identified and assessed. Farm activities were mapped against the legislation and the mitigating action outlined in the relevant regulatory rule. They were then categorised according to:

1. the pressure/pollutant being mitigated

2. the environmental pressure state in which the farming activity may cause an impact.

Table 17 Types of mitigation coverage, descriptions and scoring scales

Level of mitigation coverage	Description	Coverage Score Scale
High	Large consideration of sources, areas and pathways (or geographical area) by mitigation rules under regulation.	3
Medium	Small consideration of sources, areas and pathways (or geographical area) by mitigation rules under regulation.	2
Low	Negligible consideration of sources, areas and pathways (or geographical area) by mitigation rules under regulation.	1

NI	No discernible consideration.	0

Table 18 Types of mitigation control, descriptions and scoring scales

Level of mitigation control	Description	Control Score Scale
Negligible	Mitigation action has had minimal impact on reducing, avoiding, cancelling or compensating environmental pressure/pollutant.	1
Impacted	Mitigation action has had some impact on reducing, avoiding, cancelling or compensating environmental pressure/pollutant.	2
Controlled	Mitigation action has led to environmental pressure/pollutant being reduced, avoided, cancelled or compensated.	3
NI	No discernible control of environmental pressure/pollutant.	0

Table 19 Types of mitigation issues, descriptions and scoring scales

Level of mitigation issues	Description
Pollutant swapping	Occurs when a mitigation action introduced to reduce one pressure/pollutant results in an increase in another pressure/pollutant.
Enforcement	Poor application, administration or execution of rules and/or mitigation actions leads to poor environmental harm control.
Awareness	There is a general lack of awareness of rules and/or mitigation actions that leads to poor environmental harm control.

Extreme events	Rules and/or mitigation actions only relevant in respect of rare or unusual climatic, weather or environmental conditions, e.g., heat waves, droughts, floods, wildfires, and severe storms.
Ambiguity	Rules and/or mitigation actions are vague, obscure or lack clarity which leads to poor environmental harm control.

Table 20 Types of mitigation issues, descriptions and scoring scales

Level of mitigation issues	Description
Source	A contaminant or pollutant that is in, on or under the land and that has the potential to cause harm or pollution.
Pathway	A route by which a receptor is or could be affected by a contaminant - specific to receptor.
Receptor	Something that could be adversely affected by a contaminant or pollutant.

Annex 6 Results and interpretation for the baseline risks of impacts from farming activities on EIS

This annex presents the results and interpretation of the statistical analysis carried out for this task in detail.

A6.1 Median score values, by EIS

Table 21 presents the results of the statistical analysis of baseline risks of impacts from farming activities on EIS, as median scores. Further detail on the statistical analysis undertaken is provided in Supplementary Annex A.

Table 21 Baseline risks of impacts from farming activities on EIS (median scores)

Legend to the table

-3	-2	-1	0
Risk of High Degradation	Risk of Moderate Degradation	Risk of Low Degradation	Neutral

Farming activity	Air quality	Habitat quality	Habitat quantity	Plant health	Soil quality	Water quality	Water quantity / availability	Wildlife health
Arable and Horticulture								
Burning of crop residues	-0.5				-0.5			
Disposal of plant protection products					-3.0	-3.0		
Growing late harvested crops (maize, root crops, vegetables)					-2.0	-2.0	-2.0	
Harvesting					-1.0	-1.0		

Incorporation of ash into soil					-1.0	-1.0		
Late harvesting of crops					-2.0	-2.0		
Late sown cereals					-2.0	-2.0		
Minimum or zero till					-1.0	-1.0	-1.0	
Plant protection products application and handling				-2.0	-2.0	-2.0		-2.0
Planting of monoculture crops					-2.0	-2.0		
Ploughing	-2.0				-2.0	-2.0		
Spreading of plant matter				-1.0				
Spreading of treated sewage sludge	-1.0	-1.0		-1.0	-1.0			
Storage of manufactured fertiliser						-3.0		
Storage of plant protection products						-3.0		
Mixed								
Burning of grassland	-0.5				-0.5			
Cultivation around in-field trees	-2.0				-2.0			
Cultivation of organic soils					-2.5			
Cultivation of semi-natural habitat or uncultivated land			-2.5		-2.5	-2.5		
Disposal of plastic wrap	-2.0				-2.0			

Grass re-seeding					-1.0			
Machinery use for transportation (off-farm)	-1.0							
Machinery use for transportation (on-farm)	-1.0				-1.0			
Spreading of digestate	-1.0	-1.0		-1.0	-1.0	-1.0		
Spreading of manufactured fertiliser	-1.0	-1.0		-1.0		-1.0		
Storage of silage						-1.0	-1.0	
Water abstraction for irrigation or livestock							-2.0	
Non-Ruminant - Pigs and Poultry								
Feeding of non-ruminant livestock	-2.0					-2.0		
Heating intensive livestock housing	-3.0							
Housing of Intensive poultry	-2.0					-2.0		
Housing of non-ruminant livestock	-2.0					-2.0		
Keeping of poultry (free range)	-2.0				-2.0	-2.0		
Management of poultry litter	-1.0	-1.0				-1.0		
Spreading of poultry litter ash					-1.0			
Other - land use and management								

Anaerobic digestion	-1.0			-1.0	-1.0	-1.0		
Build boundary features (walls, stone banks and earth banks)		-1.0	-1.0		-1.0	-1.0		
Burning of heather, rough grass, bracken, gorse or vaccinium	-2.0		-2.0		-2.0			-2.0
Composting - aerobic	-1.0			-1.0	-1.0	-1.0		
Construction of farm buildings, tracks, yards and plant protection product loading areas	-1.0		-1.0		-1.0	-1.0		
Controlled waste		-1.0			-1.0	-1.0		
Domestic sewage treatment (from farm accommodations)						-2.0		
Hedgerow cutting		-1.0	-1.0					
Impoundment of water							-2.0	
Land drainage			-2.0			-2.0		-2.0
Large pest control (e.g. shooting, poison, traps)		-2.0						-2.0
Maintaining public rights of way			-1.0					
Modification of ponds, rivers and streams		-1.0	-1.0			-1.0		
Open access land			-0.5					

Planting native trees			-1.0		-1.0			-1.0
Planting non-native trees			-2.0					-2.0
Protection of historic environment or features		0.0						
Removal of earth and stone boundaries		-1.5	-1.5			-1.5		
Removal of hedgerows			-2.0			-2.0		
Removal of vegetation		-1.0			-1.0	-1.0		
Stationary combustion	-1.0							
Storage of digestate	-2.0			-2.0	-2.0	-2.0		
Storage of fuel oil					-2.5	-2.5		
Tree felling		-1.5	-1.5			-1.5	-1.5	
Use of waste in construction (on-farm)		-1.0			-1.0	-1.0		
Waste burning in the open (non-plant material)	-2.0				-2.0			
Waste incineration	-1.0				-1.0			
Ruminant - Beef Cattle and Sheep								
Feeding of ruminant livestock	-2.0					-2.0		
Housing of ruminant livestock	-2.0					-2.0		

Keeping of non-ruminant livestock (grazing)	-2.0				-2.0			
Keeping of ruminant livestock (grazing)	-2.0					-2.0		
Sheep dipping					-2.0	-2.0		
Ruminant - Dairy Cattle								
Cleaning milking parlour						-2.0	-2.0	
Milking	-1.0							
Separation of slurry	-1.0					-1.0		
Spreading of slurry	-2.0			-2.0	-2.0	-2.0		
Storage of slurry	-2.0			-2.0	-2.0	-2.0		
Universal to all Livestock								
Clean and dirty water separation					-1.5	-1.5		
Cleaning housing areas						-1.5	-1.5	
Cleaning or washing waste						-2.0		
Cleaning yards						-1.5		
Disposal of dead animals						-2.0		-2.0
Disposal of vet and medicine waste						-1.5		-1.5
Management of wastewater						-2.5		

Movement of animals (within farm)	-2.0				-2.0	-2.0		
Outwintering of stock					-2.0	-2.0		
Spreading of manure	-1.0			-1.0	-1.0	-1.0		
Storage of manure	-1.0			-1.0	-1.0	-1.0		
Transport of animals (off farm)	-1.0							

A6.2 Descriptive statistics for baseline risks of impacts, by EIS

Table 22 presents the descriptive statistics for the baseline risks of impacts from farming activities on EIS. Further detail on the underlying data for these descriptive statistics is provided in Supplementary Annex A in worksheet 'Task A Analysis-Median Score' (Columns AO:AW; Rows 95:110).

Table 22 Descriptive statistics

Legend to the table

-3	-2	-1	0
Risk of High Impact	**Risk of Moderate Impact**	**Risk of Low Impact**	**Neutral**

Descriptive statistics	Air Quality	Habitat quality	Habitat quantity	Plant health	Soil quality	Water quality	Water quantity / availability	Wildlife health
Mean	-1.50	-1.07	-1.43	-1.33	-1.55	-1.70	-1.63	-1.81
Standard Error	0.10	0.12	0.16	0.14	0.09	0.08	0.16	0.13

Median	-1.50	-1.00	-1.25	-1.00	-1.75	-2.00	-1.75	-2.00
Mode	-2.00	-1.00	-1.00	-1.00	-1.00	-2.00	-2.00	-2.00
Standard Deviation	0.60	0.43	0.58	0.49	0.62	0.58	0.44	0.37
Sample Variance	0.36	0.19	0.34	0.24	0.38	0.34	0.20	0.14
Kurtosis	-0.85	3.62	-1.00	-1.65	-1.05	-0.59	-1.48	3.20
Skewness	-0.21	0.31	-0.32	-0.81	-0.21	-0.25	0.62	1.95
Range	2.50	2.00	2.00	1.00	2.50	2.00	1.00	1.00
Minimum	-3.00	-2.00	-2.50	-2.00	-3.00	-3.00	-2.00	-2.00
Maximum	-0.50	0.00	-0.50	-1.00	-0.50	-1.00	-1.00	-1.00
Sum	-54	-15	-20	-16	-68	-94	-13	-15
Count	36	14	14	12	44	55	8	8
Confidence Level (95.0%)	0.20	0.25	0.34	0.31	0.19	0.16	0.37	0.31

A6.2.1 Interpretation

A6.2.1.1 Air quality (n = 36)

Air quality results indicate a moderate baseline risk with a mean and median of –1.50, and a wide range (2.50) indicating variability in impact severity. The standard deviation (SD) of 0.60 suggests moderate dispersion, while the negative skewness (–0.21) implies a slight tendency toward farming activities that are more likely to contribute to poor air quality outcomes under assumptions of no regulatory compliance or implementation of mitigations. Activities such as heating intensive livestock housing, spreading of slurry, and storage of

digestate were seen as having greater baseline risks of impacts due to, for example, emissions of ammonia, methane, and particulates. These emissions arise from combustion, manure handling, and volatile organic compounds. The sample size (n=36) relates to the number of farming/land management activities impacting on air quality. The sample size (n=36) is relatively robust, supporting confidence in the statistical interpretation.

The platykurtic[35] distribution (kurtosis 2.25) suggests a flatter spread of scores, indicating moderate variability without extreme outliers. This indicates some consensus on the impact of farming activities on air quality.

A6.2.1.2 Habitat quality (N = 14)

With a mean of -1.07, habitat quality has a low baseline risk of impact from farming activities under the baseline assumption of minimal regulatory compliance or implementation of mitigation measures. The standard deviation (0.43) and moderate right-skewness (0.31) suggest that while some farming activities (e.g., spreading of digestate, controlled waste, protection of historic environment or features) are likely to impact habitat conditions less without regulatory rules or mitigation in place, others (e.g., hedgerow cutting) are likely to cause greater baseline risk of degradation in habitat quality in the absence of regulatory rules or mitigations. The mesokurtic[36] kurtosis (3.62) indicates a peaked distribution with occasional baseline impact score outliers. The sample size (n=14) is limited, so caution should be taken when interpreting results.

A6.2.1.3 Habitat quantity (N = 14)

Habitat quantity results indicate moderate baseline risks with a mean of –1.43 and median of –1.25. The range (2.00) and SD (0.58) reflect moderate variability. Skewness (–0.32) shows a slight left skew, while kurtosis (–1.00) suggests a flat distribution (platykurtic), meaning impacts are spread out without strong clustering. Activities like hedgerow removal, tree felling, and cultivation of semi-natural

[35] Platykurtic refers to a distribution characterised by thinner tails, i.e. it has fewer extremes compared to a normal distribution.

[36] A mesokurtic distribution is a probability distribution characterised by an excess kurtosis of zero, closely resembling a normal distribution in shape.

habitats directly reduce habitat area, leading to ecological loss. These practices often involve land conversion or clearance, which can permanently alter landscape structure. The sample size (n=14) is limited, so caution should be taken when interpreting results.

A6.2.1.4 Plant health (N = 12)

Results for plant health indicate moderate baseline risks, with a mean of –1.33 and median of –1.00. The range is narrow (1.00) and standard deviation (0.49) is low, indicating low variability. Negative skewness (–0.81) and kurtosis (–1.65) suggest a distribution skewed toward more severe impacts but with few extreme outliers. Activities such as plant protection product application, spreading of slurry, and storage of digestate can affect plant health through chemical exposure, nutrient imbalance, or pathogen transfer. These impacts may reduce crop resilience or productivity. The small sample size (n=12) again limits statistical power, so findings should be interpreted with care.

A6.2.1.5 Soil quality (N = 44)

Soil quality results indicate moderate to high baseline risks, with a mean of –1.55 and median of –1.75. The standard deviation (0.62) and range (2.50) indicate moderate variability which suggests that while some farming activities may help improve soil health (e.g., minimum or zero till, incorporation of ash into soil) many farming activities (e.g., cultivation around in-field trees, cultivation of organic soils, cultivation of semi-natural habitat or uncultivated land, waste burning in the open (non-plant material), and the disposal of plastic wrap) are likely to lead to soil degradation under the baseline assumption of minimal regulatory compliance. Negative skewness (–0.21) and kurtosis (–1.05) suggest a relatively symmetric but flat distribution. Activities such as cultivation of organic soils, storage of fuel oil, and disposal of plant protection products were seen as having higher baseline risks likely due to scorers' perceptions and knowledge of erosion, contamination, and compaction. These practices can degrade soil structure, reduce fertility, and impair microbial activity. The sample size (n=44) is strong, supporting robust interpretation.

A6.2.1.6 Water quality (N = 55)

Results for water quality exhibit high baseline risks of impacts on the natural environment, with a mean of –1.70 and median of –2.00. The standard deviation (0.58) and range (2.00) indicate moderate variability. The mode (–2.00) and minimum (–3.00) suggest frequent high baseline risks of impacts with no regulatory compliance or implementation of mitigations on farm. Activities such as storage of manufactured fertiliser, disposal of plant protection products, and management of wastewater contribute to nutrient loading, chemical

runoff, and microbial contamination. These impacts can lead to eutrophication, toxicity, and degradation of aquatic ecosystems. The sample size (n=55) is the largest among the EIS categories, providing higher confidence to findings.

A6.2.1.7 Water quantity/availability (N = 8)

Water quantity results indicate moderate to high baseline risks, with a mean of –1.63 and median of –1.75. However, the range is narrow (1.00) and standard deviation (0.44) is low, suggesting less variability in impacts. Positive skewness (0.62) and kurtosis (–1.48) suggest a distribution with more mild impacts and fewer outliers. Activities such as cleaning milking parlour, storage of silage, and impoundment of water affect water availability through abstraction, diversion, and increased demand. These practices may reduce water flow or availability for ecosystems. The small sample size (n=8) limits statistical power, so findings should be interpreted with care.

A6.2.1.8 Wildlife health (N = 8)

Wildlife health results indicate the highest baseline risks of impacts, with a mean of –1.81 and median of –2.00. The low standard deviation (0.37) and range (1.00) suggest consistent high baseline risks across farming activities. High positive skewness (1.95) and kurtosis (3.20) indicate a distribution with frequent severe baseline risks of impacts and few mild ones. Activities such as burning of rough vegetation, disposal of dead animals, and plant protection product application pose significant threats through habitat disruption, exposure to toxins, and disease transmission. These impacts can reduce population viability and biodiversity. Small sample (n=8) limits statistical power, so caution is again advised when interpreting descriptive statistics.

A6.3 ANOVA Results

An analysis of variance (ANOVA) was conducted to assess whether there were statistically significant differences in baseline environmental impact scores (under an assumption of minimal compliance with regulatory rules or mitigation measures being implemented on-farm) across the various EIS categories resulting from farming activities.

A6.3.1 Interpretation

A one-way ANOVA was conducted to evaluate differences in baseline risks of impact scores across the eight EIS categories. The results in the tables below indicate a statistically significant effect of impact type on baseline scores ($F(7, 183) = 2.60$, $p = 0.01$), exceeding the critical value at the 95% confidence level ($F_{(}crit_{)} = 2.06$). This suggests that the nature of the EIS significantly influences the extent of

baseline risks of impacts associated with different farming activities. Descriptive statistics reveal that wildlife health and water quality exhibit the most negative mean scores (−1.81 and −1.70, respectively), with low within-group variance, indicating consistently high levels of baseline risks of impacts from farming activities. Soil quality (−1.55) and air quality (−1.50) also show substantial negative impacts. Moderate scores were observed for plant health, habitat quantity, and water availability, while habitat quality presented the least negative mean (−1.07), suggesting either less frequent or less intense baseline risks of impacts in these EIS in the absence of regulatory compliance or the implementation of mitigation measures on farms.

The between-group mean square (MS = 0.84) reflects significant variation in baseline risks of impacts across EIS categories, whereas the within-group mean square (MS = 0.32) indicates moderate variability in how farming activities influence baseline risks within environmental states.

These findings highlight the importance of EIS specific mitigation strategies and support the differentiation of environmental policy interventions based on the type and severity of impact.

Table 23 EIS single factor ANOVA

Summary						
Groups	**Count**	**Sum**	**Mean Score**	**Variance**		
Wildlife health (n=8)	8	-15	-1.81	0.14		
Water quality (n=55)	55	-94	-1.70	0.34		
Water quantity/availability (n=8)	8	-13	-1.63	0.20		
Soil quality (n=44)	44	-68	-1.55	0.38		
Air Quality (n=36)	36	-54	-1.50	0.36		
Habitat quantity (n=14)	14	-20	-1.43	0.34		
Plant health (n=12)	12	-16	-1.33	0.24		

Habitat quality (n=14)	14	-15	-1.07	0.19		
ANOVA						
Source of Variation	***SS***	***df***	***MS***	***F***	***P-value***	***F crit***
Between Groups	5.88	7	0.84	2.60	0.01	2.06
Within Groups	59.08	183	0.32			
Total	**64.96**	**190**				

Table 24 Receptor single factor ANOVA

Summary						
Groups	**Count**	**Sum**	**Mean Score**	**Variance**		
All waterbodies	55	-94	-1.70	0.34		
All soil	21	-35	-1.64	0.35		
Soil structure	15	-23	-1.53	0.30		
Atmosphere	31	-47	-1.52	0.37		
Wildlife	16	-23	-1.44	0.46		
Crops	5	-7	-1.40	0.30		
Native plants	12	-16	-1.33	0.24		
Soil health	13	-17	-1.31	0.40		
Soil organisms	9	-12	-1.28	0.32		

Livestock	2	-3	-1.25	0.13		
All plants	11	-13	-1.18	0.36		
ANOVA						
Source of Variation	**SS**	**df**	**MS**	**F**	**P-value**	**F crit**
Between Groups	5.72	12	0.48	1.36	0.19	1.81
Within Groups	62.74	179	0.35			
Total	**68.45**	**191**				

Table 25 Pollutant single factor ANOVA

Summary						
Groups	**Count**	**Sum**	**Mean Score**	**Variance**		
Herbicides	4	-9	-2.25	0.92		
Pesticides	6	-13	-2.17	0.57		
Phosphorus	25	-45	-1.78	0.29		
Nitrates	30	-51	-1.70	0.29		
Sediment	15	-25	-1.67	0.31		
Methane	11	-18	-1.64	0.25		
Other (specify)	13	-21	-1.58	0.37		
16PAH	4	-6	-1.50	0.33		

CO2	14	-21	-1.50	0.54		
NH3	16	-24	-1.50	0.27		
PM10	7	-9	-1.29	0.24		
Soil metal concentrations	11	-14	-1.27	0.22		
NOx	6	-7	-1.17	0.17		
PM2.5	6	-7	-1.17	0.17		
Carbon Monoxide	2	-2	-1.00	0.00		
ANOVA						
Source of Variation	**SS**	**df**	**MS**	**F**	**P-value**	**F crit**
Between Groups	9.99	14	0.71	2.23	0.01	1.76
Within Groups	49.50	155	0.32			
Total	**59.49**	**169**				

Table 26 Source single factor ANOVA

Summary						
Groups	**Count**	**Sum**	**Mean Score**	**Variance**		
Chemical use	4	-10	-2.50	0.92		
Pigs	4	-8	-2.00	0.57		
All ruminant livestock	11	-21.5	-1.95	0.29		

Poultry	7	-13.5	-1.93	0.29		
Machinery	3	-5.5	-1.83	0.31		
Timber production	2	-3.5	-1.75	0.25		
Arable production	24	-41.5	-1.73	0.37		
All livestock	17	-28	-1.65	0.33		
Non-ruminant livestock	5	-8	-1.60	0.54		
Grass production	13	-20.5	-1.58	0.27		
Chemical	3	-4.5	-1.50	0.24		
Dairy	4	-6	-1.50	0.22		
Other (specify)	2	-3	-1.50	0.17		
Transport	3	-4.5	-1.50	0.17		
All land management	15	-22	-1.47	0.00		
Infrastructure	15	-20.5	-1.37	0.56		
Conventional Arable Production	4	-5	-1.25	0.28		
Public service provision	5	-5.5	-1.10	2.23		
ANOVA						
Source of Variation	***SS***	***df***	***MS***	***F***	***P-value***	***F crit***
Between Groups	9.81	18	0.55	1.21	0.27	1.69
Within Groups	55.64	123	0.45			
Total	**65.46**	**141**				

Annex 7 Statistical analysis results and interpretations for the scale of effect of farming regulations and wider legislation in mitigating the baseline risks of impact from farming activities

This annex presents the results and interpretation of the statistical analysis carried out for this task in detail.

A7.1 Descriptive statistics for regulatory control, by EIS

Table 27 presents the descriptive statistics for EIS based on assessed scores for regulatory control of baseline risks from farming activities on the natural environment. Further detail on the underlying data for these descriptive statistics is provided in Supplementary Annex A in worksheet 'Task B Analysis-Median Scores' (Columns W:AE; Rows 203:218).

Table 27 Descriptive statistics: Regulatory control by EIS

Descriptive statistics	Air quality	Habitat quality	Habitat quantity	Plant health	Soil quality	Water quality	Water quantity /availability	Wildlife health
Mean	2.03	2.11	2.18	2.17	2.05	2.09	2.00	2.25
Standard Error	0.11	0.14	0.15	0.15	0.10	0.08	0.00	0.23
Median	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.25
Mode	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
Standard Deviation	0.64	0.53	0.58	0.54	0.69	0.60	0.00	0.65
Sample Variance	0.41	0.28	0.33	0.29	0.47	0.36	0.00	0.43
Kurtosis	-0.47	0.91	0.11	1.38	-0.50	2.06		0.88

Skewness	-0.11	-0.03	-0.12	-0.27	-0.34	-0.76		-0.76
Range	2.00	2.00	2.00	2.00	2.50	3.00	0.00	2.00
Minimum	1.00	1.00	1.00	1.00	0.50	0.00	2.00	1.00
Maximum	3.00	3.00	3.00	3.00	3.00	3.00	2.00	3.00
Sum	73.00	29.50	30.50	26.00	90.00	117.00	16.00	18.00
Count	36	14	14	12	44	56	8	8
Confidence Level (95.0%)	0.22	0.30	0.33	0.34	0.21	0.16	0.00	0.55

A7.1.1 Interpretation

A7.1.1.1 Air quality (N = 36)

The mean regulatory control score for air quality was 2.03 (±0.11), indicating a moderate perception of regulatory effectiveness in managing baseline risks from farming activities. The distribution is slightly negatively skewed (−0.11), suggesting a mild tendency toward higher ratings. The standard deviation of 0.64 and coefficient of variation (CV) of 0.32 reflect moderate variability in responses. The median and mode of 2.00, along with a range of 2.00, reinforce the central tendency. These results suggest that while regulatory controls are generally seen as moderately effective, there is room for improvement in consistency, particularly in relation to activities such as machinery use, ploughing, and livestock management.

A7.1.1.2 Habitat quality (N=14)

With a mean score of 2.11 (±0.14) and standard deviation of 0.53, habitat quality is perceived as moderately well-regulated in terms of controlling baseline risks, with relatively consistent responses. The skewness of −0.03 indicates a nearly symmetric distribution, and the median and mode of 2.00 support this. The relatively low coefficient of variation (0.25) supports the interpretation of consistent mitigation control performance. This suggests that regulations which include mitigating actions focused on habitat quality are well-

established and generally successful, though continued monitoring and adaptive future management may be needed to maintain or enhance outcomes.

A7.1.1.3 Habitat quantity (N=14)

The mean score of 2.18 (±0.15) and standard deviation of 0.58 indicate moderate perceived effectiveness with some variability. The skewness of −0.12 and kurtosis of 0.11 suggest a slightly left-tailed but mostly normal distribution. The median and mode of 2.00 contrast with the relatively high range (2.00), pointing to divergent views among scorers. These findings point to generally successful regulatory mitigations in preserving habitat area, but with notable exceptions that could warrant future targeted investigation for some farming activities (e.g., burning of heather, rough grass, bracken, gorse or vaccinium, modification of ponds, rivers and streams).

A7.1.1.4 Plant health (N = 12)

Plant health received a mean score of 2.17 (±0.15), with a standard deviation of 0.54 and CV of 0.25, indicating moderate control with relatively low variability. The skewness of −0.27 and median of 2.00 suggest a slight lean toward higher ratings. The results suggest that while baseline impacts on plant health were perceived as being somewhat controlled through regulatory rules or mitigations, there are gaps in control that could be improved through more tailored or integrated approaches for some farm and land management activities (e.g., spreading of treated sewage sludge, spreading of digestate). Targeted improvements could focus on organic amendments and pathogen control, for example.

A7.1.1.5 Soil quality (N = 44)

Soil quality had a mean score of 2.05 (±0.10) and standard deviation of 0.69, indicating moderate perceived control with notable variability across scorers. The skewness of −0.34 and range of 2.50 suggest that while many scorers rated control as moderate, some perceived significant gaps in regulatory control as indicated by lower scores. The median and mode of 2.00 reinforce the central tendency. Importantly, this variability potentially masks systemic weaknesses in regulatory control of soil quality components (e.g., soil health, soil organisms). Further analysis of soil-related pollutants and receptors (detailed below in section c. Anova results) confirms that soil quality is among one of the lowest-performing areas overall, with critical indicators, such as organic matter retention, erosion prevention, and compaction control, consistently underperforming. These findings suggest that soil health, soil structure and soil organisms may be under prioritised or that existing mitigation measures could be inappropriately implemented, ambiguous or too complex.

A7.1.1.6 Water quality (N = 56)

Water quality received a mean score of 2.09 (±0.08), with a standard deviation of 0.60 and CV of 0.29, indicating moderate to high perceived control with relatively consistent responses. The skewness of −0.76 and kurtosis of 2.06 suggest a left-skewed, peaked distribution, with most scorers rating regulatory control as effective. The median and mode of 2.00 support this. These results highlight the relative success of water-focused regulations (e.g., SSAFO, FRW), assuming broad compliance. These results suggest that water focused regulations (e.g., Water Resources (Control of Pollution) (Silage, Slurry and Agricultural Fuel Oil) (England) Regulations 2010 (SSAFO), Reduction and Prevention of Agricultural Diffuse Pollution (England) Regulations 2018 (FRW)) are among the more successful in addressing baseline impacts from farming activities (under an assumption of compliance).

A7.1.1.7 Water quantity/availability (N = 9)

The mean score of 2.00 (±0.00) and standard deviation of 0.00 indicate no variation in responses, with all scorers assigning the same rating. This uniformity suggests a shared perception of moderate regulatory control, though the lack of variability may reflect the small sample size, so caution is advised in drawing inference for this EIS. Further investigation is warranted, especially for activities like irrigation abstraction and water storage.

A7.1.1.8 Wildlife health (N = 8)

Wildlife health received a mean score of 2.25 (±0.23), the highest among all EIS indicators, but with a standard deviation of 0.65 and skewness of −0.76, indicating a left-skewed distribution. The median of 2.25 and mode of 2.00 suggest a central tendency toward moderate control, but the range of 2.00 and minimum score of 1.00 highlight variability in perceptions. These findings suggest that while some scorers viewed regulatory control as effective, others perceived significant gaps, possibly due to limited enforcement or ecological complexity. These findings suggest that wildlife health is one area needing more focused regulatory attention, improved monitoring, and potentially new or revised mitigation strategies. Given the small sample, caution is advised in drawing inferences for this EIS.

A7.2 Descriptive statistics for regulatory coverage, by EIS

Table 28 presents the descriptive statistics for EIS based on assessed scores for regulatory coverage of baseline risks from farming activities on the natural environment. Further detail on the underlying data for these descriptive statistics is provided in Supplementary Annex A in worksheet 'Task B Analysis-Median Scores' (Columns W:AE; Rows 93:108).

Table 28 Descriptive statistics: Regulatory coverage by EIS

Descriptive statistics	Air quality	Habitat quality	Habitat quantity	Plant health	Soil quality	Water quality	Water quantity /availability	Wildlife health
Mean	2.17	2.11	2.15	2.24	2.28	2.22	2.35	2.23
Standard Error	0.13	0.17	0.15	0.20	0.11	0.09	0.19	0.23
Median	2.33	2.00	2.00	2.33	2.33	2.33	2.00	2.25
Mode	3.00	2.00	2.00	2.33	3.00	2.00	2.00	3.00
Standard Deviation	0.78	0.64	0.57	0.68	0.70	0.64	0.54	0.65
Sample Variance	0.61	0.41	0.32	0.46	0.49	0.41	0.29	0.43
Kurtosis	-1.29	-0.46	0.29	0.06	-0.05	1.60	-2.20	0.75
Skewness	-0.49	-0.28	-0.02	-0.92	-0.88	-0.99	0.60	-0.68
Range	2.00	2.00	2.00	2.00	2.50	3.00	1.17	2.00
Minimum	1.00	1.00	1.00	1.00	0.50	0.00	1.83	1.00
Maximum	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00
Sum	78.0	29.5	30.2	26.8	100.3	124.5	18.8	17.8

Count	36	14	14	12	44	56	8	8
Confidence Level (95.0%)	0.26	0.37	0.33	0.43	0.21	0.17	0.45	0.55

A7.2.1 Interpretation

A7.2.1.1 Air quality (N = 36)

With a mean score of 2.17, air quality was perceived as moderately well covered by existing regulations and mitigation rules. The median (2.33) and mode (3.00) suggest that many scorers rated coverage relatively high, though the standard deviation (0.78) and skewness (−0.49) indicate some variability and a slight tendency toward higher-end scores. The range of 2.00 and a minimum score of 1.00 suggest that while some scorers viewed air quality regulations as robust, others perceived gaps, possibly reflecting differences in regional enforcement or the specificity of air quality mitigation rules in farming and land management contexts.

A7.2.1.2 Habitat quality (N = 14)

Habitat quality received the lowest mean score (2.11) among the EIS indicators, with a median and mode of 2.00, indicating a perception of only moderate regulatory coverage. The standard deviation (0.64) and skewness (−0.28) suggest relatively consistent but slightly conservative scoring. The range of 2.00 and minimum of 1.00 point to some concern about insufficient attention to habitat-specific regulations, particularly in areas where biodiversity was perceived as being vulnerable or where land-use pressures were perceived as being high.

A7.2.1.3 Habitat quantity (N = 14)

With a mean of 2.15, habitat quantity was also perceived as moderately covered. The median and mode of 2.00, along with a standard deviation of 0.57, suggest a relatively narrow spread of scoring responses. The slightly positive kurtosis (0.29) and near-zero skewness (−0.02) indicate a fairly normal distribution of scores. These results imply that while regulations exist to protect habitat extent, their coverage of baseline risks of impacts from farming activities may not be comprehensive or uniformly applied across different regions.

A7.2.1.4 Plant health (N = 12)

Plant health had a mean score of 2.24, placing it among the higher-rated EIS indicators. The median (2.33) and mode (2.33) suggest a central tendency toward moderately high coverage. However, the standard deviation (0.68) and skewness (−0.92) indicate a wider spread and a left-skewed distribution, suggesting that while many scorers perceived strong coverage, a subset rated coverage of plant health lower, possibly due to concerns about gaps in pest and disease management or variability in enforcement.

A7.2.1.5 Soil quality (N = 44)

With a mean score of 2.28, soil quality was among the most highly rated EIS for regulatory coverage of baseline risks of impacts from farming activities. The median (2.33) and mode (3.00), along with a standard deviation of 0.70, suggest a generally positive perception, though with some variability. The negative skewness (−0.88) and range of 2.50 indicate that while many scorers viewed soil regulations as strong, a few scorers perceived significant gaps, possibly due to the complexity of soil systems and the indirect nature of some soil-related pollutant pathways.

A7.2.1.6 Water quality (N = 56)

Water quality scored a mean of 2.22, with a median of 2.33 and mode of 2.00, indicating moderate to moderately high perceived coverage. The standard deviation (0.64) and skewness (−0.99) suggest a left-skewed distribution, with most scorers' rating coverage positively. The range of 3.00 and minimum of 0.00 highlight that while many viewed water regulations as effective (e.g., SSAFO, FRW), some scorers perceived there to be notable gaps, possibly due to localised enforcement issues or challenges in addressing diffuse pollution from various sources.

A7.2.1.7 Water quantity/availability (N = 8)

This indicator received the highest mean score (2.35), suggesting strong perceived regulatory coverage. However, the median (2.00) and mode (2.00) contrast with the mean, and the positive skewness (0.60) and low standard deviation (0.54) suggest that a few high scores may have biased the average. The small sample size (N = 8) and confidence interval (±0.45) indicate that this result should be interpreted cautiously. The data suggest that while some scorers perceived strong coverage, perhaps due to established guidelines for obtaining abstraction licenses and water resource management, others believed there were gaps, especially in regulatory coverage of extreme events such as drought or regulatory rules governing over-abstraction.

A7.2.1.8 Wildlife health (N = 8)

Wildlife health scored a mean of 2.23, with a median of 2.25 and mode of 3.00, indicating a generally positive perception of regulatory coverage. However, the standard deviation (0.65) and skewness (−0.68) suggest variability in responses, with some scorer's rating coverage lower. The range of 2.00 and minimum of 1.00 point to concerns about the adequacy of regulatory coverage for the protection for wildlife, particularly in relation to cumulative impacts and emerging threats such as chemical mixtures or habitat fragmentation.

A7.3 ANOVA Results

An analysis of variance (ANOVA) was conducted to assess whether there were statistically significant differences in baseline EIS (under an assumption of regulatory compliance or mitigation measures being implemented on-farm) across the various EIS categories resulting from farming activities.

Table 29 EIS single factor ANOVA (regulatory control)

Summary						
Groups	**Count**	**Sum**	**Mean Score**	**Variance**		
Water quantity/availability	8	16	2.00	0.000		
Air quality	36	73	2.03	0.413		
Soil quality	44	90	2.05	0.475		
Water quality	56	117	2.09	0.356		
Habitat quality	14	29.5	2.11	0.276		
Plant health	12	26	2.17	0.288		
Habitat quantity	14	30.5	2.18	0.331		
Wildlife health	8	18	2.25	0.429		

ANOVA						
Source of Variation	***SS***	***df***	***MS***	***F***	***P-value***	***F crit***
Between Groups	0.67	7	0.10	0.26	0.97	2.06
Within Groups	68.49	184	0.37			
Total	69.17	191				

A7.3.1 Interpretation

The ANOVA results for regulatory control of farming activities across the different EIS indicated that the differences in mean scores between EIS groups were not statistically significant, with an F-statistic of 0.26 and a corresponding p-value of 0.97, which is well above the conventional threshold of 0.05. This suggests that any observed differences in mean scores are likely due to random variation rather than true differences in perception or judgement across scorers. The within-group variance (MS = 0.37) substantially exceeds the between-group variance (MS = 0.10), further supporting the conclusion that group means are statistically similar. Despite some variation in sample sizes and median scores, the overall consistency in variance and low dispersion across groups implies a relatively uniform assessment of environmental indicators among scorers. These findings may reflect a shared perception of environmental conditions or limitations in the sensitivity of the scoring method used.

Table 30 Receptor single factor ANOVA (regulatory control)

Summary						
Groups	**Count**	**Sum**	**Mean Score**	**Variance**		
Soil structure	15	27.5	1.83	0.35		
Soil organisms	9	17.5	1.94	0.59		

All soil	21	41.5	1.98	0.44		
Atmosphere	31	61.5	1.98	0.44		
Livestock	2	4	2.00	0.00		
All waterbodies	54	114	2.11	0.35		
Soil health	13	27.5	2.12	0.42		
All plants	11	23.5	2.14	0.15		
Native plants	12	26	2.17	0.29		
Wildlife	16	35	2.19	0.33		
Crops	5	11.5	2.30	0.70		
Rivers/streams	3	7	2.33	0.33		
ANOVA						
Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	2.37	11	0.22	0.57	0.85	1.84
Within Groups	68.06	180	0.38			
Total	70.44	191				

Table 31 Pollutant single factor ANOVA (regulatory control)

Summary						

Groups	Count	Sum	Mean Score	Variance		
Sediment	16	29.0	1.81	0.30		
CO2	14	26.5	1.89	0.62		
Phosphorus	26	50.0	1.92	0.47		
Carbon Monoxide	2	4.0	2.00	2.00		
PM2.5	6	12.0	2.00	1.20		
Nitrates	31	63.0	2.03	0.37		
Soil metal concentrations	11	23.5	2.14	0.30		
PM10	7	15.0	2.14	0.81		
NOx	6	13.0	2.17	0.97		
Methane	11	24.0	2.18	0.16		
NH3	16	35.5	2.22	0.30		
Other (specify)	13	31.0	2.38	0.21		
16PAH	4	11.0	2.75	0.25		
Herbicides	4	11.0	2.75	0.08		
Pesticides	6	16.5	2.75	0.18		
ANOVA						
Source of Variation	***SS***	***df***	***MS***	***F***	***P-value***	***F crit***
Between Groups	10.26	14	0.733	1.74	0.05	1.75

Within Groups	66.65	158	0.422			
Total	**76.91**	**172**				

Table 32 Source single factor ANOVA (regulatory control)

Summary						
Groups	**Count**	**Sum**	**Mean Score**	**Variance**		
Dairy	4	6.0	1.50	0.33		
Grass production	13	22.5	1.73	0.78		
Conventional arable production	4	7.0	1.75	0.25		
Pigs	4	7.0	1.75	0.25		
Arable production	25	46.0	1.84	0.54		
Infrastructure	15	30.0	2.00	0.46		
Machinery	3	6.0	2.00	1.00		
Transport	3	6.0	2.00	1.00		
All land management	16	33.0	2.06	0.40		
All ruminant livestock	11	23.5	2.14	0.30		
Poultry	7	15.0	2.14	0.14		
All livestock	17	37.0	2.18	0.25		

Public service provision	5	11.5	2.30	0.45		
Timber production	2	5.0	2.50	0.50		
Non-ruminant livestock	5	13.0	2.60	0.30		
Chemical	3	8.0	2.67	0.33		
Chemical use	4	11.0	2.75	0.25		
Other (specify)	2	5.5	2.75	0.13		
ANOVA						
Source of Variation	***SS***	***df***	***MS***	***F***	***P-value***	***F crit***
Between Groups	11.14	18	0.62	1.43	0.13	1.69
Within Groups	54.02	125	0.43			
Total	**65.16**	**143**				

Table 33 EIS single factor ANOVA (regulatory coverage)

Summary						
Groups	**Count**	**Sum**	**Mean Score**	**Variance**		
Habitat quality	14	29.5	2.11	0.41		
Habitat quantity	14	30.2	2.15	0.32		
Air quality	36	78.0	2.17	0.61		

Water quality	56	124.5	2.22	0.41		
Wildlife health	8	17.8	2.23	0.43		
Plant health	12	26.8	2.24	0.46		
Soil quality	44	100.3	2.28	0.49		
Water quantity/availability	8	18.8	2.35	0.29		
ANOVA						
Source of Variation	***SS***	***df***	***MS***	***F***	***P-value***	***F crit***
Between Groups	0.65	7	0.09	0.20	0.98	2.06
Within Groups	84.61	184	0.46			
Total	**85.26**	**191**				

A7.3.2 Interpretation

Similar to the ANOVA for regulatory control, the ANOVA indicated no statistically significant differences between EIS categories. The ANOVA yielded an F-value of 0.20, substantially below the critical value of 2.06, and a high p-value of 0.98, indicating that observed differences in mean scores are likely due to random variation rather than systematic differences in scorers' perceptions of regulatory coverage of farming activities. These findings suggest that regulatory coverage within EIS groups is relatively uniform across EIS groups, with no single EIS receiving significantly more or less attention. The low between-groups MS relative to within-groups MS indicates that most variation in scores is due to differences within categories rather than between them.

Table 34 Receptor single factor ANOVA (regulatory coverage)

Summary						

Groups	Count	Sum	Mean Score	Variance		
All soil	21	42.3	2.02	0.44		
Soil structure	15	30.5	2.03	0.49		
All plants	11	23.2	2.11	0.48		
Wildlife	16	34.3	2.15	0.32		
Atmosphere	31	66.7	2.15	0.63		
All waterbodies	54	120.8	2.24	0.42		
Native plants	12	27.0	2.25	0.45		
Soil organisms	9	20.5	2.28	0.87		
Livestock	2	4.8	2.42	0.35		
Soil health	13	31.5	2.42	0.51		
Crops	5	12.5	2.50	0.60		
Rivers/streams	3	8.0	2.67	0.33		
ANOVA						
Source of Variation	***SS***	***df***	***MS***	***F***	***P-value***	***F crit***
Between Groups	4.05	14	0.29	0.59	0.87	1.75
Within Groups	87.70	180	0.49			
Total	**91.75**	**194**				

Table 35 Pollutant single factor ANOVA (regulatory coverage)

Summary						
Groups	**Count**	**Sum**	**Mean Score**	**Variance**		
Sediment	16	31.3	1.96	0.39		
Carbon Monoxide	2	4.0	2.00	2.00		
NOx	6	12.0	2.00	1.20		
PM2.5	6	12.2	2.03	1.14		
CO2	14	28.8	2.06	0.79		
Nitrates	31	66.8	2.16	0.53		
Phosphorus	26	57.2	2.20	0.68		
PM10	7	15.5	2.21	0.75		
Methane	11	24.7	2.24	0.44		
NH3	16	38.3	2.40	0.41		
Other (specify)	13	32.0	2.46	0.29		
Soil metal concentrations	11	27.5	2.50	0.37		
Pesticides	6	16.2	2.69	0.16		
Herbicides	4	10.8	2.71	0.04		
16PAH	4	11.3	2.83	0.11		
ANOVA						

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	8.01	14	0.57	1.05	0.41	1.75
Within Groups	86.35	158	0.55			
Total	94.37	172				

Table 36 Source single factor ANOVA (regulatory coverage)

Summary						
Groups	**Count**	**Sum**	**Mean Score**	**Variance**		
Dairy	4	6.3	1.58	0.47		
Transport	3	5.3	1.78	0.48		
Pigs	4	7.3	1.83	0.33		
Conventional arable production	4	7.5	1.88	0.25		
Machinery	3	5.7	1.89	0.59		
Grass production	13	25.0	1.92	1.08		
Arable production	25	51.7	2.07	0.71		
All ruminant livestock	11	23.3	2.12	0.51		
Infrastructure	15	32.0	2.13	0.54		
All land management	16	35.2	2.20	0.45		

All livestock	17	38.5	2.26	0.24		
Poultry	7	16.8	2.40	0.16		
Timber production	2	4.8	2.42	0.68		
Public service provision	5	13.0	2.60	0.40		
Chemical use	4	10.7	2.67	0.22		
Non-ruminant livestock	5	13.8	2.77	0.11		
Chemical	3	8.3	2.78	0.15		
Other (specify)	2	5.7	2.83	0.06		
ANOVA						
Source of Variation	***SS***	***df***	***MS***	***F***	***P-value***	***F crit***
Between Groups	10.36	18	0.58	1.14	0.33	1.69
Within Groups	63.30	125	0.51			
Total	**73.65**	**143**				

Annex 8 Results from the combined assessment of both tasks

The tables below present the combined outputs of the analysis of baseline risks of impact, regulatory control and coverage (regulatory effectiveness) and scorer certainty. The flags and coloured circles provide a visual representation of the scores as follows: for impact magnitude (white circle = score ≥ 0, green flag = score < 0 and ≥ -1, amber flag = score < -1 and ≥ -2, red flag = score < -2 and = -3); for certainty score (white circle = score ≤ 0.5, red circle = score > 0.5 and ≤ 1, amber circle = score > 1 and ≤ 2, green circle = score > 2 and ≤ 3); and for regulatory control and weighted coverage, colour coding represents score levels from red = 0 through to green = 3. These results can also be found in Supplementary Annex A.

Table 37 Baseline risk of impact, regulatory effectiveness and certainty scores for air quality

EIS and Farming/Land Management Activity	Baseline Impact Score (Magnitude)	Certainty Score	Regulatory Control	Source Coverage	Pathway Coverage	Receptor Coverage	Weighted Coverage Score
Air Quality							
Anaerobic digestion	-1	1	2.0	2.0	2.0	2.0	2.0
Burning of crop residues	-0.5	1	2.5	3.0	3.0	3.0	3.0
Burning of grassland	-0.5	1	2.0	3.0	3.0	3.0	3.0
Burning of heather, rough grass, bracken, gorse or vaccinium	-2	3	1.0	1.0	1.0	1.0	1.0
Composting - aerobic	-1	2	2.5	3.0	3.0	2.0	2.7
Construction of farm buildings, tracks, yards and plant protection product loading areas.	-1	1	2.0	2.0	2.0	2.0	2.0
Cultivation around in-field trees	-2	1	2.0	3.0	2.0	2.0	2.3
Disposal of plastic wrap	-2	1.5	2.0	2.5	2.5	2.0	2.3
Feeding of non-ruminant livestock	-2	2	3.0	3.0	3.0	3.0	3.0
Feeding of ruminant livestock	-2	2	2.0	1.0	1.0	1.0	1.0
Heating intensive livestock housing	-3	2	2.0	2.0	2.0	2.0	2.0
Housing of Intensive poultry	-2	2	2.0	2.5	3.0	3.0	2.8
Housing of non-ruminant livestock	-2	2	2.0	2.0	2.0	2.0	2.0
Housing of ruminant livestock	-2	2	2.0	2.5	2.5	2.5	2.5
Keeping of non-ruminant livestock (grazing)	-2	2	2.0	2.5	2.5	2.5	2.5
Keeping of poultry (Free range)	-2	2	2.0	3.0	2.5	2.0	2.5
Keeping of ruminant livestock (grazing)	-2	2	2.0	2.0	2.0	2.0	2.0
Machinery use for transportation (off-farm)	-1	1	1.0	1.0	1.0	1.0	1.0
Machinery use for transportation (on-farm)	-1	1.5	1.0	1.5	1.0	1.0	1.2
Management of poultry litter	-1	1	3.0	3.0	3.0	3.0	3.0
Milking	-1	1	1.0	1.0	1.0	1.0	1.0
Movement of animals (within farm)	-2	2	2.0	1.0	1.5	1.5	1.3
Ploughing	-2	2	1.0	1.0	1.0	1.0	1.0
Separation of slurry	-1	1	2.0	3.0	3.0	3.0	3.0
Spreading of digestate	-1	1	1.0	1.0	1.0	1.0	1.0
Spreading of manufactured fertiliser	-1	2	2.0	1.0	1.0	1.0	1.0
Spreading of manure	-1	3	2.0	2.5	2.5	2.0	2.3
Spreading of slurry	-2	2	2.0	2.5	2.5	2.0	2.3
Spreading of treated sewage sludge	-1	1	2.0	3.0	3.0	2.5	2.8
Stationary combustion	-1	1	3.0	3.0	3.0	3.0	3.0
Storage of digestate	-2	1	3.0	3.0	3.0	3.0	3.0
Storage of manure	-1	2	2.0	3.0	2.0	2.0	2.3
Storage of slurry	-2	2	3.0	3.0	3.0	3.0	3.0
Transport of animals (off farm)	-1	2	1.0	1.0	1.0	1.0	1.0
Waste burning in the open (non-plant material)	-2	1	3.0	3.0	3.0	3.0	3.0
Waste incineration	-1	1	3.0	3.0	3.0	3.0	3.0

Table 38 Baseline risk of impact, regulatory effectiveness and certainty scores for habitat quality

EIS and Farming/Land Management Activity	Baseline Impact Score (Magnitude)	Certainty Score	Regulatory Control	Source Coverage	Pathway Coverage	Receptor Coverage	Weighted Coverage Score
Habitat quality							
Build boundary features (walls, stone banks and earth banks)	-1	3	2.0	2.0	2.0	2.0	2.0
Controlled waste	-1	1	3.0	3.0	3.0	3.0	3.0
Hedgerow cutting	-1	2	2.0	2.0	2.0	2.0	2.0
Large pest control (e.g. shooting, poison, traps)	-2	1.5	2.0	2.0	1.5	2.0	1.8
Management of poultry litter	-1	1	3.0	3.0	3.0	3.0	3.0
Modification of ponds, rivers and streams	-1	2	2.0	3.0	2.0	1.0	2.0
Protection of historic environment or features	0	1	1.5	2.0	1.5	1.5	1.7
Removal of earth and stone boundaries	-1.5	1.5	2.5	2.5	2.5	2.0	2.3
Removal of vegetation	-1	3	2.5	3.0	2.5	2.5	2.7
Spreading of digestate	-1	1	1.0	1.0	1.0	1.0	1.0
Spreading of manufactured fertiliser	-1	2	2.0	1.0	1.0	1.0	1.0
Spreading of treated sewage sludge	-1	1	2.0	3.0	3.0	2.5	2.8
Tree felling	-1.5	0.5	2.0	2.0	2.0	1.5	1.8
Use of waste in construction (on-farm)	-1	1	2.0	2.5	2.5	2.0	2.3

Table 39 Baseline risk of impact, regulatory effectiveness and certainty scores for habitat quantity

EIS and Farming/Land Management Activity	Baseline Impact Score (Magnitude)	Certainty Score	Regulatory Control	Source Coverage	Pathway Coverage	Receptor Coverage	Weighted Coverage Score
Habitat quantity							
Build boundary features (walls, stone banks and earth banks)	-1	3	2.0	2.0	2.0	2.0	2.0
Burning of heather, rough grass, bracken, gorse or vaccinium	-2	3	1.0	1.0	1.0	1.0	1.0
Construction of farm buildings, tracks, yards and plant protection product loading areas.	-1	1	2.0	2.0	2.0	2.0	2.0
Cultivation of semi-natural habitat or uncultivated land	-2.5	2.5	2.5	3.0	2.0	2.0	2.3
Hedgerow cutting	-1	2	2.0	2.0	2.0	2.0	2.0
Land drainage	-2	2.5	2.0	3.0	2.0	1.5	2.2
Maintaining public rights of way	-1	3	3.0	3.0	3.0	3.0	3.0
Modification of ponds, rivers and streams	-1	2	2.0	3.0	2.0	1.0	2.0
Open access land	-0.5	1	1.5	1.5	1.5	1.5	1.5
Planting native trees	-1	2	3.0	3.0	3.0	3.0	3.0
Planting non-native trees	-2	2	3.0	3.0	3.0	3.0	3.0
Removal of earth and stone boundaries	-1.5	1.5	2.5	2.5	2.5	2.0	2.3
Removal of hedgerows	-2	1	2.0	2.0	2.0	2.0	2.0
Tree felling	-1.5	0.5	2.0	2.0	2.0	1.5	1.8

Table 40 Baseline Risk of Impact, Regulatory Effectiveness and Certainty Scores for Plant Health

EIS and Farming/Land Management Activity	Baseline Impact Score (Magnitude)	Certainty Score	Regulatory Control	Source Coverage	Pathway Coverage	Receptor Coverage	Weighted Coverage Score
Plant health							
Anaerobic digestion	-1	1	2.0	2.0	2.0	2.0	2.0
Composting - aerobic	-1	2	2.5	3.0	3.0	2.0	2.7
Plant protection products application and handling	-2	2	2.5	2.5	2.5	2.5	2.5
Spreading of digestate	-1	1	1.0	1.0	1.0	1.0	1.0
Spreading of manufactured fertiliser	-1	2	2.0	1.0	1.0	1.0	1.0
Spreading of manure	-1	3	2.0	2.5	2.5	2.0	2.3
Spreading of plant matter	-1	1	2.0	2.0	2.0	1.5	1.8
Spreading of slurry	-2	2	2.0	2.5	2.5	2.0	2.3
Spreading of treated sewage sludge	-1	1	2.0	3.0	3.0	2.5	2.8
Storage of digestate	-2	1	3.0	3.0	3.0	3.0	3.0
Storage of manure	-1	2	2.0	3.0	2.0	2.0	2.3
Storage of slurry	-2	2	3.0	3.0	3.0	3.0	3.0

Table 41 Baseline risk of impact, regulatory effectiveness and certainty scores for soil quality

EIS and Farming/Land Management Activity	Baseline Impact Score (Magnitude)	Certainty Score	Regulatory Control	Source Coverage	Pathway Coverage	Receptor Coverage	Weighted Coverage Score
Soil quality							
Anaerobic digestion	-1	1	2.0	2.0	2.0	2.0	2.0
Build boundary features (walls, stone banks and earth banks)	-1	3	2.0	2.0	2.0	2.0	2.0
Burning of crop residues	-0.5	1	2.5	3.0	3.0	3.0	3.0
Burning of grassland	-0.5	1	2.0	3.0	3.0	3.0	3.0
Burning of heather, rough grass, bracken, gorse or vaccinium	-2	3	1.0	1.0	1.0	1.0	1.0
Clean and dirty water separation	-1.5	2	1.0	2.5	2.0	2.0	2.2
Composting - aerobic	-1	2	2.5	3.0	3.0	2.0	2.7
Construction of farm buildings, tracks, yards and plant protection product loading areas.	-1	1	2.0	2.0	2.0	2.0	2.0
Controlled waste	-1	1	3.0	3.0	3.0	3.0	3.0
Cultivation around in-field trees	-2	1	2.0	3.0	2.0	2.0	2.3
Cultivation of organic soils	-2.5	1	0.5	0.5	0.5	0.5	0.5
Cultivation of semi-natural habitat or uncultivated land	-2.5	2.5	2.5	3.0	2.0	2.0	2.3
Disposal of plant protection products	-3	2	3.0	3.0	3.0	2.0	2.7
Disposal of plastic wrap	-2	1.5	2.0	2.5	2.5	2.0	2.3
Grass re-seeding	-1	0.5	1.0	1.0	1.0	0.5	0.8
Growing late harvested crops (maize, root crops, vegetables)	-2	2	2.0	3.0	3.0	3.0	3.0
Harvesting	-1	2	1.0	2.0	2.0	2.0	2.0
Incorporation of ash into soil	-1	1	2.0	3.0	3.0	3.0	3.0
Keeping of non-ruminant livestock (grazing)	-2	2	2.0	2.5	2.5	2.5	2.5
Keeping of poultry (Free range)	-2	2	2.0	3.0	2.5	2.0	2.5
Late harvesting of crops	-2	3	2.0	3.0	3.0	3.0	3.0
Late sown cereals	-2	2	1.0	2.0	2.0	2.0	2.0
Machinery use for transportation (on-farm)	-1	1.5	1.0	1.5	1.0	1.0	1.2
Minimum or zero till	-1	2	2.0	2.0	2.0	2.0	2.0
Movement of animals (within farm)	-2	2	2.0	1.0	1.5	1.5	1.3
Outwintering of stock	-2	1	2.0	2.0	2.0	1.0	1.7
Plant protection products application and handling	-2	2	2.5	2.5	2.5	2.5	2.5
Planting native trees	-1	2	3.0	3.0	3.0	3.0	3.0
Planting of monoculture crops	-2	1	2.0	2.0	2.0	1.0	1.7
Ploughing	-2	2	1.0	1.0	1.0	1.0	1.0
Removal of vegetation	-1	3	2.5	3.0	2.5	2.5	2.7
Sheep dipping	-2	2	3.0	3.0	3.0	3.0	3.0
Spreading of digestate	-1	1	1.0	1.0	1.0	1.0	1.0
Spreading of manure	-1	3	2.0	2.5	2.5	2.0	2.3
Spreading of poultry litter ash	-1	1	2.0	3.0	3.0	3.0	3.0
Spreading of slurry	-2	2	2.0	2.5	2.5	2.0	2.3
Spreading of treated sewage sludge	-1	1	2.0	3.0	3.0	2.5	2.8
Storage of digestate	-2	1	3.0	3.0	3.0	3.0	3.0
Storage of fuel oil	-2.5	2	3.0	2.5	2.5	2.0	2.3
Storage of manure	-1	2	2.0	3.0	2.0	2.0	2.3
Storage of slurry	-2	2	3.0	3.0	3.0	3.0	3.0
Use of waste in construction (on-farm)	-1	1	2.0	2.5	2.5	2.0	2.3
Waste burning in the open (non-plant material)	-2	1	3.0	3.0	3.0	3.0	3.0
Waste incineration	-1	1	3.0	3.0	3.0	3.0	3.0

Table 42 Baseline risk of impact, regulatory effectiveness and certainty scores for water quality

EIS and Farming/Land Management Activity	Baseline Impact Score (Magnitude)	Certainty Score	Regulatory Control	Source Coverage	Pathway Coverage	Receptor Coverage	Weighted Coverage Score
Water quality							
Anaerobic digestion	-1	1	2.0	2.0	2.0	2.0	2.0
Build boundary features (walls, stone banks and earth banks)	-1	3	2.0	2.0	2.0	2.0	2.0
Clean and dirty water separation	-1.5	2	1.0	2.5	2.0	2.0	2.2
Cleaning housing areas	-1.5	2	2.0	2.0	2.0	2.0	2.0
Cleaning milking parlour	-2	2	2.0	2.0	2.0	2.0	2.0
Cleaning or washing waste	-2	2	2.0	2.0	2.0	2.0	2.0
Cleaning yards	-1.5	2	2.5	2.0	2.5	2.5	2.3
Composting - aerobic	-1	2	2.5	3.0	3.0	2.0	2.7
Construction of farm buildings, tracks, yards and plant protection product loading areas.	-1	1	2.0	2.0	2.0	2.0	2.0
Controlled waste	-1	1	3.0	3.0	3.0	3.0	3.0
Cultivation of semi-natural habitat or uncultivated land	-2.5	2.5	2.5	3.0	2.0	2.0	2.3
Disposal of dead animals	-2	2	2.5	2.0	2.0	2.0	2.0
Disposal of plant protection products	-3	2	3.0	3.0	3.0	2.0	2.7
Disposal of Vet and medicine waste	-1.5	2	2.0	3.0	2.0	2.0	2.3
Domestic sewage treatment (from farm accommodations)	-2	2	2.0	3.0	3.0	2.0	2.7
Early sown cereals and OSR	2	2.5	1.5	1.5	1.5	1.5	1.5
Feeding of non-ruminant livestock	-2	2	3.0	3.0	3.0	3.0	3.0
Feeding of ruminant livestock	-2	2	2.0	1.0	1.0	1.0	1.0
Growing late harvested crops (maize, root crops, vegetables)	-2	2	2.0	3.0	3.0	3.0	3.0
Harvesting	-1	2	1.0	2.0	2.0	2.0	2.0
Housing of intensive poultry	-2	2	2.0	2.5	3.0	3.0	2.8
Housing of non-ruminant livestock	-2	2	2.0	2.0	2.0	2.0	2.0
Housing of ruminant livestock	-2	2	2.0	2.5	2.5	2.5	2.5
Incorporation of ash into soil	-1	1	2.0	3.0	3.0	3.0	3.0
Keeping of poultry (Free range)	-2	2	2.0	3.0	2.5	2.0	2.5
Keeping of ruminant livestock (grazing)	-2	2	2.0	2.0	2.0	2.0	2.0
Land drainage	-2	2.5	2.0	3.0	2.0	1.5	2.2
Late harvesting of crops	-2	3	2.0	3.0	3.0	3.0	3.0
Late sown cereals	-2	2	1.0	2.0	2.0	2.0	2.0
Management of poultry litter	-1	1	3.0	3.0	3.0	3.0	3.0
Management of waste water	-2.5	2	2.0	2.5	2.0	2.0	2.2
Minimum or zero till	-1	2	2.0	2.0	2.0	2.0	2.0
Modification of ponds, rivers and streams	-1	2	2.0	3.0	2.0	1.0	2.0
Movement of animals (within farm)	-2	2	2.0	1.0	1.5	1.5	1.3
Outwintering of stock	-2	1	2.0	2.0	2.0	1.0	1.7
Plant protection products application and handling	-2	2	2.5	2.5	2.5	2.5	2.5
Planting of monoculture crops	-2	1	2.0	2.0	2.0	1.0	1.7
Ploughing	-2	2	1.0	1.0	1.0	1.0	1.0
Removal of earth and stone boundaries	-1.5	1.5	2.5	2.5	2.5	2.0	2.3
Removal of hedgerows	-2	1	2.0	2.0	2.0	2.0	2.0
Removal of vegetation	-1	3	2.5	3.0	2.5	2.5	2.7
Separation of slurry	-1	1	2.0	3.0	3.0	3.0	3.0
Sheep dipping	-2	2	3.0	3.0	3.0	3.0	3.0
Spreading of digestate	-1	1	1.0	1.0	1.0	1.0	1.0
Spreading of manufactured fertiliser	-1	2	2.0	1.0	1.0	1.0	1.0
Spreading of manure	-1	3	2.0	2.5	2.5	2.0	2.3
Spreading of slurry	-2	2	2.0	2.5	2.5	2.0	2.3
Storage of digestate	-2	1	3.0	3.0	3.0	3.0	3.0
Storage of fuel oil	-2.5	2	3.0	2.5	2.5	2.0	2.3
Storage of manufactured fertiliser	-3	2	0.0	0.0	0.0	0.0	0.0
Storage of manure	-1	2	2.0	3.0	2.0	2.0	2.3
Storage of plant protection products	-3	2	3.0	3.0	3.0	3.0	3.0
Storage of silage	-1	2	2.0	3.0	3.0	3.0	3.0
Storage of slurry	-2	2	3.0	3.0	3.0	3.0	3.0
Tree felling	-1.5	0.5	2.0	2.0	2.0	1.5	1.8
Use of waste in construction (on-farm)	-1	1	2.0	2.5	2.5	2.0	2.3

Table 43 Baseline risk of impact, regulatory effectiveness and certainty scores for water quantity/availability

EIS and Farming/Land Management Activity	Baseline Impact Score (Magnitude)	Certainty Score	Regulatory Control	Source Coverage	Pathway Coverage	Receptor Coverage	Weighted Coverage Score
Water quantity/availability							
Cleaning housing areas	-1.5	2	2.0	2.0	2.0	2.0	2.0
Cleaning milking parlour	-2	2	2.0	2.0	2.0	2.0	2.0
Growing late harvested crops (maize, root crops, vegetables)	-2	2	2.0	3.0	3.0	3.0	3.0
Impoundment of water	-2	0	2.0	3.0	3.0	3.0	3.0
Minimum or zero till	-1	2	2.0	2.0	2.0	2.0	2.0
Storage of silage	-1	2	2.0	3.0	3.0	3.0	3.0
Tree felling	-1.5	0.5	2.0	2.0	2.0	1.5	1.8
Water abstraction for irrigation or livestock	-2	1.5	2.0	2.0	2.0	2.0	2.0

Table 44 Baseline risk of impact, regulatory effectiveness and certainty scores for wildlife health

EIS and Farming/Land Management Activity	Baseline Impact Score (Magnitude)	Certainty Score	Regulatory Control	Source Coverage	Pathway Coverage	Receptor Coverage	Weighted Coverage Score
Wildlife health							
Burning of heather, rough grass, bracken, gorse or vaccinium	-2	3	1.0	1.0	1.0	1.0	1.0
Disposal of dead animals	-2	2	2.5	2.0	2.0	2.0	2.0
Disposal of Vet and medicine waste	-1.5	2	2.0	3.0	2.0	2.0	2.3
Land drainage	-2	2.5	2.0	3.0	2.0	1.5	2.2
Large pest control (e.g. shooting, poison, traps)	-2	1.5	2.0	2.0	1.5	2.0	1.8
Plant protection products application and handling	-2	2	2.5	2.5	2.5	2.5	2.5
Planting native trees	-1	2	3.0	3.0	3.0	3.0	3.0
Planting non-native trees	-2	2	3.0	3.0	3.0	3.0	3.0

Annex 9 Visualisations

ICF created a dashboard to provide an overview of the findings of the project. It contains visualisation of interactive maps, charts, and tables to analyse impacts by region, farm type, and regulation type. There are also filters to focus on specific environmental impacted states or regulatory frameworks for deeper insights.

There are three pages included in these visualisations:

Page 1: Farms in England - summarises the number and size of farms in England. It compares the distribution of different farm types across regions of England, using either the number of farm holdings or total farmed area. This analysis provides the context for exploring baseline environmental impacts and the effectiveness of farming regulations.

Page 2: Baseline risks of impact - shows the impacts that farming activities would have on the natural environment, assuming no regulations or wider legislation were in place to mitigate them. This allows the reader to see the relative environmental impact on each impact state of a range of farm practices across different farm types.

Page 3: Effect of regulation - shows the extent of the effect that farming regulations and wider legislation would have on the natural environment if they were universally complied with and enforced.

Link to the dashboard hosted in ICF server: OEP 006 - INS305-03 - Dashboard - Power BI

Annex 10 List of regulations assessed

Regulation Name	Classification
Agriculture Act 1970	Targeted
Air Quality Standards Regulations 2020	Overarching
Agriculture Act 1993	Targeted
Clean Air Act 1993	Overarching[37]
Agriculture, Animals, Environment and Food etc. (Miscellaneous amendments) Order 2012	Overarching
Climate Change Act 2008	Overarching
Ancient Monuments and Archaeological Areas Act 1979	Targeted
Contaminated Land Regulations 2006	Targeted
Animal By-Products (Enforcement) (England) Regulations 2013	Targeted
Flood and Water Management Act 2010	Overarching
Animal Feed (Composition, Marketing and Use) (England) Regulations 2015	Targeted
Highways Act 1980	Targeted
Animal Feed (Hygiene, Sampling etc. and Enforcement) (England) Regulations 2015	Targeted
Water Environment (Water Framework Directive) (England and Wales) Regulations 2017	Overarching

[37] Although the Act provides a broad legislative framework for air-quality management across multiple sectors, it also contains targeted controls relevant to farming where agricultural activities produce smoke or other emissions.

Animal Health Act 1981	Targeted
Animal Welfare Act 2006	Targeted
Animals (Post-Import Control) Order 1995	Targeted
Animals and Animal Products (Examination for Residues and Maximum Residue Limits) (England and Scotland) Regulations 2015	Targeted
Avian Influenza (Preventive Measures) (England) Regulations 2006	Targeted
Avian Influenza (Vaccination) (England) Regulations 2006/2703	Targeted
Avian Influenza and Influenza of Avian Origin in Mammals (England) (No.2) Order 2006	Targeted
Cattle Identification Regulations 2007	Targeted
Commission delegated regulation (EU) 2019/2035	Targeted
Commission regulation (EC) 1505/2006	Targeted
Commission regulation (EC) 1082/2003	Targeted
Common Agricultural Policy (Controls and Enforcement, Cross Compliance, Scrutiny of Transactions and Appeals) Regulations 2014	Overarching[38]
Conservation of Habitats and Species Regulations 2017	Overarching[39]

[38] Note: These Regulations establish an overarching framework for CAP conditionality while also introducing targeted compliance measures that directly affect farm management and payments.

[39] Note: The Regulations form an overarching regime for protecting habitats and species, with additional targeted requirements for farming activities near sensitive or designated sites.

Control of Pesticides Regulations 1986	Targeted
Control of Pollution Act 1974	Overarching
Countryside and Rights of Way Act 2006	Overarching
Countryside Stewardship Regulations 2000	Overarching
Crop Residues (Burning) Regulations 1993	Targeted
Dairy Products (Hygiene) Regulations 1995	Targeted
Deer Act 1991	Targeted
Disease Control (England) Order 2003	Targeted
Environment Act 2021	Overarching
Environmental Damage (Prevention and Remediation) (England) (Amendment) Regulations 2017	Overarching
Environmental Impact Assessment (Agriculture) (England) Regulations 2006	Overarching
Environmental Impact Assessment (Forestry) (England and Wales) Regulations 1999	Targeted[40]
Environmental Permitting Regulations (England and Wales) 2010	Targeted[41]
Environmental Permitting Regulations (England and Wales) 2016	Targeted

[40] Note: Although focused on targeted consent for certain forestry activities, the Regulations sit within a broader assessment framework relevant where farm land-use changes involve woodland

[41] Note: While both Environmental Permitting Regulations (England and Wales) 2010 and 2016 are expansive and consolidate various separate environmental consenting areas (e.g., waste, water, pollution) into one overarching scope and framework, they also include a mix of targeted controls.

Environmental Protection Act 1990	Overarching
Food and Environment Protection Act 1985	Overarching
Forest Reproductive Material (Great Britain) Regulations 2002	Targeted
Forestry Act 1967	Targeted
Hazardous Waste (England and Wales) Regulations 2005	Targeted
Heather and Grass Burning Regulations 2007	Targeted
Hedgerow Regulations 1997	Targeted
Hill Farming Act 1946	Targeted
Invasive Non-native Species (Amendment etc.) (EU Exit) Regulations 2019	Targeted
Land drainage Act 1991	Overarching[42]
Management of Hedgerows (England) Regulations 2024	Targeted
Moorland (Livestock Extensification) Regulations 1995	Targeted
Movement of Animals (Restrictions) (England) Order 2002/3229	Targeted
Natural Environment and Rural Communities Act 2006	Overarching
Nitrate Pollution Prevention Regulations 2015 (NVZ)	Targeted
Organic Farming Regulations 1999	Targeted

[42] Note: The Act provides a wide-ranging framework for land drainage and flood-risk management but includes targeted consent requirements for works affecting agricultural watercourses.

Persistent Organic Pollutants Regulations 2007	Targeted
Plant Health (Export Certification) (Forestry) (Great Britain) Order 2004	Targeted
Plant Protection Products (Sustainable Use) Regulations 2012	Targeted
Plant Protection Products Regulations 2011	Targeted
Plant Varieties Act 1997	Targeted
Pollution Prevention and Control Act 1999	Overarching
Protection of Badgers Act 1992	Targeted
Reduction and Prevention of Agricultural Diffuse Pollution (England) Regulations 2018 (FRW)	Targeted
Reg No. 767/2009	Targeted
Reg No. 1760/2000	Targeted
Riding Establishments Act 1970	Targeted
Sludge (Use in Agriculture) (Amendment) Regulations 1990	Targeted
The Bluetongue (Amendment) Regulations 2012	Targeted
The Groundwater (England and Wales) Regulations 2009	
Town and Country Planning Act 1990	Overarching
Transport of Animals (Cleansing and Disinfection) (England) (No.3) Order 2003	Targeted
Veterinary Medicines Regulations 2013	Targeted
Waste Management (England and Wales) Regulations 2006	Targeted
Water Resources (Control of Pollution) (Silage, Slurry and Agricultural Fuel Oil) (England) Regulations 2010 (SSAFO)	Targeted

Water Resources Act 1991	Overarching
Weeds Act 1959	Targeted
Welfare of Farmed Animals (England) Regulations 2007	Targeted
Wildlife and Countryside Act 1981	Overarching

Annex 11 Summary of compliance and enforcement for shortlisted regulations

This annex provides a summary of shortlisted regulations used in this project (Table 45).

Table 45 Summary of compliance and enforcement for shortlisted regulations

Regulation (overarching marked *)	Purpose & rules	Regulators responsible / roles	Approach to monitoring compliance	Coverage & compliance (where known)	Approach to enforcement	Enforcement activities (where known)
Climate Change Act 2008*	Sets UK-wide GHG reduction targets and carbon budgets; adaptation duties	EA (environmental), others for specific parts	No routine farm-level monitoring; overarching framework	No farm-level compliance data; 308 actions (spreading to land) reported, 66% rectified (not regulation-specific)	N/A (overarching)	N/A
Common Agricultural Policy (Controls and Enforcement, Cross Compliance, Scrutiny of Transactions and Appeals) Regulations 2014*	Implements CAP controls, cross-compliance, payment scrutiny	RPA	Referral-based, site visits, desk reviews	1,754 breaches (2023); 177 advisories, 253 warning letters, payment reductions; 60 visits from 126 referrals	Payment reductions, warnings	Advisories, warnings, payment reductions

Conservation of Habitats and Species Regulations 2017*	Protects designated habitats/species of European importance	NE, EA, RPA	Investigative, complaint-led, desk-based, some site visits	28 referrals (SMR 2), 51 (SMR 3) in 2023, 0% failure to comply; NE: 98 farm investigations (2020–24), 19 offences	Warnings, sanctions, prosecution	Written/verbal warnings, RES, monetary penalties, prosecution
Environment Act 2021 *	Legal framework for environmental governance, targets for air, water, biodiversity	EA, RPA, Local Authorities	No routine farm-level monitoring; sets national targets	No farm-level compliance data; 839 actions (waste/spreading to land), 74%/71% rectified	N/A (overarching)	N/A
Environmental Impact Assessment (Agriculture) (England) Regulations 2006*	Requires EIA for certain agricultural projects	NE, RPA	Desk-based, complaint/application-led, some site visits	Since 2018: 60 screening applications, 6 environmental statements, 19 cases of unconsented cultivation; 6.35% of desk-based inspections led to enforcement	Warnings, enforcement notices, RES, prosecution	Written/verbal warnings, stop/remediation notices, monetary penalties, prosecution
Water Environment (Water Framework	Implements WFD for water quality	EA	No systematic farm-level	531 actions (waste, not regulation-	N/A	N/A

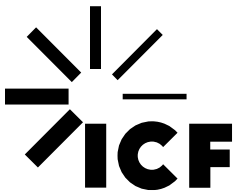
Directive) (England and Wales) Regulations 2017 *			compliance regime	specific), 74% rectified		
Wildlife and Countryside Act 1981*	Protects habitats, species, SSSIs	NE, EA, RPA	Complaint-driven, desk-based, some site visits	NE: 98 farm investigations (2020–24), 19 offences; RPA: 180 referrals (2023), most resolved with warnings	Warnings, sanctions, prosecution	Written/verbal warnings, RES, prosecution
Environmental Permitting Regulations (England and Wales) 2010/2016	Pollution control (air, water, soil); permits for installations	EA	Risk-based, site visits, remote sensing, routine every 2–4 years	8,134 actions (2022–24), 66% rectified; >80% compliance for BAT	Advice, cautions, remediation, prosecution	Advice/guidance, formal cautions, remediation notices, prosecution
Reduction and Prevention of Agricultural Diffuse Pollution (England) Regulations 2018 (FRfW)	Prevents diffuse pollution from agriculture	EA, RPA	Risk-based, site visits, remote sensing, routine every 2–4 years	7,943 EA inspections (2022–24), 53% compliance; RPA: 847 (SMR 1), 978 (GAEC 1), 1,039 (GAEC 5) referrals; 13,713 actions, 66% rectified	Advice, cautions, prosecution	Advice/guidance, formal cautions, prosecution
Nitrate Pollution Prevention	Limits nitrogen application in NVZs	EA	Risk-based, 5% of derogated farms	4,353 EA inspections (2022–24), 57%	Advice, cautions, prosecution	Advice/guidance, formal cautions, prosecution

Regulations 2015 (NVZ)			inspected annually	compliance; 11,322 actions, 66% rectified		
Water Resources (Control of Pollution) (Silage, Slurry and Agricultural Fuel Oil) (England) Regulations 2010 (SSAFO)	Storage requirements for silage, slurry, oil	EA	Risk-based, site visits, routine every 2–4 years	4,804 slurry, 6,067 silage, 6,789 oil inspections; 72–87% compliance; 11,283 actions, 66% rectified	Advice, cautions, prosecution	Advice/guidance, formal cautions, prosecution
Hazardous Waste (England and Wales) Regulations 2005	Controls movement/disposal of hazardous waste	EA	Risk-based, site visits	9,176 farms inspected (all regs); 531 actions (waste), 74% rectified	Advice, cautions, prosecution	Advice/guidance, formal cautions, prosecution
Plant Protection Products (Sustainable Use) Regulations 2012	Safe use, storage, disposal of pesticides	EA, HSE	Risk-based, site visits, some remote	262 actions (2022–24), 66% rectified	Advice, improvement notices, prosecution	Advice/guidance, improvement notices, prosecution
The Dairy Products (Hygiene) Regulations 1995	Hygiene standards for milk/dairy	Local Authorities, EA	Local authority-led, limited EA role	531 actions (waste, not regulation-specific), 74% rectified	Inspections, warnings, penalties	Inspections, warnings, penalties

The Groundwater (England and Wales) Regulations 2009	Prevents groundwater pollution	EA	Risk-based, site visits	36 actions (fertiliser store), 53% rectified	Advice, cautions, prosecution	Advice/guidance, formal cautions, prosecution
Heather and Grass Burning Regulations 2007	Controls burning of heather/grass	NE, RPA	Investigative, complaint-led	RPA: 786 referrals (2023), 0% failure to comply	Warnings, payment reductions	Written warnings, payment reductions
Management of Hedgerows (England) Regulations 2024	Protects hedgerows on agricultural land	RPA	Referral-based, desk reviews, site visits	60 visits (2024), 78 breaches	Advisories, warnings, payment reductions	Advisories, warnings, payment reductions
Transport of Animals (Cleansing and Disinfection) (England) (No.3) Order 2003	Cleansing/disinfection of animal transport	Local Authorities	Not routinely monitored	No specific compliance data	Inspections, warnings, penalties	Inspections, warnings, penalties
Sludge (Use in Agriculture) (Amendment) Regulations 1990	Controls use of sewage sludge on land	EA	Risk-based, site visits	2,644 actions (2022–24), 66% rectified	Advice, cautions, prosecution	Advice/guidance, formal cautions, prosecution

Notes:

- Overarching regulations are marked with an asterisk and are discussed separately in the narrative.
- Where compliance data is not regulation-specific, this is noted.
- Referral, inspection, and enforcement numbers are for the most recent period available (typically Jan 2022–Sept 2024 or 2023).
- “Actions” refers to all enforcement actions, including advice, warnings, and penalties.

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