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Rewarding Farm-level Environmental Outcomes – an Indicator Based Approach

Récompenser les résultats environnementaux au niveau de l'exploitation agricole – une approche fondée sur des indicateurs

Belohnung für Umweltleistungen auf Betriebsebene – ein indikatorbasierter Ansatz

Nicolas Lampkin and Jürn Sanders

Introduction

The concept of public money for public goods is often touted as a solution for targeted incentives for environmental services instead of the current distribution of agricultural subsidies but is very difficult to implement in practice. The public goods delivered may be difficult and/or expensive to measure, and their origin, for example with respect to reductions of diffuse pollution of water courses, difficult to attribute. Many support payments for agri-environmental measures are paid on a flat-rate per-hectare basis, even though the actual environmental outcomes on individual farms may be quite different (Pe'er *et al.*, 2019). Contributory factors are: the need to avoid administrative complexity and the associated transaction costs, the reliance on action-based measures, and the income-forgone basis for payment calculations resulting in averages being used to set the same payments for all farmers irrespective of their marginal costs.

This is particularly true for organic farming maintenance support, which, although paid in recognition of the environmental benefits delivered by organic farmers, provides payments that are often differentiated only in the context of broad land use categories such as arable, grassland or fruit production on a national or regional basis (Lampkin *et al.*, 2024a). An in-depth review of the environmental impacts of organic farming (Sanders *et al.*, 2025) found that for many factors, on average, there were environmental benefits compared with non-organic management. However, there was a wide variation in the results from individual studies and farms, with some studies showing much better organic performance and others worse than non-organic. A recent study on the environmental impacts of reaching the EU's 25 per cent of agricultural area target for organic farming found significant trade-offs between different land use types, their environmental improvement potential, and the areas required to meet specific environmental targets (Rey Vicario *et al.*, 2025).

There is also an ongoing issue that organic support payments, calculated on an income-foregone basis, are often reduced due to taking account of premium prices received, even though these may be more a reflection of the return on investments in marketing activities (Lampkin *et al.*, 2024a). As a result, non-organic producers might receive higher payments for undertaking the same measures, as the prices they receive are assumed unchanged. Organic producers feel discriminated against because they are paid less, while non-organic producers often feel that the organic farmers always get special treatment, both situations leading to frictions between farming sectors and neighbouring farms.

> " Il est possible de récompenser des résultats environnementaux au niveau de l'exploitation agricole en utilisant une sélection d'indicateurs et des données administratives (IACS) afin de minimiser les coûts de transaction. "

In order to address these issues, we have attempted to define a concept which captures the environmental outcomes on individual farms, irrespective of whether the farms are organic or non-organic, but in a way that can fully recognise the environmental contribution that organic farmers, with their multi-functional, systems-based approaches, are making (Sanders and Lampkin,2023).

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Our approach differs from other similar concepts in that it is not based on farmers undertaking specific measures (ex ante), but on the scoring of relevant indicators of environmental performance using farm-level data (ex post). In this way, the overall impact of all the production and other activities undertaken on a farm can be captured.

Indicator selection

Our starting point was to identify the policy objectives specified by the German federal government in various regulations, strategies (in particular the Deutsche Nachhaltigkeitsstrategie [German Sustainability Strategy]) and action plans, with respect to climate, water, soil and biodiversity, which are central to debates about the environmental impacts of farming (Lampkin and Sanders, 2023a).

For example, the Groundwater Regulation 2017 specifies that groundwater is to be protected from contamination or other disadvantageous changes to its properties and to be maintained in its natural condition, the assessment being based on the percentage of measurement points that meet specified nutrient and pesticide limits on an ongoing basis. The German Sustainability Strategy sets a target for nitrogen surpluses from the total nitrogen balance for Germany to be less than 70 kg/ha agricultural area. The first case is difficult to translate into meaningful equivalents on an individual farm basis, but the second might be possible, allowing for differences in soil type, climate and production systems. A detailed list of all the public policy objectives and related indicators identified is contained in Lampkin and Sanders (2023a).

The purpose of this exercise was to define the public policy demands that provide a justification for government action and public expenditure. From this we were able to identify a series of statements concerning the contribution that better performing farms (whether organic or not) might make to achieving the policy objectives (Tables 1–5). Although the focus for this was on German policy priorities, a similar approach can be adopted at EU level, or for other national or regional contexts.

Table 1: Key resource issues, desired performance outcomes and short-listed indicators, data sources and threshold levels for soils

Resource issue	Outcome from improved farming practice	Short-listed indicators	Unit	Data source	Level 0	Level 1	Level 2	Level 3
Soil carbon	Maintenance of humus (organic matter) rich soils	Soil organic carbon sampling	% (kg C/kg soil)	Sampling	Not finalised due to indicator limitations (transaction cost, variability, timescales)			
	Positive humus balance	Humus balance	Humus equivalents per ha	Budget, IACS[a] crop areas & farm data	Not finalised due to indicator limitations (interpretability in different soil contexts)			
Soil erosion	Reduction of erosion risk	Universal Soil Loss Equation C-factors[b]	Total factor value	IACS[a] crop areas x technical coefficient	>0.15 GAEC[c] 5,6	>0.10–0.15	0.05–0.10	<0.05
Soil compaction	Reduction of soil compaction	Visual evaluation of soil structure (VESS)	Score	Visual assessment	Not finalised due to indicator limitations (transaction cost)			
Soil contamination	Reduction of contaminants (e.g. heavy metals)	Exclusion[d] of harmful inputs (nutrients, pesticides, sewage sludge, heavy metals)	t/ha farmland	Certified/ regulated farm data	Regulations	0	n/a	n/a
Soil biodiversity	Maintenance or increase of functional and structural biodiversity in soils	Proportion of multi-annual legume/ grass mixtures (proxy)	% of arable area	IACS[a] crop areas	0 GAEC[c] 7,8,9	>5–15	>15–25	>25

[a]Integrated Administration and Control System (administrative) data.
[b]The USLE C-Factor addresses the crop type influence on soil erosion risk. The combined component values generate a total factor value for the farm or crop system.
[c]Good Agricultural and Environmental Condition requirements as defined for the CAP 2023–2027 period.
[d]Exclusion of potentially damaging inputs has been selected as an indicator in preference to percentage reductions. Exclusion is easier to audit and control, and is consistent with pesticide and nitrogen reduction eco-schemes and agri-environment measures implemented in many countries.
Source: Lampkin and Sanders (2023c).

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Table 2: Key resource issues, desired performance outcomes and short-listed indicators, data sources and threshold levels for water

Resource issue	Outcome from improved farming practice	Short-listed indicators	Unit	Data source	Level 0	Level 1	Level 2	Level 3
Surface water eutrophication	Reduction of nitrate and phosphate contamination of surface waters	Exclusion[c] of synthetic nitrogen fertilisers	kg N/ha farmland	Certified/ regulated farm data	Regulations	0	n/a	n/a
		Autumn mineral N sampling	kg N/ha farmland	Sampling	Not finalised due to indicator limitations (transaction costs, sampling date variability)			
Environmental nutrient load	Reduction of nutrient surpluses per ha of agricultural land	Nitrogen surplus	kg N/ha farmland	Budget, IACS[a] & farm data	50–120	35–<50	20–<35	0–<20
		Phosphorus surplus	kg P/ha farmland	Budget, IACS[a] & farm data	L[b] <0 H[b] >0	L[b] 0–5 H[b] −5–0	L[b] >5 H[b] <−5	n/a
Ammonia deposition	Reduction of ammonia emissions	Calculated ammonia emissions	kg NH_3-N/ha farmland	Budget, IACS[a] & farm data	>70	>50–70	25–50	<25
Water quality	Reduction of nutrient loads (see above) Reduction in biocide contamination	Exclusion[c] of synthetic pesticides	kg active ingredient/ha farmland	Certified/ regulated farm data	Regulations	0	n/a	n/a
		Pesticide Load Index	Index	Active substance x load coefficient	Not finalised due to indicator limitations (lack of reliable data in absence of legal reporting requirement)			

[a]Integrated Administration and Control System (administrative) data.

[b]Thresholds based on soil phosphorus indices: L (low) = AB, H (high) = CDE, where high index soils need P reductions, and low index P increases.

[c]Exclusion of potentially damaging inputs has been selected as an indicator in preference to percentage reductions. Exclusion is easier to audit and control, and is consistent with pesticide and nitrogen reduction eco-schemes and agri-environment measures implemented in many countries.

Source: Lampkin and Sanders (2023c).

Table 3: Key resource issues, desired performance outcomes and short-listed indicators, data sources, threshold levels for climate

Resource issue	Outcome from improved farming practice	Short-listed indicators	Unit	Data source	Level 0	Level 1	Level 2	Level 3
Greenhouse gas (GHG) emissions	Reduction in direct and indirect GHG emissions	Calculated GHG emissions	kg CO_2e/ha farmland	Budget, IACS[a] & farm data	>3,000 (average)	>2,000–3,000 (67–100% average)	1,000–2,000 (33–66% average)	<1,000 (<33% average)
		Soil organic carbon	% (kg C/kg soil)	Sampling	Not finalised due to indicator limitations (see Table 1)			
		Humus balance	Humus equivalents per ha	Budget, IACS[a] crop areas & farm data	Not finalised due to indicator limitations (interpretability in different soil contexts)			
		Exclusion of synthetic nitrogen fertilisers	kg N/ha farmland	Certified/ regulated farm data	Regulations	0	n/a	n/a
		Proportion of multi-annual legume/grass mixtures (proxy for soil carbon)	% of arable area	IACS[a] crop areas	0 GAEC[c] 7,8,9	>5–15	>15–25	>25
Ammonia emissions Particulate emissions	Reduction in ammonia emissions[d]	Ruminant livestock density (proxy)	Livestock units (LU)/ha grassland	IACS[a] grass area x LU coefficients	>2.0–2.5 Regulations	>1.4–2.0	0.3–1.4	Level 2 + 200 days grazing
		Calculated ammonia emissions	kg NH_3-N/ha farmland	Budget, IACS[a] & farm data	>70	>50–70	25–50	<25
Pesticide aerosols	Reduction in pesticide use	Exclusion of pesticide use	kg N/ha farmland	Certified/ regulated farm data	Regulations	0	n/a	n/a

[a]Integrated Administration and Control System (administrative) data.

[b]Exclusion of potentially damaging inputs has been selected as an indicator in preference to percentage reductions. Exclusion is easier to audit and control, and is consistent with pesticide and nitrogen reduction eco-schemes and agri-environment measures implemented in many countries.

[c]Good Agricultural and Environmental Condition requirements as defined for the CAP 2023–2027 period.

[d]Ammonia reactions with sulphur in the air are a significant source of particulate emissions.

Source: Lampkin and Sanders (2023c).

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Table 4: Key resource issues, desired performance outcomes and short-listed indicators, data sources & threshold levels for biodiversity (species/habitat diversity and abundance)

Resource issue	Outcome from improved farming practice	Short-listed indicators	Unit	Data source	Level 0	Level 1	Level 2	Level 3
Soil biodiversity	See Table 1 (Soils)	Indicators relevant for all outcomes:						
Species diversity	Maintenance of species, community and biotope diversity	• Species counts	Number	Sampling	Not finalised due to indicator limitations (transaction costs, seasonal variability)			
Endangered species	Reduction of threat to red-list species	• Crop species diversity (proxy)	Shannon Index	IACS[a]	<1.5 GAEC[c] 1,7,9	1.5–2.0	>2.5	Level 2 plus[d]
Agricultural fauna, flora, habitats	Maintenance of Flora, Fauna Habitat Directive species and habitats	• Proportion of landscape elements	% (LE ha/ ha farmland)	IACS[a] + farm datacc	4% GAEC[c] 2,8	>4–7%	>7–10%	>10%
High nature value areas	Management, maintenance of High Nature Value areas	• Proportion of multi-annual herbage legume mixtures (proxy)	% of arable area	IACS[a] crop areas	0 GAEC[c] 7,8,9	>5–15	>15–25	>25
Insect species	Provision & maintenance of insect habitats, biomass, species diversity, red-list species	• Exclusion of synthetic nitrogen use[b]	kg N/ha farmland	Certified/ regulated farm data	Regulations	0	n/a	n/a
Refuges	Increase in proportion of nature and refuge areas	• Exclusion of synthetic pesticide use[b]	kg active ingredient/ha farmland	Certified/ regulated farm data	Regulations	0	n/a	n/a
Ecological focus areas	Provision of ecological focus areas without use of pesticides	• Pesticide Load Index	Index	Active substance x load coefficient	Not finalised due to indicator limitations (lack of reliable data in absence of legal reporting requirement)			
Agri-environment measures	Increase participation in agri-env. Measures	• Participation in biodiversity measures	% of land area or points	IACS[a] or Certification	0–2% GAEC[c] 8	>2–5%	>5–10%	>10%

[a]Integrated Administration and Control System (administrative) data.

[b]Exclusion of potentially damaging inputs has been selected as an indicator in preference to percentage reductions. Exclusion is easier to audit and control, and is consistent with pesticide and nitrogen reduction eco-schemes and agri-environment measures implemented in many countries.

[c]Good Agricultural and Environmental Condition requirements as defined for the CAP 2023–2027 period.

[d]Additional requirements for e.g. spring-sown crops.

Source: Lampkin and Sanders (2023c).

Table 5: Key resource issues, desired performance outcomes and short-listed indicators, data sources and threshold levels for biodiversity (agricultural production)

Resource issue	Outcome from improved farming practice	Short-listed indicators	Unit	Data source	Level 0	Level 1	Level 2	Level 3
Eutrophication	See Table 2 (Water)	See Water						
Crop intensity - monocultures	Reduced parcel size	Parcel size	Av. ha/ parcel[d]	IACS[a]/LPIS[b]	>5–20	3–5	<3	n/a
Fertiliser input intensity	Reduced fertiliser use	Exclusion[c] of synthetic N fertilisers	kg N/ha farmland	Certified/ regulated farm data	Regulations	0	n/a	n/a
Pesticide input intensity	Use of less and lower risk pesticides	Exclusion[c] of pesticide use	kg active ingredient/ha farmland	Certified/ regulated farm data	Regulations	0	n/a	n/a
Livestock production intensity	Reduced livestock production intensity and associated nutrient load	Ruminant livestock density (proxy)	Livestock units (LU)/ha grassland	IACS[a] grass area x LU coefficients	>2.0–2.5, Regulations	>1.4–2.0	0.3–1.4	Level 2+ 200 days grazing
Ammonia emissions	Reduction in ammonia emissions	Calculated ammonia emissions	kg NH_3-N/ ha farmland	Budget, IACS[a] & farm data	>70	>50–70	25–50	<25
Genetic diversity	Protection of natural genetic resources	Exclusion[c] of GMOs[e]	kg GMO-seed/ ha farmland	Certified/ regulated farm data	Regulations	0	n/a	n/a
Rare breeds	Maintenance of rare breeds	Participation in biodiversity measures	% of land area or points	IACS[a] or Certification	0–2% GAEC[c] 8	>2–5%	>5–10%	>10%

[a]Integrated Administration and Control System (administrative) data.

[b]Land Parcel Identification System (administrative) data.

[c]Exclusion of potentially damaging inputs has been selected as an indicator in preference to percentage reductions. Exclusion is easier to audit and control, and is consistent with pesticide and nitrogen reduction eco-schemes and agri-environment measures implemented in many countries.

[d]Parcel boundary length (m/parcel) can also be calculated with LPIS[b] data.

[e]Genetically Modified Organisms – perceived as a threat to natural genetic resources in German nature conservation strategies.

Source: Lampkin and Sanders (2023c).

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In a second step, we looked at a wide range of sustainability assessment tools (sets of indicators embodied in a consistent framework such as SMART or the Public Goods Tool) and the indicators they used, identifying a list of 21 tools and 556 indicators that might be relevant (Thompson *et al.*, 2021). In a process of expert consultations, these were reduced to a 'short' list of indicators that could potentially be used to assess the performance statements identified. These indicators are shown in the third column of Tables 1 to 5. As can be seen, some indicators are relevant for multiple resources and problem issues. Some indicators, such as nutrient balances, explicitly measure the outcome of farmers' practices during the year. Others, such as the proportion of multi-year legume/grass mixtures are more proxy indicators, with important impacts on soil carbon, nitrogen cycling and pollinator abundance.

> "Die Belohnung von Umweltleistungen auf Betriebsebene kann unter Verwendung ausgewählter Indikatoren und Verwaltungsdaten (InVeKoS) erfolgen, um die Transaktionskosten zu minimieren."

The resources and problem issues identified, and the indicators selected, broadly correspond to the OECD agri-environment indicators developed during the 1990s and reported annually (OECD, 2013), although differences arise due to the focus in this study on farm-level rather than national data, as well as on specific regulatory frameworks.

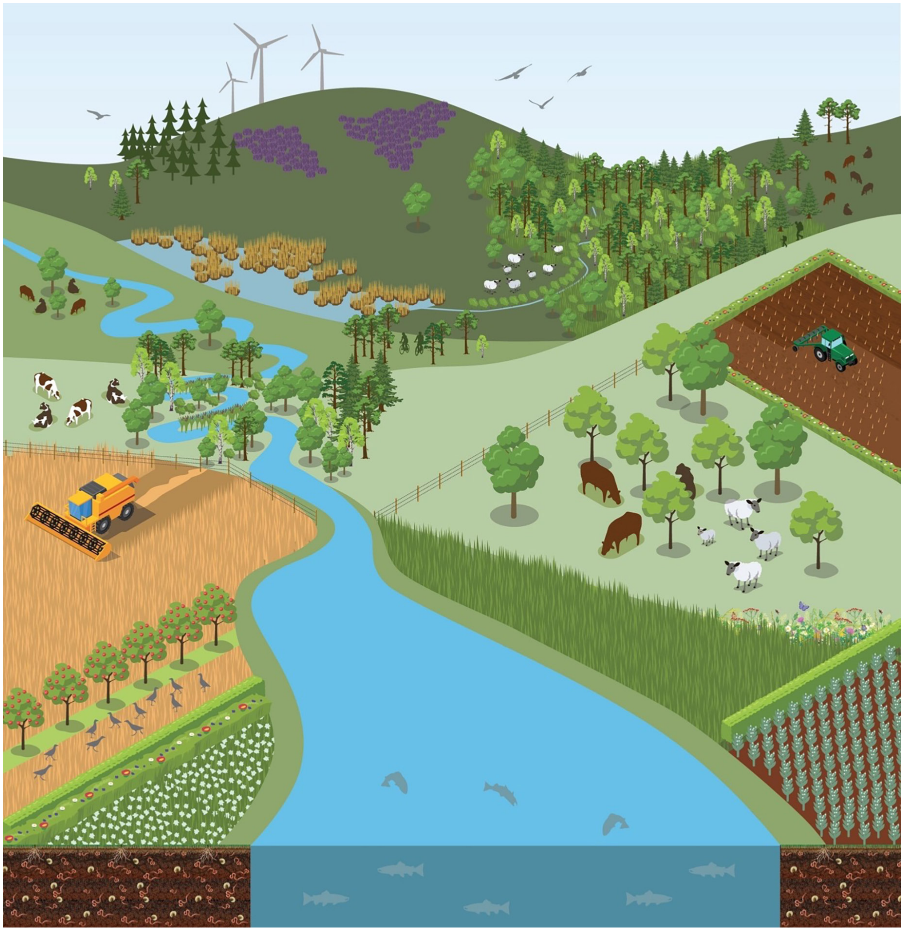
Data sources

For each of the short-listed indicators, an indicator context, methodology, and quality assessment document was

Reduced stocking rates for grazed cattle production reduces methane emissions and supports biodiversity © Phil Sumption.

produced (Lampkin *et al.*, 2024b). The methodology description included the identification of relevant data sources (see Tables 1–5 and Lampkin *et al.*, 2022). Four broad categories of data source were identified:

1. Integrated Administrative and Control System (IACS), Land Parcel Identification System (LPIS), livestock movement and agri-environment scheme participation data collected by support payment administrators in the European Union. Examples include crop species and mixtures, parcel sizes, livestock numbers and areas supported for environmental measures. These data can be used with a range of indicators, for



Diverse agricultural landscapes support multiple environmental outcomes © Nature Scotland.

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example crop species diversity (Shannon Index), small parcel sizes, livestock densities, proportion of landscape elements and proportion of multi-annual herbage legume mixtures. Some indicators, such as the C-Factor from the Universal Soil Loss Equation, can be calculated using IACS data in combination with relevant technical coefficients, which are available for most crops in Germany. As these data are already available to administrators on an individual farm basis, this is likely to be the least costly and preferred data source.

2. Certification (organic or otherwise) or regulation compliance data, for example confirming non-use or reduced use of certain inputs such as nitrogen fertilisers, pesticides, sewage sludge, antimicrobials, GMOs. Extending organic certification procedures to all farms may be a step too far, but increasingly all farms are required to document fertiliser and pesticide use so that these data might be extractable.

3. Calculated balances, for example for nutrients, organic matter (humus) and greenhouse gases/ammonia. These can be calculated from farm data but may require some assumptions to be made about inputs like manures where the nutrient content can vary widely. Data may also be lacking with respect to outputs utilised for other activities within the farm. These indicators may be more susceptible to 'adjustments' to achieve a desired outcome. However, significant investment in IT tools to standardise calculation procedures has been taking place, so that some of the problems may be resolvable.

4. Active sampling – there is a set of indicators, such as mineral nitrogen in soils, soil carbon, soil structure profiles and species counts, that require active sampling. Although some of these processes are increasingly mechanised and automated as the need for samples has become more widespread in the context of agri-environmental measures, the sampling and laboratory analysis process can still be time-consuming and expensive, often requiring specialist staff. The sampling methods may also not adequately deal with variability in soils or ecosystems, so that their reliability as a basis for payments is questionable. For these reasons, we have not prioritised the use of these indicators in our framework.

The use of remote sensing (satellite and drones) was also considered by Lampkin *et al.* (2022). Apart from georeferenced photography, the methods were not assessed mature enough yet for the indicators under consideration.

Performance level thresholds

In order to reward progressively higher levels of environmental performance, a stepped approach was defined, with thresholds for each level and each indicator. Based on the methodology and evidence reviews, we were able to define evidence-based thresholds for most indicators (see last four columns of Tables 1–5, Lampkin and Sanders, 2022c). A baseline of environmental legislation compliance is assumed to be compulsory for all farms. Level 0 represents the minimum requirement to qualify for the basic payment (e.g. Good Agricultural and Environmental Condition (GAEC) or similar). The Level 1 threshold is typically the evidence-based average performance of, or regulatory requirement for, organic farmers. Organic farmers would therefore be expected to achieve Level 1 across most if not all indicators by virtue of being certified. Additional activities to those required by the organic regulations, for example complex rotations, lower livestock

Multi-year herbage legume/grass mixtures support diverse environmental outcomes: soil carbon accumulation, nitrogen fixation and pollinators © Organic Research Centre.

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densities, or implementation of biodiversity actions, could result in higher thresholds being achieved. However, Levels 1–3 are not exclusive to organic farmers and can potentially be achieved by any farmer, allowing all farmers to be assessed and rewarded on a comparable basis.

Conceivably, a continuum of outcome performance could be considered, as an alternative to thresholds, for example using a 100-point scale, but this might be administratively more complex, at least in terms of payment rates. It could however avoid the problem of thresholds for higher levels just being missed, or activities forced to qualify for a higher level, although the nudging effect of thresholds can be seen as desirable.

Some farms might score very highly on individual indicators, or groups of indicators linked to a specific resource such as soil. Others might score well across the full range of indicators. This could be encouraged through payment mechanisms, with indicators scored separately, allowing deteriorations as well as improvements to be accounted for, and bonuses given for scoring well on multiple indicators.

> "Rewarding environmental outcomes at farm level can be achieved using selected indicators and administrative (IACS) data to minimise transaction costs."

Payment rates

We did not attempt to quantify the payment rates that might be appropriate. Assuming rates are set to reflect political priorities, within regulatory constraints, then they would be expected to vary regionally depending on geography, soils, climate and dominant production types. Regional priorities would also influence the weightings given to individual indicators or indicator combinations. Bonus rewards could be given to farmers delivering on multiple indicators simultaneously. In some cases, for example exclusion of pesticide use or the proportion of herbage legume-based mixtures, higher payments may be relevant the longer the indicator performance level is maintained, given the expected additional benefits to be derived.

The linking of payments to specific measurable outcomes (or relevant proxies) would open up options for organisations such as water agencies to get involved in payments for specific services, that can be offset against reduced costs, for example for purification of water supplies.

Double-funding is a significant issue for combinations of existing eco-schemes and agri-environment schemes, due to the need to avoid paying for the same benefit twice. The derivation of the relevant deductions to be applied is not always straight forward. If an outcome-based approach like that proposed here were used, then the top performance thresholds could be used as entry level criteria for supplementary (top-up) measures to address specific needs while avoiding double funding deductions.

Indicator quality assessment

For each indicator, we conducted a quality assessment to see how well the indicators perform with respect to relevance, legal soundness (susceptibility to fraud and resilience to legal challenges), data availability and quality, transaction costs (for farmers and administrators) and communicability (to beneficiaries, policy makers and the public). The results of this assessment are contained in each of the indicator factsheets (Lampkin *et al.*, 2024b, summarised in Lampkin and Sanders, 2023b).

A key issue is the availability of data without requiring repeat primary data collection, especially from farms, or costly sampling procedures. Clearly there are trade-offs between these indicator quality criteria – indicators that are close to the problem and accurate may be much more expensive to obtain, so that compromises between costs and benefits are required. The sampling-based indicators, typically shown as not finalised in Tables 1-4, often had methodological challenges as well as high transaction costs for data collection. For some specific situations, a cost–benefit analysis might still find that the high transaction costs could be justified by the high value of the environmental outcomes measured.

Implementation feasibility

The developed indicator set was tested with both farmers and administrators. For the farm-based tests (Brüggemann *et al.*, 2023), IACS data shared by the farmers were used to pre-populate a spreadsheet-based calculator that was developed for this purpose. Although the system demonstrated was not a fully-fledged IT-based approach, the farmers involved could see the potential to demonstrate environmental performance. They were concerned that some indicators, such as proportion of landscape elements, might be too reliant on IACS data and that additional differentiation might be required. However, they were also concerned that the approach should be kept as simple as possible and linked to data they were already collecting. In addition, the combinability of the approach with other agri-environment measures avoiding double-funding deductions was a concern.

The approach was presented to and discussed with departments responsible for agri-environment payments and organic farming in four regional government ministries (Lampkin *et al.*, 2023d). The approach was considered to be timely in terms of the 2023 policy discussions in anticipation of increasing environmental focus for the CAP. There was concern that the number of indicators should be limited, with preference for those that could be calculated internally, although some IT development would be required. Indicators that required direct sampling on farms were considered problematic.

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The approach needs to be applicable to all farmers, not only organic. There was also a need to specify clearly how it might be integrated with existing Pillar 1 eco-schemes and Pillar 2 environmental/climate measures. Many of the Pillar 2 type measures could be used as top-ups to secure additional delivery of specific environmental outcomes, but the entry level would need to be defined to be compatible with the scoring system to avoid double funding (see above). The Pillar 1 eco-schemes in some cases map well to individual indicators, so one option might be to use this approach to replace the eco-scheme framework, retaining traditional agri-environment measures as top-ups.

Conclusion

The approach as developed has strengths and weaknesses that will require further development and pilot-testing in a real-world situation. It is clear, however, that an indicator-based approach, measuring outcomes directly or indirectly using action-based proxies, could function to link farm support payments more directly to environmental outcomes. This would provide farmers with a business choice between being paid for environmental outcomes and reducing food production intensity, or being paid for more food and less environment – potentially a direct incentive to modify their production systems. It would also provide citizens with reassurance that their taxes are being used to good purpose.

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Further Reading

- Brüggemann, J., Strobel-Unbehaun, T., Griese, S., Lampkin, N. and Sanders, J. (2023). Eignung des Honorierungsansatzes aus Sicht der landwirtschaftlichen Praxis. [Suitability of the remuneration concept from a producer perspective.] *UGÖ Final Report Part II.6*. Thünen Institute of Farm Economics, Braunschweig, Germany.
- Lampkin, N., Strobel-Unbehaun, T., Brüggemann, J., Griese, S. and Sanders, J. (2022). Sekundärdaten zur Bewertung von einzelbetrieblichen Umweltleistungen der Landwirtschaft. [Secondary data for the assessment of individual farm environmental outcomes in agriculture]. *UGÖ Final Report Part II.3*. Thünen Institute of Farm Economics, Braunschweig, Germany.
- Lampkin, N. and Sanders, J. (2023a). Öffentliche Nachfrage nach Agrar-Umweltgütern in Deutschland. [Public demand for agri-environmental goods in Germany] *UGÖ Final Report Part II.1*. Thünen Institute of Farm Economics, Braunschweig, Germany.
- Lampkin, N. and Sanders, J. (2023b). Evaluation ausgewählter Indikatoren zur Bewertung von Umweltleistungen. [Evaluation of selected indicators for the scoring of environmental outcomes.] *UGÖ Final Report Part II.4*. Thünen Institute of Farm Economics, Braunschweig, Germany.
- Lampkin, N and Sanders, J. (2023c) Mögliche Ansätze zur Honorierung von Umweltleistungen. [Possible approaches for rewarding environmental outcomes] *UGÖ Final Report Part II.5*. Braunschweig: Thünen Institute of Farm Economics, Braunschweig, Germany.
- Lampkin, N., Devries, U. and Sanders, J. (2023d). Eignung des Honorierungsansatzes aus Sicht der Agrarverwaltung. [Suitability of the remuneration concept from an administration perspective.] *UGÖ Final Report Part II.7*. Thünen Institute of Farm Economics, Braunschweig, Germany.
- Lampkin, N., Lembo, G. and Rehburg, P. (2024a). Assessment of agricultural and aquaculture policy responses to the organic F2F targets. *Deliverable 1.2, EU-funded project OrganicTargets4EU*. IFOAM Organics Europe, Brussels.
- Lampkin, N., Strobel-Unbehaun, T. and Brüggemann, J. (2024b). Kontext, Methodik und Qualität von Indikatoren zur Bewertung von Umweltleistungen – Indikator Berichte für Humusbilanzen, Bodenkohlenstoff, ABAG-C-Faktor, Visuelle Bewertung Bodenstruktur, Betriebsmittelverzicht, Leguminosen, N-min Analyse, Stoffstrombilanzen, Pesticide Load Index, THG/NH_3-Emissionen, Tierbesatzdichte, Landschaftselemente, Kulturartendiversität, Kleinteiligkeit, Biodiversitsmaßnahmen. [Context, methods and quality of indicators for the assessment of environmental outcomes – Indicator reports for humus balances, soil organic carbon, USLE C-Factor, Visual examination of soil structure, legumes, soil mineral N, nutrient balances, pesticide load index, GHG/NH_3 emissions, livestock density, landscape elements, crop diversity, parcel size, biodiversity actions]. *UGÖ Final Report Parts II.8-II.21*. Thünen Institute of Farm Economics, Braunschweig, Germany.
- OECD (2013). *OECD Compendium of Environmental Indicators*. OECD Publishing, Paris. Available online at: https://doi.org/10.1787/9789264181151-en
- Pe'er, G., Zinngrebe, Y., Moreira, F., Sirami, C., Schindler, S., Müller, R., Bontzorlos, V., Clough, D., Bezák, P., Bonn, A., Hansjürgens, B., Lomba, A., Möckel, S., Passoni, G., Schleyer, C., Schmidt, J. and Lakner, S. (2019). A greener path needed for the EU Common Agricultural Policy. *Science*, **365**: 449–451.
- Sanders, J., Brinkmann, J., Chmelikova, L. *et al.* (2025). Benefits of organic agriculture for environment and animal welfare in temperate climates. *Organic Agriculture*, **15**: 213–231. Available online at: https://doi.org/10.1007/s13165-025-00493-w
- Sanders, J. and Lampkin, N. (2023). Honorierung von Umweltleistungen unter besonderer Berücksichtigung des ökologischen Landbaus. [Remuneration of environmental outcomes with specific consideration of organic farming – overview report] *UGÖ Final Report Part II*. Thünen Institute of Farm Economics, Braunschweig, Germany.
- Rey Vicario, D., Kremmydas, D., Baldoni, E., Ciaian, P. and Tillie, P. (2025). Do organic farming policies need to be more target-oriented to achieve sustainability? *Journal of Environmental Management*, **394**: 127342. Available online at: https://doi.org/10.1016/j.jenvman.2025.127342
- Thompson, M., Lampkin, N. and Sanders, J. (2021). Indikatoren zur differenzierten Bewertung von Umweltleistungen auf landwirtschaftlichen Betrieben. [Indicators for differentiated assessment of environmental outcomes of agricultural businesses] *UGÖ Final Report Part II.2*. Braunschweig: Thünen Institute of Farm Economics, Braunschweig, Germany.

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Summary

Rewarding Farm-level Environmental Outcomes – an Indicator Based Approach

Many agricultural, agri-environmental and organic support payments are paid at a flat-rate per hectare that does not reflect actual environmental outcomes on farms. We propose an indicator-based approach using a combination of result and action (proxy) based indicators to assess overall environmental outcomes at farm-level as a basis for future farm support payments. The proposed indicators were based on defined policy goals and related performance statements attributable to farming. 556 indicators from sustainability assessment tools were reduced to 20 indicators through expert consultation. A final list of 14 indicators resulted from an assessment of indicator quality relating to relevance, legal soundness, data availability, transaction costs and communicability. Most of the indicators require administrative data (IACS) avoiding repeat data collection, but others need detailed calculations (budgets), a certification/regulatory base for validation. Direct sampling was excluded on transaction cost grounds. Four performance thresholds are proposed, with entry values for each. Payment rates for each indicator and threshold, as well as weightings and bonuses for multiple indicators, will be based on regional policy priorities, conditions and dominant production types. The concept was reviewed with farmers and administrators, but some further development and pilot testing will be required prior to implementation.

Récompenser les résultats environnementaux au niveau de l'exploitation agricole – une approche fondée sur des indicateurs

De nombreuses aides agricoles, agroenvironnementales et biologiques sont versées à un taux forfaitaire par hectare, sans tenir compte des résultats environnementaux réels des exploitations. Nous proposons une approche par indicateurs, combinant indicateurs de résultats et indicateurs d'actions (indicateurs indirects), afin d'évaluer les résultats environnementaux globaux au niveau de l'exploitation et de servir de fondement aux futures aides agricoles. Les indicateurs proposés s'appuient sur des objectifs de politique définis et des énoncés de performance relatifs à l'agriculture. Sur 556 indicateurs issus d'outils d'évaluation de la durabilité, 20 ont été retenus après consultation d'experts. Une liste finale de 14 indicateurs a été établie après évaluation de leur qualité, notamment en termes de pertinence, de validité juridique, de disponibilité des données, de coûts de transaction et de communicabilité. La plupart des indicateurs nécessitent des données administratives (Système intégré de comptabilisation des données, IACS) afin d'éviter les collectes de données répétées. D'autres, en revanche, requièrent des calculs détaillés (budgets) et un cadre de certification/réglementation pour validation. L'échantillonnage direct a été exclu en raison des coûts de transaction. Quatre seuils de performance sont proposés, chacun assorti d'une valeur seuil. Les taux de paiement pour chaque indicateur et seuil, ainsi que les pondérations et les bonus pour les indicateurs multiples, seront déterminés en fonction des priorités d'action publique, des conditions et des principaux types de production au niveau régional. Le concept a été examiné avec les agriculteurs et les administrateurs, mais des développements supplémentaires et des essais pilotes seront nécessaires avant sa mise en œuvre.

Belohnung für Umweltleistungen auf Betriebsebene – ein indikatorbasierter Ansatz

Viele Beihilfen für die Landwirtschaft, den Agrarumweltschutz und den ökologischen Landbau werden pauschal pro Hektar gezahlt, ohne dass dabei die tatsächlichen Umweltleistungen der Betriebe berücksichtigt werden. Wir schlagen einen indikatorbasierten Ansatz vor, bei dem eine Kombination aus ergebnis- und handlungsbasierten (Proxy-) Indikatoren verwendet wird, um die gesamten Umweltleistungen auf Betriebsebene als Grundlage für künftige Beihilfen zu bewerten. Die vorgeschlagenen Indikatoren basieren auf definierten politischen Zielen und damit verbundenen Leistungsangaben, die der Landwirtschaft zuzuordnen sind. 556 Indikatoren aus Nachhaltigkeitsbewertungs instrumenten wurden durch Expertenkonsultationen auf 20 Indikatoren reduziert. Eine Bewertung der Indikatorqualität in Bezug auf Relevanz, rechtliche Zulässigkeit, Datenverfügbarkeit, Transaktionskosten und Kommunizierbarkeit ergab eine endgültige Liste von 14 Indikatoren. Die meisten Indikatoren erfordern Verwaltungsdaten (InVeKoS), wodurch eine wiederholte Datenerhebung vermieden wird, andere hingegen erfordern detaillierte Berechnungen (Budgets) und eine Zertifizierungs-/Regulierungsgrundlage für die Validierung. Eine direkte Stichprobenentnahme wurde aus Gründen der Transaktionskosten ausgeschlossen. Es werden vier Leistungsschwellenwerte mit jeweils eigenen Einstiegswerten vorgeschlagen. Die Zahlungssätze für jeden Indikator und Schwellenwert sowie die Gewichtungen und Boni für mehrere Indikatoren basieren auf den regionalen politischen Prioritäten, den Bedingungen und den vorherrschenden Produktionsarten. Das Konzept wurde mit Landwirtinnen und Landwirten und der Verwaltung überprüft, aber vor der Umsetzung sind noch einige Weiterentwicklungen und Pilotversuche erforderlich.

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