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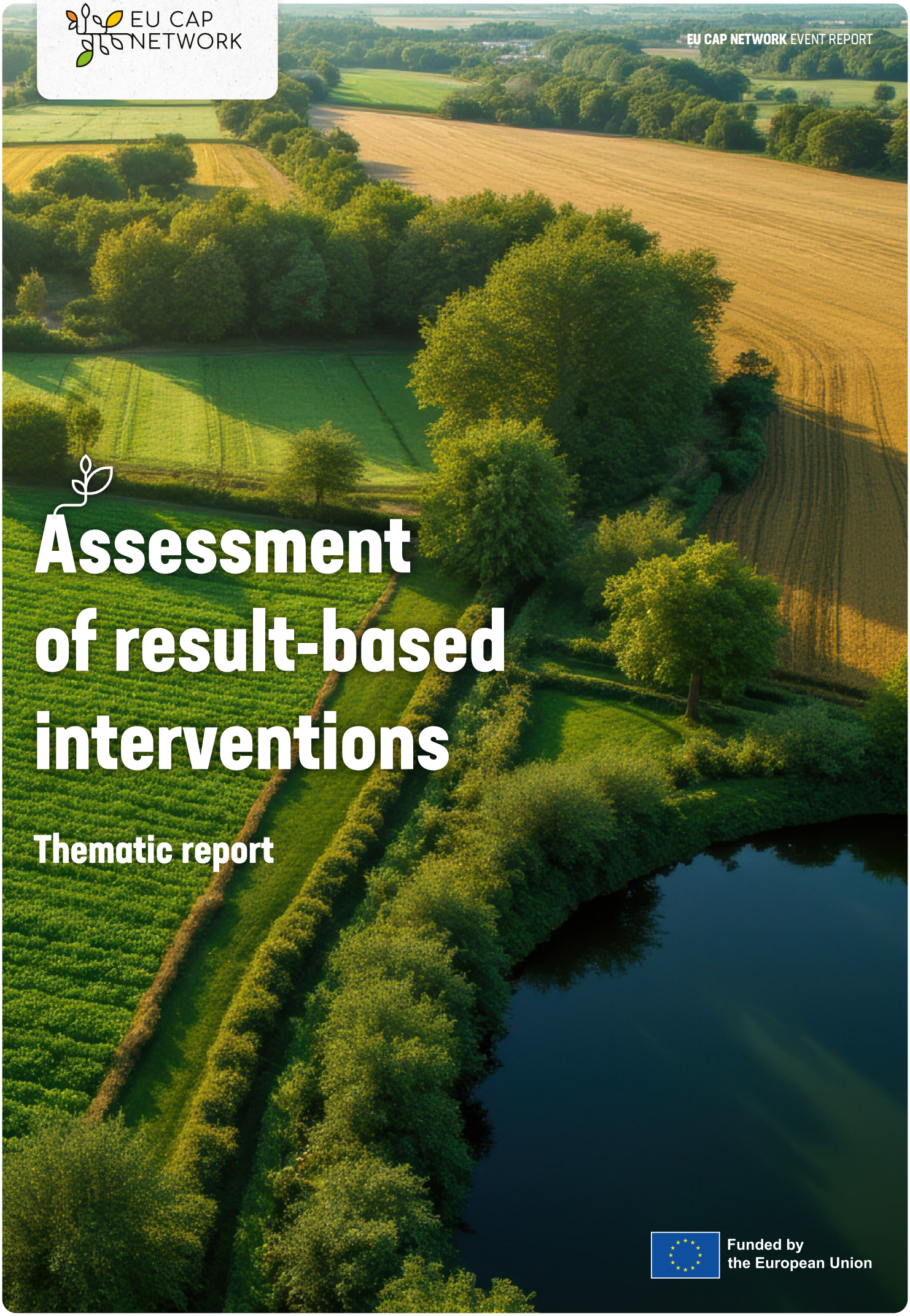

Assessment of result-based interventions

Thematic report

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List of acronyms

ACRES	Agri-Climate Rural Environment Scheme
AECM	agri-environmental and climate measures
AI	artificial intelligence
AIR	annual implementation report
AMR	antimicrobial resistance
AMU	antimicrobial use
CO_2	carbon dioxide
CO_2-eq	carbon dioxide equivalent
COOP	Cooperation (Article 77, Regulation (EU) 2021/2115)
CRP	Conservation Reserve Program
DCDA	defined course dose per animal
DCE	discrete-choice experiment
DDDA	defined daily dose per animal
EAFRD	European Agricultural Fund for Rural Development
EAGF	European Agricultural Guarantee Fund
EIP	European Innovation Partnership
ENRD	European Network for Rural Development
ENVCLIM	Environmental, climate-related and other management commitments (Article 70, Regulation (EU) 2021/2115)
GAEC	hood agricultural and environmental conditions
GHG	greenhouse gas
HNV	high nature value
IACS	Integrated Administration and Control System
IFT	Indicateur de Fréquence de Traitements phytosanitaires
INVEST	Investments (Article 73, Regulation (EU) 2021/2115)
LU	livestock unit
MAT	Matières azotées totales
MRV	monitoring, reporting and verification
MWTA	marginal willingness to accept
MWTP	marginal willingness to pay
OECD	Organisation for Economic Cooperation and Development
PCU	population correction unit
PDDA	prescribed daily dose per animal
PEPA	Performance-based Environmental Policies for Agriculture
PES	Payments for Environmental Services
PMEF	Performance Monitoring and Evaluation Framework
PP	particulate phosphorus
PPP	plant protection products
RBI	result-based intervention
ROI	return on investment
SNBC	Stratégie Nationale Bas-Carbone
TWG	Thematic Working Group
UAA	utilised agricultural area
UDDA	used daily dose per animal
VCM	voluntary carbon markets
WHO	World Health Organisation
WTA	willingness to accept
WTO	World Trade Organisation
WTP	willingness to pay

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Questions and suggestions regarding the content of the publication can be addressed to the European Evaluation Helpdesk for the CAP at evaluation@eucapnetwork.eu.

[1] Austria, Finland, France, Germany, Greece, Ireland, Netherlands, Portugal, Slovenia and Sweden.

Introduction

Voluntary schemes and commitments for environment, climate, animal welfare and combatting antimicrobial resistance are key components of the Common Agricultural Policy (CAP). However, their effectiveness and efficiency depend largely on how the payments are determined, including whether participating farmers are paid to adopt specific, predefined actions (action-based interventions), achieve specific predefined results (result-based interventions) or both. Although action-based interventions are the dominant design choice in all Member States, result-based interventions have gained momentum in recent years.

As part of the provision of methodological support to the European Commission and Member States, the EU CAP Network, supported by the European Evaluation Helpdesk for the CAP (Evaluation Helpdesk), organised a Thematic Working Group with the objective **of creating a common understanding of result-based interventions, including their design, monitoring and evaluation, to facilitate their use and set the basis for assessing the effectiveness of their implementation and their contribution to the objectives of CAP Strategic Plans.** The work of the Thematic Working Group focuses on interventions that contribute to environment/climate objectives as well as animal welfare and combatting antimicrobial resistance.

The outcome of the Thematic Working Group is summarised in this thematic report, which is addressed to Managing Authorities, Paying Agencies, evaluators and policy-makers who want to develop a better understanding of result-based interventions through an evaluation perspective.

The report aims to:

- describe the types and propose a definition of result-based interventions (Section 1);
- analyse recent experiences of implementation and assessment of result-based interventions (Section 2);
- determine the main factors that must be considered for setting up and implementing the monitoring and evaluation of result-based interventions and assessing their contribution to the objectives of CAP Strategic Plans (Section 3).

This is carried out by reviewing:

- the result-based interventions included by Member States in their CAP Strategic Plans, as these interventions are defined in paragraph 5 of Article 70, Regulation (EU) 2021/2115 of the European Parliament and the Council [2];
- other applied examples of result-based interventions, outside the CAP or the EU;
- the relevant literature for the design, monitoring, reporting, verification and evaluation of result-based interventions.

For the purpose of this report, the following definitions apply:

- **Action-based payment**: a payment provided to beneficiaries for implementing pre-defined management practices, and which does not depend on the achievement of specific environmental or climate-related results.
- **Pure result-based payments**: payments based solely on the delivery of environmental results.
- **Hybrid result-based payments**: payment based partly on results and on the basis of carrying out specific mandatory management actions.
- **Co-benefits**: improvements in environmental parameters which, although measured and documented, do not necessarily count against the expected results and may not affect the payment received by the beneficiary.
- **Monitoring, reporting and verification**: the process, usually abbreviated as MRV, through which the actual results achieved in a result-based intervention are measured, reported and validated.
- **Scorecard**: a document containing a bundle of indicators, each of which has a certain range of scores, used to determine the results achieved at parcel level in order to reward and incentivise ecosystem services delivery on farmland.
- **Collective action**: the collaboration among multiple stakeholders, such as groups of farmers, local communities or other land managers, to achieve shared environmental outcomes.
- **Payments for environmental services**: the variety of arrangements through which the beneficiaries of environmental services, from watershed protection and forest conservation to carbon sequestration and landscape beauty, reward those whose lands provide these services with subsidies or market payments.
- **Additionality**: the difference between the environmental outcome of an intervention and a hypothetical baseline of what would have been the outcome in the absence of this intervention.
- **Displacement**: the unintended consequences where efforts to improve the environment and mitigate climate change in one area led to environmental deterioration or increased emissions elsewhere.

[2] Regulation (EU) 2021/2115 of the European Parliament and of the Council of 2 December 2021 establishing rules on support for strategic plans to be drawn up by Member States under the CAP (Strategic Plans) and financed by the European Agricultural Guarantee Fund (EAGF) and by the European Agricultural Fund for Rural Development (EAFRD) and repealing Regulations (EU) No 1305/2013 and (EU) No 1307/2013. OJ L 435, 06/12/2021, p. 1-186. ELI: http://data.europa.eu/eli/reg/2021/2115/oj.

1. Understanding result-based interventions

This introductory section contributes to the development of a common understanding of result-based interventions (RBIs). Examples of result-based payments in research and practice, both in the EU and other settings are identified and briefly presented. They serve as examples to illustrate different types of result-based payments, for example in relation to their delivery mechanism ('pure' or 'hybrid'), their source of funding (public, private, combined), and their monitoring (results measured on the field, modelled results). The section concludes with a definition of RBIs in the context of CAP Strategic Plans.

1.1. RBIs in research and practice

1.1.1. Brief history of RBIs in agri-environmental support in Europe

Result-based payments incentivise farmers to deliver predefined environmental or climate-related outcomes, allowing them to choose the most appropriate management practices to achieve these outcomes. They are an alternative to action-based interventions where the beneficiary receives a payment for implementing predefined management practices and where the payment does not depend on the achievement of specific environmental or climate-related outcomes. Voluntary RBIs have been increasingly embedded in agri-environmental policies in some Member States, building on experiences and lessons learnt from early examples and experimentation in pilot schemes over the last few decades.

Early examples of result-based payments were implemented in the 1990s in the UK (conservation of hay meadow and pasture plant species in the Peak District National Park (Buckingham et al., 1998)) and Switzerland (support for ecological quality of meadows and establishing ecologically valuable networks of meadows (Schweizerischer Bundesrat, 2001, Oppermann and Gujer, 2003)).

Further early examples in Europe focused on the preservation of key animal species. For example, Zabel & Holm-Müller (2008) detail a Swedish outcome-based scheme to encourage the reproduction of large carnivores (i.e. lynx and wolverines) on reindeer grazing lands. In the Netherlands, similar result-based approaches have been targeted at improving the breeding success of meadow-bird species. For example, Musters et al. (2001) conducted a trial on using per-clutch [3] payments (i.e. payments provided for wading bird clutches on the farmland) to preserve nesting lapwings and black-tailed godwits, and Verhulst et al. (2007) similarly studied the use of per-clutch payments to enhance wader breeding success within Dutch agricultural cooperatives. A scheme in Schleswig-Holstein paid farmers for the conservation of four endangered bird species differentiating between single breeding pairs and entire colonies (Stapelholmer Naturschutzvereine, 2007).

Various national, regional and provincial government sources, national park funds and private funding were used in the pilot stages, after which many of the pilot schemes were integrated into CAP-funded agri-environmental programmes (or the equivalent in Switzerland) in the programming periods of 2007-2013 and 2014-2020. Well documented examples include result-based payments in the MEKA programme in Baden Württemberg (Russi et al., 2016) and similar payments in other German federal states (e.g. Lower Saxony, Brandenburg, Thuringia and Rhineland-Palatinate, Matzdorf et al., 2014), as well as the flowering meadows scheme in France (De Sainte Marie, 2014, Fleury et al., 2015).

To advance the understanding of the design and implementation of result-based payments in agri-environment schemes, the Commission's Directorate-General for Environment (DG ENV) commissioned pilot studies in a number of European countries in 2015 to test agri-environment results-based payments for the enhancement of biodiversity on grasslands (Ireland, Moran et al., 2021, Romania, Page et al., 2019, and Spain, Maher et al., 2018) and on arable land and grassland (in the UK, Chaplin et al., 2021). The UK example was the first major pilot study that tested result-based payments for agri-environment schemes targeted at biodiversity on arable land.

Overviews of result-based payments provided at that time by Allen et al. (2014) and Herzon et al. (2018) showed that the result-based approach was used in schemes primarily implemented in northern and western Europe and with a focus on the achievement of biodiversity objectives. In addition, result-based payments targeted at the improvement of water quality were tested in Germany and subsequently implemented in the Rural Development Programmes of three federal states (Techen and Osterburg, 2011, Burton and Schwarz, 2013).

In the current 2023-2027 programming period, RBIs and sub-interventions have been programmed in nine approved CAP Strategic Plans (see below for more details). In addition, a variety of pilot schemes and projects experimenting with result-based payments (e.g. Waters of LIFE in Ireland and the Naturalit project in Lithuania) are funded under the EU's LIFE programme for the environment and climate action. However, initiatives and research on using result-based payments for objectives other than biodiversity, e.g. soil health and functionality, carbon sequestration and reduction of greenhouse gas (GHG) emissions, are still in their infancy in Europe (COWI et al., 2021). But building on experiences outside the EU (e.g. the Carbon Farming Outreach Programe in Australia), as well as emerging projects within the EU (e.g. Polish RePeat project), technical guidance has been published by Directorate-General for Climate Action (COWI et al., 2021) for setting up result-based payments designed to support scaling up of agricultural practices that reduce emissions and deliver robust carbon removals.

[3] A clutch is the total eggs a bird lays per each nesting attempt.

Result-based payments have also received increasing attention at international level (beyond the EU), e.g. within the OECD (OECD, 2023), encouraging greater experimentation with designs of environmental, climate-related and other management commitments (ENVCLIM, Article 70, Regulation (EU) 2021/2115) and eco-scheme (Article 31, Regulation (EU) 2021/2115) types of interventions, in the 2023-2027 CAP programming period. The OECD report also acknowledges the importance of training and assistance for farmers in assessing the environmental impacts of their farming practices and implementing land management changes to reach the goals set by result-based payments. Similarly, an earlier study by the OECD on making agri-environmental payments more cost-effective, recommends the use of so-called hybrid agri-environmental payment schemes, which combine result-based payments with action-based payments in policy interventions. This is to offer farmers a lower financial risk opportunity to test the result-based features of the payments (OECD, 2022), and to address findings of studies indicating relatively low preferences of farmers for result-based payments through gradual implementation of a result-based approach (Gars et al., 2023).

1.1.2. Current examples of RBIs under the CAP and result-based payments beyond the CAP

In the 2023-2027 programming period, 14 RBIs and sub-interventions have been programmed in nine approved CAP Strategic Plans (Austria, Finland, France, Germany, Ireland, Poland, Portugal, Slovenia and Spain). Eleven of these are ENVCLIM (environmental, climate-related and other management commitments) interventions, plus two eco-schemes and one cooperation (COOP – Article 77, Regulation (EU) 2021/2115) intervention. All these interventions aim to contribute to a variety of environmental objectives and include RBIs where payments depend totally on the results achieved, and hybrid models that combine action-based and result-based payment components. Table 1 provides a brief overview of these RBIs in the nine Member States, while **a more detailed presentation can be found in** Annex I.

Table 1. Overview of RBIs in the CAP Strategic Plans and their main environmental objectives

Country	Intervention description
Austria	Intervention 70-17 'Management based on results' of the Austrian CAP Strategic Plan is an ENVCLIM intervention focusing on biodiversity by protecting habitats and species, including in Natura 2000, and preserving landscape features. Payments **depend entirely on the achievement of the expected results**. As a co-benefit, the intervention contributes to climate change mitigation through carbon storage in soil and biomass. Payments are made based on the achievement of targets for indicators defined after a farm visit that documents the condition of the participating area(s).
Finland	The result-based payment in the ENVCLIM intervention EHK-12 'Improved condition for fattening pigs' of the Finnish CAP Strategic Plan focuses on **animal welfare and antimicrobial resistance** and **depends entirely on the achievement of expected results**. The indicator used to verify the achievement of results is the percentage of animals with intact tails identified in the slaughterhouse. Beneficiaries will receive the payment if intact tails are found on more than 95% of the animals inspected.
France	The RBI 70.27 'Flat-rate AECM – Transition of practices' of the French CAP Strategic Plan is an ENVCLIM intervention that contributes to **climate change mitigation and adaptation, sustainable management of natural resources and biodiversity**. The payment is linked to **both action-based and result-based parts**. The beneficiary selects a theme from a list of themes defined by the regional authority and has to achieve certain mandatory results: › for the theme 'Plant health strategy', a minimum 30% reduction of herbicide and non-herbicide Treatment Frequency Indicator [4]; › for the theme 'Farm carbon balance', an increase in carbon balance of at least 15%; and › for the theme 'Improvement of protein autonomy in livestock farming' indicators and target values that depend on the animal sector concerned.

[4] https://agriculture.gouv.fr/indicateur-de-frequence-de-traitements-phytosanitaires-ift

Country	Intervention description
Germany	The RBI DZ-0405 'Result-oriented extensive management of permanent grassland with evidence of at least four regional characteristics' of the German CAP Strategic Plan is an eco-scheme intervention which focuses on **biodiversity**. Payments **depend entirely on the achievement of expected results** and are based on proof of the presence of at least four plant species from the list of species or groups of species defined at regional level, which are ecologically valuable and typical of the region's grassland. The sub-intervention EL-0105-04 'Result-oriented reward of more than four species of wild flora' of the German CAP Strategic plan is an ENVCLIM intervention which focuses on **biodiversity** by protecting habitats and species. It is implemented in Baden-Württemberg, Bavaria, Lower Saxony/Bremen, Rhineland-Palatinate, Saxony and Thuringia, with payments **based on proof of at least six or eight plant species** that are ecologically valuable and typical of the region's grassland.
Ireland	The scheme 'ACRES' of the Irish CAP Strategic Plan is an ENVCLIM intervention which contributes to **climate change mitigation and adaptation, and sustainable management of natural resources and biodiversity**. However, the verification of the results for which a payment is provided focuses on **biodiversity** (e.g. number and cover of species and vegetation structure). The intervention 'ACRES Cooperation' is a combination of ENVCLIM and COOP intervention which contributes to climate change mitigation and adaptation, and sustainable management of natural resources and biodiversity. It is delivered through a mechanism that offers **both fixed payment rates and result-based payments** to participating farmers. The result-based component reflects different qualities (levels) of the results, which are assessed using a scoring system. This scoring system consists of indicators grouped in scorecards [5]. Within the ACRES Cooperation, there are ten possible scorecards, which mainly assess: › ecological integrity by using a group of indicators that assess, in most cases, the presence and cover of 'positive' [6] species (zero or positive scores), the cover of 'negative' species (mostly negative scores or zero), and the vegetation structure (positive or negative scores depending on the structure); › threats and pressures or future prospects, which are, in most cases, measured by the evidence of damaging activities (negative scores or zero), risk to the quality of natural water bodies (negative scores or zero), risk of soil erosion (negative scores or zero and in some cases slightly positive scores for low risk), and the cover of non-native invasive species (negative scores or zero); › hydrological integrity, mostly measured by the presence and condition of artificial drainage (negative scores in case of fully functional artificial drainage, zero for partly functional and positive when no artificial drainage is taking place). Other indicators, relevant to certain scorecards include: › field boundary quality (positive scores or zero); › indicators that show poor management of grasslands (extent of spreading immature scrub and cover of bracken, with negative scores or zero); › indicators related to the quality of habitat for specific bird species (zero or positive scores according to the conditions). Payments are linked to the score of each field. Each scorecard must receive a score of four or higher to be considered for payment. A certain field may be scored using more than one scorecard. In this case, the combined score is calculated by applying a weight on each scorecard proportional to the corresponding area.
Poland	The interventions I.8.9.1. 'Package 4. Habitats and endangered bird species in Natura 2000 sites' and I.8.9.2. 'Package 5. Valuable habitats outside Natura 2000 sites', which are implemented as carry-overs from the 2014-2022 period, contribute to **climate change mitigation and adaptation, sustainable management of natural resources and biodiversity**. While in principle action-based, a result-based component will be applied for specific areas i.e. non-agricultural land affected by flooding (confirmed by satellite monitoring). According to the Polish CAP Strategic Plan, these interventions will cover approx. 100,000 hectare (ha) with a total public expenditure of approx. EUR 35 million.

[5] https://www.gov.ie/en/service/f5a48-agri-climate-rural-environment-scheme-acres/#acres-scorecards-and-information-general-co-operation-approach
[6] Species which reflect the adoption of practices that are beneficial for biodiversity.

Country	Intervention description
Portugal	The RBI D.2.2 'Montado management by results' of the Portuguese CAP Strategic Plan is an ENVCLIM intervention to support farmers who carry out environmentally sustainable management of the Montado agrosilvopastoral systems in cork oak and oak or black oak groves. It contributes to **carbon storage in soils and biomass, preserving habitats and species** and improving NATURA 2000 management. Payments **depend entirely on the achievement of the expected results** and are based on the score that each field receives based on the achievement of measurable results in relation to four main themes, including healthy and functional soil, oak regeneration, bio-diverse Mediterranean pastures and single landscape elements promoting biodiversity. Scores for each parcel can range from 0 to 10, with payment taking place from 'Level 5' inclusive.
Slovenia	The intervention IRP18.03 'AGRI-environment-climate payments – Biodiversity and landscape' of the Slovenian CAP Strategic Plan is an ENVCLIM intervention which contributes to climate change mitigation and adaptation, sustainable management of natural resources and biodiversity. The sub-intervention BK.14 'Habitats of birds of humid extensive meadows' aims at **protecting grassland bird species** e.g. corncrake (Crex crex), Whinchat (Saxicola rubetra), and includes an action-based and result-based component. The beneficiary will receive the result-based component in relation to the presence of corncrake habitat, differentiating between foraging and nesting habitats, and several corncrake specimens in the same area. The intervention INP 8.09 'Priba (lapwing) nest protection' is a result-based eco-scheme intervention contributing to **biodiversity**. The result is to protect the nesting of the lapwing species. This is monitored by checking the bird presence within a certain period, meaning 15 June, as set by ornithologists and this is the date by which the lapwings should have successfully nested. The monitoring of the nests is done by ornithologists who inform the farmer advisors, who are responsible for informing the farmers. Farmers are asked to protect the nests and this should be proved by the submission of two geotagged photographs. Payments are linked to protected nests and are calculated using the proxy '1 nest = 1 ha'. If several nests are found in the same field, the farmer who applies to the scheme is obliged to protect all nests found in his field in order to receive the payment that corresponds to the number of protected nests.
Spain	The RBI 6501.3 'Agri-environment commitments on agricultural areas. Commitments to promote and sustainably manage pastures' of the Spanish CAP Strategic plan is an ENVCLIM intervention which focuses on **biodiversity** by protecting habitats and species. The implementation of this intervention in the region of Navarra takes the form of an RBI with the **payment linked entirely to the result** of maintaining or improving the existing high floral diversity for five consecutive years.

Source: EU CAP Network supported by the European Evaluation Helpdesk for the CAP (2024), based on the descriptions extracted using the Catalogue of CAP interventions.

In addition to RBIs implemented in the CAP Strategic Plans, a range of examples of result-based payments exists in Europe outside the CAP, including payments publicly funded through other policies at the EU, national or municipality level, and payments financed through the private sector. Further information on existing RBIs in Europe can also be found on the website of the Result-based Payments Network (https://www.rbpnetwork.eu). Numerous examples of result-based payments can also be found beyond Europe (e.g. in Australia and North America) that address particular objectives related to water quality, reduction of GHG emissions and carbon sequestration. Table 2 briefly introduces selected examples to illustrate the diversity of different result-based payments in terms of scale, objectives, funding sources, delivery mechanisms and indicators used.

Table 2. Selected examples of current RBIs outside the CAP

Name of the result-based scheme and country	Scheme description
Waters of LIFE – Ireland	Waters of LIFE [7] is funded under the LIFE programme and focuses on **water quality**. As a co-benefit, the result-based payment contributes to biodiversity through habitat improvements and includes **both action-based and result-based parts**. Results indicators relate to different factors of the river habitat, which can impact water quality, biodiversity and climate change. The better the quality of the river habitat, the higher the score to which the level of payments is linked.
Label Bas Carbone – France	The Label Bas Carbone [8] has been implemented based on a stand-alone legislation (décret n° 2018-1043 du 28 Novembre 2018 créant un Label «Bas-Carbone», modifié en Mars 2022), within the context of the low carbon national strategy (Stratégie Nationale Bas-Carbone (SNBC)). The result-based scheme mainly addresses the objectives of **reduction of GHG emissions and carbon sequestration**. Payments **depend totally on the achievement of expected results**, which are defined through simulation tools (e.g. for livestock CAP2ER and Horizon 360 Production Laitière Durable, and for crops CAP2ER, CarbonExtract, My EasyCarbon and Sysfam), based on the different features of the planned actions. The emission reduction potential is then reviewed by an independent auditor. Upon receiving the results of the audit, the competent authority validates the expected results before the project is listed on the marketplace for carbon offsets. Agriculture is one of the sectors covered by the scheme. Throughout the lifetime of the project, the actual implementation of the planned actions is also periodically audited (field visits, invoice verification etc).
Result-based payments for botanical grassland development in Beverhoutsveld – Belgium	The result-based payment in Beverhoutsveld, Belgium, implemented in 2012, is an example of a **collective scheme** at the local level funded by a municipality. The result-based scheme mainly addresses **biodiversity objectives** and renumerates farmers according to the botanical value of their grassland. Through a tender contract (renewed every three years) the municipality pays a fixed payment per ha to the group of farmers each year. The money is then distributed amongst the farmers **based totally on the results** measured with habitat indicators such as the presence and abundance of key indicator species. The higher the species number, the higher the payment. Secondary objectives of the scheme relate to landscape amenities, including recreation and tourism.
Clean Lakes, Estuaries, And Rivers initiative CLEAR30 – USA	The Clean Lakes, Estuaries, And Rivers initiative CLEAR30 [9] is part of the Conservation Reserve Program (CRP) funded by the US Department of Agriculture. The scheme mainly addresses the objectives of **water quality and use** and includes **both action-based and result-based parts**. Secondary objectives of the scheme relate to biodiversity and soil quality. CLEAR30 is a long-term initiative with a contract duration of up to 30 years. The CRP provides incentives to farmers to remove environmentally sensitive land from agricultural production. The expected result is set on minimum areas that have practices under the CRP contract, which are ranked according to the Environmental Benefits Index (EBI). The CLEAR is an extra incentive to water quality practices.
California's Compliance Offset Programme – USA	The CCOP [10] is a privately funded programme that is positioned within a broader cap-and-trade programme. The initiative addresses the objectives of **reducing GHG emissions and carbon sequestration** and is accessible to GHG reduction projects from various sectors. In agriculture, it is focused on livestock and forestry. The expected results are estimated by modelling carbon dioxide (CO_2) savings, e.g. for livestock, savings are modelled based on a list of eligible actions that the projects can implement. The payments are **totally linked to the expected results** through the purchase of the offsets by private buyers.

[7] https://www.watersoflife.ie/
[8] https://label-bas-carbone.ecologie.gouv.fr/
[9] https://www.fsa.usda.gov/programs-and-services/conservation-programs/conservation-reserve-program/clear30
[10] https://ww2.arb.ca.gov/our-work/programs/compliance-offset-program

Name of the result-based scheme and country	Scheme description
Carbon Farming Initiative – Australia	The Carbon Farming Initiative legislation [11] was passed in 2011 and amended in 2014 to support new arrangements for the Emissions Reduction Fund, which forms a central plank of the Australian emissions reduction policy. The initiative addresses the objectives of **reducing GHG emissions and carbon sequestration**. The expected results are estimated by modelling the potential of a project. Australia's clean energy egulator can purchase offsets from carbon farming. The fund operates as a competitive reverse auction mechanism, where the regulator sets a benchmark price and 25% of the volume under that price is accepted.

Source: EU CAP Network supported by the European Evaluation Helpdesk for the CAP (2024)

As apparent from the selection of examples above, there is a wide range of differences in result-based payments, which raises the questions: i) what exactly are result-based agri-environmental schemes?; ii) what are common characteristics?; iii) what types of result-based payments can be identified?; and iv) how can RBIs be defined in the context of CAP Strategic Plans?

1.2. Towards a typology and definition of RBIs

There is no single agreed definition of what constitutes a result-based payment. Within the literature, a number of different reference terms are used (other terms used are 'payment by results', 'outcome-based', and 'performance payment', see Burton and Schwarz, 2013). Despite the varied nomenclature, all refer to the same concept: agri-environmental payments that pay farmers, not for performing specific management actions, but for achieving set environmental, climate and animal welfare results, such as an increase in species diversity of grassland swards or for achieving GHG emissions avoidance/reductions. An additional commonality is that the absence of prescriptions provides flexibility at the field, farm, local and regional level, rather than a national 'one-size-fits-all' set of prescriptions and permits the farmer to innovate (Chaplin et al., 2021), thus, at least theoretically, drawing on their experience and local knowledge to achieve better and more cost-effective results with higher positive returns on investment (Wuepper and Huber, 2022, Bartkowski et al., 2021), and foster an educational role for farmers and wider society (COWI et al., 2021, Fleury et al., 2015). A set of indicators needs to be developed to measure the results achieved. These indicators should be: i) measurable and identifiable following initial training; ii) responsive to agricultural practices and not be easily achievable by means other than agricultural management; and iii) understandable and consistent with ecological objectives that are acceptable to land managers and Paying Agency representatives (Burton and Schwarz, 2013, Herzon et al., 2018, Pinto-Correia et al., 2022).

While the result-based approach can be easily distinguished conceptually from action-based payments, in practice considerable variation exists in the extent to which payments are based on verified results, differentiate between qualities and quantities of results and farmers ability to innovate within the intervention or scheme. This reflects a continuum of approaches from prescriptive action-based approaches to those that provide farmers flexibility in choosing optimal practices to achieve the results required for delivering environmental and climate objectives on agricultural land, with payments provided according to the quality and quantity of the achieved results (Allen et al., 2014).

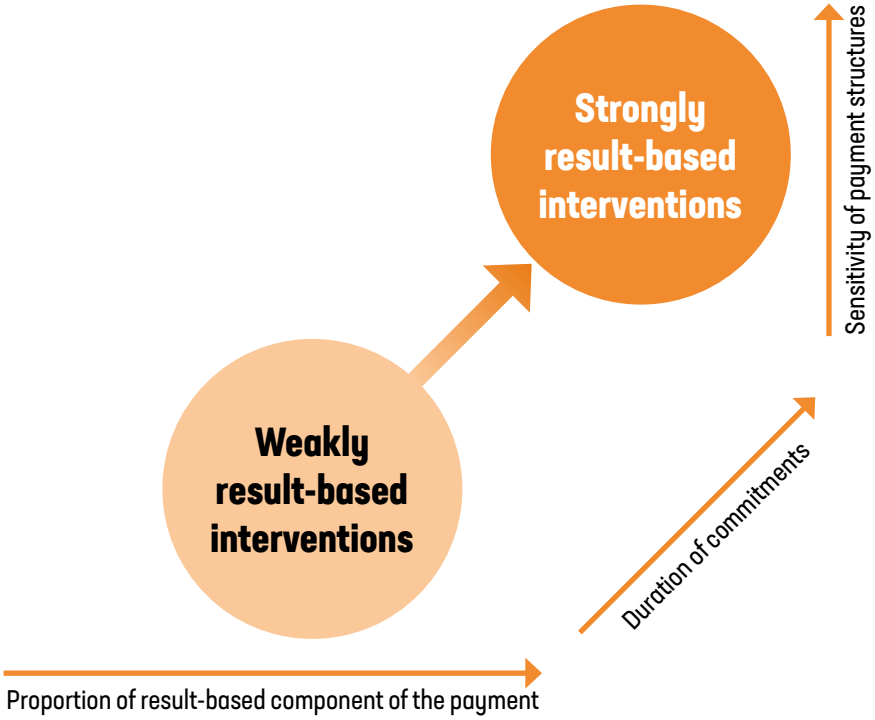
The examples of result-based payments briefly introduced in Section 1.1 also highlight different approaches, differing in their source of funding (public or private), their delivery mechanism (totally based on results or comprising action and result-based parts, individual or collective), their monitoring (results measured in the field, modelled results), their sensitivity to different levels of results achieved or their contract duration and lifetime. It is important for the design of future CAP interventions to understand the differences between different types of result-based payments and other approaches (Allen et al., 2014). In a first attempt to improve the understanding of the boundaries of result-based payments and different levels of result-orientation, Burton and Schwarz (2013) proposed a framework for examining result-based approaches. From reviewing the literature, they identified three key dimensions (Figure 1) along which result-based payments can differ, namely:

- the proportion of payment derived from results;
- the sensitivity of the payment structures; and
- the duration of the commitments.

These dimensions differentiate between 'strongly result-oriented' and 'weakly result-oriented' payments.

[11] https://www.legislation.gov.au/F2015L00156/latest/versions

Figure 1. Three dimensions contribute to 'weak' and 'strong' linkages of payments to results (adapted from Burton and Schwarz, 2013)



Source: EU CAP Network supported by the European Evaluation Helpdesk for the CAP (2024), adapted from Burton and Schwarz, 2013

The **proportion of the payment derived from results** can vary from cases where all components of the payment depend on the achievement of the required results to combinations of result-based and action-based payment components e.g. an action-based base payment combined with a result-based top-up. **The sensitivity of the payment structure** relates to payment differentiation according to the level of result, such as applying stepped payment thresholds where the result-based payment is made when two or more increasingly demanding indicator thresholds are achieved. The application of scorecards that are straightforward to use is an important tool for the measurement and verification of stepped payment thresholds. Weightings between different scored elements can be adjusted to accommodate local priorities or specific targets (Prager et al., 2022). In some situations, a modelling approach could predict the outcomes of a set of management actions, but these approaches must be robust and modelling results need to be validated (Bartkowski et al., 2021). The third dimension of **the duration of commitments** relates to the performance parameter of the longevity of the effects and benefits, which, in addition to aspects related to education, advice, training, cooperation and the related building of social and cultural capital, is also driven by the length of the contracts (D'Alberto et al., 2024).

The first dimension has been further explored by Allen et al. (2014) and Herzon et al. (2018) focusing on the distinction between pure and hybrid result-based payments. **Pure result-based payments** provide payments based solely on the delivery of environmental results. There are no mandatory management actions to be fulfilled by the farmers although some management guidance may be given.

The advantages of pure result-based payments are flexibility for farmers to choose the management actions specifically suited to deliver the results on their farm and the payment is fully linked to results measured and verified through indicators. However, not all environmental objectives can be practically measured through indicators and farmers might be reluctant to take up pure result-based payments due to a higher perceived risk [12] (Herzon et al., 2018, Massfeller et al., 2022). Examples of pure result-based payments include (amongst others) the ENVCLIM and eco-scheme interventions in the CAP Strategic Plans in Austria, Finland, Germany, Portugal, Slovenia and Spain and the payments for botanical grassland development financed by the municipality in Beverhoutsveld (Belgium) (Table 1 and 2).

Hybrid result-based payments are those where the payment is based partly on results and partly on carrying out specific mandatory management actions (Allen et al., 2014). This hybrid approach can address the potential issues of a lack of measurable indicators for some environmental objectives and low preferences of farmers for pure-result-based payments raised in the previous paragraph. They have also been recommended to gradually increase the experience of farmers and paying agencies with result-based payments (Gars et al., 2023, Burton and Schwarz, 2013). Examples of hybrid result-based payments are (amongst others) the sub-intervention 'BK.14' (habitats of birds of humid extensive meadows) of the Slovenian CAP Strategic Plan, the ACRES Cooperation intervention in the Irish Strategic Plan, the French 70.27 – 'Flat-rate AECM – Transition of practices' and CLEAR30 (Clean Lakes, Estuaries, And Rivers initiative) (Table 1 and 2).

[12] Risk perception is a highly idiosyncratic process concerning the prospective beneficiary. Perception, i.e. the sensory ability to receive, understand and interpret the world, is affected by an individual's psychological, economic, social and demographic traits and community characteristics (peer effects). Risk is exposure to danger, hazard, harm or mischance. The risk to the prospective beneficiary is receiving reduced support or support well below the incurred cost and efforts.

This overarching categorisation into pure and hybrid result-based payments can then be further divided according to the **sensitivity of the payment structure**, which reflects the extent to which payments are differentiated into different levels according to the quantity and/or quality of the result. Possible sub-types are:

- non-differentiated payments (single payment level), e.g. payment for a certain percentage of animals with intact tails in the ENVCLIM intervention 'Improved condition for fattening pigs' of the Finnish CAP Strategic Plan);
- stepped payment differentiation (multiple payment levels), e.g. stepped payments based on the scoring system in the intervention 'AECM Cooperation' in the Irish CAP Strategic Plan or the 'Montado management by results' in Portugal; and
- continuous payment differentiation (unrestricted number of payment levels), e.g. certified amount of (modelled) CO_2-eq emission avoided or sequestered is sold to CO_2-eq credit buyers.

Further key characteristics for a more detailed categorisation of different approaches (types) of result-based payments include:

- type of funding/administrator, e.g. public, private or hybrid (Bredemeier et al., 2022);
- individual/collective payments (Kelemen et al., 2023);
- key themes of environmental objectives (Matzdorf et al., 2014);
- availability of advice and training (Bredemeier et al., 2022); and
- measurement of results and monitoring approaches for result verification, e.g. measurement with scorecards with expert and/or farmer monitoring and modelling of results (Schwarz and Morkvenas, 2012, Moran et al., 2021, Bartkowski et al., 2021).

For the purpose of the concept of result-based payments in the CAP and the analyses of recently implemented experiences, a distinction between pure and hybrid result-based payments is suggested accompanied by a set of key characteristics for the comparative analysis of experiences and consistent derivation of recommendations for the future CAP in Section 2. Table 3 summarises the suggested categorisation (typology).

Table 3. Categorisation of approaches in result-based payments for CAP interventions

Higher level	Result orientation	Pure result-based based solely on the delivery of environmental results
		Hybrid result-based based partly on results and partly on specific mandatory management actions
Lower level	Payment sensitivity	Continuous payment levels
		Multiple payment levels
		Single payment level
	Measurement of results	Measurement in the field (e.g. scorecards)
		Modelling of results
	Contract duration	Long term (+5 years)
		Medium term (2-5 years)
		Short term (annual contracts)
	Availability of advice	None
		Voluntary option
		Mandatory requirement
	Funding and administration	Public
		Combined public/private
	Beneficiary	Individual
		Collective (group of farmers)

Source: EU CAP Network supported by the European Evaluation Helpdesk for the CAP (2024)

N.B.: The purpose of the categorisation is to illustrate differences in the design of result-based payments and does not indicate or suggest a ranking or prioritisation regarding the potential effectiveness of payments and CAP interventions.

Care should be taken in the use and interpretation of result-based payments to avoid confusion with the terminology describing an overall result or performance-based approach of the CAP, which refers to the monitoring and evaluation of results and impacts as a basis to review the performance of the CAP and reform its instruments.

Box 1 proposes a definition and the main characteristics of result-based CAP interventions.

Box 1. Definition and main characteristics of CAP result-based interventions

A result-based CAP intervention provides a payment – or at least a component of the payment – to beneficiaries that is directly linked to and dependent on the achievement of defined and verifiable results.

Results are mostly measured in terms of parameters that have a direct link to the objective to which the intervention aims to contribute (e.g. for biodiversity, the number of species present in a supported grassland), but they may also include measurements reflecting a reduction of pressures or threats to the environment (e.g. measuring the reduction of the use of pesticides instead of measuring the concentration of active substances in water bodies). These results can be verified through on-site monitoring or predicted using robust scientific modelling approaches in cases where on-site monitoring is not feasible. In the case of modelling approaches, a verification of the results at an appropriate point in time by an independent auditor might be required for them to qualify as result-based interventions.

Beneficiaries (e.g. farmers or other land managers) must be allowed the flexibility to choose the most appropriate management to achieve the result.

Result-based interventions can provide a single payment level for achieving a result threshold or include differentiated payments that reflect different levels of the quantity and/or quality of the results achieved. In modelling approaches, payment may be structured in a way that smaller payments, based on modelled results, are made during the implementation, while a 'balloon' payment is made upon the verification of the actual results by an independent auditor.

Result-based CAP interventions can be implemented for individual beneficiaries or a group of beneficiaries (e.g. collective of farmers), depending on the type and level of objectives of the intervention and may include guidance on management practices that will deliver the desired results.

Interventions that link payments to: a) the immediate outputs of actions (e.g. the presence of a hedgerow is the direct output of the actions of planting or maintaining a hedgerow); or b) merely the changes in farm practices and not their results should not be considered as result-based.

Source: EU CAP Network supported by the European Evaluation Helpdesk for the CAP (2024)

2. Experiences from practical approaches to RBIs

This section analyses recent experiences with implementing RBIs in CAP Strategic Plans based on interviews with Member States administrations and experts. This is complemented by insights from the scientific literature and result-based payments outside the CAP (in particular for those environmental themes with limited history in CAP Strategic Plans). It presents common aspects found across most of the themes as well as specific aspects for the themes, for example, regarding the definition of indicators to measure results, how the expected level of result is determined, and how the actual results are monitored and validated. Based on this, lessons learnt in terms of good practices and constraints in the use of RBIs in the CAP Strategic Plans and in their monitoring and evaluation are identified.

2.1. Common aspects of monitoring and verifying results

2.1.1. Key issues for farmers and other beneficiaries

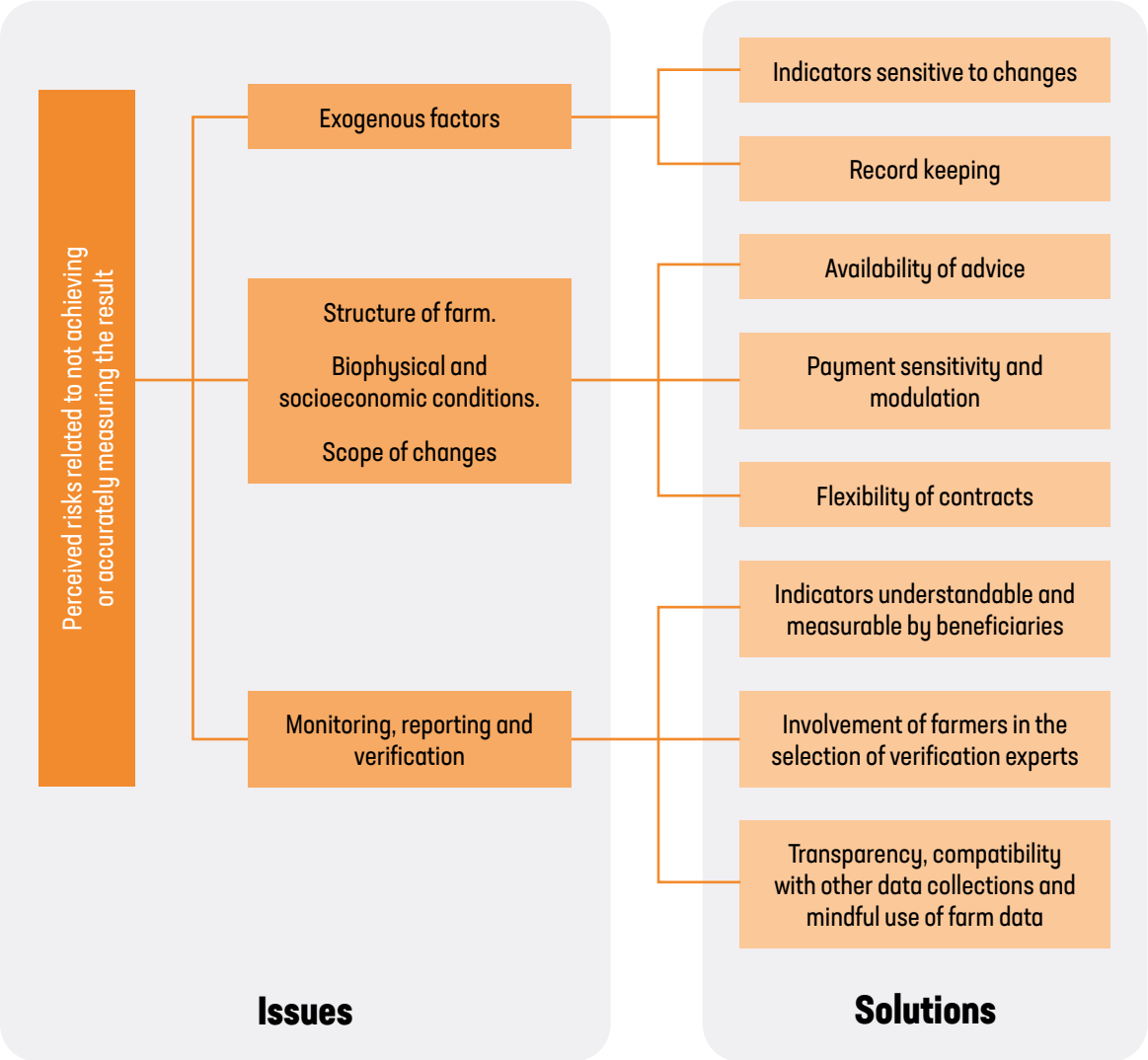
The monitoring and verification of results, as well as the payment design of RBIs are key factors for the acceptability and uptake of such interventions by farmers and other beneficiaries. Several studies explored and analysed the acceptability and preferences of farmers of RBIs in comparison to standard action-based agri-environmental payments. The ultimate issue for farmers relates to different **perceived risks related to not achieving the result** and, consequently the loss of payment. Farmers have been concerned about factors outside of their control, such as weather or pest-related issues, which may affect the results and therefore increase the risk of non-payment (Chaplin et al., 2021) and showed a preference for hybrid schemes, only when the share of payment linked to achieving biodiversity results was low (10%) (Gars et al., 2024). Preferences of farmers for result-based or action-based interventions also depend on the particular types of interventions that are compared e.g. what type of practices are prescribed in action-based interventions (Granado-Díaz et al., 2024). However, experiences also show that if these risks are addressed, RBIs do encourage innovation and the adoption of actions which are more likely to deliver environmental benefits on the farm (O'Rourke and Finn, 2020, Herzon et al., 2018).

Remarkable solutions have been found in the examples analysed to address perceived risks. They can be grouped by source of risk as follows:

- exogenous factors;
- the probability of achieving the results given the structure of the farm, the (changing) biophysical and socioeconomic operating conditions and the scope for management changes; and
- the monitoring, reporting and verification of results.

The key issues and solutions are visually summarised in the following diagram and explained in the following paragraphs.

Figure 2. Key issues and possible solutions for farmers and other beneficiaries of result-based interventions



Source: EU CAP Network supported by the European Evaluation Helpdesk for the CAP (2024)

Risks through **exogenous factors** are acknowledged in many of the implemented examples (e.g. the impact of extreme weather events for ACRES-Cooperation in Ireland) and do not impact the payment if they are declared by the ministry and therefore recognised by the national administration (e.g. 'Montado management by results' in Portugal). Risks through exogenous factors can be reduced by selecting **indicators sensitive to changes in agricultural management** and less likely to be influenced by factors beyond the control of the land manager (e.g. indicators on vegetation structure in result-based management in Austria). In addition, **record keeping** through drafting and maintaining an action plan, which is tailor-made to the conditions of the farm, can guide farmers to achieve results and provides records of the actions undertaken during the commitment period. These records can be used to confirm that deviations from the expected results, which are noted during verification controls, were not a consequence of poor or lacking management practices of the beneficiary (e.g. 'Flat-rate AECM – Transition of practices' in France). Finally, monitoring of further biodiversity indicators, in addition to those that are directly linked to the payment, can provide additional evidence on the biodiversity effects of the farmers' actions and on exogenous effects impacting the results (e.g. result-based management in Austria).

Further risks arise from the uncertainty of the farmer about the extent to which the **structure of the farm, biophysical and socioeconomic operating conditions and scope for management changes** can be conducive to achieving the expected result. For example, Chaplin et al. (2021) refer to conditions in relation to soil type and size of plots, seedbed conditions, seed choice and agronomic (farm) practices such as sowing depth and sowing date. These kinds of risks can be mitigated by the availability of advice, payment sensitivity and modulation and flexible design of contracts.

The **availability of advice** on the suitability of the RBI for a particular farm is a key issue for the participation of farmers (e.g. support by the farmer advisor in the drafting of an action plan to achieve the results, 'Flat-rate AECM – Transition of practices' in France; assessments of the status of the habitat, Result-based Management in Austria; training provided to farmers by the advisory service and ornithologists in INP 8.09 Priba (Lapwing) nest protection in Slovenia). Bringing together the knowledge of a scheme advisor with the own knowledge of the farmer of their land enables farmers to decide on the most appropriate management to achieve the required results, rewarding the skills and experience of the farmer while at the same time also reducing the perceived risk or uncertainty (Chaplin et al., 2021).

Risks for farmers increase with the scope of management changes required and the complexity and level of results to be achieved. **Payment sensitivity and modulation** can reduce the risk for farmers and other beneficiaries. Beneficiaries can still receive part of the payment in case the achieved result is lower than the target but higher than a certain minimum level defined by the scheme administration (e.g. 'Flat-rate AECM – Transition of practices' in France, 'ACRES-Cooperation' in Ireland, 'Montado management by results' in Portugal). In other cases, inspections take place twice a year and the payment is made separately for both periods. Therefore, if the beneficiaries cannot achieve the result in one period of the year, they do not lose the whole annual support but only the support that corresponds to that particular period (e.g. in relation to the livestock units (LU) that have been processed in the slaughterhouse for this period, EHK-12 in Finland). However, while enhancing the alignment of the intervention with farmers' needs encourages adoption, excessive alignment carries the risk of self-selection bias toward baseline-complying [13] beneficiaries, which can constrain the additionality of the intervention (Canessa et al., 2024).

Risks particular to (changing) biophysical and socioeconomic operating conditions can be addressed through a **flexible design of contracts**. Increased flexibility of RBIs in enabling farmers to choose management practices that deliver the results can reduce the expected costs of participation (Schaub et al., 2023). Other studies highlight the issue of flexibility, particularly for contracts with longer durations and with respect to the termination of contracts (Canessa et al., 2024, Schulze et al., 2024, Polman and Slangen, 2008). However, if increased flexibility comes with a (perceived) increase in uncertainty of achieving the results, then the willingness to participate might also be negatively affected (Canessa et al., 2023).

Another category of perceived risks relates to the **monitoring, reporting and verification of results**. Results of a recent survey of farmers in several German federal states suggest that farmers require a result-based remuneration system to be simple, user-centred, transparent, flexible and with little effort for documentation (Brüggemann et al., 2023).

Indicators to measure the results achieved need to be understandable and preferably measurable by beneficiaries (e.g. through visual assessments) following initial training, as well as consistent with ecological objectives acceptable to farmers (Pinto-Correia et al., 2022). **Farmers and other beneficiaries must understand and**, where possible, **carry out the monitoring and verification of the results**. Encouraging farmers to monitor results themselves helps them make the decisions that will contribute to achieving the results. Beneficiaries may receive specific training to recognise and measure the results (e.g. BK.14 in Slovenia, Result-based Management in Austria). In Ireland, where the ACRES-Cooperation intervention is a Cooperation type of intervention (Article 77, Regulation (EU) 2021/2115), each project team is responsible for involving both the advisors, but also the farmers who would like to engage and learn more about how to improve their scores. This is considered valuable regardless of whether the beneficiaries are required to carry out the verification independently because it allows assessment of the performance and facilitates adaptive management (Fleury et al., 2015). Insights from beneficiary surveys suggest that many farmers welcome a chance to learn more about the features they are managing (Birge et al., 2017).

In cases where verification of the results by beneficiaries is not possible, farmers' trust in the monitoring and verification process can be strengthened by **engaging them in the process and involving them in the selection of the experts** conducting the verification. Farmers can select from a pool of trained advisors and pay them for the verification of results and the submission of the payment claim. In Ireland's ACRES-Cooperation, the monitoring, reporting and verification is done by the ACRES farm advisors. These advisors are employed by the farmers and act on behalf of the farmers by submitting a claim. Thus, it's not seen as an inspection but more as a technical assistance. Advisors are obliged to visit the field at least three times in five years. This decision was based on the experience that usually there is not any substantial year-on-year increase in the scores, and reducing the visits increases the efficiency of the delivery by lowering the costs since the farmers pay farm advisors that visit the farms. Alternatively, technical staff of local farmer associations can be trained to verify results. In Portugal's Montado management results, technical staff of local farmers' associations have been trained by experts from the University of Evora to assess the indicators. The training included assessments carried out jointly by technical staff and researchers at the beginning of the intervention. As the technical staff is gaining experience, the involvement of researchers will be phased out and limited to verifying the assessments made by the technical staff. The training included assessments carried out jointly by technical staff and researchers at the beginning of the intervention. As the technical staff is gaining experience, the involvement of researchers will be phased out and limited to verifying the assessments made by the technical staff.

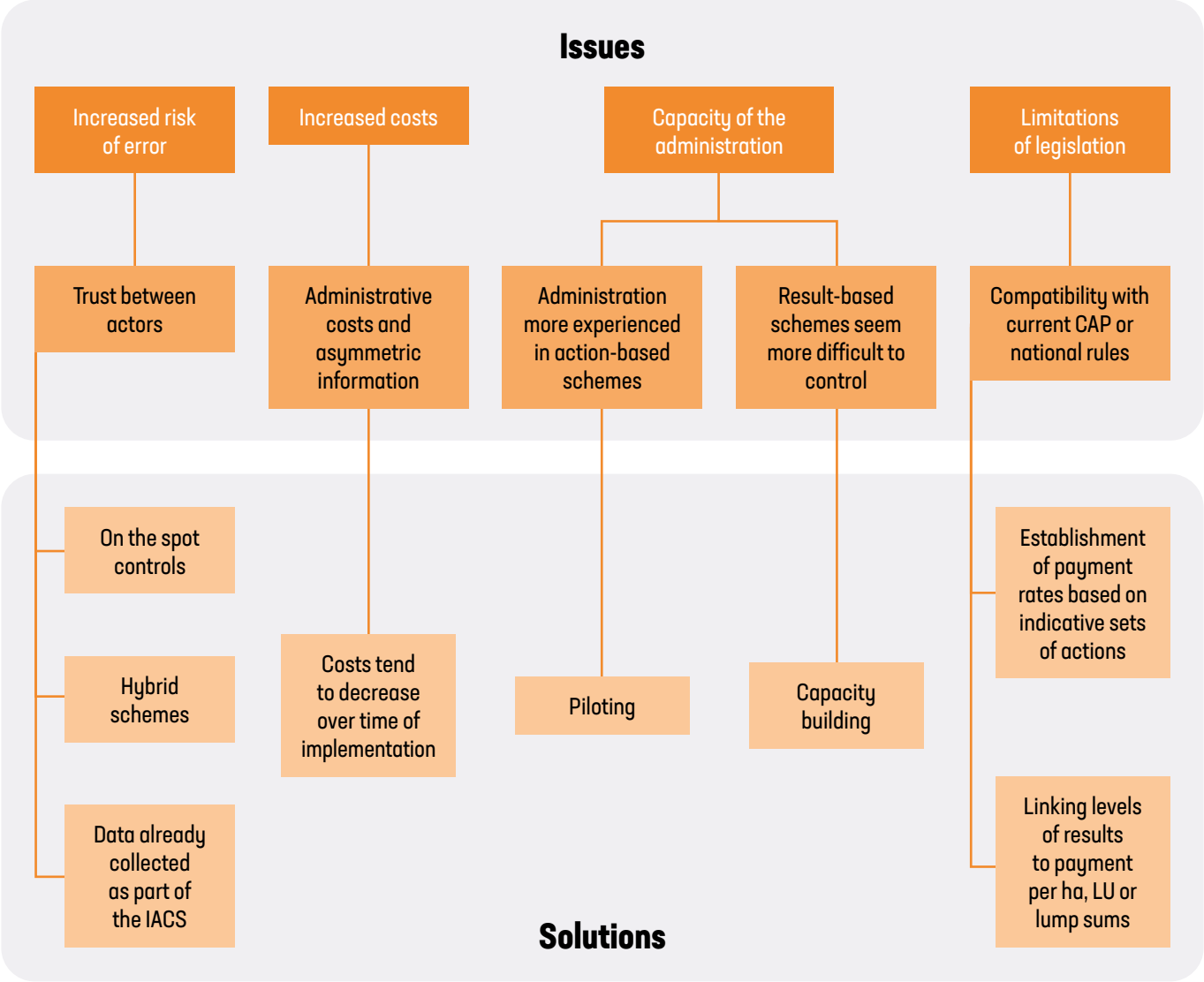
Transparency, compatibility of data collection with the collection of other farm data **and mindful use of farm data** are essential to avoid the perception of farmers that data may be used negatively against them and to maintain farmers' trust in the programme and its assessment procedures. The use of scorecards, beyond contributing to a more holistic assessment of the farm, is also aimed at ensuring consistent and transparent recording of result indicators as a basis for the payment (e.g. Waters of LIFE – Ireland, 'ACRES Cooperation' in Ireland, Beverhoutsveld, Belgium, 'Montado management by results' in Portugal). However, the use of the scoring results for payment validation needs to consider that the different inspectors may not carry out the scoring in exactly the same way. Specific and adequate training, including on how to maintain a consistent commitment to the high standards required for accurate assessments, printed material and/or the use of dedicated mobile applications can be used to mitigate this challenge (e.g. 'ACRES Cooperation' in Ireland, 'Montado management by results' in Portugal).

2.1.2. Key issues for administrative and control bodies

The main issues for administrations relate to the potentially increased risk of errors, the high public transaction costs, especially at the beginning of a result-based intervention, the capacities of the administration and the limitations posed by current EU rules or national legislation. Some solutions have already been identified in the examples analysed. The key issues and solutions are visually summarised in the following diagram and explained in the following paragraphs.

[13] The term 'baseline' throughout this document means the initial status of a beneficiary's farm, before the implementation of a result-based intervention, against which the progress towards specific expected results can be measured. It should not be confused with the meaning of baseline in the context of cross-compliance or conditionality.

Figure 3. Key issues and possible solution for administrative and control bodies of result-based interventions



Source: EU CAP Network supported by the European Evaluation Helpdesk for the CAP (2024)

The issues around the potentially increased risk of error are linked to the existence of a culture of **trust between the different actors** (e.g. administration and control bodies on the one side and farmers and other beneficiaries on the other side), which would allow for fair and low-cost verification of results and accountability levels (Herzon et al., 2018). For administration, the risk could arise from the fact that the results are monitored by farm advisors and reported by the farmer without any verification from the administration or delegated body. To mitigate the risks for the administration, on-the-spot controls are established to verify the results reported (e.g. 'ACRES Cooperation' in Ireland, 'Flat-rate AECM – Transition of practices' in France, Result-based Management in Austria).

In addition, simpler delivery mechanisms and monitoring processes may also mitigate the risk of errors. The results of a recent survey of CAP administrations in several German federal states indicated broad acceptance of **hybrid payment schemes**, combining action and result-based components, with preferences for a small number of indicators to avoid complexity. Indicators that can be calculated with **data that are already collected as part of the IACS** (Integrated Administration and Control System) would be favoured, while indicators that require samples are considered difficult to implement. Some indicators, such as material flow balances and GHG emissions, are seen as more complicated to calculate and are associated with justiciability weaknesses (Lampkin et al., 2023). Simple, reliable and unambiguous methods of indicator measurement provide a sound basis for the financial control of the scheme by the Paying Agency (e.g. Result-based Management in Austria, EHK-12 'Improved conditions for fattening pigs' in Finland).

Public transaction costs of RBIs are another key issue for administrations and control bodies. Such transaction costs typically include those that arise for designing interventions, ex ante evaluation, administration and support, provision of information, provision of training and education (i.e. for ministry staff, advisory services and farmers), compliance inspection, monitoring, ex post evaluation and reporting (Moran et al., 2021). Many of these stem from or are enhanced by asymmetric information. Asymmetric information arises out of hidden information, hidden actions, complex products, high information costs and uncertainty. If we exclude hidden information and hidden actions (moral hazard is not considered to be higher in the result-based designs than in any other measure) then the sources should be searched in the complexity of the results and the high information cost of verifying them. Gathering information about the validity of the result can be expensive and time-consuming and if it outweighs the potential benefits, the administration may decide not to adopt such interventions to avoid an information asymmetry. Experiences from Ireland indicate that result-based interventions can be expected to reduce their per-participant transaction costs over time as they become more efficient and increase the number of participants (O'Rourke and Finn 2020). Moran et al. (2021) highlight that administrative costs for the Burren Programme and other examples, such as the Hen Harrier Programme and the Pearl Mussel Project, do not exceed 15% of the total budget of each scheme.

Other important issues, such as the **capacity of the authorities** and **compatibility with EU and national legislation** are common to action- and result-based schemes (Herzon et al, 2018). However, action-based interventions may be more easily controllable and, given also the long experience in their management, more preferable for Paying Agencies. Piloting result-based payment schemes before their wider implementation and providing capacity building for the administration may mitigate this issue. Beyond that, limitations in designing flexible RBIs may be caused by the rigidity of the current CAP rules. For example, in 'Montado management by results' in Portugal, certain areas that are most degraded could not participate in the scheme due to the definitions of agricultural land and forest and other wooded land. Potential limitations in combining RBIs with other support payments may impact negatively on their potential adoption rates, putting the corresponding budget at risk. For example, such limitations in the compatibility between interventions were noted in the case of the Montado management by results in Portugal, as most of the other schemes are not compatible with the RBI, including animal welfare, to avoid double-funding of certain practices and outcomes. The only other agri-environmental support scheme that can be combined with this RBI is the organic farming scheme.

However, the major issue related to the compatibility with EU legislation is **how payments which depend on the achievement of results comply with the requirements** set out in Regulation (EU) 2021/2115. First of all, the payment rates must be calculated:

- either as additional to the basic income support (only for eco-schemes, point (a) of paragraph 7, Article 31 of this regulation); or
- on the basis of additional costs and income forgone (for eco-schemes point (b) of paragraph 7, Article 31, and for agri-environment-climate and other commitments paragraph 4, Article 70 of this regulation), which can then be adjusted considering the targets set in the CAP Strategic Plan.

At the same time, one of the main characteristics of RBIs is that beneficiaries must be allowed the flexibility to choose the most appropriate management to achieve the result, which means that there are not any pre-described management practices which could be used to calculate the income forgone and the additional costs incurred due to their implementation. Moreover, simply compensating the opportunity costs (additional costs and income forgone) may limit the attractiveness of RBIs, given the beneficiaries' increased perception of risk for these interventions.

In addition, paragraph 7 of Article 31 of this regulation provides that payments for eco-schemes granted to compensate all or part of the additional costs incurred and income foregone can be made only per hectare except the ones related to animal welfare, antimicrobial use and, where duly justified, climate, which can be made per livestock unit. Similarly, paragraph 8 of Article 70 of this regulation, requires that payments for agri-environment-climate commitments or commitments to convert to or maintain organic farming practices and methods are made per hectare. For other commitments, Member States may apply units other than hectares. In duly justified cases, Member States may grant support under this article as a lump sum.

Therefore, there should be a mechanism by which the **achieved results are linked to eligible hectares of agricultural land or livestock units** on which these results have been observed, or, in duly justified cases and for commitments under Article 70 of this regulation, to a lump sum.

Member States have tried to tackle all these issues when designing RBIs in the CAP Strategic Plans. Regarding the calculation of payment rates, they have mostly used an average set of actions that can lead to the achievement of the expected results and calculated the payment rate based on the opportunity costs of implementing this set of actions. The average set of actions was determined on the basis of:

- similar action-based payment schemes that have been already implemented for several years (e.g. Austria's Result-based Management);
- general experience of the implementing bodies and researchers (e.g. in Finland 'Improved conditions for fattening pigs', the calculation was done by the Natural Resources Institute; in Slovenian RBIs, the calculation was done by the University of Ljubljana);
- specific previous in-depth research (e.g. in Portugal 'Montado management by results', the calculation was based on research work as described in Guimaraes et al., 2023); and
- specific experience gained through pilot actions (e.g. Ireland ACRES – Cooperation).

No RBIs have been identified in CAP Strategic Plans where the payments rates go beyond the opportunity costs to provide income incentives that could make these interventions attractive to a wider range of beneficiaries.

Regarding the links between results and payments, Member States have used all the options provided by Regulation (EU) 2021/2115. As the different approaches followed tend to be specific to different objectives, more details about both the calculation of the payment rates and linkages between results and payments per hectare, livestock unit or lump sum are provided in the next section, according to the objective each intervention contributes to.

2.2. Specific aspects by objective

2.2.1. Biodiversity

As outlined in Section 1.1, most of the RBIs and sub-interventions currently programmed in CAP Strategic Plans, focus on objectives related to farmland biodiversity. Key elements of farmland biodiversity relate to seminatural areas, landscape features and extensively managed, species-rich grasslands (Jeanneret et al., 2021). Indicators in biodiversity-oriented result-based schemes are: i) proxies for biodiversity more generally; and ii) measurements against which payments to farmers are determined (Elmiger et al., 2023). Biodiversity indicators can be categorised into:

- biotic indicators, including all living things, such as plants, insects, birds or mammals; and
- non-biotic indicators capturing habitat and management conditions (Kleinebecker et al., 2018). Non-biotic indicators also comprise structural elements, such as hedgerows and their quality, which have been positively linked to biodiversity (Montgomery et al., 2020). Other non-biotic indicators at the landscape scale can predict biodiversity, such as the composition and configuration of the landscape (e.g. Martin et al., 2019).

Indicators in biodiversity-oriented result-based schemes need to be representative of the target habitats and species and occur consistently in farmland habitats in the area where the intervention shall be implemented. Combining different indicators in the measurement and assessment of results, e.g. using scorecards, can provide a more comprehensive overview of the biodiversity state.

More comprehensive biodiversity assessments can potentially be facilitated by harnessing new developments in biodiversity monitoring, such as automated passive acoustic monitoring (Biffi et al., 2024), which has become an increasingly popular method for non-invasive monitoring of bird and bat communities, thanks to the recent development of low-cost autonomous recording units. However, the identification of vocalisations within these recordings, particularly for bird species, has been frequently processed manually or semi-automatically, relying on labour-intensive expert evaluation. Fully automated vocalisation identification is a more recent technique, largely resulting from the increasingly widespread application of novel machine learning algorithms to mass-process large amounts of audio data, bypassing the need for expert evaluation of the recordings. However, more complex combinations and composite indices come with additional monitoring requirements and costs, which need to be weighed against their benefits (Elmiger et al., 2023).

Table 4 provides an overview of the indicators used to measure results and other identified key aspects for the payment design, monitoring, reporting and verification of selected examples of RBIs targeted at biodiversity. The examples include:

- the pure result-based intervention 'Montado management by results' of the Portuguese CAP Strategic Plan, which is an ENVCLIM intervention that supports farmers who carry out environmentally sustainable management of agrosilvopastoral systems in cork oak and oak or black oak groves;
- the hybrid sub-intervention BK.14 'Habitats of birds of humid extensive meadows' of the Slovenian CAP Strategic Plan, which aims at protecting grassland bird species by differentiating between different habitat types; and
- the pure result-based intervention 70-17 'Management based on results' of the Austrian CAP Strategic Plan, an ENVCLIM intervention which focuses on biodiversity by protecting habitats and species, including in Natura 2000, and preserving landscape features.

Table 4. Assessment of selected examples of RBI targeted at biodiversity: overview of key aspects

Key issue	'Montado management by results', Portugal	BK.14 'Habitats of birds of humid extensive meadows', Slovenia	'Result-based Management', Austria
Type of result-based intervention	Pure	Hybrid	Pure
Objective (on key theme)	Biodiversity: to contribute preserving habitats and species and improving NATURA 2000 management in agrosilvopastoral systems in cork oak, oak or black oak groves.	Biodiversity: to protect grassland bird species by preserving moist extensive meadows, which represent a breeding habitat for the bird species, focusing on the corncrake as a leading species.	Biodiversity: to improve or maintain biodiversity by protecting habitats and species, including in Natura 2000, and preserving landscape features.

Key issue	'Montado management by results', Portugal	BK.14 'Habitats of birds of humid extensive meadows', Slovenia	'Result-based Management', Austria
Definition of indicators	Four groups of indicators: healthy and functional soil (A); quercus regeneration (B); biodiverse Mediterranean pastures (C); and singular elements for biodiversity (D): A1-Degree of coverage with negative herbaceous species. A2-Extent of bare soil. B1-Regeneration density at the shrub stage. B2-Conservation status of regeneration. C1-Herbaceous balance level of the grassland. C2-Degree of thistle coverage. C3-Degree of bush cover. D1-Level of diversity of singular items. D2-Representativeness of singular items. D3-Retention status of singular items. Every parcel is assessed against the whole range of indicators included in the scorecard.	The scheme uses a single species indicator (presence of a singing male) and habitat indicators. Based on the annual census of the corncrake, the monitoring contractor delimits the areas of nesting and feeding habitats: › nesting habitat: polygon with a radius of 50 meters around the location of the corncrake; › feeding habitat: polygon between a radius of 50 meters and a radius of 150 meters around the location of the corncrake.	The scheme uses parcel-specific indicators. These show that the area is in good condition or is developing accordingly. Indicators can be both biotic indicators such as the presence (or absence) of species (e.g. at least four of a list of eight plant species occur on the site) as well non-biotic indicators such as the presence (or absence) of structural elements (e.g. in relation to vegetation density). Information on additional indicators (e.g. on animal species, such as insects) are collected. These are not part of the control system and do not impact the achievement of the results for the payment. The purpose of these additional indicators is to give the farmer more information and to improve their understanding of the environmental objectives on their sites. The additional indicators are also used to evaluate the objectives.
Determination of the level of result	'Transdisciplinary arena' established with a selection of land owners, farmers, researchers and the ministry of agriculture defines environmental results, the validation of indicators as well as the conversion of the assessment of indicators into the final score and payment. No obligation for farmers to increase the score during implementation.	The determination of results was tested in a pilot project involving farmers, different research and advisor organisations and environmental organisations. The piloting tested the suitability of the indicators, as well as the success and speed of information transfer between stakeholders. No obligation for farmers to increase the result during implementation.	An initial inspection ensures farmers of the status of their habitat. As part of an inspection, the habitat status is assessed and concrete results for biodiversity to be achieved on the land are agreed together with the farm. The actions to achieve these results are decided annually by the farm itself and therefore remain flexible. An improvement of the status is not obligatory.
Use and setting of baseline	No baseline established. Farmers are paid according to the score of the parcel, calculated at the time of the inspection.	There is no baseline as such. The presence of the corncrake is determined by the annual monitoring of birds in the agricultural landscape.	There is no baseline as such, but the initial assessment is used to decide on the participation of the farm in the intervention and to establish the results to be achieved.

Key issue	'Montado management by results', Portugal	BK.14 'Habitats of birds of humid extensive meadows', Slovenia	'Result-based Management', Austria
Approach for monitoring, reporting and verification	The monitoring is done by certified technical staff of the farmer associations and also involves the farmers. Scientific experts verify the results through on-the-spot checks. As the parcels are quite big, a grid is created for each parcel, with a cell size of 5 ha, and indicators are measured at the centre of each cell. Each indicator can get a value between 0 (worst) and 4 (best), always indicated by ranges. The score for each indicator for the whole parcel is calculated as the mode [14] of observed values in each cell of the grid. Then the values of the indicators are summed up producing a total score for the parcel on a scale of 0 to 10. Training, including guidelines and fiches, is provided for the technical staff of the farmer association and the farmers.	Inspections are done by administration and certified experts, also using satellite or other earth observation sensors. Based on the annual census of the corncrake, the contractor delimits the nesting (50 m radius around the nest) and feeding habitat (between 50 m and 150 m around the nest). The parcels (GERKs) polygons are then superimposed to the nesting and feeding habitats to determine the area of each parcel that intersects nesting and feeding habitats. Mandatory training for farmers on nature conservation and environmental issues.	The monitoring of the results is obligatory for farmers. The documentation of the results is done via an app; big farms use an excel sheet. Each parcel is assessed using the indicators agreed during the initial inspection and classified as best, medium or worst. There are two levels of verification. The first level is done by the project managers who inspect 10% of farms. The second level of verification is done via on-the-spot controls by the Paying Agency. Capacity building and awareness raising activities for farmers are key elements of the intervention to ensure farmers understand the indicators and the purpose of the assessment.
Consideration of co-benefits	The indicators of the scorecard reflect co-benefits across all four groups of environmental indicators.	Ban of fertilisers and plant protection products (as part of the management prescriptions) is expected to provide co-benefits for water and soil quality.	In some cases, biodiversity indicators also cover aspects of water and soil quality, especially on arable plots.
Establishment of payment rates	An indicative set of practices for achieving the results and the costs associated with these practices were determined through scientific research (Guimarães et al., 2023). Then the costs for implementing these actions to achieve an average level of results were estimated by the ministry of agriculture. The level of payments is not linear but slightly progressive, meaning that the better results are achieved (meaning higher scores), the more funds the farmer will receive.	Payment level per hectare has been established on the basis of the additional costs incurred and income foregone resulting from an average set of practices. The calculation was made by an independent institution – University of Ljubljana, Biotechnical Faculty.	The payment levels have been estimated based on a list of actions related to a well-known action-based measure which has been in place in Austria since 1995.

[14] The most frequent value observed.

Key issue	'Montado management by results', Portugal	BK.14 'Habitats of birds of humid extensive meadows', Slovenia	'Result-based Management', Austria
Linking results to payments	The payment is released when the score of the parcel is at least five. In this case, the total eligible area of the parcel, as determined in IACS, is multiplied by the payment rate to derive the amount of the support. Some level of payment sensitivity is implemented, with payments slightly increasing with better results.	The presence of a corncrake is needed to achieve the results of successful grassland management, which represents the presence of feeding and nesting habitats, determined based on location of singing males. To calculate the amount of support, the eligible area of each parcel, as determined by IACS, which intersects with the nesting and/or feeding habitats, is identified and multiplied by the corresponding payment rate as follows: Level 1 – feeding habitat: payment is granted for the part of the parcel that intersects with the area between a 50 m and 150 m radius around the identified singing male. Level 2 – nesting habitat: a higher payment is granted for the part of the parcel that intersects with the area within a radius of 50 m around the singing male. Level 3 – population density: an even higher payment is granted for the part of the parcel that intersects both feeding and nesting habitats of several individuals of the corncrake in the same area. In addition, action-based component provides payment for management prescriptions, e.g. regarding the timing and method of mowing and ban of grazing. Payment sensitivity is implemented through different rates at three levels for the presence of feeding habitats, nesting habitats and population density.	The payment is based on the quality level of habitats (best, medium, worst). The total eligible area of the parcel, as determined in IACS, is multiplied by the corresponding payment rate to derive the amount of the support. A monitoring supplement of the payment is granted to compensate farmers for the time and effort involved in monitoring and recording. Payment sensitivity is implemented through progressive payments according to the status levels.
Evaluation process	The evaluation will apply a counterfactual approach. This will include soil samples from a set of plots within the scheme as well as control plots outside the scheme. The evaluation will focus on the effectiveness of the intervention.	The evaluation analyses data on the implementation, analysing trends if the scheme contributes to the objectives.	A result evaluation is planned for 2025 (while the measure is still running).

Source: EU CAP Network supported by the European Evaluation Helpdesk for the CAP (2024)

2.2.2. Water and soil quality

Water quality refers to the status of waterbodies in terms of the physical, chemical, biological and organoleptic (taste-related) properties of water [15]. Soil quality is an account of the ability of soil to provide ecosystem and social services through its capacities to perform its functions and respond to external influences. Soil quality encompasses complex information on the sum of different soil characteristics, with some of these parameters used to quantify and evaluate the effects of agricultural soil management practices on soil quality and the environment (EJP Soil, 2023).

Only a few examples of result-based interventions outlined in Section 1.1.2 explicitly target water and soil quality and include indicators to measure results as a basis for the payment. This may be due to the fact that result-based interventions targeted at water and soil quality pose a number of challenges. The impact of land management to reduce diffuse pollution from run-off may only be apparent lower down the catchment and distinguishing the locations and farms from which the pollution originates is a key problem within catchments. This suggests that a catchment scale (collective) approach would be required to achieve a measurable impact on water quality indicators (Reaney et al., 2019).

Achieving water and soil quality objectives requires a long timescale. The results of improved soil management are often not reliably measurable in the early years and take many years to achieve full effect. Long-term monitoring connected to the mitigation of point source risks, for example as identified by the drainage risk assessment and the scoring of terrestrial habitat integrity done by Overy et al. (2024), would assist in determining the contribution to catchment scale water quality. Longer contracts offer farmers a lasting commitment to support soil and water management, and a greater chance of achieving noticeable positive results. However, for Managing Authorities to commit to longer contracts will require negotiating extended EU support for more than one programming period, in order to avoid the risk that EU priorities change in future and the Member State is left to honour the extended agreement through national funds. Long-term contracts would also need to account for possible changes in landowners or managers, e.g. to spatially link the results-based component of the payment to a particular parcel of land to allow continued positive management towards soil and water objectives (ENRD, 2018).

Many important issues for water quality, such as nitrogen leaching and runoff, phosphorus runoff, sediment runoff and pesticide runoff, which are considered 'non-point source pollution', can be difficult and costly to measure at parcel level, potentially rendering direct environmental results measurement infeasible. Recent studies (e.g. Overy et al., 2024) point further attention to drainage assessments and include measurements of instream sedimentation as a means to improve the assessment of management risks for water quality. These measurements can be more easily associated with agricultural land connected to the assessed drainage streams. Their results, based on experiences with result-based interventions in Ireland, indicate that linking payments to farmers to the drainage risk assessments could positively contribute to improving catchment scale watercourse quality. Indicators that measure directly the state of water quality can be used, such as nitrate, phosphorous and pesticide pollution (European Commission, 2023a).

Another option is to use pressure indicators, e.g. measuring the reduction of the use of pesticides instead of measuring the concentration of active substances in water bodies. Pressure indicators for water quality, based on field and management data, include gross nitrogen balance, risk of pollution by phosphorus and pesticide risk. Similarly for soil quality, a pressure indicator could be the risk for soil erosion (European Commission, 2023) to tackle the issue that changes in soil parameters, such as soil organic matter, nutrient status of soils including contents of main macronutrients and micronutrients, and physical parameters such as texture, stoniness, porosity, and bulk density, might only be observable after several years.

This option can be supported by the increased use of **data registered in farm management information systems**, which could be a direct source of information about the actual use of nutrients, pesticides and other inputs. Supported by DG AGRI, the EU Space Programme (DG DEFIS) and the EU ISA2 Programme (DG DIGIT), the FaST digital service platform [16] makes capabilities for agriculture, environment and sustainability available to EU farmers, Paying Agencies, farm advisors and developers of digital solutions. It is an open-source platform, deployed as a mobile or web application, that provides, among others, recommendations on fertilisation plans based on operational algorithms provided by Member States. It can support farmers to improve agronomic performance while reducing fertiliser costs and environmental impact, but, at the same time, it can be used to monitor the amount of nutrients applied in each parcel. Some Member States incentivise farmers to use such digital tools through which a wealth of data at the farm level will be available, including on the use of fertilisers, pesticides and irrigation practices [17]. While verification of these data remains a challenge, it could be addressed by complementing the registered data with actual measurements of soil nutrient levels carried out by independent laboratories.

After several years of implementation and further advances in the development of the monitoring framework, a new (bonus) component could be added to the intervention which provides an additional payment for measured results directly in the water body or drainage streams. This could also reflect a bonus component for achieving results at catchment level (Fleming et al., 2022). These catchment level performance measures, e.g. monitoring water quality at the mouth of a watershed, were tested to trigger bonus payments to participating farmers in the Iowa and Vermont (USA) Performance-based Environmental Policies for Agriculture (PEPA) initiative. The experience highlights that the monitoring of catchment level results can help to meet agency and taxpayer objectives if it is secondary to an accurate and flexible farm-level performance measure (e.g. using indicators such as P Index and soil testing) (Winsten et al., 2011).

Alternatively for both water and soil quality, OECD (2022) suggested basing payments on modelled environmental results when the modelling is sophisticated and considers site-specific agronomic, ecological and biophysical features of a given field parcel, such as field slope, soil type, hydrology, or crop rotation to predict the effects of selected practices on environmental results. Several studies have

[15] United Nations Statistics Division - Environment Statistics

[16] https://fastplatform.eu

[17] Unleashing digital tools to back evaluations of CAP support for the management of natural resources. EU CAP Network, CAP Evaluation News, Issue 5 (December 2023) p. 9 https://eu-cap-network.ec.europa.eu/publications/cap-evaluation-news-december-2023_en.

explored the feasibility of using ex ante modelling for result-based interventions. A case study in Sweden (Sidemo-Holm et al., 2018) used a nutrient emission model to design a RBI for nonpoint-source pollution abatement from arable land, based on expected results of relocating buffer strips to where they are predicted to be more effective.

Further examples using modelling to overcome the difficulty of estimating water quality improvements include a pilot scheme in the US using a model-based online decision support tool, the Great Lakes Watershed Management System. This tool provided the basis for result-based payments for model-estimated effects on water quality of various management practices (False et al., 2016). Another example is the modelling of the phosphorus index as a performance measure in Iowa and Vermont (USA), as part of PEPA (Berthet et al., 2021). The model enabled a priori evaluation of alternative actions that the farmer is willing to consider. It is however important to account for time and resources needed for data collection on the farms as well as for processing that information through the model (Winsten et al., 2011).

However, examples of RBIs currently implemented in CAP Strategic Plans rely on on-field inspections. Modelling to define results and payment is not used. Modelling of results can increase payment certainty for farmers and other beneficiaries in the context of existing difficulties and complexities with in situ monitoring of the results of measures (Zilans et al., 2019). However, models must also be credible and conservative in their estimates of environmental performance to avoid undermining the credibility of the result-based incentive (Winsten et al., 2011). Issues to be solved relate to the transparency and certainty of modelled environmental outcomes and the complexity and data intensity of such approaches. It is necessary that models predict at an adequate temporal and spatial resolution to allow policymakers to evaluate the contribution of local actions to the probability of reaching environmental goals and use such information to design future interventions. The complexity and data- ntensity of modelling approaches can result in errors throughout the modelling chain. Uncertainties in the modelled results have to be quantified (Bartkowski et al., 2021).

As mentioned above, very few of the existing examples of RBIs target water and soil quality. Table 5 provides an overview of the indicators used to measure results and other identified key aspects for monitoring, reporting and verifying selected examples of RBIs targeted at water and soil quality.

The theme 'Plant health strategy' of 70.27 'Flat-rate AECM – Transition of practices' in France, an ENVCLIM intervention contributing to water and soil quality by reducing threats stemming from the use of plant protection products. It is a hybrid payment scheme where beneficiaries must undertake specific actions to establish a baseline and draft an action plan, and also to reduce the Treatment Frequency Indicator (IFT) [18] by at least 30% (further details on the IFT indicator are provided in the table).

Another intervention included in the table is 'ACRES Cooperation' in the Irish Strategic Plan, which is an ENVCLIM intervention that aims to contribute to water and soil quality alongside other environmental objectives such as biodiversity and climate change mitigation and adaptation. It offers result-based payments to participating farmers that reflect different qualities (levels) of the results, using a system of ten possible scorecards covering different target agricultural habitats and species (e.g. grassland, peatland, shrub and woodland, rough grazing, breeding waders, corncrake). While the verification of the results for which a payment is provided focuses on biodiversity (e.g. number and cover of species and vegetation structure), the scorecards include indicators of relevance for water and soil quality (e.g. risk of soil erosion, hydrological integrity).

In addition, some key aspects are added to the 'Water of Life' intervention in Ireland, but full details of the intervention are not yet published. The Waters of LIFE is funded under the LIFE programme (https://www.watersoflife.ie/) and focuses on water quality. It is a hybrid intervention with result indicators relating to different factors of the river habitat. The better the quality of the river habitat, the higher the score to which the level of payments is linked.

Table 5. Assessment of selected examples of RBIs targeted at water and soil quality: overview of key aspects

Key issue	Plant health strategy – 'Flat-rate AECM – Transition of practices', France	ACRES – Cooperation, Ireland	Waters of Life, Ireland
Type of result-based intervention	Hybrid.	Hybrid.	Hybrid.
Objective	Water and soil quality.	Water and soil quality.	Water quality and use: to help reverse the deterioration of Ireland's most pristine waters.

[18] Indicateur de Fréquence de Traitements phytosanitaires (IFT) | Ministère de l'Agriculture et de la Souveraineté alimentaire

Key issue	Plant health strategy – 'Flat-rate AECM – Transition of practices', France	ACRES – Cooperation, Ireland	Waters of Life, Ireland
Definition of indicators measuring the results	The result-based component of the interventions uses the Treatment Frequency Indicator (IFT). The IFT monitors the use of phytosanitary products and counts the number of reference doses used per hectare at a spatial unit over a given period. Generally, the spatial unit is the plot of land and the time period is the crop year. The definition of reference doses of a product is based on the information in the decisions related to the marketing authorisations of plant protection products and is specific for each year, crop and enemy targeted by the phytosanitary product. Treatments included in the indicator can be those carried out on the plot, on the seed, or the plant before planting. Treatments on the harvested products are not considered in the indicator. This indicator can be aggregated at the scale of a set of plots, a cropping system, a farm, a group of farms, a territory or a region. It can also be segmented by family or type of plant protection products, type of treatments, enemy targeted or type of crops.	The results are measured by indicators grouped in scorecards, which mainly assess: ecological integrity, threats and pressures or future prospects, and hydrological intensity. Of relevance for water and soil quality are different pressure indicators: › Threats and pressures: assessment of risk to the quality of natural water bodies, risk of soil erosion. › Hydrological integrity, mostly measured by the presence and condition of artificial drainage (with positive scores when no artificial drainage is taking place).	Results indicators related to a range of factors which can impact on water quality, biodiversity and climate change, will be used to determine a score for environmental quality at the farm level. The scorecard allocates marks to reflect the quality of the habitat in terms of water management and exposed soil and damaging activities. Further indicators relate to plant species, vegetation structure. Further development of a field scoring systems for water quality was envisaged in the development of the intervention.

Key issue	Plant health strategy – 'Flat-rate AECM – Transition of practices', France	ACRES – Cooperation, Ireland	Waters of Life, Ireland
Determination of level of result	A beneficiary must achieve a reduction in the IFT of at least 30%. This target has been set based on the experience of relevant stakeholders.	The indicators and their score and weight in each scorecard have been set based on previous experiences (e.g. the Burren project for more than 20 years). Additionally, the results of and the knowledge accumulated by relevant cooperation projects in the 2014-2020 period have been used as input for the initial drafting of scorecards. These drafts were then discussed with the cooperation teams and selected for the 2023-2027 period to reach their final form. There is no obligation for the farmers to increase their score during the implementation of the intervention.	The better the quality of the habitat, the higher the mark awarded in each section. Habitats receive a final score on a scale of 0 (low) to 10 (high) and the level of payments are linked with this score.
Use and setting of baseline	A baseline establishment is required.	There is no baseline establishment, as the farmers are paid according to the combined score of all the parcels in the farm, calculated by the advisors at the time of the inspection.	Not clear as the full scheme has not yet been published.

Key issue	Plant health strategy – 'Flat-rate AECM – Transition of practices', France	ACRES – Cooperation, Ireland	Waters of Life, Ireland
Approach for monitoring, reporting and verification	Farm advisors establish the baseline and monitor results. After the initial inspection and establishment of the baseline, the farmers are equipped with a personalised action plan that is tailored to the conditions of the farm and guides them in achieving the results. Beneficiaries must record the actions they have undertaken during the commitment period. Both the baseline and the results are submitted by the farm advisors to the farmers and the latter report them to the Paying Agency. The values of the IFT for field crops, viticulture, and some fruits and vegetables are calculated at the national or regional level by the French Ministry of Agriculture and Food Sovereignty to serve as a benchmark against which individual parcels or other aggregations can be compared. On-the-spot controls for the verification of the results have been planned by the administration but had not yet been put in place when this report was drafted.	The monitoring, reporting and verification is done by ACRES farm advisors. These advisors are employed by the farmers and they act on behalf of the farmers by submitting a claim. Thus, it's not seen as an inspection but more as a technical assistance. Advisors are obliged to visit the field at least three times in five years, based on the experience that usually there is no substantial increase in the scores year-on-year. Reducing the visits increases the efficiency of the delivery by lowering the costs since farm visits of advisors are paid by the farmers. Each farmer is assigned to a cooperation team responsible for a specific area. Each cooperation team has background information for each parcel of the zone. Training and guidance are provided to advisors. The registration of the scores by the advisors is done through a mobile app. The Managing Authority carries out on-the-spot checks, whereby the inspectors rescore the parcels.	Details of the approach for monitoring and verification are not yet published. The following elements were considered in the development phase: Reporting: participants will score their own land at least every year with support from the project team. Training for participants will be provided on results-based payments, habitat recognition, water quality and biodiversity. Monitoring: considered options for monitoring include: i) use of existing methods to monitor outcomes with an increased number of monitoring stations; ii) trial innovative monitoring methods, e.g. simple compliance scorecards; and iii) monitor attitude and engagement of participants. Verification: suggested options include: i) using existing methods such as Earth Observation Data and on-the-ground verification of actions; ii) exploring novel means of developing a verification system such as trialling Artificial Intelligence to assess the consistency of self-assessments; iii) developing a project database with real-time information for result verification.
Consideration of co-benefits	No specific co-benefits are measured under this intervention theme.	The intervention considers co-benefits across several environmental themes covered by the scorecards. The use of the data in the scorecards would enable the extraction of further information (e.g. regarding water pollution and carbon storage) by making certain assumptions, but this would be qualitative and subject to uncertainties.	The intervention considers co-benefits across several environmental themes through the combination of indicators in the scorecards. The main co-benefits are in terms of biodiversity.

Key issue	Plant health strategy – 'Flat-rate AECM – Transition of practices', France	ACRES – Cooperation, Ireland	Waters of Life, Ireland
Establishment of payment rates	The payment rates have been established by external consultants based on the cost and/or income forgone of an indicative, average set of actions that may lead to the achievement of the results. A flat rate approach has been adopted, whereby every beneficiary can receive a certain amount of money, regardless of the managed utilised agricultural area or livestock units and only conditional to the implementation of the action-based part and the achievement of the corresponding result. This approach has been chosen to address the challenge of a very diverse set of actions a beneficiary may undertake to achieve the target. However, it must be noted that this approach may favour smaller farms for which the additional costs or income forgone in order to achieve the target may be smaller than the ones in larger farms.	The payment rate has been calculated based on additional costs and income forgone incurred by adopting a theoretical set of practices that can lead to the highest score level. This initial rate has then been reduced to fit within the available budget. The set of practices was determined based on the experience of the long implementation of similar pilot projects. The payment rate is the same for all scorecards to avoid cannibalism between them.	Not clear as the full scheme has not yet been published.
Linking results to payments	Beneficiaries must achieve a 30% reduction in the IFT in order to receive the result-based component of the payment. As this is a lump sum payment there is no need to link the result to eligible hectares. Each region can decide on how to issue the payment tranches (annually or differently).	Payments are linked to the score of each parcel. A certain field may be scored using more than one scorecard. The combined score is calculated by applying a weight on each scorecard that is proportional to the corresponding area. Then eligible hectares of each parcel, as determined in IACS, are multiplied by the payment rate that corresponds to the score achieved to calculate the amount of the support. Payment sensitivity is reflected in non-linear changes in payment rates from one score level to the next. The change is smaller between the lower levels and bigger between the higher levels, reflecting the more demanding changes in the practices required to achieve higher score levels.	Not clear as the full scheme has not yet been published. However, different options to link payments to results and to implement payment sensitivity were explored during the development phase. These options include: › Implement digressive payments › Lower payments to landowners in low pressure areas › Frontload payments › Offer collective bonus at catchment level › Review payments regularly

Key issue	Plant health strategy – 'Flat-rate AECM – Transition of practices', France	ACRES – Cooperation, Ireland	Waters of Life, Ireland
Evaluation process	At national level, there will be a thematic evaluation of all AECM (including the result-based ones). A wider evaluation covering all environment-climate objectives is also envisaged. Based on these evaluations (the AECM-specific and the climate objectives-specific) the Managing Authority and the regions will make improvements to the design of the interventions.	The evaluation is planned at the thematic level rather than individual scheme level. Themes to be evaluated include habitat quality, water and soil, and emissions.	Not clear as the full scheme has not yet been published.

Source: EU CAP Network supported by the European Evaluation Helpdesk for the CAP (2024)

Beyond the examples analysed above, some new approaches emerge regarding the sustainable management of water used for irrigation. A specific case found in the Corsica region in France is illustrated in Box 2 below. It is a scheme implemented as a combination of an INVEST and a flat-rate ENVCLIM intervention. This cannot be considered an RBI since a specific level of results that must be achieved by the beneficiaries has not been defined. However, it sets the basis that will allow it to potentially evolve into a typical RBI in the next programming period.

Box 2. Emerging approaches to sustainable water management: quantitative management of water resources in Corsica, France

The option 'Quantitative water management' of the intervention 70.25 Flat-rate AECM 'Protection of water resources' implemented in the Corsica region provides support to farmers to make the necessary changes to their farming practices towards improved management of the water used for irrigation.

It includes an initial assessment of the farm to establish the baseline and determine the action plan that must be followed by the beneficiary. This plan includes specific training to be followed by the beneficiary and a set of obligatory and optional investments to improve water consumption. The investments selected by the beneficiary may be subject to specific financial support, with an increased rate of aid for some of them, and they are financed by the intervention 73.09 'Productive investments on farm – Corsica'.

On top of these actions, the beneficiaries must monitor water consumption for irrigation in their farms and compare it with the theoretical consumptions for the same type of crop both for a normal and dry year, but without any obligation to achieve a certain reduction in consumption.

This scheme could evolve into a hybrid intervention, where the action-based component consists of the training and the obligatory investments, while the result-based component is conditional upon maintaining a consumption between the theoretical optimal consumptions for a normal and dry year.

Source: EU CAP Network supported by the European Evaluation Helpdesk for the CAP (2024)

2.2.3. Animal welfare

Animal welfare is assessed by observing or measuring physical or behavioural features of the animal or qualities of the animal's environment. These signs of animal welfare are known as 'welfare indicators' and can be used to measure the results achieved by an on-farm intervention.

For these indicators, one can observe directly the animals, look at the resources available to them or observe the management practices applied to them. The corresponding categories of indicators, depending on how the assessment of animal wellbeing is approached include:

- Animal-based indicators that are measured directly on animals, such as changes in behaviour, appearance (physical), health and physiological parameters, e.g. lesions (foot pad dermatitis in broilers, lameness in dairy cows) and behavioural disorders (feather peaking in hens, tail biting in pigs).
- Resource-based indicators that are not measured in the animals but in their environment, e.g. access to pasture for cows, available space and floor slipperiness.
- Management-based indicators for management procedures (or the absence of them) that animals undergo, e.g. the presence of tail docking in pigs, dehorning of cattle, feeding and handling practices.

These categories of indicators are used to monitor the progress in relation to the five domains of animal welfare: (1) nutrition, (2) environment, (3) health, (4) behaviour, and (5) mental state (Mellor et al., 2020). The complexity of assessing animal welfare, illustrated by the intersection between the categories of indicators and the five domains, leads inevitably to the need to have many indicators in order to properly reflect the animal welfare conditions and improvements. The study on CAP measures and instruments promoting animal welfare and reduction of antimicrobial use (European Commission, 2022) has identified 15 indicators most widely used in EU projects and protocols and in the conducted case studies. The list of these indicators can be found in Annex II.

In 2022, the Evaluation Helpdesk organised a Thematic Working Group [19] to identify a reduced number of indicators (or a composite one) that could be used in the evaluation of CAP interventions for the improvement of animal welfare, building on the above list of indicators. As part of the Thematic Working Group, a survey was carried out to assess the state of play of data collected for animal welfare in Member States. The results of the survey [20] showed that:

- Several indicators (mortality rate, indoor density rate, absence of injuries, absence of disease, antimicrobial use) are already monitored for most species in most of Member States.
- The data collected for these indicators represent a good coverage of the underlying livestock farms.
- These data are collected, in most cases, by qualified or specifically trained personnel.
- For some species (pigs, poultry) the data may be collected as part of private schemes and might not be available to public agencies.

Recently, there has been growing interest in positive animal welfare, which focuses not only on the negative aspects of welfare, which should be alleviated but also emphasises the positive aspects of welfare that animals should be experiencing in their lives. The indicators that can be used to monitor positive welfare at farm level are animal- or resource-based and mostly related to the behavioural dimension. Papageorgiou and Simitzis (2022) provide an overview of these indicators for ruminants.

The monitoring of indicators and the verification of the results of animal welfare-related RBIs can be done by independent inspectors affiliated to the Paying Agency. Complementarities may be sought with regular inspections that are carried out in the farms for other legal requirements and official controls (for example in the framework of Regulation (EU) 2017/625 of the European Parliament and Council [21]).

Dedicated monitoring systems can also be used for the monitoring, reporting and verification of animal welfare practices at farm level. The Classyfarm system, financed by the Italian Ministry of Health, was elaborated in 2018 by the Instituto Zooprofilattico Sperimentale of Lombardia and Emilia Romagna together with the University of Parma. ClassyFarm can analyse and compare a large amount of information from different sources to monitor animal welfare, farm biosecurity and antimicrobial use and resistance. This data collection and analysis enables, among others, the efficient scheduling of official animal welfare, pharmacosurveillance and biosecurity controls for those farms with a higher risk rating (Classyfarm, 2023).

In order to navigate the complexity of animal welfare monitoring and verification, administrations must develop targeted interventions addressing the aspects of animal welfare that are most important for each species and production system in their specific context. To this end, a certain level of consensus must be reached between beneficiaries and administrations regarding the indicators that will be used and their ability to reflect the outcome of a variety of actions carried out at the farm level, while, at the same time, minimise the burden of monitoring reporting and verification. An example of this can be found in the Finish CAP Strategic Plan, summarised in Table 6.

[19] Development of Animal Welfare Indicator | EU CAP Network (europa.eu)

[20] The results have been presented in the Expert Group on the Implementation of the CAP Strategic Plans Regulation, focus on monitoring and evaluating the CAP on 11 November 2022.

[21] Regulation (EU) 2017/625 of the European Parliament and of the Council of 15 March 2017 on official controls and other official activities performed to ensure the application of food and feed law, rules on animal health and welfare, plant health and plant protection products, amending Regulations (EC) No 999/2001, (EC) No 396/2005, (EC) No 1069/2009, (EC) No 1107/2009, (EU) No 1151/2012, (EU) No 652/2014, (EU) 2016/429 and (EU) 2016/2031 of the European Parliament and of the Council, Council Regulations (EC) No 1/2005 and (EC) No 1099/2009 and Council Directives 98/58/EC, 1999/74/EC, 2007/43/EC, 2008/119/EC and 2008/120/EC, and repealing Regulations (EC) No 854/2004 and (EC) No 882/2004 of the European Parliament and of the Council, Council Directives 89/608/EEC, 89/662/EEC, 90/425/EEC, 91/496/EEC, 96/23/EC, 96/93/EC and 97/78/EC and Council Decision 92/438/EEC. OJ L 95, 7.4.2017, p. 1–142. ELI: http://data.europa.eu/eli/reg/2017/625/oj

Table 6. Assessment of selected examples of RBIs targeted at animal welfare: overview of key aspects

Key issue	EHK-12 'Improved conditions for fattening pigs', Finland
Type of result-based intervention	Pure.
Objective (on key theme)	Animal welfare – improve well-being of pigs.
Definition of indicators	Percentage of carcasses with intact tales identified in the slaughterhouse. A minimum of 95% of carcasses with intact tails per farm must be achieved. Although the assessment in the slaughterhouse depends also on the transportation of animals from the farm to the slaughterhouse, it mostly reflects the conditions on the farm as there are no major issues in the transportation. An intact tail describes the lifelong well-being of the entire pig.
Determination of the level of result	The level (95% of carcasses) has been defined through consultation with relevant stakeholders (e.g. farmers, researchers, advisers, veterinarians, inspectors from paying agencies, companies and NGOs). The levels have been set in such a way that it is well above the minimum level defined in the national legislation, and, at the same time, attainable so that farmers are willing to participate.
Use and setting of baseline	There is no baseline as the design is not linked to an improvement against an initial situation. A 95% of intact tails indicates the lifelong well-being of the vast majority of the pigs in the corresponding farm.
Approach for monitoring, reporting and verification	The results are monitored at the slaughterhouse, where an independent inspector assesses each carcass. To ensure standardisation of monitoring, trainings are organised by the Paying Agency and advisory services. The Paying Agency trains the inspectors that assess the intact tails in the slaughterhouse. According to the intervention, no specific actions are requested to be followed by the farmers; on the contrary, the farmers are free to decide what is best applied on the farm and, therefore, which actions to take. Advisors are trained to provide relevant advice to the farmers about the actions that can decrease tail biting and achieve the expected level of results. This process allows the creation of a link between the actions made on the farm and the results achieved. The inspector assesses the carcasses of both beneficiaries and non-beneficiaries and reports the data to the farmer. The farmers that participate in the intervention must share the inspector's report with the Managing Authority and Paying Agency, by uploading it to the dedicated IT system. The results are already verified because they are monitored and reported by independent inspectors affiliated with the Paying Agency.
Consideration of co-benefits	No information on antimicrobial resistance is collected under this intervention. Nonetheless, there is an independent (private) system maintained by ETT [22]. This system for pigs is called Sikava. It relies on veterinarians who go into farms, perform a health classification and advise farmers on the actions they have to take to increase animal welfare and biosecurity, and on the medication and vaccination of animals. The aim of the RBI is to improve animal welfare and reduce the use of antibiotics, but also Finnish consumers are very concerned about the topic, so having an improvement on animal welfare could have positive impacts on the consumer as well.

[22] https://www.ett.fi/en/home/

Key issue	EHK-12 'Improved conditions for fattening pigs', Finland
Establishment of payment rates	The payment rate has been estimated by the Natural Resources Institute of Finland, an independent body. The rate reflects the income forgone and additional costs of an indicative set of actions that can lead to the achievement of the result.
Linking results to payments	Payments are linked to results and the corresponding livestock units. The cumulative percentage of carcasses with intact tails is calculated twice per year. If it is greater than or equal to 95% the farmer receives the payment that corresponds to the total livestock units that have been processed in the slaughterhouse in the period concerned. There isn't any progressive payment if the result achieved is higher than 95%. If the 95% threshold is not reached for any given period, no payment is issued. The inspection takes place twice a year and a separate payment is made for each period. Therefore, if the farmers cannot achieve the result in one semester, they do not lose the whole annual support but only the support that corresponds to the livestock units that have been processed in the slaughterhouse for this period.
Evaluation process	The data collected for this intervention can improve the evaluation of Specific Objective 9 by providing evidence for animal welfare improvements using an animal-based indicator. An evaluation has been launched and it includes all interventions related to animal welfare, including health and biosecurity. It is planned to be completed in two years.

Source: EU CAP Network supported by the European Evaluation Helpdesk for the CAP (2024)

2.2.4. Antimicrobial use

No examples of RBIs could be identified for antimicrobial use. In this section, we provide information on the key aspects that could be considered towards the development of an RBI for this topic.

Following WHO definitions, antimicrobial resistance (AMR) occurs when bacteria, viruses, fungi and parasites change over time and no longer respond to medicines making infections harder to treat and increasing the risk of disease spread, severe illness and death. It is widely recognised that antimicrobial use (AMU) leads to the selection of resistant variants and that animals may constitute one of the reservoirs of resistant bacteria and resistance genes. Consequently, reducing AMU in both humans and animals is an essential step toward limiting the prevalence of AMR in both humans and animals.

There is considerable diversity in the indicators used by the Member States to analyse antimicrobial use at the farm level. Nevertheless, for any RBIs combatting AMR, the result can be expressed in a technical unit able to quantify exposure to antimicrobials. Such indicators are defined (Sanders et al., 2020) as the ratio between:

a) the quantity of administered antimicrobials; and

b) the animal population at risk.

The quantity of administered antimicrobials can be mass-based, dose-based or count-based:

- Mass-based units are expressed as milligrammes, kilogrammes or tonnes (i.e. metric tonnes) of the active substance.
- Dose-based units are expressed as the number of doses with several types being distinguished, e.g. defined daily dose animal (DDDA), used daily dose animal (UDDA), prescribed daily dose animal (PDDA), or defined course dose animal (DCDA).
- Count-based units express the number of treatment days or treatment courses.

The first two units require data on the actual amount of antimicrobial used while the last unit only requires data about the number of treated animals and treatment days.

The unit that can be most easily automated is the PDDA, if IT systems for digital prescriptions are in place. However, the use of UDDA provides the most accurate reflection of AMU but would require administration data (paper/electronic treatment logbooks) to be maintained.

Animal populations at risk can be measured by considering the (average) number or mass of animals at risk at farm-level. The number of animals housed can be based on the maximum capacity of the barns (the maximum number of animals present on a farm), the number of animals present on average or the number of animals present at a given moment. This number of animals housed is then multiplied by an estimated or standardised weight in systems that use mass- and dose-based indicators.

The choice of the indicator impacts the interpretation of AMU monitoring results. However, deciding on which AMU indicator to use can be complex, given the range of existing options. The guidelines on the AACTING [23] website highlights various aspects to consider when deciding which indicator to use for AMU monitoring.

Once the result is defined by selecting the most appropriate and feasible indicator, reporting and verification can be done using dedicated monitoring systems. An overview of these systems is provided in Sanders et al., 2020. These systems may ensure the minimisation of data manipulation by allowing to determine which parties are authorised to alter the data, and which changes are allowed. They can also ensure data quality and integrity by integrating a number of controls that guide how the data are registered. A quality check can also be implemented after sending the data. Standard quality measures should include plausibility checks of whether the reported variables are within the expected range. The Classyfarm system described above (see Section 2.2.3) does not only consider animal welfare assessment but also combines these data with the electronic prescription system for veterinary drugs (De Monte et al. 2020), official national registry as well as slaughter animal findings from the slaughterhouses for sanitary risk evaluation.

For linking payments to results, benchmarking of the participating farms is necessary. Benchmarking of AMU refers to the comparison of a beneficiary's AMU with the AMU of other similar farms (the reference population), given that AMU for all farms is quantified in a comparable manner. According to Sanders et al., 2020, benchmarking is carried out – or planned to be carried out as soon as good quality data are available and a methodology is developed – in 12 countries (AT, BE, CZ, DE, DK, ES, FI, FR, IE, IT, NL, SE) encompassing 20 AMU monitoring systems.

When designing the benchmarking strategy, the following aspects must be considered (Sanders et al., 2020):

- **The frequency of the benchmarking** (e.g. twice per year) and the period of the AMU that is taken into consideration (time interval), which depend on the production cycle of the animal species and on the need to find a balance between allowing for frequent reporting of the benchmarking indicator (short time interval) and obtaining a longer-term view of AMU (long time interval).
- **The number of features on which the benchmarking is based** is suggested to be kept limited, e.g. the total AMU per species or, if different age/weight categories of a species are present, per production stage.
- **The reference population** can be based on geography (e.g. country, region), economic traits (e.g. sector, quality assurance scheme), animal traits (e.g. species, age/weight category), or simply on selection criteria and the willingness of parties to co-operate.

Contractual arrangements must be carefully designed to address risks and uncertainties. Designing payments that are proportionate to the achievement of reduction targets, as well as allowing sufficient time for targets to be met, are the most important ones. The whole process should be as inclusive as possible, involving at least the administration, the veterinarians and the farmers.

2.2.5. Carbon sequestration and GHG emissions

Agriculture is one of the sectors with significant GHG emissions, but it is also one of the sectors with sizable carbon sinks that can be further activated. This section is focused on interventions and schemes from the CAP, public sector and private sector that incentivise carbon sequestration and GHG emission reduction in the agriculture sector through result-based approaches. Two main types of schemes are discussed: RBIs and carbon credit schemes.

Although the indicator unit is always similar (CO_2 or CO_2-eq), three types of indicators can be envisaged for this type of RBI:

- **Reduced GHG emissions**: generally measured in CO_2-eq, these indicators are the results of farm management decisions taken to reduce overall emissions. They can span across topics from livestock to soil management and from manure management to fertilisation approaches.
- **Sequestered carbon**: measured in CO_2 permanently stored in the ground, these indicators can come from soil management and fertilisation decisions or afforestation.
- **Carbon balance improvement**: Usually measured in CO_2-eq, these indicators combine the first two to obtain the net change in the farm carbon balance. The carbon balance is the difference between the gross carbon sequestration and gross CO_2-eq emissions from farm activities and soil management.

At the time of writing this report, there was only one CAP intervention where carbon sequestration and GHG emissions were embedded in a result-based mechanism. That intervention was the French 'Flat-rate AECM - Transition of practices' (intervention 70.27), which covers three different themes, one of which is the farm carbon balance.

The key result indicator selected in that RBI is the farm carbon balance that farmers should improve by 15% to receive the full payment. The baseline and result reporting are obtained through modelling tools and verified through audit controls.

[23] https://www.aacting.org

Table 7. Assessment of selected example of RBIs targeted at carbon sequestration and GHG emission: overview of key aspects

Key issue	Flat-rate AECM – Transition of practices
Type of result-based intervention	Hybrid.
Objectives (on key theme)	Climate change mitigation.
Definition of indicators	The indicator used is the farm carbon balance, which is the difference between the gross carbon sequestration and gross CO_2 equivalent emissions from farm activities and soil management.
Determination of the level of result	Beneficiaries must achieve an increase of at least 15% of their carbon balance i.e. emitting 15% less or sequestering 15% more or any combination of the two that can result in a 15% increase in carbon balance. The threshold was selected based on previous feasibility studies for French farms to improve their carbon balance across five years.
Use and setting of baseline	The carbon balance results are defined through a simulation tool (such as CAP'2ER [24] for cattle or CarbonExtracts [25] or Sysfarm [26] for crops) by selecting the different actions implemented by the farmer and documenting the starting point in a baseline scenario.
Approach for monitoring, reporting and verification	The modelled carbon balance baseline and achieved results throughout the implementation period can be verified by external auditors through an audit of the proofs and other documents supporting the baseline diagnostics and implemented actions (invoices, farm management documents, maps, etc).
Consideration of co-benefits	Co-benefits are not considered in the result-based mechanisms. However, the co-benefits of carbon sequestration practices that improve soil health were driving the design of the intervention (needs assessment, etc).
Linking results to payments	To receive the maximum payment amount, beneficiaries must achieve the 15% target. As this is a lump sum payment, there is no need to link the result to eligible hectares. The region of Nouvelle-Aquitaine allows that in case beneficiaries do not achieve the target, they can still receive a part of the result-based payment proportional to the result achieved. However, below a certain level of result (e.g. below 10% increase in farm carbon balance) no result-based payment is delivered.
Evaluation process	At national level, there will be a thematic evaluation of all AECM (including the result-based ones). In addition, a wider evaluation covering all environment-climate objectives is also envisaged. Based on these evaluations (the AECM specific and the environment-climate objectives specific), the Managing Authority and the regions will improve the design of the interventions.

Source: EU CAP Network supported by the European Evaluation Helpdesk for the CAP (2024)

Agricultural carbon credits have seen an increase in total volumes on voluntary carbon markets (VCM) in recent years. This is mainly due to improvements in carbon sequestration modelling and monitoring tools, and an increase in actors in the space. More farmers are adopting carbon sequestration practices, more buyers are active in VCMs (partly nudged by scope 3 emissions scrutiny), more broker firms are offering agricultural credit issuance services, and finally, more firms are developing and offering monitoring, reporting, and verification (MRV) solutions.

Aside from the carbon balance RBI in France, several **public or semi-public schemes** (i.e. organised by the public sector but involving private sector credit buyers) significantly contributed to structuring the agricultural carbon credit market:

- Label Bas Carbone (France - https://label-bas-carbone.ecologie.gouv.fr)
- Carbon Farming Initiative (Australia - https://cer.gov.au/schemes/australian-carbon-credit-unit-scheme)
- California's Compliance Offset Programme (USA - https://ww2.arb.ca.gov/our-work/programs/compliance-offset-program/compliance-offset-protocols)

[24] La méthode CarbonAgri | Label bas carbone - Ministère de la transition énergétique (ecologie.gouv.fr)
[25] Carbon Extract (monbilan-carbonextract.com)
[26] SysFarm - Décarboner naturellement avec l'agriculture régénératrice

Alongside these public-managed schemes, **private sector initiatives** also leverage result-based approaches to increase carbon sequestration and reduce GHG from farming. They do that by using carbon markets organised by the public sector, such as the Label Bas Carbone in France, or by relying on their own platforms.

Carbon credit issuers working with farmers in and outside the EU include:

- Carbone farmers (https://www.carbonefarmers.com)
- Agoterra (https://www.agoterra.com)
- Rize (https://www.rizeag.com)
- MyEasyCarbon (http://myeasycarbon.com)
- ReSoil (https://www.resoilag.com)
- Soil Capital (https://www.soilcapital.com)
- Klim (https://www.klim.eco)
- Climate Farmers (https://www.climatefarmers.org)
- Scature (https://www.scature.com/)
- Soil Heroes (https://soilheroes.com)
- Indigo (US) (https://www.indigoag.com)
- Trinity Natural Capital Markets (US) (https://www.trinityncm.com)
- AgoroCarbon (US) (https://agorocarbonalliance.com)

In addition to the carbon credit issuers listed above, crop input providers also develop solutions for farmers to issue credits when using some of their inputs or advisory services, leading to carbon sequestration. Examples include:

- CarbonProgram by Nutrien [27]
- CarbonNow by Locus Ag [28]

Finally, agrifood processors also develop programmes to decarbonise their supply chains and compensate farmers for their efforts. Often these programmes are built in partnership with a pre-existing carbon credit platform solution. Examples include:

- Friesland Campina (https://www.frieslandcampina.com/news/frieslandcampina-dairy-farmers-receive-over-245-million-euros-in-premiums-for-their-sustainability-achievements-in-2023/)
- Arla (https://www.arla.com/sustainability/the-farms/arlas-sustainability-incentive-model-qa/)
- Valio (https://www.valio.com/sustainability/climate-programme/)
- Kellanova (https://www.regrow.ag/case-studies/kellanova)
- RegenConnect (Cargill) (https://regenconnect.cargill.com)
- Bayer Carbon Program (https://bayerforground.com/carbon-initiative)

Carbon credit issuers usually rely on third-party MRV providers that calculate the reduction of emissions or the carbon sequestered at the farm level.

Table 8. Overview of MRV providers for agricultural carbon credits

Name of MRV provider	Features
Regrow https://www.regrow.ag	Modelling based on self-reported farm data. Modelling based on remote sensing.
Label bas-carbone https://label-bas-carbone.ecologie.gouv.fr	Modelling based on self-reported farm data. Third party audit controls.
Regen Insight https://www.regeninsight.com	Remote sensing as a mean of verification. Farm data upload. ISO 14064-2 standard.
Seqana https://www.seqana.com	Remote sensing for modelling. Soil samples.
Carbonfarm https://carbonfarm.tech	AI modelling based on remote sensing.

[27] https://www.nutrien.com/news/press-releases/2020-nutrien-launching-industrys-most-comprehensive-carbon-program-drive
[28] https://locusag.com/carbonnow

Name of MRV provider	Features
Downforce Technologies https://www.downforce.tech	Modelling based on self-reported farm data. Remote sensing.
Planboo https://planboo.eco	Focused on biochar, with dedicated IoT-based MRV.
Indigo Ag https://www.indigoag.com	Modelling based on farm data. Remote sensing.
NetCarbon https://en.netcarbon.fr	Modelling based on farm data. Remote sensing.
Trinity AgTech https://www.trinityagtech.com	Modelling based on farm data. Remote sensing.
Nadar https://www.nadar.earth/carbon-mrv	Forestry focused. Remote sensing.
AgriCarbon https://www.agricarbon.co.uk/	Soil sampling only.

Source: EU CAP Network supported by the European Evaluation Helpdesk for the CAP (2024)

2.2.5.1. How most carbon farming MRV works

Farm data uploaded to a platform. The farm level data are the baseline characteristics of the farm and practices or actions that are or will be implemented (incl. evidence such as photos or invoices). Farm level data capturing is required in most carbon farming MRVs. There usually is a platform accessible to farmers or carbon advisors to capture the farm data and transmit it to the modelling step.

Remote sensing. Satellite image processing and analysis are used in three ways across MRVs. First, it might be used to model the baseline and predict the potential for carbon sequestration. Second, it might be used as a reporting mechanism e.g. soil organic content changes inferred from vegetation data. Third, those carbon sequestration inferences based on satellite images can be used to cross-check and verify data reported through another mechanism i.e. verify practices, such as the presence of cover crops and mowing events or verify projected carbon sequestration.

Modelling. Modelling of the soil organic content and carbon balance is recurrent in all MRV systems. Those models (CAP2ER, CoolFarm, etc) usually start from the farm data and GHG reduction and carbon sequestration strategy (planned actions). The process can then be supplemented by soil sampling and/or satellite imagery.

Soil sampling. This is an effective means of getting a ground truth. It can increase the accuracy of the modelling and the quality of the carbon credits. However, it is not often adopted in MRVs due to the high cost of a systematic soil sampling strategy.

Verification. A third-party auditor is an essential part of most MRVs. Those can be independent third-party verifiers or an organisation's internal auditors. Verification often entails a review of the documentation submitted by the farmers (e.g. invoices, pictures and other administrative documents), or farm visits to witness practices and review documents. Digital MRVs, in particular, also generally leverage satellite data analysis for verification.

2.2.5.2. How carbon credit transactions (payments) work

Price setting. Multiple price-setting mechanisms were observed when preparing this report. On the Label Bas Carbon platform, project developers upload their projects with modelled GHG sequestration potential and project costs. Buyers can then finance part or the whole of the project and be entitled to claim the pro rata of sequestration when the sequestration has been audited. This makes it a pricing mechanism driven by the seller. In other carbon farming platforms, industry actors buying carbon certificates to remunerate farmers for increasing sustainability within their supply chain have more impact on the price of the certificates. Farmers might be guaranteed a floor price upon enrolling with a final price defined at a later stage when a transaction is cleared. Prices can also be invariant and fixed by the sponsors of the scheme. In those cases, the pricing mechanisms are driven by the buyer side.

Sales brokered by the credit issuer. In this case, the credit issuer works with a third-party auditor and issues the carbon credit on its own. Some have their auctioning platform and directory, and some work directly with credit buyers without the platforms.

Sales brokered by a third party. In this other case of a transaction, credits are issued on a third-party platform which maintains the credit directory (i.e. a register of carbon credit certificates and related transactions). For example, the issuer can rely on the platform and registry of the Label Bas Carbone in France. The credit issuer is, therefore, not exactly an issuer, but rather a project developer that will perform the necessary steps to enlist and validate the carbon sequestration project on the platform.

2.2.5.3. Key issues for monitoring and validation of results include:

Capturing the baseline data. This is a key initial step that is needed in all forms of carbon farming schemes. An IT solution is needed for that, as well as a data capturing phase at farm level. This data collection might be subcontracted to advisors/credit issuer staff or carried out by the farmer (self-reported data).

Modelling the baseline and projected results. Many models exist. Some are publicly available; some are part of the intellectual property assets of MRV providers. They all rely on practices implemented by farmers and, to various extents, on some level of remote sensing (satellite data).

Measuring the results. Often the achieved results are not directly measured but assumed from the model projection (of which the underpinning environmental practices can be audited, see below). Sometimes a combination of practice modelling, soil sampling and remote sensing is used. Soil sampling is, in theory, the superior approach, but its prohibitive cost makes it inefficient to scale. In addition, even soil sampling has limitations i.e. soil sample depth, seasonal variations and spatial variations, which also require some logistics and coordination).

Another essential element to account for when measuring results is the **slow nature of carbon sequestration**. Effective results can take five or more years to take place. Year on year changes at farm level are generally just projections of what the farm practices performed that year and will have contributed to the soil if maintained five years on. This temporality can be solved with a balloon type of payment (the balance) after a second soil sample is analysed five years later.

Validating the results. Auditors play an important role in certifying carbon credits. Those can be independent third-party verifiers (e.g. accredited auditors) or an organisation's internal auditors. Digital MRVs in particular generally leverage satellite data analysis for verification.

2.3. Lessons learnt

From the experiences reviewed in Section 2.2, different lessons learnt in terms of good practices and challenges in using RBIs can be derived. Lessons relate to the objectives and overall scheme design, indicators, monitoring, payments and how these are linked to results, and emerging issues for the evaluation of RBIs that are discussed in more detail in Section 3.

2.3.1. Objectives and overall design

The analysed examples showed clearly that although RBIs may have been developed with the aim of contributing primarily to a certain objective, they often deliver co-benefits that extend their contribution to additional objectives. For example, although the Irish 'ACRES-Cooperation' focuses on biodiversity, it can demonstrate contributions to water or soil quality. Similarly, the Portuguese 'Montado management by results' shows results on biodiversity, soil quality and landscape features while the Farm Carbon Balance theme of the French 'Transition of practices' can produce results related to healthier soils.

This means that RBIs can be designed to accommodate a **whole farm approach** that compensates the beneficiaries for the total environmental services they provide. However, moving towards interventions targeted at multiple objectives and co-benefits increases the complexity of the design, implementation and monitoring of the intervention, both for beneficiaries and administrations. Experiences highlight the successful application of **scorecards** as a basis to link payments to results (scores) achieved in relation to a set of indicators covering different environmental themes. The use of scorecards enables a more holistic assessment of the environmental services at parcel and farm levels taking into account not only co-benefits but also potential trade-offs between different (environmental) objectives. More specifically, since the scores for specific indicators can take values from a range that spans from negative to positive, they can cover cases where an improvement in one indicator (positive score) may lead to the deterioration of another (negative score). For example, in the Irish ACRES-Cooperation intervention, the grassland scorecard gives up to 25/100 points if certain positive species are found in a specific parcel while it can equally deduct up to 25/100 points depending on the level of risk to the quality of natural water bodies [29].

Further insights on different combinations of indicators suitable for a whole farm approach will be available in the future from follow-up studies and pilot-testing of result-based remuneration systems. For example, follow-up studies and pilot-testing for organic farming that use combinations of indicators that cover a range of public goods from agriculture (e.g. Lampkin and Sanders, 2023) or pilots building on life cycle assessments and indicators to measure ecosystem services in a result-based approach (Hörtenhuber, 2023). In the same context, the report 'Possibilities for the use of KPIs in the eco-scheme', carried out for the Dutch government, proposes the use of farm-level key performance indicators for the targeting, implementation, monitoring and evaluation of eco-schemes that will allow a whole-of-farm, result-based approach for the CAP after 2027 (Terwan and Westenburg, 2024).

This holistic approach can be further enhanced if RBIs are delivered through collective action. **Collective action** in RBIs refers to the collaboration among multiple stakeholders, such as groups of farmers, local communities or other land managers to achieve shared environmental outcomes. A key characteristic of the collective action is that the payments are not made to individual

[29] See footnote 5, page 4.

farms but to the collective scheme. Group members must work together to agree upon the conditions of the arrangement they will jointly enter and then monitor each other and enforce the terms of the agreement (Kerr et al., 2014). Obviously, collective action may not be suitable for all objectives. For example, while it can be perfectly fit for biodiversity or water quality-related interventions as it can ensure a landscape level effect, it may be less relevant for animal welfare-related interventions.

The importance of collective action is rooted in its potential benefits, such as enhancing the effectiveness of interventions, addressing landscape-scale environmental challenges and improving resource use efficiency. This is due to synergistic effects and can be better illustrated through the following example. Consider a farm that participates in an RBI, where the results are defined in terms of the presence of nesting birds in a specific parcel. Having neighbouring farms that also follow practices to achieve the same results, increases the probability that more birds will select this wider area for nesting, making it more possible that all neighbouring farms achieve the results or even get higher payments due to synergistic effects.

In contrast, the payments for action-based interventions are not sensitive to the achievement of results and they are delivered once the management commitments are fulfilled, regardless of the situation in neighbouring farms. In this case, the farmers may benefit from peer effects and the exchange of knowledge or experiences, but this will not impact payments.

Bellassen et al. (2015) argue that one way to reduce the high share of MRV-related costs of RBIs, that is, the fixed costs that are invariant to farm size, may be by aggregating and coordinating farms into larger units. Although this is not a pure collective action as payments are made to individual farms, the Irish ACRES-Cooperation showed that cooperation may address landscape-level challenges requiring coordinated efforts across more significant landscapes or ecosystems that extend beyond individual farm boundaries. The decision to deliver this intervention as a cooperation type of intervention delegated the coordination role to the project teams, which are supported to involve as many farmers as possible to cover the area in which they operate. It also showed that it affected the pooling of resources and knowledge and enhanced the design, monitoring and verification by enabling the use of shared data, tools and methodologies. Kreft et al. (2022) provide evidence that the effectiveness of policy incentives aiming at agricultural climate change mitigation can be improved by simultaneously supporting knowledge exchange and opportunities for social learning and social networks (Kreft et al., 2023) in farming communities. Collective action in RBIs can strengthen social ties and create a sense of shared responsibility among participants, contributing to the durability of the effects.

Regardless of whether RBIs are targeting individual or collective beneficiaries, **capacity building** for farmers, advisors, other experts and administrations on RBIs and their monitoring requirements are key for their success and must be taken into account early in their design phase. Capacity building is also important for action-based incentives, but the novelty and new requirements of RBIs for farmers require particular attention. The training and follow-up of individuals responsible for assessing the indicators are essential to maintaining maximum objectivity and high-quality standards, which are critical for the success of the schemes. Regular field visits and knowledge exchange among these assessors are also necessary to ensure consistent application of assessment criteria. Over time, deviations may occur, even unintentionally, making such exchanges important for maintaining uniformity in assessments. Various approaches and methods may be needed for training and capacity building, including written guidance materials, face-to-face training seminars and workshops. It is also recommended to foster peer-to-peer learning by providing more intensive training to a network of farmers who can act as champions and further share knowledge and train their colleagues.

2.3.2. Indicators and monitoring, reporting and verification processes

The analysed examples showed the importance of carefully selected indicators and well-designed MRV processes in mitigating the beneficiaries' risk perception and reducing the higher initial costs and information asymmetry for the administration.

Indicators to measure the results achieved need to be understandable, easily identifiable and measurable by beneficiaries and other actors involved in the monitoring, including the Paying Agency. They must be consistent with environmental and climate objectives that are acceptable to land managers, sensitive to changes in agricultural management and less likely to be influenced by exogenous factors, in order to reduce the risk for land manager.

The use of **additional indicators**, which do not impact on the payment, to collect further information on the environmental objectives (e.g. on abundance and diversity of invertebrates in the case of biodiversity) can deliver a more **comprehensive picture of the effects** of an RBI on biodiversity. Such indicators can contribute to reducing the risk that the main results and effects are not manifestable at the time of measurement due to external factors and improve land managers' understanding of the environmental objectives on their sites. It can also help monitor and prevent risks or unwanted consequences of management actions (e.g. maximising results on one specie at the costs of another).

The experiences also highlight the importance of recognising limitations and challenges in linking farm management changes to environmental results and impacts. For example, impacts of farm management on changes in water and soil quality are often not reliably measurable directly in the water body and soil in the early years and require long-term monitoring. Moreover, RBIs targeted at water quality might be better prioritised at catchment level, involving land managers within and outside agriculture, as agriculture is just one factor of the issue and not always the most important.

The use of pressure indicators to score results of farm management for water and soil quality can be a useful solution towards addressing these challenges. Furthermore, and especially for RBIs with a long-term implementation, a good practice would be to design an **evolving monitoring system** that builds on **pressure indicators** for measuring the results of the early stages of implementation, and phasing in direct **impact indicators** that measure longer term results over the later years of implementation of the intervention. A result-based bonus payment component could be added to the intervention which then provides an additional payment for measured results of improved quality of the affected water bodies at catchment level (Fleming et al., 2022, Winsten et al., 2011) or improved quality of the soil in terms of increased organic content. This, however, requires the development of a monitoring framework that considers all

(eventually) used pressure and impact indicators to ensure data availability, consistency of application and enabling counterfactual evaluations. Possible benefits of using satellite data, such as Earth Observation data, and remote sensing data, should be explored.

Another approach to overcome the limitations is using models to estimate the results. This has been proven particularly useful for RBIs contributing to climate change mitigation. At the initial stages of implementation, payments can be linked to the results estimated by the model, while at a later stage, the results can be verified by an independent auditor, through actual measurement of the indicators on the field. This verification can be the basis for the final payment, which may comprise a bigger share of the total support compared to the payments made on the basis of modelled results.

Table 9 summarises the key lessons on indicators and MRV processes in RBIs for the different objectives.

Table 9. Indicators and monitoring, reporting and verification processes in RBIs – some key lessons

Objective	Types of indicators used	Key lessons
Biodiversity	Combination of plant/animal species, vegetation structure and habitat indicators	Multiple indicators covering different biodiversity elements are needed for result measurement. Use of scorecards to facilitate data collection for comprehensive indicator combinations and to promote a whole-farm approach. Use of additional indicators (e.g. abundance of invertebrates) delivers further insights into effects.
Water and soil quality	Mainly indicators in relation to threats and pressures (e.g. pesticide use for water quality and risk of erosion for soil quality)	Evolving indicator system that builds on pressure indicators and phases in direct impact indicators measuring results in the long term. Use of scorecards to facilitate data collection for comprehensive indicator combinations.
Animal welfare	Mainly animal-based indicators such as absence of injuries (e.g. percentage of pigs with intact tails)	A combination of animal-, resource- and management-based indicators must be selected that addresses the aspects of animal welfare that are most important for the targeted species and production system. Monitoring, reporting and verification processes can be supported by dedicated IT systems.
Antimicrobial use	No applied examples identified	Using the number or mass of animals at risk of treatment is an appropriate indicator for the animal population at risk monitored at farm level. Dedicated monitoring systems (e.g. Classyfarm) combine animal welfare assessment with the electronic prescription system for veterinary drugs, national registry and data from slaughterhouses for sanitary risk evaluation.
Climate change mitigation	Farm carbon balance	Three types of indicators can be envisaged: › Reduced GHG emissions (measured in CO_2-eq) › Sequestered carbon (measured in CO_2 lastingly stored in the ground). › Carbon balance improvement (measured in CO_2-eq) Modelling of results is necessary for initial stages of the intervention. Validation of modelled results by independent auditors towards the end.

Source: EU CAP Network supported by the European Evaluation Helpdesk for the CAP (2024)

2.3.3. Linking payments to results

In line with the current rules [30], the calculation of payments of RBIs implemented in CAP Strategic Plans follows a standard **fixed-rate approach of using additional cost and income foregone** of standard practices assumed needed to achieve results. Most result-based CAP Strategic Plans interventions have estimated the payments rates per hectare based on additional cost and income forgone incurred by the implementation of an indicative set of practices that have the potential to achieve the expected results. The Finnish intervention 'Improved conditions for fattening pigs' estimated the payment rate per livestock unit again based on an indicative set of practices. Finally, the French ENVCLIM intervention 'Transition of practices' estimated the payment rate as a lump sum payment per farm regardless of the managed utilised agricultural area or livestock units and only conditional to the implementation of the action-based part and the achievement of the corresponding result. This approach has been chosen to overcome the challenge of a very diverse set of actions that a beneficiary may undertake to achieve the target. In any case, all the above approaches may favour smaller farms, for which the additional costs or income forgone to achieve the target may be smaller than the ones in larger farms.

Another approach applicable to eco-schemes is the option provided for in point (a) of paragraph 7 of Article 31, whereby payments can be granted as **a top-up to the basic income support**. The calculation of these payments is not limited to additional costs and income forgone and the payment levels can be set in a way that incentivises beneficiaries to provide higher levels of environmental services. However, result-based eco-scheme interventions where payments are calculated as a top-up to basic income support must not be related to, or based on, the type or volume of production (including livestock units) undertaken by the producer in any year after the base period in order to be WTO compliant [31]. This means that such interventions must fulfil the following conditions [32]:

- the intervention needs to address all types of agricultural areas (mainly arable land, grassland and pastures, and permanent crops) and cannot be targeted to specific crop categories;
- the eco-schemes should be designed following a whole farm approach;
- the basic payment per hectare cannot be linked to types/categories of crops; this implies that the aid amount is justified in all cases. However, the modulation of the support according to criteria not linked to types/categories of crops is possible (e.g. according to the results achieved if these are not linked to a specific type/category of crop);
- farmers should be required to enrol all eligible agricultural areas of the holding into the eco-scheme or an equal minimum share of each land category. For instance, in the case of a holding with vineyards, arable land and pastures, the farmer would need to engage all the area in the eco-scheme or at least a minimum share of the three farmland types (e.g. 25% of vineyards, arable land and pastures) and comply with the practices set for each of the land types.

Other approaches to calculating and determining payment rates, such as auctions, offer alternative ways to overcome issues of inefficient resource allocation of fixed-rate approaches. **Auctions** in agri-environmental schemes have the objective to maximise the services obtained from a limited budget to conserve environmental services in agriculture. Within such auctions, a buyer of environmental services (the payment agency) invites bids from suppliers of environmental services (the land managers) and closes contracts with the lowest bid-prices (Berkhout et al., 2018). The empirical evidence suggests that, due to the heterogeneity in bidders' opportunity costs, auctions can be more cost-effective than a uniform payment in delivering the target result (Vergamini et al., 2020, Latacz-Lohmann and Schilizzi, 2007). However, the performance of auctions is sensitive to the strategic behaviour of land managers and their expectations about the bid caps, revealing the opportunity to use both the competition effect and information leverage associated with the implementation mechanism to increase the auction outcome when the budget is limited (Vergamini et al., 2020). In addition, challenges in administration and farmer participation highlighted the need for careful design and adequate support mechanisms.

Auctions have been tested in various countries and contexts, such as the United States, Australia and, to a lesser extent, Europe (Claasen et al., 2008, Grammatikopoulou et al., 2012, Banerjee, 2018), e.g. to address windfall gains of fixed-rate payments. Cost-effectiveness and budget efficiency have been realised in the Conservation Reserve Program in the United States and the Bush Tender in Australia. Indicatively in Europe, the Dutch Biodiversity Auction aimed to enhance biodiversity in agricultural landscapes, and farmers were invited to submit bids indicating the payment they would accept to undertake specific conservation actions. The auction was designed to select bids that offered the highest biodiversity benefits relative to cost, using **a scoring rule to prioritise areas with the most significant ecological potential**. In Germany, the Auction for the Protection of the Capercaillie Habitat called landholders in targeted areas to submit bids for implementing habitat improvement measures such as maintaining open spaces and creating underbrush for nesting. Bids were evaluated based on their potential to enhance the habitat quality and cost for the capercaillie. Also in Germany, the Landcare Auction in Bavaria invited landowners to participate in an auction to undertake specific landscape management activities, such as maintaining grasslands or planting native tree species. The auction format aimed to ensure funds were allocated to the most cost-effective and environmentally beneficial projects. In Italy, the Conservation Auction Pilot Projects explored the potential of using auctions to allocate funds for environmental conservation on agricultural lands. In the UK, Agri-Environment Auctions tested the effectiveness of auctions in allocating agri-environmental contracts for landscape-scale conservation. Farmers were invited to bid for contracts to implement measures like creating wildflower margins, managing water quality or protecting soil health. Bids were ranked based on their **environmental benefit-to-cost ratio** with a focus on enhancing biodiversity and ecosystem services.

[30] Point (b) of paragraph 7 of Article 31 and paragraph 4 of Article 70, Regulation (EU) 2021/2115.
[31] Point (b) of paragraph 6 of Annex 2 to the WTO Agreement on Agriculture.
[32] Questions and Answers Eco-schemes Article 28 of the SPR proposal and related provisions V3, Expert Group for Direct Payments, 20 July 2021. https://webgate.ec.europa.eu/regdel/web/meetings/2293/documents/6126

In the Netherlands, the results indicated that competitive bidding can be a viable tool to enhance cost-effectiveness in delivering environmental public goods. In Germany, the auctions successfully engaged landholders in conservation efforts and improved habitat conditions for the capercaillie. In the UK, the auctions proved that competitive bidding could lead to better-targeted and more cost-effective conservation outcomes.

The lessons from the application of conservation auctions in Europe are beneficial for implementing RBI evaluations. RBIs can learn a great deal from the experiences of European conservation auctions by focusing on cost-effectiveness, encouraging innovation, fostering collaboration, ensuring robust monitoring and preventing strategic behaviour. By incorporating these lessons, result-based incentives can become more effective in achieving environmental outcomes, using public funds better and engaging landholders in meaningful conservation efforts.

Finally, **payments** can be made **per unit of result achieved** e.g. per tonne of carbon sequestered. Each unit or result is usually converted to a credit which can be traded between the project developers, including the beneficiaries of result-based interventions, and the buyers. This type of remuneration is only met in private sector result-based payments as it is not allowed by the current rules of the CAP. In these cases, the payment level can be either influenced mostly by the seller or by the buyer (see Section 2.2.5.2 above).

The **sensitivity of the payment** structure, which reflects the extent to which payments are differentiated into different levels according to the quantity and/or quality of result, is a key mechanism to address the risk for farmers and other beneficiaries. Beneficiaries can still receive part of the payment if the achieved result is lower than an upper-level target but higher than a certain minimum level defined by the scheme administration. Such payment differentiation is common practice in the reviewed examples. Implementing non-linear changes in payment rates from one score level to the next with bigger changes between the higher payment levels reflect more demanding changes in the practices required to achieve higher score levels. Attention also needs to be paid to the definition of the minimum score for which payment is provided to ensure additionality of the RBI.

2.3.4. The role of evaluation

Although the examples of RBIs included in the CAP Strategic Plans have not yet been evaluated, a range of evaluation studies has been conducted in different countries and agricultural contexts, highlighting common themes, methodologies and results, setting the agenda for future examinations and research. Several studies have been conducted in real situations and evaluate actual policies or policy reforms, while others evaluate realistic scenarios built on simulations.

Several common trends and themes emerge from the review of these studies and can provide valuable insights on the role of evaluation in the design of RBIs (ex ante evaluations) as well as during (process or formative evaluations) and after (summative evaluations) their implementation. The following table summarises the main common themes and stages they can be evaluated. Details on each theme are described in the following paragraphs.

Table 10. Main common themes identified in evaluations of RBIs and the stage they can be mostly evaluated at

Theme	Evaluation stage		
	Ex ante	Process or formative	Summative
Farmer behaviour and incentives			
Policy design and integration			
Spatial and subject targeting			
Implementation complexity Equity and fairness			
Monitoring, reporting and verification challenges			
Additionality			
Permanence of results			
Displacement			

Source: EU CAP Network supported by the European Evaluation Helpdesk for the CAP (2024)

Farmer behaviour and incentives: Farmer participation is a critical factor in any scheme, but as shown in this report, it is vital for the success of RBIs. Understanding farmer preferences, risk perceptions and behavioural responses to different payment structures is essential for designing effective schemes. Ex ante evaluations should pay particular attention to the fact that RBI design takes account of farmer behaviour, such as reluctance to change, individual preferences and others that can impact uptake rates and affect the choice of evaluation methodologies. These behaviours may be critically affected by the **complexity of implementation**. RBIs may be perceived as more challenging to implement than action-based schemes, and some farmers may feel uneasy and thus discouraged, while others may feel more comfortable. As a result, the statistical identification may encounter selection bias because the farmers who enrol in RBIs may not compare to those who do not. That is, they do not share a common counterfactual. Although implementation simplicity is something to be considered ex ante, the impacts of implementation complexity should be addressed in summative evaluations, mainly if the evaluation adopts a micro approach. In the same context, evaluation of RBIs may also deal with issues such as **equity and fairness** of the intervention, especially if there are indications that the schemes fail to include certain households, such as the financially constrained or those with lower skills and education.

Box 3. The role of evaluation in assessing preferences of potential beneficiaries and adjusting the design of RBIs to maximise adoption.

Several studies have focused on the analysis of potential beneficiaries' willingness to participate in result-based payment schemes and comparing it also with more traditional action-based schemes. They illustrate how the evaluation can be used to understand the preferences of potential beneficiaries and adjust the design RBIs to maximise adoption.

Sumrada et al. (2021) assessed the participation in the maintenance of high nature value farmland in Slovenia and found that half of the surveyed farmers would choose the result-based approach (49.1%) to incentivise extensive use of dry grasslands, compared to 38.0% that preferred the action-based and 12.9% none.

In contrast, Block et al. (2024) assessed participation and other design characteristics, like the frequency of payments and the source of funding (public or private), in a hybrid payment scheme for carbon sequestration in Germany. They found that farmers are about twice as likely to participate in a humus programme if it offers an action-based payment instead of a results-based payment. Farmers accept a reduction of the absolute premium by 19.92 €/t CO_2 if it is paid on the basis of actions rather than results. An annual payment reduces the required absolute premium by 13.29 €/t CO_2 compared to a summarised payment at the end of the programme duration. A government-based absolute premium can be reduced by 4.40 €/t CO_2 and a company-based premium by 2.91 €/t CO_2, compared to a private household-based premium.

Similarly, Späti et al. (2022) assessed farmers' marginal willingness-to-accept (result-based payments) and willingness-to-pay (action-based payments) for nitrogen reduction through the adoption of precision farming in Switzerland. They found substantial differences between the two, indicating that farmers require higher compensation for adopting environmentally beneficial practices than they are willing to pay. This highlights their preference for action-based over results-based interventions.

Villanueva et al., 2024 compared participation scenarios for action and result-based payment schemes contributing to carbon sequestration or biodiversity in Spain. They found that focusing on carbon sequestration RBIs can enhance both carbon and biodiversity provision, while also requiring lower compensation for farmers. This implies that policies should prioritise carbon sequestration objectives to increase farmer participation and overall policy efficiency, preferably through hybrid payment schemes. The interventions should address monitoring uncertainties and promote educational campaigns to build trust in remote sensing-based monitoring systems. Digital tools have the potential to reduce uncertainty and assist farmers in complying with scheme requirements.

Föhr et al. (2019) contribution to the 'AIR 2018 – measure-specific evaluations for biodiversity' observed a very low level of uptake of 106 ha (8.5% of the target area of 1251 ha in 2023) in the RBI 'Result-orientated grassland use'. The evaluators considered the main cause of farmers' uncertainty to be correct implementation and the avoidance of sanctions in the event of non-compliance. They recommended increasing information and training activities to motivate farmers to take up the measure in the future.

Source: EU CAP Network supported by the European Evaluation Helpdesk for the CAP (2024)

Policy design and integration: Evaluators should also assess how the design of an RBI has been considered and compared in terms of efficiency to existing action-based schemes as well as the role and potential for farmers participating in already existing public schemes not funded by the CAP (e.g. Label Bas Carbone). In addition, private sector initiatives offer a lot of options to farmers. For example, carbon farming options range from carbon credit advisors (middlemen) to fully fledged agricultural carbon credit issuers managing a credit registry, and from MRV solution providers to input suppliers or agrifood processors seeking to remunerate farmers for carbon sequestrations. Coherence in this context touches on the concept of additionality and the issue of crowding out (i.e. public sector initiatives substituting private sector efforts). A carbon credit issued on the voluntary offset market is valid only if the practice was compensated only once and would not have happened without the carbon credit. Furthermore, public funding should carefully assess existing decarbonisation financial efforts by downstream actors across value chains. Coherence and the possibilities for a more integrated approach combining operational action and results-based components to optimise environmental and economic outcomes should be examined during ex ante evaluations of RBIs.

Box 4. The role of evaluation in integrating result-based interventions in policy options

Several evaluation studies have been found that focus on assessing the effectiveness of result-based payment schemes and/or how these schemes compare to more traditional action-based schemes in terms of efficiency.

Result-based schemes have been proven very effective in increasing the number of species in supported grasslands. The contribution of Sander and Bathke (2020) to the evaluation of Focus Area 4A (biodiversity) showed that in grassland parcels subject to commitments for four indicator species, the total number of species observed was between 10 and 26 with a mean number of species at 19.1. In grassland parcels subject to commitments for six indicator species, the total number of species observed was between 11 and 36 with a mean number of species at 21.8 to 28.8 and thus significantly higher than on the parcels that were subject to commitments for four indicator species. The evaluation concludes that in addition to the maintenance effect, the measure also appeared to trigger positive developments in the number of species. The number of areas under contractual commitments on which at least six indicator species were present rose continuously. The RBI requiring the presence of at least four species is rated with at least a medium positive biodiversity impact. Very positive biodiversity effects are particularly conceivable for commitments with six and eight species records respectively.

Regarding efficiency, Wuepper and Huber (2022) compared action and result-based payment schemes for enhanced biodiversity on cropland and grassland in Switzerland. Findings indicate that a 1% increase in action-based payments leads to an average increase of 0.6% in biodiversity conservation areas. In comparison, a 1% rise in results-based payments correlates with a 1% increase in those areas. The benefit-transfer estimated value for results-based is 5 580 CHF/ha and for action-based 2 342 CHF/ha. Results suggest that there is no significant difference in the effectiveness of the two schemes with respect to their intended outcomes. However, the average return on investment is much higher for results-based payments supporting the theoretical claim that, if the program's budget allows, results-based payments should be prioritised.

Sidemo-Holm et al. (2018) assessed water quality based on the quantities of particulate phosphorous (PP) in runoff and abatement by buffer strips on crop fields in Sweden, where 19.06 ha of buffer strips under the action-based scheme led to an abatement of 5.46 kg of PP. In comparison, 5.38 ha under the result-based scheme abated 6.33 kg of PP. Payments per abated PP were EUR 1 082/kg for action-based and EUR 933/kg for result-based schemes. Considering the cost of maintaining 19.06 ha versus only 5.38 ha, it is estimated that farmers' net profits from participating in the action-based scheme are EUR -2 117 compared EUR 2,803 for the results-based scheme.

Source: EU CAP Network supported by the European Evaluation Helpdesk for the CAP (2024)

Spatial and subject targeting of RBIs: The lack of targeted action implies that farmers undertake general management actions rather than tailored practices that specifically address the needs of particular species, habitats, or locations, resulting in inefficient biodiversity outcomes. Specific examples from the literature indicate the environmental gains of targeting and the increase in effectiveness and efficiency. RBIs can address issues of targeting much better than action-based schemes because results are defined and the sensitivity of payments to the achievement of these results can target habitats or spatial units that are most in need and ensure that conservation efforts are directed at the most ecologically valuable areas, which can lead to higher biodiversity gains (Cardwell, 2023). Also, results-based schemes can mitigate adverse selection by ensuring that only those farmers who are likely to meet the desired outcomes receive payments and avoid practices that do not lead to significant environmental improvements, which may be the case with action-based interventions that do not examine the actual environmental or other outcome (Villanueva et al., 2024). Thus, targeting must be an issue in ex-ante evaluations of RBIs.

Monitoring, reporting and verification challenges: Accurately measuring and verifying environmental outcomes is a significant challenge for RBIs, widely documented in this report. Even with the latest advances in AI modelling, science-based projections and remote sensing, result measurement accuracy is still a key issue. Its implementation requires a robust monitoring system and the integration of potentially innovative monitoring practices such as remote sensing or citizen science. The operation of the monitoring system for RBIs and validating that all data relevant to the evaluation of schemes are collected and stored must be one of the subjects of evaluations during the implementation of RBIs.

Especially for carbon farming, where, as discussed in this report, RBIs must rely on modelled results, setting up a robust MRV system may require a combination of modelling and practices assessment combined with soil analysis (hybrid solution), as it is currently done by private carbon credit providers. Managing Authorities, in collaboration with evaluators, should assess ex ante capacity of Paying Agencies to deploy such a process or delegate it to third parties and ex post validity of the modelled results, comparing them to corresponding soil analyses.

Additionality: Additionality is defined as the difference between the environmental outcome of an intervention and a hypothetical baseline of what would have been the outcome in the absence of this intervention (Wunder, 2005, pp. 8-10). Additionality is an issue in any agri-environment evaluation. Although in developed economies the references are very few (Wuepper and Huber, 2022) and the issue needs more research, the lack of additionality has been identified as one of the most serious design problems for Payments for Ecosystem Services (PES) in the developing world (Naeem et al., 2015; Pattanayak et al., 2010). In the case of RBIs, assessing additionality, in formative or summative evaluations, may be challenging because this requires a realistic baseline in environmental terms i.e. a specific biodiversity indicator(s) and not simply the number of hectares of agricultural land participating in the RBI.

Permanence of results: In agri-environmental interventions, permanence refers to the durability of the environmental benefits achieved through these projects (Kuhfuss et al., 2016). Essentially, it means ensuring that the positive impacts, such as improved soil health, increased biodiversity or reduced GHG emissions, continue even after the intervention or funding period ends. Permanence is crucial for addressing persistent environmental issues like climate change and biodiversity loss. Lankoski et al. (2020) highlight that "Carbon sequestration in arable soils, while technically promising, faces the problems of heterogeneity in sequestration capacity, measurement, verification and permanence of sequestration". Kuhfuss et al. (2016) found that farmers who have adopted practices that align well with environmental goals may continue these practices due to a combination of learned behaviours, social acknowledgement and a sense of altruism. In addition, they found that lower levels of change in land management practices are more likely to be permanent than major changes. This suggests that when farmers make gradual adjustments and experience positive outcomes, they are more inclined to continue those practices beyond the duration of the agri-environmental schemes. The duration of the contracts has been found to play a role in the permanence of the effects since farmers who intend to continue the activity for more than ten years are more strongly and positively willing to enrol RBIs (D' Alberto at al., 2024). Finally, the permanence of results increases cost-effectiveness in the long run because it reduces the need for repeated interventions and funding, making better use of resources. Evaluators may consider assessing the potential or actual durability of the effects during ongoing and ex post evaluations, respectively.

Displacement: Displacement in agri-environmental and climate projects refers to the unintended consequences where efforts to improve the environment and mitigate climate change in one area led to environmental deterioration or increased emissions elsewhere. This is well documented, especially for climate change mitigation activities (carbon leakage) and less for conservation and habitat protection or resources management. Although it has not been documented in the literature, experts believe that the displacement of environmentally harmful activity elsewhere may be more intense in RBIs. Depending on the incentive structure, farmers may focus more intensively on achieving the paid outcomes without considering broader ecological impacts. Evaluators may consider this aspect in all evaluation stages.

Annex III summarises the main elements of indicative studies evaluating RBIs in the thematic areas of biodiversity, water quality, carbon sequestration and GHG emissions reduction.

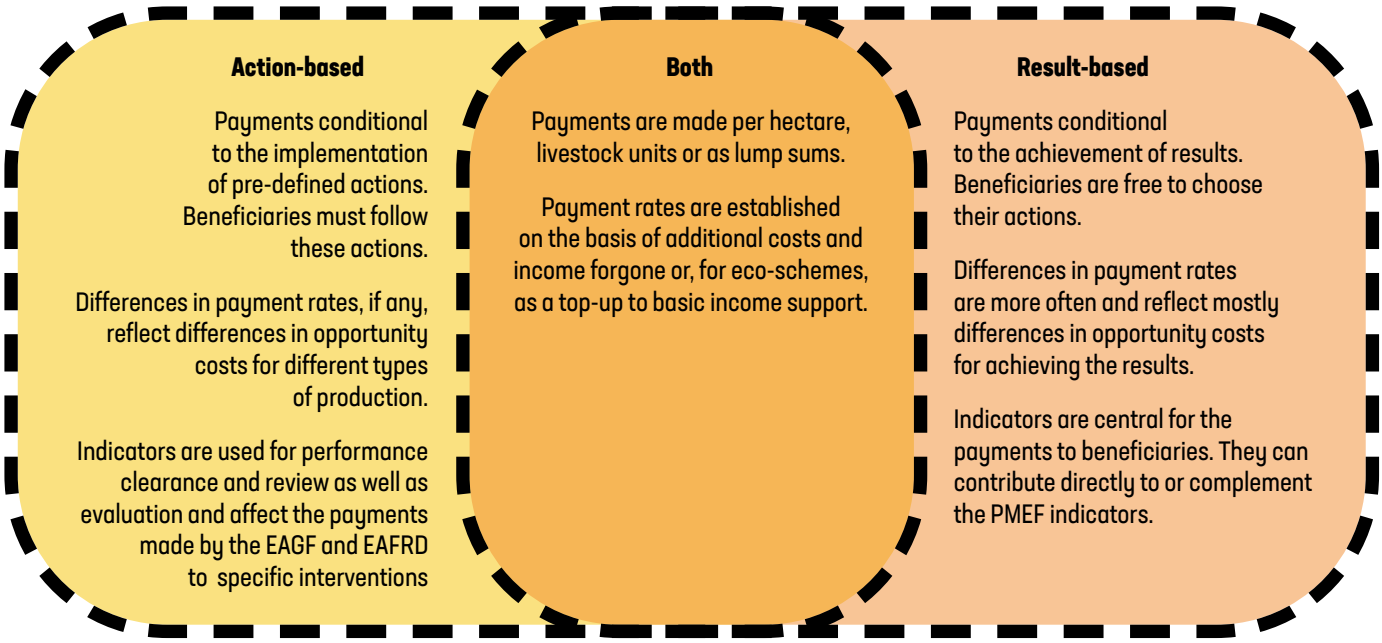
3. Assessing RBIs' contribution to better evaluations of the CAP

Based on the lesson learnt, this section presents the main factors for setting up a monitoring system for RBIS (selecting appropriate indicators, establishing levels of expected results, measuring, reporting and verifying actual results, etc.), ongoing and ex post evaluation of RBIs (effectiveness in achieving expected results) as well as assessment of RBIs' contribution to the objectives of CAP Strategic Plans (relationship with PMEF indicators, complementarities in estimating the net effects).

3.1. What is different when evaluating RBIs?

The aim of the evaluation of RBIs does not differ from the aim of the assessment of any other interventions. However, evaluation should take into account certain specificities arising from the differences between action and RBIs as they are illustrated in Figure 4.

Figure 4. Comparing and contrasting action- and result-based interventions



Source: EU CAP Network supported by the European Evaluation Helpdesk for the CAP (2024)

These differences may impact the evaluation process and concerns, including:

- the payment for results and the sensitivity of the payments to the different levels of results achieved to incentivise better performance and more significant environmental benefits;
- the flexibility beneficiaries enjoy in determining the most appropriate practices to achieve the expected results; and
- the consequent requirement for a robust system of measurable and identifiable indicators, responsive to agricultural practice changes, as these are central for calculating the payments to beneficiaries but also for assessing the contribution of each beneficiary towards the objectives.

These three generic traits of RBIs can differentiate evaluation activities because they challenge the conventional way we interpret and examine the evaluation criteria. In RBIs, the effectiveness of the intervention is directly linked to measurable environmental outcomes. Thus, effectiveness may be measured by the 'kilogrammes of particulate phosphorous (PP)' that is abated as a result of implementing a measure of buffer strips (Sidemo-Holm et al., 2018). Likewise, efficiency is the payment per abated kilogramme (€/kg), calculated as the total payments made for achieving the abatement, divided by the total amount of PP abated. According to the Commission's Better Regulation approach, "effectiveness analysis considers how successful EU action has been in achieving or progressing towards its objectives". **This implies that the objectives of the policy and targets for each beneficiary and the corresponding interventions should also be expressed in physical units of environmental outcomes and compared against a baseline**.

In the above example, evaluating gross effectiveness means that the baseline, the targets and the progress can be measured in physical units of the environmental outcome. In other words, in order to make full use of the potential of RBIs to better demonstrate the performance of the policy, the objectives as well as any targets set at Member State or intervention level must be aligned with the way resulst are measured at the level of the beneficiaries.

The second significant difference between RBIs and action-based interventions stems from the reliance on achieving specific environmental or agricultural outcomes for payment. It leads to a higher level of perceived uncertainty and risk at both ends of the contract, farmers and administrations. In RBIs, non-payment risk is higher for the beneficiaries because payments are contingent on achieving and accurately measuring specific outcomes. This risk can be a barrier to participation, creating uncertainty for the administration as regards the achievement of the targets set in the CAP Strategic Plan and the implication for performance clearance and review. **Practically speaking, and from the evaluation point of view, perception of higher than usual risk may impact the uptake rates and farmers' satisfaction, and introduce bias concerning risk attitudes** on top of a bias related to comprehension and familiarity with the RBIs. These will have severe implications for the scheme's effectiveness and the methodological options open to the evaluator. For example, low uptake rates may not support a viable sampling procedure and turn the evaluation into a mix of simulations and sampling. Considerable and multi-source sample selectivity will introduce severe bias in the estimations of econometric effectiveness, as further discussed and analysed in Section 3.4.

Finally, as the indicators used to measure results are central to the calculation of the payments to beneficiaries, they must have specific characteristics that ensure they are reliable, practical and aligned with the intervention's objectives. Evaluators must ensure that the indicators are:

- measurable, quantifiable and verifiable in a cost-effective and practical way through field inspections, remote sensing or other appropriate methods within the constraints of the available resources;
- sensitive and responsive to farmers' specific actions as regards management practices and changes in management practices;
- clear, simple and understandable by all stakeholders, including farmers, administration, policymakers and evaluators;
- aligned with the environmental, climate and other policy objectives the RBI contributes to; and
- consistent and reliable in providing data across different contexts and over time, allowing for environmental, climatic and socioeconomic variations.

An important aspect of the indicators used to measure the results (RBI indicators) is how they can fit within the PMEF; that is, how they link, contribute or complement the PMEF indicators. RBI indicators measure the environmental or other predefined result (antimicrobial reduction or increase in animal welfare) achieved by farmers. However, in order to calculate the payments to the beneficiaries, these measurements must correspond to eligible hectares or livestock units on which they are achieved. Thus, the output for RBIs can be expressed in terms of hectares or livestock units using O.14 [33] or O.18 [34] output indicators of PMEF correspondingly.

The relationship is not equally straightforward when it comes to the links between RBI indicators and PMEF result indicators. More specifically, RBI indicators related to pressures and threats can complement the PMEF result indicators. For example, RBI indicators that measure the reduction of the risk of erosion can complement the PMEF result indicator R.19 [35]. In contrast, RBI indicators that directly reflect the improvements in environmental or climate conditions can be rather linked and complement PMEF impact than result indicators. For example, the quantity of sequestered carbon due to an RBI may well count for the 'Soil organic carbon in agricultural land' (I.11) impact indicator. The same can happen for RBIs whose result is the number of birds that contribute towards the 'Farmland Bird Index' (I.19).

However, in some cases the RBI indicators do not directly contribute to an impact indicator or are incompatible with the impact indicator, or a corresponding impact indicator does not exist in the PMEF. For example, an RBI measuring floristic diversity in grasslands does not contribute to any of the PMEF biodiversity impact indicators (I.19 or I.20), but can be used complementary to them. Similarly, there is no PMEF impact indicator for animal welfare, but corresponding RBI indicators can perfectly play this role and fill this gap. In all these cases the ex ante evaluation should suggest ways in which the RBI indicators will be utilised in the PMEF either as 'additional' indicators or as contributing to one of the existing PMEF impact indicators directly or after adaptation or for filling gaps in the PMEF.

[33] O.14 Number of hectares (excluding forestry) or number of other units covered by environmental or climate-related commitments going beyond mandatory requirements.
[34] O.18 Number of livestock units (LU) benefitting from support for animal welfare, health or increased biosecurity measures.
[35] R.19 Improving and protecting soils: Share of utilised agricultural area (UAA) under supported commitments beneficial for soil management to improve soil quality and biota (such as reducing tillage, soil cover with crops, crop rotation included with leguminous crops).

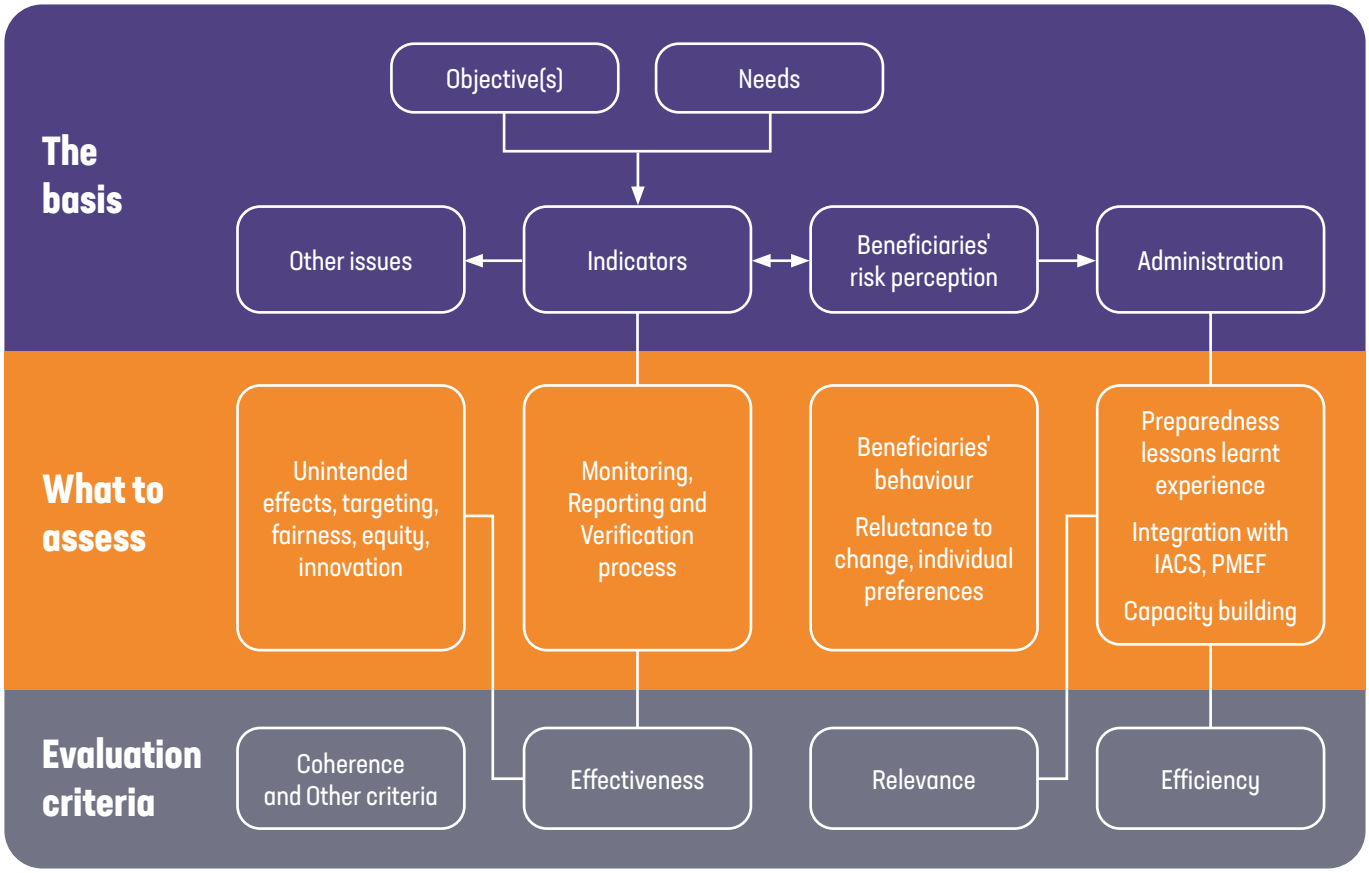
3.2. Assessment during the design of result-based interventions

The overall aim of the ex ante evaluation (paraphrasing Article 139(1) of Regulation (EU) 2021/2115) is to improve the quality of the design of the RBI. Thus, the ex ante assessment aims, as in every evaluation, to ensure:

- the relevance of the interventions:
  - by examining that the proposed RBIs align with the needs identified in the CAP Strategic Plan during the SWOT analysis and needs assessment; and
  - by ensuring that all relevant stakeholders are engaged. Stakeholders may be outside agriculture and thus easy to be neglected.
- the coherence of the interventions:
  - by inspecting that RBIs are in line with the CAP Strategic Plan's and EU's general and specific objectives and fit within existing agricultural and environmental policies, including compatibility with other support schemes and regulations; and
  - by ensuring that the proposed RBIs are based on a sound and well-documented intervention logic that demonstrates how it can contribute to a specific objective to deliver positive results and impacts, in combination with eligibility conditions, definitions and conditionality.
- the effectiveness and efficiency of the interventions by examining:
  - adequate resources are allocated to the RBI, including an assessment of payment rates, and any potential for simplification and burden reduction was considered (special attention to contracting requirements and transaction costs); and
  - the excepted results and timing for their delivery are realistically set.

The conceptual framework that underpins the ex ante assessment of RBIs is illustrated in Figure 5.

Figure 5. Conceptual framework for the ex ante assessment of result-based interventions



Source: EU CAP Network supported by the European Evaluation Helpdesk for the CAP (2024)

The basis on which the assessment is built is determined by the identified needs the RBI is planned to address and the objectives that it contributes to. These shape the definition of the expected results and the indicators to measure them, which, in turn, affect the beneficiaries' risk perception and challenges faced by the administration.

Starting from this basis, the ex ante evaluators should delve into the following issues:

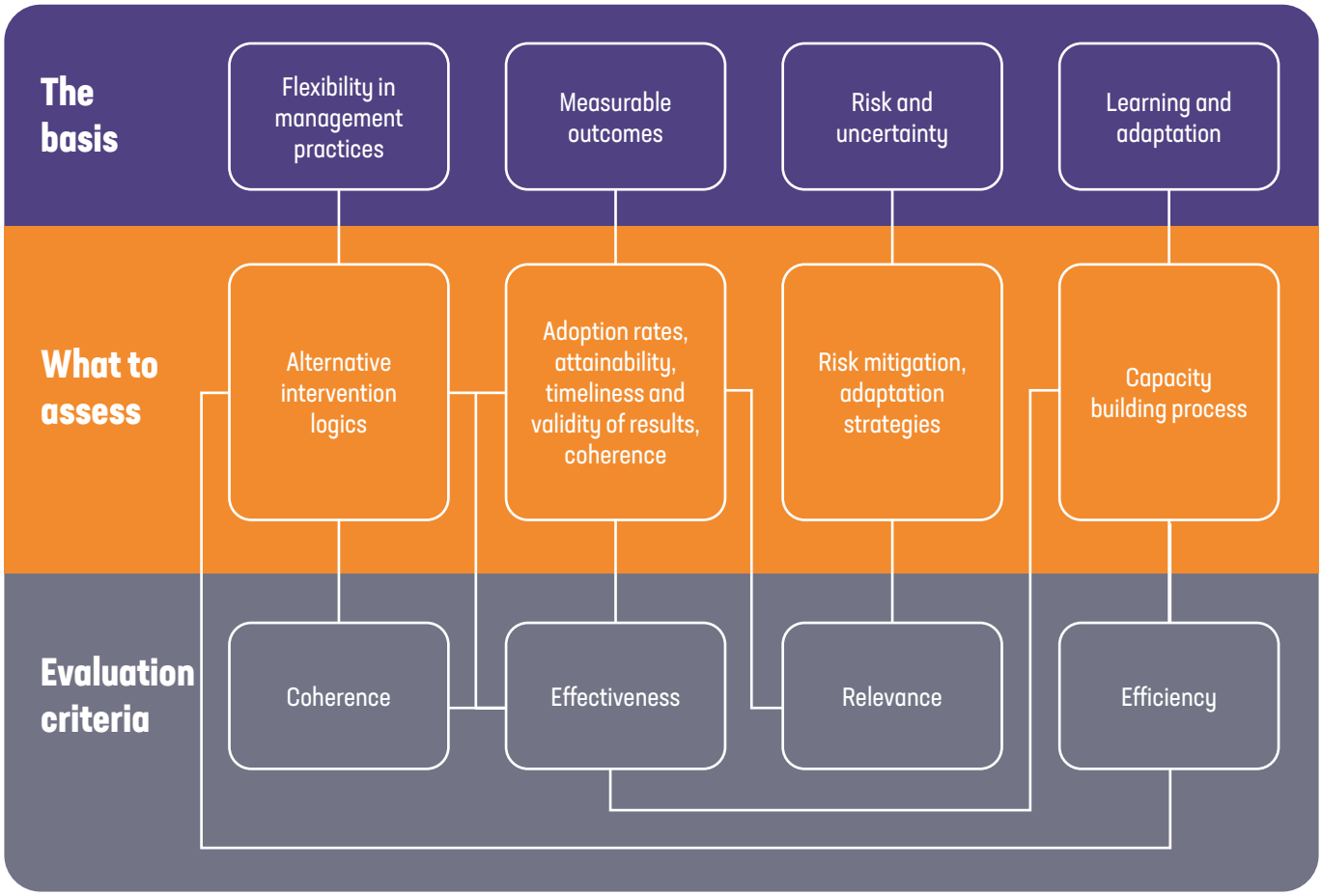
1. The extent to which the formulation of the results and corresponding indicators fulfil the characteristics listed above.
2. The assessment of expected adoption by potential beneficiaries and its temporal distribution, including an assessment of risks and ways to mitigate them.
3. Lessons learnt from previous evaluations of similar action-based interventions and reviewing relevant private sector initiatives.
4. The potential, where relevant, to develop an evolving indicator system, which starts with the use of indicators related to pressures and threats on specific environmental parameters (such as soil and water quality) and which advances over time to include indicators about the actual impact of the intervention on these environmental parameters, as described in detail in Sections 2.2 and 2.3 above.
5. Various issues related to additionality, displacement, permanence of results, equity and inclusion are taken into account.
6. How the indicators can fit within the PMEF, how they link, contribute or complement the PMEF impact indicators.

The main characteristic of RBIs is that they affect the risk perception of farmers usually by increasing the perceived risk of non-payment due to many factors and not only due to a possible failure to achieve results. Increased risk perceptions can jeopardise the success of the whole operation due to the very low adoption rates. If the RBI is designed to incorporate extensive areas or achieve considerable and crucial results, then the ex ante evaluation may consider drawing a risk management strategy and hedge the RBI against the risk of low adoption rates and the consequent administrative risks of failing to produce results through this intervention. Annex IV details the stages and contents of a risk management strategy for RBIs during the ex ante evaluation.

3.3. Assessment during the implementation RBIs

When referring to the evaluation during the implementation (ongoing evaluation), the report implies and includes all types of process evaluation. The ongoing evaluation for RBIs serves several critical aims and objectives, all focused on ensuring the intervention remains effective and aligned with its intended outcomes. The conceptual framework that underpins the ongoing evaluation of RBIs is illustrated in Figure 6.

Figure 6. Conceptual framework of ongoing evaluations of result-based interventions



Source: EU CAP Network supported by the European Evaluation Helpdesk for the CAP (2024)

The basis for the ongoing evaluation is shaped again by the specific characteristics of the RBIs. First of all, the payments are closely linked to the results, meaning that the focus is on **measuring actual environmental outcomes** (such as increased biodiversity or reduced emissions), rather than simply ensuring that prescribed actions were followed, as in action-based schemes. This implies that the evaluation requires more sophisticated and often more resource-intensive monitoring systems to verify that expected results have been achieved. As described, RBIs use indicators based on species counts, habitat conditions, soil health metrics, etc., rather than just compliance with management practices.

Beneficiaries are **free to choose the management practices** that will ensure the achievement of the results. An ongoing evaluation must be adaptable and capable of capturing diverse approaches to achieving these results. Thus, a more dynamic and context-sensitive evaluation process than action-based schemes is required.

The inherent **uncertainty of RBIs** is due to the payments depending on achieving results that can be influenced by external factors (e.g. weather, pests), making them less predictable than in action-based schemes. This implies that ongoing evaluation in RBIs may involve more frequent monitoring, risk mitigation strategies and adaptive management processes to ensure that external factors do not unduly disadvantage participants.

Finally, as RBIs are relatively novel in many regions, an ongoing evaluation must place a stronger emphasis on **learning and adaptation** to refine the intervention, improve outcome achievement and explore innovations in result-based approaches.

The ongoing evaluation for RBIs should take a close look at the issues stemming from this basis. The achievement of **measurable results**, which are as directly associated as possible with the objectives the interventions contribute to, is key not only for the effectiveness of the RBIs but, most importantly, for the payment to the beneficiaries. The evaluator should assess during the implementation:

- whether adoption rates are satisfactory and expected levels of results are actually attainable in the timeframe of the intervention;
- the MRV process and how it ensures the accuracy of the measurement of the results without incurring unnecessary burdens to the beneficiaries and administrations, considering the incorporation of various monitoring and evaluation technologies, such as mobile apps or other digital tools, to record data efficiently. The robustness of any sampling procedure [36] for measuring the results and associating them with corresponding hectares or livestock units to comply with IACS rules must also be assessed;
- the coherence between the result-based and other interventions and any trade-offs arising from the efforts of the beneficiaries to achieve the results; and
- any **risks in the delivery mechanism** that may compromise the adoption rate and the timely attainability and accurate measurement of the results.

Based on these assessments, they will be able to provide recommendations to adjust the delivery mechanism of the RBIs to improve their adoption and effectiveness as well as any adaptation strategies to mitigate anticipated risks.

The flexibility beneficiaries have in selecting the appropriate management practices to achieve the results may give rise to **alternative intervention logic**. Evaluators may compare these alternatives in terms of:

- the comparative difficulty in their implementation and the associated costs;
- the relative effectiveness of each alternative pathway, as, for example, a certain set of management practices may constantly lead to suboptimal levels of results, having also an impact on the payments received by the beneficiaries that implement these practices. The potential generation of co-benefits, as described in Section 2, should also be taken into account when estimating the relative effectiveness;
- the efficiency of the different alternatives, by comparing the estimated costs of implementation to the levels of results achieved; and
- their comparative coherence with other interventions.

These assessments may provide valuable insights about the transferability of each alternative intervention logic to other contexts, setting the basis for the provision of advice and capacity building to beneficiaries, in order to optimise the achievement of the expected results.

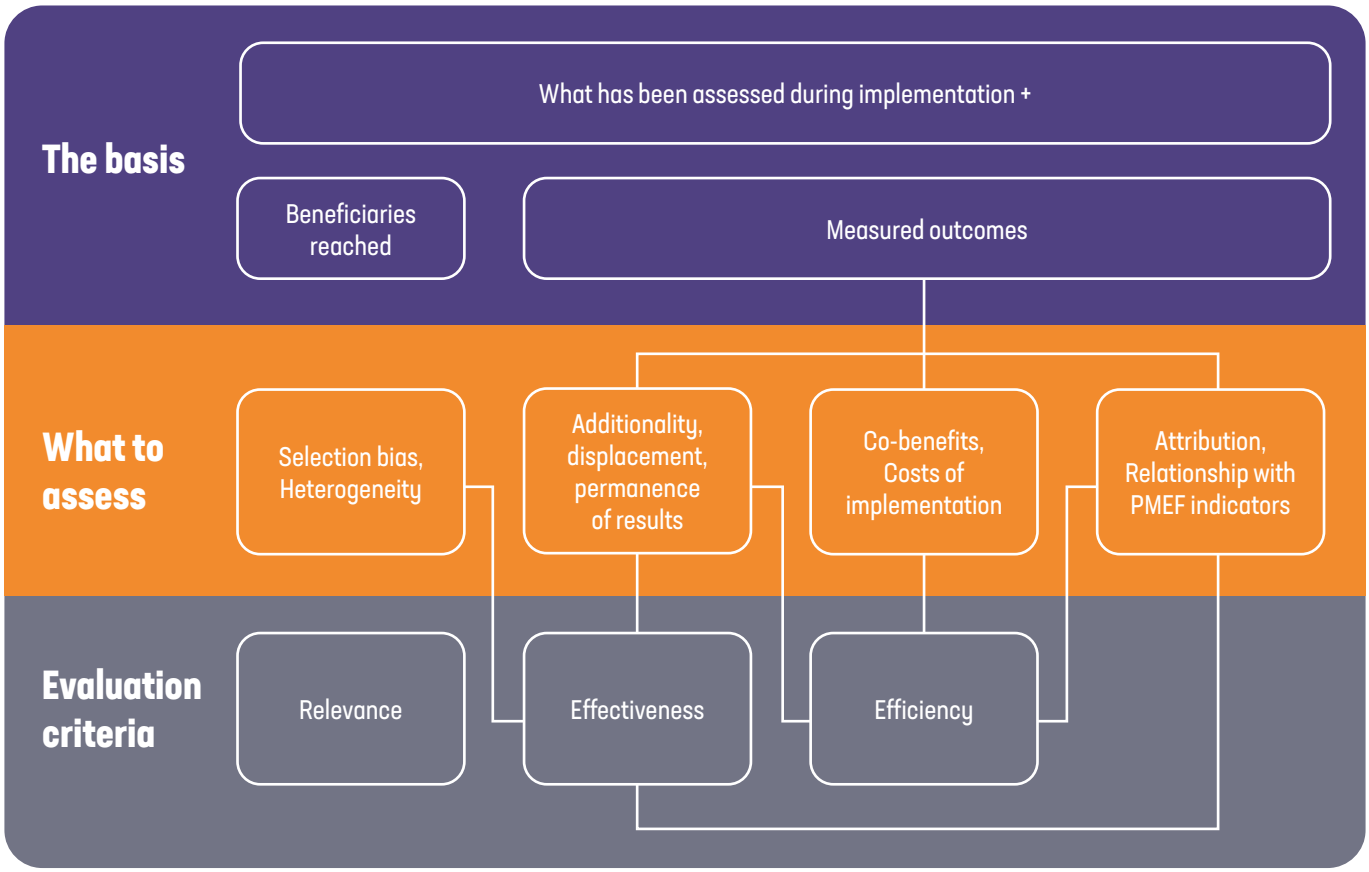
Finally, the evaluators should assess the **learning and adaptation process** both for the beneficiaries and administration and how the continuous building of capacities supports the adoption and the improvement in the effectiveness of the RBIs.

[36] For example, in the 'Montado management by results' in Portugal, each parcel is divided into 5 ha cells and the indicators are measured in the centroid of each cell and then aggregated to the whole parcel by means of the most frequent observation. Alternative sampling methods, potentially employing digital solutions or earth observation and remote sensing, could be explored by the evaluators.

3.4. Assessment after the completion of RBIs

The term 'summative evaluation' is used in this report for any evaluation that is carried out after the completion of an intervention. Summative evaluations should make a judgement about the overall quality of the implementation of the RBIs considering the generic traits of RBIs that have been described in Section 3.1, to inform future policy and interventions by extracting lessons learned and providing recommendations for improving the design, implementation and monitoring of future agri-environmental interventions, including identified successful approaches, as well as areas that need improvement, to enhance the effectiveness of future RBIs or similar policies. The conceptual framework for the summative evaluation of RBIs is illustrated in Figure 7.

Figure 7. Conceptual framework of summative evaluations of result-based interventions



Source: EU CAP Network supported by the European Evaluation Helpdesk for the CAP (2024)

The basis for the assessment is the results of the ongoing evaluation(s) of the RBI complemented with the final data on the actual beneficiaries reached and the results achieved.

Evaluators should examine the following issues during the summative evaluations of RBIs:

1. Heterogeneity among the potential adopters of RBIs, which may give rise to selection bias.
2. Uptake rates and the adoption process, including the responsiveness of the delivery mechanism to the perceived risk of beneficiaries and incorporating equity, fairness and inclusivity into the RBI.
3. The additionality of RBIs.
4. Any co-benefits generated and possible adverse effects, including displacement.
5. The costs and benefits of spatial targeting.
6. The net contribution of RBIs to the results achieved and their overall integration with the PMEF.

The population of beneficiaries that participated throughout the life cycle of the intervention is shaped by the perception of risk among the whole population of potential beneficiaries. RBIs use more complex MRV processes compared to action-based ones which record the achieved results and verify that the results are accurate, consistent, and lasting using multi-tiered verification systems, including field assessments, satellite monitoring and sometimes independent audits. Depending on beneficiaries' knowledge, cognitive abilities and trust in rural institutions and science, this can immediately segregate them into groups.

The risk of non-achievement or non-accurate measurement of results implies that participants may not receive payment. This risk can further segregate beneficiaries into various groups, depending first on their ability to perceive risk and second on their risk attitudes (averse-neutral-lovers).

As a result, **heterogeneity** among the potential adopters of the RBI increases, with some groups being more probable (or even favoured) to adopt. In contrast, other groups may be less likely to adopt the RBI or even excluded. This may give rise to significant methodological issues for the evaluators. Sample heterogeneity refers to the variation within a sample population regarding characteristics such as demographics, behaviours or environmental conditions. From a statistical perspective, high heterogeneity can lead to differences in how individuals or groups respond to an intervention, making it challenging to derive a single, general effect from the data. The evaluation literature assigns sample heterogeneity to various reasons, including heterogeneous preferences (Huber et al., 2023), differences in farmers' behavioural characteristics (Späti et al., 2022; Kreft et al., 2022) or decision-making (Block et al., 2024).

Wuepper and Huber (2022) argued that failing to account for self-selection can lead to overestimation or underestimation of the intervention's effectiveness. Many econometric methods can treat possible selection bias. Wuepper and Huber (2022) used a difference-in-differences (DiD) approach combined with matching techniques, constituting what they named a "doubly robust" estimator approach. Späti et al. (2022), in a discrete choice experiment (DCE) combined with an online survey of farmers, used mixed logit models to capture farmers' heterogeneity in preferences for different attributes of variable-rate nitrogen fertilisation technologies, including economic, environmental and technical factors.

Beyond checking for heterogeneity and selection bias, the estimation of uptake rates and the adoption process of RBIs are crucial because they provide vital insights into the success of the intervention and its broader impacts. Understanding how widely the intervention was adopted and what factors influenced participation as a binary decision (yes-no) among all potential adopters. Moreover, the intensity of results achieved among actual adopters helps evaluators assess the RBI's environmental and socioeconomic consequences. Frequently, adoption studies are followed by satisfaction surveys among adopters. Uptake/adoption assessment of RBIs is essential because they:

- Assess the scale of the environmental impact (effectiveness). Evaluators need to examine how many eligible participants adopted the intervention to understand whether the environmental goals were achieved at the landscape or ecosystem level.
- Identify the barriers and motivators influencing farmers' decisions to participate in the RBI. Summative evaluations must investigate the socioeconomic, cultural and practical barriers (e.g. financial risks, lack of knowledge or resource constraints) that prevented some farmers from participating and the incentives that encouraged others to adopt the intervention. This understanding is critical for designing more effective interventions in the future by addressing the factors that may have limited participation. Adoption surveys can also examine an RBI's relevance and coherence from the farmers' perspective.
- Evaluate the social and economic impacts of RBIs. Adoption process assessments provide insights into the intervention's social equity and economic outcomes since high uptake rates across diverse farm types and regions indicate that the intervention was accessible and equitable. In contrast, low uptake among certain groups (e.g. small-scale or marginalised farmers) may suggest barriers that must be addressed.
- Highlight factors for the long-term permanence of results and shed light on the likelihood that participants will continue achieving the results after the financial support ends. Understanding the drivers of long-term adoption is critical to ensuring that the intervention's benefits are sustained.

Another major issue summative evaluations must examine is additionality, that is, to what extent the results would have been achieved without the support from the CAP, or in private sector schemes, from private sector stakeholders. It is related to evaluating the net effects of interventions. The summative evaluation of additionality for RBIs is not different to any other estimation of the net effect but RBIs present specific opportunities that may improve the quality of the evaluation. These opportunities come from the wealth of data collected under RBIs and the more direct link of these data to the corresponding objectives and relate to:

- the potential to establish a clear baseline of the environmental conditions serving as a benchmark for quantifying the additional impact of the intervention, and;
- the potential to complement the indicators of the PMEF.

In several examples analysed in Section 2, a baseline is established for each indicator during an initial inspection of the participating farm, e.g. the case of the Austrian RBI to improve or maintain biodiversity by protecting habitats and species. Promoting such initial inspections and establishment of baselines can significantly improve the potential to better assess additionality and net out the effect of the intervention. These inspections could also be part of the capacity building of beneficiaries and/or administrative or technical staff involved in the MRV process. Moreover, these inspections could also include a carefully selected sample of neighbouring farms of non-beneficiaries, which, if followed up during the timeframe of the intervention, will allow evaluators to design and carry out more sophisticated counterfactual evaluations.

The valuable data collected as part of monitoring, reporting and verifying the results at parcel level, have a great potential of complementing the PMEF indicators, as already discussed in Section 3.1. Indicators used in RBIs may complement PMEF indicators, usually at the level of result indicators and, in some cases, even at the level of impact indicators, or close gaps of the PMEF. Some indicative examples of how RBI indicators and PMEF indicators can work together are presented in Table 11. These complementarities can considerably improve the ability to attribute changes in environmental or climate parameters to the support provided by the RBIs, but, most importantly, to increase the potential to understand *why* and *how* these interventions have contributed to the observed changes.

Table 11. Examples of complementarities between indicators used in result-based interventions and PMEF indicators

Objective		Output indicators	Result indicators	Impact indicators
Biodiversity	PMEF	O.8, O14	R.31	I.19, I.20
	RBIs		Total number or % change of 'positive' species; Total number or % change of 'negative species'; Number of nests or % change of the area of nesting habitats per bird species.	
Water quality	PMEF	O.8, O14	R.21, R.22, R.24	I.15, I.16, I.18
	RBIs		% change in pesticides Treatment Frequency Indicator; Change in the assessment of risk to the quality of natural water bodies.	
Soil quality	PMEF	O.8, O14	R.19	I.13
	RBIs		Change in the extent of bare soil or erosion.	
Climate change mitigation	PMEF	O.8, O14	R.14	I.10, I.11
	RBIs			Reduced GHG emissions, sequestered carbon, carbon balance improvement.
Animal welfare	PMEF	O.18	R.44	
	RBIs			Absence of injuries: % of animals with intact tails.

Source: EU CAP Network supported by the European Evaluation Helpdesk for the CAP (2024)

Permanence and environmental sustainability are another way to look at the temporal dimension of additionality, whether practices continue after the financial incentives end and whether the environmental outcomes (e.g. improved habitat conditions, carbon sequestration) are sustained in the long term.

The potential delivery of **co-benefits** is one of the RBIs' strengths, and it should be taken into account by summative evaluations. Thus, for RBIs, evaluators must capture and quantify a range of co-benefits besides the principal results and activity that may require a broader set of indicators and potentially more complex methodologies to assess indirect outcomes. Of course, RBIs may also produce adverse effects, including displacement, due to the incentive structures, which can lead farmers to focus solely on achieving those results without considering broader ecological impacts. For instance, if farmers receive results-based payments related to reducing fertiliser use on temporary grasslands, they may shift to other practices that could increase emissions elsewhere or increase the purchase of feedstuff, thus increasing leakage. Of course, these points call for an evaluation with a more comprehensive scope, which can be justified only by large-scale interventions forecasted to impact the supply of agricultural products considerably.

Quantifying co-benefits or possible adverse effects and leakages depends on the existence of corresponding baseline environmental indicators. It is an evaluation exercise that the scale of the RBI should justify. The evaluator should only flag the co-benefits or the adverse effects for less extensive operations. Of course, most co-benefits or unintended negative effects are benefits pursued by other interventions in the same or other specific objectives. Thus, co-benefits can be seen as the synergistic effect of coherent interventions within the CAP Strategic Plan or between the CAP Strategic Plan and other policies. As such, the examination of co-benefits can be part of evaluating the coherence criterion.

Spatial targeting is particularly suitable to RBIs because differentiated payments may consider the local costs or the importance of specific places where more farmers should be mobilised and engaged. Summative evaluation can assess spatial effectiveness and efficiency and examine whether targeting was successful, and the factors RBI designers should consider in the future spatial targeting of the programmes.

Finally, summative evaluations must also assess or review the results of the ongoing evaluation(s) as regards the mechanisms in place for adaptive management, allowing for changes in the design of the intervention if results are not being met. In this sense, adaptive management is part of the risk management strategy. Assessing the risk management strategy of an RBI during a summative evaluation involves examining how well the intervention identified, managed and mitigated risks during its implementation, that is how responsive it has been to the identified risks. The goal is to understand how effectively risks were addressed to ensure the success of the RBI, maintain participant engagement and achieve the desired environmental outcomes. Additionally, evaluators must consider the permanence of the intervention's outcomes and whether the risk management strategies helped participants develop resilience to future challenges.

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Annex I: RBIs in the CAP Strategic Plans

Austria

The intervention 'Management based on results' from the Austrian CAP Strategic Plan is an ENVCLIM intervention which focuses on biodiversity by protecting habitats and species, including in Natura 2000, and preserving landscape features. As a co-benefit, it contributes to climate change mitigation through carbon storage in soil and biomass.

In the first step, the current condition of the habitat in the participating area(s) is determined and documented during a farm visit. Based on this, main and additional indicators are selected from a pre-defined list and corresponding targets are set. The main indicators serve to monitor the status of the habitats based on three levels (best, good, worst) and are linked to the payment. Additional indicators are more difficult to monitor (e.g. number of insects) and are used to provide a deeper understanding of the biodiversity status, but are not linked to the payment. In some cases, indicators also cover soil quality, especially on arable plots and water quality.

Both the initial inspection and the monitoring are done by means of a dedicated app. The initial inspection and assessment of the habitat status in the participating farms is done by trained experts. The main indicators are monitored by the farmers, after they have received targeted training, who then report results to the Paying Agency. Geotagged photos are used as documentation. Farmers may also provide documentation on the practices they have applied, but this is optional. Verification is done in two levels. The first level is done by trained experts who inspect 10% of farms. The second level of verification is done on-the-spot by the Paying Agency. Additional indicators are verified by the trained experts.

The payment is linked to the values of the main indicators and is progressive. The better the results, the higher the payment. There is no obligation for the beneficiary to increase the status of the habitat compared to the initial inspection. The payment is granted on a per hectare basis for grassland and arable land with an objective and indicators, which are determined as part of a selection process and documented in a project confirmation. Costs and income losses incurred as a result of management in accordance with the biodiversity conservation objectives are considered. The premium results from the management requirements assumed for the individual objectives and defined in other ÖPUL (agri-environment) measures. According to the CAP Strategic Plan, beneficiaries must enrol at least one hectare of eligible area in the first year of the commitment. The intervention's average planned unit amount is 575 EUR/ha for the first year and 621 EUR/ha for the next four years.

The per ha payment is supplemented by a uniform flat-rate surcharge of EUR 250 per farm for the observations and documentation of the indicators. From 2024 onwards this optional supplement is linked to participation in a 'Regional Nature Conservation Plan' and increased to EUR 270 per farm. If the optional supplement for the Regional Nature Conservation Plan is applied for, objectives for a delimited region (e.g. Natura 2000 area, part of a protected area) must be defined in a project community and implemented with the support of the project community. In the course of joint planning, workshops and farm visits, the suitable areas of the region are identified and their need for protection is outlined. The indicators required to achieve the regional objectives are recorded in the project confirmation and must be adhered to in the respective area. An annual confirmation of participation is also required.

The indicators are determined individually with the farmer on site. This guarantees that the farmer recognises the plant species and structures independently. Indicators can include the presence of plant species or structures and the absence of plant species or structures. Only species or structures for which there is a close correlation between occurrence and management are used. These indicators must be reviewed by the farm on an annual basis. Box 5 provides two concrete examples of selected indicators and an overview of the indicators and additional indicators can be found on the website of the RBI (https://www.ebw-oepul.at).

Box 5. Examples of indicators defined in agreements with farms in the Austrian intervention 70-17 'Management based on results'

Example 1:

The commitment aims to conserve the species-rich meadow on a not-too-dry site with many different grasses and herbs. In this specific example, some specimens of the invasive and non-native Canadian goldenrod are growing in the meadow.

Main indicators:

At least four of the following six plant species are growing in the area: buttercup, meadow sage, quaking grass, sweet vernal grass, real bedstraw, kidney vetch...

No woody plants (except for dwarf shrubs, seedlings, scattered fruit trees, re-cutting and landscape elements) older than two years occur on the site.

Goldenrod does not flower on the site.

Additional indicators:

Plant community is dominated by grasses from nutrient-poor habitats, such as meadow oat, fescue, meadow-grass and brushwood.

Example 2

The commitment aims to provide winter food for birds on a set-aside arable field that is already home to numerous seed-forming plant species.

Main indicators:

At least five plant species suitable as winter food for birds reach seed maturity and the seed heads are present in the area until at least 1 March of the following year.

Additional indicators:

None.

Source: EU CAP Network supported by the European Evaluation Helpdesk for the CAP (2024)

Finland

The intervention 'EHK-12' (improved conditions for fattening pigs) of the Finnish CAP Strategic Plan is an ENVCLIM intervention which focuses on animal welfare and the reduction of the use of antimicrobials.

The conditions of the pig farm and the care of pigs are measured by means of an animal welfare indicator that relates to the absence of injuries. Pigs are inspected in the slaughterhouse to monitor tail biting or docking. Beneficiaries will receive the payment if intact tails are found on more than 95% of the animals inspected.

Each beneficiary can choose the management practices to ensure improved welfare conditions (e.g. more detailed monitoring of pig welfare, littering, daily enrichment, space, suitability and availability of feed, and number of feeding cycles). These conditions must concern all fattening pigs on the holding between 3-8 months old, and the beneficiary must keep records of the management practices implemented. Improving the conditions can reduce tail biting and reduce the use of antibiotics needed for inflammation. Advisors are trained to provide relevant advice to the farmers about the actions that can decrease tail biting and achieve the expected level of results. This process creates a link between the actions made on the farm and the results achieved.

The monitoring is done in the slaughterhouse by independent inspectors trained by the Paying Agency. The inspectors then report the data about the percentage of carcasses with intact tails to the farmer. The farmer must forward the result to the Paying Agency.

Payments are linked to results and the corresponding LUs. The cumulative percentage of carcasses with intact tails is calculated twice per year. If it is greater than or equal to 95%, the farmer receives the payment corresponding to the total LUs processed in the slaughterhouse in the period concerned. Therefore, if the farmers cannot achieve the result in one semester, they will not lose all annual support but only the support corresponding to the LUs processed in the slaughterhouse for this period.

There isn't any progressive payment if the achieved result is higher than 95%. If the 95% threshold is not reached for any given period, no payment is issued.

According to the Finnish CAP Strategic Plan, at least 15 LU must be enrolled on average for every year of the commitment. The intervention's uniform planned unit amount is 59 EUR/LU for every year.

France

The intervention 70.27 'Flat-rate AECM – Transition of practices' of the French CAP Strategic Plan is an ENVCLIM intervention which contributes to climate change mitigation and adaptation and sustainable management of natural resources and biodiversity.

Intervention is subdivided into three themes:

- Plant health strategy
- Farm carbon balance
- Improvement of protein autonomy in livestock farming.

Farmers can choose to participate in only one of the three themes. It is a five year commitment.

Plant health strategy

The indicator for the plant health strategy is the herbicide and non-herbicide Treatment Frequency Indicator [37] (IFT). The IFT is used to monitor the use of phytosanitary products and counts the number of reference doses used per hectare at a spatial unit over a given period. Generally, the spatial unit is the plot of land, and the time period is the crop year. The definition of reference doses of a product is based on the information contained in the decisions related to the marketing authorisations of plant protection products (PPP) and are specific for each crop year, crop and target.

Treatments included in the indicator can be those carried out on the plot, on the seed, or the plant before planting. Treatments on the harvested products are not considered in the indicator.

This indicator can be aggregated at the scale of a set of plots, cropping system, farm, group of farms, territory or region. It can also be segmented by family or type of PPP, type of treatments, target or crop type. The values of the IFT for field crops, viticulture, and some fruits and vegetables are calculated at the national or regional level by the Finnish Ministry of Agriculture and Food Sovereignty to serve as a benchmark against which individual parcels or other aggregations can be compared.

Beneficiaries must achieve a reduction of at least 30% of the IFT.

Farm carbon balance

The carbon balance results are defined through a simulation tool (such as CAP'2ER [38] for cattle or CarbonExtracts [39] or Sysfarm [40] for crops), by selecting the different actions implemented by the farmer and also documenting the starting point in a baseline scenario.

These tools allow a multi-criteria assessment, taking into account GHG emissions and carbon storage, as well as the quality of water, air, energy consumption and production, and biodiversity. GHG emission gains are calculated from the carbon intensity of the products for each production activity. The results are presented in kg CO_2 equivalent/unit of product. The gains linked to carbon sequestration are calculated based on the surface area for each type of practice, at the farm scale. Regions may apply discounts on the results calculated to account for the risk of non-permanence of results.

The modelled carbon balance baseline and achieved results can be verified by external auditors through an audit of the proofs and other documents supporting the baseline diagnostics and implemented actions (invoices, farm management documents, maps, etc).

Beneficiaries must achieve an increase of at least 15% of their carbon balance. Using the models listed above, and based on the practices followed by the beneficiaries, both the carbon sequestered and the current CO_2 equivalent emissions from farm activities and soil management are estimated. Then, the farm carbon balance is calculated as the difference between the estimated gross carbon sequestration and estimated gross CO_2 equivalent emissions.

Protein autonomy in livestock farms

In relation to protein autonomy, there are four technical blocks:

- increase in the agricultural area for high protein forage crops;
- improvement of husbandry practises;
- increase in self-production of concentrates; and
- reduction in the dependence on proteins imported.

Farmers must participate in at least two technical blocks. The indicators used and corresponding targets are shown in the following table.

[37] Indicateur de Fréquence de Traitements phytosanitaires (IFT) | Ministère de l'Agriculture et de la Souveraineté alimentaire
[38] La méthode CarbonAgri | Label bas carbone – Ministère de la transition énergétique (ecologie.gouv.fr)
[39] Carbon Extract (monbilan-carbonextract.com)
[40] SysFarm – Décarboner naturellement avec l'agriculture régénératrice

Table 12. Indicators and targets for the protein autonomy theme in France's 70.27 intervention 'Flat-rate AECM – Transition of practices'

Technical block	Species concerned	Indicator	Target
Increase in the agricultural area for high protein forage crops	Sheep, goats, and dairy and fattening cattle	Agricultural area for high protein forage crops per total area of forage crops	Increase by at least 10%
Improvement of husbandry practises	Sheep, goats, and dairy and fattening cattle	Grassland area per livestock unit	Increase by at least 15%
	Pigs, poultry	Kg of MAT [41] per 100 kg of live weight	Improvement of 5%
Increase in self-production of concentrates	Sheep, goats, and dairy and fattening cattle, pigs, poultry	Self-produced concentrates per total concentrates consumed	Cereals or mixtures with <50% of protein: increase by at least 20%
		Agricultural area for high protein forage crops per total area of forage crops	Pure proteins or meslin with ≥50% protein: increase by at least 10%
Reduction in the dependence on proteins imported	Sheep, goats, and dairy and fattening cattle, pigs, poultry	Simple feed: % MAT imported per total MAT purchased	Decrease of at least 10%
	Sheep, goats, and dairy and fattening cattle	Quantity of compound feed MAT purchased per unit of production	Decrease of at least 10%
	Pigs, poultry		Decrease of at least 5%

Source: Additional costs and income foregone- Regional AECM. Additional information relating to the issue of protein autonomy on farms (*Répertoire des surcoûts et manques à gagner- MAEC dans le périmètre Régions. Compléments relatifs à l'enjeu autonomie protéique des exploitations*) shared by the FR representatives.

A baseline establishment is required for all three themes. After the initial inspection and establishment of the baseline, the farmers are equipped with a personalised action plan which is tailormade to the conditions of the farm and which can guide them to achieve the results. The establishment of the baseline and the monitoring of results for all the themes are carried out by farm advisors. For farm carbon balance, the initial inspection and the subsequent monitoring are done by trained farmed advisors, using the tools described above. For protein autonomy, farmers and advisors may use a dedicated web application called Devautop. It allows them to measure the level and quality of the protein autonomy of the farm in terms of MAT. Both the baseline and the results are submitted by the advisors to the farmers and the latter report them to the Paying Agency. Verification controls are planned by the regions that will implement the intervention.

Remuneration is paid on a flat-rate basis determined on the basis of the average characteristics of French agricultural holdings (average UAA in particular). Each region can decide on how to issue the payment (annually or differently). In Nouvelle Aquitaine, where only the carbon balanced theme has been opened, the payment is issued in two tranches; the first one refers to the initial assessment for establishing a baseline and for the draft of the action plan, and the second payment is related to the achieved results.

For each theme, and in order to receive the maximum amount, beneficiaries must achieve the targets set. If they do not achieve the corresponding target, beneficiaries can still receive a part of the result-based payment proportional to the result achieved. However, no result-based payment is delivered below a certain level of result (e.g. below 10% increase in farm carbon balance).

According to the French CAP Strategic Plan, the uniform planned unit amount is EUR 18 000 per beneficiary.

[41] MAT; matières azotées totales, N x 6,25: all the nitrogenous constituents of plant foods: proteins, free amino acids, amides, nitrates, etc. They contain an average of 16% nitrogen. Their content is therefore the product of the nitrogen content of the feed by a factor of 6.25. (Utilisation des fourrages grossiers en régions chaudes (Étude FAO – Production et santé animales – 135), fao.org.

Germany

The intervention DZ-0405 'Result-oriented extensive management of permanent grassland with evidence of at least four regional characteristics' of the German CAP Strategic Plan is an eco-scheme intervention which focuses on biodiversity by protecting habitats and species.

The obligation under this eco-scheme consists of proof of the presence of at least four species, which are ecologically valuable and typical of the region's grassland.

Areas of permanent grassland shall be eligible for support if they demonstrate the presence, with a high density, of at least four plant species from the list of species or groups of species of grassland defined by the Länder where the area is located.

The methods for identifying the specific species or groups of species are determined at the level of the Länder. In principle, these specific species are recorded by a predetermined and systematic inspection of the areas by the farmer. The results of the inspection must be recorded in detail by means of forms, geotagged photos or a dedicated app. In addition, on-the-spot checks are carried out to verify with certainty the presence of the species and the eligibility of the applicant's area.

According to the German CAP Strategic Plan, the intervention's uniform unit amount is 240 EURO/ha for the first two years, decreasing to 225 EUR/ha and 210 EUR/ha for the last two years.

The sub-intervention EL-0105-04 'Result-oriented reward of more than four species of wild flora' of the German CAP Strategic Plan is an ENVCLIM intervention implemented in Baden-Württemberg, Bavaria, Lower Saxony/Bremen, Rhineland-Palatinate, Saxony and Thuringia, which focuses on biodiversity by protecting habitats and species.

It is implemented similarly to the DZ-0405 eco-scheme, but the obligation is to prove the presence of at least six or eight species, which are ecologically valuable and typical of the region's grassland. According to the German CAP Strategic Plan, the intervention's uniform unit amount is 340 EUR/ha.

Ireland

The intervention 53AECMGEN 'ACRES General' of the Irish CAP Strategic Plan is an ENVCLIM intervention which contributes to climate change mitigation and adaptation, sustainable management of natural resources and biodiversity. It includes four sub-interventions related to result-based management.

The sub-intervention LIPG 'Low input peat grassland' rewards farmers for improved grassland management on peat soils next to raised bog sites. The sub-intervention uses a scorecard, which is a series of questions which are answered by the surveyor for each field being scored. The result is a rating for the field on a scale of 1 (poor) to 10 (excellent). The higher the score a parcel receives on the scorecard the higher the payment rate per hectare the beneficiary receives for this action. A large portion of the score is based on the condition of the peat soils. The wetter the peat, the less carbon emitted and hence, the higher the score. A higher proportion of the points on the Wet Grassland Scorecard are based on how wet the soil is. Points are also awarded for biodiversity – high cover of native meadow species such as meadowsweet, bird's-foot trefoil and common knapweed, result in more points. Points can be lost if threats or damaging activities exist.

The sub-intervention LIG 'Low Input Grassland' aims to encourage farmers to manage their farmland in an environmentally friendly manner by linking the payment they receive to the quality of the environmental outcome delivered. Permanent pastures that are extensively grazed and managed using low fertiliser and herbicide inputs sustain a greater variety of plants and wildlife, improve soil structure, promote water quality and contribute to carbon sequestration. Fields are assessed by an approved advisor between the 1 June and the 31 August in years 1, 3 and 5 and given a quality score, which reflects their ecological integrity. The scorecard is comprised of result indicators which are surrogates for measuring the actual biodiversity present. The scorecard is a series of questions which are answered by the surveyor for each field being scored. The result is a rating for the field on a scale of 1 (poor) to 10 (excellent). The higher the score a parcel receives on the scorecard, the higher the participant's payment rate per hectare for this action. A negative score is applied if the current level of management is too low with no signs of grazing/mowing or if there is poaching damage to the field.

The sub-intervention 'Commonage' aims at improving the condition of the heathland/grassland and associated species e.g. red grouse, curlew and hen harrier. Fields are assessed and given a quality score, which reflects their ecological integrity. The scorecard is comprised of results indicators which are surrogates for measuring the actual biodiversity present. The scorecard is a series of questions which are answered by the surveyor for each field being scored. The result is a rating for the field on a scale of 1 (poor) to 10 (excellent). The higher the score a parcel receives on the scorecard, the higher the participant's payment rate per hectare for this action.

The intervention 'ACRES Cooperation' of the Irish CAP Strategic Plan is a combination of ENVCLIM and COOP intervention which contributes to climate change mitigation and adaptation, sustainable management of natural resources and biodiversity. The majority of 'commonage' is nested in this intervention. It is delivered through a hybrid model that intends to offer both result-based payments and fixed payment rates to participating farmers. Most payments are results-based using scorecards specifically designed for the land types and regions involved. However, most of the farmers in the defined geographical areas, who can avail of the ACRES Cooperation, are farming in regions which have challenging conditions and/or which need bespoke actions carried out to restore the land or water to more favourable environmental conditions. Eight local action plans will be developed to create a catchment (zone) diagnosis, including an assessment of the various environmental priorities and threats from water to biodiversity to assist in trying to target priority issues. The initial diagnosis will set recommendations and an action plan that may specify the necessary actions and/or training to achieve objectives. Scorecards for each land type clearly indicate to the farmer the improvement needed to land to achieve the highest points and maximum payment. Trained advisers, with the support of a cooperation team, will advise and support the farmer to achieve the optimum score.

Results-based payment models are designed to ensure that farmers are appropriately incentivised to improve the landscapes and catchments within which they farm. Payments reflect the quality of the result indicator. The results are measured by indicators grouped in scorecards. Within the ACRES cooperation, there are ten possible scorecards [42], which mainly assess:

- ecological integrity, by using a group of indicators that assess, in most cases, the presence and cover of 'positive' [43] species (zero or positive scores), the cover of 'negative' species (mostly negative scores or zero), and the vegetation structure (positive or negative scores depending on the structure);
- threats and pressures or future prospects, which are, in most cases, measured by the evidence of damaging activities (negative scores or zero), risk to the quality of natural water bodies (negative scores or zero), risk of soil erosion (negative scores or zero and in some cases slightly positive scores for low risk), and the cover of non-native invasive species (negative scores or zero); and
- hydrological integrity, measured mostly by the presence and condition of artificial drainage (negative scores in case of fully functional artificial drainage, zero for partly functional and positive when no artificial drainage is taking place).

Other indicators relevant to certain scorecards include:

- field boundary quality (positive scores or zero);
- those that show poor management of grasslands (extent of spreading immature scrub and cover of bracken, with negative scores or zero); and
- those related to the quality of habitat for specific bird species (zero or positive scores according to the conditions).

The monitoring, reporting and verification are done by the ACRES farm advisors. These advisors are employed by the farmers and act on behalf of the farmers by submitting a claim. Thus, it's not seen as an inspection but as technical assistance.

There is no baseline establishment as the farmers are paid according to the combined score of all the parcels in the farm, calculated by the advisors at the time of the inspection. There is no obligation for the farmers to increase their score during the implementation of the intervention.

Advisors are obliged to visit the field at least three times in five years. This decision was based on the experience that usually there is no substantial increase in the scores year-on-year. Reducing the visits increases the efficiency of the delivery by lowering the costs since the farmers pay farm advisors that visit the farms. Farm visits from the advisors can only take place between June and August, and advisors can decide to go on years 1, 3 and 5 or on years 1, 2, 4. During the years in between, the farmer is paid based on the previous year's score.

When the farmer joins the scheme, they are assigned to a specific cooperation team, which is therefore responsible for a specific cooperation zone. Each cooperation team has a pool of background information related to each parcel of the zone, and according to it, a specific scorecard has been preassigned to each parcel. The farm advisor walks through the parcel and, based on the observed conditions, marks the score for each indicator.

The registration of the scores by the advisors is done by means of a dedicated mobile application (Agri snap). The application allows the uploading of geotagged photos as evidence of the assigned score. Once the inspection is completed the advisors can submit the score into the system. The Manging Authority carries out on-the-spot checks, whereby the inspectors rescore the parcels and compare the score to the one produced by the advisers.

Payments are linked to the score of each field. Each scorecard must receive a score of four or higher to be considered for payment. Score from 0-3 (inclusive) are considered to correspond to the conditionality and therefore are not remunerated. However, the payments for a field score of four will be significant enough to incentivise farmers to work at further improving habitat quality. The top payment for a total of ten points altogether, will only be achieved where the habitat is considered to be in optimal condition and therefore deserving of the highest payment for delivering environmental benefits.

The payment level per ha is related to the combined score of all parcels on the farm. The change in the payment rate from one score level to the next is not linear. The change is smaller between the lower levels and gets bigger between the higher levels, reflecting the more demanding changes in the farm practices that are required to achieve these higher score levels.

A certain field may be scored using more than one scorecard. In this case, the combined score is calculated by applying a weight on each scorecard that is proportional to the corresponding area. For more details on the intervention, see here.

According to the Irish CAP Strategic Plan the average planned unit amount of the intervention is 230 EUR/ha.

Poland

The interventions I.8.9.1. 'Package 4. Habitats and endangered bird species in Natura 2000 sites' and I.8.9.2. 'Package 5. Valuable habitats outside Natura 2000 sites', which are implemented as carry-overs from the 2014-2022 period, contribute to climate change mitigation and adaptation, sustainable management of natural resources and biodiversity.

These interventions are in principle action-based, but for specific areas i.e. non-agricultural land affected by flooding (confirmed by satellite monitoring), a result-based component will be applied.

According to the Polish CAP Strategic Plan, the uniform unit amount for I.8.9.1 is 352 EURO/ha and for I.8.9.2 389 EUR/ha.

[42] https://www.gov.ie/en/service/f5a48-agri-climate-rural-environment-scheme-acres/#acres-scorecards-and-information-general-co-operation-approach

[43] Species which reflect the adoption of practices that are beneficial for biodiversity.

Portugal

The intervention D.2.2 'Management of payments by results' of the Portuguese CAP Strategic Plan is an ENVCLIM intervention to support farmers who carry out environmentally sustainable management of agrosilvopastoral systems in cork oak (Quercus suber), holm oak (Quercus rotundifolia) and pyrenaica oak (Quercus pyrenaica) groves, in a result-oriented approach. The intervention gives farmers flexibility in choosing appropriate management practices and remunerates the achievement of measurable results expressing environmental and climate benefits, including biodiversity associated with these production systems. It contributes to carbon storage in soils and biomass, preserving habitats and species and improving NATURA 2000 management.

There are four groups of indicators which aim for different results. The four groups of indicators correspond to the four main environmental results that should be achieved.

- Result A – Healthy and functional soil.
  - Indicator A1 – Degree of coverage with negative herbaceous species.
  - Indicator A2 – Extension of bare soil.

The indicator aims to assess whether there is a general improvement in soil health and in particular a decrease in soil erosion. The higher the coverage with negative species and the extent of bare soil, the lower the score of the parcel.

- Result B – Quercus Regeneration.
  - Indicator B1 – Regeneration density at the shrub stage.
  - Indicator B2 – Conservation status of regeneration.

The indicator aims to assess the recovery and maintenance potential of the tree cover through new trees through the natural and artificial regeneration of trees. Montado was based mostly on natural regeneration, but due to certain factors, such as more grazing, more mortality of trees and more mechanical interventions, the number of trees has been reduced. For this reason, farmers try to invest in new plantations in addition to natural regeneration, and in protection devices for the young trees, to protect such trees from damages caused by livestock.

The assessment of regeneration is measured with the rate between adult trees and new trees (60-100 cm tall). The conservation status of regeneration is measured by observing the condition of the new trees. The higher the regeneration and the conservation status, the higher the score.

- Result C – Bio-diverse Mediterranean pastures.
  - Indicator C1 – Herbaceous balance level of the grassland.
  - Indicator C2 – Degree of thistle coverage.
  - Indicator C3 – Degree of bush cover.

This indicator refers to agro-silvo-pastoral environments and the aim is to see whether grazing is sustainable. The objective is to look at the ecosystem, meaning the combination of trees, shrubs and pasture.

- Result D – Singular elements (remnant habitats) that promote biodiversity
  - Indicator D1 – Level of diversity of singular items.
  - Indicator D2 – Representativeness of singular items.
  - Indicator D3 – Retention status of singular items.

The presence of these singular elements is extremely important for biodiversity as they provide habitats, feeding, breeding and nesting sites for a variety of wildlife and connectivity between different areas and habitats. Six types of singular elements have been identified in two categories: humid elements and dry elements. The humid elements are riparian galleries, Mediterranean temporary ponds and artificial ponds. The dry elements are rocky outcrops and structures, small woods and tree and/or shrub clusters. The rocky outcrops and structures are natural rocky outcrops and man-made rock structures such as clumps of stones, ruins or stone walls, colonised by rupestrian vegetation and shelter various species. Another indicator is representativeness, meaning the relation between the area of the singular elements and the whole parcel that is evaluated. The conservation status or retention of singular elements is evaluated through specific indicators for each different habitat.

Every parcel is assessed against the whole range of indicators. As the parcels are quite big, a grid with a 5 ha cell size is created for each parcel and the indicators are measured at the centre of each grid cell. The final score for each indicator is calculated as the mode [44] of the observed values. There is no baseline establishment, as the farmers are paid according to the score of the parcel, calculated at the time of the inspection. There is no obligation for the farmers to increase their score during the implementation of the intervention. The monitoring is done by local association staff, trained by the University of Evora that has designed the RBI, calculate the score for each parcel, based on the indicators, on a scale from 0 to 10. Verification is done by the University of Evora by rescoring sample parcels and submitting the results to the Paying Agency.

The payment is made only if the score is equal or above five.

According to the Portuguese CAP Strategic Plan the average planned unit amount is 92 EUR/ha for the first year and 159 EUR/ha for the subsequent years.

[44] The most frequent value observed.

Slovenia

The intervention IRP18.03 'AGRI-environment-climate payments – Biodiversity and landscape' of the Slovenian CAP Strategic Plan is an ENVCLIM intervention, which contributes to climate change mitigation and adaptation, sustainable management of natural resources and biodiversity. The sub-intervention BK.14 'Habitats of birds of humid extensive meadows' aims at protecting grassland bird species, e.g. corncrake (Crex crex) and rapeseed (Saxicola rubetra), includes an action-based part and a result-based part. The action-based part includes mowing from 10 July of the current year for meadows on which the corncrake is not present in the current year, or from 1 August of the current year for meadows on which the presence of the corncrake in the current year is confirmed with an annual bird monitoring. The method and direction of mowing are also prescribed. Fertilisation, grazing, mulching and plant protective products are not allowed.

The result-based component is based on the presence of the corncrake. This is determined by the annual monitoring of birds in the agricultural landscape. Parcels are entitled to the payment, where singing corncrake males are recorded in the current year. Based on the annual census of the corn crake, the monitoring contractor prepares three layers:

- polygon with a radius of 50 meters around the location of the corncrake;
- polygon with a radius of 150 meters around the location of the corncrake; and
- polygon between a radius of 50 meters and a radius of 150 meters around the location of the corncrake.

Feeding and nesting habitats are determined by cross-sections of parcels and the mentioned polygons.

Determining the area for the allocation of payment for the result-based part of the intervention is carried out on the basis of annual bird monitoring. The bird monitoring contractor sends information about the locations of the corncrake to the Paying Agency, which performs the calculations for the result-based part of the operation. The Paying Agency, based on the data on the locations of the corn crake, determines every year the area or part of the area where mowing is allowed from 10 July or 1 August of the current year. The Paying Agency then informs beneficiaries about the mowing dates by email if they indicate it on the application or by regular mail.

The presence of a corncrake is considered to achieve the results of successful grassland management, which represents the presence of feeding and nesting habitat, determined on the basis of the location of singing males. In order to achieve the result, i.e. the feeding or nesting habitat of the corncrake, the beneficiary receives payment, which is granted in three levels:

- Level 1 – feeding habitat: payment is granted for the presence of the feeding habitat of the corncrake, i.e. the area within a radius of 150 m around the singing male.
- Level 2 – nesting habitat: payment is granted for the presence of the nesting habitat of the corncrake, i.e. the area within a radius of 50 m around the singing male.
- Level 3 – population density: payment is granted for the presence of feeding and nesting habitats of several individuals of the corncrake in the same area.

According to the Slovenian CAP Strategic Plan, the uniform unit amount for the result-based component is 500 EUR/ha.

The intervention INP 8.09 'Priba nest protection' is a result-based eco-scheme intervention contributing to biodiversity. The result is to protect the nesting of the priba species. This is monitored by checking the bird's presence within a certain period, meaning 15 June, as set by ornithologists, which becomes the date the priba should have successfully nested. The monitoring of the nests is done by ornithologists who inform the farmer advisors, who are responsible for informing the farmers. Farmers are asked to protect the nests, as proved by the submission of two geotagged photographs.

Payments are linked to protected nests. If this is done, as proven by the geotagged photos, the farmer receives a payment. If several nests are found in the same field, the farmer who applies to the scheme is obliged to protect all nests found in his field. In this case, the farmer receives payment for the number of nests.

According to the Slovenian CAP Strategic Plan, the uniform unit amount of the intervention is 200 EUR/ha.

Spain

The intervention 6501.3 'Agri-environment commitments on agricultural areas. Commitments to promote and sustainably manage pastures' of the Spanish CAP Strategic plan is an ENVCLIM intervention, which focuses on biodiversity by protecting habitats and species. The implementation of this intervention in the region of NAVARRA takes the form of an RBI. More specifically, in grasslands which have been characterised as high natural value (high or very high), the payment is linked to the result of maintaining or improving the existing high floral diversity for five consecutive years. In order to achieve the result, the beneficiaries must receive specific advice to draw up a plan of activities to maintain or improve the conservation status of agricultural parcels.

Annex II: Most cited indicators for animal welfare

The indicators most widely used in EU projects and protocols and identified in the conducted case studies under the study on CAP measures and instruments promoting animal welfare and reduction of antimicrobials use (European Commission, 2022).

Indicator Category	Indicator
Animal based	**Body condition score** Animals are inspected and scored according to the condition of their body, with most protocols focusing on extreme conditions (very thin and very fat), as these can be related to welfare problems. (Welfare Quality, AWIN Protocol, AssureWell, AWARE protocol, case studies (Sweden)).
Animal based	**Comfort around resting** Animals are inspected and the time needed to lie down is recorded. (Welfare Quality, AWIN Protocol, AssureWell).
Animal based	**Cleanliness of the animals** Animals are inspected and the degree of dirt on the body parts is assessed. (Welfare Quality, AWIN Protocol, AssureWell, AWARE protocol, case studies (Denmark for pigs, Netherlands, Austria, Spain – Catalonia for pigs, France, Italy – Friuli Venezia Giulia, Italy – Veneto)).
Resource based	**Thermal stress** Animals are inspected for signs of heat stress (accelerated respiration rate) or cold stress (huddling, horripilation, postures and movement of the body). (Welfare Quality, AWIN Protocol).
Resource based	**Indoor density rate** Usable space (m^2) per animal or per kg of animal weight. (Welfare Quality, AWIN Protocol).
Management based	**Individual or group housing** The indicator measures both the animals housed individually and the animals housed in groups: 1. Percentage of animals housed individually 2. Percentage of animals housed in groups
Animal based	**Absence of injuries** Number of animals with lesions. Type of lesion depends on animals: Cattle: number of lesions on the carcass at the slaughterhouse (breast, hoofs), carcass quality indexes, lesions on tails, shoulders and legs. Pigs: number of animals concerned by tail-biting or lesions on the tails, shoulders, vulva; ear and flank biting. Poultry: rate of broken wings or broken legs; presence of hock burns, foot pad dermatitis; feather loss. Rabbits: lesions on legs and shoulders. (Welfare Quality, AWIN Protocol, AssureWell, AWARE protocol, case studies (Italy – Friuli Venezia Giulia, Spain – Catalonia, Netherlands, Germany – North Rhine – Westphalia, Sweden)).

Indicator Category	Indicator
Animal based	**Absence of disease** Animals are clinically observed and the number of animals with observations is recorded. Clinical observations may include cough, nasal, ocular or vulval discharge, diarrhoea, bloated rumen, abscesses, bad hair condition, joint and claw/hoof health, udder asymmetry, carcass integrity, presence of lung lesions for calves etc. (Welfare Quality, AWIN Protocol, AssureWell, AWARE protocol).
Animal based	**Metabolic health** Number of somatic cells found in the milk. (Welfare Quality, AWIN Protocol, AWARE protocol).
Management based	**Antimicrobial use** Antimicrobial quantity used (mg/kg or mg/PCU).
Animal based	**Locomotion score** Assessment of lameness: lameness describes an abnormality of movement and is most evident when the animal (and so the legs) is in motion. It is caused by reduced ability to use one or more limbs in a normal manner. Lameness can vary in severity from reduced mobility to inability to bear weight. Animals are scored according to a scale system which may differ depending on the types of farm animals and protocols. (Welfare Quality, AWIN Protocol, AssureWell, AWARE protocol).
Animal based	**Mortality rate** Mortality is defined as the 'uncontrolled' death of animals as well as cases of euthanasia and emergency slaughter. The number of animals which died on the farm, were euthanised due to disease or accidents, or were slaughtered in emergencies during the last 12 months is recorded. (Welfare Quality, AWIN Protocol, AssureWell, AWARE protocol).
Animal based	**Evidence of painful husbandry practices** The indicator is measured by identifying the percentage of animals with evidence of painful practices. It should be accompanied by data on the use of anaesthetics and/or post-surgery analgesics. (Welfare Quality, AWIN Protocol, AssureWell, AWARE protocol).
Animal based	**Expression of social behaviour** Animals are inspected and the occurrence of aggressive behavior, queuing at drinking or feeding, social withdrawal etc. is recorded. (Welfare Quality, AWIN Protocol, AssureWell).
Animal based	**Good human-animal relationship** Animals are approached by the assessor and the avoidance distance, i.e. the minimum distance between the animal and the assessor before the animal moves back, turns their head to the side, pulls back the head etc. Alternative measurements include the minimum duration before the assessor is approached by the first animal or the closest distance the stockperson can approach the animals before a flight response is elicited. (Welfare Quality, AWIN Protocol, AssureWell).

Source: European Commission, 2022

Annex III: Indicative evaluations of real or simulated results-based interventions

Authors and thematic area	Evaluation criteria and indicators	Evaluation methodology and techniques	Results	Conclusions and recommendations
Wuepper and Huber (2022), Switzerland **Biodiversity**: Enhanced biodiversity on cropland and grassland	Effectiveness. Efficiency. Results-based on the area of species-rich grassland, i.e. grassland that has a minimum number of rare species from the red list as verified by a botanical assessment. Action-based on the area of extensively managed grassland.	Counterfactual with DiD and propensity score matching. Elasticity of supply of areas. Return on investment (ROI). Benefit transfer.	The increase of payments in action-based programmes increased extensive grasslands by 0.44 ha, per treated farm and year and increased species-rich grassland by 0.38 ha, per treated farm and year. Findings indicate that a 1% increase in action-based payments leads to an average increase of 0.6% in biodiversity conservation areas. A similar rise in results-based payments correlates with a 1% increase in those areas. The benefit-transfer estimated value for results-based is 5 580 CHF/ha and for action-based 2 342 CHF/ha.	Results suggest that there is no significant difference in the effectiveness of the two schemes with respect to their intended outcomes. However, the average return on investment is much higher for results-based payments, which supports the theoretical claim that, if the program's budget allows, results-based payments should be prioritised.
Sidemo-Holm et al. (2018), Sweden **Water quality**: Particulate phosphorous (PP) in runoff and abatement by buffer strips on crop fields	Effectiveness of vegetated buffer strips to intercept particulate phosphorus (PP) runoff. Cost-effectiveness. The indicator is the total amount of PP in kg mitigated because of the buffer strips.	Simulation of the amount of PP abated using the ICECREAM model with existing buffer strips (action-based) and buffer strips of variable width aiming to maximise abatement (results-based).	With total payments of EUR 5907 and 19.06 ha of buffer strips for the action-based and 5.38 ha for the results-based, the abated PP was 5.46 kg and 6.33 kg respectively and payments per abated PP (€/kg) to EUR 1,082 kg and EUR 933 kg respectively. The cost of maintaining 19.06 ha versus only 5.38 ha estimated a farmer's Net Profits from participating in the action and results-based schemes at EUR -2 117 and EUR 2 803, respectively.	The results suggest that schemes based on modelled results could be implemented on a larger scale avoiding high transaction costs, since the model needs only to be adapted to the particular region's characteristics and GIS data on individual farms fed into it.

Authors and thematic area	Evaluation criteria and indicators	Evaluation methodology and techniques	Results	Conclusions and recommendations
Sumrada et al. (2021), Slovenia **Biodiversity**: Maintenance of HNV farmland	Effectiveness. Uptake and adoption rates. Indicator plant species.	Survey among farmers and statistical measurement of knowledge, opinions, perceptions and attitudes.	Half of the surveyed farmers would choose the RBI (49.1%) to incentivise extensive use of dry grasslands, 38.0% preferred the action-based and 12.9% none. For 40 indicator species, respondents identified 14.6 on average.	Flexibility was not understood as a choice between different farming alternatives but as a possibility for minor adjustments to established management practices. Poor spatial targeting of measures is a critical issue.
Block et al. (2024), Germany **Carbon sequestration**	Uptake and adoption rates. Efficiency. Action-based component includes specific carbon farming measures selected from a range of scientifically proven options. Results-based payment is based on the tons of CO_2 sequestered in the soil, regardless of the measures taken.	Discrete Choice Modelling on 190 German farmers. D-efficient Bayesian design. Machine learning-based variable selection model called 'Lasso'.	Farmers are about twice as likely to participate in a humus programme if it offers an action-based payment instead of a results-based payment. Farmers accept a reduction of the absolute premium by 19.92 €/t if it is paid on the basis of actions rather than results. An annual payment reduces the required absolute premium by 13.29 €/t compared to a summarised payment at the end of the programme duration. A government-based absolute premium can be reduced by 4.40 €/t and a company-based premium by 2.91 €/t, compared to a private household-based premium.	Quantitative results strongly support the conclusions regarding farmers' preferences for action-based and shorter-duration humus programmes with annual, government-funded payments.

Authors and thematic area	Evaluation criteria and indicators	Evaluation methodology and techniques	Results	Conclusions and recommendations
Kreft et al. (2022), Switzerland **GHG emissions**	Efficiency. Uptake. Four GHG mitigation measures including: (i) replacing concentrate feed with legumes grown on the farm; (ii) increasing the number of lactations per dairy cow; (iii) applying manure using drag hoses; and (iv) introducing feed additives to reduce enteric fermentation of cattle. Action-based component paid per scheme. Results-based component provided CHF 370 per reduced tonne of CO_2 equivalent.	Agent-based bio-economic modelling framework FARMIND.	The government spend a total amount of CHF 424 782 under the action-based and CHF 536 473 under the results-based policy design to achieve an approximate 10% reduction of baseline GHG emissions. Farmers' individual preferences and reluctance to change lower overall reduction of GHG emissions by roughly 20% in both action- and results-based payment schemes.	Results-based policy designs for agricultural GHG reduction constitutes a challenge since the outcome is hard to measure. A promising way to overcome this challenge could be to (ex ante) model the results instead of measuring them.

Authors and thematic area	Evaluation criteria and indicators	Evaluation methodology and techniques	Results	Conclusions and recommendations
Späti et al. (2022), Switzerland **Water quality**: Nitrogen reduction through the adoption of precision agriculture	Effectiveness. Efficiency. The authors use a split-sample approach to estimate both willingness-to-accept (WTA) and willingness-to-pay (WTP) welfare measures and to discuss different types of policies that can be used to encourage the adoption of precision agriculture techniques. In the action-based (area-based) approach farmers bear the cost of adoption and provide environmental benefits (WTP to adopt precision agriculture). In the results-based approach, payments are directly provided to farmers to reduce the use of nitrogen (WTA payments for reducing nitrogen use). These scenarios can be promoted by policies aiming either at increasing the costs of non-adoption (e.g. tax on nitrogen) or at decreasing the costs of adoption (subsidies). The split sample thereby implies two different decision contexts for the farmer.	A discrete choice experiment combined with an online survey of 418 Swiss farmers. Farmers were presented with hypothetical scenarios that included different attributes related to precision agriculture. Farmers were informed of the gross margin/costs reflecting the additional annual gross margins resulting from the application of the technology (in the WTA sample) and the additional annual costs of the technology (in the WTP sample).	Farmers' marginal willingness-to-accept (MWTA) (results-based compensation) for reducing nitrogen by 40% was 598 CHF/ha/year, whereas their marginal willingness-to-pay (MWTP) (action-based payments) for the same reduction was significantly lower at 210 CHF/ha/year. For a 20% reduction in nitrogen the respective figures were 355.69 CHF/ha/year and 146.66 CHF/ha/year and in both cases the difference was statistically significant.	The substantial difference between MWTA and MWTP indicates that farmers require higher compensation for adopting environmentally beneficial practices than they are willing to pay. This highlights the effectiveness of action-based interventions over results-based measures.

Authors and thematic area	Evaluation criteria and indicators	Evaluation methodology and techniques	Results	Conclusions and recommendations
Villanueva et al., 2024, Spain **Carbon sequestration** **Biodiversity**	Effectiveness. Efficiency. Uptake. Carbon sequestration quantified in (t/ha). Results are defined as moderate for a provision of carbon sequestration at least 10% higher than the average for the agricultural district, and high for a provision of at least 20% higher than the average for the agricultural district. Biodiversity is measured by the number of predefined bird species. Moderate and high provision is determined for carbon sequestration.	A labelled choice experiment focusing on olive groves in southern Spain measures differences in farmers' willingness to accept (WTA) payments for participation in different scenarios.	Farmers show no statistically significant difference in their WTA for participating in action-based versus result-based schemes for carbon sequestration. (WTA for action-based is EUR 112.54/ha/year and for result-based EUR 96.72/ha/year). For biodiversity, farmers require significantly higher WTA for result-based (the WTA for a high level of biodiversity is EUR 130.44/ha/year) and for a moderate is EUR 64.73/ha/year. Farmers prefer field monitoring systems over satellite-based monitoring (WTA increases by EUR 64.65/ha/year when satellite control is introduced, reflecting scepticism about this monitoring method). The study indicates a general preference for action-based schemes (62% of farmers willing to participate) over result-based (53% willing to participate). The mean WTA for various scenarios and their combinations with different monitoring methods shows a trend where more stringent schemes demand higher compensation, as expected.	Focus on carbon sequestration RBIs can enhance both carbon and biodiversity provision, while also requiring lower compensation for farmers. This implies that policies should prioritise carbon sequestration objectives to increase farmer participation and overall policy efficiency. The interventions should address monitoring uncertainties. Promote educational campaigns to build trust in remote sensing-based monitoring systems. Develop digital tools because they have a potential to reduce uncertainty and assist farmers in complying with scheme requirements. Examine the provision of hybrid agri-environmental schemes that combine practice-based and results-based approaches allowing for baseline payments to adhere to practice-based conditions and additional payments based on results achieved. Use insurance policies.

Authors and thematic area	Evaluation criteria and indicators	Evaluation methodology and techniques	Results	Conclusions and recommendations
Sander and Bathke (2020) **Germany, Lower Saxony** **Contribution to the evaluation of focus area 4a – biodiversity**	Uptake. Relevance. Effectiveness. Results-based on the area of species-rich grassland, i.e. grassland that has four, six or eight species from a predefined list verified by a botanical assessment.	Assessment of intervention logic of programme and its measures. Analysis of measure design and uptake, literature review and qualitative assessment of biodiversity effects of measures.	Reviewed early monitoring studies showed that for commitments for four indicator species, the total species numbers were between 10 and 26 grassland species, and the mean species number was 19.1. For commitments for six indicator species, the total species numbers were between 11 and 36, the mean species number was 21.8 to 28.8 and thus significantly higher than on the plots with commitments for four indicator species. Further and more detailed monitoring results are expected to be available for ex-post evaluation. The evaluation concludes that in addition to the maintenance effect, the measure also appeared to trigger positive developments in species numbers. The number of areas under contractual commitments on which at least six indicator species were present rose continuously. The result-based intervention is rated with at least a medium positive biodiversity impact. Very positive biodiversity effects are particularly conceivable for commitments with six and eight species records respectively.	The measure, which was introduced in 2007, has a good level of acceptance, which could be further increased through improved and continuous advisory services, also involving landscape conservation associations.
Föhr et al. (2019) **Germany, Bavaria** **Contribution to the AIR 2018 – measure-specific evaluations – biodiversity**	Uptake. Relevance. Results-based on the area of species-rich grassland with a minimum number of species from a predefined list verified by a botanical assessment.	Assessment of intervention logic of measures and assessment of uptake targets.	In 2018 only a very low level of uptake of 106 ha (8.5% of the target area of 1251 ha in 2023) can be found in the result-based intervention 'Result-orientated grassland use'. This may be due to the uncertainty of farmers regarding correct implementation and thus the avoidance of sanctions in the event of non-compliance.	To dispel concerns of farmers it is recommended to increase information and training activities and to motivate farmers to take up the measure in the future.

Source: EU CAP Network supported by the European Evaluation Helpdesk for the CAP (2024)

In Switzerland, Wuepper and Huber (2022) evaluated the impacts of a policy change in 2013 to improve Switzerland's agri-environmental payment schemes designed to enhance biodiversity on existing action-based and results-based (RB) agri-environmental payments. The reform involved a considerable increase in funding, which modified both action-based and RB payments. The goal of the reform was to support biodiversity conservation on agricultural lands better and address existing shortcomings in the pre-2013 payment schemes, which had failed to meet biodiversity conservation targets adequately.

The study included all types of farms in Switzerland, specifically dairy and crop farms. It thus encompassed different structural characteristics such as farm size, land use, intensity and labour, allowing for a comprehensive evaluation of the impact of agri-environmental payment schemes on biodiversity conservation across different farming systems. RB payments are provided to farmers who request a botanical assessment of their grasslands and find a minimum number of predefined rare species from the red list. The monetary reward depends on where this land is located, for example, in lowlands or mountain regions.

Effectiveness is measured by examining the increase in biodiversity conservation areas due to payment increases. The methodology is a **difference-in-differences** approach which compares the effects of payment increases on various groups of farmers – those who received only action-based payments, those with only results-based payments, those with both and a control group with no payment increase. The main estimates suggest that the increase in action-based payments increased extensive grasslands by 0.44 ha and cropland measures by 0.04 ha per treated farm and year. The increase in RB payments increased species-rich grassland by 0.38 ha per treated farm and year. Finally, both payments increased extensive grasslands by 0.56 ha, species-rich grasslands by 0.62 and cropland measures by 0.02 ha per treated farm and year. An **elasticity of supply** estimation complemented effectiveness measures to show how responsive the supply of biodiversity conservation areas is to changes in payment levels. For example, a 1% rise in payments corresponds to an average increase in the area of conservation, showing specific ratios for both action- and results-based schemes. Findings indicate that a 1% increase in action-based payments leads to an average increase of 0.6% in biodiversity conservation areas. A similar rise in RB payments correlates with a 1% increase in those areas. Additionally, the effectiveness is analysed in terms of the cost to the government to achieve additional hectares of biodiversity conservation area, allowing for comparisons of cost-effectiveness between the two schemes.

The work approaches the concept of **efficiency** in two ways: The **cost-effectiveness** in the conventional approach of the cost per hectare and the **return on investment (ROI)** measure. Cost-effectiveness is the cost per hectare approached by the average government spending required to achieve an additional hectare of conservation area. This measure allows the evaluators to compare the cost-effectiveness of the two payment schemes directly. For example, the payment effectiveness, i.e. an additional hectare of biodiversity conservation area, was 327 and 535 CHF for farmers with action- and results-based schemes whose payments increased, respectively. However, this difference was not found to be statistically significant. While action-based payments are generally considered more cost-effective, RB payments provide a higher return on investment due to the superior ecological value of the areas they support.

The ROI measure requires an estimation of the benefits of the measures. The work employs a **benefit-transfer** approach [45] to derive the societal benefits (returns) associated with the estimated treatment effects of the payment schemes. Benefits to society stem from enhanced ecosystem services such as soil quality, pollination and recreational opportunities due to the increased biodiversity of extensively managed grasslands. The benefit transfer estimated value of species-rich grasslands under RBIs is significantly higher (approximately 5 580 CHF/ha) than extensively managed grasslands under action-based schemes (approximately 2 342 CHF/ha). The difference suggests that society places a greater on well-conserved biodiversity. By calculating the costs (investment) associated with each scheme and the expected benefits (in terms of biodiversity conservation), the authors determine the ROI (benefits to costs). Specifically, ROI was found to be significantly higher for RB payments indicating that, on average, these schemes offer a more excellent ecological value of conserved areas for the funds expended.

The study also evaluated the **windfall gains** for farmers. Windfall gains are unexpected financial benefits that farmers receive without significantly changing their farming practices. In the case of the Wuepper and Huber (2022) study, windfall gains occurred because of the policy reform, when farmers received higher payments for areas already enrolled in the biodiversity conservation programmes without requiring them to adopt new conservation practices or invest further effort. For example, farmers experienced windfall gains of CHF 700-800 per farm under the action-based payment scheme, while those under the RB scheme had CHF 400-470.

The study becomes very technical as it concerns the treatment of possible **selection bias**, which constitutes the highest risk for deriving biased evaluation results, especially for RBIs. Wuepper and Huber (2022) confront possible selection bias using a difference-in-differences (DiD) approach combined with matching techniques. For example, **propensity score matching** and **coarsened exact matching** are used to balance observable characteristics between the treated and control groups. This helps to ensure that comparisons made are between comparable groups of farmers. Together, matching techniques and DiD constitute a **'doubly robust' estimator** approach, which means that if either the matching technique or the DiD method is valid, an unbiased estimate of the treatment effect can be provided. The study examines the plausibility of **the assumption of parallel trends** [46] by comparing observable characteristics between the treatment (farmers receiving higher payments) and control groups (farmers not receiving increases). Some researchers propose robust inference and sensitivity analysis methods to address these challenges. The authors implement the 'honest approach to parallel trends' [47] suggested by Rambachan and Roth (2019) to evaluate

[45] Benefit transfer is a valuation method used to estimate the value of ecosystem services by applying (transferring) findings (benefits calculations) from existing studies to new contexts or locations. This approach involves taking the results, such as the willingness to pay (WTP) for environmental benefits, from previous research (often meta-analyses) and adapting them to assess the economic value of similar environmental services in a different setting. Wuepper and Huber (2022) derive economic valuations for areas under action-based and results-based payments by analysing changes in biodiversity conservation practices and incorporating WTP estimates for ecosystem services.

[46] This DiD assumption posits that, in the absence of treatment, the difference between the treatment and control groups would remain constant over time.

[47] The "honest approach" to the parallel trends assumption (Rambachan and Roth, 2019) involves robust inference methods that do not require the parallel trends assumption to hold exactly. Instead, this approach imposes restrictions on possible violations of the parallel trends assumption, ensuring valid ('honest') inference when these restrictions are satisfied.

their results' sensitivity to any deviations from the parallel trends requirement. They also evaluate whether trends in both groups were parallel before the treatment began. Finally, the study conducts **robustness tests** and compares various specifications to confirm the stability of their estimates. By integrating these methodologies, the authors aim to mitigate the risks of selection bias and improve the reliability of their findings on the effectiveness of different agri-environmental payment schemes.

In general, the study highlights that the effectiveness of both schemes generally increases when farmers benefit from both types of payments, suggesting that a combined approach may enhance overall biodiversity conservation outcomes.

Sidemo-Holm et al. (2018) evaluated the **effectiveness** of result-based payment schemes in improving agricultural pollution abatement, particularly for nonpoint-source pollution from arable land, by comparing these schemes to traditional action-based payments. The objective was to demonstrate that result-based payments can enhance cost-effectiveness and environmental outcomes by incentivising farmers to achieve specific pollution reduction results, ultimately promoting better participation in voluntary abatement initiatives. The modeling approach calculated the effectiveness of the buffer strips as a function of their width and the slope of the land, indicating that wider and properly placed strips are more effective in reducing particulate phosphorus (PP) runoff. The total abatement achieved is then quantified as the total area of buffer strips multiplied by their efficiency in retaining phosphorus, allowing for the comparison of cost-effectiveness between action-based and result-based payment schemes. Overall, rather than measuring actual results at the farm level—which can be prohibitively expensive—the study utilises **modelled results** to predict and estimate effectiveness, thereby guiding payment schemes and enhancing environmental outcomes.

For this study, effectiveness is the abatement results achieved by implementing vegetated buffer strips to intercept PP runoff from agricultural land for different buffer strip widths (6, 10 and 20 meters), assessing their capability to retain PP, which varies based on factors such as field slope and width of the buffer strips. Efficiency is measured by comparing the **cost-effectiveness** of different payment schemes for agricultural pollution abatement, specifically focusing on the reduction of PP runoff through vegetated buffer strips. The key indicators used for measuring effectiveness and efficiency include the total abatement as the total amount of PP that is mitigated as a result of the implemented measures (buffer strips) and is quantified in kilogrammes (kg); the payment per abated PP, which is calculated as the total payments made for achieving the abatement, divided by the total amount of PP abated, expressed in euros per kilogramme (EUR/kg) and serving as an indicator of the cost incurred for each unit of pollution reduced; the average abatement cost derived by taking the total abatement cost (which includes forgone profits from land converted to buffer strips) and dividing it by the total amount of abated PP, also resulting in a cost expressed in euros per kilogramme (EUR/kg); and finally the farmer's net profit measuring the financial impact of the payment schemes on farmers, factoring in total payments received and any losses incurred from converting arable land to buffer strips.

The work examined the existing scheme and five simulated scenarios which included: (1) the existing action-based scheme with payment per area buffer strip to EUR 310 per hectare; (2) a result-based with existing budget aiming to maximise pollution abatement given a budget equal to the total payments in the existing action-based scheme; (3) a result-based with existing target aiming to minimise the cost of achieving the abatement achieved in the existing action-based scheme; (4) a simulated action-based assuming that the farmer chooses locations and widths of buffer strips to maximise farm profit; (5) a result-based with simulated budget set equal the total payments in the simulated action-based scenario in (4); and (6) a result-based with a simulated target set equal to the abatement achieved with the simulated action-based scenario in (4).

Indicative results for effectiveness show that the existing action-based scheme (1) covers an average area of 19.06 ha per farm when the result-based with existing budget scenario (2) and the result-based with existing target scenario (3) cover 4.12 ha and 5.38 ha, correspondingly. Similarly, total payments are EUR 5 907 (1), EUR 5 907 (2) and EUR 3 690 (3). Total abatements (kg) are 5.46 kg (1), 6.33 kg (2) and 5.46 kg (3). Payments per abated PP (€EURkg) are EUR 1 082/kg (1), EUR 933/kg (2) and EUR 676/kg (3). The total abatement costs are EUR 8 024 (1), EUR 3 104 (2) and EUR 2 416 (3). The average abatement costs (EUR/kg) at EUR 1 470/kg (1), EUR 490/kg (2) and EUR 442/kg (3). Finally, the farmers' net profits were EUR -2 117 (1), EUR 2 803 (2) and EUR 1 274 (3).

The evaluation's main findings highlight various points regarding the evaluation of result-based payment schemes for agricultural pollution abatement. Result-based payments have the potential to enhance pollution abatement efficiency significantly. Result-based schemes are more cost-effective than action-based schemes, while result-based payments could achieve higher pollution abatement for similar or lower costs. Result-based payments allow for more strategic land management by enabling the targeting of resources to areas where they are most effective, leading to more significant overall environmental benefits. In addition, result-based payment schemes could reduce the cost of abatement per unit of pollutant (particulate phosphorus) while delivering higher levels of total abatement compared to action-based schemes. Modelled results suggest that these schemes could help overcome measurement challenges in monitoring pollution reduction efforts, thereby improving farmers' awareness and motivation to participate in voluntary abatement initiatives. Overall, the findings advocate for considering and implementing result-based schemes as a viable alternative to action-based payments to enhance agricultural pollution control.

Sumrada et al. (2021) explored the potential of payment-by-result approaches in supporting the maintenance of high nature value (HNV) farmland in Slovenia. They developed a pilot result-based scheme for conserving dry grasslands in a Natura 2000 site, assessed local farmers' familiarity with selected plant indicators and preferences towards result-based schemes, and discussed the prospects and limitations of such schemes with researchers, decision-makers and agricultural advisers. In this work, although no explicit definition of effectiveness was provided, **effectiveness** was related to several factors, including the achievement of conservation outcomes, the farmers' acceptance and willingness to participate in the schemes, the flexibility in management practices that allow farmers to adapt to local conditions, the cost-effectiveness, the better targeting of conservation efforts and the ability to address challenges facing HNV farmland, including the needs of small farmers and land access issues. The achievement of conservation outcomes in RBIs was evaluated through indicator species and the adoption of quantitative thresholds. The study developed a list of plant indicators for the target habitat type, including positive and

negative indicators. Conservation outcomes were measured by the number of positive indicator species present and their total coverage in the meadow. Finally, this work highlights issues often neglected by more quantitative and econometrically-minded evaluation approaches. Poor **spatial targeting** of measures was highlighted as one of the existing AEM's critical weaknesses in Slovenia, attributed mainly to the lack of spatial data on species and habitat distribution needed to determine eligible areas. This lack of monitoring and ecological data for detailed planning of conservation measures, is evident in many Member States, particularly in central, eastern and southern Europe (Fenu et al., 2017; Sutcliffe et al., 2015). Of course, this is not an issue only for RBIs but is more challenging considering the RBIs' needs for detailed data and spatial targeting, which can increase efficiency.

Hasund (2020) presents a three-year pilot study to assess the **viability** of a result and value-based payment model for agri-environmental payments at the national Swedish level. The objectives were to investigate if the model works in practice and has significant advantages over previous management and cost-based payments, evaluating **effectiveness**, **efficiency**, **administrative issues**, **control properties**, **transaction costs** and **farmers' experiences**. This evaluation found that result and value-based payments were generally preferred by farmers over previous management-based (practice-based) payments, offering greater flexibility, valuing farmers' skills, and promoting responsibility and pride. The indicators used to compare results-based and practice-based schemes included indicators for environmental quality, such as the absence of brushwood and the presence of value trees and flower species. The author used a combination of methods including **farmer surveys**, **interviews**, **field surveys**, **controls** and **workshops** to derive the results. The work presented limited quantitative results, such as average payments of 220 SEK/ha and farm allowances ranging from SEK 3 200 to 69 500 per year. The short three-year project period limited observable management improvements and was the study's main disadvantage. For this reason, the researcher recommended longer-term contracts or a hybrid model combining result and practice based payments to better maintain and increase environmental services. One recommendation was to revise some indicators, such as a problematic flower indicator, and modify payment levels to provide stronger incentives for enhancing environmental qualities. In addition, the recommendations emphasised the importance of effective **information dissemination** through a combination of workshops, written materials, websites and field walks.

Block et al. (2024) compare action-based and results-based programmes for carbon sequestration in agricultural soils to understand how different programme features influence farmers' willingness to participate. Specifically, it investigates how payment methods, programme duration and other key attributes affect farmer preferences, using a **discrete-choice experiment** (DCE) with German farmers to inform the design of more effective carbon sequestration policies. The action-based approach involved paying farmers for applying specific carbon farming measures selected from a range of scientifically proven options, including establishing flowering strips, sequestering approximately 0.48 tonnes carbon/ha/year, implementing cover crops and applying manure, which can contribute to soil organic carbon sequestration when combined with inorganic fertilisers. They also refer to a very interesting comprehensive overview of humus-preserving and humus-increasing measures for arable land provided by Wüstemann et al. (2023), suggesting there are likely more scientifically proven options available for action-based approaches. Results-based approaches for carbon sequestration in agricultural soils paid farmers based on the tonnes of CO_2 sequestered in the soil, regardless of the specific measures taken. Payment followed a measure of the humus content in the soil as an approximation of carbon sequestration. However, this method has some inaccuracies, with samples taken by independent certified laboratories to determine the amount of carbon sequestered.

The methodology was based on a DCE with 190 German farmers presented with 12 different choice sets, each consisting of two alternative humus programme options and an opt-out option. A **D-efficient Bayesian design** [48] was applied to reduce the number of choice sets from a complete factorial design of 46 656 to a feasible 12. The data from the DCE was analysed using a mixed logit model to account for heterogeneity in farmers' decision-making. The analysis was supported by a **machine learning**-based variable selection model called **'Lasso'** to select relevant interaction terms. The action-based humus programmes were selected with a probability of 47.5%, while results-based humus programmes were selected with a probability of 25.4%. A novel element in this study includes a choice of who offers the compensation as one of the attributes in the DCE. The attribute is called '**funding agency**' and varies between three options: the government, a company and a private household. It was included to control for differences in farmers' preferences regarding the programme provider.

Results show that farmers are about twice as likely to participate in a humus programme if it offers an action-based payment instead of a results-based payment. Farmers accept a reduction of the absolute premium by 19.92 €/t if it is paid on the basis of actions rather than results. This means that the same level of carbon sequestration through a results-based humus programme costs the funding agency about 20 €/t more, assuming that action-based and results-based humus programmes sequester the same amount of CO_2. An annual payment reduces the required absolute premium by 13.29 €/t compared to a summarised payment at the end of the programme duration. Concerning the funding agency, a government-based absolute premium can be reduced by 4.40 €/t and a company-based premium by 2.91 €/t, compared to a private household-based premium. The absolute premium must be increased by 2.49 €/t for each additional year between the start and end of the programme.

The methodological issues faced by the researchers were related to the limited field data on humus programmes, which necessitated the collection of primary data through a DCE, the reduction of the complete factorial design from 46 656 possible choice sets down to 12. This aimed to help farmers understand the attributes and levels in the DCE, using detailed explanations, learning questions and constant availability of information during the experiment, taking account of heterogeneity in farmers' decision-making and the transferability of results from hypothetical decisions in the DCE to real-world decisions, which the authors acknowledge as a limitation of their methodology. Considering the methodological limitations, these quantitative results strongly support the study's conclusions regarding farmers' preferences for action-based and shorter-duration humus programmes with annual, government-funded payments.

[48] D-efficient Bayesian design is a statistical method used to optimise the design of experiments. It's particularly useful when prior information about the system under study is available.

Kreft et al. (2022) compared **simulations** from action-based and results-based policy designs for reducing GHG emissions in agriculture, specifically focusing on their effectiveness and efficiency in incentivising farmers' adoption of mitigation practices. They assessed the impact of these policy designs on total GHG reductions, governmental spending, and the role of farmers' behavioural characteristics, such as reluctance to change and individual preferences, in influencing the adoption of climate change mitigation measures on Swiss dairy and beef cattle farms. The study used an **agent-based bio-economic modelling** approach for decision-making and a farm programming simulation model to calculate the effects of action-based and results-based policy designs on GHG emissions reduction in Swiss dairy and beef cattle farms. This methodology incorporates farmers' heterogeneous behavioural characteristics, such as reluctance to change and individual preferences, allowing for a detailed analysis of total GHG reductions, governmental spending and the marginal abatement costs associated with different policy incentives. The study found that total governmental expenditure to achieve a 10% reduction from baseline GHG emissions is higher under results-based policy designs than action-based designs, suggesting that action-based payments may be more efficient from a taxpayer perspective. Additionally, the analysis revealed that when farmers' individual preferences and reluctance to change were considered, the overall GHG emissions reduction was lower by approximately 20% in both policy schemes compared to scenarios where farmers act purely as profit maximisers.

In the same realm of bio-economic agent-based modelling, Huber et al. (2023) assess the cost-effectiveness and efficiency of policy measures designed to promote the adoption of precision agriculture technologies, specifically for reducing nitrogen input in Swiss wheat production. The work emphasised the importance of **incorporating farmers' behavioural factors**, such as their perceptions of profitability and reluctance to change, to understand better how these factors influence their adoption decisions and the overall effectiveness of the policies implemented. The main policy measures proposed to support precision agriculture include results-based payments for compensation for each kilogramme of nitrogen reduced, and area-based subsidies that provide financial support for each hectare managed with precision agriculture technology, as well as fixed payments for the application of such technologies, aiming to enhance adoption rates among farmers. The study found that for the same level of nitrogen reduction, a results-based payment (paying farmers for reduced nitrogen) is 1.5 times more cost-efficient than area-based subsidies and subsidies for technology use. Results suggest that farmers' perception of costs and benefits decreases the potential to reduce nitrogen input by about 20% and that disregarding behavioural factors such as the perception of the instrument may result in a significant overestimation of the policy effect.

Closely related to Huber et al. (2023) is the study by Späti et al. (2022) investigating the factors influencing **farmers' adoption** of precision agricultural technologies, specifically variable-rate nitrogen fertilisation, in small-scale Swiss farming systems, as above. The objectives include eliciting farmers' preferences and estimating their **willingness-to-pay** (WTP) and **willingness-to-accept** (WTA) compensation for adopting these technologies, thereby informing policy measures that could incentivise greater adoption to reduce nitrogen losses in agriculture. The action-based intervention alternatives included compensation or subsidies for adopting precision agricultural technologies, reflecting a WTA framework. This approach focused on financially rewarding farmers for reducing nitrogen use, for example, regardless of the direct outcomes. The results-based interventions included increased costs of non-adoption, such as a tax on nitrogen use, aligning with a WTP framework.

The study implemented a DCE combined with an online survey of 418 Swiss farmers to derive their results. A **split-sample approach** estimated WTA and WTP welfare measures, respectively, representing action-based and RBI scenarios. The choice experiment data were analysed using **mixed logit models,** which captured farmers' heterogeneity in preferences for different attributes of variable-rate nitrogen fertilisation technologies, including economic, environmental and technical factors. They also recommend including **interaction terms** to explore how specific farm characteristics, attitudes and risk preferences influence adoption decisions. The study came across several methodological challenges, including the complexity of designing a DCE that accurately reflects the different policy contexts of WTA and WTP. The researchers had to ensure that the two experimental designs were comparable while accounting for the opposite economic implications of these measures.

Additionally, accurately capturing farmers' preferences required carefully framing attributes and attribute levels to avoid biases. The low **adoption rates** of precision agricultural technologies added difficulty in obtaining realistic responses. At the same time, the challenge of dealing with heterogeneity in farmers' preferences and ensuring that the sample was representative of the broader farming population in Switzerland was also significant. In the preparation stages of the evaluation, the study highlighted the importance of pre-testing the survey and experiment design with target groups, such as farmers, to validate the relevance and clarity of attributes and levels. It also stressed the need for robust robustness checks and simulations to ensure the reliability of the experimental design, especially when comparing results across different policy frameworks.

The study found that farmers preferred action-based interventions over results-based interventions. However, the willingness to accept compensation was generally higher than the willingness to pay for the same environmental benefits, suggesting that action-based incentives may be more effective in increasing the adoption of these technologies. Specifically, farmers' marginal willingness-to-accept (MWTA) compensation for reducing nitrogen by 40% was 598 CHF/ha/year, whereas their marginal willingness-to-pay (MWTP) for the same reduction was significantly lower at 210 CHF/ha/year. This substantial difference indicates that farmers require higher compensation for adopting environmentally beneficial practices than they are willing to pay, highlighting the effectiveness of action-based interventions over results-based measures.

Villanueva et al. (2024) analysed farmers' preferences toward practice- and results-based agri-environmental schemes (AES) using a labelled choice experiment, specifically focusing on sloping olive groves in Andalusia, southern Spain. The main objectives of the study include (a) to compare farmers' WTA payments for participating in practice-based (pAES) versus results-based (rAES) agri-environmental schemes, particularly under different environmental objectives targeting carbon sequestration and biodiversity; (b) to investigate the impact of an innovative satellite-based monitoring system on farmers' preferences and WTA for these schemes; (c) to explore the variability in farmers' preferences, examining factors such as attitudes toward risk and beliefs about environmental service provision and monitoring capacity; and (d) to derive policy implications regarding the design of AES, especially concerning the joint provision of environmental services and measures to mitigate uncertainties related to participation in these schemes.

Indicators were defined for two levels, moderate and high. Biodiversity is measured using the number of bird species per farm. Carbon sequestration is measured by the amount of organic carbon sequestered, expressed in tonnes per hectare (t/ha). Practice (action-based) interventions have to use herbaceous cover strips between rows of olive trees with the two levels differing in the width of the strip, with 2m and 3.5m wide strips for moderate and high levels respectively. The former (2m strips) corresponds to an eco-scheme proposed in the Spanish CAP Strategic Plan. RBIs can use any farming practice they consider appropriate to achieve the results. Biodiversity and carbon sequestration RBIs were expected to achieve moderate and high results of at least 10% and 20% higher than the average of the agricultural district respectively.

The methodology combined rigorous experimental design, comprehensive data collection, and advanced statistical modelling to derive insights into farmers' preferences for different agri-environmental schemes. The study utilised a DCE, which presented farmers with different scheme attributes, including the level of environmental service provision, environmental objectives, monitoring type, and yearly payment. A **Bayesian efficient design** was used to optimise the DCE for a **multinomial logit specification**. Multi-stage cluster sampling was employed to select agricultural districts in Andalusia, followed by a random selection of villages and farmers within those districts. The survey yielded 320 completed questionnaires. The analysis used a **mixed logit model** which allowed for the estimation of WTA for different attributes while capturing preference heterogeneity. The study also examined interactions between AES attributes and farmers' socioeconomic characteristics, attitudes and opinions to understand the factors influencing WTA.

Results show that farmers do not present statistically significant differences in their WTA for participating in practice-based schemes versus RBIs for carbon sequestration. (WTA for practice-based is EUR 112.54/ha/year and for RBIs EUR 96.72/ha/year). For biodiversity, farmers require significantly higher WTA for RBIs (the WTA for a high level of biodiversity is EUR 130.44/ha/year) and for the moderate is EUR 64.73/ha/year. Farmers prefer field monitoring systems over satellite-based monitoring (WTA increases by EUR 64.65/ha/year when satellite control is introduced, reflecting scepticism about this monitoring method). The study indicates a general preference for practice-based schemes over RBIs, with 62% of farmers willing to participate in practice compared to 53% for RBIs. The mean WTA for various scenarios and their combinations with different monitoring methods shows a trend where more stringent schemes demand higher compensation, as expected. Significant preference heterogeneity is observed, influenced by factors such as farmers' attitudes toward risk and their beliefs about environmental service provision and monitoring capacity.

The study draws significant conclusions and policy recommendations. Focus on carbon sequestration RBIs can enhance both carbon and biodiversity provision, while also requiring lower compensation for farmers. This implies that policies should prioritise carbon sequestration objectives to increase farmer participation and overall policy efficiency. The interventions should address monitoring uncertainties. Policy should promote educational campaigns to build trust in remote sensing-based monitoring systems. The development of digital tools has the potential to reduce uncertainty and assist farmers in complying with scheme requirements. Finally, the authors suggest the likely provision of hybrid AES that combine practice-based and results-based approaches allowing for baseline payments to adhere to practice-based conditions, and additional payments based on results achieved and the use of insurance policies to mitigate risks.

Annex IV: The ex ante evaluation of RBI indicators and the ex ante risk management of RBIs

The ex ante evaluation of RBI indicators

During the ex ante evaluation of RBIs, it is crucial for evaluators to carefully consider the characteristics of the indicators described in Section 2 to ensure they are aligned with objectives, measurable, sensitive to changes, feasible, relevant to stakeholders, based on a clear baseline and adaptable to local contexts. These considerations will help design effective interventions that can be accurately monitored and evaluated over time. In short, failing to comply with the RBI indicators characteristics will have implications for the evaluation of RBIs as follows:

- alignment with objectives;
- measurability and quantifiability;
- sensitivity to changes;
- feasibility and cost-effectiveness;
- relevance to stakeholders;
- baseline establishment; and
- adaptability to local contexts.

The table below summarises the ex-ante evaluation mandate and the implications for each of the indicator characteristics above.

Table 13. Ex ante evaluation of RBI indicators and their implications

Indicator characteristic	Ex ante evaluation mandate	Implications
1. Alignment with objectives	Ensure that the indicators selected will accurately reflect the intended outcomes of the intervention. This alignment helps in predicting whether the intervention is likely to achieve its goals and allows for adjustments before implementation begins.	Misaligned indicators may lead to misleading assessments of the intervention's potential success, resulting in ineffective implementation or failure to achieve desired outcomes.
2. Measurability and quantifiability	Consider the practicality of measuring these indicators to ensure that data can be collected effectively once the intervention is underway.	If indicators are not easily measurable, it may be difficult to track progress, which can hinder the ability to make informed decisions during the intervention's implementation.
3. Sensitivity to changes	Assess whether the chosen indicators are capable of capturing the effects of the intervention within a reasonable timeframe and at an appropriate scale.	Insensitive indicators may fail to detect meaningful changes, leading to an underestimation of the intervention's impact and potentially undermining support for the continuation or expansion of the intervention.
4. Feasibility and cost-effectiveness	Consider if the cost and feasibility of monitoring and evaluating the indicators during the ex ante evaluation must be examined. If yes, assess whether the necessary resources (technology, expertise and financial support) are available to measure the indicators effectively throughout the intervention's lifecycle.	Indicators that are too expensive or difficult to measure may not be sustainable, leading to gaps in monitoring and evaluation and reducing the overall effectiveness of the intervention.
5. Relevance to stakeholders	Involve in consultations with stakeholders to ensure that the indicators are perceived as meaningful and that they will motivate desired behaviours.	Indicators that are not understood or valued by stakeholders may lead to disengagement or non-compliance, reducing the likelihood of achieving the intervention's objectives.

Indicator characteristic	Ex ante evaluation mandate	Implications
6. Baseline establishment	Determine whether sufficient baseline data exist or can be collected for the indicators in question.	Without a clear baseline, it will be difficult to assess the true impact of the intervention, as changes over time cannot be accurately measured or attributed to the intervention.
7. Adaptability to local contexts	Assess whether the indicators can be tailored to different contexts without losing their validity or relevance.	Indicators that are not adaptable may fail to capture the diversity of conditions across different implementation sites, leading to inconsistent or inaccurate assessments of the intervention's impact.

Source: EU CAP Network supported by the European Evaluation Helpdesk for the CAP (2024)

Ex ante risk management for RBIs

The ex ante evaluation is crucial in building a risk management plan for RBIs. It ensures that the proposed interventions achieve their targets and attract participation without causing adverse economic, social or environmental impacts. One way the ex ante evaluation can approach this is by examining that an effective risk management plan for RBIs is in place. During the ex ante, evaluators can follow the steps shown in Table 14.

Table 14. Ex ante actions for a RBI risk management strategy

Components (stages) of a risk strategy	RBI areas of concern	Ex-ante action
1. Risk identification	Economic risks: RBI has insufficient payments, high upfront costs, unstable market conditions and low cost-effectiveness. Social risks: RBI risks the marginalisation of low skills and resources or vulnerable households with unequal access to resources or information. Environmental Risks: RBI may cause unintended negative outcomes.	Conduct stakeholder consultations, field assessments, and baseline studies to gather input on potential risks across economic, social, and environmental dimensions.
2. Risk Analysis and Assessment	Probability and Impact Analysis: For each identified risk, assess the likelihood of it occurring and its potential impact on the RBI's success. Vulnerable Group Identification: Ensure all groups are considered in the risk assessment.	Ex-ante Action: Use qualitative and quantitative methods to assess risk exposure for different participant groups and determine the potential scale of risks.

Components (stages) of a risk strategy	RBI areas of concern	Ex-ante action
3. Risk Mitigation Strategies	Economic Risk Mitigation: Ensure RBI payment structures are adequate, consider hybrid payment models to reduce financial risks, provide access to financial support (e.g. grants or low-interest loans) to help participants with initial costs. Social Risk Mitigation: Review the participation criteria to ensure that they are inclusive and flexible, allowing diverse farm households to participate. Environmental Risk Mitigation: Incorporate adaptive management approaches to adjust practices based on real-time monitoring. Ensure environmental indicators are carefully selected to avoid unintended consequences.	Ex-ante Action: Ensure that each risk has a corresponding mitigation plan, detailing how the intervention will be adjusted if the risk materialises. Stakeholder input is critical for designing these strategies.
4. Monitoring and Adaptive Management	Continuous Monitoring: Implement real-time monitoring of economic, social, and environmental indicators throughout the intervention. Adaptive Management: Set up adaptive management frameworks that allow flexibility in the RBI's design and implementation. If certain practices or payment structures are not working, the RBI should be able to pivot based on monitoring data.	Ex-ante Action: Design a feedback loop where monitoring data informs decision-making, and the intervention can be adjusted accordingly. Use scorecards, field assessments, and participatory monitoring to involve stakeholders in this process.
5. Building Resilience and Contingency Planning	Resilience Building: Ensure the RBI promotes practices that enhance both the environmental and socio-economic resilience of participants. Contingency Plans: Develop contingency plans for high-probability, high-impact risks. For example, if extreme weather disrupts environmental outcomes, the plan should detail steps for reallocating resources or adjusting payment criteria.	Ex-ante Action: Include a clear outline of how the intervention will respond to unexpected shocks or disruptions, ensuring that participants are not unfairly penalised due to circumstances beyond their control.

Source: EU CAP Network supported by the European Evaluation Helpdesk for the CAP (2024)

Annex V: Glossary

For the purpose of this report, the following definitions apply:

Action-based payment: a payment provided to beneficiaries for implementing pre-defined management practices, and which does not depend on the achievement of specific environmental or climate-related results.

Pure result-based payments: payments based solely on the delivery of environmental results.

Hybrid result-based payments: payment based partly on results and partly on the basis of carrying out specific mandatory management actions.

Co-benefits: improvements in environmental parameters which, although measured and documented, do not necessarily count against the expected results and may not affect the payment received by the beneficiary.

Monitoring, reporting and verification: the process, usually abbreviated as MRV, through which the actual results achieved in a result-based intervention are measured, reported and validated.

Scorecard: a document containing a bundle of indicators, each of which has a certain range of scores, used to determine the results achieved at parcel level in order to reward and incentivise ecosystem services delivery on farmland.

Collective action: the collaboration among multiple stakeholders, such as groups of farmers, local communities, or other land managers, to achieve shared environmental outcomes.

Payments for Environmental Services: the variety of arrangements through which the beneficiaries of environmental services, from watershed protection and forest conservation to carbon sequestration and landscape beauty, reward those whose lands provide these services with subsidies or market payments.

Additionality: the difference between the environmental outcome of an intervention and a hypothetical baseline of what would have been the outcome in the absence of this intervention.

Displacement: the unintended consequences where efforts to improve the environment and mitigate climate change in one area led to environmental deterioration or increased emissions elsewhere.

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