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(Road4Schemes)**

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an overall inventory and analysis

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ABSTRACT

Carbon farming is considered as one of the mitigation options to reach the targets of the Paris Agreement and the European Green Deal. The purpose of this report is to assess which carbon farming schemes are available throughout Europe, how they can be characterised and to which extent they deal with principles like additionality, fairness and long-term carbon storage, besides the issues of a proper MRV (monitoring, reporting and verification)-system with acceptable costs and sufficient payments for the farmers.

The way in which carbon farming is organised is very different depending on the type of scheme. In this report, a carbon farming scheme is defined as any voluntary agreement in which a farmer or a group of farmers commit themselves to apply carbon farming measures to get a positive balance between soil carbon accumulation and GHG emissions (possibly measured as CO₂ equivalents) or reduction of GHG-emissions in return for a payment or compensation in any form.

The research team of the EJP SOIL - Road4Schemes project carried out an inventory among their member states of the EU, some nearby states, member to be (Turkey) and some schemes in the USA and Australia. In total, 162 schemes were identified in a first round, mainly looking at public data sources like websites, reports, etc. In a second round, 45 scheme holders were approached for an interview, for which a structured questionnaire had been developed. This questionnaire addressed a large number of characteristics that are or could become important for a successful adoption and implementation of carbon farming schemes in the EU. These characteristics were divided into six main themes: (1) General scheme information, (2) Payment / buyers information, (3) Monitoring, reporting and verification (MRV), (4) Safeguards for the society and the environment, (5) Transparency, and (6) Attractiveness. From this set of 45 schemes, two were not taken into account, since they worked with biochar production¹. The remaining 43 schemes were scored for each of these themes with a three-level scoring method, attributing a value of 1 for a poor performance, of 2 for a medium performance and of 3 for a perfect performance. In order to find characteristics that contribute to a promising scheme structure, 23 out of these 43 were selected, having an average unweighted score of 2.0 or more over the six themes listed.

We analysed the selected 23 schemes in more detail. It appeared that of these 23 schemes, the majority of result-based schemes was private, whereas the public schemes were mostly action-based or hybrid. 'Private' means that the organiser is a private stakeholder, so that the payment model is privately funded. Public schemes are relatively often linked to the Common Agricultural Policy (CAP) of the EU, like agro-climatic-environmental measures, providing a compensation payment for additional costs and/or lost revenues. Even in schemes that had been qualified as result-based, accurate measurements of organic matter contents are not always organised according to the scheme description. Misinterpretation of terms by the respondents, i.e. the scheme holders, probably gave an incomplete picture of the true character of some of the schemes in the survey. Some schemes may have been characterised by the scheme holders as 'result-based' but were in fact 'action-based' according to our definitions.

¹ Biochar application can be a measure for carbon sequestration, but in fact the production of biochar is the main activity, not so much the application of more or less inert carbon to the soil.



Compared to the 43 schemes that had been selected in the second survey, the top 23 schemes are characterised as follows:

- They have a larger share of private schemes.
- They are more often result-based, at least according to the scheme holders.
- Their level of documentation is higher.
- Soil sampling is less often applied.
- Trade-offs and leakage are more often considered.
- They score more or less equally high on attractiveness for farmers, funders and policy makers.

For international (and perhaps EC) acceptance by policy makers and buyers, an international standardization could be a prerequisite. However, most schemes in the top 23 ranks, regardless of payment model, do not have an internationally approved standard for monitoring or prediction of the carbon amount stored or carbon emission avoided. On the other hand, relatively more result-based schemes have an internationally approved standard than action-based schemes.

The results of this inventory can only be seen as preliminary, not only because of possible misinterpretations by scheme holders but also because of further developments of existing schemes and the occurrence of new schemes since the survey was carried out in 2022.



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1. Introduction

1.1 Background of the study

Carbon farming is considered as one of the mitigation options for agriculture to reach the targets of the Paris Agreement and the European Green Deal. The European Commission's proposal for a regulation recognises the role of carbon farming as a form of "green business" that increases the carbon sequestration of biomass and soils, reduces emissions and guarantees co-benefits (e.g. fertility and biodiversity) and for this reason promotes it through public or private initiatives. The intention of the European Union is to provide member states with a single regulation that can promote a voluntary carbon market based on strict, transparent and verifiable standards. The EJP Soil research project Road4Schemes was designed to contribute to the policy design and implementation in this field. A broader literature review including the developments in the European policy making is given by Thorsøe et al. (2024).

Road4Schemes has three goals:

- 1 To assess the strengths and weaknesses of existing and planned schemes for carbon farming and additional Ecosystem Service (ESS) payments, including respective tools for monitoring, reporting and verification (WP2);
- 2 To assess stakeholders' perceptions and preferences with respect to strategies for scheme design and policy drivers and barriers (WP3); and
- 3 deliver a roadmap for developing and implementing contextually sensitive result-based schemes for carbon farming and additional ESS payments (WP4) ².

The final purpose of Road4Schemes is to provide a roadmap for an effective and efficient introduction and implementation of carbon farming schemes that are optimally equipped to contribute to the targets of the Paris Agreement and the European Green Deal.

This report describes the set-up, methodologies and results of WP2, that is the stocktake and analysis of carbon farming schemes throughout the EU.

1.2 Research purpose and research question

For Road4Schemes WP2, the main research question is what we can learn from carbon farming schemes that already exist or are planned and in some cases tried out in a pilot setting. The purpose of this report is to assess which carbon farming schemes are available throughout Europe, how they can be characterised and to which extent they deal with principles like additionality, if they apply result- or action-based payments, how they have set-up a proper MRV-system with acceptable costs and sufficient payments for the farmers. Together with an inventory of perceptions of stakeholders including farmers and policy makers run by WP3, the results of WP2 were used as inputs to the roadmap developed by WP4.

² 'Contextually sensitive' means that the scheme takes into account context specific characteristics, like climate, soil type, type of agriculture and local instruments to stimulate carbon farming.



1.3 Definitions

Appendix 1.1 provides a glossary of terms as used in this project. Three of six terms are presented here, since they represent the heart of this project:

Carbon farming

Carbon farming means applying agricultural measures that are proven to increase the amount of soil carbon in soil, or specific measures to decrease GHG emissions, e.g. caused by organic matter oxidation in peatlands. The agricultural measures applied with carbon farming need to be additional to the basic requirements for soil management such as specified in the GAEC (Good Agricultural and Environmental Conditions, established by the mandatory environmental conditionality of the CAP). This is not easy to guarantee from a governance point of view.

Carbon Farming Scheme

A Carbon Farming Scheme is any voluntary agreement in which a farmer or a group of farmers commit themselves to apply carbon farming measures to get a positive balance between soil carbon accumulation and GHG emissions (possibly measured as CO₂ equivalents) in return for a payment or compensation in any form.

Carbon Farming Measures

Carbon Farming measures are specific decisions and/or changes in management practices taken to sequester carbon in the soil or reduce CO₂-emissions from the soil. Therefore, measures can either include something new (conservative tillage of the soil) or exclude actions (and abandon something, such as intensive tillage or the use of chemical fertilizers) or modify an action (more precisely, change intensity, frequency, or timing). Examples can be the application of biochar, digestate or (extra) manure, maintenance of permanent grasslands i.e. un-ploughed, conservative tillage of the soil, maintenance of the characteristic features of the landscape, growing catch and cover crops, crop rotation, afforestation, and mulching.

In summary, a carbon farming scheme in this context can represent any agreement on implementation of certain (additional) measures for net carbon sequestration and/or reduction of GHG-emissions (see also figure 1.1):

- public, i.e., between a farmer or a group of farmers and the government, e.g. in the context of the Common Agricultural Policy (CAP) of the EU and farm payments (FP), or other national/regional/municipality funds;
- private within a value chain, i.e., between a farmer or a group of farmers and partners in the corporate supply chain (CSC), mainly food processors;
- private outside value-chains, i.e., between a farmer or a group of farmers and buyers of carbon sequestration certificates on voluntary carbon markets (VCM) for such certificates (e.g., businesses and entrepreneurs).

In this report, however, the distinction between private schemes within or outside value-chains has not always been made, since information on this issue was not always available. Besides, also combined public-private payment models have been included in the results of the survey.



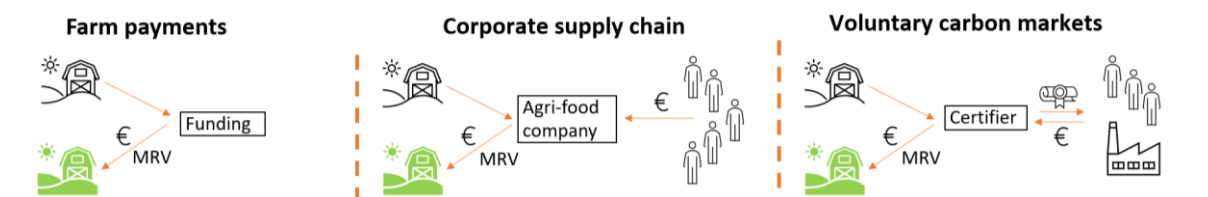


Figure 1.1: Typology of schemes applied in the assessment of CF schemes (Source: et al., 2024, adapted from McDonald et al., 2021).

For simplicity reasons, also concept-phase and pilot-phase initiatives that are included in the inventory, are named 'scheme', although officially and juridically they have not (yet) been settled as an agreement as defined above.

Carbon farming schemes are distinguished between action- and result-based schemes and hybrid schemes, in between. Here the definitions reported also in Appendix 1.1 are given:

Action-based carbon farming scheme

An action-based carbon farming scheme is a scheme where the farmer or landowner receives a payment for implementing defined carbon farming measures, independently of the resulting impact of those measures.

Result-based carbon farming scheme

A result-based carbon farming scheme is a scheme where the farmer or landowner receives a payment for reducing net GHG fluxes from their land, whether that is by reducing their GHG emissions or by sequestering and storing carbon in soil (or in biomass, which is the case in e.g. afforestation and agroforestry). A result-based approach requires a direct and explicit link between results delivered and payments. The measurable result is the net sum of reduction of GHG emissions and carbon sequestered.

Hybrid carbon farming scheme

A hybrid carbon farming scheme is a scheme in which part of the payment is a reward for the carbon farming measures applied and the remainder is only paid when the results of these measures is as positive as agreed beforehand.

1.4 Background of the project Road4Schemes

The project Road4Schemes has been developed as a part of EJP Soil, the European Joint Programme on Soil ([EJP SOIL - Towards climate-smart sustainable management of agricultural soils](#)). This is a consortium of 26 partners from 24 countries that carry out at the moment research and knowledge dissemination projects. The themes addressed are summarised in:

- 1 Sustainable soil management
- 2 Climate change mitigation
- 3 Climate change adaptation
- 4 Assessing & monitoring



5 Fostering adoption.

Road4Schemes is a concrete implementation of theme 5 in this list. In this project, the following EJP Soil partners were involved:

- 1 Aarhus University (AU), Denmark
- 2 Stichting Wageningen Research (WR), specifically the institutes Wageningen Economic Research and Wageningen Environmental Research, the Netherlands
- 3 Flanders Research Institute for Agriculture, Fisheries and Food (EV ILVO), Belgium
- 4 INRAE, France
- 5 BIOS/AGES (Austrian Agency for Health and Food Safety), Austria
- 6 Thünen Institute, Germany
- 7 International Agricultural Research and Training Center of General Directorate of Agricultural Research and Policy (GDAR/TAGEM), Ministry of Agriculture and Forestry, Turkey
- 8 CZU - Czech University of Life Sciences Prague, Czechia
- 9 Agroscope (AGS), Switzerland
- 10 CREA Research Centre for Agricultural Policies and Bioeconomy, Italy, which joined in a later stage of the project.

1.5 Contents of the report

After this introduction, the report is made of a chapter on the methodologies applied in this research (Chapter 2) and two chapters on the results of two inventory rounds and a scoring (Chapters 3 and 4). The results are discussed in Chapter 5 and conclusions are given in Chapter 6. Finally, the report contains a list of references and a number of appendices.



2 Materials and methods

The work in WP2 consisted of an inventory of carbon farming schemes carried out in two steps and a scoring of a selection of the schemes of the inventory (scheme 2.1).

As a first step, all partners reviewed the schemes available across Europe and in two extra-EU countries, based on public sources – websites, reports, etc. for their own country, some neighbouring countries and in Australia and U.S.A.. The EU Member States included in the database were: Austria, Belgium, Croatia, Czech Republic, Denmark, Estonia, Finland, France, Germany, Hungary, Ireland, Italy, Latvia, Lithuania, Netherlands, Poland, Portugal, Slovakia, Slovenia, Spain, and Sweden. Non-EU Member States included in the database were: Norway, Switzerland, Turkey, UK, and Ukraine. EU Member States currently not in the database were: Greece, Cyprus, Luxembourg, Malta, Romania, and Bulgaria.

The request to the project partners was to contribute to a heterogeneous database with a reliable and representative set of carbon farming schemes, covering different regions and agricultural sectors, containing both result- and action-based schemes and also hybrid schemes, both with successful and failing schemes, including concepts and pilots. In summary, the objective of this phase of the study was to take stock of the different carbon farming schemes throughout Europe and beyond.

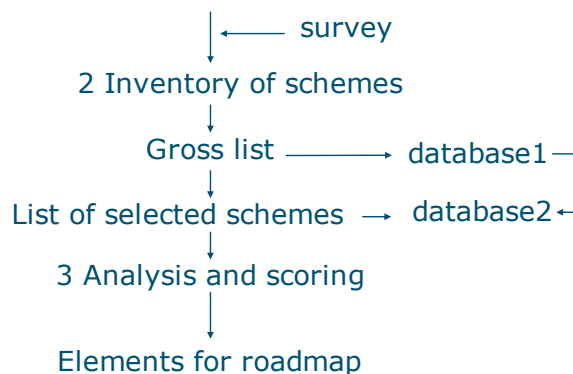
This phase led to the identification of 162 schemes (including concepts and pilots) with information on their name, country, contact details, website, and information on the following aspects:

- Regional scheme, also in other countries, EU-widely or globally used?
- Release of Certificate/ Label/ Official document?
- Multiple focuses/ESS (yes/no)?
- Concept phase or implemented?
- Payment model: public or private?
- Action-based, result-based or hybrid?
- Co-benefits accounted for?
- Trade-offs accounted for?
- Category of land-use, e.g. grassland on peatland, mineral arable farming, mineral grasslands, agroforestry, complete farm schemes or biochar?
- Measure(s) taken, e.g. rewetting of peatlands, biochar application, agroforestry.



Steps in inventory + analysis of CF-schemes

1 Criteria for selecting schemes + SWOT-analysis



Scheme 2.1 Overview of the methodological steps taken in this part of the Road4Schemes-project.

This first inventory resulted in a quite diverse list of schemes.

As a second step, the partners selected 1-5 schemes in each country for a more in depth analysis. The objective of this phase was to identify how different schemes balance the trade-offs³ involved in scheme design and which elements of the scheme design may contribute to its success in terms of adoption and long-term commitment by farmers. Hence, we adopted a purposive sampling approach in which we selected schemes based on maximum variation⁴.

To acquire data, partners completed an interview with scheme holders based on a joint protocol, which contained a series of questions describing the scheme design grouped under six themes (general scheme information, payment/buyer information, MRV, safeguards for the society and the environment, transparency and attractiveness for farmers), as given in Appendix 1.

Since answers contained sensitive information for some scheme holders (e.g. MRV costs), results of the second inventory were anonymised in our data processing and presentation for this report.

The questionnaire included in this protocol covered most of the issues that had been addressed in previous discussions among the partners in the project, e.g. additionality, permanence, fairness and attractiveness for farmers. The results of the interviews, (i.e., the answers to the questions in the

³ Trade-offs are to be expected between different characteristics of the schemes as elaborated on in Appendix 1, e.g. between ‘attractiveness for farmers’ on one side and ‘additionality’ and ‘being result-based’ on the other.

⁴ Partners were asked to select 1-5 schemes per country involved, paying attention to ‘interest’ (how promising does a scheme look?) and ‘breadth’ (select different types with geographical spread). We tried to also include hybrid and result-based schemes and both very successful and failing schemes. The selection did not include the American and Australian schemes from the first inventory.



questionnaire), were brought together in an Excel file. In a later stage, the answers were also 'cleaned', i.e. worded in a uniform and standardised way, making it easier to group schemes for further analysis and presentation. As a third step, a scoring of the most promising schemes, selected for the second inventory, was applied.

The questions and categories in Appendix 1 were based on the opportunities and threats that we see for adoption and implementation of carbon farming. On the one hand, the Paris Agreement, the Kyoto Protocol and the European Green Deal (in particular the European Climate Law) offer the agricultural sector opportunities to reach climate targets through carbon farming. Besides, these policies have led to the adoption of the proposal for a Regulation of the European Parliament and of the Council establishing a Union certification framework for carbon removals. This proposal for a Regulation makes it possible to make carbon farming part of a business model of farmers and other stakeholders and at the same time to improve soil quality and, in some cases, other ecosystem services like biodiversity. On the other side, there are quite a number of conditions under which carbon farming schemes will be acceptable for policy makers as well as other stakeholders including investors and the (majority of) farmers.

The policy context of this project is currently to a large extent determined by the proposal for an EU-certification framework for carbon removals within the European Green Deal that was presented at the end of 2022 (EC, 2022). The European Commission calls this 'a proposal for a first EU-wide voluntary framework to reliably certify high-quality carbon removals'. The proposed regulation established four Q.U.A.L.I.T.Y criteria:

- 1 **Quantification:** Carbon removal activities need to be measured accurately and deliver unambiguous benefits for the climate;
- 2 **Additionality:** Carbon removal activities need to go beyond existing practices and what is required by law;
- 3 **Long-term storage:** Certificates are linked to the duration of carbon storage so as to promote long-term storage;
- 4 **Sustainability:** Carbon removal activities must preserve or contribute to sustainability objectives such as climate change adaptation, circular economy, water and marine resources, and biodiversity (cited from EC (2022)).

Several amendments to the proposal for a regulation have been tabled in recent months and, to date (March 2024), the Q.U.A.L.I.T.Y criteria in the Regulation text have been amended as follows:

1. **Quantification:** for carbon farming activities both the net benefit of carbon absorption by the agricultural-forestry sector and the reduction of greenhouse gas emissions from agricultural soils are considered;
2. **Additionality:** Carbon removal activities must go beyond national and EU-wide regulatory requirements or be determined by the incentive effect of certification;
3. **Long-term storage:** Carbon removal activities must ensure long-term carbon permanence. The activities of agricultural carbon farming must be carried out for a period of at least five years.
4. **Sustainability:** the same requirements as described in the original text.



For the Road4Schemes project, this means that result-based and hybrid schemes may have a higher preference by the EC than action-based schemes, although e.g. the conditionality requirements under the CAP-regulations, the subsidies for CAP-eco-schemes (1st pillar) and agri-climatic-environmental measures (CAP rural development, 2nd pillar) are mostly action-based. Besides, additionality, permanence as well as positive co-benefits of carbon farming (e.g. biodiversity) are considered as important issues.

Such and other aspects were included in the questionnaire and formulated as questions to the scheme holders. They were grouped in six categories (Appendix 1), each with four or more underlying issues:

1 General scheme information:

- Documentation Available
- General transparency
- Project holder
- Farmer responsibility
- Number of farmers involved
- Potential number of farmers
- Share of farmers (%)
- Total area
- Share of the area (%)
- Land use type
- GHG
- Field basis / Farm basis
- Eligibility criteria
- Certified / Registered
- Scheme measures
- Available and reliable information about measures
- Measures flexibility
- Regional adaptation
- Contract duration
- Expected climate mitigation.

2 Payment / buyers information

- Internationally approved standard
- Payments to farmers
- Who pays farmers?
- Price of CO2 equivalent
- Trading of carbon farming credits
- Cost-Benefit ratio for farmers
- Paid shares of carbon credits



- EU Cost-effectiveness
 - Funders Cost-effectiveness
- 3 MRV**
- Action-based/ Result-based/ Hybrid
 - Validated methodology
 - Science based or on models/estimates
 - Soil sampling strategy
 - MRV results available
 - MRV Costs
 - who pays for MRV?
- 4 Safeguards for the society and the environment**
- Robustness
 - Are measures additional?
 - In- or off-setting
 - Ecosystem services
 - Trade-offs
 - Leakage
 - Leakage - How?
 - Fairness
 - Arrangement for permanence
- 5 Transparency**
- Number of farmers
 - MRV data for stakeholders involved
 - MRV cost
 - Information about risks
- 6 Attractiveness for farmers**
- Attractive for farmers
 - Attractive for policy makers
 - Attractive for funders
 - What happens if the scheme is failing?

Wageningen Research scored each of the schemes selected, as an average over the issues under each of the six categories listed above, based on the results of the questionnaire. That led to six scores with three levels:

- **1 point:** when the specific category has not been settled and/or there is very little information available on this category (or a large number of items under this category);
- **2 points:** when the specific category has not been settled very well and/or the information available on this category (or a large number of items under this category) is incomplete;
- **3 points:** when the specific category has been settled very well and the information available on this category is complete.



Each scheme also received a total score, being the unweighted average of the six individual scores. This overall score was used to identify the best performing schemes in the inventory (chapter 4).

After the assessment, the different partners were asked to give their feedback on the scores given for the schemes they had taken care of in the second inventory. In some cases, some scores were adapted as a consequence of the feedback given. These scores served as input for further analysis to derive lessons from the inventories.

In the assessment, being result-based was evaluated as a positive characteristic, since the EC is in favour of result-based schemes and payments from governments. In general, public and private stakeholders increasingly want a closer link between performance of sustainability measures and payments to compensate the costs of such measures. Result-based schemes require some form of soil sampling. The measures taken in a scheme should be additional to common practice for a reward for activities/practices implemented/avoided and/or results predicted. Funders expect that the impact will endure for a period of several years and not be undone through (significant) trade-off effects, through leakage effects or through counteracting activities after the payment period. Having a multiple focus was also regarded as positive, making the impact of a scheme broader than only carbon farming. Compliance with an official international standard will make it easier to receive recognition by stakeholders and policy makers. Finally, schemes need to be attractive for farmers, since they are the actors that will need to adopt and implement carbon farming schemes.



3 Results of the first inventory

The first inventory contained 162 carbon farming schemes, from which four outside the EU (Australia and USA). The origin of the remaining 158 schemes is shown in map 3.1.



Map 3.1 European countries involved in the inventory. Source: CSI (Carbon Schemes Inventory)-webtool ([CREA PB](#)).

European CF schemes in the database can be divided into three main categories: public payments (PP) to farmers, where local authorities finance CF projects; voluntary carbon market (VCM), where polluting actors buy credits generated by carbon removal activities to offset their emissions; and business-led initiatives (CI), where consumers finance carbon removal projects (Thorsøe et al., 2024). CF schemes have shown several differences in the methodologies for quantifying carbon removals, the agricultural practices involved, the storage time, and the management of reversal and leakage risks. Half of the schemes in the inventory had been designed for arable farming and/or grassland (Figure 3.1)⁵. Similarly, half of the schemes, not necessarily the schemes for arable farming and/or grassland, were action-based, whereas 21% were result-based and 10% hybrid; the remaining 18% had combinations of these three categories (Figure 3.2). In total, in one third of the schemes there was a link between result monitoring and payments. About half of the schemes did not contain information about the carbon farming measures taken (Figure 3.3). In part of these cases that will mean that farmers are free to select measures to reach the targets of the scheme. In the other half

⁵ In this first inventory, the information was retrieved from public sources. The answer category 'not known' indicates that information on that specific subject in the questionnaire was not available. In the second inventory, interviews were held and much more information became available.



of the schemes a large variety of measures is given as options. More than half of the schemes in the inventory are already implemented and 20% were still in a concept phase (Figure B2.1 in Appendix 2).

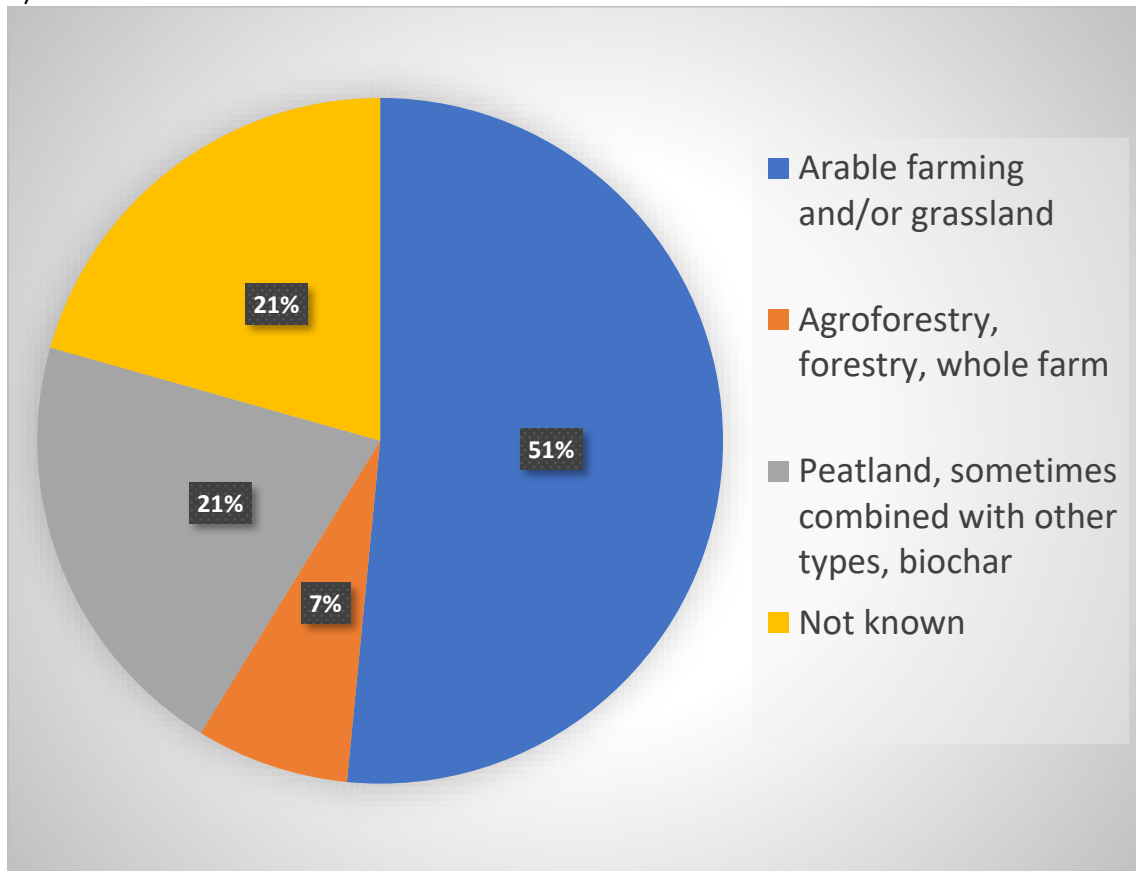


Figure 3.1 Distribution of the schemes in the first inventory over different land use categories (n = 162).



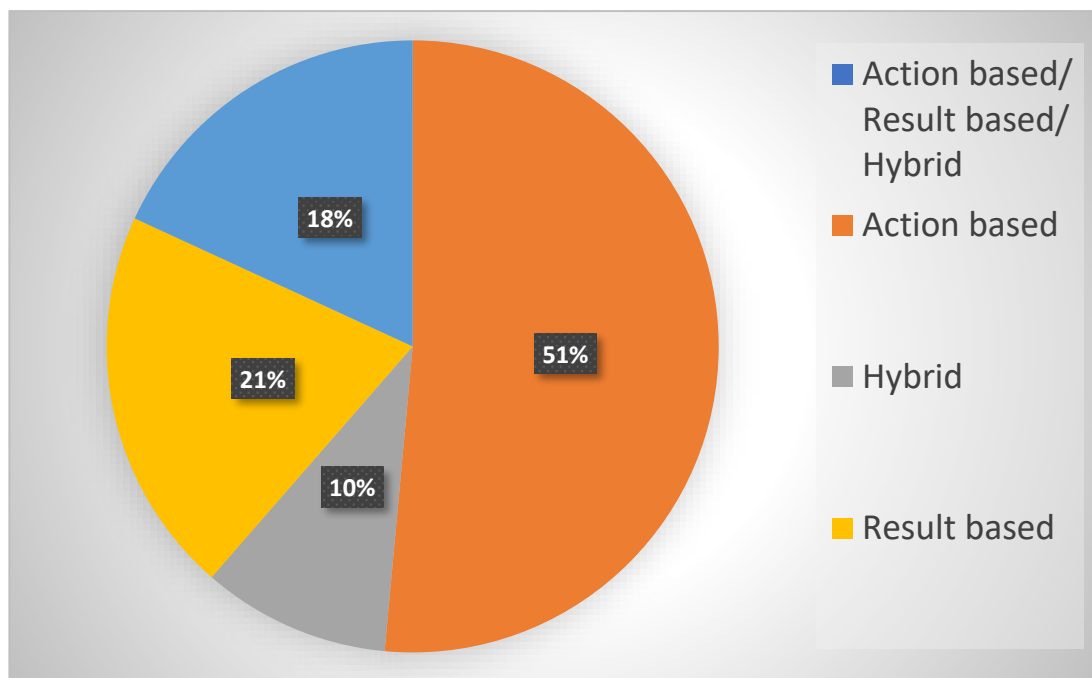


Figure 3.2 Distribution of the schemes in the first inventory over action-, result-based and hybrid types (n = 162).

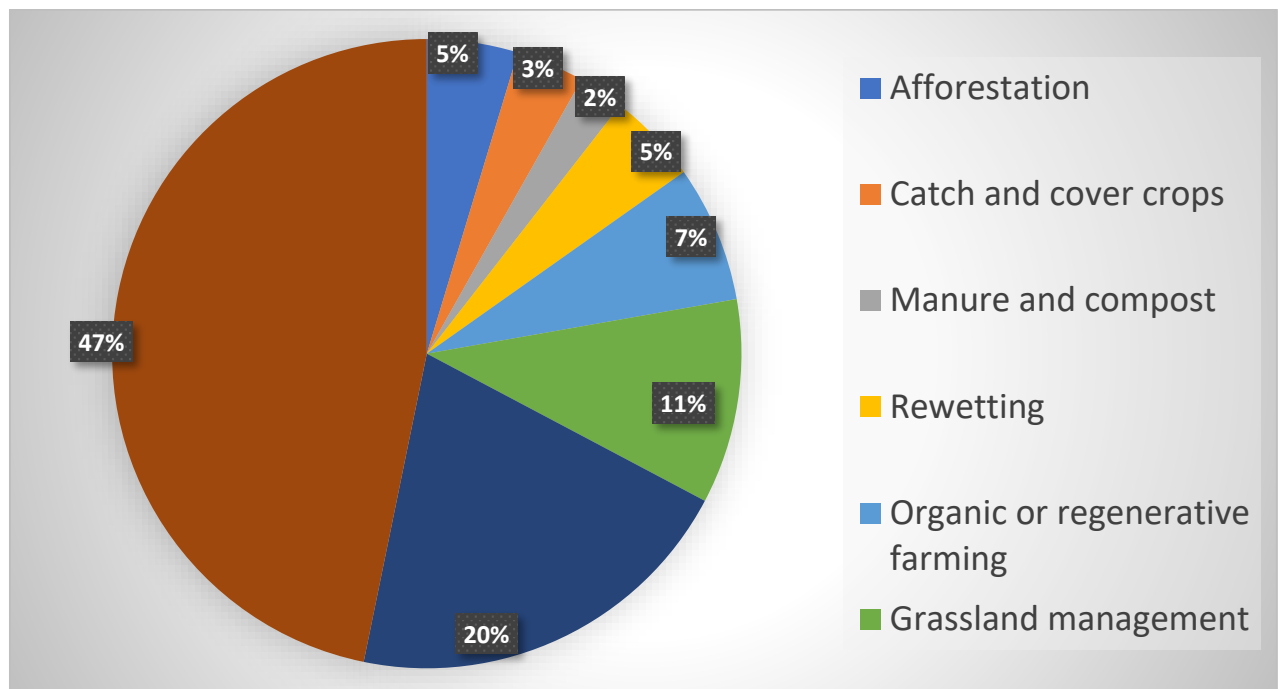


Figure 3.3 Distribution of the schemes in the first inventory over different carbon farming measures (n = 162).



In the inventory, there was also a scheme that had failed. It was a scheme in the Netherlands that had been derived from an Austrian scheme but appeared not to be feasible in the Netherlands because of the nutrient regulation there. Half of the schemes already had a certificate, a label or another official document, presenting their officially recognised status (Figure B2.2). Half of the schemes in the inventory had a private payment model (45%) or a private/public model (5%) (Figure 3.4). One third was paid publicly. The description of a third of the schemes had information about additional focuses besides carbon sequestration or reduction of GHG-emission from soils (Figure B2.3). In most cases, the additional ES was linked to biodiversity. Finally, in 40% of the schemes listed, co-benefits were mentioned, in most cases an improved soil quality (Figure B2.4).

Overall, many start-ups and pilot projects have been identified throughout Europe. Because of this, early development stage, much information on the schemes was not (yet) available on the websites of the schemes, as shown by relatively high percentages ‘not known’ in the figures 3.1 – 3.4 and B2.1 – B24. However, in the second inventory, part of the missing information was collected through interviews.

One of the EJP partners, Turkey, could not identify any CF-scheme in their country. However, a number of schemes with a potential for carbon farming have been described in Appendix 3.

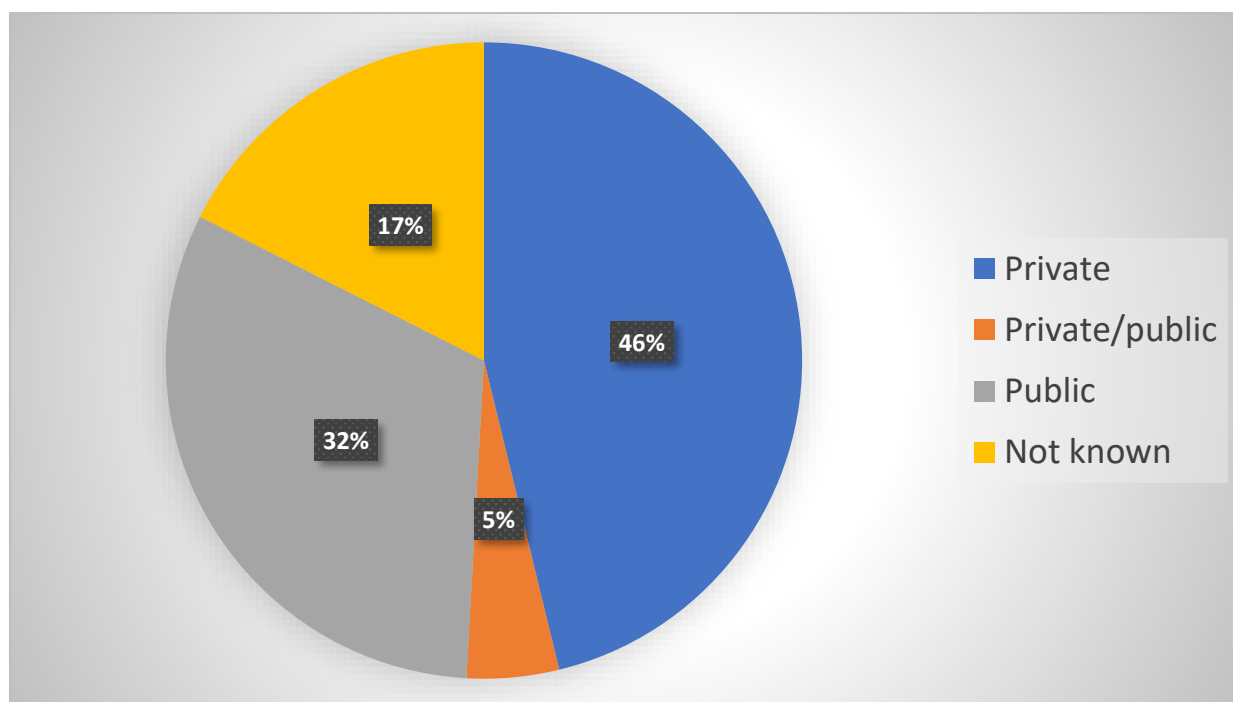


Figure 3.4 Distribution of the schemes in the first inventory over different payments models (n = 162).

4 Results of the second inventory and scoring

4.1 Overview

In the second inventory, the partners selected 43 schemes and interviewed the scheme holders or assessed available websites in more detail following the questionnaire in Appendix 1⁶. This second inventory added a lot of information on these 43 schemes that had been assessed as ‘most promising’ or ‘interesting’ in the first inventory. But still quite some information was lacking, probably because the designers of such schemes had not been thinking how to tackle all the issues listed in the questionnaire (as shown in Appendix 1). Other schemes were much more complete in addressing all these issues, being an important reason of large differences in overall scores between schemes.

Based on the results of this inventory, the 43 schemes were scored on the six categories listed in chapter 2 (general scheme information, payment / buyers Information, MRV, safeguards for the society and the environment, transparency, and attractiveness). The distribution of the scores is presented in figure 4.1. It shows a great range in scores and therefore in quality in terms of the conditions required for successful adoption and implementation in practice. One of the schemes scored 2.8, meaning that the scheme had been well designed for all six categories. On the other hand, there was also a scheme with a score of 1.0, meaning that there was very little information about all six categories of items or they had not been settled them at all. This means that within Europe great differences were found in the quality of the schemes for carbon farming and that even within this selection of 43 schemes not every scheme seemed future-proof, at least not at the time of the survey.

⁶ In the case of the two German schemes, sufficient information was available on their websites, and an interview was not held.



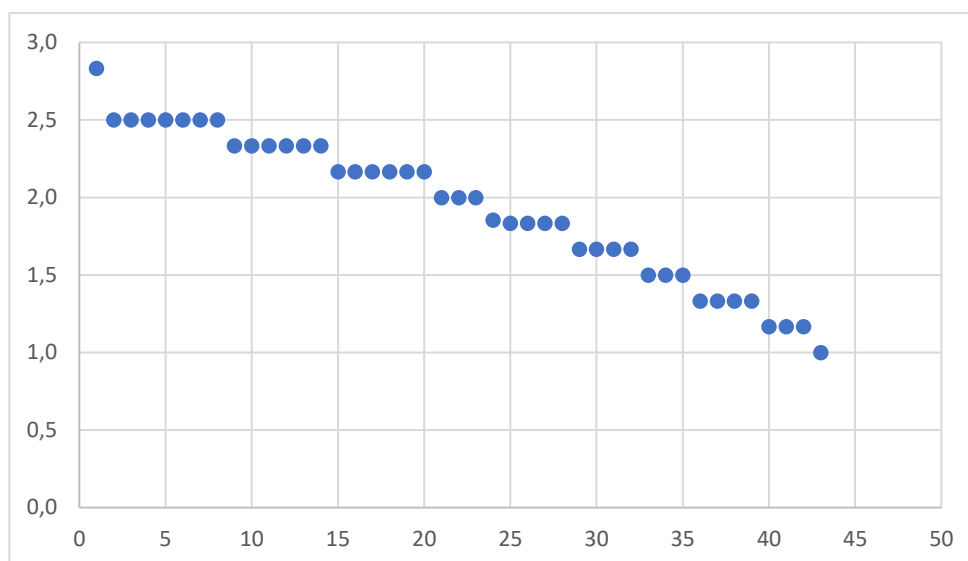


Figure 4.1 Overall scores over 43 carbon farming schemes after a first screening of the schemes in (mainly) the EU. The scoring for each of the six underlying items was as follows:

- 1 point: when the specific item has not been settled and/or there is very little information available on this item;
- 2 points: when the specific item has not been settled very well and/or the information available on this item is incomplete;
- 3 points: when the specific item has been settled very well and the information available on this item is complete.

All schemes in the second inventory with an overall score of 2.0 or higher were analysed. This is more than half of the schemes in the second inventory. The non-weighted scores of the six categories were used in this analysis. The schemes which were only about biochar are left out, leading to 23 schemes with a score higher than 2.0 and 43 schemes selected in the second inventory. Figure 4. gives an overview on the number of schemes in a certain category class.

From these 23 schemes with a score higher than 2.0, 12 have a private payment model, showing that this kind of payment is more frequent or performs better than mixed (4) or publicly paid (4) schemes. All schemes have documentation available, but only eight schemes have an internationally approved standard.

Further observations made from figure 4.2:

- Action-based and result-based schemes are equally represented (9 each), while there are fewer hybrid schemes (5).
- Most (10) schemes include multiple focuses, but nine of the schemes are purely focused on carbon farming.
- The majority of schemes does not include soil sampling (12 versus 10 which do).
- Leakage is not calculated in for many schemes (14), however, trade-offs are considered in almost half of them (11 out of 23).
- Most schemes seem to be attractive to farmers, policy makers, or funders.



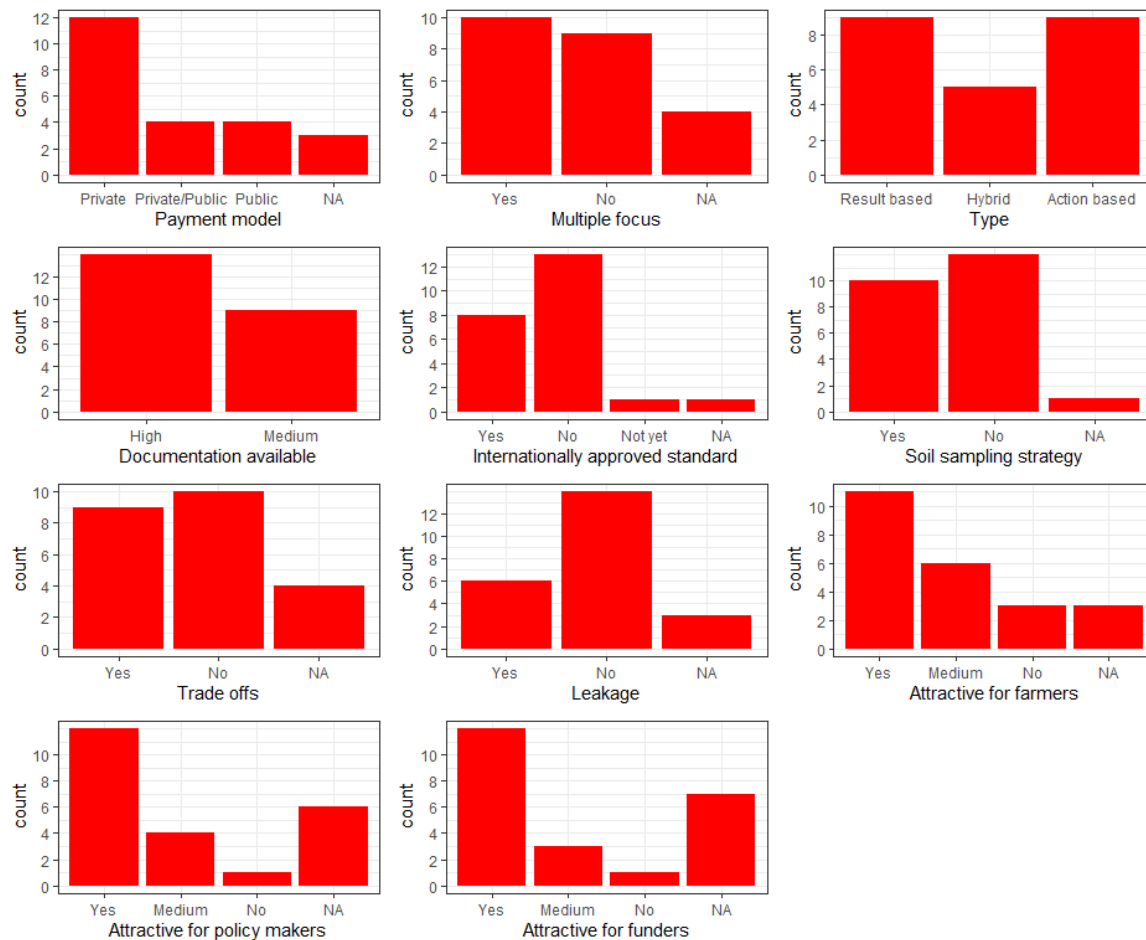


Figure 4.2: Overview of counts for different categories in the top 23 schemes.

4.2 Discussion

The procedure followed in this project to obtain data on carbon farming schemes has not given us full insight in all their characteristics. After the first survey in public sources, still a lot of data were missing. But even after the second survey, in which the scheme holders were interviewed, a lot of data were still missing, mostly because of scheme holders not having decided or even thought about tricky issues like additionality, permanence or leakage. Besides, the interpretation of the questions by either the interviewers and/or the respondents seems to be different among partners, although both a glossary of terms and an explanation of the questions was available. Cultural, language and context differences can play a role in such an international survey. In some cases, answers given raised questions on the interpretation of the questions or the answers themselves. This makes picture from the results of both surveys incomplete. A repetition of such a survey might bring better results after a good exchange between interviewers on the interpretation of the questions. Apart from the procedure followed, also an increase of data in the schemes may have appeared, since most of the schemes were in a development stage then and can show now much more information



about 'tricky issues'. The discussion continues, both in society as a whole as among scheme holders themselves.

One reason behind high scores in a survey like this may be that in some cases the implementation and MRV-methodology is already far in its development and clear answers can be given to the questions in the questionnaire. However, a well-known and well-described methodology is not a guarantee that the scheme involved is really sufficiently attractive and robust for farmers and other stakeholders including policy makers, investors and legal officers. On the other side, low scores on some of the schemes in the list do not mean that a certain scheme cannot be helpful in a development towards a more integral approach of farming, including other ESS than productivity.

For Road4Schemes and for the scheme-holders it will be a challenge to develop and combine an optimal methodology with a high adoption and implementation rate by farmers and other stakeholders with the framework as developed by the EC.



5 Characteristics of the best-scoring schemes

5.1 Overview

Figure 5.1 (with data from Appendix 4) presents a comparison of the top 23 schemes with the 43 schemes in the second inventory (two biochar schemes were excluded) to check whether the top 23 had different characteristics than the other half of this group of schemes. The top 23 are characterised as follows:

- They have a larger share of private schemes.
- They are more often result-based or hybrid.
- Their level of documentation is higher.
- Soil sampling is less often applied.
- Trade-offs and leakage are more often considered.
- They score somewhat higher on attractiveness for farmers, funders and policy makers.
- There were no clear differences for the other characteristics as presented in Figure 4.1.

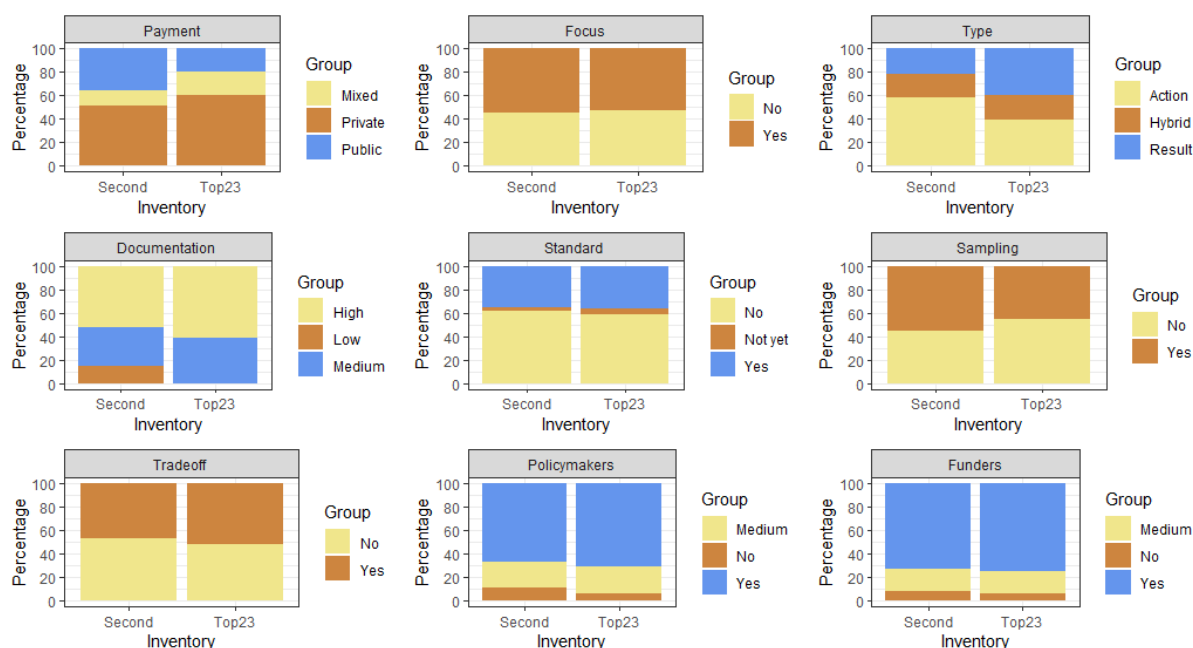


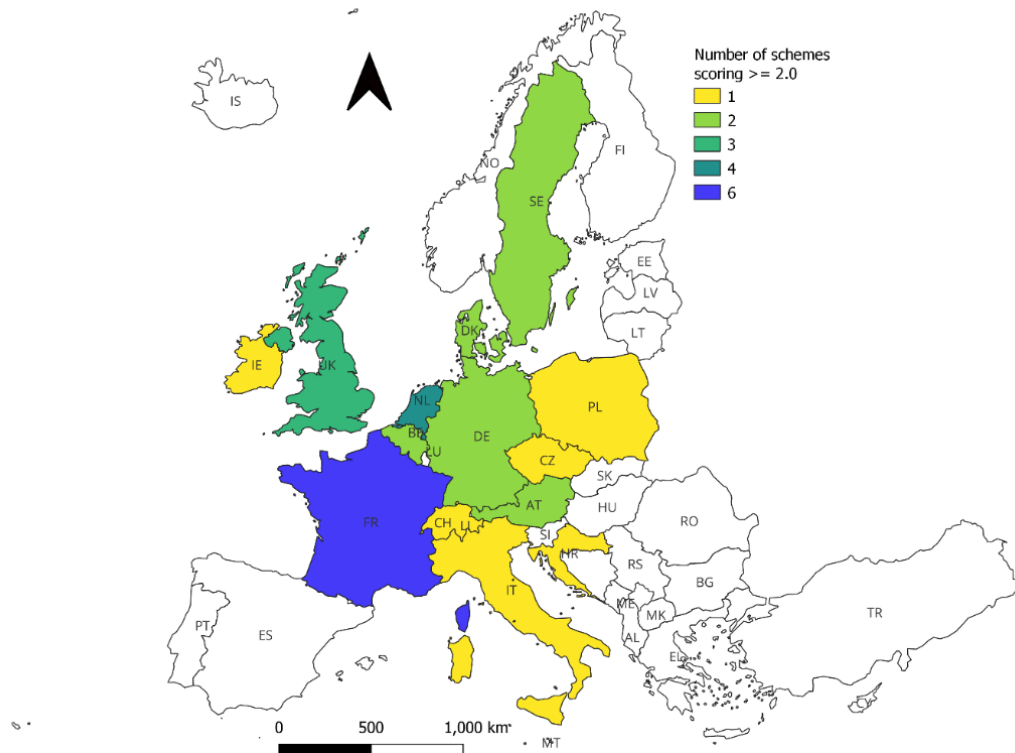
Figure 5.1 Overview of the comparison of the top 23-schemes with the dataset of schemes from the second inventory (data from Appendix 4).

Summarising, the best-scoring group contains relatively many private, well-documented and result-based schemes with attention to trade-offs and leakage. Their quality is better than the remainder of the schemes in the second inventory. However, soil sampling is less often applied. Although this is not obligatory in result-based schemes, their performance should be documented somehow. Soil sampling is then an activity that one would expect for setting accurate baselines. This observation raises the question whether there is a misunderstanding of the word ‘result-based’ in some cases. It appeared that a result in a so-called result-based scheme was not always an increase in carbon



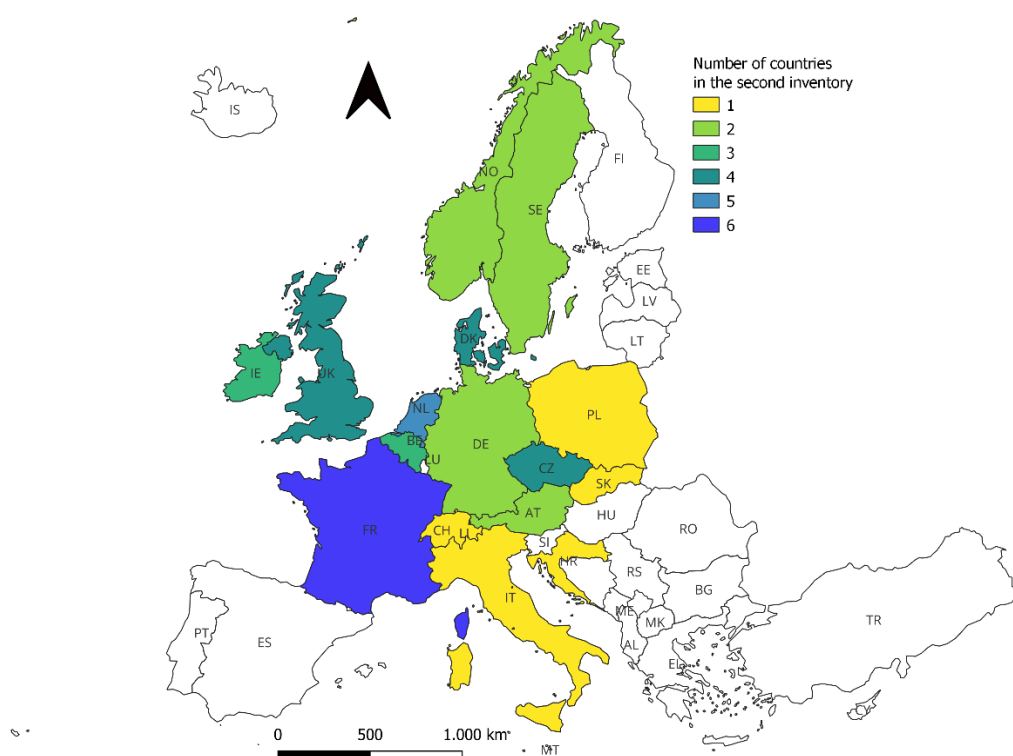
content of the soil measured, but sometimes this was interpreted as a measure carried out. This was especially the case when the scheme held measures which were officially documented as ‘contributing to carbon sequestration or emission reduction’, e.g. in CAP-documents. Therefore, some of the result-based schemes may, in reality, according to our definition, be action-based schemes.

Map 5.1 shows the member states of the EU and the number of schemes with a score higher than 2.0 and Map 5.2 the number of all schemes in the second inventory.



Map 5.1: Countries where one or more projects have a score of at least 2.0.





Map 5.2: Number of schemes in the second inventory per country⁷.

Most schemes in the second inventory (six) are located in France (Map 5.12; France Carbon Agri Association, Naturellement Pop Corn, Sols de Bretagne, CarbonThink, OleoZE and Soil Capital). Many eastern European countries do not have any scheme or only one which scores higher than 2.0.

5.2 Measures and land use in top 23 group

The land use type most schemes operate in is arable land (Figure 5.2). The second most common land use type is grassland, followed by peatland. Biochar is not a land use type; however, it is mentioned like this in the database. To make a better overview of the different land use types, several classes are combined such as dairy farming and grassland, peat grassland and peatland, forestry on peat with tree crops, groups 'Mixed' and 'NA' (meaning that no specific land use types had been indicated) (table 5.1). Most schemes are on arable land and include a high variety of measures to store carbon, both result and action-based. Some measures are temporary, like growing cover crops, which need to be repeated each year. Other measures are more or less permanent, like peatland restoration and agroforestry.

⁷ The Turkish partner in the project also reviewed five schemes, but they did not include carbon farming as defined in this report.



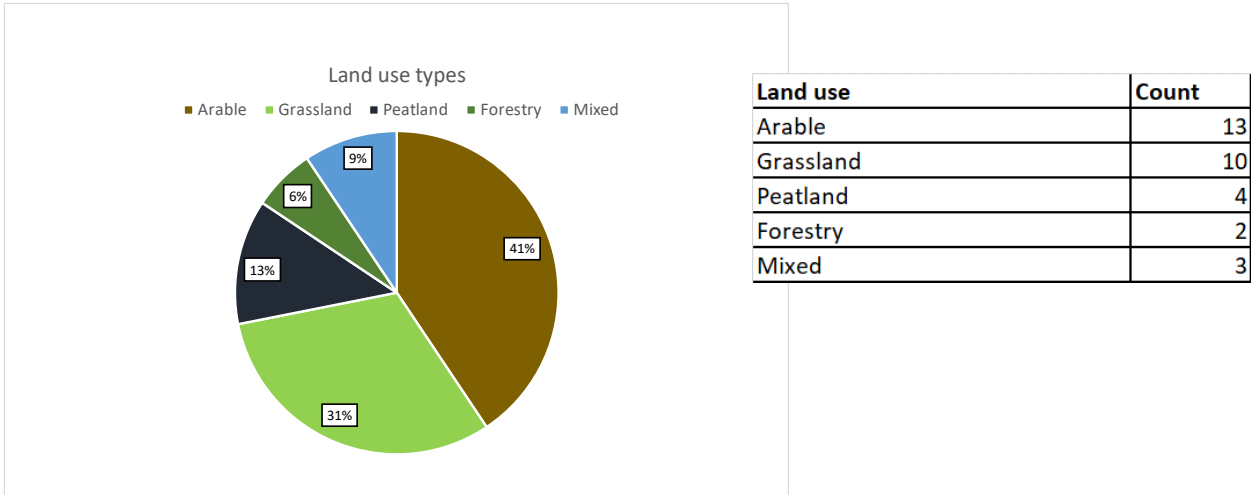


Figure 5.2: Summarised land use types in top 23 group.



Table 5.1: Overview of measures in top 23 group. One scheme could have several measures.

| Measure | Count | Payment | Scheme type |
|------------------------------|-------|------------------------------------|------------------------|
| Agroforestry | 4 | Private; Private/Public | Action; Hybrid; Result |
| Buffer strips | 1 | Public | Action |
| Compost | 1 | Private | Result |
| Cover crops | 7 | Private; Private/Public; Public | Action; Hybrid; Result |
| Crop residues | 1 | Private | Result |
| Crop rotation adjustments | 3 | Private; Private/Public | Action; Hybrid; Result |
| Establish intermediate crops | 1 | Private | Hybrid |
| Fertiliser adjustments | 7 | Private; Private/Public | Action; Hybrid; Result |
| Intercropping | 1 | Private | Hybrid |
| Limiting tillage | 5 | Private; Private/Public; Public | Action; Hybrid; Result |
| Mineral arable farming | 1 | Private | Action |
| NA a) | 2 | Private/Public | Action; Result |
| Optimized grazing | 1 | Private/Public | Action |
| Organic fertiliser | 4 | Private | Result |
| Peatland restoration | 2 | Private; Public | Action; Result |
| Permanent grassland | 3 | Private | Hybrid; Result |
| Permanent soil cover | 2 | Private; Private/Public | Action; Result |
| Permanent tree crops | 1 | Private/Public | Action |
| Revert to grassland | 1 | Public | Action |
| Rewetting | 2 | Private; Public | Action |
| Slurry management | 1 | Private | Result |
| Tillage type adjustments | 1 | Private | Hybrid |
| Waste application | 1 | Private | Result |

a) NA: No specific measures were measured in the scheme information or in the interview.

5.3 Payment model, status and scheme type

As already presented in the overview in chapter 4 (Figure 4.2), most top 23 schemes are private. These private schemes are relatively diverse in terms of type (two action-based, six result-based, and four hybrid⁸), while the public schemes only have one result-based and three action-based schemes (figure 5.3). The same holds for the private/public schemes. The majority of result-based schemes is thus privately funded.

⁸ Two schemes dealt with biochar application and have not been included in this overview. Two other schemes had been classified as action based in the first inventory but were classified as result or hybrid in the second inventory.



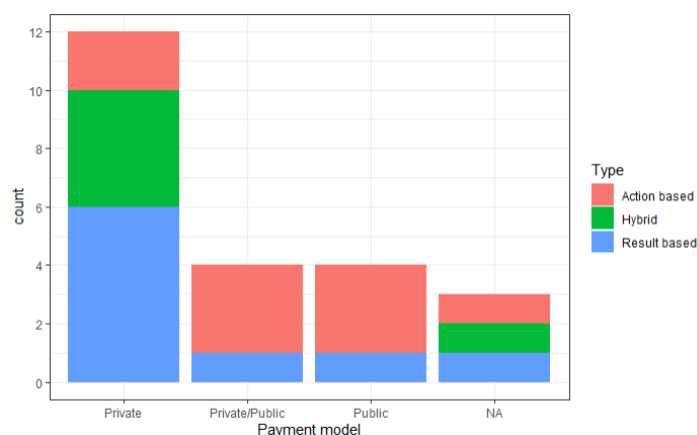


Figure 5.3: Relationship between payment model and scheme type.

In the second inventory (43 schemes), 6 out of the 24 action-based schemes were private (25%), 4 were private/public (20%), and 12 were publicly funded (50%) (Appendix 4). For the top 23, this is 25%, 37.5%, and 37.5%, respectively. Thus, private/publicly funded action-based schemes are overrepresented and publicly paid action-based schemes are underrepresented in this group of best-scoring schemes.

In the first inventory, 51% was action-based, 21% result-based, 10% hybrid and 18% unknown (meaning that the public information that had been used in the first inventory did not give information on this subject). Of the total set of schemes, 46% was private, 32% public, 5% private/public and 17% unknown. That means that in the total set action-based and private schemes were dominant. The combination of action-based and private schemes occurred 33 times or 20%.

5.4 Recognition by an international standard

Most schemes, regardless of payment model, do not have an internationally approved standard (Figure 5.4). In the case of public/private schemes, half do have an international standard, but since there are only four, it is not possible to draw conclusions from this. For the scheme type, relatively more result-based schemes have an internationally approved standard than action-based schemes (Figure 5.4).

In the second inventory, the ratio of schemes with an international standard was similar to the top 23. In the first inventory, 48% of the schemes (for 29% this was unknown) seemed to have any kind of certificate, label or official document, not necessarily being an international standard. 15 (9%) had a label, 34 (21%) a certificate, and 14 (9%) carbon credits.



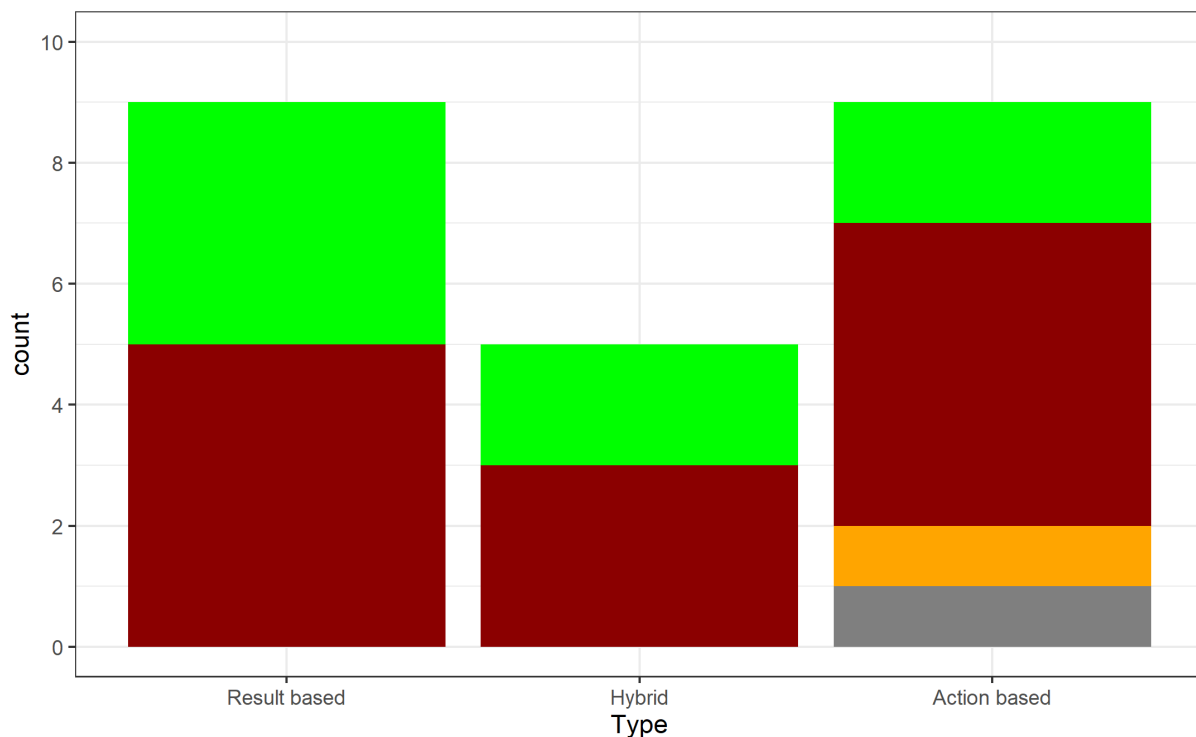


Figure 5.4: International approved standard in relation with and scheme type (right).

5.5 Additionality, soil sampling and payment period

Most schemes are considered additional, which means that the activities carried out go beyond standard farm practice according to the GAEC (Good Agricultural and Environmental Conditions), which implies already a certain amount of carbon sequestration but not sufficient to include in a scheme. Less than half of the result-based schemes include soil sampling (four out of nine); for the action-based schemes this is even less (three out of nine) (Figure 5.5). Only in the hybrid schemes, more than half include soil sampling (three out of five). Thus, even though many schemes are focused on achieved carbon sequestration (result-based), they do not have soil sampling included, which seems contradictory at first sight.

We also looked at the relation between additionality and payment period:

- Schemes with additionality had a minimum project duration ranging between 1 and 5 years, between 5 and 10 years or longer than 10 years. One is permanent (land use conversion), in two there is no duration given in the project, and for two there is no information available in the database.
- Most non-additional schemes (in total five) had a minimum duration of 1 year (3). For one project duration was given as not necessary and one scheme has a project duration of 10 years.



This shows that in general, schemes which were classified as additional, have a longer project duration. There is some logic in that. In order to reach a significant carbon sequestration rate, schemes need to cover additional actions compared to standard farming practices and these actions need to be maintained for a longer period (preferably ten years or more).

In the second inventory, 55% was said to apply soil sampling compared to 45% among the top 23. This could be linked to a relatively high share of action-based schemes in the best-scoring group.

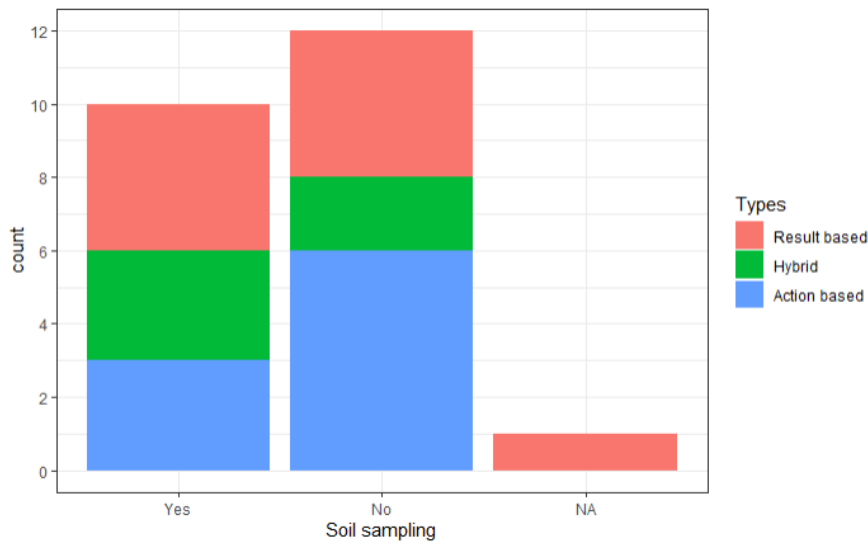


Figure 5.5: Soil sampling and scheme type.

5.6 Leakage and trade-offs

Most schemes (14) did not consider leakage (Figure 5.6; see Appendix 1 for a definition of leakage). Only one of the action-based schemes did that and only two of the result-based schemes. All hybrid schemes, except one, where this information is available, considered leakage. Trade-offs (Figure 5.5) were overall more considered ('Yes', 11) than not considered ('No', 10). While 55.6% of action-based schemes considered trade-offs, only 33.3% of result-based schemes did. Trade-offs in hybrid measures were more often counted (60%).



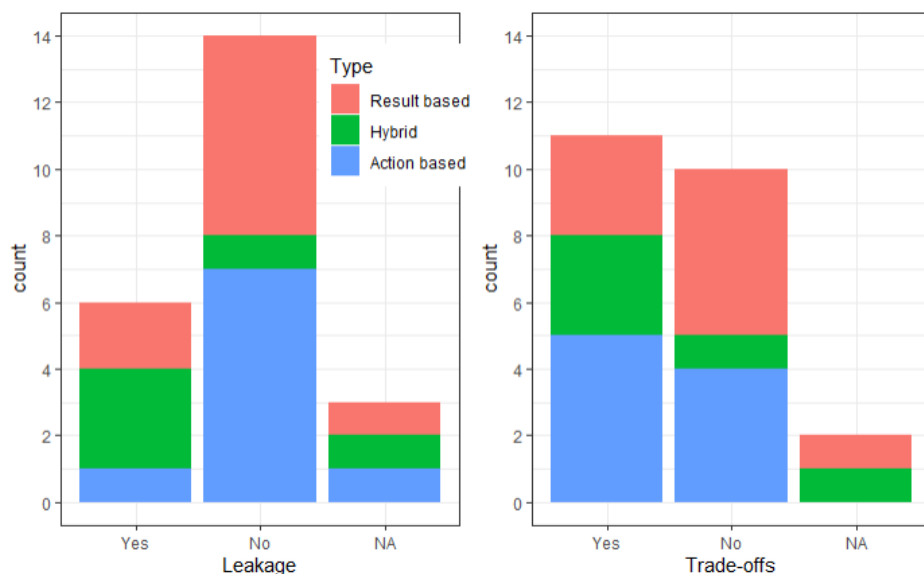


Figure 5.6: Leakage (left) and trade-offs (right) with scheme type.

In the top 23, 30% of the schemes had considered leakage compared with 25% in the total group selected in the second inventory.

Slightly fewer schemes where leakage was not considered, had a multiple focus (six out of 14) and four out of 14 did not (Figure 5.7). Schemes where leakage was considered, often did not have a multiple focus (four out of six). This means that most schemes with a multiple focus belong to the group which did not consider leakage. However, for the schemes which had a single focus, the same number can be found in the 'No' and 'Yes' group (four each).

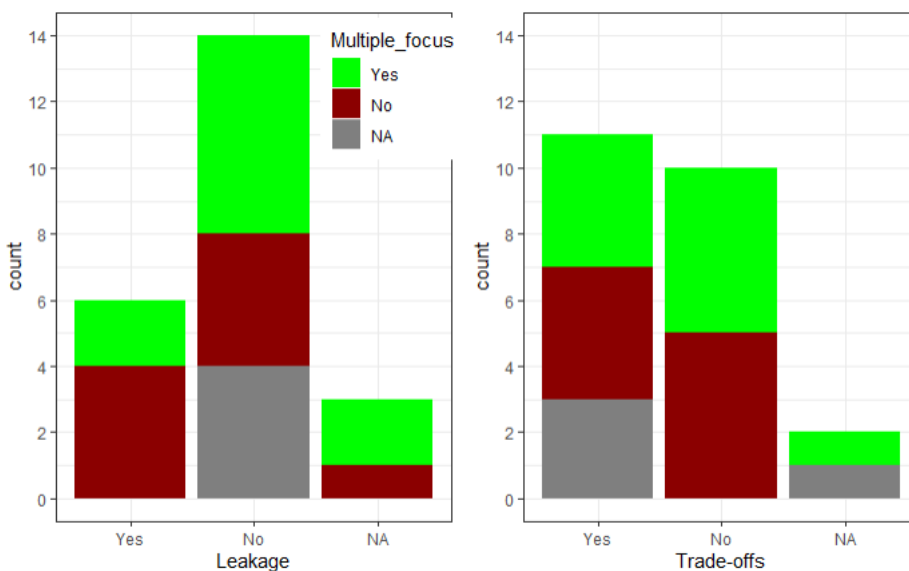


Figure 5.7: Leakage (left) and trade-offs (right, x-axis) together with multiple focus (legend).

For the trade-offs, we found the same number of multiple focus as single focus is in the 'Yes' and 'No' groups. In the 'Yes' group 36% had a single focus and 36% a multiple focus. Both single and multi-



focus schemes thus had the same distribution: five multi-focus schemes were found in the 'No' group and four in the 'Yes' group, respectively, and the same holds for the single-focus schemes.

In the second inventory, 53% of the schemes of the top 23 had a multiple focus and the full group, 55%. For leakage, the shares also were more or less similar, meaning that the top 23 did not deviate too much from the total selection in the second inventory. In the first inventory, 30% of the schemes had a multiple focus, 32% did not have that and for 38% this was unknown.

5.7 Attractiveness

For farmers, all action-based schemes were at least medium attractive and most hybrid schemes were also attractive except for one (Figure 5.8). For the result-based schemes, two were not attractive. These two were all peatland projects, which would lead to higher water tables in the field or setting fields apart from agriculture. Both would lead to a decrease or loss of productivity. For policy makers such schemes are attractive since they can be very effective in terms of decreased carbon losses.

For policy makers, there is only one unattractive scheme, which is an action-based scheme (Figure 5.7). The reasoning given in the database was: 'Policymakers are a bit sceptical due to the use of a certain tool in that scheme, and because of the action-based payments.' Also, the relative number of only medium attractive schemes is highest in the action-based group compared to hybrid and result-based schemes.

Also funders found one action-based scheme unattractive (Figure 5.8). This particular scheme is under development in a value chain but raises doubt because models which attract 'price premiums' have not been developed yet.

The total selection in the second inventory presented 48% of the schemes as attractive for farmers compared with 55% among the top 23. Among the policy makers, 67% of the schemes was considered attractive compared to 71% among the best-scoring group. Finally, 73% of the schemes was presented as attractive for funders compared with 75% among the top 23 schemes.



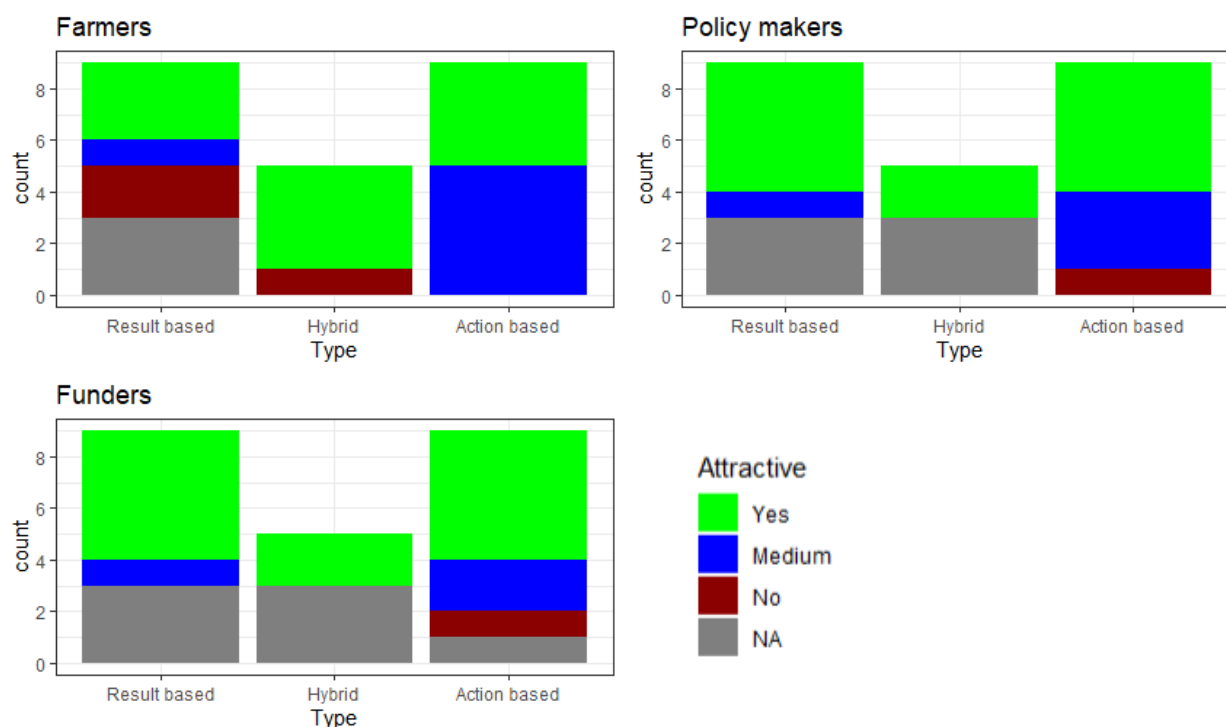


Figure 5.8: Attractiveness of schemes for farmers (upper left), policy makers (upper right) and funders (lower left).

5.9 Overall comparisons

A comparison of schemes in the first and second inventory and the best-scoring schemes showed a higher share of schemes with a multiple focus in the selection (the second inventory, 39% versus 33%) and even higher among the top 23 (44%, figure 5.9). As observed before, the share of private payment models was higher in the top 23 (52%) than in both the first and second inventory (47%). The same is true for the private /public models, which was higher in the second inventory (12%) than in the first (5%) and highest in the top 23 selection (17%, figure 5.10). In the first inventory, 51% of the schemes appeared to be action-based schemes (figure 5.11). In the second survey this was 47% and in the top 23 39%. For the result-based schemes, the selection showed an opposite trend, 22%, 23% and 39%, respectively. For hybrid schemes, the shares were 12%, 17% and 22%, respectively. This comparison confirms that among the best-scoring schemes there is more often a multiple focus, and a private or private/public payment model. The share of result and action-based schemes were equal in the top 23 selection (both 39%, figure 5.11) and hybrid schemes (22%) were relatively over-represented in this group.

Summarising, the selection of schemes in the second inventory is representative for the complete dataset in the first inventory when it comes to the share of publicly funded schemes and the distribution over action and result-based and hybrid schemes. But the share of multiple focus schemes was higher in the second than in the first inventory.



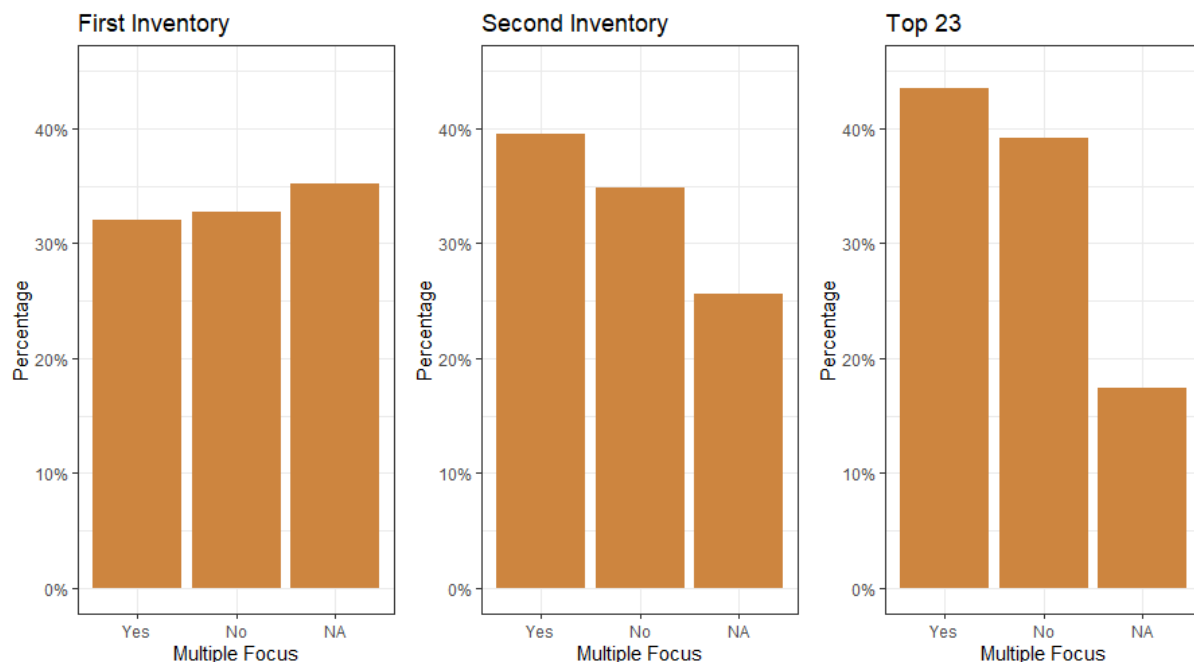


Figure 5.9 Share of multiple focus in schemes in the first and second inventory and in the best-scoring schemes (from left to right).

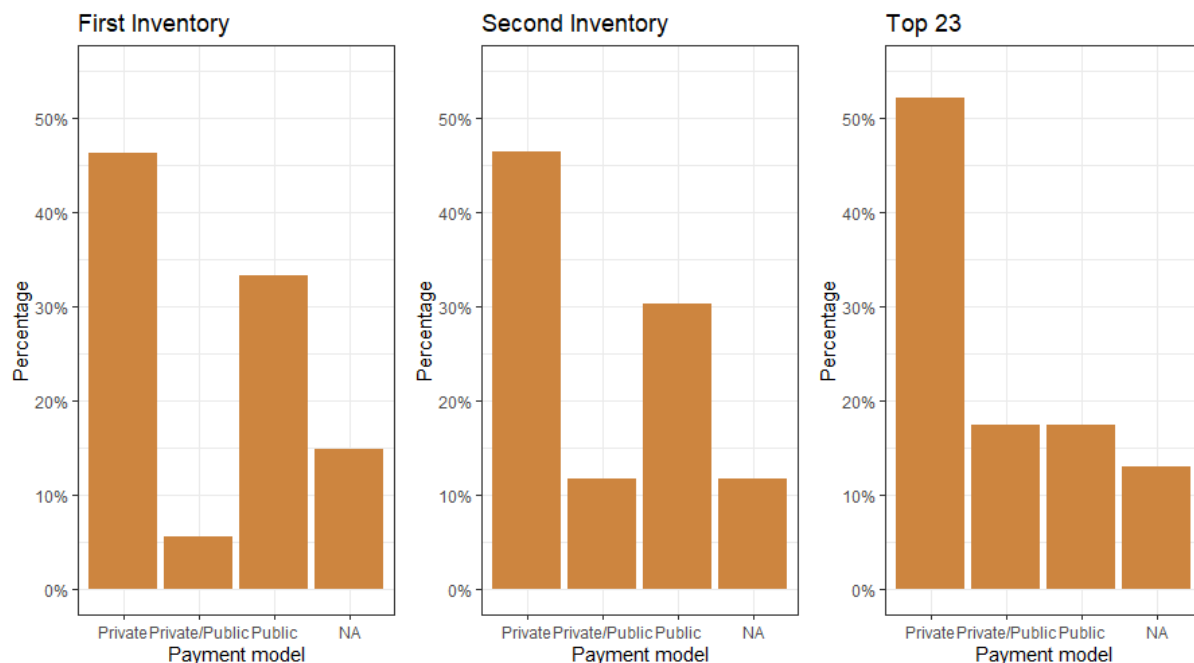


Figure 5.10 Distribution of schemes over payment models in the first and second inventory and in the best-scoring schemes (from left to right).



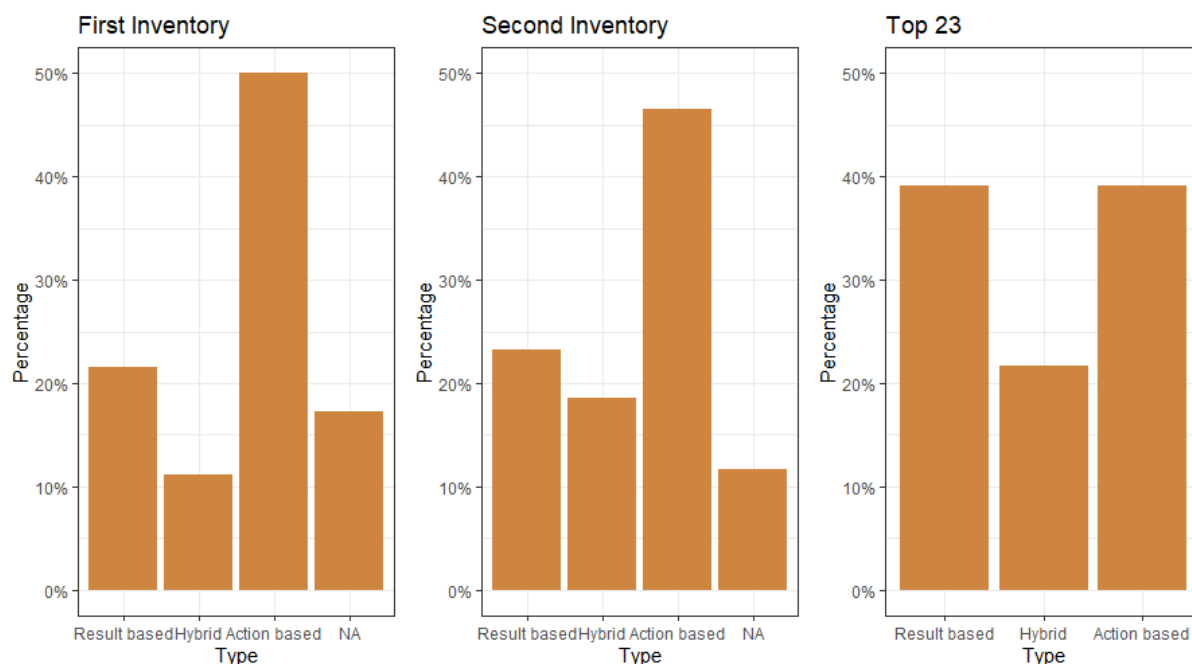


Figure 5.11 Distribution of scheme types in the first and second inventory and in the best-scoring schemes (from left to right).

5.10 Discussion

One could say that the more or less theory-based scores in this report do not fully represent the popularity of schemes by farmers and other stakeholders. The highest score was given to the French scheme ‘Label Bas Carbone’, but a presentation by a researcher from INRAE showed that the adoption rate by farmers was relatively low due to relatively low payments levels (Lancriet, 2023). However, in the evaluation, this scheme was said to have a ‘good cost-benefit ratio’ for farmers. Much will depend on the final cost/benefit ratios of the carbon farming measures that should be taken and the feasibility in daily farming processes to implement both the measures themselves and the administrative obligations for rewarding carbon farming.

In the questionnaire, the number of farmers and the area involved in the schemes were asked for, including the shares of the total numbers and area in that specific region or member state. Unfortunately, most of the scheme-holders were not able to give these figures. In the end, the adoption rate in terms of numbers of farmer and areas involved are ‘the proof of the pudding’. A follow-up study would probably bring more data on these indicators because of quick developments of existing and new schemes since our inventory was carried out.

In the dataset, different prices per ton CO₂ sequestered have been mentioned, but it would require a more in-depth analysis to compare the final cost-benefit ratio, including all costs of participation in a scheme for the farmer on the one hand and the costs and benefits of the measures taken on the other.



6 Conclusions

This report presents the results of a survey of carbon farming schemes, mainly throughout Europe. It shows that there is a large variety in design between different schemes across Europe and beyond. The differences refer to e.g. the type of payment model (public or private, but also whether activities or results are paid for), the market type (policy driven, organised by value chain partners or subject to a voluntary carbon market) and with highly differing prices per ton of carbon sequestered. The schemes in this inventory are widely spread all over Europe, even though the highest scoring schemes are in Northwestern Europe. Although, developing result-based schemes are emphasized as an important policy objective, this analysis documents that most existing CF schemes in Europe is based on action-based incentives. Such schemes score high on the themes of (1) general scheme information, (2) Payment / buyers Information, (3) MRV, (4) Safeguards for the society and the environment, and (5) Transparency, and (6) Attractiveness for farmers, policy makers and funders. However, schemes with high scores on the first five themes do not always score high on attractiveness for farmers. For farmers, the cost-benefit ratio is a dominant condition to become involved in a certain scheme.

Schemes might not work everywhere as seen for the Dutch scheme that failed. That could e.g. be caused by differences in legislation between member states. In the specific Dutch case, an Austrian concept was adopted, but it did not work because of stricter legislation on manure application in the Netherlands than in Austria. More in general, even though carbon farming is an international development, the cost-benefit ratio will be highly dependent on regional dynamics such as import- and labour costs, as well as land- and food prices, contrasted with potential revenue from carbon farming schemes. That is why importing schemes across borders should be done carefully.

It is remarkable that the best scoring schemes showed more private funding in contrast to all other schemes. Besides, most result-based schemes had private payments and publicly paid schemes were mainly action-based. The EU wants result-based schemes, however, but most public schemes are actually activity based.

The results of this inventory can only be seen as preliminary because we saw that different interviewers or perhaps respondents interpreted some of the questions in a different way. Moreover, no farmers were interviewed, which can have an influence on the results. There is still a lot of information missing or is subjective, making it difficult to really identify strength and weaknesses of the schemes. Therefore, there is a need for clear definitions and a common understanding of concepts such as additionality and what it means to be result-based. The interviews gave the status-quo in a given period (2022). An update in 2024 may show further development in addressing the different themes and underlying issues as included in the questionnaire. A new survey would likely show an improvement in quality of many schemes in both the first and second inventory and probably a higher share of schemes with a score of 2.0 or higher (and an increase in the total number of schemes in Europe). At the same time, carbon farming scheme development can be hindered due to a lack of quick and decisive clarity in the mid- to long-term from the government. On the other hand, if existing schemes converge towards the EC proposed quality criteria, scores might improve.





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Appendices

Appendix 1 Questionnaire

Questionnaire second round of inventory of (selected) carbon farming schemes

Introduction and protocol

- Each partner is asked to select 1-5 promising⁹ schemes per country according to your impression in the first inventory round.
- Please, try to find the data and information on the scheme(s) in the questionnaire that you selected for the second round (you may have collected some of these data and information already in the first round). You can do this through a survey sent by E-mail but an interview with the owners of a scheme or a member of their team may bring you more information.
- You are asked to enter the answers to the questions in the inventory Excel file on the Aarhus Teams site. Additional columns for these answers will soon be added to the file containing the results of the first inventory.
- In most cases, the type of answer demanded is quite clear, whether a name, a number or a 'yes/no'. In some cases, a score is required like low, medium or high. The meaning of these scores will be explained below that specific question.
- Each question has an explanation underneath it. In some cases, reference is made to a glossary, which is given as an appendix to this questionnaire.
- The questionnaire contains all (or most) key-aspects of a scheme discussed in our meetings so far. This has resulted in quite a number of questions. In some cases not all answers may be available, not even after a thorough search and interview. Nevertheless, try to be as complete as possible to make a fruitful SWOT-analysis possible. Further, in case that you experience a challenge identifying the information, please clarify if this is because this is "not reflected in the scheme design" or if the information is "not available".
- To create some overview, we have grouped the questions in six parts:
 1. General scheme information
 2. Payment / buyers Information
 3. MRV
 4. Safeguards for the society and the environment
 5. Transparency
 6. Attractiveness for farmers.

⁹ Promising in terms of what can be learnt from the scheme design about certain elements that do or do not contribute to its success in terms of adoption and long term commitment by farmers.



- Some schemes may not appear to be as promising in terms of providing information about opportunities and barriers for scheme design as expected beforehand. In that case, it could be suggested to dig into one of the other schemes in your country.

In case of questions, let us know!
Laura and Bert.

Questionnaire

Part 1 General scheme information

- Is documentation on the scheme available?

Explanation: The more mature schemes will be documented in official documents and on official websites. This makes it easier to refer to in this project. It also makes it easier for farmers and other stakeholders to find information on the scheme as a first step to become involved.

Answer options: 1) Low; 2) Medium; 3) High.

- Does the documentation/contact person give good insight in the scheme's functioning?

Answer options: 1) Low; 2) Medium; 3) High.

- Who is the project holder, project developer or project leader of the scheme?

Explanation: the project holder, project developer or project leader is the person, organisation, company or governmental body that has developed the scheme and put it into practice.

- Are farmers involved in the governance of this scheme, directly or through e.g. a board of stakeholders?

Explanation: It makes a difference for the governance structure of a scheme whether farmers are (co-) owner of at least co-responsible for the design and/or implementation of the scheme.

Answer options: 1) No; 2) as a member of the cooperative that is in charge of the scheme; 3) as a member of the board of a body that is in charge of the scheme; 4) as a shareholder of such a body; 5 other.

- How many farmers participate in the scheme? How many farmers could possibly join in the specific region or country?

Explanation: It makes a difference for the impact of a scheme whether 1% or 90% of the farmers participate in the scheme. Please give absolute numbers and if possible the share of farmers in that specific region or country. In the case of discontinued projects the number in the past is of



interest. In the case of projects that have been implemented for a long time, the total number of farmers that have been involved over the years is of interest besides the current number.

- What is the total area of land involved in the scheme?

Explanation: It makes a difference for the impact of a scheme whether 10 or 10,000 ha of land is involved in the scheme. If possible, make a difference between the total area of land on which measures are applied and the total area of land of the farms involved. In some schemes, only part of the farm area is included in the scheme. If possible, please also add the total area in the region or country involved, so that a share can be calculated.

- Which type of land use does the scheme apply to?

Explanation: Type of land use is mainly arable land or grassland on mineral or on peat soils. A scheme may be applicable on different types. Please, list them all. Agroforestry or afforestation are considered as changes to these major types.

- Which type of impacts in terms of GHG are considered in the scheme?

- C-removal and/or
- Reduced GHG-emissions and/or
- Avoided GHG-emissions?

Explanation: We include these three impacts to get a full picture of key-aspects of different schemes. We focus on C-removal, but especially in peatland areas avoided GHG-emissions are of greater importance. Reduction of GHG-emissions in general is also a way to mitigate climate change, but it is not in the centre of carbon farming.

- Do farms enter a scheme on a field basis or on a farm basis?

Explanation: In case of partial participation of a farm in the scheme there is a risk of leakage in the case that a farmer compensates the measures on the selected fields with contrasting measures on the other fields. P.S. Such a risk may be approached through extending monitoring outside of the number of fields where practices are implemented. A farmer could enter the scheme with 5 out of 10 fields, but the monitoring (for leakage) could cover the 10 fields.

- Are there eligibility criteria in place, e.g. relating to production system, farm size or location?

Explanation: Some schemes may be specifically designed for specific conditions, e.g. small dairy farms on peatland. In that case the applicability of the scheme will be restricted to just a part of the farms in the region or country.

- Is the scheme certified or registered in another official document?

Explanation: A certificate or another official document implies that the scheme has been evaluated by a certain authority, e.g. a certification body. That also implies that most probably a number of



answers on the questions below have already been provided in such a document or an evaluation report. It should e.g. contain information how double-counting is avoided.

- Which measures are available to farmers under the scheme?

Explanation: Measures are e.g. application of compost, waste or fertiliser inputs and (other) off-farm carbon inputs, permanent grassland and rewetting of peatland. Enter 'yes' when at least two different measures are given as an option to fulfil the scheme.

- Is advice available on the practices and the measures applied under the scheme so far?

Explanation: Knowing that some measures may have a higher impact than other measures, information about the actual implementation of the measures in the portfolio can improve adoption.

- Are all farmers under a scheme obliged to take the same measure(s) or can they select one or more measures for their own farms that they prefer most?

Explanation: The attractiveness of a scheme for farmers partly depends on the options that a scheme offers to choose one or more measures that suit him and his farm best. Not all possible measures fit well in the specific conditions of a certain farm or the preferences of a certain farmer.

- Does the scheme offer regional adaptation opportunities?

Explanation: Some schemes may have a local focus, specifically designed for certain, perhaps very specific regional conditions. One should think of e.g. major farming systems, agro-pedo-climatic conditions, average farm size and population density, factors that have an influence on (the effects) of carbon farming and need to be specifically addressed in the scheme design. Regional schemes may not be easily adapted to other regions. On the other hand, broader schemes (in terms of geographical spread) may be too general for certain specific regional conditions, making adoption in such regions more or less infeasible. Ideally, a scheme should offer opportunities for both wider and more specific regions. After the design is accepted, it should stay equal for a long period, to avoid uncertainty among farmers.

- What is the total duration of the contracts/commitment in this scheme?

Explanation: The longer the duration of the project, the higher the impact of the scheme probably will be, all other conditions being similar. Sometimes a scheme starts as a project for 5 years, but then it is repeated several times. We are interested in the total duration over perhaps different repetitions. P.S. Sometimes the monitoring continues after the project has ended. E.g. Soil Capital works with a buffer pool of 20%; these certificates are released after yr +10 yrs. In this period, the monitoring continues (less strict).

- What is the expected carbon removal (or climate mitigation effect) of the project over this period?



Explanation: When a scheme is certified, it may be expected that an estimation of the foreseen effect has been made, both per ha per year, in total per year and in total per ha and over the full area included over the total project period. If possible, collect all four indicators. In case a scheme is not yet certified but is still in the design or pilot phase, most probably some kind of estimation may be available for the interest of potential participants. A complicating factor may be that the number of participants changes of time, so that it will not be easy to estimate the total project result over a number of years in the future.

Answer options: 1) ... ton CO₂-eq per ha per year; 2) ... ton CO₂-eq in total per year; 3) ... ton CO₂-eq per ha over the full project duration; 4) ... ton CO₂-eq in total over the full project duration.

Part 2 Payment / buyers Information

- Is the scheme conforming to an internationally approved standard, allowing it to sell carbon credits?

Explanation: This question is closely linked to the question above, about having a certificate or another official document. The addition here is that the certification or registration has been carried out in such a way that payments through selling carbon credits are made possible.

- Are payments to farmers made, by whom and which amounts per ha or per ton CO₂-equivalent?

Explanation: Depending on the payment model (public, private or a combination), payments may come from governments (e.g. through CAP-regulations), from private funders (carbon credits) or a combination.

- Are there opportunities for trading carbon farming outcomes across sectors or national borders?

Explanation: Does the scheme include regulations about trading the contribution to 'Paris' to other sectors or even other MS? There should at least be a paragraph on the risks of such trading opportunities.

Answer options: 1) No; 2) Yes, across sectors; 3) Yes, across borders; 4) Yes, across sectors and borders.

- What is the cost-benefit ratio of carbon farming for participating farmers?

Explanation: An important aspect for farmers to adopt a scheme is whether the payments contribute to their income, i.e. outweigh the cost of the measures and other cost involved like the MRV-cost in the case they have to pay these themselves.

Answer options: 1) ratio < 1.0 (when the payments outweigh the cost); 2) ratio >= 1.0 (when the cost outweigh or are equal to the payments).

- In the case that carbon credits apply, what share of these carbon credits are paid to farmers?



Explanation: This question is more or less similar to the earlier one, in this case focusing on a system with carbon credits. Part of these credits may be used as an entry fee, for MRV, certification, marketing, etc. A relatively low share (below e.g. 90%) shows that a relatively large proportion of the payments by private funders is used to pay other cost instead of the activities and their results.

- Does the scheme or other documents, e.g. a research report, give information on the cost-effectiveness for the EU and/or the member state (MS)?

Explanation: This question is only relevant for a scheme that is linked to EU and/or national policies and payments. The question is about the budget that governments pay for 1 ton of CO₂ sequestered. Ideally, this would make a comparison of cost prices of carbon farming among the schemes selected possible.

- Does the scheme give information on the cost-effectiveness for private or public funders?

Explanation: This question is only relevant for a scheme that is linked to private funders, e.g. through a system of carbon credits or with payments in a supply chain. The question is about the budget that private parties pay for 1 ton of CO₂eq. taken-up or avoided. Ideally, this would make a comparison of cost prices of carbon farming among the schemes selected possible. N.B.1. The background of this question is whether in the future companies might be interested in the purchase of carbon credits or rewarding carbon farming in a supply chain as an alternative for the purchase of CO₂-rights at the ETS-market. N.B.2. A public party can also be a municipality, i.e. when they pay farmers for carbon farming through carbon credits, not as a compensation regulation through national or EU-policies.

Answer options: 1) Yes, for private funders; 2) Yes, for public funders; 3) Yes, for both private and public funders; 4) No, not for either group.

Part 3 MRV

- Is the scheme action or result-based or hybrid?

Explanation: see definitions in glossary.

- Has the project methodology (incl. calculation methods) been validated by an official bureau or institute?

Explanation: Part of a certification procedure will most probably be that the estimation or calculation procedure e.g. the model used, has been evaluated by an independent authority¹⁰.

- Is the certification system science-based?

¹⁰ E.g. In the Netherlands, a bureau called 'Stichting Nationale Koolstofmarkt' ('Foundation National Carbon market') does this type of evaluation.



Explanation: In order to compare certification systems over different schemes and countries, a pre-condition is that the systems are science-based.

- Is the effect of the scheme measured through soil sampling?

Explanation: Some schemes have been put into practice during only a limited number of years. Thus, MRV-results may not yet be available. Nevertheless, we would like to know whether measurements are carried out and with which frequency and intensity (how many samples per ha).

- Are MRV-results available?

Explanation: See Glossary for an explanation on MRV. Does the scheme have documentation on the broader MRV strategy? (Soil samples, modelling, how are these reported, can the sampling protocol be verified by a third party afterwards? How does the lab analysis occur, etc.)

- Is information available on the cost of MRV? Who pays these?

Explanation: The cost of MRV can be relatively high compared to the payments for the measures.

Part 4 Safeguards for the society and the environment

- How robust is the scheme?

Explanation: Robustness evaluates the integrity and methodological robustness of project outcome quantification (according to the second definition in the Glossary). See the glossary to decide whether the answer should be 'low', 'medium' or 'high'.

- Is additionality or the lack thereof addressed by the scheme? And if yes, how?

Explanation: See the definition in the Glossary. This aspect also deals with the question what level of practices is considered as the baseline for the project. Additionality means e.g. that the measures that a farmer takes, are additional to what is usually done in his farming system. That can be different for different regions or countries.

- Is the scheme meant for in- or off-setting and if the C figure is included in national inventory reports?

Explanation: In-setting means that carbon farming activities count as a contribution of the agricultural sector to the goals of the Paris Agreement. Off-setting means that sectors outside agriculture 'buy' these results for the satisfaction of their sector goals, leaving agriculture without contribution to those goals. The question is whether this issue is addressed in the scheme in such a way that the agricultural sector is not only compensated for the cost of carbon farming but also can show their contribution to the national and EU-goals for climate mitigation.



- Does the scheme hold information on synergy or contradictions with other (EU or national) regulations and/or ecosystem services (ESS)? If so, on which themes?

Explanation: Carbon farming may also lead to improved soil quality. In that case there is synergy between the scheme itself and national or EU Soil Policies. Carbon farming can also lead to an increase of biodiversity, one of the most 'popular' ESS at the moment besides climate mitigation. On the other hand, application amounts of compost may be limited to e.g. manure legislation, which was the case in a pilot in the Netherlands.

Answer options: 1) There is no synergy or contradiction; 2) There is synergy, namely on the theme(s) of ...; 3) There is a contradiction with the theme(s) of ...; 4) There are both synergies and contradictions (In that case, fill in the theme(s) under options 3 and 4.

- Does the scheme include take trade-off risks into account, like N₂O- and nitrate emissions?

Explanation: Official evaluations will pay attention to such risks and perhaps include these in the estimations of the total effect of the project. Very promising measures may become less acceptable when such risks are taken into account. Removal of carbon from the air and sequestering it to the soil or reduction of C (e.g. from peat soils) may not be sufficient. When a measure leads to C-removal or reduced C-emission but at the same time to more N₂O-emission, then the balance between both is important. It is even better to avoid all GHG-emissions besides C-removal or reduced C-emissions.

Answer options: 1) No; 2) Yes, limited information; 3) Yes, detailed information

- Is the risk of leakage considered in the scheme design?

Explanation: According to the definition in the Glossary, this aspect deals with emissions/removals that occur outside the project boundary. The project boundary may be the fields that participate in the scheme in case not all fields of a farm are included, or the farm as a whole, or a co-operative of farmers working together in a scheme. See also the explanation under 'Do farms enter with some or with all fields at their farm?' An example is that the application of compost may take long transportation distances, partly reducing the effect of the measures taken on the fields of the participating farms. N.B. we do not exclude production shifts or international leakage or restrict this to import of organic amendments.

Answer options: 1) No; 2) Yes; If 'yes', then how?

- Does the scheme take into account aspects of fairness and a level playing field for farmers under the same scheme and taking the same measures?

Explanation: Fairness deals with payments for stocks versus fluxes. Do farmers with similar baselines, conditions and measures receive the same compensation? How are good performers (with high C-stocks due to management) incorporated in the scheme and how are poor performers (with low C-stocks due to management) prevented from being rewarded? Such questions could also be asked when comparing fairness between MS, but that can only be done for schemes complying with international standards or international scheme organizers. We do not go into detail comparing payment values or cost-benefit ratios for different regions.



Answer options: 1) Yes, on fairness; 2) Yes, on level playing field; 3) Yes, on both fairness and level playing field; 4) no, on either.

- What will happen with the carbon stored or emission avoided after the end of the ‘official’ commitment period? Have arrangements been made to avoid loss of permanence?

Explanation: It is not effective when the effect of the measures applied during the project duration will be lost afterwards (a loss of 'loss of permanence'). Does the scheme include regulations or agreements to avoid such an effect?

Part 5 Transparency

- In the case of a value chain scheme: Is there transparency about the scheme, specifically how many farmers are involved?

Explanation: Lack of publicly available agreements in a scheme between farmer and company may hinder the credibility of that scheme.

- In the case of a value chain scheme: Is there transparency about the scheme, specifically whether MRV-data of are publicly available or being kept between farmer and company?
- In the case of a value chain scheme: Is there transparency about the scheme, specifically about the administrative and MRV-cost?
- In the case of a result-based or hybrid scheme, does the scheme give information about the risk of not reaching initial goals of scheme and how to deal with that?

Answer options: 1) No; 2) Yes, through an insurance facility; 3) Yes, in a different way.

Part 6 Attractiveness for farmers

- How is the scheme made attractive for farmers?

Explanation: This question deals with the full design of the scheme including a good cost-benefit ratio, a low administrative burden, feasible measures, opportunities for farmers to estimate their contribution with relatively simple calculations or a decision support tool. Finally, attractiveness is expressed in adoption and long-term commitment by farmers. Long-term commitment means that farmers commit themselves for a period of at least ten years to the scheme and take care of restoring the results afterwards.

- How is the scheme made attractive for policy makers?



Explanation: This question deals with the full design of the scheme including a good cost-benefit ratio for public funds, a low administrative burden, a large impact expected and synergy with other policy or ESS-frameworks. This type of attractiveness may be expressed in terms of governmental support for the scheme and synergy with other (EU or national) policies.

- How is the scheme made attractive for private and public funders?

Explanation: This question deals with the full design of the scheme including a good cost-benefit ratio for the private or public funder, a low administrative burden and a good contribution to his image in the public domain. This type of attractiveness may be expressed in terms of a high interest to be involved in the scheme, leading to a high impact financed.

- In the case of a failing scheme, what are the major impediments and drawbacks with this scheme which cause severe, medium or mild unattractiveness?

Appendix 1.1 Glossary of terms in the questionnaire of carbon farming schemes

Carbon farming

Carbon farming means applying agricultural measures that are proven to increase the amount of soil carbon in soil, or specific measures to decrease in GHG emissions, e.g. caused by oxidation in peatlands. The agricultural measures applied with carbon farming need to be additional to the basic requirements for soil management such as specified in the GAEC.

Carbon Farming Scheme

A Carbon Farming Scheme is any voluntary agreement in which a farmer or a group of farmers commit themselves to apply carbon farming measures to get a positive balance between soil carbon accumulation and GHG emissions (possibly measured as CO₂ equivalents) in return for a payment or compensation in any form.

Action-based carbon farming scheme

An action-based carbon farming scheme is a scheme where the farmer or landowner receives a payment for implementing defined carbon farming measures, independently of the resulting impact of those measures.

Result-based carbon farming scheme

A result-based carbon farming scheme is a scheme where the farmer or landowner receives a payment for reducing net GHG fluxes from their land, whether that is by reducing their GHG emissions or by sequestering and storing carbon in soil. A result-based approach requires a direct and explicit link between results delivered and payments. The measurable result is the balance between reduction of GHG emissions and carbon sequestered.



Hybrid carbon farming scheme

A hybrid carbon farming scheme is a scheme in which part of the payment is a reward for the carbon farming measures applied and the remainder is only paid when the results of these measures is as positive as agreed beforehand.

Carbon Farming Measures

Carbon Farming measures are specific decisions and/or changes in management practices taken to sequester carbon in the soil or reduce CO₂-emissions from the soil. Therefore, measures can either include something new (adding extra manure) or exclude action (and abandon something) or modify an action (more precise, change intensity, frequency, or timing). Examples can be the application of biochar or (extra) manure, keeping grassland permanent i.e. un-ploughed, growing catch and cover crops, afforestation, and mulching.

Payment models

Payments for carbon farming can come from private partners (including airports, processors, retailers and private persons) and from public partners (the EU, national and local governments) or a mix of these types. Public sources can also include subsidies and basic flat rates that farmers receive on the condition that they comply with certain regulations, e.g. applying catch and cover crops.

Additionality

Additionality refers to what extent the carbon farming project increases carbon removals and/or carbon reductions beyond what would have occurred in the baseline, i.e. in the absence of the project. Additionality implies that the removals/reductions were caused by the carbon farming measures.

Baseline

A counterfactual against which the impact of a carbon farming project is compared, i.e., the baseline describes the carbon removals and carbon reductions that would have occurred in absence of the carbon farming project. The baseline can be a quantitative number (e.g., in terms of t CO₂-e) or can refer to a scenario (i.e., a hypothetical reference case that best represents the conditions most likely to occur in the absence of a proposed carbon farming project).

Carbon removals

Carbon removals occur when all the GHG emissions are being offset by carbon accumulation and soil carbon accumulation is significantly high compared to a baseline, therefore, it can be concluded that the system is removing carbon from the atmosphere in locking into the soil.

Carbon reductions

Carbon reductions occur when the balance between GHG emissions and soil carbon accumulation is positive compared to a baseline, but there are still some emissions that are not being offset and therefore the system is still a source of carbon rather than a sink.



Leakage

The net change of anthropogenic emissions/removals that occur outside the project boundary. If leakage occurs, the overall mitigation impact of the project is reduced; if this is not considered in net quantification of removals, these removals will not all be additional.

Monitoring, Reporting, and Verification (MRV)

To ensure that carbon farming actions have a real and positive impact on the climate, one needs to be able to measure them and be confident that they are occurring. This is achieved through monitoring, reporting, and verification: monitoring refers to measuring the decrease in emissions or the increase in sequestration; reporting to the processes for communicating these results; and verification to the ability of administrators or other external parties to ensure the truthfulness and accuracy of the results (McDonald *et al.*, 2021).

Permanence

Refers to the longevity of the storage of removals as a result of carbon farming measures.

System boundary**Robustness**

1- Based on (McDonald *et al.*, 2021).

Robust MRV is essential to ensure that GHG mitigation and carbon removals have environmental integrity and are real, additional, measurable, permanent, and avoid carbon leakage and double counting.

While robust MRV is essential, it also poses a major challenge as it can be expensive to accurately measure and validate the GHG impact of carbon farming, resulting in a trade-off between MRV accuracy and cost. High MRV costs (financial or time) decrease the net-benefit of carbon farming and can act as a significant barrier to farmers voluntarily implementing carbon farming actions or to administrators establishing policies.

The monitoring part of MRV poses a particular challenge for carbon farming. Monitoring can be achieved by direct measurement, modelling, or combined modelling/measurement approaches, each of which has different strengths and weaknesses:

- Direct measurement: on-site measurement of carbon stored e.g., in trees or soil and of GHG gases emitted. Direct measurement can monitor GHG impacts with considerable accuracy but can be prohibitively expensive.
- Modelling: GHG emissions and removals are estimated based on a combination of measurable proxy data and already-known scientific relationships. Modelling requires previous scientific research to establish relationships between proxies and estimated emissions/sequestration. Modelling has higher uncertainty than direct measurement but lower costs.

2- Based on (Zelikova *et al.*, 2021)



Robustness evaluates the integrity and methodological robustness of soil carbon quantification.

High: The scheme uses empirical crediting based directly on soil sampling and overall quality of both sampling and modelling is as high as possible.

Medium: The scheme relies on modelling for crediting, models are calibrated or parameterized with samples, and overall quality of both sampling and modelling is as high as possible. Alternatively, the scheme uses empirical crediting based directly on soil sampling, and overall quality of sampling is adequate.

Low: The scheme relies on modelling for crediting, and either does not use sampling or has only weak or adequate sampling. Alternatively, protocol uses empirical crediting but with weak sampling.¹¹

CO₂ equivalent

A carbon dioxide equivalent or CO₂ equivalent, abbreviated as CO₂-eq is a metric measure used to compare the emissions from various greenhouse gases on the basis of their global-warming potential, by converting amounts of other gases to the equivalent amount of carbon dioxide with the same global warming potential (Eurostat;

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Zelikova J, Chay F, Freeman J (2021) A buyer's guide to soil carbon offsets. carbon) plan, July, **15**.

¹¹Use of emission factors based on long term field experiments is another option.



Appendix 2 Additional figures from the first inventory (chapter 3)

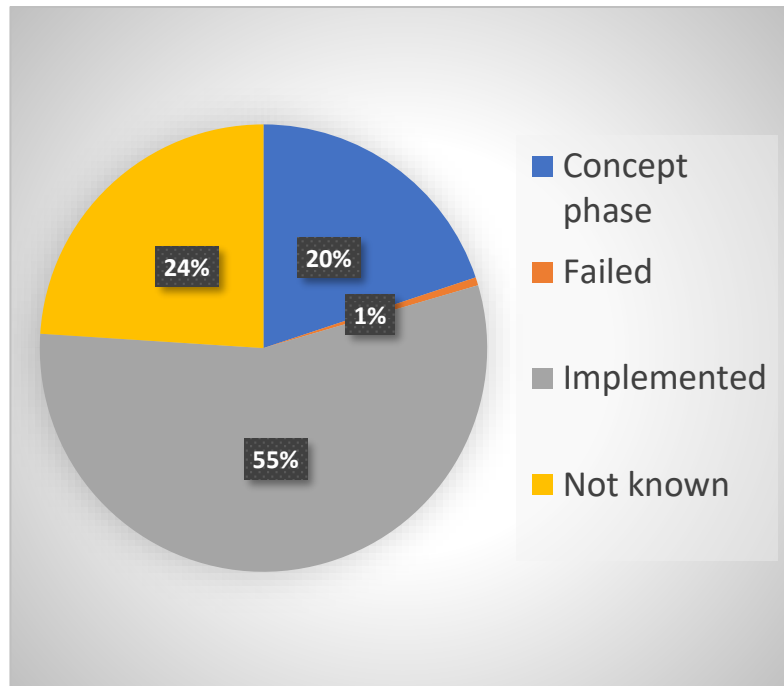


Figure B2.1 Distribution of the schemes in the first inventory over different stages of implementation (n = 162).

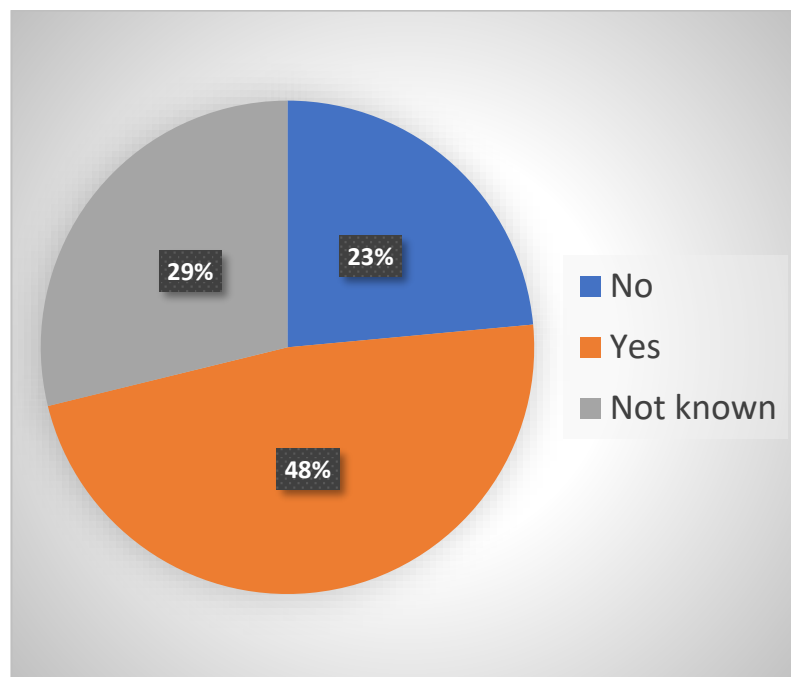


Figure B2.2 Distribution of the schemes in the first inventory over schemes with or without a certain type of legal status (n = 162).

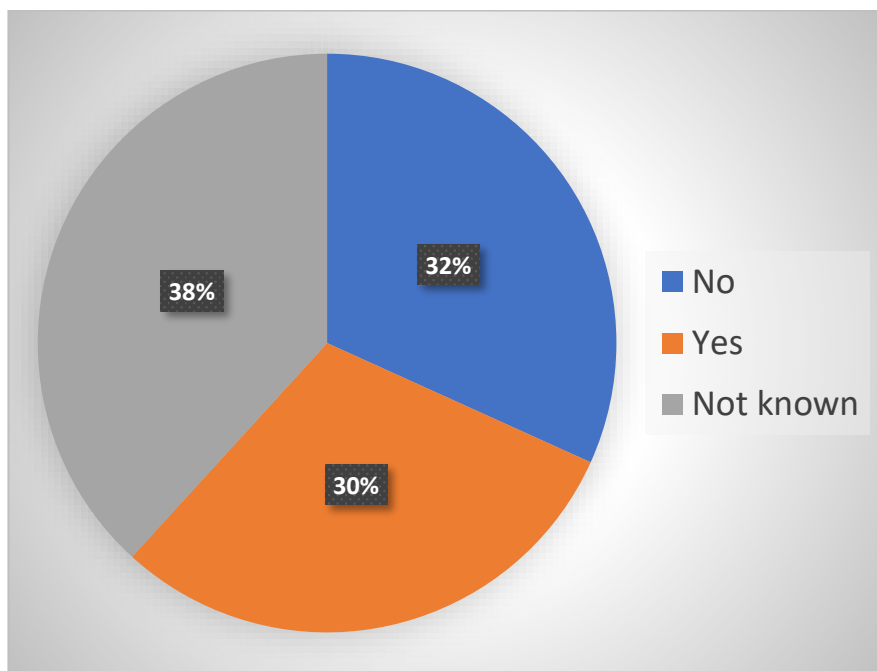


Figure B2.3 Distribution of the schemes in the first inventory with and without multiple focused (n = 162).



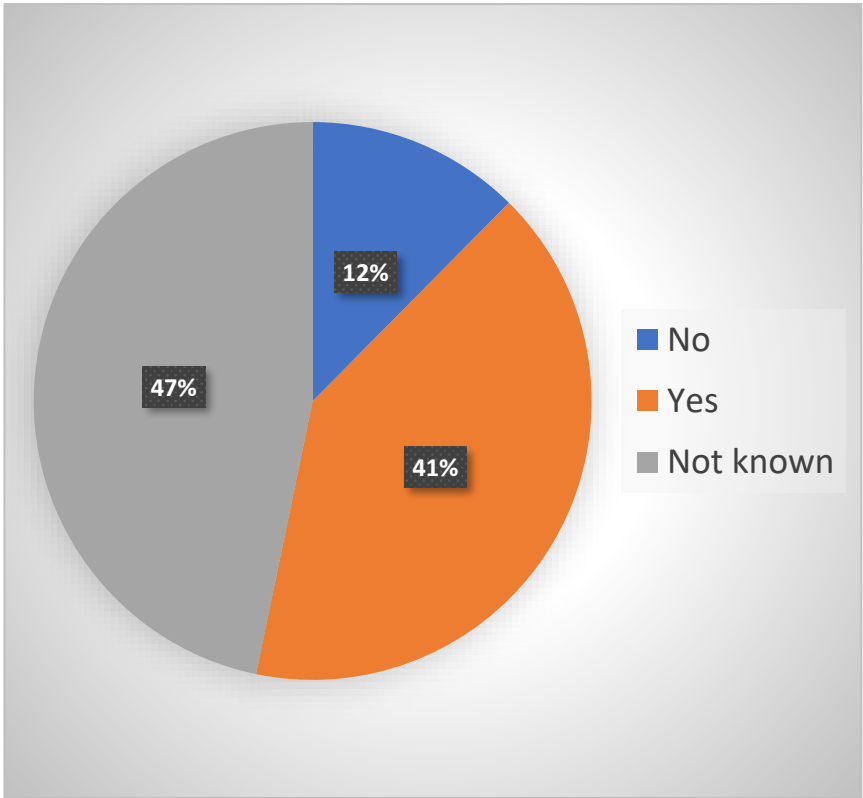


Figure B2.4 Distribution of the schemes in the first inventory over the presence or absence of co-benefits (n = 162).



Appendix 3 Description of schemes in Turkey

So far, Turkey has no real carbon farming schemes. However, as an EJP Soil Partner, Turkey wants to develop such schemes and learn from this project. This chapter contains a description of the Turkish schemes in the inventory, but none of them had an MRV system.

Organic Farming Scheme: Apart from MRV, it is a well-established certification body system in organic farming practices in Turkey. It provides transparency, traceability and safeguards for the society and the environment. Additionally, the Ministry of Agriculture and Forestry provides information concerning buyers, payments and farmers involved in organic farming scheme. All organic farmers and producers are registered and all related data is recorded by the Ministry of Agriculture and Forestry. Subsidies have a significant role for farmers to get attracted to organic practices.

Good Agricultural Practices Scheme: This scheme includes a certified and third party control system as in organic farming. But they do not provide safeguards for the society and the environment as Organic Farming does. It provides transparency and adequate buyer, payment and farmer information. Subsidies have a significant role for farmers to get attracted to such practices. In this scheme, all farmers and producers are registered and all related data is recorded by the Ministry of Agriculture and Forestry.

Forage Crops Scheme: It is not a large scale scheme and it does not have a certification by a third party nor any control mechanism. It provides transparency, adequate buyer, payment and farmer information. Payment support is provided for farmers by the Ministry of Agriculture and Forestry.

If the ÇATAK scheme had been implemented in a systematic way, it could have been a sustainable one and provided the traceability. To conclude, it does not provide any certification, payment information, legislation and as a result any transparency. However, according to our discussions with farmers involved in the scheme we came to know that from farmers' side the scheme was attractive enough and they wanted the scheme to stay implemented. When it ended, they regretted this to a large extent.

No-till Scheme: Due to the fact that it does not provide any certification, transparency and control mechanism, it poses serious challenges for farmers; they have to work harder and keep their ambitions alive consequently put much effort for the sustainability of the scheme. It provides safeguards for the society and the environment.



Appendix 4 Table B4.1 Comparison of classes in the top 23 with the second inventory

| Category | Group | 2nd inventory (%) [1] | Score >= 2.0 (%) [1] | 2nd inventory (%) [2] | Score >= 2.0 (%) [2] |
|--------------------------|---------|-----------------------|----------------------|-----------------------|----------------------|
| Payment model | Private | 45.2 | 52.2 | 51.4 | 60.0 |
| | Mixed | 11.9 | 17.4 | 13.5 | 20.0 |
| | Public | 31.0 | 17.4 | 35.1 | 20.0 |
| Multiple focus | No | 33.3 | 39.1 | 45.2 | 47.4 |
| | Yes | 39.5 | 43.5 | 54.8 | 52.6 |
| Type | Action | 57.1 | 39.1 | 58.5 | 39.1 |
| | Hybrid | 19.1 | 21.7 | 19.5 | 21.7 |
| | Result | 21.4 | 39.1 | 22.0 | 39.1 |
| Documentation | Low | 14.3 | 0.0 | 15.0 | 0.0 |
| | Medium | 31.0 | 39.1 | 33.0 | 39.1 |
| | High | 50.0 | 60.9 | 52.5 | 60.9 |
| Standard | No | 50.0 | 56.5 | 61.8 | 59.1 |
| | Not yet | 2.4 | 4.4 | 2.9 | 4.6 |
| | Yes | 28.6 | 34.8 | 35.3 | 36.4 |
| Soil sampling | No | 31.0 | 52.2 | 44.8 | 54.6 |
| | Yes | 38.1 | 43.5 | 55.12 | 45.5 |
| Trade off | No | 35.7 | 43.5 | 53.6 | 47.6 |
| | Yes | 33.0 | 47.8 | 46.4 | 52.4 |
| Leakage | No | 42.9 | 60.9 | 75.0 | 70.0 |
| | Yes | 14.3 | 26.1 | 25.0 | 30.0 |
| Attractive farmers | No | 9.5 | 13.0 | 13.8 | 15.0 |
| | Medium | 26.2 | 26.1 | 37.9 | 30.0 |
| | Yes | 33.3 | 47.8 | 48.3 | 55.0 |
| Attractive policy makers | No | 7.1 | 4.4 | 11.1 | 5.9 |
| | Medium | 14.3 | 17.4 | 22.2 | 23.5 |
| | Yes | 42.9 | 52.2 | 66.7 | 70.6 |
| Attractive funders | No | 4.8 | 4.4 | 7.7 | 6.3 |
| | Medium | 11.9 | 13.0 | 19.2 | 18.8 |
| | Yes | 45.2 | 52.2 | 73.1 | 75.0 |

[1] NAs are included in the total, [2] NAs are excluded from the total.

