

## **Policy analysis:**

# **Promoting SICS adoption in Baden-Württemberg, Germany**

Authors: Alicia McNeill, Melanie Muro, Tugce Tugran, Zuzana Lukacova, Milieu and Moritz Hallama, Paula Mayer-Gruner, Carola Pekrun, Ellen Kandeler, University Hohenheim

Report number: **18**

Deliverable: **-**

Report type: **Scientific Report**

Issue date: **10/02/2021**

Project partner: **Milieu**

Version: **1.0**





<b>DOCUMENT SUMMARY</b>	
<b>Project Information</b>	
Project Title:	Soil Care for profitable and sustainable crop production in Europe
Project Acronym:	SoilCare
Call Identifier:	H2020-SFS-2015-2b
Grant agreement no.:	677407
Starting Date:	01.03.2016
End Date:	28.02.2021
Project duration	60 months
Web-Site address:	<a href="http://www.soilcare-project.eu">www.soilcare-project.eu</a>
Project coordinator:	Wageningen Environmental Research (WEnR)
EU project representative & coordinator of the project:	Dr. Rudi Hessel - ( <a href="mailto:rudi.hessel@wur.nl">rudi.hessel@wur.nl</a> ) +31 317 486 530
Project manager(s):	Erik van den Elsen ( <a href="mailto:erik.vandenelsen@wur.nl">erik.vandenelsen@wur.nl</a> ), Simone Verzandvoort ( <a href="mailto:simone.verzandvoort@wur.nl">simone.verzandvoort@wur.nl</a> ), Falentijn Assinck ( <a href="mailto:falentijn.assinck@wur.nl">falentijn.assinck@wur.nl</a> )
<b>Report Information</b>	
Report Title:	Policy analysis: Promoting SICS adoption in Baden-Württemberg, Germany
Principle Author(s):	Alicia McNeill, Melanie Muro, Tugce Tugran, Zuzana Lukacova, Milieu and Moritz Hallama, Paula Mayer-Gruner, Carola Pekrun, Ellen Kandeler, University Hohenheim
Principle Author e-mail:	<a href="mailto:melanie.muro@milieu.be">melanie.muro@milieu.be</a>
Deliverable Number:	-
Work Package:	WP7
WP Leader:	Milieu
Nature:	PU
Dissemination:	Document
Editor (s):	-
E-Mail(s):	-
Telephone Number(s):	-
Report Due Date	-
Report publish date:	10-02-2021
Copyright	©2021 the SoilCare project and Partners Copyright notice and disclaimer: <a href="http://tinyurl.com/soilcare-disclaimer">http://tinyurl.com/soilcare-disclaimer</a>

No.	Participant organisation name	Abbreviation	Country
1	Wageningen Environmental Research	WEnR	Netherlands
2	University of Newcastle upon Tyne	UNEW	United Kingdom
3	Katholieke Universiteit Leuven	KUL	Belgium
4	University of Gloucestershire	UoG	United Kingdom
5	University Hohenheim	UH	Germany
6	Research Institute for Knowledge Systems	RIKS	Netherlands
7	Technical University of Crete	TUC	Greece
8	Joint Research Centre	JRC	Italy
9	University of Bern	UNIBE	Switzerland
10	Milieu LTD	MLTD	Belgium
11	Norwegian Institute of Bioeconomy Research	NIBIO	Norway
12	Bodemkundige Dienst van België	BDB	Belgium
13	Aarhus University	AU	Denmark
14	Game & Wildlife Conservation Trust	GWCT	United Kingdom
15	Teagasc	TEAGASC	Ireland
16	Soil Cares Research	SCR	Netherlands
17	Instituto Politecnico De Coimbra	IPC/ESAC	Spain
18	National Research and Development Institute for Soil Science, Agrochemistry and Environmental Protection	ICPA	Romania
19	University of Padova	UNIPD	Italy
20	Institute of Agrophysics of the Polish Academy of	IAPAN	Poland
21	Wageningen University	WU	Netherlands
22	University of Pannonia	UP	Hungary
23	Swedish University of Agricultural Sciences	SLU	Sweden
24	Agro Intelligence Aps.	AI	Denmark
25	Crop Research Institute	VURV	Czech Republic
26	University of Almeria	UAL	Spain
27	Fédération Régionale des Agrobiologistes de Bretagne	FRAB	France
28	Scienceview Media BV	SVM	Netherlands

## Contents

Executive summary .....	2
1 Introduction.....	6
2 Analysis of policy shortcomings and opportunities in Baden-Württemberg.....	11
2.1 Which existing policies and policy instruments shape agricultural practices in Baden-Württemberg?.....	12
2.2 To what extent do existing policies facilitate adoption of soil-improving practices in Baden-Württemberg?.....	17
2.3 Which factors shape success or failure of policy instruments in Baden-Württemberg?.....	19
3 Recommendations for actions to promote the uptake of SICS.....	22
Annex: Overview of key policies in Taschenhausen, DE .....	24

## Tables

Table 1: Coverage of SICS in existing national and regional policies, instruments and measures in the German state of Baden-Württemberg.....	2
Table 2: Adoption barriers, enablers, and actions to increase uptake of the SICS tested at study site identified by stakeholders.....	4
Table 3: List of promising general SICS.....	6
Table 4: Summary of policy approaches .....	7
Table 5: Description of the study site.....	11
Table 6: Overview of experiments carried out in the German study site, and the SICS category and cluster under which they are grouped .....	12
Table 7: Coverage of SICS in existing national and regional policies, instruments and measures in Baden-Württemberg, Germany .....	18
Table 8: SICS being tested, adoption factors (enablers + or barriers -) and actions to overcome barriers and support enablers.....	22

## Figures

Figure 1: Research strategy .....	9
Figure 2: Types of stakeholders participating in the German adoption workshop.....	11



Policy	Crop rotation	Green manures, cover crops, catch crops	Integrated nutrient management	Enhanced efficiency irrigation	Controlled drainage	Reduced tillage	Integrated pest management	Smart weed control	Smart residue management	Controlled traffic management	Integrated landscape management
2014-2010)											
Act on Nature Protection, Landscape Management and Recreation Baden-Württemberg ( <i>Landesnatorschutzgesetz Baden-Württemberg</i> )											
Water Act Baden-Württemberg ( <i>Wassergesetz für Baden-Württemberg</i> )											
Teilbearbeitungsgebiet 41 - Neckar unterhalb Starzel oberhalb Fils, Bearbeitungsgebiet Neckar, FGE Rhein, Baden-Wuerttemberg ( <i>Management plan sub-catchment 41 - Neckar below Starzel and above Fils (RBD Rhine, Neckar catchment, Baden-Wuerttemberg)</i> )											
Förderprogramm für Agrarumwelt, Klimaschutz und Tierwohl (FAKT) ( <i>Funding Program for Agronomic Environment, Climate Protection and Animal Welfare</i> )											
Verwaltungsvorschrift zur Förderung landwirtschaftlicher Betriebe in Berggebieten und in bestimmten benachteiligten Gebieten ( <i>Compensation for agriculture in disadvantaged location</i> )											
Verordnung über Schutzbestimmungen und die Gewährung von Ausgleichsleistungen in Wasser- und Quellenschutzgebieten (SchALVO) ( <i>Ordinance on safeguards and compensation in water and spring protection zones</i> )											
Landesbodenschutzgesetz ( <i>Soil Protection Act Baden-Wuerttemberg</i> )											
Erosionsschutzverordnung Baden-Württemberg ( <i>Erosion Protection Ordinance Baden-Wuerttemberg</i> )											

Evidence gathered through interviews, desk research and a stakeholder workshop shows that different contextual factors contribute to and undermine the uptake of SICS in general, and of the practices tested in the study site in particular. Some of the findings suggest that the uptake of SICSs is improving. On the other hand, barriers to the uptake of these practices remain.

The key factors shaping the success of policy instruments include:

- Lack of adequate financial incentive
- Influence of and information sharing within farmer communities and networks
- Strength and consistency of the regulatory framework

The table below provides an overview of barriers and enablers for the SICS tested at the study site and which were identified by stakeholders during the adoption workshop.

Table 2: Adoption barriers, enablers, and actions to increase uptake of the SICS tested at study site identified by stakeholders: Due to time limitations, some of the workshops only addressed a subset of SICS tested in the respective study site. Participants were asked to identify actions for the most important factors affecting SICS adoption; therefore, not all adoption factors were discussed in detail. To assess the effectiveness and feasibility of an action, a scale from 1 (not at all effective/feasible) to 4 (highly effective/feasible) was used.

<b>Cover crops</b>			
<b>Adoption factors (+ or -)</b>	<b>Actions</b>	<b>Effectiveness</b>	<b>Feasibility</b>
Reduced need for fertilisers (+)	<i>None identified</i>	--	--
Insufficient knowledge of farmers a problem	Establishment of network of model farms that demonstrate regional adaptation of SICS	4	4
	Dissemination of practice examples from research	2	4
Biodiversity enhancement; sustainable technique (+)	Highlighting of ecological aspects through effective dissemination of research results	4	2
Cost for seeds (-)	Reward environmental benefits through subsidies	4	2
Crop rotation management is complicated e.g., establishment and timing of tillage must be precisely matched (-)	Integrate soil protection more strongly into vocational training 4	3	4
	Use network of model farms (see above)	4	4
<b>Reduced/no tillage</b>			
<b>Adoption factors (+ or -)</b>	<b>Actions</b>	<b>Effectiveness</b>	<b>Feasibility</b>
Reduced fuel consumption, reduced workload (+)	Promote benefit to farmer's work-life-balance	--	--
Heavy soils can be cultivated (+)	<i>None identified</i>	--	--
Decreased erosion (+)	Reward environmental benefits achieved through direct seeding (e.g., reduced run-off), option to increase prices for sustainably produced products	4	2
Societal demand for sustainable products (+)	Educate society to appreciate the social value of climate, soil, and water body conservation (as a precondition for willingness to pay higher process)	3	1
Field demonstrations (+)	Establish network of model farms (see above)	4	4
	Effective dissemination of practice examples from research	2	4
Possibly lower yields, increased need for pesticides/new machines (-)	Establish mechanism for machine exchange	4	4
	Provision of grants	4	2
Crop rotation management is complicated (-)	Use network of model farms to share experiences	4	4
Application of practice on stony soils (-)	Facilitate exchange of experiences through network of model farms (see above)	4	4
"It looks wild"; pest management not possible without chemical plant protection (-)	Fund research on direct seeding vs no glyphosate	--	--
Impact of market forces, particularly on glyphosate debate	Limiting the influence of lobby groups on policymaking	4	2
Promotion of organic farming with derogations from the ploughing ban (-)	Provision of financial measures to counter economic pressure from the world market	4	1
	Reward environmental benefits achieved through direct seeding (reduced run-off, sustainable agriculture),	4	3
	Effective dissemination of practice examples from research	4	3

### Recommendations for actions to promote the uptake of SICS

Based on this analysis, and feedback collected from stakeholder, the following recommendations were formulated:

- **Establish mechanisms for information sharing between farmers:** Some of the practices benefitting soil will require farmers to learn about these techniques, their application to different conditions as well as their benefits. Since farmers tend to place a lot of trust in their peers, establishing a network of model farms demonstrating how to use and adapt different SICS in the region would effectively support farmers in learning and sharing experiences about these practices.
- **Subsidise transition to practices benefitting soil health:** The uptake of certain SICS might require upfront investments, such as the purchasing of new machinery. Grants should be made available to farmers buying new equipment to implement these practices or groups of farmers intending to set up a 'machinery exchange'. Such an exchange could also be set up and managed by the regional/local farm advisory services or municipalities.
- **Make soil health a stronger component of vocational training and continued education of farmers:** The move from conventional practices to SICS and sustainable agricultural practices requires a shift in attitudes as well as knowledge. Soil, as the main medium on which food and feed are grown, should feature highly on the curriculum for farmer training, be it basic vocational or continued adult learning.
- **Reward environmental benefits generated by SICS and talk about it:** market forces need to be counterweight with subsidies rewarding the environmental benefits generated through the SICS to make their uptake more appealing to farmers. It will be equally important to continue to educate consumers about the advantages and disadvantages of conventional farming practices vs. sustainable practices to ensure increased demand for sustainably produced products and encourage the retail sector to make these more widely available to all sections of society.
- **Design more cohesive policies and effective enforcement mechanisms:** policies have great potential to shape practices, especially for large-scale farms. However, in order to achieve real impact, their implementation needs to be monitored more effectively and consistently. Furthermore, an improved synergy between different policies are considered important factors for future success.

## 1 Introduction

Soil is increasingly recognised as a crucial resource providing products such as feed, fibre, food and fuel as well as critical ecosystem services including water storage, filtration, and carbon sequestration. Soil offers a habitat for billions of organisms and is the foundation for our cities and towns. Despite its recognised importance in sustaining ecosystems functions, human life and economic activities, soil is being over-exploited, degraded and irreversibly lost due to inappropriate land management practices, industrial activities and land use changes that lead to soil sealing, contamination, erosion, and loss of organic carbon.

Agriculture occupies a substantial proportion of European land and consequently contributes significantly to various forms of degradation. The uptake of innovations associated with potential benefits to soil quality, such as precision farming and conservation agriculture is slowly expanding across Europe. However, these are often not adopted to their full potential and in some cases are eventually abandoned, and the question remains as to why support and adoption of these practices by European farmers is still considerably weak.<sup>1</sup>

### Research aim and questions

The work presented here was carried out as part of the EU-funded SoilCare project.<sup>2</sup> The overall aim of SoilCare is to identify, evaluate and promote promising soil-improving cropping systems (SICS). SoilCare defines SICS as cropping systems that improve soil quality (and hence its functions), and that have positive impacts on the profitability and sustainability of agriculture. Cropping systems refer to crop type, crop rotation, and associated agronomic management techniques (see Table 3).

Table 3: List of promising general SICS<sup>3</sup>

Component	Expected impact
<b>Crop rotation</b>	Improves crop productivity, soil biodiversity and system sustainability; decreases need for pesticides and risk of erosion
<b>Green manures, cover crops, catch crops</b>	Improves Soil Organic Matter (SOM) content, soil structure, soil biodiversity, nutrient use efficiency; decreases nutrient leaching, run-off, erosion
<b>Integrated nutrient management</b>	Improves crop productivity, soil nutrient status and resource use efficiency;
<b>Enhanced efficiency irrigation</b>	Improves crop productivity and resource use efficiency; minimizes risks of salinization and desertification
<b>Controlled drainage</b>	Improves crop productivity and resource use efficiency; minimizes the risk of waterlogging

<sup>1</sup> e.g. Lahmar 2010. Adoption of conservation agriculture in Europe: Lessons of the KASSA project. *Land Use Policy* 27(1): 4-10.

<sup>2</sup> SoilCare: Soilcare for profitable and sustainable crop production in Europe, <https://www.soilcare-project.eu/>

<sup>3</sup> D2.1 – A review of soil improving cropping systems, available at : <https://www.soilcare-project.eu/downloads/public-documents/soilcare-reports/75-report-06-d2-1-a-review-of-soil-improving-cropping-systems-wenr-oene-oenema>

Component	Expected impact
<b>Reduced tillage</b>	Reduces energy cost and may enhance SOM content and soil structure; may increase the need for herbicides/pesticides
<b>Integrated pest management</b>	Improves crop productivity and resource use efficiency; minimizes the loss of biodiversity.
<b>Smart weed control</b>	Improves crop productivity and resource use efficiency; may decrease the need for herbicides
<b>Smart residue management</b>	Reduces evaporation and soil temperature; may increase/decrease the success of germination
<b>Controlled traffic management</b>	Reduces energy cost and the risk of soil compaction
<b>Integrated landscape management</b>	Improves biodiversity and cropping systems sustainability

The main aim of the work presented here was to formulate policy alternatives<sup>4</sup> and actions at EU and study site level to facilitate the adoption of soil-improving cropping systems. Understanding common barriers to the adoption of soil improving practices is an important prerequisite for identifying and designing policy measures to encourage farmers to adopt effective soil conservation practices. A second important foundation for developing appropriate policies is an appreciation of the effectiveness of soil conservation policies in agriculture.

A starting point for any policy analysis is to recognise the success and failures of different types of policy – whether they are regulatory instruments, economic instruments, voluntary instruments, or educational/information instruments. There is plenty of academic research available on the efficiency and effectiveness of these instruments in general, and it is beyond the scope of this Country Report to assess them in detail. However, it is important to recognise the limitations of each, as many of the success and failures of national soil policy may be attributed to the fundamental successes and failures of the types of policy. Table 2 below provides a summary of the different types of policies.

*Table 4: Summary of policy approaches*

Policy approach	Premise	Positive attributes	Negative attributes
<b>Regulatory instruments</b>	Force farmers to adopt SICS	<ul style="list-style-type: none"> <li>Levels the playing field between competitors, as everyone must play by the same rules</li> <li>Fairly consistent (often long-term)</li> </ul>	<ul style="list-style-type: none"> <li>Inflexible regardless of individual situations</li> <li>May be costly to implement</li> <li>Monitoring and enforcement can be costly</li> <li>Discourages innovation</li> </ul>
<b>Economic instruments</b>	Incentivise farmers to adopt	<ul style="list-style-type: none"> <li>Encourages innovative methods</li> </ul>	<ul style="list-style-type: none"> <li>Can be subject to fluctuations as the</li> </ul>

<sup>4</sup> Policy, loosely defined, is “officially accepted set of rules or ideas about what should be done” or “a system of courses of action with a common long-term objective (or objectives) formulated by governmental entities or its representatives” (see <http://learnersdictionary.com/definition/policy> and <https://www.thefreedictionary.com/policy>). Policy alternative refers to a set of different types of policy options including economic instruments, regulatory instruments, planning instruments and information/knowledge instruments.

Policy approach	Premise	Positive attributes	Negative attributes
	SICS using subsidies and taxes etc.	<ul style="list-style-type: none"> <li>• Can offset cost of implementation and/or discourage adverse behaviour</li> <li>• Allows a certain amount of flexibility</li> </ul>	<ul style="list-style-type: none"> <li>• market fluctuates</li> <li>• High likelihood of setting subsidies/taxes at incorrect rate (which leads to inefficiencies)</li> <li>• Can be subject to game-playing behaviour</li> </ul>
<b>Voluntary instruments</b>	Encourage farmers to adopt SICS	<ul style="list-style-type: none"> <li>• Sense of "ownership" as the decision was taken freely</li> <li>• High degree of flexibility</li> </ul>	<ul style="list-style-type: none"> <li>• Does not guarantee implementation</li> </ul>
<b>Educational/information instruments</b>	Educate farmers so they understand the importance of SICS	<ul style="list-style-type: none"> <li>• Implementation as a result of truly understanding the impacts of the actions</li> <li>• High degree of flexibility</li> </ul>	<ul style="list-style-type: none"> <li>• Does not guarantee implementation</li> <li>• Relies on interest of affected parties</li> <li>• Often takes more time to become effective</li> </ul>

Against this background, the following research objectives were formulated at the outset of the work:

- A. To identify existing policies and policy instruments at EU-level as well as national and (sub)regional level in the 16 SoilCare countries promoting soil quality, and particularly the adoption of soil-improving cropping systems.
- B. To describe the intended mechanisms and impacts of existing policies, instruments, and practices.
- C. To assess the extent to which existing policies, policy instruments and practices promote the adoption of soil-improving cropping systems.
- D. To identify contextual factors, particularly institutional settings, influencing policy impact on farmer adoption.
- E. To identify existing policies, policy alternatives and complementary actions that could promote the uptake of SICS.
- F. To assess the performance of good policy alternatives, their advantages, and disadvantages.

This report presents an inventory and analysis of bottlenecks and opportunities in sectoral and environmental policies to facilitate the adoption of SICS in Switzerland and fits into a

larger research initiative involving 16 European countries in total.<sup>5</sup> Based on this analysis, it presents policy alternatives and actions for the national and/or (sub)regional level with the potential of promoting the uptake of SICS.

## Methods

The research and preparation of this report were undertaken by two groups of researchers – the core team of the task, who were responsible for the preparation and research for EU-level policy and all 16 study sites, working in close coordination with researchers with specific knowledge about the study site – the study site researchers. This approach ensured that there was both consistency between the 16 country reports, of which this Swiss report is but one, but local knowledge and documents and information in local languages were also well utilised.

Figure 1 illustrates the overall study design and methods, which were applied to answer specific research questions. Whilst each data collection activity focused on a sub-set of the research questions, they are closely related, and the information gathered through the mix of methods applied were used to feed into different research questions.

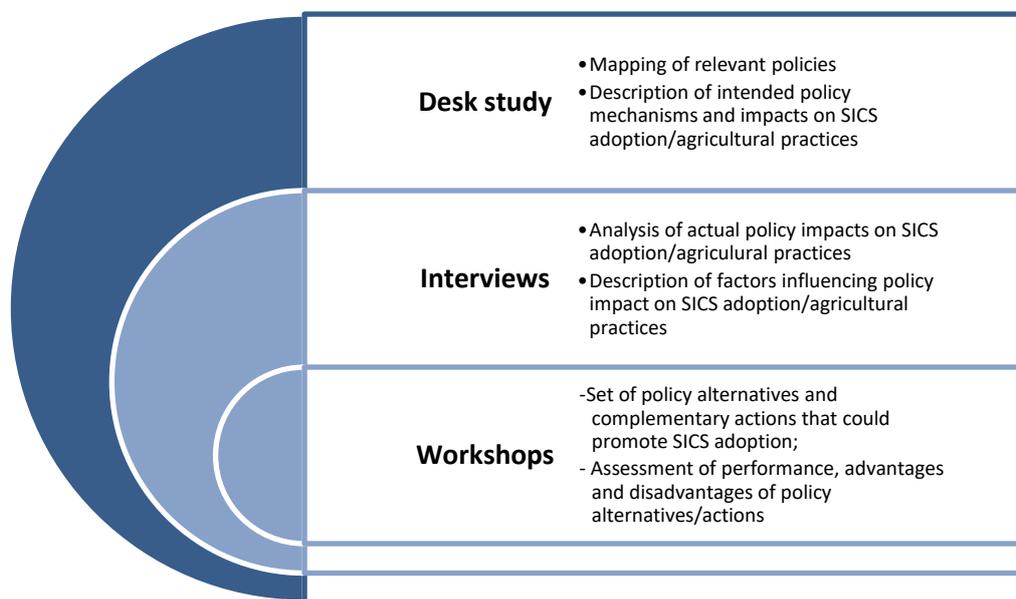


Figure 1: Research strategy

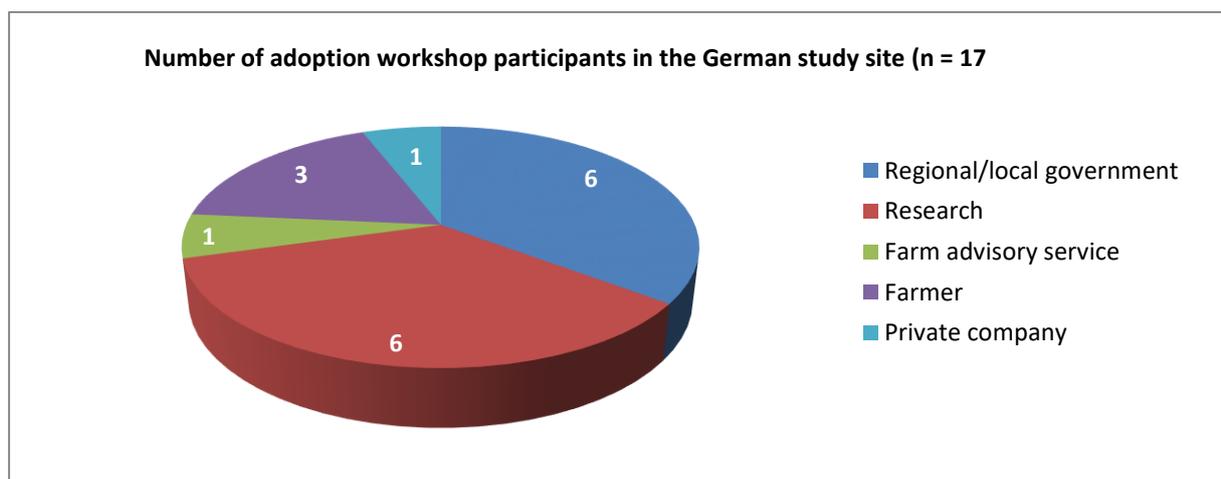
Data collection and analysis involved the following three activities:

### 1) A desk-study of policy documents (in the broadest sense) and relevant

<sup>5</sup> The 16 countries include 13 EU Member States, i.e. Belgium, Germany, France, Czech, Poland, Hungary, Romania, Denmark, Sweden, Greece, Spain, Italy, and Portugal and three non-EU countries, i.e. UK, Switzerland, and Norway.

**literature:** policies potentially impacting the adoption of SICS in the study sites were identified. The aim of this step was to provide a broad overview of soil-related national and regional<sup>6</sup> policies from which the most relevant policies could be selected for in-depth analysis. A draft inventory was compiled, including those national, regional, and sub-regional policies that were linked to a set of pre-selected EU policies (primarily concerning environmental and agricultural topics); however, in the case of regional and sub-regional policies, these were limited to those directly relevant to the study site (i.e. not all regions and sub-regions were included). For each policy, the following information was recorded: date of adoption, governance scale, type of instrument, link to cropping system (components) etc.<sup>7</sup> Based on the screening done in the first step, the national and regional policies deemed most relevant for the study site were subject to a more in-depth analysis. This was done through desk research carried out by the study site researchers.

- 2) Interviews with selected national and regional policymakers and stakeholders:** based on this analysis, Study Site Researchers then conducted interviews with policy-makers and stakeholders using a semi-structured interview guide. In Germany, one interview was carried out with the Ministry of Agriculture of the federal state of Baden Württemberg.
- 3) An adoption workshop with national and regional policymakers and stakeholders:** To develop and assess policy alternatives, the Study Site Research Teams organised a stakeholder workshop in each site, following a common guidance document which detailed the structure and methods for the event. Study site teams mostly invited those stakeholders they were already working with, either within the context of SoilCare or as part of their regular engagement activities. The German workshop brought together 17 stakeholders, including farmers, policymakers, advisory services, and researchers (see **Error! Reference source not found.**).



<sup>6</sup> The term "region" refers in this context to the sub-national level, particularly the area of the country where the respective study site is located.

<sup>7</sup> The policy inventory is available at: <https://www.soilcare-project.eu/resources/deliverables>

Figure 2: Types of stakeholders participating in the German adoption workshop

## Report outline and where to find supplementary information

**Section 2** of this report presents an analysis of policy instruments relevant for shaping agricultural practices in the federal state of Baden-Württemberg where the German study site is located. It examines how existing instruments may impact on the adoption of SICS and explores the factors which enable or hamper uptake of these practices.

**Section 3**, on the basis of the previous section, formulates actions which could promote a shift in agricultural practices in the study site region and facilitate a wider adoption of SICS.

A detailed analysis of all relevant EU-level policies as well as national, regional and sub-regional policies in the countries covered by this research is reported in *D7.1 Inventory of opportunities and bottlenecks in policy to facilitate the adoption of soil-improving techniques* for, available at: <https://www.soilcare-project.eu/resources/deliverables>.

A synthesis of findings and recommendations from the EU-level and cross-country analysis can be found in *D7.2 Report on the selection of good policy alternatives at EU and study site level*, available at: <https://www.soilcare-project.eu/resources/deliverables>.

## 2 Analysis of policy shortcomings and opportunities in Baden-Württemberg

This section provides a review and analysis of national instruments relevant for shaping agricultural practices in Baden-Württemberg, Germany, where the study site, “Tachenhausen”, is located. Policies investigated include both policies implementing EU instruments as well as those initiated by national and regional institutions<sup>8</sup>: The information is drawn from the policy inventories compiled by the Study Site Researchers as well as interviews and an adoption workshop conducted with key stakeholders.

The case study site is briefly described in the table below.

Table 5: Description of the study site

Site Name	<b>Tachenhausen, Germany</b>
Study site	Luvisol with a silty loamy texture
Main soil threats	Soil erosion, nitrate pollution, soil fauna at risk (study site)
Current practices	Conservation agriculture with the intention to improve soil fertility and resilience of the soil, Long-term non-inversion, no irrigation, application of nutrients according to official recommendations (VDLUFÄ method) and expected yield, pests according to decision support systems

<sup>8</sup> See the Annex for a more detailed overview of the policies described in this section.

The experiments carried out in the study site are described below. Each field trial provides evidence on the costs and benefits.

*Table 6: Overview of experiments carried out in the German study site, and the SICS category and cluster under which they are grouped*

General treatment category	SICS cluster <sup>9</sup>	Experiments
<b>Cover crops, reduced/no tillage,</b>	<b>Soil improving crops, soil cultivation</b>	Reduced tillage with/without cover crops and with/without glyphosate application No tillage with/without cover crops and with/without glyphosate application

## 2.1 Which existing policies and policy instruments shape agricultural practices in Baden-Württemberg?

A policy analysis at the national and regional level identified the following policies which may directly or indirectly shape agricultural practices in the Baden-Württemberg. The overview below provides a description of those policies identified as most important for soil-improving practices and does not intend to provide an exhaustive overview of the policy landscape governing agricultural methods in the region.

### *Agricultural policies*

Concerning the policies that derive from the EU legislation, the most relevant policy is the Common Agricultural Policy (CAP) and all the policies and instruments associated with it at the National and federal level in Germany.

The **Ordinance on the Implementation of the Common Agricultural Policy**, among others, is the most relevant for the implementation of CAP. It specifies administrative procedures and responsibilities for the implementation of the CAP instruments within the state of Baden-Wuerttemberg including direct payments, greening payments, and cross-compliance. For conditional payments, the farmers in Germany may apply all types of ecological priority areas such as fallow areas, buffer strips, reforestation areas etc.

The **Rural Development Programme (RDP) for Baden-Württemberg 2014-2020** is another regional level instrument implementing the CAP's Rural Development Policy. RDP for the region emphasises the improvement of soil management as a key priority and reserves a

<sup>9</sup> SICS are grouped into four clusters: (1) Soil-improving crops, (2) Fertilisation/amendments, (3) Soil cultivation, and (4) Alleviation of compaction.

considerable portion for funds to measures improving water management, soil management and to measures contributing to carbon sequestration or conservation. More specifically, the RDP for Baden-Württemberg focuses mainly on two priority areas. Under the first– restoring, preserving and enhancing ecosystems related to agriculture and forestry - nearly 9% of agricultural land and 0.6% of forest area will be placed under funded contracts to improve biodiversity. Additionally, almost 7% of farmland is targeted to be under contract to improve soil management and 4% to improve water management. Under the second main priority – competitiveness of the agri-sector and sustainable forestry – nearly 4% of farm holdings will receive support for investments in modernisation or restructuring of farms. There is focus on knowledge transfer and innovation in agriculture, forestry and rural areas with training of people in the rural areas, competitiveness of agricultural sector and sustainable forestry, food chain organisation, including processing and marketing of agricultural products, animal welfare and risk management in agriculture, restoring, preserving and enhancing ecosystems related to agriculture and forestry, social efficiency and climate and social inclusion and local development in rural areas. Contracts available under the various funding programmes aim to achieve these objectives and will therefore directly impact on farming practices adopted by the participating farmers.

The **Organic Farming Act** implements the Organic Regulation. It pulls together executive functions in organic farming in Germany, whilst increasing the effective implementation of the EU legislation governing organic farming. It keeps the record for organic farms that are subject to the label inspections which account for 8.7 % of all holdings and farming around 6.5 % of the total utilised agricultural area. Some of the guidelines of German organic farming associations are stricter than those laid down in the EU legislation governing organic farming. For example, pursuant to the EU legislation governing organic farming, a holding may under certain circumstances only partially convert to organic farming, whereas in Germany, the conversion of the entire holding is a prerequisite for support with public funds. The regulation sets the standards for organic production, marketing and labelling organic products. Organic production standards have rules relating to crop rotation and chemical inputs that have a direct effect on soil quality. The regulation explicitly deals with soil fertility and quality in its objectives i.e.: organic plant production should contribute to maintaining and enhancing soil fertility as well as to preventing soil erosion. Plants should preferably be fed through the soil eco-system and not through soluble fertilisers added to the soil and highlights the essential role of soil fertility management systems such as choice of species, crop rotation, recycling organic materials and cultivation techniques. It also addresses the maintenance and enhancement of soil life and natural soil fertility, soil stability and soil biodiversity to prevent and combat soil threats such as soil compaction and soil erosion. In addition, principles for maintaining the fertility and the biological activity of the soil, such as crop rotation including green manure and crop rotation with legumes and application of composted manure or organic material. For those farmers setting up an organic production, the Organic Farming Act and ordinance explicitly formulate accepted practices and therefore directly impact on their practices. Farmers are regularly controlled through the inspection system, particularly if they have been awarded the Biosiegel meaning that there should be a

high level of compliance with the provisions of the national law.

At national level, **Soil Protection Act (Landesbodenschutzgesetz)** is a regulatory measure that directly impacts the agricultural practices. The SICS impacted the most are tillage management, landscape management, cover crops, crop rotation, nutrient and pest management and drainage management.

The **Erosion Protection Ordinance Baden-Wuerttemberg** is another regulatory measure that aims to control erosion. All arable land needs to be classified based on the degree of risk of erosion and documented in an erosion register. Different measures apply for the areas classified as under different levels of risk. As part of the cross-compliance checks on farms by the lower agricultural authorities, compliance with the erosion ordinance is reviewed. Complaints lead to a reduction in state subsidies. This policy instrument has direct impact on tillage management.

The **Ordinance for compensating agriculture in disadvantaged locations** (Ausgleichszulage Landwirtschaft für benachteiligte Gebiete) is an important economic tool for supporting the sustainable use of agricultural land in less favoured areas (e.g. mountain areas). It also aims preserving the landscape and to maintain and promote sustainable management. The partial compensation of costs and income losses as well as other disadvantages on agricultural land in mountain areas and other disadvantaged areas of Baden-Württemberg and neighbouring federal states is promoted. Farmers who apply for this funding will need to comply with the requirements of the program, which has therefore a direct impact on farmers' practices.

### *Water Policies*

The Water Framework Directive is transposed into German law through the Federal Water act. Its provisions indirectly impact on farming practices by aiming to achieve good water quality in all surface (and groundwater) bodies. Diffuse pollution from agricultural areas is one of the main pressures in all German RBD and therefore, river basin management plan and programs of measures all contain actions promoting a change in certain agricultural practices. It impacts nutrient management, irrigation, drainage management, pest and landscape management.

The **Water Act for Baden-Wuerttemberg** (WG) specifies the administrative implementation of the WFD in the state of Baden-Wuerttemberg. In 2014, additional requirements were introduced for agricultural parcels close to watercourses. In a zone of five meters width, the use of pesticides and fertilisers is prohibited. As of 1 January 2019, basically only grassland use is permitted in these buffer strips. The only exceptions are the uninterrupted preservation of flowering strips and the planting of shrubs with harvest intervals of more than two years. The buffer strips thus serve to reduce the discharge of nutrients and pesticides into nearby watercourses.

The **Ordinance on safeguards and compensation in water and spring protection zones (SchALVO)** prescribes measures to protect the quality of raw water destined for public supply in water protection zones. The main purpose of the ordinance is to protect the groundwater against impairments caused by discharge from land management. Existing impacts on the groundwater are to be eliminated. For instance, possible nitrate-contaminated groundwater reserves are to be remediated. Depending on the measured nitrate concentrations in the raw water and trend projections, the SchALVO identifies problem areas and remediation areas in which special protection provisions apply in addition to the general provisions. In protected areas (zones II and III), changes to permanent grassland and the use of certain pesticides are banned. In addition, agricultural practices need to be adapted to site conditions as to avoid nitrate nitrogen leaching as much as possible. The SchALVO also contains specifications for greening and tillage practices, e.g. the cultivation of winter crops on areas after fruit crops with nitrogen-rich harvest residues and after maize, is only permitted with mulch or no-till. Yield losses and additional expenses caused by these measures are offset by a defined compensation by ha.

The **Management Plan for the Sub-Catchment 41 - Neckar below Starzel and above Fils (RBD Rhine, Neckar catchment, Baden-Wuerttemberg)** contains both basic measures which essentially aim at ensuring compliance with relevant environmental regulations and standards as well as supplementary measures. Supplementary measures formulate actions which are intended to go beyond mandatory requirements and good agricultural practice but are voluntary. They address a variety of practices and should have a direct but probably weak impact due to their voluntary character. The catalogue of measures contains those eligible for funding under different programmes, including the **Funding Program for Agronomic Environment, Climate Protection and Animal Welfare (FAKT)**. As such, the management plan has the potential to impact practices related to nutrient management; irrigation; drainage management; pest management; landscape management and tillage management.

The **Fertiliser Act** implements the Fertiliser Regulation and the Nitrates Directive. The purpose of the Fertiliser Act is to ensure the nutrition of agricultural crops, to preserve or improve soil fertility, especially the humus content that is typical of the location and use, to prevent risks to the health of humans and animals and also to the ecosystem, which may arise through the manufacture, placing on the market or application of fertilisers, soil improvers, and plant aids and also growing media or through other fertilization measures. Fertilisers must be used in accordance with good agricultural practice, in line with the needs of plants and soils. It also regulates the correct use of fertilisers in accordance with good agricultural practice and prevents soils from oversupply and therefore impacts documentation requirements. These criteria pertain to matters such as determining fertiliser in dependence on plant needs, the timing (off-time during winter), amounts and technical needs of fertiliser application, buffer strips for surface water bodies and rules concerning ammonia emission abatement. This regulatory measure directly impacts on nutrient management by placing certain restrictions on farmers depending on the location of the production areas.

### *Nature Policies*

The **Act on Nature Protection, Landscape Management and Recreation of Baden-Württemberg** is another piece of legislation implementing a national framework law, the Federal Act on Nature Protection and Landscape Management. This regulatory instrument is considered partially relevant. It includes several important measures, such as: standards for good agricultural practices. While being not very specific it describes the principles for agricultural management of soils. Specifically, it calls for agricultural practices that are “appropriate to the relevant location” and sustain the long-term use of soils and natural resources. Landscape elements should be preserved as well as the linking of biotopes. Regulations also include requirements on appropriate use of fertilisers and a suitable balance between animal husbandry and crop cultivation. The impact on the farmers can be direct as the regulation restricts practices in certain areas – e.g., pesticides are banned in nature reserves, in the core and conservation zones of biosphere areas, in legally protected biotopes and in natural monuments outside intensively used agricultural and fishery areas - and mostly landscape management; tillage management; nutrient management; and mixed farming systems.

The **Sewage Sludge Ordinance** implements the Sewage Sludge Directive. It regulates the utilization of sewage sludge. For this purpose, the input of inorganic and organic pollutants is limited to an environmentally safe level. This is done by specifying application limits and limit values above which sewage sludge may no longer be used agriculturally. The ordinance also establishes regular soil and sewage sludge investigations in approved and supervised laboratories. The Sewage Sludge Ordinance regulates the conditions for application to agricultural or horticultural soils, the application bans and restrictions, the application rate and the proof requirements. The ordinance directly impacts on farmers by setting application standards and restrictions for the use of sewage sludge as fertiliser and has an impact on nutrient management.

The **National Action Plan on the Sustainable Use of Pesticides** establishes global targets for reducing the risks and adverse impacts associated with plant protection products for human health and the environment. The **Plant Protection Act** implements the Sustainable Use of Pesticides Directive. There are multiple ordinances under this Act, dealing with the relevant technical standards e.g., in the area of operator training and testing of pesticide application equipment (PAE). The directly applicable rulings in plant protection law relate to the approval of plant protection products, operator-related regulations, application-related regulations, area-related regulations, and regulations relating to plant protection equipment and also to monitoring. Furthermore, aerial spraying of plant protection products is banned unless there is a legitimate need for exception (there are no other alternatives for application). Concerning the protection of aquatic environment and drinking water, it imposes the preferential use of plant protection products containing active substances that are not declared to be of particular concern, that are not classified as dangerous for the aquatic environment, and that contain no priority hazardous substances. There is also a

requirement to stipulate measures that prohibit or reduce the use of plant protection products on or alongside streets, railways, very permeable surfaces or other infrastructure facilities close to surface waters or groundwater, as well as on hard surfaces, in instances in which there is a high risk of the material flowing away into the surface waters or into the sewerage system. That impacts farmers in their pest management.

## 2.2 To what extent do existing policies facilitate adoption of soil-improving practices in Baden-Württemberg?

The main soil threats in the study site include soil erosion, nitrate pollution and soil fauna at risk. SICS that are being tested at the study site are thought to address these soil threats and include reduced/no tillage and cover crops. They therefore represent important practices that might benefit soil health in the region if widely taken up. This section takes the policies identified in the previous section and evaluates how they can mitigate the soil threats in the German study site region.

**Tillage management**, addressed through regulations implementing CAP through direct payments, greening measures, and rural development plans. Furthermore, among the focus areas of RDPs, one is particularly pertinent since it aims to improve soil management (see section above). However, interviewees have suggested that these funds are not effective enough to change behaviour especially where they are needed the most, namely regions with intensive agriculture.

The Organic Farming Act is also very relevant for tillage management since it lays down the rules for tillage and cultivation practices that maintain or increase soil organic matter, enhance soil stability and soil biodiversity, and prevent soil compaction and soil erosion. As mentioned above, application of the regulation is closely monitored since compliance determines whether producers are awarded the related ecolabel. The Nature Directives, which are transposed in Germany through the national and regional nature conservation acts, indirectly impact on tillage techniques since farmers are not allowed to plough on Natura 2000 sites and parts of other areas protected under national and regional laws.

Regulations that transpose EU level directives at regional level such as the River Basin Management Plan for the Neckar catchment indirectly affect tillage management practices, but their influence remains low these are mainly focusing on advice rather than specific actions. The Ordinance on safeguards and compensation in water and spring protection zones directly impacts on tillage practices in water protection zones: the cultivation of winter crops on areas after fruit crops with nitrogen-rich harvest residues and after maize, is only permitted with mulch or no-till.

Several national policies encourage good practices in tillage management. For instance, the Soil Protection Act stipulates that tillage must be carried out in accordance with the site conditions. In the same vein, the Erosion Protection Ordinance sets no-ploughing periods and prohibits ploughing before sowing row crops with a spacing of 45 centimetres and more.



Policy	Crop rotation	Green manures, cover crops, catch crops	Integrated nutrient management	Enhanced efficiency irrigation	Controlled drainage	Reduced tillage	Integrated pest management	Smart weed control	Smart residue management	Controlled traffic management	Integrated landscape management
Pflanzenschutzgesetz ( <i>Plant Protection Act</i> )											
Sewage Sludge Ordinance ( <i>Klärschlammverordnung</i> )											
<b>Regional policies</b>											
Massnahmen- und Entwicklungsplan Laendlicher Raum Baden-Wuerttemberg (BW) 2014-2020 ( <i>Rural Development Programme for Baden-Wuerttemberg 2014-2020</i> )											
Verordnung zur Umsetzung der Gemeinsamen Agrarpolitik 2014 – 2020 ( <i>Ordinance on the Implementation of the Common Agricultural Policy 2014-2010</i> )											
Act on Nature Protection, Landscape Management and Recreation Baden-Württemberg ( <i>Landesnaturschutzgesetz Baden-Württemberg</i> )											
Water Act Baden-Württemberg ( <i>Wassergesetz für Baden-Württemberg</i> )											
Teilbearbeitungsgebiet 41 - Neckar unterhalb Starzel oberhalb Fils, Bearbeitungsgebiet Neckar, FGE Rhein, Baden-Wuerttemberg ( <i>Management plan sub-catchment 41 - Neckar below Starzel and above Fils (RBD Rhine, Neckar catchment, Baden-Wuerttemberg)</i> )											
Förderprogramm für Agrarumwelt, Klimaschutz und Tierwohl (FAKT) ( <i>Funding Program for Agronomic Environment, Climate Protection and Animal Welfare</i> )											
Verwaltungsvorschrift zur Förderung landwirtschaftlicher Betriebe in Berggebieten und in bestimmten benachteiligten Gebieten ( <i>Compensation for agriculture in disadvantaged location</i> )											
Verordnung über Schutzbestimmungen und die Gewährung von Ausgleichsleistungen in Wasser- und Quellenschutzgebieten (SchALVO) ( <i>Ordinance on safeguards and compensation in water and spring protection zones</i> )											
Landesbodenschutzgesetz ( <i>Soil Protection Act Baden-Wuerttemberg</i> )											
Erosionsschutzverordnung Baden-Württemberg ( <i>Erosion Protection Ordinance Baden-Wuerttemberg</i> )											

### 2.3 Which factors shape success or failure of policy instruments in Baden-Württemberg?

Research indicates that there are several factors that shape the success or failure of policy instruments in Baden-Württemberg, and the uptake of SICS tested in the sites in general. These factors include:

- Lack of adequate financial incentive
- Influence of and information sharing within farmer communities and networks
- Strength and consistency of the regulatory framework

#### *Lack of adequate financial incentives*

Stakeholders highlighted that market forces and mechanisms create an environment favouring intensive agriculture. With its well-established systems and supply chains, intensive agricultural production is economically more attractive to farmers than the income generated through sustainable practices, at least in the short term. One stakeholder specifically emphasised that the income generated by intensive agriculture is preferred to the funding available through the second pillar of CAP. This also means that the more intensive the agriculture in a farm, the less attractive subsidies are for farmers. That creates a compound effect that undermines efforts of policies aiming to encourage SICS where it might be most needed.

An assessment of factors influencing the adaptation of the SICS tested in the German study site shows that their uptake is likely to be affected by the costs of seeds and new machinery. Whilst economic incentives could effectively remove these barriers, they are simply not available yet or not sufficiently high to motivate farmers to transition to new practices. By the same token, the ecological benefits generated to some of these practices – for instance, direct seeding is thought to reduce surface run-off – are not sufficiently rewarded.

#### *Influence of and information sharing within farmer communities and networks*

It has been stated that Farmers' Associations have an important influence over the farmers and the decision-making processes. For instance, the Farmers' association related communication tools are said to strongly favour conventional agriculture over new and more sustainable approaches. Because the farmers tend to trust their peers more than politicians and outside experts, this might create a barrier for adoption of SICS.

Stakeholders participating in the adoption workshop in the site identified multiple actions that were assessed as potentially highly effective in educating farmers about the use and benefits of the SICS tested in the site. Workshop participants proposed the establishment of a network of model farms which could serve multiple purposes: raising awareness about the economic, social and environmental benefits of the practices, demonstrating the application of SICS in the specific regional context, and sharing practice experiences about their use in different physical/environmental conditions.

#### *Strength and consistency of the regulatory framework*

It has been suggested that the existing policy, whether CAP or national remains weak and

ineffective. That can stem from different reasons like lack of specificity (such as in the case of greening requirements), lack of weight (such as in the case of second pillar payments). It is also suggested that big intensive farms require regulatory checks since education or socio-cultural drivers simply remain too weak to counter market forces. In addition, although policies are designed to have a positive impact on soil quality, a lack of coherence might produce adverse effects. For instance, it has been mentioned that subsidies for bioenergy have the potential to promote unsustainable practices and adverse impacts will need to be corrected through a revision of the policy.

The box and table below provide a summary of the stakeholder recommendations for actions to promote SICS adoption in the site as well as a detailed overview of the assessment of their effectiveness and feasibility.

*Box 2.1: Stakeholder recommendations for actions to promote the uptake of promising SICS in the Germans study site region*

**Summary of stakeholder recommendations for actions to promote SICS adoption**

The SICS tested in the study site include covers crops and reduced/no tillage. For the first SICS, stakeholders identified knowledge and awareness as the most important prerequisites for ensuring wider uptake of cover crops (in combination with reduced tillage). The establishment of model farms was assessed to be the most feasible and effective action to increase awareness among farmers for adapting these techniques to the local conditions and their benefits. A second possible action proposed was the dissemination of project findings, e.g. from SoilCare. To highlight the positive environmental effects of SICS. The cost of seeds is seen as one of the main barriers to uptake which could be addressed by providing subsidies. However, stakeholders assessed this option as not being highly feasible. The proposed crop rotation system was considered by stakeholders as complicated, presenting another barrier to adoption. The most effective as well as feasible action suggested to overcome this challenge was to integrate soil protection more strongly into vocational training. The network of model farms (see above) could also serve to demonstrate how to establish new tillage regimes which requires careful timing

The wider uptake of the second SICS tested, reduced or even no tillage, -could be promoted through better funding recognising the ecological benefits of direct seeding (reduced run-off, sustainable agriculture), and applying higher prices for products. Stakeholders assessed this action, however, as unfeasible. Another important enabler that was identified were field demonstrations which were evaluated as both effective and highly feasible. Again, here the model farms suggested by the workshop participants could play an important role. One of the barriers identified was related to the possible reduction in yield, an increased need for pesticide application and the purchasing of new machines. Stakeholders suggested the establishment of a machine exchange to overcome some of these challenges which was considered both as highly effective and feasible. Grants were identified as another possible action which would have a significant impact on SICS uptake but was considered as unfeasible by participants. To deal with the biophysical conditions which can also hamper the adoption of direct seeding techniques, the exchange of experiences with applying this practice to e.g. stony soils would be important. As highlighted above, demonstration farms could prove very effective here and would be relatively simple to set up. Looking at the policy framework, stakeholders identified the limiting of the influence of lobby groups and the establishment of financial measures to counter economic pressure from the world market as important preconditions for the uptake of this SICS. Whilst these actions were assessed to be highly effective, it was acknowledged that their implementation would not be feasible.

Table 8: SICS being tested, adoption factors (enablers + or barriers -) and actions to overcome barriers and support enablers<sup>10</sup>

Cover crops			
Adoption factors (+ or -)	Actions	Effectiveness	Feasibility
Reduced need for fertilisers (+)	<i>None identified</i>	--	--
Insufficient knowledge of farmers a problem	Establishment of network of model farms that demonstrate regional adaptation of SICS	4	4
	Dissemination of practice examples from research	2	4
Biodiversity enhancement; sustainable technique (+)	Highlighting of ecological aspects through effective dissemination of research results	4	2
Cost for seeds (-)	Reward environmental benefits through subsidies	4	2
Crop rotation management is complicated e.g., establishment and timing of tillage must be precisely matched (-)	Integrate soil protection more strongly into vocational training 4	3	4
	Use network of model farms (see above)	4	4
Reduced/no tillage			
Adoption factors (+ or -)	Actions	Effectiveness	Feasibility
Reduced fuel consumption, reduced workload (+)	Promote benefit to farmer's work-life-balance	--	--
Heavy soils can be cultivated (+)	<i>None identified</i>	--	--
Decreased erosion (+)	Reward environmental benefits achieved through direct seeding (e.g., reduced run-off), option to increase prices for sustainably produced products	4	2
Societal demand for sustainable products (+)	Educate society to appreciate the social value of climate, soil, and water body conservation (as a precondition for willingness to pay higher process)	3	1
Field demonstrations (+)	Establish network of model farms (see above)	4	4
	Effective dissemination of practice examples from research	2	4
Possibly lower yields, increased need for pesticides/new machines (-)	Establish mechanism for machine exchange	4	4
	Provision of grants	4	2
Crop rotation management is complicated (-)	Use network of model farms to share experiences	4	4
Application of practice on stony soils (-)	Facilitate exchange of experiences through network of model farms (see above)	4	4
"It looks wild"; pest management not possible without chemical plant protection (-)	Fund research on direct seeding vs no glyphosate	--	--
Impact of market forces, particularly on glyphosate debate	Limiting the influence of lobby groups on policymaking	4	2
	Provision of financial measures to counter economic pressure from the world market	4	1
Promotion of organic farming with derogations from the ploughing ban (-)	Reward environmental benefits achieved through direct seeding (reduced run-off, sustainable agriculture),	4	3
	Effective dissemination of practice examples from research	4	3

### 3 Recommendations for actions to promote the uptake of SICS

The main soil threats in study site include soil erosion, nitrate pollution and soil fauna at risk. SICS that were tested at the site, reduced/no tillage in combination with cover crops, aim to

<sup>10</sup> Due to time limitations, some of the workshops only addressed a subset of SICS tested in the respective study site. Participants were asked to identify actions for the most important factors affecting SICS adoption; therefore, not all adoption factors were discussed in detail. To assess the effectiveness and feasibility of an action, a scale from 1 (not at all effective/feasible) to 4 (highly effective/feasible) was used.

control weeds as an alternative to the use of chemical plant protection products and are thought to be suitable to address these soil threats.

This report presented an inventory and analysis of bottlenecks and opportunities in sectoral and environmental policies to facilitate the adoption of SICS in Germany, and specifically the state of Baden-Württemberg where the study site "Tachenhausen" is located. Based on this analysis, and feedback collected from stakeholder, it presented actions for the national and/or (sub)regional level with the potential of promoting the uptake of SICS.

Drawing on these insights, the following general recommendations can be made:

- **Establish mechanisms for information sharing between farmers:** Some of the practices benefitting soil will require farmers to learn about these techniques, their application to different conditions as well as their benefits. Since farmers tend to place a lot of trust in their peers, establishing a network of model farms demonstrating how to use and adapt different SICS in the region would effectively support farmers in learning and sharing experiences about these practices.
- **Subsidise transition to practices benefitting soil health:** The uptake of certain SICS, such as reduced tillage, might require upfront investments, such as the purchasing of new machinery. Grants should be made available to farmers buying new equipment to implement these practices or groups of farmers intending to set up a 'machinery exchange'. Such an exchange could also be set up and managed by the regional/local farm advisory services or municipalities.
- **Make soil health a stronger component of vocational training and continued education of farmers:** The move from conventional practices to SICS and sustainable agricultural practices requires a shift in attitudes as well as knowledge. Soil, as the main medium on which food and feed are grown, should feature highly on the curriculum for farmer training, be it basic vocational or continued adult learning.
- **Reward environmental benefits generated by SICS and talk about it:** market forces need to be counterweight with subsidies rewarding the environmental benefits generated through the SICS to make their uptake more appealing to farmers. It will be equally important to continue to educate consumers about the advantages and disadvantages of conventional farming practices vs. sustainable practices to ensure increased demand for sustainably produced products and encourage the retail sector to make these more widely available to all sections of society.
- **Design more cohesive policies and effective enforcement mechanisms:** policies have great potential to shape practices, especially for large-scale farms. However, to achieve real impact, their implementation needs to be monitored more effectively and consistently. Furthermore, an improved synergy between different policies is considered an important factor for future success.

## Annex: Overview of key policies in Taschenhausen, DE

Policy name	English translation	Scale	EU or MS based policy	SICS addressed	Description of policy
<b>National policies</b>					
Öko-Landbaugesetz ÖLG-Kontrollstellen- Zulassungsverordnung	Organic Farming Act Ordinance regulating the approval of inspection bodies in accordance with the Organic Farming Act	National	EU (organic Regulation)	Crop rotation; green manure, cover crops and catch crops; integrated nutrient and pest management	<p>The Organic Farming Act (ÖLG) serves to clarify and supplement the changes in EU legislation in the area of organic farming. These changes are concerned with the publication of records and certificates of organic companies that are subject to the organic inspection system. At the end of 2015, there were 24,736 organic-production holdings in Germany farming 1,088,838 hectares of land organically in accordance with the EU legislation governing organic farming. They account for 8.7 % of all holdings, farming around 6.5 % of the total utilised agricultural area. Most organic farms in Germany have joined associations. In addition to the Bioland and Demeter associations (the largest and oldest organic associations), there are also other associations such as Naturland, Biokreis, Bundesverband Ökologischer Weinbau (Federation for Organic Viticulture, ECOVIN), Gäa, Ecoland, Biopark and the Verbund Ökohöfe. Some of the guidelines of German organic farming associations are stricter than those laid down in the EU legislation governing organic farming. For example, pursuant to the EU legislation governing organic farming, a holding may under certain circumstances only partially convert to organic farming, whereas the organic farming associations always prescribe the total conversion of a holding. In Germany, the conversion of the entire holding is a prerequisite for support with public funds.</p> <p>The regulation sets the standards for organic production, marketing and labelling organic products. Organic production standards have rules relating to crop rotation and chemical inputs that have a direct effect on soil quality. The regulation explicitly deals with soil fertility and quality in its objectives i.e.: organic plant production should contribute to maintaining and enhancing soil fertility as well as to preventing soil erosion. Plants should preferably be fed through the soil eco-system and not through soluble fertilisers added to the soil and high; and highlights the essential role of soil fertility management systems such as choice of species, crop rotation, recycling organic materials and cultivation techniques (13, 14). Art. 3 a (i) specifically addresses the relations and balance between health of soil, water, plants, and animals. Art 5. (a) addresses the maintenance and enhancement of soil life</p>

Policy name	English translation	Scale	EU or MS based policy	SICS addressed	Description of policy
					and natural soil fertility, soil stability and soil biodiversity as a means to prevent and combat soil threats such as soil compaction and soil erosion. The regulation also lays down the rules for use of tillage and cultivation practices that maintain or increase soil organic matter, enhance soil stability and soil biodiversity, and prevent soil compaction and soil erosion. In addition, principles for maintaining fertility and the biological activity of the soil, such as crop rotation including green manure and crop rotation with legumes and application of composted manure or organic material.
Düngegesetz (DüG) Düngeverordnung (DüV)	Fertiliser Act Ordinance on good fertilising practices	National	EU (Nitrates Directive)	Integrated nutrient management; crop rotation	The purpose of the Fertiliser Act is to ensure the nutrition of agricultural crops, to preserve or improve soil fertility, especially the humus content that is typical of the location and use, to prevent risks to the health of humans and animals and also to the ecosystem, which may arise through the manufacture, placing on the market or application of fertilisers, soil improvers, and plant aids and also growing media or through other fertilisation measures. Fertilisers have to be used in accordance with good agricultural practice, in line with the needs of plants and soils. The Fertiliser Ordinance (DüV) also transposes Directive 91/676/EEC into German law. It rules the correct use of fertilisers in accordance with good agricultural practice and prevents soils from oversupply and therefore rules documentation requirements. These criteria pertain to matters such as determining fertiliser in dependence on plant needs, the timing (off-time during winter), amounts and technical needs of fertiliser application, buffer strips for surface water bodies and rules concerning ammonia emission abatement. Directly impacts on nutrient management by placing certain restrictions on farmers depending on the location of the production areas.
Nationaler Aktionsplan zur nachhaltigen Anwendung von Pflanzenschutzmitteln	National Action Plan on the Sustainable Use of Pesticides	National	EU (Sustainable Use of Pesticides Directive)	Integrated pest management	The global targets of the Action Plan are to reduce the risks and adverse impacts associated with plant protection products for human health and the environment must be further reduced. This means the following: <ul style="list-style-type: none"> <li>• by 2023, there must be a 30 % reduction in the risks that using plant protection products entail for the environment (base: average value for 1996 – 2005),</li> <li>• by 2021, the exceeding of the maximum residue levels must be reduced to below 1 % in all product groups for both domestically-produced and imported foods,</li> <li>• the adverse impacts of use of chemical plant protection products must be further reduced for operators, workers, bystanders and residents.</li> <li>• The introduction and further development of plant protection measures,</li> </ul>

Policy name	English translation	Scale	EU or MS based policy	SICS addressed	Description of policy
					<p>involving limited use of plant protection products in integrated plant protection, must be fostered. This includes further extending the proportion of practicable non-chemical measures in plant protection concepts, e.g. using biological, biotechnical or mechanical plant protection measures, and securing sufficient availability of active substances used in plant protection products for efficient resistance strategies.</p> <ul style="list-style-type: none"> <li>• The use of plant protection products must be limited to the necessary minimum.</li> <li>• Further improvements must be made to safety in dealing with plant protection products.</li> <li>• Further improvement must be made to the provision of well-balanced information to the public, concerning the benefits and risks of plant protection, including the use of chemical plant protection products. The strength of these impacts will depend on the type of measures implemented under the NAP.</li> </ul>
Pflanzenschutzgesetz	Plant Protection Act	National	EU (Sustainable Use of Pesticides Directive)	Integrated pest management	<p>Germany transposed the SUD into national law via the Plant Protection Act of 6 February 2012. In addition, there are a number of ordinances under this Act, dealing with the relevant technical standards e.g. in the area of operator training and testing of pesticide application equipment (PAE). The directly applicable rulings in plant protection law relate to the approval of plant protection products, operator-related regulations, application-related regulations, area-related regulations, and also regulations relating to plant protection equipment and also to monitoring. The central role is taken by the Plant Protection Act (PflSchG). The approval of plant protection products is a core element in the reduction of risks which can emerge due to the use of plant protection products. It not only prevents unsuitable substances from being made available for trade: i.e. substances that entail dangers or unjustifiable risks for human beings (particularly for operators, workers, residents, and bystanders), animals, surface water, groundwater and the environment. The provisions directly impact on pest management practices adopted by farmers but strength of impact depends on specific targets and activities formulated in the NAP and subsequent actions.</p>
Klärschlammverordnung	Sewage Sludge Ordinance	Nation	EU (Sewage Sludge Directive)	Integrated nutrient management	<p>The German Sewage Sludge Ordinance regulates the utilisation of sewage sludge. For this purpose, the input of inorganic and organic pollutants is limited to an environmentally safe level. This is done by specifying application limits and limit values above which sewage sludge may no longer be used</p>

Policy name	English translation	Scale	EU or MS based policy	SICS addressed	Description of policy
					<p>agriculturally. The ordinance also establishes regular soil and sewage sludge investigations in approved and supervised laboratories. The Sewage Sludge Ordinance regulates:</p> <ul style="list-style-type: none"> <li>• the conditions for application to agricultural or horticultural soils,</li> <li>• the application bans and restrictions,</li> <li>• the application rate and</li> <li>• the proof requirements.</li> </ul>
<b>Regional Policies</b>					
Verordnung der Landesregierung zur Umsetzung der Gemeinsamen Agrarpolitik 2014 – 2020	Ordinance on the Implementation of the Common Agricultural Policy 2014-2010	Regional	EU (CAP)	Crop rotation; green manures, cover crops, catch crops; integrated nutrient management; controlled drainage; integrated pest management; integrated landscape management	This regulation specifies administrative procedures and responsibilities for the implementation of the CAP instruments within the state of Baden-Wuerttemberg.
Massnahmen- und Entwicklungsplan Laendlicher Raum Baden-Wuerttemberg (BW) 2014-2020 (MEPL III)	Rural Development Programme for Baden-Wuerttemberg 2014-2020	Regional	EU (CAP RDP)	All	The RDP for BW emphasises the improvement of soil management as a key priority and reserves a considerable portion for funds to measures improving water management, soil management and to measures contributing to carbon sequestration or conservation. These will be delivered through contracts available under the various funding programmes and will therefore directly impact on farming practices adopted by the participating farmers.
Gesetz zum Schutz der Natur, zur Pflege der Landschaft und über die Erholungsvorsorge in der freien Landschaft (Landesnaturchutzgesetz Baden-Württemberg - NatSchG)	Act on Nature Protection, Landscape Management and Recreation Baden-Württemberg	Regional	EU/national	Crop rotation; efficient irrigation management; reduced tillage ; integrated landscape management	The use of pesticides (plant protection products and biocides) in accordance with Article 3 (10) of Directive 2009/128 / EC of the European Parliament and of the Of 21 October 2009 establishing a framework for Community action in the sustainable use of pesticides (OJ L 309, 24.11.2009, p. in its current version is prohibited in nature reserves, in the core and care zones of biosphere areas, in legally protected biotopes and in natural monuments outside intensively used agricultural and fishery areas.
Wassergesetz für Baden-Württemberg (WG)	Water Act Baden-Württemberg	Regional	EU (WFD)	Integrated nutrient and pest management; efficient irrigation management; controlled drainage	The Water Act for Baden-Wuerttemberg (WG) specifies the administrative implementation of the WFD in the state of Baden-Wuerttemberg. Additional requirements for the protection of surface waters from January 1, 2014 have been introduced for agricultural parcels close to watercourses. In a zone of five meters width, the use of pesticides and fertilizers is prohibited. As of 1 January 2019, basically only grassland use is permitted in these buffer strips.

Policy name	English translation	Scale	EU or MS based policy	SICS addressed	Description of policy
					The only exceptions are the uninterrupted preservation of flowering strips and the planting of shrubs with harvest intervals of more than two years. The buffer strips thus serve to reduce the discharge of nutrients and pesticides into nearby watercourses.
Teilbearbeitungsgebiet 41 - Neckar unterhalb Starzel oberhalb Fils, Bearbeitungsgebiet Neckar, FGE Rhein, Baden-Wuerttemberg	Management plan sub-catchment 41 - Neckar below Starzel and above Fils (RBD Rhine, Neckar catchment, Baden-Wuerttemberg)	Local	EU (WFD)	Integrated nutrient management; efficient irrigation management; controlled drainage management; integrated pest management; integrated landscape management; reduced tillage	<p>The plan contains both basic measures which essentially aim at ensuring compliance with relevant environmental regulations and standards as well as supplementary measures. Supplementary measures formulate actions which are intended to go beyond mandatory requirements and good agricultural practice but are voluntary. They address a variety of practices and should have a direct but probably weak impact due to their voluntary character. The plan for the sub-catchment identifies specific measures in line with the general types of measures identified in the Management plan for the Neckar. It includes the following specific measures:</p> <ul style="list-style-type: none"> <li>• Crop diversification (at least 5-unit crop rotation)</li> <li>• Extensive management of permanent grassland with livestock</li> <li>• Extensive management of certain permanent grassland areas without nitrogen fertilization</li> <li>• Conservation of fruit orchards</li> <li>• Abandonment of chemical-synthetic means of production</li> <li>• Change to organic farming</li> <li>• Maintaining organic farming</li> <li>• Autumn plant cover in the field</li> <li>• Plant cover in fallow fields with flowering mixtures</li> <li>• No use of herbicides</li> <li>• Application of trichogramma in corn</li> <li>• - Pheromone use in fruit production</li> </ul>
Förderprogramm für Agrarumwelt, Klimaschutz und Tierwohl (FAKT)	Funding Program for Agronomic Environment, Climate Protection and Animal Welfare	Regional	MS/region	All SICS	<p>The aim of FAKT is the preservation and maintenance of the cultural landscape, the protection of the climate and the natural resources of water, soil, air, the preservation and improvement of biodiversity and the promotion of animal welfare. Almost a third of the funding for MEPL III is attributable to this program, with around 40 sub-measures. FAKT differs from its predecessor program MEKA in particular in a better promotion of grassland sites, a stronger promotion of organic farming and water and erosion protection. FAKT is structured as a modular system and foresees the following types of measures:</p> <ul style="list-style-type: none"> <li>• Environmental management</li> </ul>

Policy name	English translation	Scale	EU or MS based policy	SICS addressed	Description of policy
					<ul style="list-style-type: none"> <li>• Maintenance and preservation of the cultural landscape and protected habitats</li> <li>• Preservation of endangered animal breeds and uses</li> <li>• Organic farming / abandonment of chemical-synthetic means of production</li> <li>• Environmentally friendly plant production and application of biological / biotechnical measures</li> <li>• Voluntary measures for water and erosion protection</li> <li>• Species-appropriate husbandry support means to improve soil fertility and the agroecosystem in total.</li> <li>• Farmers who apply for funding will need to comply with the requirements of the programme; this means that there is a strong direct impact</li> </ul>
Verwaltungsvorschrift zur Förderung landwirtschaftlicher Betriebe in Berggebieten und in bestimmten benachteiligten Gebieten	Compensation for agriculture in disadvantaged location	Regional	MS/region	All SICS	The financial compensation helps to ensure the sustainable use of agricultural land in less favoured areas (eg mountain areas) - to preserve the landscape and to maintain and promote sustainable management. The partial compensation of costs and income losses as well as other disadvantages on agricultural land in mountain areas and other disadvantaged areas of Baden-Württemberg and neighbouring federal states is promoted. Farmers who apply for funding will need to comply with the requirements of the programme; this means that there is a strong direct impact
Verordnung über Schutzbestimmungen und die Gewährung von Ausgleichsleistungen in Wasser- und Quellenschutzgebieten (SchALVO)	Ordinance on safeguards and compensation in water and spring protection zones	Regional	EU (Groundwater Directive)	Crop rotation, integrated nutrient and pest management; reduced tillage	The SchALVO prescribes measures in water protection areas for the protection of raw water of the public water supply. The purpose of the SchALVO is to protect the groundwater against impairments caused by discharge from land management. Existing impacts on the groundwater are to be eliminated and as soon as possible nitrate-contaminated groundwater reserves remediated. In addition, microbial impurities should be avoided. Depending on the measured nitrate concentrations in the raw water and trend projections, the SchALVO identifies problem areas and remediation areas in which special protection provisions apply in addition to the general provisions on protection. According to the requirements of the SchALVO it is to be taken into account in the protected areas (zones II and III) and establishes a ban on changes to permanent grassland, a ban on the use of pesticides with terbutylazine or tolylfluorid and the requirement to adapt all management measures to the site conditions so that nitrate nitrogen leaching so far be avoided as much as possible. In addition, the SchALVO also contains specifications for greening and tillage. The cultivation of winter

Policy name	English translation	Scale	EU or MS based policy	SICS addressed	Description of policy
					crops on areas after fruit crops with nitrogen-rich harvest residues and after maize, is only permitted with mulch or no-till. The SchALVO stipulates the adaptation of operational crop rotations to the site conditions so that they contribute to reducing the leaching rate of nitrate nitrogen in autumn. In the problem areas and redevelopment areas, yield losses and additional expenses caused by the conditions are offset by a defined compensation by ha.
Landesbodenschutzgesetz Baden-Württemberg	Soil Protection Act Baden-Württemberg	Regional	MS/region	Reduced tillage; integrated landscape management; green manure, cover crops, and catch crops; crop rotation; integrated nutrient and pest management; controlled drainage	The Act implements the provisions of the National Soil Protection Act which outlines principles of good agricultural which include the conservation of soil fertility and soil performance as a natural resource. In particular, one of the principles of good technical practice is that: 1. the tillage must be carried out in accordance with the site, 2. the soil structure is maintained or improved, 3. soil compaction, in particular by consideration of the soil type, soil moisture and agricultural land use is to be avoided 4. soil erosion by site-adapted use, in particular by taking into account the slope, the water and wind conditions and the ground cover, shall be avoided if possible 5. structural elements, especially hedges shall be preserved, 6. the biological activity of the soil is maintained or promoted by appropriate crop rotation design and the location - typical humus content of the soil shall be maintained by reducing agricultural activities or by introducing soil organic matter. The Soil Protection Ordinance focuses particularly on water-related soil erosion and contamination.
Erosionsschutzverordnung Baden-Württemberg	Erosion Protection Ordinance Baden-Württemberg	Regional	MS/region	Reduced tillage	One of the basic requirements of the CAP for the conservation of land in good agricultural and ecological condition is erosion control. The protection of the soil must be ensured by complying with comprehensive minimum standards regarding soil cover, tillage and the maintenance of terraces. All parcels with a partial or complete use as arable land need to be classified according to the degree of risk of erosion and risk of wind erosion and are documented in an erosion register based on parcels. The classification is based on the risk of erosion by water after soil erodibility and slope, as well as the risk of erosion by wind according to the type of soil. All parcels or sub-areas classified as at high risk for water erosion (risk class 2) may not be ploughed without an agri-environmental measure for erosion control and cross-slope management from 1 December to the end of 15 February. Ploughing after the harvest of the pre-crop is only allowed for sowing before 1 December. All parcels or sub-areas classified as at a slower risk (risk class 2) class may not be ploughed from 1 December to 15 February without an agri-environmental erosion control measure. Ploughing between the 16th of

Policy name	English translation	Scale	EU or MS based policy	SICS addressed	Description of policy
					February and the end of the 30th of November is only permissible in case of an immediate sowing.