

Policy analysis:

Promoting SICS adoption in Thurgau, Switzerland

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Executive summary

The main soil threats in Switzerland include low organic carbon content and compaction. SICS that are being tested at the study site are thought to address these soil threats and include compaction alleviation measures (Controlled traffic management on grass verges), integrated nutrient management (Under-foot fertilisation after CULTAN procedure) as well as green manure in combination with minimum tillage (Green manuring and minimum tillage applied between crop rotations). They therefore represent important practices that might benefit soil health in the region if widely taken up.

Policy shortcomings and opportunities

The table below provides an overview of policies promoting the full range of SICS covered by the SoilCare project (shaded in light green). Several policies, including Federal Act on the Protection of the Environment, the Soil Damage Ordinance, and the Federal Act on Agriculture contain provisions which allow the cantons to define measures to prevent soil erosion and a deterioration of soil fertility, and which might include different SICS. Compliance with these measures is often linked to financial support paid out to farmers (under the Direct Payment Ordinance) and can also involve penalties if agricultural practices result in soil losses (under the Soil Damage Ordinance). Compaction alleviation measures, the use of cover crops, reduced tillage, and green manure, the SICS tested at the study site (shaded in dark green), are regulated and incentivised to some extent: there are no dedicated policies regulating or incentivising controlled traffic management methods to reduce compaction other than through the pieces of legislation mentioned above. The use of crop rotation is promoted by the main national and cantonal agricultural policies, specifically the Soil Damage Ordinance which mentions crop rotations as a possible practice to protect the fertility of soil and reduce the loss of organic content. The Direct Payment Ordinance has the potential to promote crop rotation by providing financial incentives to adopt the practice (Article 16 Controlled crop rotation and Article 17 Suitable soil protection). Green manure is not explicitly mentioned but the crop rotation requirements above can potentially lead to cover crops being used as green manure. In addition, the Ordinance stipulates that nutrient circuits should be closed as far as possible. No excess phosphorus and nitrogen are to be applied which might indirectly promote the use of green manure. Similarly, reduced tillage practices do not seem to be explicitly incentivised or regulated by any of the policies analysed. However, they might be considered as soil protection measures to prevent erosion in line with Article 17 and could therefore be eligible for financial support.

Table 1: Coverage of SICS in current national and regional policies, instruments and measures in Thurgau, CH

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
National policies											
Bundesgesetz über den Umweltschutz (Federal Act on the Protection of the Environment)											
Gewässerschutzverordnung (Ordinance on Protection of Waterbodies)											
Verordnung ueber die Belastungen des Bodens (Soil Damage Ordinance)											
Bundesgesetz ueber die Landwirtschaft (Federal Act on Agriculture)											
Direktzahlungsverordnung (Direct Payment Ordinance)											
Chemikaliengesetz (Federal Chemicals Act)											
Chemikalien-Risikoreduktions-Verordnung (Chemical Risk Reduction Ordinance)											
Pflanzenschutzmittelverordnung (Ordinance on Plant Protectants)											
Duenger-Verordnung (Fertilizer Ordinance)											
Regional policies											
Landwirtschaftsgesetz (Act on Agriculture)											
Verordnung über die Strukturverbesserungen in der Landwirtschaft (Ordinance on structural improvements in agriculture)											

Recommendations for actions to promote the uptake of SICS

Research indicates that there are several factors that shape the success or failure of policy instruments in Thurgau, Switzerland, and the uptake of SICS tested in the study site region in general. These factors include:

- Lack of policies incentivising development or use of more efficient machinery
- Costs of SICS adoption
- Weak monitoring and enforcement
- Lack of knowledge and effective dissemination
- Insufficient/biased information available

- Market pressures favour short-term priorities over long-term investment in soil health
- Reluctance to change due to perceived peer pressure and closed farming community
- Self-perception as “food suppliers”

Table 2: SICS being tested, adoption factors (enablers or barriers) and actions to overcome the barriers: 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

Compaction alleviation: Green verges			
Adoption factors (+ or -)	Actions	Effectiveness	Feasibility
More yield with less effort, incl. manuring input (+)	Information dissemination/spreading awareness e.g., through the creation of lighthouse farms or innovation awards	3	4
Improved soil activity (less compaction) (+)	<i>None identified</i>	--	--
Green strips (always passable) (+)	Information and field inspections	2	4
Lack of knowledge transfer (-)	Field demonstrations (+) Farm advice (canton)	3	4
Effort/practicability (-)	<i>None identified</i>	--	--
Takes time for effects to be visible (-)	Technical aids to visualise changes	4	4
GPS required (1x per sowing), width of parcel, material quality (e.g., light machines) (-)	<i>None identified</i>	--	--
Implementing new ideas needs interest and time of the farmer, willingness to take risks (-)	Risk coverage	2	2
D2 system does not fit yet, e.g., flower strips in favour of a functional biodiversity (-)	Practical suitability	3	3
Fertilisation/amendments: Fertilisation with Controlled Uptake of Long-Term Ammonium Nutrition (CULTAN)			
Adoption factors (+ or -)	Actions	Effectiveness	Feasibility
Long term pricing (+)	<i>None identified</i>	--	--
Homogeneous and raw soils, flat roots, legumes (+)	<i>None identified</i>	--	--
Precise fertilisation, chrome steel (+)	<i>None identified</i>	--	--
Extraction of ammonia from sewage treatment plants will reduce the prices (+)	CULTAN manuring as part of climate strategy -> WIN-WIN situation on local, regional and global level	4	4
Side-line business, livestock-free, specialisation, innovative ideas (+)	<i>None identified</i>	--	--
Increase humus content in soils (+)	<i>None identified</i>	--	--
Very expensive, price must be lower at every level, corrosion, and logistics (-)	Lower prices on all levels -> Ecosystem services must be weighted differently / valued differently	3	4
Stony soils, compacted soils, dry soils, taproot (-)	<i>None identified</i>	--	--
Yeast concentration, working width, material quality, need specialist for the injection (-)	<i>None identified</i>	--	--
Common doctrine, dominance of the fertilizer industry. Need of more promotion, publications (-)	<i>None identified</i>	--	--
Structural opinion, added value on farms (-)	<i>None identified</i>	--	--
Principles of Agricultural Crop Fertilisation in Switzerland (PRIF), organic suitability (-)	Intermediate step: disclosure of research, intensify dissemination of results and research, then: adapt guidelines accordingly - the benefits should be considered at long term and over large chain (including ecosystem services).	4	4
Sulphur content (-)	<i>None identified</i>	--	--

Recommendations for actions to promote the uptake of SICS

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

- **Consider introducing weight limitations for agricultural machinery into legislation:** for road vehicles, legislation establishes limitations on maximum weight. This is lacking for agricultural machines and should be integrated in existing agricultural legislation or a new, dedicated technical standard. In addition, farm advisory services need to include information on lighter vehicles farmers may use in the services they offer.
- **Facilitate the extraction of ammonia from sewage treatment plants:** the cost of applying the CULTAN procedure could be reduced if ammonia extracted from sewage treatment plants could be made available to farmers. This might require the investment in research on different methods for ammonia recovery by public institutions, a dissemination of findings and technologies and a subsequent adaptation of current guidelines on “Principles of Agricultural Crop Fertilisation in Switzerland” (PRIF).
- **Establish better monitoring and enforcement mechanisms:** while it was found that there are several policies already in place that – directly and indirectly - regulate and incentivise different SICS, stakeholders report that outcomes on soil health are limited due to weak implementation and enforcement mechanisms. It is clear mechanisms for checking compliance with existing regulations need to be strengthened and expanded. Performance indicators and measurements need to be clearly specified and monitored.
- **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. Farmers also need to be shown how to observe and measure soil changes – using simple methods and instruments - to make the benefits of SICS adoption visible in the short-term (where possible).
- **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. An innovation award could be an effective instrument to create awareness for sustainable producers and production methods amongst consumers and farmers alike.

- **Provide balanced information and establish opportunities for peer-to-peer learning:** personal conviction of farmers to adapt new practices is a powerful tool in the face of multi-layered challenges. Education plays a very important role in that regard. Therefore, unbiased knowledge and information- must be made accessible to farmers. This information should not favour any particular interest. Some of the practices benefitting soil will require farmers to learn about these techniques, their application to different conditions as well as their benefits to change their misconceptions about these methods. Since farmers tend to place a lot of trust in their peers, establishing a network of lighthouse farms demonstrating how to use and adapt different SICS in the region would effectively support farmers in learning and sharing experiences about these practices.

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 (e.g. Lahmar 2010).

Research aim and questions

The work presented here was carried out as part of the EU-funded SoilCare project.¹ 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 SICS²

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

¹ SoilCare: Soilcare for profitable and sustainable crop production in Europe, <https://www.soilcare-project.eu/>

² 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
Reduced tillage	Reduces energy cost and may enhance SOM content and soil structure; may increase the need for herbicides/ pesticides
Integrated pest management	Improves crop productivity and resource use efficiency; minimizes the loss of biodiversity.
Smart weed control	Improves crop productivity and resource use efficiency; may decrease the need for herbicides
Smart residue management	Reduces evaporation and soil temperature; may increase/decrease the succes of germination
Controlled traffic management	Reduces energy cost and the risk of soil compaction
Integrated landscape management	Improves biodiversity and cropping systems sustainability

The main aim of the work presented here was to formulate policy alternatives³ 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
Regulatory instruments	Force farmers to adopt SICS	<ul style="list-style-type: none"> Levels the playing field between competitors, as everyone must play by the same rules Fairly consistent (often long-term) 	<ul style="list-style-type: none"> Inflexible regardless of individual situations May be costly to implement Monitoring and enforcement can be costly Discourages innovation

³ 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
Economic instruments	Incentivise farmers to adopt SICS using subsidies and taxes etc.	<ul style="list-style-type: none"> • Encourages innovative methods • Can offset cost of implementation and/or discourage adverse behaviour • Allows a certain amount of flexibility 	<ul style="list-style-type: none"> • Can be subject to fluctuations as the market fluctuates • High likelihood of setting subsidies/taxes at incorrect rate (which leads to inefficiencies) • Can be subject to game-playing behaviour
Voluntary instruments	Encourage farmers to adopt SICS	<ul style="list-style-type: none"> • Sense of “ownership” as the decision was taken freely • High degree of flexibility 	<ul style="list-style-type: none"> • Does not guarantee implementation
Educational/information instruments	Educate farmers so they understand the importance of SICS	<ul style="list-style-type: none"> • Implementation as a result of truly understanding the impacts of the actions • High degree of flexibility 	<ul style="list-style-type: none"> • Does not guarantee implementation • Relies on interest of affected parties • Often takes more time to become effective

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.⁴ 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.

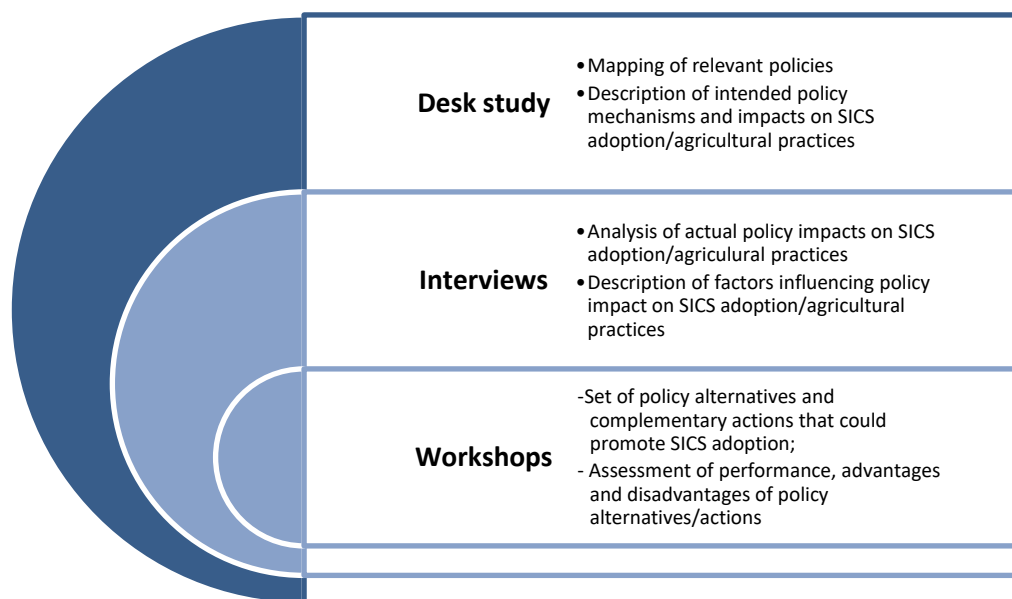


Figure 1: Research strategy

Data collection and analysis involved the following three activities:

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

⁴ The 16 countries include 14 EU Member States, i.e. Belgium, Germany, UK, France, Czech, Poland, Hungary, Romania, Denmark, Sweden, Greece, Spain, Italy, and Portugal and two non-EU countries, i.e. Switzerland and Norway.

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 regional⁵ 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.⁶ 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 Switzerland, five interviews were carried out (see Table 5).

Table 5: Organisations represented by interview partners

Organisation	Stakeholder category
Amt für Umwelt Kanton Thurgau (Cantonal Office for the Environment Thurgau)	Regional/local government
Agridea (Swiss Association for the Development of Agriculture and Rural Areas)	Farm advisory service
Bildungs- und Beratungszentrum Arenenberg (Centre for Education and Advice Arenenberg)	Farm advisory service
Bundesamt für Landwirtschaft (Federal Office for Agriculture)	National government
Bundesamt für Umwelt (Federal Office for the Environment)	Regional/local government

- 3) An adaption 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 Swiss workshop brought together 14 stakeholders, including farmers, policymakers, advisory services, and scientists (see Figure 2).

⁵ 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.

⁶ The policy inventory is available at: <https://www.soilcare-project.eu/outputs>

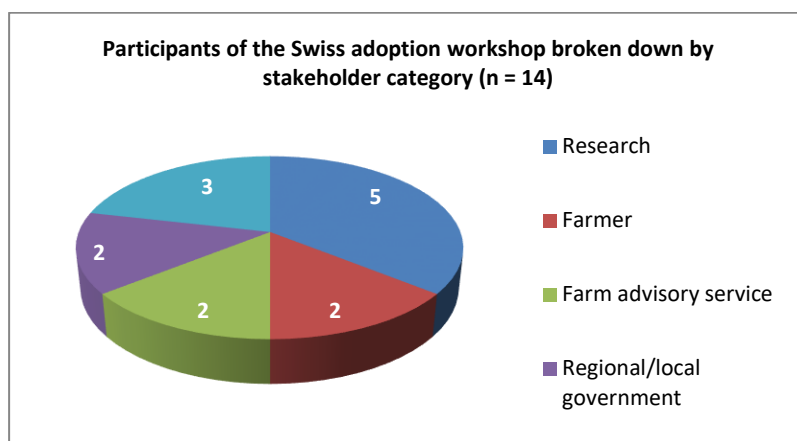


Figure 2: Types of stakeholders participating in the Swiss adoption workshop

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 canton Thurgau where the Swiss study site is located.⁷ 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 Thurgau, Switzerland

This section provides a review and analysis of national and regional policy instruments relevant for shaping agricultural practices in the region of Thurgau where the study site, "Frauenfeld", is located. 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.

⁷ See D7.1 at <https://www.soilcare-project.eu/outputs>

Table 6: Description of the study site

Site Name	Frauenfeld- Thurgau
Climate	Abundant precipitation, two predominant influence climates: the continental and the Alpine South climates
Temperatures	Annual average temperature: 11.2 °C
Study site	Sandy loam topsoil
Main soil threats	Low organic carbon content, compaction (autumn) - the compaction risk under wet soil conditions causes crop loss and not enough time remaining for cover cropping and green manuring in autumn.
Current practices	Both conventional and conservation cropping systems. (rotary cultivator or plough (furrow wheel), minimum soil tillage, crop rotation.

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

Table 7: Overview of experiments carried out in the Swiss study site, and the SICS category and cluster under which they are grouped

General treatment category	SICS cluster	Experiments
Controlled traffic management, integrated nutrient management, green manure, reduced tillage	Compaction alleviation	Grass verges: Area with grass verges and no grass verges (in culture) are compared, while both areas are driven on with the same weight.
	Fertilisation/amendments	Under-foot fertilization after Controlled Uptake of Long-Term Ammonium Nutrition (CULTAN) procedure: Under-foot fertilisation after CULTAN is compared to organic and mineral fertilisation.
	Soil improving crops	Green manure and minimum tillage: Green manuring and minimum tillage are applied between crop rotation and to avoid the usage of Glyphosate

2.1 Which existing policies and policy instruments shape agricultural practices in Thurgau?

This section provides a description of those national and regional level which may directly or indirectly shape agricultural practices in Switzerland.⁸ The focus is on policies identified as most important for soil-improving practices and the overview does not intend to provide an exhaustive overview of the policy landscape governing agricultural methods.

Agricultural policies

The most important policy instrument regarding soil in Switzerland is the **Soil Damage Ordinance** (SDO) which promotes protection of soils, defines appropriate management practices and targets and introduces financial penalties for non-compliance. The SDO differentiates between three types of farms based on their location: farms in low-lying areas (Talgebiet), farms in mountainous areas (Berggebiet) and farms in alpine pastures (Soemmerungsgebiet). This ordinance applies to all types of farms and formulates provisions for all types of soils where crops/plants may grow. Anyone who cultivates soil and uses vehicles, machinery and equipment for this purpose is required to take into account the physical properties and the moisture of the soil to avoid compaction and other structural changes of the soil, so that soil fertility is maintained in the long term. The SDO also contains provisions for the protection of water bodies from contamination from fertilisers and plant protection products. To prevent erosion, farmers are required to apply appropriate management and construction methods such as erosion-inhibiting building or cultivation technologies, and crop rotation. The ordinance defines a set of parameters to measure and monitor soil erosion on arable land. Farmers must meet the target values defined by the SDO. In case these values are not met, the region (canton) can set mandatory measures to ensure compliance with these targets. Repeated failure to conform with the standard might result in financial penalties. By setting specific soil erosion targets, the SDO therefore directly promotes the protection of soil which in turn impacts a range of agricultural practices, including crop selection and rotation, tillage management, nutrient management and pest management, as well as machine and traffic management.

Another highly relevant policy is the **Federal Act on Agriculture**. The act aims to support a sustainable but market-oriented agriculture which provides healthy food to the citizens, all the while contributing to the protection of natural resources. Provisions are included allowing for direct payments to farmers providing public and ecological services (see Direct Payment Ordinance). Payments are made on the condition that agricultural production methods comply with the provisions of legislation on the protection of waters, the environment and animal welfare, and excludes land within a designated building zone that has been legally excluded

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

under planning legislation. In addition, farmers are obliged to report on nutrient flows from and to their farms. At regional level, the **Act on Agriculture** provides guidance and support for sustainable farming methods.

The **Direct Payment Ordinance** regulates direct payments to farmers which is a main income-source for most Swiss farmers. There are several specific soil-improving requirements set out in the legislation. Participating in the payment scheme is voluntary and requires farmers to fulfil the requirements established by the ordinance to receive the financial support. It essentially refunds agricultural businesses for their environmental services deliver, such as maintaining and improving biodiversity and landscape quality. The policy establishes mandatory standards for crop rotation, cropping areas, pesticides, and defines inter alia "adequate soil protection". The Ordinance states that soil protection is to be ensured by optimum soil coverage and by means of measures to prevent erosion and chemical and physical soil contamination. The following articles define relevant requirements

- Art. 16 Controlled crop rotation: Seedlings must be defined in such a way as to prevent pests and diseases and to avoid erosion, soil compaction and soil fouling, as well as seepage and flooding of fertilisers and plant protection products. Farms with more than three hectares of open farmland must have at least four different arable crops per year.
- Article 17 Suitable soil protection: Soil protection is to be ensured by optimum soil coverage and by means of measures to prevent erosion and chemical and physical soil contamination. Farms with more than three hectares of open arable land must cultivate a winter culture, intermediate fodder or planting on each parcel with crops harvested before the 31st of August.
- Article 17 Suitable soil protection: Soil protection is to be ensured by optimum soil coverage and by means of measures to prevent erosion and chemical and physical soil contamination. Farms with more than 3 hectares of open arable land must cultivate a winter culture, intermediate fodder or planting on each parcel with crops harvested before the 31st of August.
- Article 18: Specific selection and application of plant protection products: In the protection of crops from pests, diseases and weeds, primary preventive measures, natural regulation mechanisms as well as biological and mechanical methods are to be applied. The use of plant protection products must consider the harmful thresholds as well as the recommendations of forecasting and warning services. Only plant protection products which have been placed on the market in accordance with the Plant Protection Ordinance of 12 May 2010 may be used.

In the same vein, the **Ordinance on structural improvements** in agriculture provides financial support to farms or groups of farms for investing in structural improvement measures, including inter alia soil improving measures. To qualify for financial support, these measures

should aim to improve or maintain the structure and hydrological balance of the soil (for example through drainage systems or dry-stone walls) and the maintenance or restoration of arable soil after natural hazards.

Environmental policies

The **Federal Act on the Protection of the Environment** dedicates one chapter to soil and highlights the need to ensure the long-term preservation of soil fertility, the prevention of soil compaction and erosion as well the remediation of polluted soils. It states that soil may be physically affected only to the extent that its fertility is not durably degraded and that the Federal Council may issue regulations or recommendations on measures against physical impacts such as erosion or compaction. According to the law, regional authorities (cantons) may adopt stricter measures against soil pollution or to reduce physical impacts in cases where fertility cannot be guaranteed in the long term. Measures to protect the soil from chemical and biological pollution are largely regulated by other legislation, such as the Ordinance on Protection of Waterbodies. Other type of emissions, including air pollutants, noise, vibrations, and radiation are also addressed and must be reduced as far as technically and economically possible in accordance with the law. Thus, the Environmental Protection Act may be relevant for SICS, for example when it comes to fuel emissions from agricultural machines or the application of chemicals.

The above-mentioned **Ordinance on Protection of Waterbodies** aims to reduce negative impacts on surface and groundwater to allow their long-term use. It stipulates that businesses with commercial livestock-husbandry need to be able to bring out at least 50% of their own manure according to the maximum nitrogen and phosphorus volumes allowed for their land. Agricultural businesses taking special measures to eliminate nitrogen may qualify for financial support through the Department for Agriculture and the cantonal office. To qualify for the payment, farmers need to comply with the limit values defined for manure, fertiliser and pesticide use established by the Ordinance.

Chemical policies

The **Federal Chemicals Act** intends to protect the lives and health of human beings against harmful effects arising from substances and preparations, including plant protection products. People handling such chemicals need Specific provisions for using these products are described in the **Chemical Risk Reduction Ordinance**. The Ordinance restricts the use of the particularly dangerous substances, preparations and articles covered by the annexes; it also specifies the personal and professional qualifications required for the use of certain particularly dangerous substances, preparations, and articles. It specifies applications requiring a license, such as aerial spreading and spraying of plant protection products, biocidal products, and fertilisers. It also includes a list with the uses which require an appropriate certificate or

qualification, such as the use of plant protection products. Annexes specify areas where the use of plant protection products is prohibited and formulate provisions for the use of fertilisers.

The **Ordinance on Plant Protectants** aims to ensure that the use of plant protection products has no unacceptable side effects for humans, animals, or the environment, neither immediate nor long-term. It limits their application to the extent necessary for the intended purpose. Approval for application is given by the Federal Office of Agriculture and may require information on different aspects such as maximum applicable dose per usage, time between last application and harvesting, maximum applications per year, protective measures for health of users, application intervals and so on. The use of devices for proper and targeted application is mandatory. Furthermore, plant protection products cannot be used in groundwater protection zones if they or their biologically significant metabolites can enter drinking water due to their mobility or lack of degradability.

Finally, the **Fertiliser Ordinance** governs the licensing, sale, import and use of fertilisers. Fertilisers are manure, fertilisers from recycled materials such as agricultural/gardening residues or sewage sludge, mineral, organic, composting substances, soil improving substances, microorganisms and others. The licensing does not apply to in-farm manure and fertilisers that are intended for export.

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

The main soil threats in Switzerland include low organic carbon content and compaction. The compaction risk under wet soil conditions causes crop loss and there is not enough time remaining for cover cropping and green manuring in autumn. SICS that are being tested at the study site are thought to address these soil threats and include compaction alleviation measures (Controlled traffic management on grass verges), integrated nutrient management (Under-foot fertilisation after CULTAN procedure) as well as green manure in combination with minimum tillage (Green manuring and minimum tillage applied between crop rotations). 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 region of Thurgau, Switzerland.

Before looking at policy instruments regulating or incentivising the individual SICS tested at the site, it should be noted that there are several policies which may indirectly promote the uptake of all SICS covered by the SoilCare project. For instance, the Federal Act on the Protection of the Environment stipulates that long-term soil degradation should be avoided. The formulation of (stricter) measures has been delegated to the cantons, and these may include obligations to use the practices trialled by SoilCare in areas where soil fertility is at risk and depending on the type of soil threat present. Similarly, the Soil Damage Ordinance allows

cantons to define measures in areas to reduce soil erosion. Finally, the Federal Act on Agriculture includes provisions allowing for direct payments to farmers providing public and ecological services and refers to environmental standards farmers must comply with to receive financial support, similar to cross-compliance mechanisms under the EU Common Agricultural Policy.

Compaction alleviation

There are no dedicated policies regulating or incentivising the use of machinery to reduce compaction other than through the pieces of legislation mentioned above. Since traffic and machine management can be directly linked to the loss of soil fertility and increased erosion, which are both targeted by these policies, cantonal measures could define requirements for the use and type of equipment used on areas at risk of or already experiencing soil compaction.

Integrated nutrient management

Fertilisation is regulated by all agricultural, environmental and chemicals policies analysed in this study. The SDO establishes mandatory targets for soil quality and may punish farmer who fail to meet the defined criteria. The Federal Act on Agriculture imposes measures such as fertiliser reporting to observe nutrient flows. The Direct Payment Ordinance stipulates that nutrient cycles should be closed as far as possible. Based on a nutrient balance, farmers need to demonstrate that no excess phosphorus and nitrogen are applied. The permissible phosphorus and nitrogen quantities are measured according to the plant requirements and the operational management potential. For N and P, a balancing error of 10% is allowed. Conducting such a nutrient balance can be an effective tool toward smarter nutrient management.

Green manure and reduced tillage in crop rotations

The use of crop rotation is promoted by the main national and cantonal agricultural policies introduced above, specifically the Soil Damage Ordinance which mentions crop rotations as a possible practice to protect the fertility of soil and reduce the loss of organic content. Because it is a regulatory measure with the possibility of punishment for non-compliance, the SDO has great potential to encourage farmers to adopt crop rotation. The same can be said for the Federal Act on Agriculture which gives economic support to farmers who provide ecological services which include crop rotation through direct payments.

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
(Act on Agriculture)											
Verordnung über die Strukturverbesserungen in der Landwirtschaft (Ordinance on structural improvements in agriculture)											

2.3 Which factors shape success or failure of policy instruments in Thurgau, Switzerland?

Research indicates that there are several factors that shape the success or failure of policy instruments in Switzerland, and the uptake of SICS tested in the study site region in general. These factors include:

Lack of policies incentivising development or use of more efficient machinery

Soil compaction is one of the biggest challenges to soil quality in Switzerland. However, policy does not seem to give enough attention the issue. For instance, several interviewees highlighted that a rule on maximum weight was lacking in the agricultural sector. Others suggested that farmers preferred bigger, heavier machinery. Furthermore, certain crops commonly found in Switzerland, e.g., sugar beet, necessitated extremely heavy machines and were harvested in wet periods exacerbating the problem. It has been suggested that the farmers might consider their machinery as unnecessarily big but were not given appropriate advice on alternatives.

Costs of SICS adoption

The stakeholders consulted pointed out that whilst costs can be prohibitive for some SICS, others came with a reduction in effort and inputs. Workshop participants noted that green verges could result in higher yields while lowering the volume of fertilisers needed. In contrast, the application of CULTAN procedures was assessed to be expensive due to the need of special injection equipment. There is anecdotal evidence that yield might be reduced.

Weak monitoring and enforcement

Stakeholders criticised the lack of mandatory control values for soil compaction, which made it impossible to monitor any hazardous activity. They explained that even in instances where measures called for the collection of data, it seemed that these data were not exploited to their fullest potential. For instance, there is a fine for soil erosion, but many of the cases go unnoticed. In the same vein, even when the soil samples are analysed, the results are not considered and usually treated as procedural details.

Lack of knowledge and effective dissemination

Stakeholders consulted for this study repeatedly mentioned that regulatory measures have a limited impact if farmers do not understand or are convinced of the benefits of changing their practices. For instance, workshop participants identified the lack of knowledge dissemination as one of the factors hampering the wider uptake of green verges despite their benefits (see above) as well as CULTAN fertilisation. Field demonstrations, better farm advice and dissemination of research findings as well as a network of lighthouse farms were suggested as effective and feasible actions to improve knowledge sharing.

Insufficient/biased information available

Interviewees mentioned how regional government's vested interests in certain business (for instance in meat or crop farming) resulted in both information and support being more readily available for these operations. Stakeholders explained that cantons were responsible for controlling and distributing direct payments. This means they will have limited interest in measures that might decrease agricultural productivity, and consequentially, the tax revenues for the region.

Time needed until positive changes in soil health can be observed

Stakeholders pointed out that soil quality was not easily observable. This is a problem for soil compaction, the main soil threat found in the site, which is not always apparent when looking at the soil surface. Since soil benefits might only materialise after several growing seasons, farmers need to be sufficiently motivated to change their practices now to reap the long-term benefits.

Market pressures favour short-term priorities over long-term investment in soil health

Interviewees highlighted that retailers exercised pressure on farmers to deliver products to specified deadlines. As a result, agricultural practices were decoupled from whether conditions

and soil conditions. For instance, one stakeholder stated that industrialised methods allowed farmers to meet these deadlines, but they were usually contributing to a worsening of the situation, e.g., through increased mechanisation which impacts on soil compaction. Soil management, on the other hand, requires long-term care and investment, but farmers are under pressure of meeting deadlines and harvesting pressure from the companies they are working with.

Reluctance to change due to perceived peer pressure and closed farming community

Voluntary economic incentives, such as the existing system of direct payments, may not always guarantee that farmers will take up certain practices as they have to weigh the financial reward against their potentially conflicting interests or personal motivations and attitudes. Stakeholders stated that some of the practices were highly visible to neighbouring farms such as crop rotations or reduced tillage methods. Some of these practices can result in a 'messy' look in the field which might discourage some farmers, as they fear the judgement of their peers, especially if they are the one adopting these particular practices as first in the region. In addition, stakeholders noted that current policy favours existing farmers when it comes to buy land for farming. This makes it very hard for outsiders to get access to the profession. This in turn has a negative impact as these groups have been found to experiment more, and to take up new practices more easily than traditional farmers.

Self-perception as "food suppliers"

Interviewees suggested that farmers culturally see themselves as the ones producing food for people which is a source of pride and identity. If the suggested SICS are likely to decrease productivity in the short term, farmers might see it as a failure therefore might be reluctant to adopt these practices. Stakeholders concluded that ecosystem services delivered by farmers needed to be valued more. This might result in a shift in farmers' self-perception as both food suppliers and land stewards who protect and maintain ecosystem services. This was particularly highlighted in discussions around the CULTAN fertilisation method which could recover and reuse ammonia from sewage treatment plants and thus contribute to a regional climate strategy.

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

Table 9: SICS tested in the site, adoption factors (enablers and barriers) and action to promote adoption identified by stakeholders⁹

Compaction alleviation: Green verges			
Adoption factors (+ or -)	Actions	Effectiveness	Feasibility
More yield with less effort, incl. manuring input (+)	Information dissemination/spreading awareness e.g., through the creation of lighthouse farms or innovation awards	3	4
Improved soil activity (less compaction) (+)	<i>None identified</i>		
Green strips (always passable) (+)	Information and field inspections	2	4
Lack of knowledge transfer (-)	Field demonstrations (+) Farm advice (canton)	3	4
Effort/practicability (-)	<i>None identified</i>		
Takes time for effects to be visible (-)	Technical aids to visualise changes	4	4
GPS required (1x per sowing), width of parcel, material quality (e.g., light machines) (-)	<i>None identified</i>		
Implementing new ideas needs interest and time of the farmer, willingness to take risks (-)	Risk coverage	2	2
D2 system does not fit yet, e.g., flower strips in favour of a functional biodiversity (-)	Practical suitability	3	3
Fertilisation/amendments: Fertilisation with Controlled Uptake of Long-Term Ammonium Nutrition (CULTAN)			
Adoption factors (+ or -)	Actions	Effectiveness	Feasibility
Long term pricing (+)	<i>None identified</i>		
Homogeneous and raw soils, flat roots, legumes (+)	<i>None identified</i>		
Precise fertilisation, chrome steel (+)	<i>None identified</i>		
Extraction of ammonia from sewage treatment plants will reduce the prices (+)	CULTAN manuring as part of climate strategy -> WIN-WIN situation on local, regional and global level	4	4
Side-line business, livestock-free, specialisation, innovative ideas (+)	<i>None identified</i>		
Increase humus content in soils (+)	<i>None identified</i>		
Very expensive, price must be lower at every level, corrosion, and logistics (-)	Lower prices on all levels -> Ecosystem services must be weighted differently / valued differently	3	4
Stony soils, compacted soils, dry soils, taproot (-)	<i>None identified</i>		
Yeast concentration, working width, material quality, need specialist for the injection (-)	<i>None identified</i>		
Common doctrine, dominance of the fertilizer industry. Need of more promotion, publications (-)	<i>None identified</i>		
Structural opinion, added value on farms (-)	<i>None identified</i>		
Principles of Agricultural Crop Fertilisation in Switzerland (PRIF), organic suitability (-)	Intermediate step: disclosure of research, intensify dissemination of results and research, then: adapt guidelines accordingly - the benefits should be considered at long term and over large chain (including ecosystem services).	4	4
Sulphur content (-)	<i>None identified</i>		

⁹Due 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.

3 Recommendations for actions to promote the uptake of SICS

The main soil threats in Switzerland include low organic carbon content and compaction. SICS that are being tested at the study site are thought to address these soil threats and include compaction alleviation measures (Controlled traffic management on grass verges), integrated nutrient management (Under-foot fertilisation after CULTAN procedure) as well as green manure in combination with minimum tillage (Green manuring and minimum tillage applied between crop rotations).

This report presented an inventory and analysis of bottlenecks and opportunities in sectoral and environmental policies to facilitate the adoption of Soil-Improving Cropping Systems (SICS) in Thurgau, Switzerland. The analysis shows that the existing policy framework promotes integrated nutrient management, the application of green manure and reduced tillage practices to some extent through economic incentives and regulatory measures. However, only regulatory approaches might fall short in instigating real change in behavior. Soil compaction, which is mainly due to the use of heavy machinery is addressed to a lower extent since there is no direct motivating factor for the farmers to reduce the size of their machines.

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

- **Consider introducing weight limitations for agricultural machinery into legislation:** for road vehicles, legislation establishes limitations on maximum weight. This is lacking for agricultural machines and should be integrated in existing agricultural legislation or a new, dedicated technical standard. In addition, farm advisory services need to include information on lighter vehicles farmers may use in the services they offer.
- **Facilitate the extraction of ammonia from sewage treatment plants:** the cost of applying the CULTAN procedure could be reduced if ammonia extracted from sewage treatment plants could be made available to farmers. This might require the investment in research on different methods for ammonia recovery by public institutions, a dissemination of findings and technologies and a subsequent adaptation of current guidelines on “Principles of Agricultural Crop Fertilisation in Switzerland” (PRIF).
- **Establish better monitoring and enforcement mechanisms:** while it was found that there are several policies already in place that – directly and indirectly - regulate and incentivise different SICS, stakeholders report that outcomes on soil health are limited due to weak implementation and enforcement mechanisms. It is clear mechanisms for checking compliance with existing regulations need to be strengthened and expanded. Performance indicators and measurements need to be clearly specified and monitored.
- **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. Farmers also need to be shown how to observe and measure soil changes – using simple methods and instruments - to make the benefits of SICS adoption visible in the short-term (where possible).

- **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. An innovation award could be an effective instrument to create awareness for sustainable producers and production methods amongst consumers and farmers alike.
- **Provide balanced information and establish opportunities for peer-to-peer learning:** personal conviction of farmers to adapt new practices is a powerful tool in the face of multi-layered challenges. Education plays a very important role in that regard. Therefore, unbiased knowledge and information- must be made accessible to farmers. This information should not favour any particular interest. Some of the practices benefitting soil will require farmers to learn about these techniques, their application to different conditions as well as their benefits to change their misconceptions about these methods. Since farmers tend to place a lot of trust in their peers, establishing a network of lighthouse farms demonstrating how to use and adapt different SICS in the region would effectively support farmers in learning and sharing experiences about these practices.
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Annex: Overview of key policies in Thurgau, Switzerland

Policy name	English translation	Scale	Impact on SICS	Description of policy
Verordnung über die Belastungen des Bodens	Soil Damage Ordinance	National	Crop rotation Green manure, cover crops, catch crops Integrated nutrient management Controlled drainage Reduced tillage Integrated pest management Smart residue management Controlled trafficking	This ordinance applies to all types of farms and formulates provisions for all types of soils where crops/plants may grow. Anyone who cultivates soil and uses vehicles, machinery and equipment for this purpose is required to take into account the physical properties and the moisture of the soil to avoid compaction and other structural changes of the soil, so that soil fertility is maintained in the long term (Art 6). Soils are to be managed according to the state of the art and in such a way that the water bodies are not affected, in particular by washing out of fertilisers and plant protection products (in reference to Article 27 (1) GSchG. To prevent the decrease of soil fertility by erosion, appropriate construction and management methods are to be applied, through erosion-inhibiting construction or cultivation technology and crop rotation and river formation. Annex 3 (in accordance with Art. 5.1 and 5.6) gives standard values for controlling soil erosion on arable lands. If these values are not met, the canton sets mandatory measures to be taken and will, with repeated unsatisfactory control, take financial measures. If a farmer does not meet the standard values or has soil loss, he has to take measures ordered by the canton. If there are repeatedly bad soil conditions due to inadequate agricultural practices, he can be punished financially.
Bundesgesetz über den Umweltschutz	Federal Act on the Protection of the Environment	National	Crop rotation Green manure, cover crops, catch crops Integrated nutrient management Controlled drainage Reduced tillage Integrated pest management Smart residue management Controlled trafficking Integrated landscape management	Part 1, Chapter 2, Art 7.4: Soil impacts are defined as physical, chemical or biological change in the natural soil quality. Part 2, Chapter 5 of the Environmental Protection Law is dedicated to soil and highlights the need to ensure the long-term preservation of soil fertility, the prevention of soil compaction and erosion as well the remediation of polluted soils. It states that soil may be physically affected only to the extent that its fertility is not durably degraded and that the Federal Council may issue regulations or recommendations on measures against physical impacts such as erosion or compaction (Art. 33). Art 34 allows regional authorities (cantons) to adopt stricter measures against soil pollution to regulate sewage infiltration, the use of substances and organisms or physical impacts on soil in cases where fertility cannot be guaranteed in the long term. They are also required to enact measures to reduce soil pollution to such an extent that non-hazardous cultivation is possible on soils where it is impossible to cultivate them in a normal way (Art 34).

Policy name	English translation	Scale	Impact on SICS	Description of policy
Gewässerschutzverordnung	Ordinance on Protection of Waterbodies)	National	Integrated nutrient management Controlled drainage Integrated pest management Smart weed control	The ordinance protects surface and groundwater from negative impacts and allows their long-term use. Chapter 4 defines that businesses with commercial livestock-husbandry need to have enough area, where they can bring out at least 50% of their own manure according to official N and P maxima (Art. 23, 25). Chapter 9, Article 54 Agricultural businesses taking special measures on nitrogen elimination may get financial support in accordance to the BLW (Department for Agriculture) and the cantonal office.
Bundesgesetz über die Landwirtschaft	Federal Act on Agriculture	National	Crop rotation Green manure, cover crops, catch crops Integrated nutrient management Reduced tillage Integrated pest management Smart residue management Controlled machine and traffic management	The Act aims to ensure that the agricultural sector makes a significant contribution towards inter alia the reliable provision of the population with food, preserving natural resources, the upkeep of the countryside through sustainable, market-orientated production. Provisions are included allowing for direct payments to farmers providing public and ecological services (see Direct Payment Ordinance). Via the Act, the state supports agricultural production financially, creates good socio-economic conditions for agricultural businesses, supports research and information and more. Agricultural production methods must comply with the provisions of legislation on the protection of waters, the environment and animal welfare, and the land farmed does not lie within a designated building zone that has been legally excluded under planning legislation. SICS relevant: Art 54 the state is free to give additional financial support for solitary cultures. Farmers are obliged to report on the nutrient flows from and to their farms (HODUFLU - web application for reporting fertilizer flows between different businesses) LwG, 910.1 Art. 165f.
Landwirtschaftsgesetz	Act on Agriculture	Regional	Crop rotation Plant cover Tillage management Nutrient management Pest management Machine and traffic management Mulching management Drainage management	The cantonal Act supplements the federal act on agriculture. The canton's aim and duty of supporting and enabling an economically and ecologically sustainable agriculture is formulated in a guiding policy and supporting measures are to be taken by the canton and also on a community level. Chapter 2, Art. 6.2: The canton can promote ecological cultivation methods. Chapter 5, Art. 13-15 regulates that methods such as crop type and adequate crop rotation must be followed by the farmers to prevent plant pests.
Verordnung ueber die Strukturverbesserung	Ordinance on structural improvements in agriculture	National	Drainage management, Landscape management	Governs financial support to farms or groups of farms for investing in structural improvement measures. Communal measures include inter alia soil improving measures, regional development projects, as well as measures to improve biodiversity. Applicants must supply a proof of Ecological Performance as specified by Art 11 of the Direct Payment

Policy name	English translation	Scale	Impact on SICS	Description of policy
rungen in der Landwirtschaft				Ordinance. Soil improving measures that get financial support are defined in Chapter 2, Article 14: Measures for improving or keeping structure and hydrologic balance of the soil (payments for drainage, dry stone walls) and their maintenance; restoration of arable soil after natural hazard; Supporting diverse business plans of individual farmers OR financially supporting soil-improving investments of at least two agricultural or two horticultural businesses.
Direktzahlungsverordnung	Direct Payment Ordinance	National	Plant cover Nutrient management Pest management, Crop rotation	Direct payments present a main income-source for most Swiss farmers. The Ordinance refunds agricultural businesses for their contribution on additional values, i.e. (a) agricultural landscapes, (b) agricultural produce self-subsistence, (c) biodiversity, (d) quality of landscapes, (e) production system (higher animal care standards, ecological standards), (f) efficient resource management. It details the procedures and conditions for receiving direct payments. Agricultural businesses can additionally to the compulsory regulations in the Act on Agriculture, comply with regulations defined under this Ordinance. The Ordinance defines the main categories, for which farmers will receive additional financial support. The Appendix contains specific data on mandatory standards for crop rotation, cropping areas, pesticides, and else. In Appendix Chapter 5, "adequate soil protection" is defined in more detail. The funding is distributed onto the cantons, which are then responsible for inspection of measures on farm level and for distributing or cancelling monetary support. Following these measures is voluntary, but only fulfilment allows for financial support.
Chemikaliengesetz (ChemG)	Federal Chemicals Act	National	Integrated pest management, smart weed control	This Act is intended to protect the lives and health of human beings against harmful effects arising from substances and preparations, including plant protection products. People handling such chemicals need Specific provisions for using these products are described in the Chemical Risk Reduction Ordinance.
Chemikalien-Risikoreduktions-Verordnung (ChemRRV)	Chemical Risk Reduction Ordinance	National	Pest management, weed control	This Ordinance prohibits or restricts the use of the particularly dangerous substances, preparations and articles covered by the Annexes; it also specifies the personal and professional qualifications required for the use of certain particularly dangerous substances, preparations and articles. Art. 4 specifies applications requiring a license, such as aerial spreading and spraying of plant protection products, biocidal products and fertilisers. Art. 7 lists the uses which require an appropriate certificate or qualification, such as the use of plant protection products. Annex 2.5 specifies areas where the use of plant protection products is prohibited; Annex 2.3 formulates provisions for the use of fertilisers.

Policy name	English translation	Scale	Impact on SICS	Description of policy
Pflanzenschutzmittelverordnung (PSMV)	Ordinance on Plant Protectants	National	Pest management, weed control	Plant protection products are chemical or organic. Anyone using plant protection products must ensure that they have no unacceptable side effects for humans, animals or the environment, neither immediate nor long-term. They may be applied only to the extent necessary for the intended purpose. Marketing and usage approval are duties of the producers or importers. Approval for application is given by the Federal Office of Agriculture and may require information on (a) max. applicable dose per usage (b) time between last application and harvesting (c) max. applications per year (d) protective measures for health of users (e) non-/professional application (f) application intervals (g) time until area can be entered again. The information on the packaging, in the package leaflet or on the safety data sheet as well as the notes on the possible applications and the requirements for the use (see Annex 11) must be observed. Only devices can be used that allow for a proper and targeted use of the plant protection product (Article 61 PSMV). In groundwater protection zones S2, Article 68 (1) and (2) PSMV are authoritative: Plant protection products cannot be used in groundwater protection zones if they or their biologically significant metabolites can enter drinking water due to their mobility or lack of degradability.
Duenger-Verordnung (DuV)	Fertiliser Ordinance	National	Integrated nutrient management	This Regulation governs the licensing, sale, import and use of fertilisers. Fertilizers are manure, recycling fertilizers (agricultural/gardening plant left-overs or sewage sludge), mineral, organic, composting substances, soil improving substances, microorganisms and others. The licensing does not apply to (a) in-farm manure and (b) fertilizers that are to be exported. Federal Office sets permissions etc, canton is responsible for controlling.