SoilCare
SOILCARE FOR PROFITABLE AND SUSTAINABLE CROP PRODUCTION IN EUROPE

Policy analysis:

Promoting SICS adoption in Veneto, Italy

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Executive summary

The soil-improving cropping systems (SICS) tested at the SoilCare study site in Veneto, Italy include cover crops and no-tillage and aim to address loss of soil-organic matter, the main soil threat found at the study site. 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). The analysis shows that several policies regulate and incentivse the use of cover crops and no-tillage, the SICS tested at the study site (shaded in dark green): Cover crops are incentivised through GAEC 4 of the CAPs cross-compliance standards, particularly on land showing signs of erosion. However, cover cropping is not included in the list of EFA options available to Italian farmers. In addition, area-based payments under FA 4C and 5E of the RDP may also be used to incentivise the use of cover crops as well as no-tillage, the second SICS practice tested at the site. Finally, water policies are also relevant for tillage management in the study site area, which is located in the Nitrate Vulnerable Zone of the Veneto Region which was established in compliance with the Nitrates Directive. The Veneto Region has recently implemented a specific agro-environmental measure to increase soil organic matter content through organic amendment input and conservative tillage.

Table 1: Coverage of SICS in existing national and regional policies, instruments and measures in the Veneto region in Italy

Policy	Crop rotation	Green manures, cover crops, catch crops	Integrated nutrient management	Enhanced efficiency irrigation	Controlled drainage	No- tillage	Integrated pest management	Smart weed control	Smart residue management	Controlled traffic management	Integrated landscape management
CAP GAEC Cross-compliance standards *Decreto 18 gennaio 2018. Disciplina del regime di condizionalità ai sensi del regolamento (UE) n. 1306/2013 e delle riduzioni ed esclusioni per inadempienze dei beneficiari dei pagamenti diretti e dei programmi di sviluppo rurale*											
National CAP rural development programmes 2014-20- *Programmi di Sviluppo Rurale*											
CAP rural development programmes 2014-20 for the Veneto region *Programmi di Sviluppo Rurale Veneto*											

Policy	Crop rotation	Green manures, cover crops, catch crops	Integrated nutrient management	Enhanced efficiency irrigation	Controlled drainage	No- tillage	Integrated pest management	Smart weed control	Smart residue management	Controlled traffic management	Integrated landscape management
River Basin Management Plan for the Eastern Alps *Piano di Gestione delle Acque, Distretto Idrografico delle Alpi Orientali*											
General criteria and technical standards for the regional regulation of the agronomic use of livestock manure *Criteri e norme tecniche generali per la disciplina regionale dell'utilizzazione agronomica degli effluenti di allevamento*											
Application of the directive 91/676 / CEE on the protection of waters from pollution by nitrates from agricultural sources *Applicazione della direttiva 91/676/CEE sulla protezione delle acque dall'inquinamento da nitrati provenienti da fonti agricole*											
Implementation of the directive on the sustainable use of pesticides *Attuazione della direttiva 2009/128/CE che istituisce un quadro per l'adozione comunitaria ai fini dell'utilizzo sostenibile dei pesticidi.*											
Ministerial Decree on the correct use of plant protection products, as well as of the municipal regulation proposal for the use of plant protection products, in application of the National Action Plan for the sustainable use of plant protection products *Indirizzi regionali per un corretto impiego dei prodotti fitosanitari, nonché della proposta di regolamentazione comunale per l'utilizzo dei prodotti fitosanitari, in applicazione del Piano di Azione Nazionale per l'uso sostenibile dei prodotti fitosanitari*											

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:

- Limited influx of young farmers prevents change
- Established practices increase need for inputs and heavy machinery
- Lack of a clear vision in policy for sustainable farming
- Complex policies which focus on short-term solutions

- Translation of national policies at regional level creates different outcomes
- No-tillage management and weed control without glyphosate
- Lack of education and training

Recommendations for actions to promote the uptake of SICS

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

- **Develop horizontal, long-term strategies for sustainable agriculture:** A strategic vision which goes beyond the regional differences and short-term political interest has great potential in facilitating a transition to sustainable agriculture and thus better soil management practices. In the same vein, policies should thrive to be more holistic. The European Farm to Fork Strategy already could provide a starting point for developing such a vision.
- **Flexible but well-informed policy design:** Italy has a great diversity of regions and farming systems, each with their own problems. Policy should take these differences into account so that they do not undermine the successful implementation or lead to success only in the areas which are already progressive. The policy must be based on the identification of problems and designing solutions based on scientific input.
- **Education and training:** More emphasis should be put on training of farmers and consumers. Technical and scientific knowledge provided by regions should be better transmitted to 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 in order to change their misconceptions about these methods. To this end, research findings should be made accessible and widely disseminated and educational activities should be encouraged. Knowledge should be disseminated via multiple channels, through the provision of guidance document but also farms visits and demonstration days.
- **Improve farmers' connection with research results:** At the final study site workshop farmers expressed the need for a stronger link between research results on one hand and farming community on the other. They also suggested to involve farmers in the research work with farm scale experiments. Researchers suggested to create to an intermediate institution to diffuse the knowledge from scientific results to farmers. Farmers confirmed researchers' suggestions, adding that they need independent and objective advice and information on SICs. Researchers and technical experts underlined the need for an on-field demonstration activities and farmers' cooperation and permanent exchange of views between researcher and farming community to share the results.
- **Demographic change:** Policies, especially in the long term should aim to make the profession of farming more attractive to young farmers and people who are not

farmers by family background. Furthermore, access for those who are willing to take up farming should be facilitated.

- **Need of extensive studies at farm scale -** Policy makers attending final study site workshop confirmed the positive environmental effect of conservation agriculture, and expressed the need to carry out more extensive studies of SICS at farm scale.

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 2).

Table 2: List of promising general SICS[2]

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
No-tillage	Reduces energy cost and may enhance SOM content

[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
	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 biodiversty and cropping systems sustainability

The main aim of the work presented here was to formulate policy alternatives[3] 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 3: Summary of policy approaches

Policy approach	Premise	Positive attributes	Negative attributes
Regulatory instruments	Force farmers to adopt SICS	• Levels the playing field between competitors, as everyone must play by the same rules • Fairly consistent (often long-term)	• Inflexible regardless of individual situations • May be costly to implement • Monitoring and enforcement can be costly • Discourages innovation
Economic instruments	Incentivise farmers to adopt SICS using	• Encourages innovative methods • Can offset cost of	• Can be subject to fluctuations as the market fluctuates

[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
	subsidies and taxes etc.	implementation and/or discourage adverse behaviour • Allows a certain amount of flexibility	• 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	• Sense of "ownership" as the decision was taken freely • High degree of flexibility	• Does not guarantee implementation
Educational/information instruments	Educate farmers so they understand the importance of SICS	• Implementation as a result of truly understanding the impacts of the actions • High degree of flexibility	• 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

[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.

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.

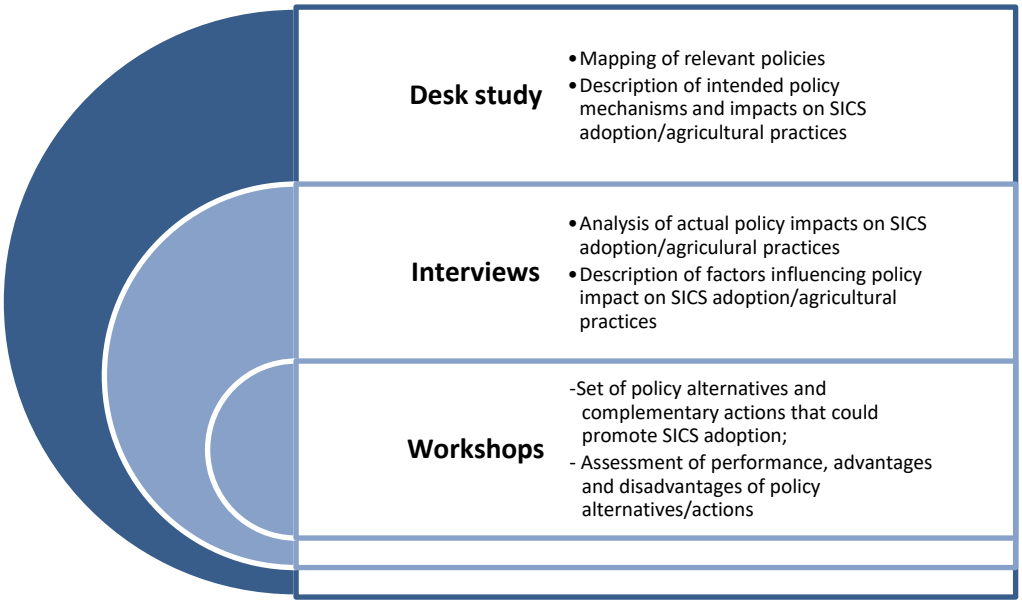

Figure 1: Research strategy

Data collection and analysis involved the following three activities:

1) **A desk-study of policy documents (in the broadest sense) and relevant literature:** 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[5] 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 Italy, three interviews were carried out(see **Error! Reference source not found.**).

Table 4: Table 3: Organisations represented by interview partners

Organisation	Stakeholder category
Ufficio Caccia e Pesca - Amt für Jagd und Fischerei *(Authority for hunting and fishing), Bolzano/Bozen Province)*	Regional/local government
University of Teramo (IT)/CREA (Consiglio per la ricerca in agricoltura e l'analisi dell'economia agrarian) *(Council for agricultural research and analysis of the agrarian economy)*	Research
Ministry of Agriculture (Section on rural development coordination at the Ministry)	National government

3) **An adption 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 Italian workshop brought together ten stakeholders, including farmers, policymakers, advisory services, and scientists.

[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

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 region of Veneto where the study site, "Legnaro" 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 D*7.1 Inventory of opportunities and bottlenecks in policy to facilitate the adoption of soil-improving techniques* for, available at: https://www.soilcare-project.eu/outputs/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/outputs/deliverables.

Individual country policy inventories can be downloaded from: https://www.soilcare-project.eu/outputs

2 Analysis of policy shortcomings and opportunities in the Veneto region, Italy

This section provides a review and analysis of national instruments relevant for shaping agricultural practices in the Veneto region where the study site, "Legnaro", is located. Policies investigated include both policies implementing EU instruments as well as those initiated by national and regional institutions[8]: 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	**Legnaro, Veneto**
Climate	Mediterranean North pedo-climatic zone. Sub-humid, with annual rainfall of about 850 mm
Study site	Sedimentary loamy soils with shallow groundwater (<2 m).
Main soil threats	Loss of organic matter (SOM) in mineral soils causing GHG emissions and worsening of soil functions. Soil compaction.
Current practices	Conventional, different crop rotation, mouldboard ploughing, chemical weed and pest control.

[7] See D7.1 at https://www.soilcare-project.eu/outputs

[8] 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 Italian study site, and the SICS category and cluster under which they are grouped

General treatment category	SICS cluster[9]	Experiments
No-tillage, cover crops	**Soil cultivation**	**Loss of soil-organic matter and compaction control** Mouldboard plough and bare soil Mouldboard plough and deep rooting cover crop (tillage radish) No tillage and bare soil No tillage and deep rooting cover crop (tillage radish)

2.1 Which existing policies and policy instruments shape agricultural practices in the Veneto region?

A policy analysis at the national and regional level identified the following policies which may directly or indirectly shape agricultural practices in the Veneto region. 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

The different funding instruments established under the EU **Common Agricultural Policy (CAP)** greatly influence farming practices in the region. Direct payments are tied to farmers meeting the **Good Agricultural and Environmental Conditions (GAEC)** as well as the greening requirements set out by the policy. The GAEC cross compliance standards are implemented through **Norme per il mantenimento del terreno in buone condizioni agronomiche e ambientali (BCAA)[10].** The following GAECs are highly relevant for soil management and related practices:

- GAEC 4: Minimum soil cover:
    - for arable land that is no longer used for production purposes and showing signs of erosion, plant cover needs to be maintained (natural or sown), throughout the year.
    - on all soils showing signs of erosion, green cover needs to be maintained for at least 90 consecutive days between 15 September and 15 May; or,

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

[10] Decreto 18 gennaio 2018. Disciplina del regime di condizionalità ai sensi del regolamento (UE) n. 1306/2013 e delle riduzioni ed esclusioni per inadempienze dei beneficiari dei pagamenti diretti e dei programmi di sviluppo rurale.

alternatively, techniques for soil protection need to be applied (such as splitting or subsoiling in place of ordinary ploughing, leaving of crop residues, etc.).

- GAEC 5: Minimum management requirements to limit soil erosion
    - The creation of temporary ditches, so that the rainwater collected maintains a speed that does not compromise the function of the furrow itself and is directed drainage canals and natural riverbeds bordering fields. This includes sloping land showing evidence of soil erosion.
    - The prohibition of unauthorized levelling.
    - The maintenance of the hydraulic infrastructure to guarantee their efficiency and functionality.
- GAEC 6: Maintaining soil organic matter: crop residue is to be managed appropriately to avoid loss of organic matter. The burning of stubble and straw is therefore prohibited
- GAEC 7: Maintaining landscape features: Maintenance of landscape features, including, where appropriate, hedges, ponds, ditches, trees in rows, in groups or blocks, field edges and terraces and including a ban on pruning hedges and trees in the breeding and nesting season of birds and, optionally, measures to combat invasive plant species

Greening requirements were first introduced in 2015 and apply to direct payments under Pillar 1 of the CAP. Cover cropping is one of the options farmers may implement for Ecological Focus Areas (EFAs). Farmers with over 15 ha of arable land have had to devote 5% of their farmed area to EFAs to qualify for full direct subsidy payments. Italy chose to make all EFA options excepting catch crops and green cover available to their farmers.[11]

In addition to these conditional payments, the **Rural Development Plans (RDP)** provide funding for contractual, voluntary commitments by farmers to implement certain sustainable agricultural practices. In Italy, **RPDs** are implemented at national and regional level: there is one national and 21 regional RDPs, one for each of the 19 administrative regions and the two autonomous provinces, Trento and Bolzano. The RDP for the Veneto outlines the region's priorities for allocating the € 1.169 million of public money (€ 5.4 million from the EU budget and € 655 million of national co-funding plus € 10 million of additional top-ups) available over the seven-year funding period. Veneto's RDP focuses on all six EU-level rural development priorities, with an emphasis on "restoring, preserving and enhancing ecosystems related to agriculture and forestry" (priority 4). The RDP aims to protect more than 82 000 hectares of land through management contracts targeted to specific biodiversity, water objectives and preventing soil erosion. A further 8 000 hectares of farmland will receive support to either convert to or maintain organic farming. Under Focus Area 4C "preventing

[11] Hart K (2015), Green direct payments: implementation choices of nine Member States and their environmental implications, IEEP London.

soil erosion and improving soil management", the RDP established the target of "10.41% of agricultural land under contracts". Measures to be used to reach this coal include inter alia agri-environment-climate measures (M11) and cooperation (M11). In addition, the RDP aims to have "6.09" of agricultural and forest land under management contracts contributing to carbon sequestration or conservation" under Focus Area 5E "carbon conservation and sequestration". [12]

Water policies

The **Water Framework Directive (WFD)** was transposed into Italian law in 2006 with the publication of the Environmental code (Decree 152/2006) which abolished all previous water legislation . It divided the national territory into eight RBDs, and the number has since been no- to seven (in 2016). The Veneto region lies within the River Basin District "Eastern Alps" covering an area of approximately 37,600 km^2.[13] The **Piano di Gestione delle Acque Distretto Idrografico delle Alpi Orientali** (River Basin Management Plan for the Eastern Alps) defines the standards for water quality and the specific measures for protection of waters from pollution, increasing the efficiency of water use at sub-regional level. With the main pressures on water quality from agriculture being diffuse pollution from nutrients and chemicals, and abstractions in surface water and groundwater, measures established by the River Basin Management Plan place certain requirements on nutrient, pest, and irrigation management practices. Whilst these measures primarily aim to maintain and improve water quality, they can reasonably expect to benefit soil health by reducing soil pollution, salinisation, acidification, and erosion.

The **EU Nitrates Directive** is implemented through **Criteri e norme tecniche generali per la disciplina regionale dell'utilizzazione agronomica degli effluenti di allevamento**. The national law requires that organic fertilisers are used following the good agricultural practices (defined in the law) and sets some prohibition of the use of solid and liquid manures in specific environmental conditions. It stipulates that the use of organic fertilisers is done in agricultural areas, guaranteeing a high level of efficiency of the inputs. At regional level, the law defines the vulnerable zones and the limits of application for organic fertilisers for both vulnerable and non-vulnerable zones. It also imposes the use of crop rotations and defines the application methods to be used for enhancing the efficiency of organic inputs and applies the prohibitions prescribed in the national law.

Chemicals policies

The **EU Sustainable Use of Pesticides Directive (SUPD)** is implemented through national and regional level legislation. It defines the measures to be taken for a sustainable use of

[12] European Commission. 2015. Factsheet on 2014-2021 Rural Development Programme for the Region Veneto. https://ec.europa.eu/info/sites/info/files/food-farming-fisheries/key_policies/documents/rdp-factsheet-italy-veneto_en.pdf

[13] Balzarolo, D.; Lazzara, P.; & Colonna, P.; Becciu, G.; and Rana, G. 2011. The implementation of the Water Framework Directive in Italy. *Options Mediterrannées.* A98. 155-168.

pesticides in order to reduce the adverse impacts on human health, the environment and biodiversity and it promotes alternative approaches and non-chemical methods in the phytosanitary domain. The link with soil is mentioned in the articles that regulate the sustainable use of pesticides so that the soil is protected.

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

The soil-improving cropping systems (SICS) tested at the SoilCare study site in Veneto, Italy include cover crops and no-tillage. The SICS trialled at the site aim to address loss of soil-organic matter, the main soil threat found at the study site. Loss of organic matter causes inter alia GHG emissions which negatively impacts on soil functions, such as the hydraulic properties of soil and nutrient supply. This in turn pushes farmers to rely on external chemical input. In the last fifty years, soil organic matter in the North Eastern Italy decreased at rates ranging from 0.02 to 0.58 t C/ha/year because of the intensification and simplification of cropping systems (e.g., monocultures) and the uncoupling of crop and livestock production. Most recently, the removal of crop residue for bioenergy production has raised concerns about its impact on evolution of the soil organic matter. Cover crops and no-tillage methods therefore represent important practices that might benefit soil health in the region if widely taken up.

The table below provides an overview of policies promoting the full range of SICS covered by the SoilCare project (shaded in light green). The analysis shows that several policies regulate and incentivse the use of cover crops and no-tillage, the SICS tested at the study site (shaded in dark green): Cover crops are incentivised through GAEC 4 of the CAPs cross-compliance standards, particularly on land showing signs of erosion. However, cover cropping is not included in the list of EFA options available to Italian farmers. In addition, area-based payments under FA 4C and 5E of the RDP may also be used to incentivise the use of cover crops as well as no-tillage, the second SICS practice tested at the site. Finally, water policies are also relevant for tillage management in the study site area, which is located in the Nitrate Vulnerable Zone of the Veneto Region which was established in compliance with the Nitrates Directive. The Veneto Region has recently implemented a specific agro-environmental measure to increase soil organic matter content through organic amendment input and conservative tillage.

Table 7: Coverage of SICS in existing national and regional policies, instruments and measures in the Veneto region in Italy

Policy	Crop rotation	Green manures, cover crops, catch crops	Integrated nutrient management	Enhanced efficiency irrigation	Controlled drainage	No- tillage	Integrated pest management	Smart weed control	Smart residue management	Controlled traffic management	Integrated landscape management
CAP GAEC Cross-compliance standards *Decreto 18 gennaio 2018. Disciplina del regime di condizionalità ai sensi del regolamento (UE) n. 1306/2013 e delle riduzioni ed esclusioni per inadempienze dei beneficiari dei pagamenti diretti e dei programmi di sviluppo rurale*											
National CAP rural development programmes 2014-20- *Programmi di Sviluppo Rurale*											
CAP rural development programmes 2014-20 for the Veneto region *Programmi di Sviluppo Rurale Veneto*											
River Basin Management Plan for the Eastern Alps *Piano di Gestione delle Acque, Distretto Idrografico delle Alpi Orientali*											
General criteria and technical standards for the regional regulation of the agronomic use of livestock manure *Criteri e norme tecniche generali per la disciplina regionale dell'utilizzazione agronomica degli effluenti di allevamento*											
Application of the directive 91/676 / CEE on the protection of waters from pollution by nitrates from agricultural sources *Applicazione della direttiva 91/676/CEE sulla protezione delle acque dall'inquinamento da nitrati provenienti da fonti agricole*											
Implementation of the directive on the sustainable use of pesticides *Attuazione della direttiva 2009/128/CE che istituisce un quadro per l'adozione comunitaria ai fini dell'utilizzo sostenibile dei pesticidi.*											
Ministerial Decree on the correct use of plant protection products, as well as of the municipal regulation proposal for the use of plant protection products, in application of the National Action Plan for the sustainable use of plant protection products *Indirizzi regionali per un corretto impiego dei prodotti fitosanitari, nonché della proposta di regolamentazione comunale per l'utilizzo dei prodotti fitosanitari, in applicazione del Piano di Azione Nazionale per l'uso sostenibile dei prodotti fitosanitari*											

2.3 Which factors shape success or failure of policy instruments in Italy?

Evidence gathered through the interviews and desk research show that different contextual factors contribute to and undermine the success of the policy instruments. Findings can be summarised around the following main points:

- Limited influx of young farmers prevents change
- Established practices increase need for inputs and heavy machinery
- Lack of a clear vision in policy for sustainable farming
- Complex policies which focus on short-term solutions
- Translation of national policies at regional level creates different outcomes
- No-tillage management and weed control without glyphosate
- Lack of education and training

Limited influx of young farmers prevents change

In the region, and the Province of Bolzano in particular, land is passed from father to the first-born son, meaning that farming is essentially closed to newcomers (outsiders). This has a potential negative impact on the adoption of new practices and creates a conservative attitude towards environmental protection, with a higher average age for farmers.

Established practices increase need for inputs and heavy machinery

Stakeholders observed a negative feedback look which intensifies the application of practices that undermine soil health. For instance, mechanisation and the use of heavy machinery lead to more soil compaction. This, in turn, forces farmers to apply deep tillage although the policy tries to push them in the opposite direction.

Lack of a clear vision in policy for sustainable farming

Although EU legislation has a significant impact on the farmers' behaviour through various instruments, there seems to be a general perception that there is not a specific and clearly defined strategy for transitioning towards a sustainable farming system, especially at the national level. As such, various initiatives remain disconnected from one another and fail to create an overall sense of direction.

Complex policies which focus on short-term solutions

Stakeholders highlighted a disconnect between policy and the technical aspects of agricultural production on the ground. Furthermore, policies are perceived to be short-

sighted, aiming to solve the problems of the current situation, without paying any attention to the future. Especially the CAP is considered to be unnecessarily complex and in need of simplification. The complexity acts as a barrier for innovation as well as adoption of new techniques. Technical experts attending the final study site workshop[14] likewise reported the need for a simplified legislation to regulate the subsidies and practical seminars both for farmers and advisors.

Translation of national policies at regional level creates different outcomes

The national framework was criticised as being poorly outlined, transferring almost all power to the regions. This created differences in how legal requirements and policy objectives were understood and applied, leading to conflicting interventions.

No-tillage management and weed control without glyphosate

Finally, stakeholders concluded that the main barrier to an uptake of no or reduced tillage practices could be the control of weeds, especially in sub-humid climates. With the widely-used pesticide glyphosate facing a potential ban by EU lawmakers, farmers will require advice on how to combine no-tillage practices with sustainable with control methods.

Lack of education, and training

One expert mentioned that farmers are not very keen on acquiring new knowledge and techniques, with the dissemination of knowledge being one of the main problems. It was noted that the agricultural advisory services offered by the Regions were of variable quality. The differences between regions were thought to cause some of these quality issues. Within this context, stakeholders emphasised that the farming community in Italy was quite heterogenous and that the level of acceptance of new practices highly variable. This was also highlighted during the final study site workshop[15,] where farmers themselves stated that of the main limitations to SICs application would be farmers' resistance to change. On the other hand, stakeholders highlighted that the new generation of farmers were more educated and aware of environmental issues, providing a real opportunity for fostering change through targeted advisory activities.

[14] Final on line stakeholder meeting, Legnaro study site (Italy), 29/01/2021
[15] Ibid.

3 Recommendations for actions to promote the uptake of SICS

SICS that are being tested at the study site in the Veneto region in Italy (no- and no tillage and cover crops) aim to address the main soil threats of soil organic matter loss and soil compaction.

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 the Veneto region in Italy. 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:

- **Develop horizontal, long-term strategies for sustainable agriculture:** A strategic vision which goes beyond the regional differences and short-term political interest has great potential in facilitating a transition to sustainable agriculture and thus better soil management practices. In the same vein, policies should thrive to be more holistic. The European Farm to Fork Strategy already could provide a starting point for developing such a vision.
- **Flexible but well-informed policy design:** Italy has a great diversity of regions and farming systems, each with their own problems. Policy should take these differences into account so that they do not undermine the successful implementation or lead to success only in the areas which are already progressive. The policy must be based on the identification of problems and designing solutions based on scientific input.
- **Education and training:** More emphasis should be put on training of farmers and consumers. Technical and scientific knowledge provided by regions should be better transmitted to 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 in order to change their misconceptions about these methods. To this end, research findings should be made accessible and widely disseminated and educational activities should be encouraged. Knowledge should be disseminated via multiple channels, through the provision of guidance document but also farms visits and demonstration days.
- **Improve farmers' connection with research results:** At the final study site workshop[16] farmers expressed the need for a stronger link between research results on one hand and farming community on the other. They also suggested to involve farmers in the research work with farm scale experiments. Researchers suggested to create to an intermediate institution to diffuse the knowledge from scientific results to farmers. Farmers confirmed researchers' suggestions, adding that they need independent and objective advice and information on SICs. Researchers and technical experts underlined the need for an on-field demonstration activities and farmers'

[16] Final on line stakeholder meeting, Legnaro study site (Italy), 29/01/2021

cooperation and permanent exchange of views between researcher and farming community to share the results.

- **Demographic change:** Policies, especially in the long term should aim to make the profession of farming more attractive to young farmers and people who are not farmers by family background. Furthermore, access for those who are willing to take up farming should be facilitated.
- **Need of extensive studies at farm scale -** Policy makers attending final study site workshop[17] confirmed the positive environmental effect of conservation agriculture, and expressed the need to carry out more extensive studies of SICS at farm scale.

[17] Ibid.

Annex: Overview of key policies in the Veneto region, Italy

Policy name	English translation	Scale	EU or MS level	Impact on SICS	Description of policy
Decreto 18 gennaio 2018. Disciplina del regime di condizionalità ai sensi del regolamento (UE) n. 1306/2013 e delle riduzioni ed esclusioni per inadempienze dei beneficiari dei pagamenti diretti e dei programmi di sviluppo rurale	CAP GAEC Cross-compliance standards	National	EU (CAP cross compliance)	All SICS	The Decree identifies: a) the mandatory criteria for agricultural management practices and the standards for maintaining soil health required for accessing the contributions related to cross compliance ; b) defines the cases of exclusion or reductions of the contribution to farmers, according the EU regulations n. 809/2014 and n. 640/2014 c) defines the minimal requirements for fertiliser and pesticide applications for accessing cross-compliance. The Decree specifies the following GAECs that are highly relevant for soil management and related practices: GAEC 4: Minimum soil cover: – for arable land that is no longer used for production purposes and showing signs of erosion, plant cover needs to be maintained (natural or sown), throughout the year. – on all soils showing signs of erosion, green cover needs to be maintained for at least 90 consecutive days between 15 September and 15 May; or, alternatively, techniques for soil protection need to be applied (such as splitting or subsoiling in place of ordinary ploughing, leaving of crop residues, etc.). GAEC 5: Minimum management requirements to limit soil erosion – The creation of temporary ditches, so that the rainwater collected maintains a speed that does not compromise the function of the furrow itself and is directed drainage canals and natural riverbeds bordering fields. This includes sloping land showing evidence of soil erosion. – The prohibition of unauthorized levelling. – The maintenance of the hydraulic infrastructure to guarantee their efficiency and functionality. GAEC 6: Maintaining soil organic matter: crop residue is to be managed appropriately to avoid loss of organic matter. The burning of stubble and straw is therefore prohibited

Policy name	English translation	Scale	EU or MS level	Impact on SICS	Description of policy
					GAEC 7: Maintaining landscape features: Maintenance of landscape features, including, where appropriate, hedges, ponds, ditches, trees in rows, in groups or blocks, field edges and terraces and including a ban on pruning hedges and trees in the breeding and nesting season of birds and, optionally, measures to combat invasive plant species Greening requirements were first introduced in 2015 and apply to direct payments under Pillar 1 of the CAP. Cover cropping is one of the options farmers may implement for Ecological Focus Areas (EFAs). Farmers with over 15 ha of arable land have had to devote 5% of their farmed area to EFAs to qualify for full direct subsidy payments. EFA options available are: – Land lying fallow; – Terraces; – Landscape features, – Buffer strips, – Areas of agro-forestry, – Strips of eligible hectares along forest edges (with or without production), – Areas with short rotation coppice with no use of mineral fertiliser and/or plant protection products, – Previously afforested areas which are still eligible for direct payments, – Areas with catch crops, or green cover established by the planting and germination of seeds, – Areas with nitrogen fixing crops. - Italy chose to make all EFA options excepting catch crops and green cover available to their farmers.
Programmi di Sviluppo Rurale	CAP rural development programmes 2014-20- National Programmes	National	EU (CAP RDP)	Integrated landscape management, integrated pest management, integrated nutrient management	Italy has got 21 RDPs, one per each administrative Region (19) and autonomous Province (Trento and Bolzano provinces). Each RDP is set up by Regions and Provinces according to Reg. (UE) N. 1305/2013 and related regulations, based on regional specific pedo-climatic and socio-economic conditions and on a dedicated regional needs assessment. Each RDP has to contribute to the achievement of 6 EU priorities. Soil conservation is targeted within priority 4 (environment) (restoring, preserving and enhancing ecosystems related to agriculture and forestry and priority 5 (climate) (promoting resource efficiency and supporting the shift towards a low carbon and climate resilient economy in agriculture, food and forestry sectors). Soil conservation, in particular, is targeted within the Focus Area 4C

Policy name	English translation	Scale	EU or MS level	Impact on SICS	Description of policy
					(preventing soil erosion and improving soil management) and 5E (fostering carbon conservation and sequestration in agriculture and forestry).
Programmi di Sviluppo Rurale	CAP rural development programmes 2014-20- Regional Programmes	Regional	EU (CAP RDP)	Integrated landscape management, integrated pest management, integrated nutrient management	The Regional RDP defined the specific instruments to achieve the results defined in the National RDP. Considering SICS, the most important actions are related to Integrated and Organic agriculture (limiting the pest management practices available and fertilisations and aiming toward crop rotation) and the specific measures for the implementation of no-tillage. At the agro-environmental level, the measures to preserve and enhance the presence of woody buffer strips are also significant.
Piano di Gestione delle Acque, Distretto Idrografico delle Alpi Orientali	River Basin Management Plan for the Eastern Alps	Regional	EU (WFD)	Efficiency irrigation, controlled drainage management, integrated landscape management	The Water Framework Directive was transposed into Italian law in 2006 with the publication of the Environmental code (Decree 152/2006) which abolished all previous water legislation. It divided the national territory into eight RBDs, and the number has since been no- to seven (in 2016). The Veneto region lies within the River Basin District "Eastern Alps" covering an area of approximately 37,600 km^2. The Piano di Gestione delle Acque Distretto Idrografico delle Alpi Orientali (River Basin Management Plan for the Eastern Alps) defines the standards for water quality and the specific measures for protection of waters from pollution, increasing the efficiency of water use. NOTE: the area considered encloses the Provinces of Trento and Bolzano, Veneto Region and Friuli-Venezia Giulia Region. It should be considered as a 'sub-national' regulation.
Criteri e norme tecniche generali per la disciplina regionale dell'utilizzazione agronomica degli effluenti di allevamento	General criteria and technical standards for the regional regulation of the agronomic use of livestock manure	National	EU (Nitrates Directive)	Crop rotations, cover crops, no-tillage, integrated nutrient management; integrated landscape management	The national law requires that organic fertilisers are used following the good agricultural practices (defined in the D.M. 19 April 1999 - http://www.gazzettaufficiale.it/eli/id/1999/05/04/099A3435/sg) and sets some prohibition of the use of solid and liquid manures in specific environmental conditions. The use of organic fertilisers must be done in agricultural areas, guaranteeing a high level of efficiency of the inputs. The specific application in agriculture, defining Vulnerable Zones and specific limits in terms of N applicable per hectare, are prescribed for the Regions.
Applicazione della direttiva 91/676/CEE sulla protezione delle	Application of the directive 91/676 / CEE on the	Regional	EU (Nitrates Directive)	Crop rotations; cover crops,	The regional law defines the Vulnerable zones and the limits of application of organic fertilisers for both Vulnerable and non-vulnerable zones. The law imposes the use of crop rotations and defines the application methods to be used for

Policy name	English translation	Scale	EU or MS level	Impact on SICS	Description of policy
acque dall'inquinamento da nitrati provenienti da fonti agricole	protection of waters from pollution by nitrates from agricultural sources			no-tillage, integrated nutrient management; integrated landscape management	enhancing the efficiency of organic inputs and apply the prohibitions prescribed in the national law.
Attuazione della direttiva 2009/128/CE che istituisce un quadro per l'adozione comunitaria ai fini dell'utilizzo sostenibile dei pesticidi.	Implementation of the directive on the sustainable use of pesticides	National	EU (SUPD)	Integrated pest management, integrated nutrient management	The legislative decree defines the measures to be taken for a sustainable use of pesticides in order to reduce the adverse impacts on human health, the environment and biodiversity and it promotes alternative approaches and non-chemical methods in the phytosanitary domain. The link with soil is mentioned in the articles that regulate the sustainable use of pesticides so that the soil is protected.
Approvazione degli Indirizzi regionali per un corretto impiego dei prodotti fitosanitari, nonché della proposta di regolamentazione comunale per l'utilizzo dei prodotti fitosanitari, in applicazione del Piano di Azione Nazionale per l'uso sostenibile dei prodotti fitosanitari approvato con DM 22 gennaio 2014	Approval of the regional addresses for the correct use of plant protection products, as well as of the municipal regulation proposal for the use of plant protection products, in application of the National Action Plan for the sustainable use of plant protection products approved by Ministerial Decree of 22 January 2014	Regional	EU (SUPD)	Integrated pest management, smart weed control	Regional application of the national Directive for the Sustainable use of pesticides.
Policy name	**English translation**	**Scale**	**EU or MS level**	**Impact on SICS**	**Description of policy**

Policy name	English translation	Scale	EU or MS level	Impact on SICS	Description of policy
Decreto 18 gennaio 2018. Disciplina del regime di condizionalità ai sensi del regolamento (UE) n. 1306/2013 e delle riduzioni ed esclusioni per inadempienze dei beneficiari dei pagamenti diretti e dei programmi di sviluppo rurale	CAP GAEC Cross-compliance standards	National	EU (CAP cross compliance)	All SICS	The Decree identifies: d) the mandatory criteria for agricultural management practices and the standards for maintaining soil health required for accessing the contributions related to cross compliance ; e) defines the cases of exclusion or reductions of the contribution to farmers, according the EU regulations n. 809/2014 and n. 640/2014 f) defines the minimal requirements for fertiliser and pesticide applications for accessing cross-compliance. The Decree specifies the following GAECs that are highly relevant for soil management and related practices: GAEC 4: Minimum soil cover: – for arable land that is no longer used for production purposes and showing signs of erosion, plant cover needs to be maintained (natural or sown), throughout the year. – on all soils showing signs of erosion, green cover needs to be maintained for at least 90 consecutive days between 15 September and 15 May; or, alternatively, techniques for soil protection need to be applied (such as splitting or subsoiling in place of ordinary ploughing, leaving of crop residues, etc.). GAEC 5: Minimum management requirements to limit soil erosion – The creation of temporary ditches, so that the rainwater collected maintains a speed that does not compromise the function of the furrow itself and is directed drainage canals and natural riverbeds bordering fields. This includes sloping land showing evidence of soil erosion. – The prohibition of unauthorized levelling. – The maintenance of the hydraulic infrastructure to guarantee their efficiency and functionality. GAEC 6: Maintaining soil organic matter: crop residue is to be managed appropriately to avoid loss of organic matter. The burning of stubble and straw is therefore prohibited GAEC 7: Maintaining landscape features: Maintenance of landscape features, including, where appropriate, hedges, ponds, ditches, trees in rows, in groups or blocks, field edges and terraces and including a ban on pruning hedges and trees in the breeding and nesting season of birds and, optionally, measures to combat

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