SoilCare
SOILCARE FOR PROFITABLE AND SUSTAINABLE CROP PRODUCTION IN EUROPE

Interactive mapping tool for the application of soil improving cropping systems across Europe

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6	Research Institute for Knowledge Systems	RIKS	Netherlands
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8	Joint Research Centre	JRC	Italy
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Executive summary

The SoilCare project studied the adoption of sustainable agricultural practices, in particular those related to improving soil quality. To do so, it looked at various scales (from local to European level) at the biophysical, socio-economic, political, and technological factors impacting on adoption of these practices.

To facilitate the uptake of results from the SoilCare project and enhance the understanding of the applicability and transferability of Soil Improving Cropping Systems (SICS) throughout Europe the SoilCare Interactive Mapping Tool (IMT) was developed with the aim to show the potential of various SICS across Europe using interactive maps. The maps are complemented with a description of additional adoption factors less suitable to be captured at a high level of spatial detail.

The SoilCare IMT is available as a web-based freely available tool. Target audiences include organisations operating within the agri-environmental space at the European, national and regional scale, in particular the European Commission (e.g. DG AGRI, DG ENV, JRC), national policy makers, farm organisations, NGOs, advisory services and companies.

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1. Introduction

European agriculture faces a real challenge: it must reduce its negative environmental impacts but also remain competitive. A key area of concern is the ongoing degradation of agricultural soils, which is likely to increase further in the coming decades because of climate and socio-economic developments (European Environment Agency, 2019; Mission Board for Soil Health and Food, 2020). While there are well-known agricultural management techniques that can help to improve soil quality, uptake of these techniques remains low in Europe - despite various policy incentives (McNeill et al., 2018, 2020).

The SoilCare project studied the adoption of sustainable agricultural practices, in particular those related to improving soil quality. To do so, it looked at various scales (from local to European level) at the biophysical, socio-economic, political, and technological factors impacting on adoption of these practices.

In this deliverable we report on the work carried out as part of Task 6.4 of the SoilCare project, which comprised the development of an interactive webtool, named the SoilCare Interactive Mapping Tool, or SoilCare IMT. This tool is the actual deliverable D6.3 (Interactive mapping tool for the application of soil-improving CS across Europe) and was developed to facilitate the dissemination and uptake of results from the SoilCare project, and thus enhance the understanding of the applicability and transferability of Soil Improving Cropping Systems (SICS) throughout Europe.

The SoilCare IMT shows the potential of various SICS across Europe using interactive maps. The maps are complemented with a description of additional application and adoption factors less suitable to be captured at a high level of spatial detail. The SoilCare IMT is freely available as a web-based tool.

This report provides a short introduction into the SoilCare IMT by providing its aim, target audience and functionality. The latter is facilitated by providing some examples to navigate through the tool. The report concludes with some recommendations for future work.

2. Defining the SoilCare Interactive Mapping Tool (IMT)

2.1 Aim

The aim of the SoilCare Interactive Mapping Tool (IMT) is to show the potential of various Soil Improving Cropping Systems (SICS) across Europe using interactive maps, complemented with a description of additional adoption factors less suitable to be captured at a high level of spatial detail.

2.2 Target audience

As a web-based tool, the tool is freely available to anyone who is interested to learn more about the potential for applying SICS across Europe. Target audiences include organisations operating within the agri-environmental space at the European, national and regional scale, in particular the European Commission (e.g. DG AGRI, DG ENV, JRC), national policy makers, farm organisations, NGOs, advisory services and companies. With these users in mind Europe-wide maps have been used as inputs.

However, if use can be made of national or regional input maps, the tool would be equally-well suited to support those in the same field operating at national or regional scale. The current tool offers the possibility to zoom in on the different SoilCare study sites and other regions, to facilitate the communication with local and regional stakeholders.

2.3 Overview and functionality

The SoilCare IMT builds on the results from D6.1 and D6.2. It uses the SICS Potential Index methodology from D6.1 and hence includes information on applicability, relevance and impact of cropping systems, and the SICS Potential Index, as further detailed in 'D6.1 Report on the integration and synthesis of Study Site results and their potential for upscaling'. Impact assessments that are part of the SICS Potential Index are calculated using the SoilCare Integrated

Assessment Model (IAM), developed as part of task D6.2 and further described in 'D6.2 Report on the potential for applying soil-improving CS across Europe'.

The SoilCare IMT allows users to compare information between 2 maps. For each map, users can select a specific SICS, and next make decisions on the year, relevance, and impact factors, as well as the type of map they want to investigate: applicability, relevance, impact or SICS potential index (combination of the previous). In this way, users can e.g. compare applicability maps between SICS, or compare applicability and relevance maps of a particular SICS. A screenshot of the interface of the tool is provided in Figure 2.1.

The SoilCare IMT has been designed with a similar look and feel as the SoilCare project website to provide a seamless integration. The SoilCare IMT is available through the SoilCare project website: https://www.soilcare-project.eu/resources/mapping-tool or directly through imt.soilcare-project.eu.

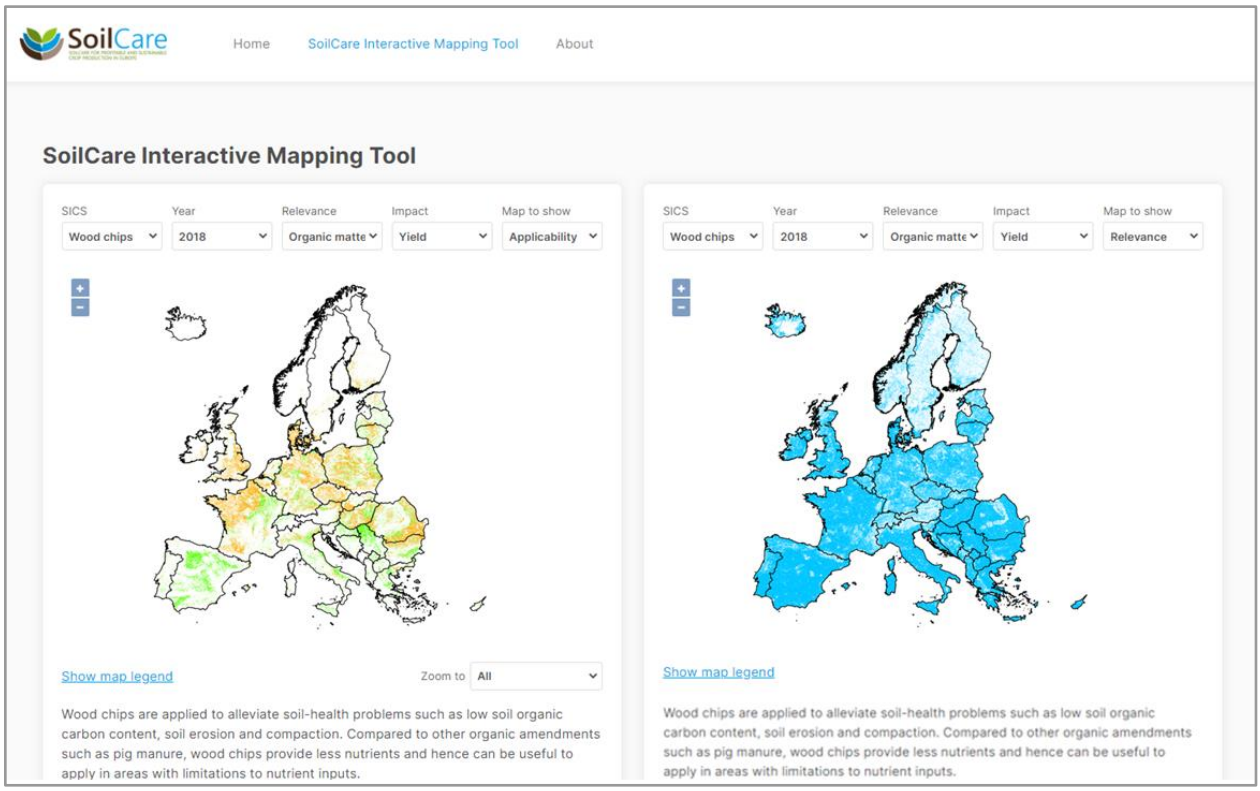

Figure 2.1: Screenshot of the SoilCare Interactive Mapping Tool showing the applicability of wood chips (left) vs the relevance of wood chips to increase soil organic matter (right). Categories on the applicability map are

'applicable' (green), 'not preferred' (orange) and 'not applicable' (white). Categories on the relevance map are 'relevant' (blue) and 'not relevant' (white).

A selection of the types of studies the SoilCare IAM is intended for is provided below. In the next section (2.4) examples are provided for studies I, III and V:

I. Comparing the applicability of one SICS vs another SICS to understand what SICS could be applied where in Europe
II. Assessing the applicability of a particular SICS over time, to explore consequences of climate change and socio-economic changes
III. Comparing different relevance factors (e.g. water erosion, compaction risk, or organic amendments) for a particular SICS to understand e.g. where the SICS could be applied to mitigate which threat or problem
IV. Assessing the relevance for a particular SICS over time, to explore consequences of climate change and socio-economic changes
V. Comparing the applicability of a SICS vs different relevance factors:
    A. a combination of factors
    B. individual relevance factors
VI. Comparing the SICS Potential Index of one SICS vs another SICS to understand what SICS has the highest potential for successful application in regions of interest in Europe
VII. Assessing the SICS Potential Index for a particular SICS over time

2.4 Navigating through the SoilCare IMT

The user of the SoilCare IMT can select various options on the left and the right hand side of the screen to compare two maps.

Options available to the user are

- Selecting the SICS
    - Selection out of 27 different SICS
- Selecting the year
    - 2018, 2030, 2050
- Selecting the relevance factor(s)
    - e.g. wind erosion, compaction risk, SOM content, …, or a combination of factors
- Selecting the impact (for those SICS for which an impact is calculated):
    - yield, erosion, SOC or combined
- Selecting the map(s) to show
    - applicability, relevance, impact, SICS potential index

Based on the selection of the SICS, a short text is provided below the map with additional information on the applicability and adoption of the SICS as they are currently perceived. If a user selects the same SICS in both maps, the same additional information is provided twice.

The user can furthermore automatically zoom in to the SoilCare study site regions and countries, by selecting those from the list provided after 'Zoom to'.

To demonstrate the functionality of the tool we provide a few examples of how the studies from the previous page can be conducted:

An example of study type I: *Comparing the applicability of one SICS vs another SICS*, is provided in Figure 2.2. On the left side the applicability map for conservation agriculture is selected, on the right side the applicability map for wood chips, while all other factors are the same. The figure shows that in most of Europe, conservation agriculture is more suitable than applying wood chips. However, there are also areas in which wood chips would be more suitable. For

example, the maps suggests that a policy maker in Spain should further investigate the option of applying wood chips.

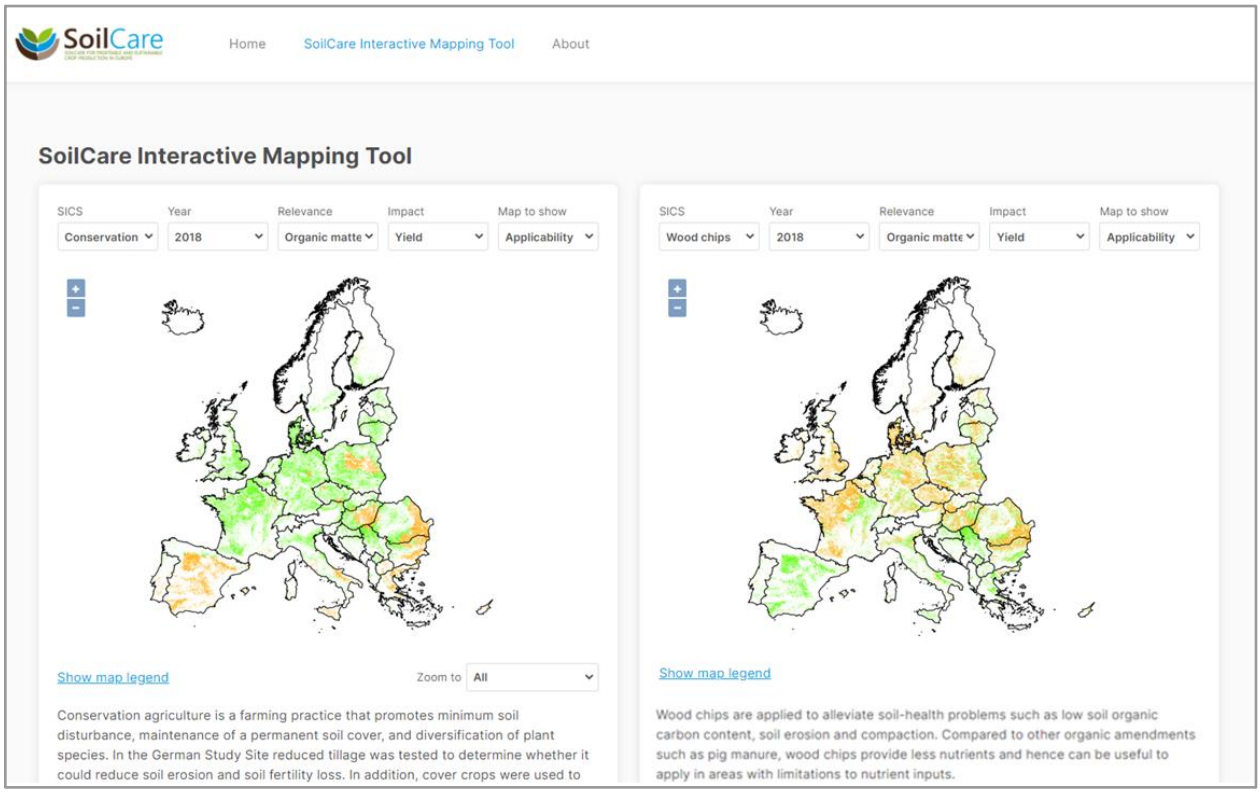

Figure 2.2: Screenshot of the SoilCare Interactive Mapping Tool showing the applicability of conservation agriculture (left) vs the applicability of wood chips (right). Categories on the maps are 'applicable' (green), 'not preferred' (orange) and 'not applicable' (white).

An example of study type III: *Comparing different relevance factors for a particular SICS*, is provided in Figure 2.3. Here an interpretation of two different relevance maps for application of wood chips is shown: organic matter and water erosion. These maps indicate that if there is an interest to apply wood chips to improve the organic matter content of the soil, this could be done almost everywhere around Europe. However if the aim is to reduce erosion in areas of (medium to high) water erosion risk, application is relevant in a much smaller part of Europe. In case the aim of the application of wood chips is both to increase soil organic matter and reduce water erosion risk, then areas where both maps intersect (e.g. in central Europe) would be most relevant.

A final example, of study type V, subtype B: *Comparing the applicability of a SICS vs a single relevance factor*, is provided in Figure 2.1. Here the applicability of woodchips is compared to the relevance of applying wood chips based on soil organic matter content. These maps suggest that it would be relevant to apply wood chips almost all over Europe, while it would be most suitable to apply them in the south of Europe.

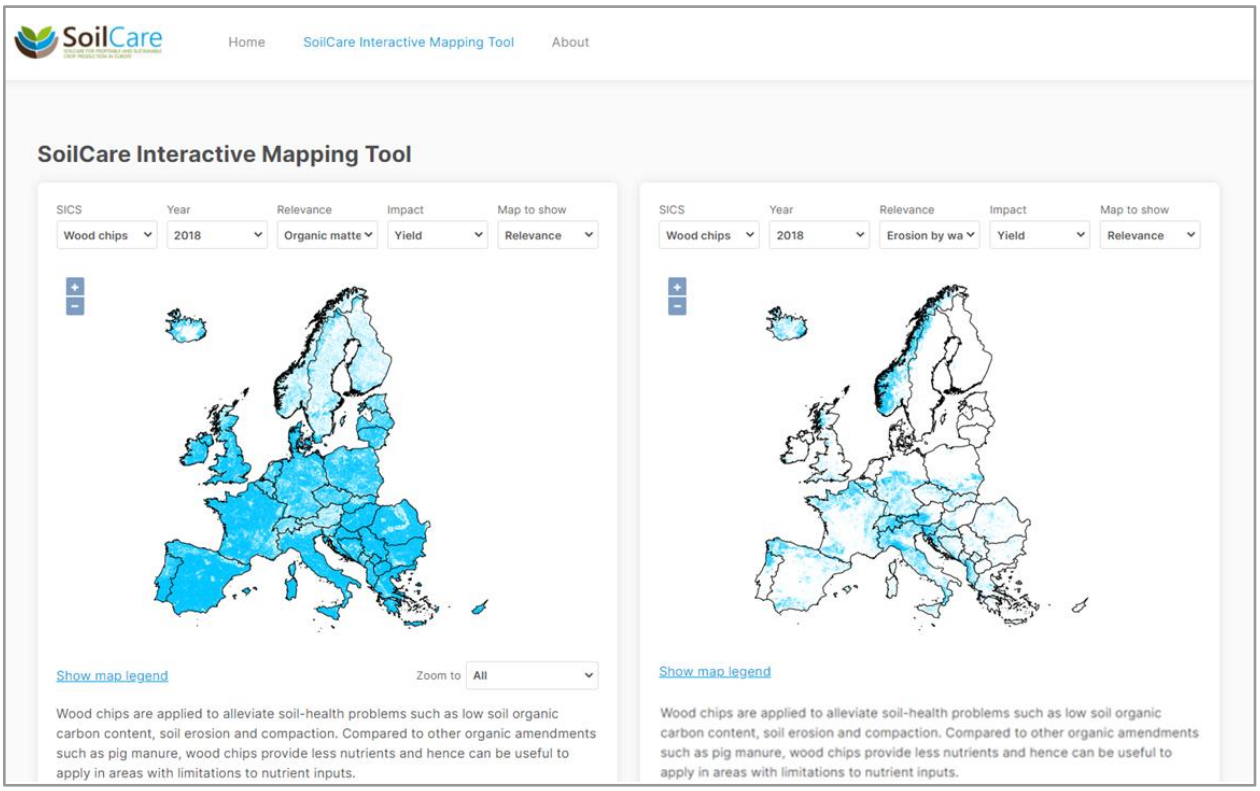

Figure 2.3: Screenshot of the SoilCare Interactive Mapping Tool showing the relevance for applying wood chips based on areas where an increase in soil organic matter is desired (left) vs areas where it would be relevant to mitigate medium-high water erosion risk (right). Categories on the maps are 'relevant' (blue) and 'not relevant' (white).

3. Recommendations for future work

The main aim of the current version of the SoilCare IMT was to communicate results from the SoilCare project. The level of interactivity is therefore limited to selecting the maps that will be shown. Future work could focus on expanding the tool, so that users could interact more with the actual analysis carried out in creating the maps and/or in post-processing map results to carry out further analysis. Suggestions for both are provided below.

Enhanced interaction in preparing the SICS Potential Index

In this extension of the tool, users could e.g. upload their own base maps for applicability, relevance and maybe even impact and thus make their own decisions on the data source based on which the analysis is carried out. This option would be especially relevant if users would be able to upload data for a region of choice, instead of all for all of Europe, as this would allow users with a national or regional interest to include more precise maps for the region of interest. Furthermore, users would benefit from the ability to set the interpretation from base maps to applicability and relevance maps themselves. This would allow them to repeat the type of analysis carried out as part of D6.1 without the need for much (software) development knowledge. If the tool would be further developed to carry out the calculations needed for the interpretation with limited computation time, the tool could be used in interactive sessions in which stakeholders could directly see the impacts of various settings and hence discuss these in a group setting.

Enhanced interaction for post-processing and analysing results

The current version of the tool is mainly focused on visualising and (visually) comparing various maps. The tool could be expanded to further support the interpretation of results or even to carry out extra analysis. Suggestions from study site partners include e.g. a numerical assessment of the percentage of the total agricultural land that is both applicable and relevant for application of a specific SICS, as well as an improved ability to compare maps using an extra map comparison window to create difference maps as is e.g. available in the Map Comparison Kit (www.riks.nl/mck). It would furthermore be useful to be able to query the tool about different

types of information available in the (result) maps. An example would be to carry out an analysis that starts with a specific soil threat (relevance) and obtain guidance on which SICS would be applicable to mitigate it, and what their respective impact would be on mitigating the soil threat. This type of question would also require integration with an impact assessment model such as the SoilCare IAM.

Further development of the tool should be carried out in parallel to its use for practical cases as this will help to fine-tune the new developments and ensure their relevance. Involving users in a co-design process to further develop the tool also helps to build ownership amongst the user community and thus increase the actual uptake of the tool in practice.

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