SMARTLAGOON

DELIVERABLE 4.4

User Manual for the System Dynamics (SD) model interface – Mar Menor Socio-Ecological System

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101017861.

SMARTLAGOON

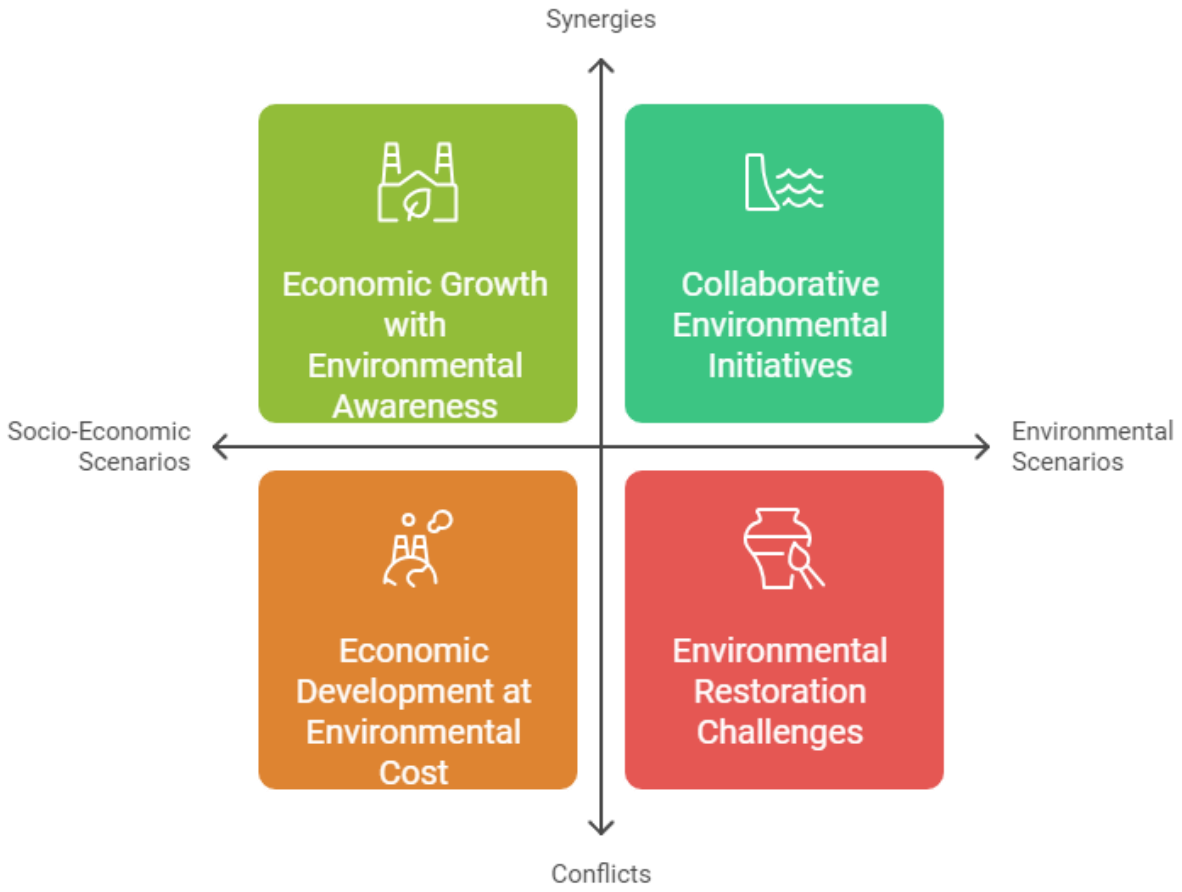
Innovative modelling approaches for predicting Socio-environMentAl evolution in highly anthRopized coasTal LAGOONs

Deliverable 4.4

Deliverable No.:	4.4
Project Acronym:	SMARTLAGOON
Full Title:	User Manual for the system dynamics (SD) model interface – Mar Menor Socio-Ecological System
Grant Agreement No.:	101017861
Workpackage/Measure No.:	4
Workpackage/Measure Title:	Socio-environmental dynamics modelling
Responsible Author(s):	Mahla Rashidian (NIVA) Isabel Seifert-Dähnn (NIVA) Valentina Tartiu (NIVA)
Responsible Co-Author(s):	
Date:	23. December 2024
Status:	Final
Dissemination level:	Public

Abstract

This deliverable presents a user guide for the system dynamics (SD) user interface designed for a socio-ecological model of the Mar Menor lagoon. The interface is a user-friendly platform that allows users to test various socio-economic and environmental scenarios. It facilitates providing an overview of conflicts, synergies, and trade-offs within the socio-ecological systems of the Mar Menor catchment area, thereby supporting the decision-making process. This deliverable showcases the operational online platform through several screen captures, proving its functionality and accessibility. It is intended to demonstrate the interface rather than serve as a traditional written report.



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101017861.

Table of Contents

List of Figures

List of Tables

Purpose of Deliverable

The purpose of this deliverable is to demonstrate, through several screen captures, that the SD user interface for the socio-ecological system in the Mar Menor catchment is now operational and accessible online. This interface is developed based on participatory socio-ecological modeling involving local stakeholders (WP 4, Deliverable 4.3). It enables users to test various scenarios and observe their impacts, both individually and in combination, across different sub-systems (e.g., the water quality of Mar Menor, agriculture, tourism, and social indicators). This comprehensive assessment supports the sustainable management of the socio-economic and environmental systems in Mar Menor.

Accessing the Interface

The SD user interface is hosted on isee Exchange and integrated into the SMARTLAGOON digital twin (Mar Menor Sensing) under scenario section. It is publicly accessible and open to all users (Figure 1). The interface is available in both Spanish and English. Users can begin navigating and interacting with the interface by clicking "START" for the English version or "EMPEZAR" for the Spanish version.

Figure 1. Start page view for the SD interface.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101017861.

Interface Environment Overview

Upon entering the interface, users will see a menu bar (Figure 2) that allows them to navigate the environment and interact with the simulation. This menu bar provides access to various sections, enabling users to explore and engage with different parts of the interface.

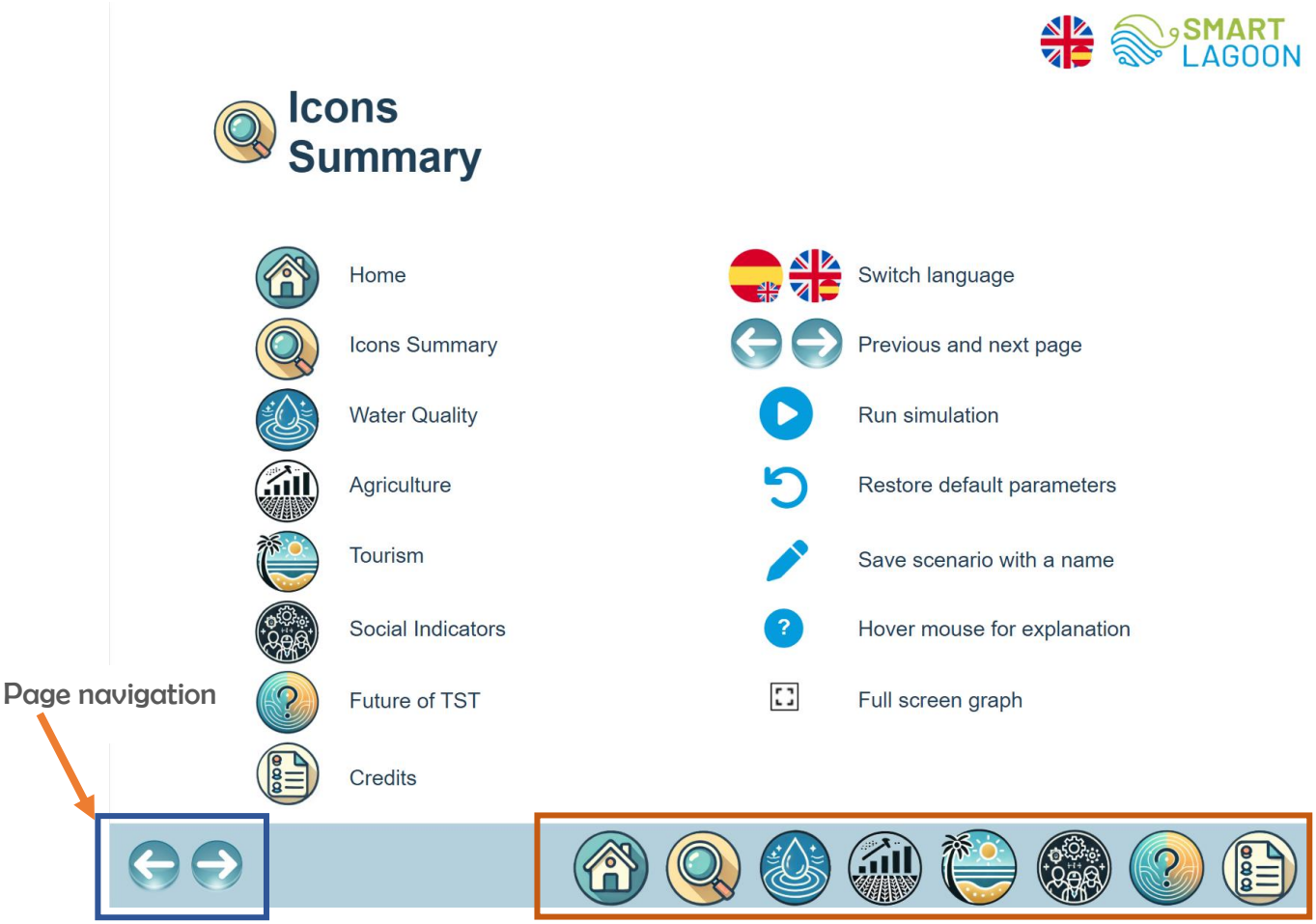


Figure 2. Navigation bar view for the SD interface

A summary of the navigation bar titles and descriptions is provided in Table 1.

Table 1. Summary of the icons under the navigation bar in the SD interface

Icon	Title	Description
	**Home page**	This section provides an introduction and overview of the socio-ecological modeling case study for the Mar Menor catchment, detailing the various dimensions of the problem.
	**Icons Summary**	This section provides a guideline for all the symbols used in the interface.
	**Water quality**	This section examines changes in the total nitrate load into Mar Menor under various scenarios. Total nitrate is calcu-

		lated from the sum of nitrate carried by various sources, including surface runoff, groundwater, brine produced from groundwater desalination for agricultural irrigation, and urban waste.
	**Agriculture**	This section showcases the impact of different scenarios on crop yield, product price at the farm gate, farming income, and the share of agricultural workers in total revenue.
	**Tourism**	This section investigates the impact of different scenarios on the number of visitors in three main tourist groups: tourists in La Manga, tourists in the rest of Mar Menor (towns around the lagoon), and second-home seasonal tourists.
	**Social indicators**	This section examines the impact of various scenarios on the workforce in the tourism and agriculture sectors.
	**Future of TST**	This section explores potential scenarios regarding the uncertainty of water availability for the agriculture sector from the Tagus-Segura water transfer (TST). These uncertainties may arise due to climate change or political decisions.
	**Credit**	This section provides the contact information of the SD modeler, who can be contacted for more technical details about the model, boundary conditions, and assumptions.

Interacting with the Interface

By clicking on each section, users will be taken to a page that briefly describes the sub-models within the SD model (e.g., water quality, as shown in Figure 3). Each description provides an overview of the specific sub-model and its relevance to the overall system. After reviewing the sub-model, users are guided to the main simulation page, where they can run various scenarios and observe the outcomes. For demonstration purposes, we used water quality as an example. All sections follow the same design, ensuring a consistent user experience across different sub-models.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101017861.

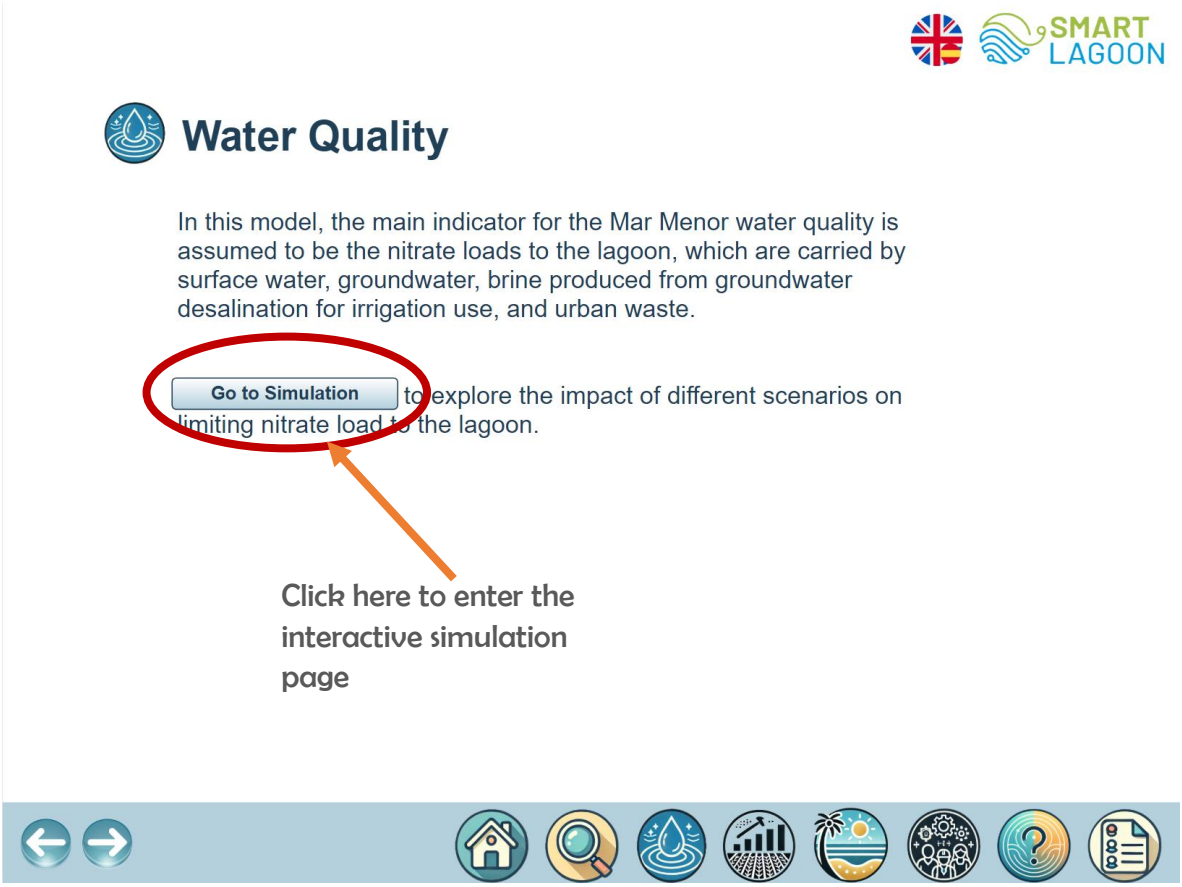


Figure 3. Water quality section view - the SD interface.

Users will see a **yellow box** in the top left corner of the simulation page (Figure 4), which serves as the main simulation panel. This panel allows users to **run**, **reset**, **save the simulation**, and set the **simulation duration** (1960-2090) from left to right.

On the left-hand side, users will find scenarios listed in **grey boxes**. To interact with these scenarios:

1. Choose a scenario from the list.
2. Adjust the scenario parameters to your preference.
3. Click on the "Run Simulation" tab to simulate and observe the impact on water quality, specifically through the total nitrate load into Mar Menor.

Users can navigate through tabs at the top of the graph to observe the scenario's impact on different pollution sources in more detail. These tabs allow users to see the effects on surface runoff and nitrate discharge from groundwater, brine, and wastewater treatment plants.

Additionally, users can access detailed information for all scenarios' inputs and output graphs by clicking on the **blue circle** with a question mark next to the graphs and input parameters. This feature provides comprehensive insights into the data and helps users understand the implications of their simulations.

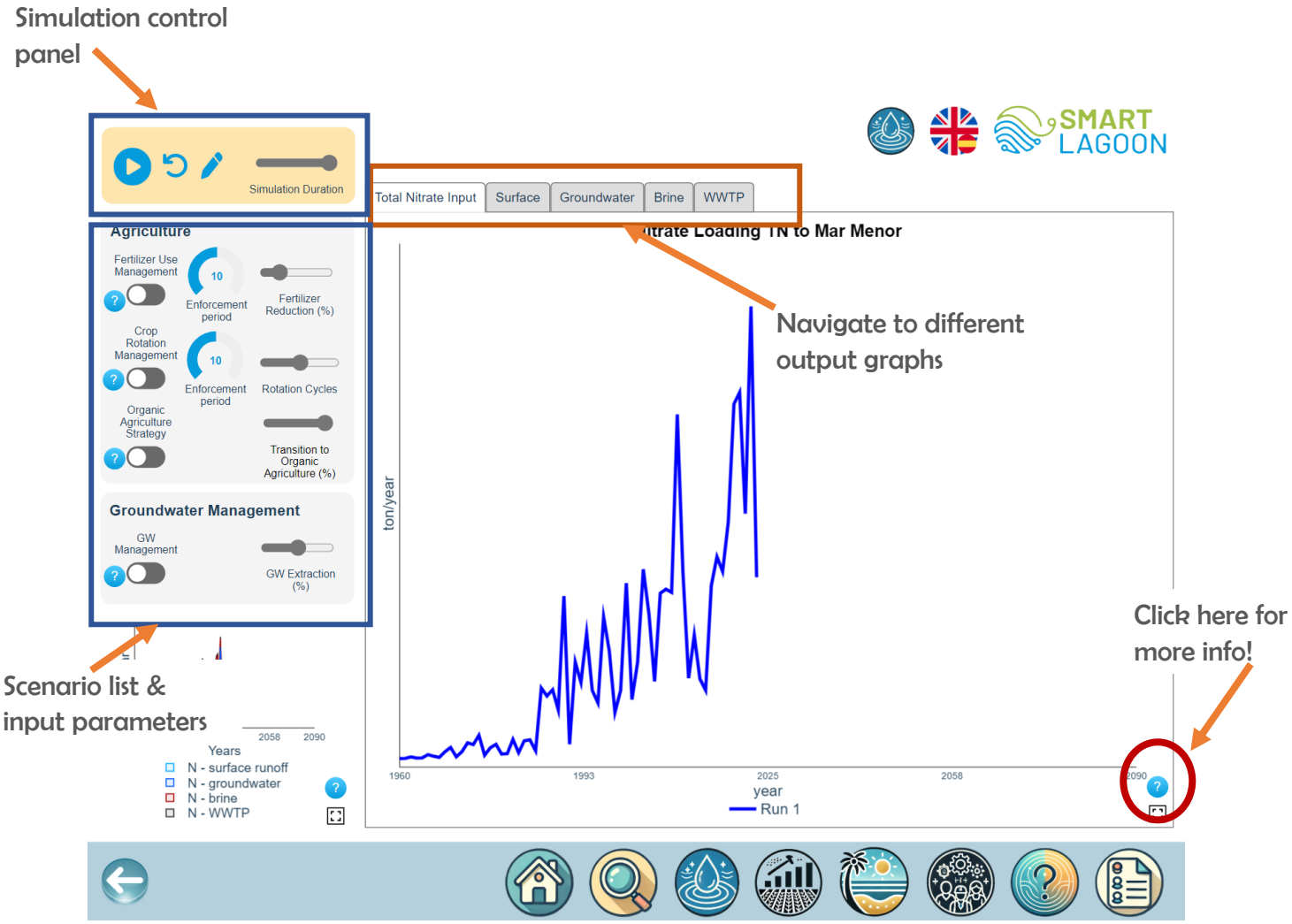
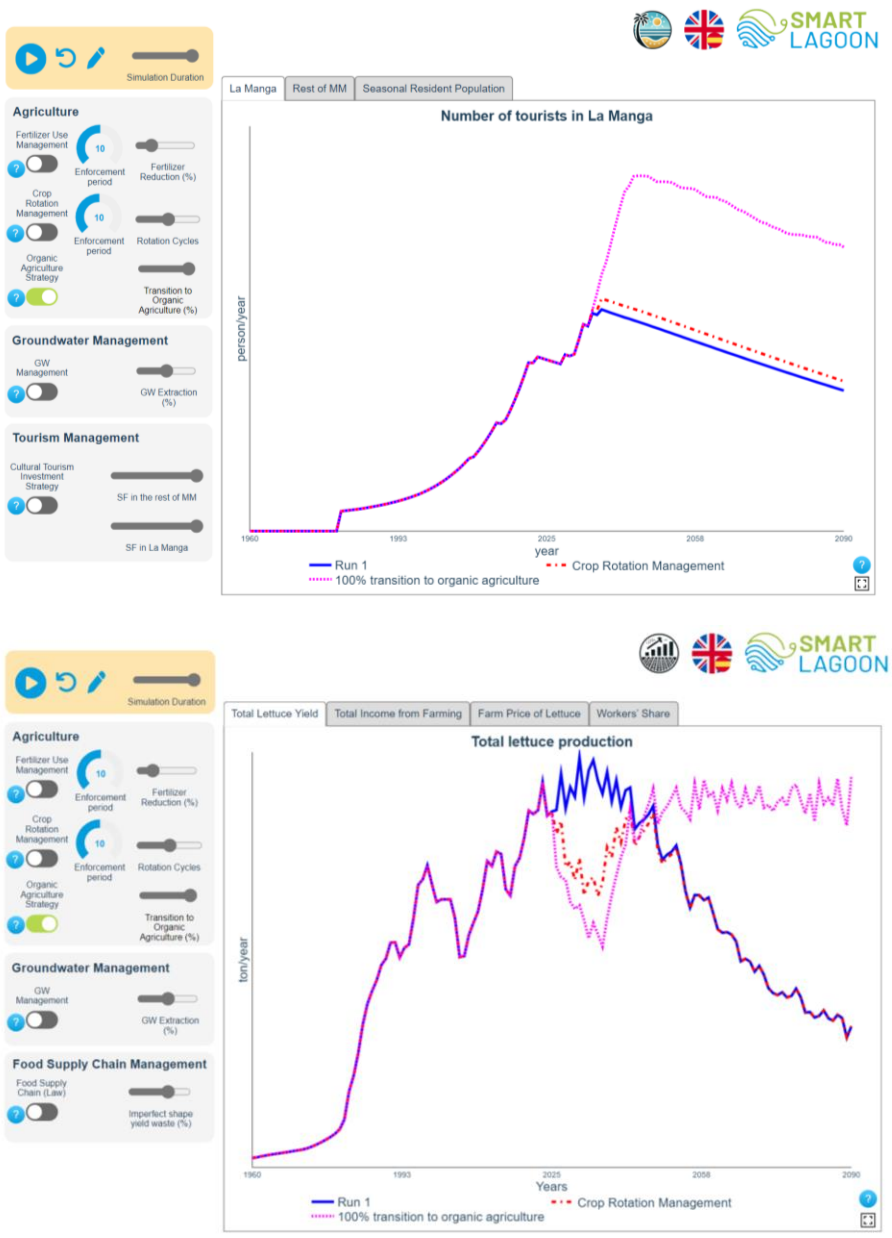


Figure 4. Interactive simulation page, water quality section view – demonstrating control panels (simulation and scenarios) and output graphs

Users can also observe the impact of the simulated scenarios across other sections by selecting the desired one from the navigation bar at any time (Figure 5). For example, the interface allows for a comparison between the base run (no intervention), shown by the **blue** line, the crop rotation management scenario, indicated by the **red** dashed line, and the 100% transition to organic agriculture, represented by the **pink** line. These comparisons can be made across the water quality, agriculture, tourism, and social indicators.

The interface retains users' last changes across all sections unless the simulation is reset. It is recommended that each scenario run be saved with its associated name using the pen icon in the yellow box. This practice facilitates easier comparison between different scenarios and helps document the results effectively for an integrated assessment.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101017861.



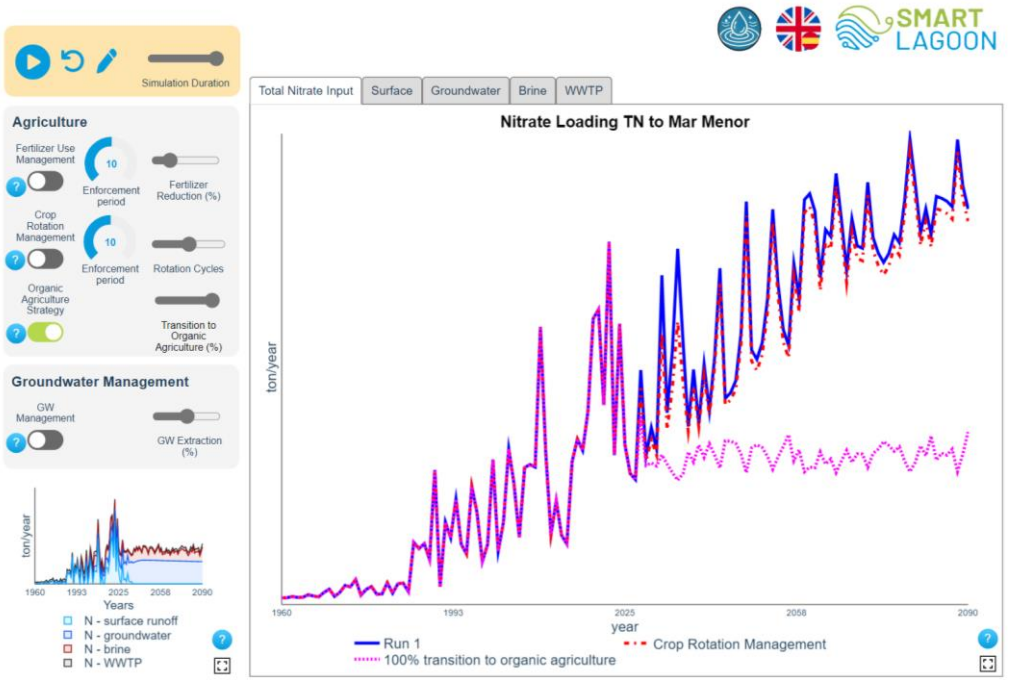


Figure 5. Demonstrating Scenario Testing: Save the run with the associated scenario name and observe the impact of different scenarios across various sub-models by selecting their respective sections in the navigation bar.

Summary Steps for Interpreting Simulation Results

After running simulations, users can interpret the results by examining the output graphs and data provided by the interface. Here are the steps and key points to consider:

1. **Accessing Results:**
    - Once a scenario is run, the results are displayed in the main simulation panel. Users can view the impact on various sub-models, such as water quality, agriculture, and tourism.
    - To explore the results in detail, navigate through the tabs at the top of the graph.
2. **Comparing Scenarios:**
    - Users can compare different scenarios by observing the lines on the graphs.
    - This comparison helps in understanding the relative impact of each scenario on the socio-ecological system.
3. **Saving and Documenting Runs:**
    - Save scenarios using the pen icon in the yellow box. This practice allows for easier comparison between different scenarios and helps in documenting the results for future reference.
4. **Detailed Information:**
    - For a more comprehensive understanding, users can click on the blue circle with a question mark next to the graphs and input parameters. This feature provides detailed information about the inputs and outputs, aiding in a deeper analysis of the scenario's impact.
5. **Navigating Between Sections:**
    - Users can observe the impact of the simulated scenarios across other sections by selecting the desired one from the navigation bar. This allows for a holistic view of how different scenarios affect various aspects of the socio-ecological system.
6. **Retaining Changes:**
    - The interface retains users' last changes across all sections unless the simulation is reset. This feature ensures continuity and consistency in the analysis process.

By following these steps, users can effectively interpret the results of their simulations, gaining valuable insights into the socio-ecological dynamics of the Mar Menor catchment area. This understanding supports informed decision-making for sustainable management.

Tips for Effective Use as Learning Tool

This interface can be used as a learning tool for systematically understanding socio-ecological systems in similar case studies. For effective use, consider the following steps:

- **Engage with Stakeholders:** Collaborate with local stakeholders to test scenarios and discuss the results.
- **Iterate and Refine:** Continuously test different scenarios, aligning with the goal of sustainable development for the socio-ecological system, and refine based on stakeholder feedback.
- **Document Findings:** Keep detailed records of the scenarios tested and their outcomes for future analysis.

Conclusion

The SD user interface for the socio-ecological model of the Mar Menor catchment provides a valuable and user-friendly platform for exploring and understanding the complex interactions within this unique environment. By enabling users to test various socio-economic and environmental scenarios, the interface supports informed decision-making and promotes sustainable management practices.

Through this user manual, we have demonstrated how to navigate the interface, run simulations, and interpret results. Key features such as scenario comparison, detailed information access, and the ability to save and document runs ensure that users can effectively analyze and understand the impacts of different management strategies. We hope this tool will be valuable for stakeholders, researchers, and decision-makers working towards the preservation and sustainable development of the Mar Menor catchment area.

SMARTLAGOON

End of Deliverable 4.4

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101017861.