OPTAIN

Optimal Strategies to Retain Water and Nutrients

D2.2: Tailored environmental and socio-economic performance indicators for selected measures

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based on data collected by the case study partners

Delivery Date: 31. May 2022

This project has received funding from the European Union's Horizon 2020 research and innovation programme under Grant agreement No. 862756.

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Project Consortium

Document Information

Program	EU Horizon 2020 Research and Innovation Action H2020-EU.3.2.1.1 (SFS-23-2019)
Grant agreement No.	862756
Project acronym	OPTAIN
Project full name	Optimal strategies to retain and re-use water and nutrients in small agricultural catchments across different soil-climatic regions in Europe
Start of the project	September 2020
Duration	60 months
Project coordination	Prof. Dr. Martin Volk Helmholtz-Centre for Environmental Research GmbH - UFZ www.optain.eu
Deliverable	D2.2: Tailored environmental and socio-economic performance indicators for selected measures List of tailored and case-specific performance indicators (environmental and socio-economical) that help to evaluate the effectiveness of NSWRM monitored (existing measures) and modelled (potential future measures) in the OPTAIN case studies as well as used to establish a common language across project members and activities and to facilitate the knowledge sharing with stakeholders and the wider dissemination of project results.
Work package	WP2: Measures and indicators
Task	Task 2.2: Identification of performance indicators for the selected NSWRM
Lead beneficiary	Norwegian Institute for Bioeconomy (NIBIO)/ University of Milano (UMIL)
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Quality check	Felix Witing (UFZ), Martin Volk (UFZ)
Planned delivery date	Month 20 (May 2022)

Actual delivery date	31/05/2022
Citation	Krzeminska D. & Monaco F. (2022): *Tailored environmental and socio-economic performance indicators for selected measures*. Deliverable D2.2 EU Horizon 2020 OPTAIN Project, Grant agreement No. 862756
Dissemination level*	PU

*PU = Public; PP = Restricted to other program participants (including the Commission Services; CO = Confidential, only for members of the consortium (including the Commission Services).

Deliverable status

Version	Date	Author(s)/Contributor(s)	Notes
	27.04.2022	Dominika Krzeminska (NIBIO)	First draft
	29.04.2022	Federica Monaco (UMIL)	Inputs, comments
	03.05.2022	Dominika Krzeminska (NIBIO) →WP2 team	Comments, review
	18.05.2022	Federica Monaco (UMIL)	Inputs, edits, etc.
	19.05.2022	Dominika Krzeminska (NIBIO), Federica Monaco (UMIL)	Final draft
	23.05.2022	Felix Witing (UFZ), Martin Volk (UFZ)	Quality check
	30.05.2020	Dominika Krzeminska (NIBIO), Federica Monaco (UMIL)	Final revisions
	31.05.2022	Felix Witing (UFZ), Martin Volk (UFZ)	

Summary

The content of this deliverable addresses the activities of the task 2.2 “Identification of performance indicators for the selected NSWRM” within the H2020 project OPTAIN. The core purpose of the task is to develop a customized set of indicators that allow assessing the effectiveness of selected (either existing or potential future) Natural/Small Water Retention Measures (NSWRMs) in and across the OPTAIN case studies (CS). The relevance of specific NSWRMs to face local challenges, their multifunctional nature and the manifold impacts they may have in the territory require identifying key elements that easily resume such features, while being flexible and adaptable enough to be used in different contexts.

Therefore, task 2.2 elaborated a pathway to produce a list of Performance Indicators (PI), to set the focus for model parametrisation at different scales as well as to ensure an appropriate model setup and utilisation of modelling outcomes (WP4, WP5).

For this reason, the screening, selection and tailoring of the most relevant indicators, to be used as PI, have been conducted from both the environmental (EPIs) and socio-economic (SPIs) points of view. The selection process was built at the interface between science and society, in a fruitful process of knowledge co-creation and sharing. As such, agreed lists of indicators can be used to support the harmonized approach of OPTAIN by establishing a common language across project members and activities, favour the understanding and the comparison of modelling results across CS, facilitating the dialogue with stakeholders and the wider dissemination of project results.

The methodology followed to outline the customized list of indicators, to be used as PIs, was based upon the initial contribution of scientific / academic partners’ expertise to compile all the potential or candidate indicators and preselect the most relevant ones for the selected NSWRMs. As a result, we ended up with short lists of both environmental (25) and socio-economic (17) indicators that cover the most relevant issues of the OPTAIN case studies. In the second instance a participative approach involved local research teams and stakeholders in the valuation, adjustment and prioritisation of the most important indicators, also owing to the intensive consultation with OPTAINs Multi-Actor-Reference Groups (MARG). Based on the feedback obtained, the task 2.2 partners conducted an analysis of the commonalities and differences between CSs and scales. This allowed drawing the conclusion that, despite CS are experiencing diverse challenges, the most important issues covered by the selected indicators, and priorities given are very similar. Finally, for comparison purposes across CSs, a common set of PIs is proposed, including first discussions on the best way to represent selected PIs based on monitoring and/or modelling results to be available in CS.

Table of Contents

Abbreviations

CS	Case Study
ESS	Ecosystem Services
EPI(s)	Environmental Performance Indicator(s)
MARG	Multi Actors Reference Group
MAES	Mapping and Assessment of Ecosystems and their Services
NSWRM	Natural/Small Water Retention Measures
NWRM	Natural Water Retention Measures
PI(s)	Performance Indicator(s)
SDG	Sustainable Development Goals
SPI(s)	Socio-economic Performance Indicator(s)
SWRM	Small (technical) Water Retention Measures
TBL	Triple Bottom Line approach
TEEB	The Economics of Ecosystems and Biodiversity
WP	Work Package
MS	Milestone (report)

1. Introduction

1.1. General concept of NSWRM

Natural Small Water Retention Measures (NSWRM) in the OPTAIN project are in line with the Natural Water Retention Measures (NWRM) concept (described on the nwrm.eu website). NWRM primary focus is on the enforcement of water retention through the use of natural means to mimic natural processes. NWRM pay lower attention to nutrients management. Despite this, some of some NSWRM also enable the recovery and re-use of water and nutrients, such as Small (technical) Water Retention Measures (SWRM): like small hydro-technical systems (small reservoirs, damming on watercourses) and new methods for utilizing existing water system.

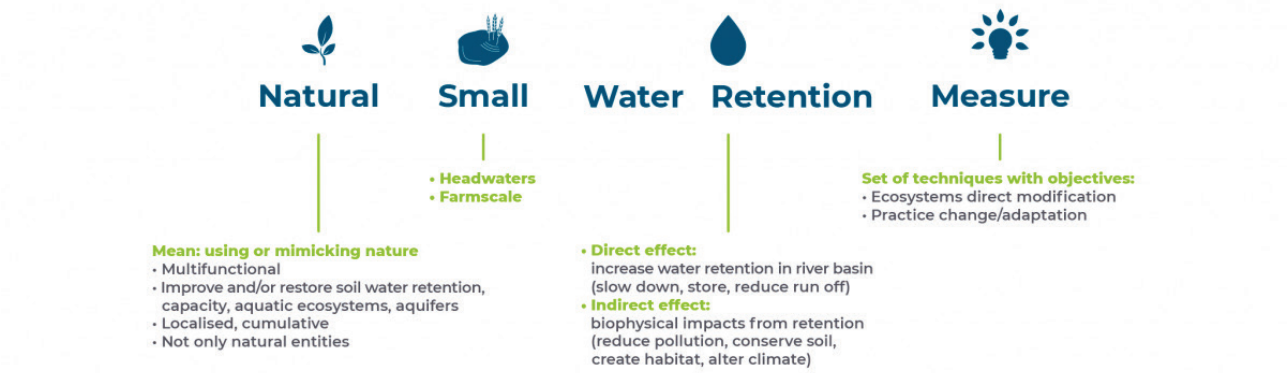

Figure 1: *Definition of Natural Small Water Retention Measures as conceived within OPTAIN project (www.optain.eu)*

The implementation of NSWRMs can help mitigate the water and nutrient-related challenges experienced (or expected to occur) in case study areas, such as the negative consequences of climate change (e.g.: increased/reduced precipitation in total, and more intense precipitation episodes, leading to increasing number of extreme events). Furthermore, NSWRMs can increase the resilience of (agricultural) catchments while providing other services and benefits (environmental, social, and economic) for the stakeholders in these territories. The multifunctional nature of NSWRMs requires an integrated approach to assess the effectiveness of current and potential solutions. This can be addressed by using proper and tailored indicators, able to resume the connections with sustainability pillars and their implications on the rural environment at different scales.

1.2. Indicators

The European Environment Agency defines an **indicator** as "an observed value representative of a phenomenon of study. In general, indicators quantify information by aggregating different and multiple data. The resulting information is therefore synthesized. In short, indicators simplify information that can help to reveal complex phenomena" (EEA, 2003). Indicators generally simplify the reality to make its representation understandable and properly communicated to different target audiences. Various projects or institutions sought to identify properties for good indicators (Segnestam 1999; FAO, 1999; EPA, 2000; CEC, 2004, DEVCO, 2016). Above all, an indicator must be practical, realistic, and understandable.

Indicators are used in manifold fields of investigation (e.g., marketing, economics, education, legal studies, etc.) to measure a project's progress and/or success (i.e., Key Performance Indicators), but also estimate impacts of specific intervention(s). They are also important when dealing with environmental related issues, such as evaluating the status of ecosystem services, its trends and associated monetary values. The indicators can range from addressing global challenges at from national level (e.g., through national water or carbon accounts) to specific local level indicators, where data needs should be specifically tailored to the local problem and context.

In the case of the OPTAIN project, the expected impacts and the effectiveness of targeted NSWRMs in each Case Study (CS) should be addressed by proper indicators. Therefore, we are working with fit-for-purpose **performance indicators** (e.g., Segnestam 1999; Kummar 2020) that inform whether and how the states of the local environment and economy could be affected by the implementation of a single NSWRMs or by a combination of them. In a nutshell, performance indicators have a twofold value added: they resume the change – positive or negative – in local conditions (i.e., direction of change) and provide a measure of that change (i.e., magnitude of change) (Figure 2).

Figure 2: *Illustrative definition of a performance indicator as meant to be in OPTAIN*

The strength of a performance indicator lies in its ability to look at the bigger picture and include multiple variables – particularly regarding the impacts. However, whether an impact is considered meaningful depends on the values and perspectives of the local contexts. This stresses the significant role of Multi Actors Reference Group (MARG) members in a process of selecting and tailoring the performance indicators (PIs) most relevant and understandable for each CS.

Moreover, in OPTAIN we see the PIs as a tool that enables a common language for an effective communication and knowledge sharing with MARG members and all interested actors, and the wider dissemination of project results.

1.3. The role of performance indicators in OPTAIN

In OPTAIN we aim at creating a list of tailored and case -specific performance indicators that will help to evaluate the effectiveness of NSWRM monitored (existing measures) and modelled (potential future measures) in the CSs. They will also help to further explore the effect of potential combinations of measures realized through the modelling exercises in WP 4 and 5. In particular, PIs are used to support OPTAINs harmonized approach by establishing a common language across project members and activities and to favour the understanding and the comparison of modelling results across case study sites.

Performance indicators in fact constitute the key elements upon which all the modelling exercises are based and are fundamental for the development of OPTAINs multi-objective optimization process (WP5) (Figure 3).

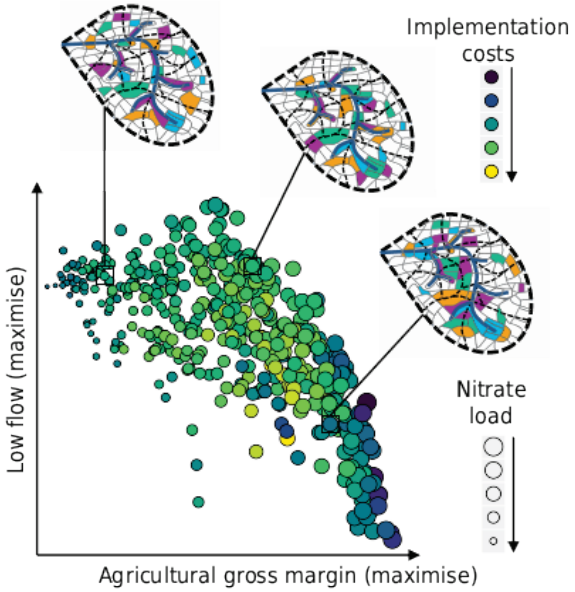

Figure 3: Illustration of how PIs relate to the optimization process in WP5. In this example the PIs are low flow, agricultural gross margins, implementation costs, and nitrate load. PIs represent the multiple case-specific environmental and economic objectives that will feed the multi-objective optimisation platform CoMOLA (Strauch et al., 2019; Verhagen et al., 2018), used to search for optimal NSWRMs allocation and combination schemes.

Given the multiplicity of local challenges, the multifunctional nature of NSWRMs and the large array of their possible impacts, PIs should address all the sustainability-related aspects of water and/or nutrient management, especially in the agricultural sector. For this reason, the approach adopted for their identification firstly stemmed from the need to downscale a set of global indicator frameworks, like the Triple Bottom Line approach (TBL; Elkington, 1994), the concept of Ecosystem Services (ESS; MA, 2005) and Sustainable Development Goals (SDG), to be of use at the catchment and field level.

In general, it means that we aim at having two main distinct, though interrelated, groups of indicators:

- Environmental performance indicators (EPIs) – concern the environmental and biophysical impacts of NSWRM on water quantity and quality (e.g., water and nutrient fluxes), soil erosion and yield at field and catchment scale. With these indicators we cover the relevant ESS and SDG.
- Socio - economic performance indicators (SPIs) – aspire to cover the relevant aspects depicted by the TBL approach. As such, they relate to the financial and/or economic features of individual measures (e.g., implementation costs), but also to the possible implications on the economics of agriculture at farm- and catchment-level (e.g., farm gross margin, agricultural net value added). They also concern the societal impacts expected from NSWRMs' implementation, owing to a better quality of natural resources or to a higher resilience to climate and environmental risks.

2. Overall approach & methodology

The methodology followed to outline the customized sets of PIs was based upon two complementary strands: (i) the contribution of scientific partners' expertise to list all the potential or candidate indicators, and (ii) a participative approach that involved the local research teams and stakeholders, enforcing the relationships and the knowledge sharing between academia and science and the real-world operators.

In order to reach the aim taking into account local context and main actors' perceptions, we proceeded conducting the three consecutive steps as depicted in Figure 4.

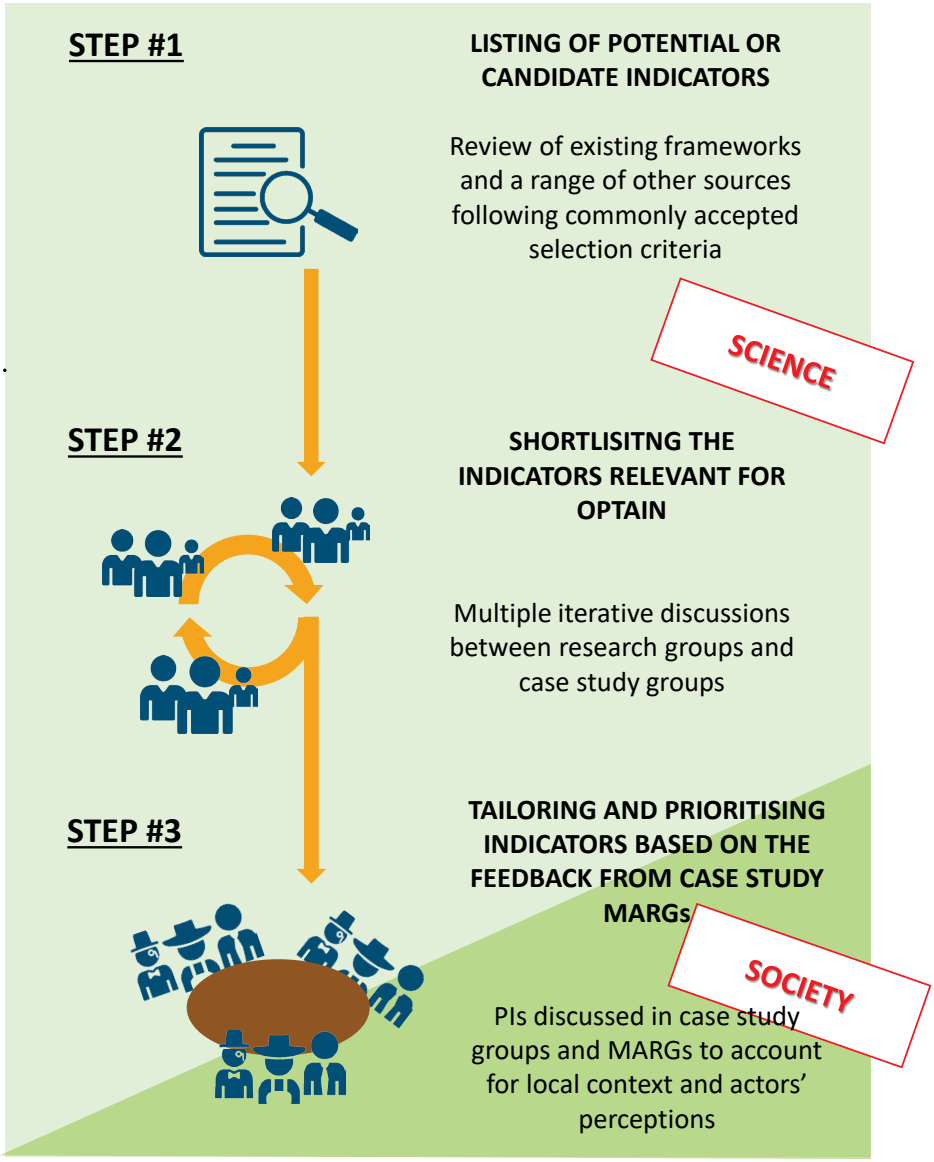

Figure 4: Workflow illustrating how the tailoring of performance indicators (PIs) was approached.

3. Initial selection of performance indicators

The compilation of a comprehensive list of PIs related to the topics of interest started with a review of existing indicator frameworks, which allowed to collect potential or

candidate indicators of from a range of widespread sources. The selection of appropriate indicators claims for considering commonly accepted criteria (modified after Segnestam, 1999):

- *Relevance* - PIs should respond to the main objective of the project, challenges of the CSs and adherent to the selected NSWRMs;
- *Spatial and temporal scale* - the scale of analysis (either farm or catchment) affects the availability and the relevance of data needed for the quantification or the estimation of specific indicators;
- *Quality and reliability* - the possibility for a quantification (e.g. using modelling approaches), which enables their comparison under different conditions;
- *Targets and baselines* - the type of action/NSWRM, which implies the identification of whom promotes, implements or benefits from the measure(s), along with the possible stakeholders involved;
- *Clear cause and effect links* - the potential impacts (direct and indirect), as well as positive and negative (ecosystem) services associated to their implementation or wider uptake;
- *Limited/reasonable number.*

The screening for initial performance indicators, relevant for OPTAIN purposes, started with looking into known and existing frameworks:

- Triple Bottom Line approach (TBL; Elkington, 1994) - an accounting framework employed to assess the sustainability level based on economic, social and environmental parameters.
- Ecosystem services framework (ESS; MA, 2005) – a framework that reveals ecosystems' benefits to society and presents a fundamental natural resource management approach with the connected lists of indicators for assessment of ecosystem services across different ecosystems (e.g., Maes et al. 2015).
- Sustainable Development Goals (SDG) and global indicator framework for the SDG and targets of the 2030 Agenda for Sustainable Development (UNSD, 2020).

Within the OPTAIN project this translates into seeking for performance indicators that address the multifunctional nature of NSWRMs, and their impacts on different sustainability pillars, at farm and catchment scale. Specifically, environmental performance indicators (EPIs) examine environmental issues such as pollution, biodiversity, climate, energy, erosion, ecosystem services, etc. Under the umbrella term of socio-economic performance indicators (SPI) as conceived in the project, various concepts can be placed: the intrinsic financial features of measures, the quality of life in rural areas, farm business results, positive and/or negative externalities of natural resources management.

After analysing the frameworks listed above, we ended up working with two commonly used lists of *'global'* indicators, particularly useful for screening environmental-related aspects:

- The Economics of Ecosystems and Biodiversity (TEEB) - [link to document]

- Mapping and Assessment of Ecosystems and their Services (MAES) - [link to document]

The following criteria were used when selecting the initial set of indicators (modified after Segnestam, 1999):

Criteria:	How is it addressed?
Relevance	To evaluate the effectiveness of NSWRMs and create the list of tailored indicators we need to have good overview of the problems we want to address with the measures. As to start with we listed more general challenges of the OPTAN case studies: - Improve water and nutrients retention - Prevent flooding - Cope with droughts - Secure water availability - Control nutrients loads and erosion to improve water quality - Stabilize agricultural production
Spatial and temporal scale & *Quality and reliability*	We build up the initial performance indicator list based on: - Previous experience (e.g., RECARE project) - Literature review, incl. WOCAT, nwrm.eu, etc. - Models input/output information (WP3/WP4)
Targets and baselines	We need to report magnitude of change. For that we need to: - have a baseline (WP3, MARG, WP4) - monitor/model respective parameters (CS, WP4)
Clear cause and effect links & limited number	Next step (see section 3.2 and 3.3) - Discussion/feedback from all project partners (especially CS leaders and modellers) - Discussion/feedback from MARG meetings (CS)

3.1. Selecting initial EPIs

The initial list of EPIs was created based on critical review of TEEB and MAES global indicators, and catchment scale experiences from other projects:

- WOCAT (see OPTAIN deliverable D2.1; Leman et al., 2022) - The list of criteria (indicators) taken from the "Evaluation" section of the WOCAT database that investigates which impacts a certain technology has, e.g., economically, socio-culturally, and environmentally (https://qcat.wocat.net/en/wocat/)
- nwrm.eu platform (see OPTAIN deliverable D2.1; Leman et al., 2022) – the benefits of NSWRM implementation as identified and classified in the synthesis documents related to environmental aspects (http://nwrm.eu/implementing-nwrm/synthesis-documents)
- Experience from RECARE project (https://www.recare-hub.eu/recare-project) (Bachmann et al., 2018)

In order to collect indicators that will be relevant for the OPTAIN project, we first considered the problems/challenges listed by the CS (Table 1; as initially presented in the project proposal).

Table 1. Overview about the problems and challenges listed in the OPTAIN case studies

Case Study	Problems/Challenges			
	P losses	N losses	Floods	Droughts
CS01-Germany	x		x	
CS02-Switzerland	x			x
CS03-Hungary	x		x	
CS04 - Poland	x	x	x	x
CS05-Austria/Slovenia			x	x
CS06- Slovenia/Hungary	x	x	x	x
CS07 - Belgium			x	x
CS08- Lithuania	x	x		
CS09- Italy		x	x	x
CS10- Norway	x	x	x	
CS11- Hungary	x		x	
CS12- Czech Rep.	x	x	x	
CS13 - Latvia	x	x	x	
CS14-Sweden	x		x	x

Based on this information, we searched for indicators that would allow to assess the influence (performance) of the proposed NSWRM on the environmental characteristic connected to the listed challenges. For example, in case of drought, the indicators need to address following aspects:

- Type of drought - hydrological drought (low water levels in the streams/river) vs. agricultural drought (low soil moisture)
- Important characteristic of the event - timing, frequency, duration, and intensity.

Then, the initially listed indicators to reflect on the drought problem were: water level in the stream/river, discharge at the outlet, soil moisture (surface and subsurface) as well as timing, frequency, duration, and intensity of the drought event.

As a result of creating an initial set of environmental indicators, to be used as EPIs, we have listed 27 indicators for further adjustments within the OPTAIN research group and case studies. The table with the initial set of indicators to be used as EPIs has been shared with all OPTAIN case study leads for review and discussion (in form of the milestone report; MS5).

3.2. Selecting initial SPIs

To our best knowledge, no systematic and comprehensive sets of socio-economic indicators exist for the whole set of relevant NSWRMs considered in OPTAIN. This is due to the wide heterogeneity of practices, features, purposes and impacts also across sites, which make indicators not equally applicable everywhere nor to different measures. Under the umbrella of "NSWRMs", in fact, we identify two main types of measures that may coexist, with quite different cost categories and economic results. On one hand the (i) *structural* measures (e.g., small reservoirs, buffer strips and hedges) that require a permanent or long-lasting built-up or green (infra)structures on agricultural fields and

neighbouring areas; on the other (ii) the *management-related* measures, typically the agronomic practices (e.g., conservation tillage, cover crops) that imply soil management and affect the land cover at farm level. Henceforth, the creation of a harmonized list of potential indicators, able to capture the sustainability level and implications of the variety of NSWRMs on a territory (either farm or catchment level for OPTAIN purposes), was performed through the screening of multiple sources:

- WOCAT (see OPTAIN deliverable D2.1; Leman et al., 2022) - The list of criteria (indicators) taken from the "Evaluation" section of the WOCAT database that investigates which impacts a certain technology has, from the economic, socio-cultural and environmental points of views (https://qcat.wocat.net/en/wocat/)
- Nwrm.eu platform (see OPTAIN deliverable D2.1; Leman et al., 2022) – the benefits and costs of NSWRM implementation as identified and classified in the synthesis documents related to socio-economic aspects (http://nwrm.eu/implementing-nwrm/synthesis-documents)
- Scientific and grey literature concerning effectiveness, assessment and evaluation of manifold interventions, either going under the names of either Natural Water Retention Measures and similar concepts (e.g., green infrastructures, nature-based solutions, etc.)(Nika et al., 2020; Pakzad et al., 2017; ES, 2021; STELLA consulting, 2012) or referred to specific structural and management-related measures applicable in the agricultural and forestry sectors (e.g., crop rotations, buffer strips, etc.) (Collentine and Futter, 2018; Kelly et al., 2018; Troccoli et al., 2015; Lautenbach et al., 2016; Sun et al., 2014; Schüler, 2006). A literature review was carried out taking into account the selection criteria stated above, while considering the challenges to be addressed and the case-specific measures indicated by local teams during the activities planned within task 2.1 (see also D2.1). The following areas of concern - reflecting the possible water and nutrient management challenges, inspired by the responses of local teams in preliminary and previous *ad hoc* investigations, see task 4.5 and D4.1 (Čerkasova et al., 2021) were addressed:
    - Economic sustainability of implementing and maintaining measures related to water/nutrient management, at micro- (i.e., single farms, single measures) and local (agriculture, catchment) level, including the current policy incentives financing or subsidizing NSWRMs (e.g., Common Agricultural Policy);
    - Quality of life in urban and rural areas, concerning whether and how the resilience to environmental, disaster and climate risk may vary after the implementation of NSWRMs;
    - Quality of land and natural resources, connected to the availability and quality of natural resources given the presence, the new implementation or the wider take up of NSWRMs;
    - Local development of the agricultural and rural environment.

As a result of the overall process, the initial set of socio-economy indicators, to be sued as SPIs, counted nearly 50 potentially relevant performance indicators for further selection and adjustments within the OPTAIN research group and CSs (presented in form of milestone report; MS5). To facilitate further the understanding of SPIs, a

comprehensive catalogue of SPIs was distributed among the consortium partners, providing key information.

4. 'Short lists' of indicators

The development of a universal set of indicators that can be equally applicable in all cases is quite challenging, which is mainly caused by the different site-specific conditions and challenges. As shown in section 2, a science-based shortening of the initial lists of EPIs and SPIs was required to tailor the indicators to OPTAIN needs. This shortening was an iterative process that involved both project research groups and CS groups with the aim to select the most promising PIs.

We started with including the modellers' perspective (WP3 and WP4), to discuss the possibilities and limitations of estimating or quantifying listed indicators based on modelling results, data availability, relevance of indicators, feasibility for an as easy as possible application of appraisal techniques. In parallel, the WP2 team elaborated a common protocol (i.e., guidelines) to guide CS teams in the tailoring and adjusting of indicators during MARG workshops (milestone MS6). The document was used as a starting point for a series of discussions with the case study teams, including:

- World Café forum during the OPTAIN plenary meeting Warsaw (September 2021),
- InterVision meetings in December 2021 and March 2022,
- One-to-one email exchange and virtual calls.

The discussions aimed to reach a common understanding of the concept of indicators in OPTAIN and to clarify the practical meanings behind all initially listed indicators, which turned out to be challenging with the socio-economic ones. Moreover, the discussions focussed on the challenging need for indicators to be *relevant* and to present *clear cause and effect links*, as well as to find trade-offs between *quality and reliability* and *reasonable number* of indicators.

As a result, we ended up with "short lists" of indicators to be used as EPI (Table 2) and SPI (Table 3). In case of EPI, the "short list" is actually not shorter than the "initial list", because some initially listed indicators have been replaced by other indicators to cover all settings and environmental issues of the 14 CS.

*Table 2: Shortlist of indicators to be used as **Environmental Performance Indicators (EPIs). A** more detailed description is available in Annex 1.*

Topic	Indicator	Scale of relevance
*Water retention in the catchment***		
	Soil moisture (surface and subsurface)	Farm & catchment
	Surface runoff	Farm & catchment
	Water distribution in the catchment	Catchment
	Water level in the river/stream	Catchment
	Groundwater level	Farm & catchment
	Soil temperature	Farm & catchment
	Drainage outflow	Farm & catchment
	Water harvesting	Farm & catchment
Flooding – Improve resilience towards adverse events		
	Timing of flooding	(Farm &) catchment
	Frequency of flooding	(Farm &) catchment
	Duration of flooding	(Farm &) catchment
	Intensity of flooding	(Farm &) catchment
Drought – Improve resilience towards adverse events		
	Timing of drought	(Farm &) catchment
	Frequency of drought	(Farm &) catchment
	Duration of drought	(Farm &) catchment
*Water quality***		
	River/streams:	
	Suspended sediment concentration and loads	Catchment
	Nutrient's concentration and loads	Catchment
	Surface runoff:	
	Suspended sediment concentration and loads	Farm & catchment
	Nutrient's concentration and loads	Farm & catchment
	Subsurface:	
	Nutrient's concentration and loads	Farm & catchment
	Groundwater:	
	Nutrient's concentration and loads	Farm & catchment
	Drainage water:	
	Nutrient's concentration and loads	Farm & catchment
*Other***		
	Soil erosion	Farm & catchment
	Crop production	Farm & catchment
	Biomass yield	Farm & catchment

** There might be some trade-offs, depending on the time and spatial scale. E.g. Storing more water in the soil (increased soil moisture at the field scale) might reduce the overall annual discharge (catchment scale). To avoid a trade-off between the indicators we might need a temporal component in the indicator, e.g. reduce discharge volume in spring and increase soil water content in summer.

Additionally, Annex 1 provides a more detail description of all short-listed environmental indicators. It also includes the information about expected/desired "direction of change" (as a part of creating EPI; see section 1.2). Moreover, it includes the information about possibility to model the particular indicators with the OPTAIN modelling part (WP4) and provide the "baseline" information in case no monitoring data is available (as a part of creating EPI; see section 1.2).

In the case of SPIs, following the discussion with project partners and case study leaders and coordinators, we opted to strongly reduce the number of candidate indicators to those more strictly connected to local challenges and relevant measures. Based on this, the final "short list" of SPIs consists of 17 indicators (Table 3). The table illustrates key information of SPIs (relation with economic models, data needed and sources), while a brief description of how they are defined is provided in Annex 2.

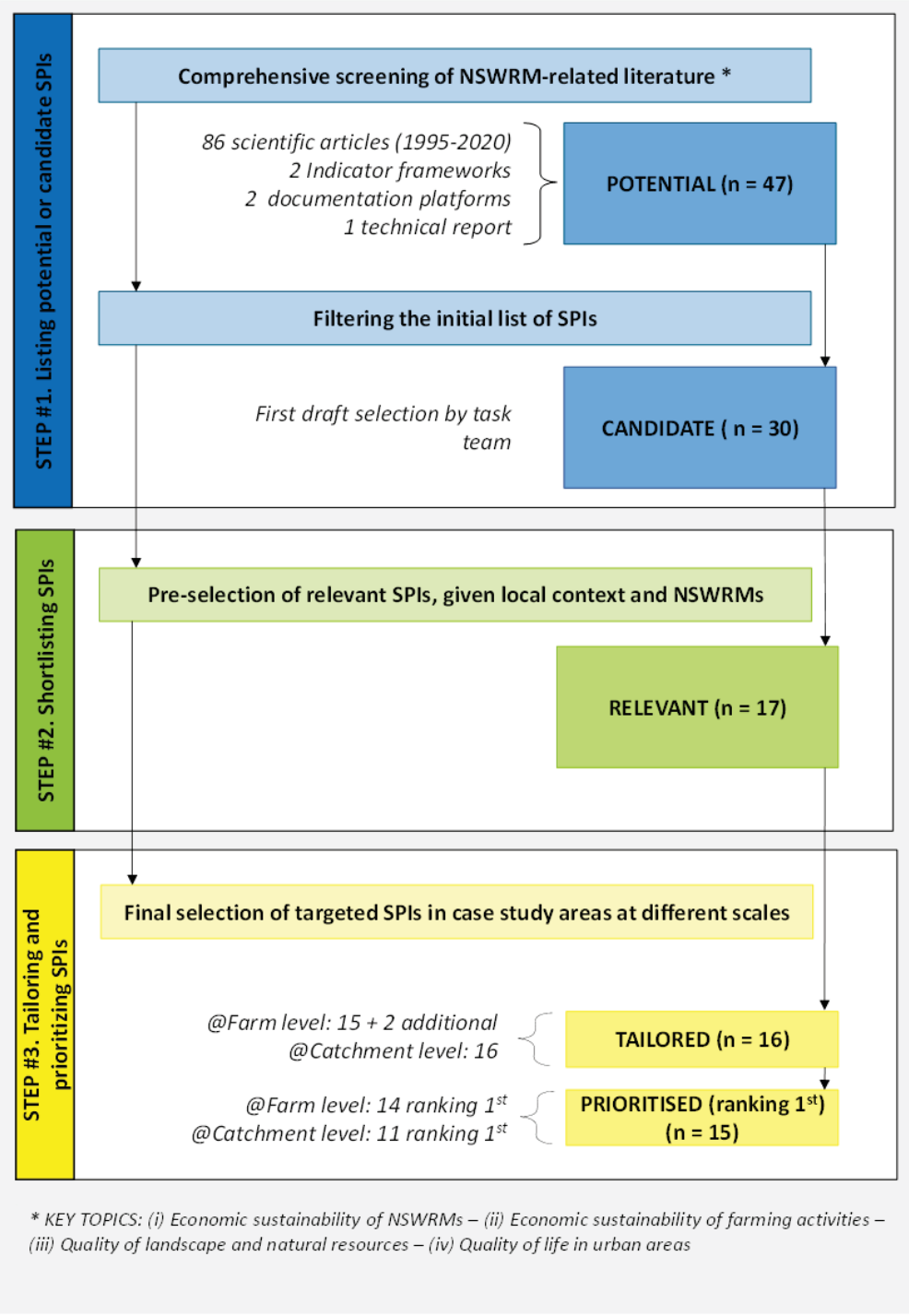

Figure 5: *Workflow for the screening, pre-selection and tailoring of SPIs, with key facts. Note: see the text for the topics of interest; details about tailored indicators are included in the next sections.*

*Table 3: Shortlist of indicators to be used as **Socio-economic Performance Indicators (SPIs)***

Challenge	Challenge-driven indicators	Scale of relevance	Type[1]	Model	Type of data needed[2]
Economic sustainability of NSWRMs	*Lifecycle costs*				
	Implementation costs	Farm, catchment	M	Not needed	SD
	Maintenance/operating/management costs	Farm, catchment	M	Not needed	SD
Economic sustainability of farming activities	*Economic results of farm holdings*				
	Total output value	Farm, catchment	(M), B, I	Feasible	SD, MO
	Gross margin	Farm, (catchment)	(M), B, I	Feasible	SD, MO
	Factor productivity	Farm, (catchment)	B, I	Feasible	SD, MO
	Gross or net value added	Farm, (catchment)	B, I	Feasible	SD, MO
Quality of landscape and natural resources	Land use intensity	Farm, catchment	B, I	Feasible	SD
	Total land economic score	Farm, catchment	B, I	Feasible	SD
	Soil quality improvement	Farm, catchment	I	Difficult	SD, MO
	Water quality improvement	Farm, catchment	I	Feasible	SD, MO
	Air quality improvement	Farm, (catchment)	I	Difficult	SD
	Value of C sequestration	Farm, catchment	I	Feasible	SD
	Value of avoided CO_2 emissions	(Farm), catchment	I	Difficult	SD
	Greater local economic activity	(Farm), catchment	I	Difficult	SD
Quality of life in urban and rural areas	Increased/decreased environmental or disaster risk	(Farm), catchment	I	Difficult	SD
	Increased/decreased vulnerability to climate change	(Farm), catchment	I	Difficult	SD
	Value of reduced flood damage and hazard	(Farm), catchment	I	Difficult	SD

[1] **M**: *measure-specific indicators* reflecting its specific financial and economic characteristics - **B**: *background (or context) indicators*, which describe the general background of case study areas providing a snapshot of the current setting in which farmers operate and NSWRMs are/can be implemented (*van Eijck and Faaij, 2014*) - **I**: *impact-related indicators*, related to the implications or consequences of NSWRMs' implementation.

[2] Standard data (**SD**) retrieved from literature or public EU database (e.g., EC FADN, EUROSTAT) and adjusted to local contexts, where available. Data gaps should be filled after the consultation of local stakeholders, agencies or other actors. For the quantification of some SPIs other data needed are the outcome of biophysical models (e.g., crop yield) (**MO**), others may have to be modelled using appraisal and other estimation methods.

5. Tailoring the indicators – involvement of stakeholders and key actors

An important step in the process of tailoring performance indicators was the involvement of stakeholders and key actors in order to take into account the local context and main actors' perceptions. Due to unforeseen changes in the timeline of MARG meetings (esp. COVID-19 related), the process of further tailoring the indicators was two-fold: 1) building up on expert knowledge and previous experience within case study teams and 2) getting feedback from MARG workshops.

5.1. Case study specific indicators – CS survey

A short survey was sent to all CS leads with the request for feedback about "most important/commonly used" indicators that would work in specific case study settings (please find the survey form in Annex #3).

To start with, we asked the CS leaders to give a bit more specific information about the challenges to be addressed within the OPTAIN project in their case studies (Table 4; see also Čerkasova and Idzelytė 2021)

*Table 4: More precise definition of the challenges in the CS, based on the **CS survey**. The numbers correspond to the rank of the challenge.*

	Soil erosion	Water quality	Droughts	Floods	Extreme event	Water availability (for irrigation)	Water deficits	Biodiversity loss	Soil quality	Land drainage
CS01 - Germany/Schwarzer Schöps	1	2	3	4						
CS02 – Switzerland/Petit Glâne		2	1							
CS03a – Hungary/Csorza			1	3	2					
CS03b – Hungary/ Felső-Válicka	1		2		3					
CS04 – Poland/Upper Zglowiaczka		1	2	4		3				
CS05 – Slovenia/Pesnica		1	4	3						
CS06a – Slovenia/Kobliski Potok		4	1	2				3		
CS06b – Hungary/Kebele		3	2	2			1			
CS07 – Belgium/La Wimbe	3	4	2	1						
CS08 – Lithuania/ Dotnuvėlė	2	3	4						1	
CS09 – Italy/Cherio		3	1	2		2				
CS10 – Norway/ Hobøl	2	1		3						
CS11 – Hungary/Tetves	1		3	4	2					
CS12 – Czechia/Cechticky	1	4					2			3
CS13 – Latvia/Dviete		1		2						
CS14 – Sweden/ Sävjaån		1	2	3						

Notes:

CS01: Water quality - P

CS04: Water quality - nitrogen

CS03a Droughts- increasing frequency, water deficits;
extreme events - floods and droughts occurring alternatively

CS03b: Soil erosion - run-off and nutrient loss;
Droughts: increasing frequency, low water levels in summer.

Extreme events – climate change

C04: Agricultural drought - shortage of water in general due to climatic conditions: low precipitation, high evapotranspiration.
Availability of water for irrigation - balance between surface and groundwater;
Pluvial floods - excess water on agricultural fields, improvement of drainage system functioning.

C05: Water quality - leaching of nitrogen and pesticides, maintaining buffer strips vegetation along the river basin;

CS06b: Water deficit – decreased water level
Water quality - leaching of nitrogen and pesticides
Floods - on agricultural land in the winter months
Droughts - in the summer months

CS07: Erosion - in general and bank erosion
Water quality - nitrate vulnerable zone; although water quality is fine, but the region is identified as nitrate vulnerable zone

CS08: Water quality - nutrient leaching
Droughts - low water levels in summer

CS12: Soil erosion connected to runoff episodes
Water deficit - lack of water in soil
Land drainage - failures, undue runoff

CS13: Water quality – P losses and N losses

Tables 5-8 present the results of the survey – lists of EPIs and SPIs chosen by CS leaders as the most relevant for their CS, with the ranking given by CS teams.

Table 5: *Farm scale relevant indicators to be used as EPIs listed by case study teams as most relevant in their specific setups. Note: rank#1 means the most important indicator(s). It is possible to have several indicators with the same rank. Last column is the summary, for all OPTAIN CS. It shows the number of CS where particular indicator was ranked at least 2 (the most important and the second most important).*

Challange/Problem	Indicator	CS01	CS02	CS03a	CS03b	CS04	CS05	CS06a	CS06b	CS07	CS08	CS09	CS10	CS11	CS12	CS13	CS14	OPTAIN
*Water retention**	Soil moisture (surface and subsurface)	3	2	1	1	1	4	1			1		2	1				8
	Surface runoff	2		1	1			1					1	1	1			7
	Groundwater level/depth			2	2	2		1		5		3		2				5
	Soil temperature			5	5		4	2						5				1
	Drainage outflow					2					2				1			3
	Water harvesting					4	2		2									2
Flooding – Improve resilience towards adverse events	Timing of flooding			1	4			2				1		1		2		5
	Frequency of flooding			1	4	4		2				1	2	1		2		5
	Duration of flooding			1	3	3		1		3		2		1		1		5
	Intensity of flooding			1	3	4		2		5			2	2		1		5
Drought – Improve resilience towards adverse events	Timing of drought			1	2	1		1			2	1		1				7
	Frequency of drought			2	1			1				3		2				4
	Duration of drought			2	1	1		1		4	2	3		2	2			7
*Water quality** Surface runoff	Suspended sediment concentration and loads	2								1			3					2
	Nutrient's concentration and loads	2					3		3				3					1
Groundwater	Nutrient's concentration and loads					2												1
Drainage water:	Nutrient's concentration and loads					1					2				1			3
*Other**	Soil erosion	1	3	3	3			1			1		1	1	1			6
	Crop production	1	1	1	1	1	1	1	1	2	1	1	2	1	2			14
	Biomass yield			4	2		1	2	1					1				5
	Nutrient loss	3					2		2				1					3
Additional - added to the shortlisted EPI by CS team	Flooded area							1										1
	Drought intensity							1										1
	GHG emissions						3		3									

Comments from CSs:

CS01: Soil moisture is related to droughts.
Nutrient concentrations, focusing on phosphorus.
Nutrient loss - ratio of nutrient loss and nutrient input.

CS02: Soil moisture information, including soil cover.

CS04: Flooding is restricted to 'pluvial' only as in the catchment are practically no river flooding.
Groundwater quality - restricted to 'nitrate' only as other nutrients are not a problem.
Drainage water - restricted to 'nitrate' only as other nutrients are not a problem.
CS05: GHG emission - Greenhouse gas emissions per unit of revenue.
Nutrient loss – incl. plant nutrient consumption, fertilizer consumption per production unit and consumption of plant protection products per production unit.
CS06b: GHG emission - Greenhouse gas emissions per unit of revenue.
Nutrient loss – incl. plant nutrient consumption, fertilizer consumption per production unit and consumption of plant protection products per production unit.
CS14: Based on stakeholders' perspective; farm EPIs seem to be less important for stakeholders than catchment scale EPI. Therefore, not listed here.

Table 6: Catchment scale relevant indicators to be used as EPIs listed by case study teams as most relevant in their specific setups. Note: rank#1 means the most important indicator(s). It is possible to have several indicators with the same rank. Last column is the summary, for all OPTAIN CS. It shows the number of CS where particular indicator was ranked at least 2 (the most important and the second most important).

Challange/Problem		Indicator	CS01	CS02	CS03a	CS03b	CS04	CS05	CS06a	CS06b	CS07	CS08	CS09	CS10	CS11	CS12	CS13	CS14	OPTAIN
*Water retention **		Soil moisture (surface and subsurface)	4	1	1	1	2		1			1			1				7
		Surface runoff	2	1	1	1			1					1	1	1			8
		Water distribution in the catchment			3	3			3				3		3				
		Discharge at the outlet	3	1	2	1	4	2	2	2	2	2	1	2	2			1	12
		Groundwater level/depth		1	3	2	3		1						2				4
		Soil temperature			5	5			2						5				1
		Drainage outflow					3					2				1			2
		Water harvesting					4												
Flooding – Improve resilience towards adverse events		Timing of flooding			1	4			1			3			1		4		3
		Frequency of flooding			1	4	5	1	2	1			1		1		4	1	7
		Duration of flooding	3		1	4	4	1	1	1	5	2			1		3		6
		Intensity of flooding	5		1	4	5		1		4		1	2	1		2	1	7
Drought – Improve resilience towards adverse events		Timing of drought		1	1	2	2		1				1		1				7
		Frequency of drought	5	1	2	1	2		1	1			1		2				8
		Duration of drought		1	2	2	2		1	1	5		1		2	2			9
*Water quality**	*River/streams (at the outlet):*	Suspended sediment concentration and loads	1	3	3	1		3	2	3	1	1	1	1	1				8
		Nutrient's concentration and loads	1	2	2	1	1	3	2	3	5	1	2	1	2	1	1	1	13
	Surface runoff:	Suspended sediment concentration and loads		3				3	2	3		1							2
		Nutrient's concentration and loads		2				3	2	3		1							3
	Groundwater:	Nutrient's concentration and loads		2			3		2										2
	Drainage water:	Nutrient's concentration and loads					2					1				1			3
*Other**		Soil erosion	2	3	3	1		3	1			1		1	1	1			7
		Crop production	3	1	1	1	2		3		3			1	1	2			7
		Biomass yield			4	4			1				1		4				2
Addiational - added to the shortlisted EPI by CS team		Drought severity/intensity			1	1			1				5		2				4
		Flodded area							1										2

Comments from CSs:
CS01: Suspended sediment concentration in the river, at the outlet from the catchment.
Nutrient concentrations in the rivers at the outlet.
Water level in the river/Discharge = yearly/seasonally Q_{max}/Q_{min}.
CS02: Soil moisture information, including soil cover.
CS04: Flooding is restricted to 'pluvial' only as in the catchment are practically no river flooding.
Stream water quality - restricted to 'nitrate' only as other nutrients are not a problem.
Groundwater quality - restricted to 'nitrate' only as other nutrients are not a problem.
Drainage water quality- restricted to 'nitrate' only as other nutrients are not a problem.
CS10: Flood intensity – more in connection with water quality.
CS14: Based on stakeholders' perspective; farm EPIs seem to be less important for stakeholders than catchment scale EPI.

It is natural that the choice of case study specific environmental indicators (Table 5 and 6) is driven by the CS-specific problems/challenges (Table 4) and identified relevant measures (done within task 2.1; Leman et al, 2022).

It is important to notice that there are "conceptual" differences between the CS as well. Most of the CS list between 1 and 4 indicators that are of high importance for them, both at field scale and catchment scale level. However, in some CS more than 8 indicators were listed as with rank 1 – "most important/relevant". This can indicate the complexity of the problems to address in these CS and should be treated more like the list of problems to address than actual prioritisation of indicators.

In order to identify the most important indicators across all 16 CS in OPTAIN, the last column in Tables 5 and 6 shows the number of CSs that listed a particular indicator as rank #1 or #2 (the most important and the second most important). These shows that at the field scale the most important indicator across the OPTAIN CS is crop production (important in 13 out of 16 CS) and indicators connected to water quantity (soil moisture, surface runoff, soil erosion and timing and duration of drought). At the catchment scale, it is water quality in the river/stream and discharge at the outlet of the catchment that is most important across the OPTAIN CS (important in more than 12 out of 16 CS).

Table 7: *Farm scale relevant indicators to be used as SPIs listed by case study teams as most relevant in their specific setups. Note: rank#1 means the most important indicator(s). It is possible to have several indicators with the same rank. Last column is the summary, for all OPTAIN CS. It shows the number of CS where particular indicator was ranked at least 2 (the most important and the second most important).*

Challange/Problem	Indicator	CS01	CS02	CS03a	CS03b	CS04	CS05	CS06a	CS06b	CS07	CS08	CS09	CS10	CS11	CS12	CS13	CS14	OPTAIN
Economic convenience of water/nutrienst management solutions	Implementation costs	1	1			1	2		2	1	1	1	1		1	1	1	13
	Maintenance/operating/management costs	1	1	1	1	1	2	1	2	2	1	1	1		1	1	1	15
Economic sustainability of farming activities	Total output value		1			1	5		5	4		1	1					4
	Gross margin					1	1		1	3		1			2			5
	Factor productivity					3	1		1									2
	Gross or net value added	1				3					1							2
Quality of landscape and natural resources	Land use intensity		1			2	3		3							2		3
	Total land economic score					1					1							2
	Soil quality improvement					1	3		3		1							2
	Water quality improvement					2									1			2
	Air quality improvement																	
	Value of C sequestration		1			4	4		4									1
	Value of avoided CO_2 emissions					4	4		4									
	Greater local economic activity																	
Quality of life in urban and rural areas	Increased/decreased environmental or disaster risk			3	3	2		1								2		3
	Increased/decreased vulnerability to climate change	1	1	3	3	2					1		2					5
	Value of reduced flood damage and hazard			3	3			1				2	2			2		4
Additional - added to the shortlisted EPI by CS tean	Product diversity		2															2
	Opportunity costs						2		2									2

NOTE:
Some case study areas expressed priorities for a larger number of indicators, based on the comprehensive list in initially provided. For brevity and comparison purposes, the table includes the corresponding SPIs from the "Shortlist" only.

Table 8: Catchment scale relevant indicators to be used as SPIs listed by case study teams as most relevant in their specific setups. Note: rank#1 means the most important indicator(s). It is possible to have several indicators with the same rank. Last column is the summary, for all OPTAIN CS. It shows the number of CS where particular indicator was ranked at least 2 (the most important and the second most important).

Challange/Problem	Indicator	CS01	CS02	CS03a	CS03b	CS04	CS05	CS06a	CS06b	CS07	CS08	CS09	CS10	CS11	CS12	CS13	CS14	OPTAIN
Economic convenience of water/nutrienst management solutions	Implementation costs	1	2			1	2		2		1	2	3		1	2		9
	Maintenance/operating/management costs	1	2	1	1	1	2	1	2		1	2	2		1	2		13
Economic sustainability of farming activities	Total output value					2				3		1						2
	Gross margin	1				2				1					2			4
	Factor productivity					4												
	Gross or net value added	1				4	1		1									3
Quality of landscape and natural resources	Land use intensity		2			3				1		1				3		3
	Total land economic score					2												1
	Soil quality improvement					2				4								1
	Water quality improvement	2	1			1	4		4	5	1	4			1			5
	Air quality improvement																	
	Value of C sequestration		2			3												1
	Value of avoided CO_2 emissions					3												
	Greater local economic activity	4					3		3		1		1					2
Quality of life in urban and rural areas	Increased/decreased environmental or disaster risk			3	3	3		1				3				3		1
	Increased/decreased vulnerability to climate change	3		3	3	3	3		3		1		2					2
	Value of reduced flood damage and hazard			3	3		4	1	4	2		3	1			2		4

NOTE:
Some case study areas expressed priorities for a larger number of indicators, based on the comprehensive list in initially provided. For brevity and comparison purposes, the table includes the corresponding SPIs from the "Shortlist" only.

The choice of most important indicators to be used as SPIs was likely driven by both the specific challenge to be addressed in the local contexts and by the effects that NSWRMs may produce on the territory (either the field or the catchment scale) under investigation.

At the field/farm level (table 6), it must be noted the differences between CS, as some of them listed all the selected SPIs as equally important (rank #1), while others consider a large array of indicators with different priorities attributed. As expected, the most important socio-economy indicators identified at the farm scale are related to the economic convenience of implementing and maintaining NSWRMs. Both implementation and maintenance costs are objectives highly prioritized (rank #1 or #2 priority) in each CS area, indicated respectively by 12 out of all and all the respondents. At the same time, importance is given to the implications that NSWRMs implementation or their wider take-up may have on the economic performance of farmers and agricultural sector in general. This is concerned in a lower number of cases, mostly in relation to the output value and the gross margin of agricultural production. The SPIs connected to quality and the productivity of landscape (land use intensity, total land economic score) were given a lot of importance in 6 CS, with the highest priority only in 3 of them. This reflects the major challenges undergoing in the study areas, which are overall complemented by concerns about the quality of natural resources (water, soil, air) and their management. It must be pointed out that, despite the quality of life in urban and rural areas is felt in a discrete number of CS, the relevance of such problems

and hence the priority score given to the relative socio-economy indicators is in many cases of secondary importance.

At the catchment scale (Table 7), a similar configuration of the case study specific socio-economy indicators configuration can be observed. In particular, the economic convenience of possible solutions and the economic performance of farming activities are still important for most of the CS; scores in general attributed fall into a larger range (1 to 4) and the average score across CS is lower than for the field level. On the other hand, at this scale other challenges not relevant before more clearly emerge. The quality of the environment and life become important for a higher number of case studies: water quality improvement is selected in 9 out of 12 areas though with differentiated priorities. The variations in the possibility to address environmental, disaster and climate change risks are existing problems in more than half of CS. Nonetheless, the respective SPIs rank first for importance only in very few cases.

5.2. Common indicator across all CS

Additionally, based on the survey, and several following discussions within WP2, WP4 and WP5 teams, we have selected a set of indicators that should be used in all CS, and consequently build up the base for further analysis of NSWRM performance/effect across the studies. When choosing the indicators that are recommended to be used in all CS, we were looking for indicators that:

- can reflect on/cover/include the range of specific needs in OPTAIN CSs;
- are possible to be calculated/estimated in the same manner across the CSs;
- are realistic to model or can be extracted in the post processing calculations, within the scope of OPTAIN modelling (WP4 and WP5).

Table 9 shows the set of indicators that are recommended to be used in all CS. A more detailed description of these indicators can be found in Annex 1 and 2.

Table 9: *Set of indicators to be used as EPIs and SPI that is recommended to be use in all CS (in addition to tailored EPIs and SPIs considered important for each case study; Tables 4-7).*

Environmental indicators		Socio-economic indicators	
Farm level	Catchment scale	Farm level	Catchment scale
Crop production	Nutrient's concentrations and loads in the stream/river	Implementation costs	Implementation costs
Soil moisture	Discharge at the outlet	Maintenance costs	Maintenance costs
Soil erosion	Surface runoff (in connection to soil erosion)	Gross margin	Increased/decreased vulnerability to natural/extreme event hazards
Nutrient loss	Suspended sediment concentration and loads in the stream/river	Increased/decreased vulnerability to natural/extreme event hazards	Water quality improvement

5.2.1. Further specification of EPIs

While some of the listed indicators are rather intuitive to address with monitoring data or/and modelling results (e.g., nutrients loads and concentrations) others need more elaboration. There might be a need to account for spatial and temporal dimensions, e.g., reduce discharge volume in spring and increase soil water content in summer. Therefore, there is a need for precise definitions that are robust and reliable. Moreover, it is possible that definitions should be adjusted on the CS levels. Table 10 shows the first attempt to address these challenges.

Table 10: First attempt to list the potential EPIs relevant for the OPTAIN case studies

Recommended indicators	What to measure/ model?	Potential EPIs*	Comment	Reference/ comment
Farm scale environmental indicators				
Crop production	Yield [t/ha/year]	Gaps in actual vs potential yields.	This indicator requires two annual measurements: (1) estimates of crop yields of the sample of targeted farmers in the project area based on farmer production estimates and measurements of planted areas; and (2) estimates of yields for the same crops or cropping systems on demonstration plots, based on the complete harvesting method. The calculation is simply the difference between them	Diskin (1997); Guilpart et al. (2017)
Soil moisture	Soil moisture content of the characteristics soils layers [m^3/m^3] Thickness of each layer [m]	Soil moisture index-SMIX: $SMIX = \int_{t1}^{t2} \int_{l1}^{l2} S \, dl \, dt$	The SMIX combines the amount, duration and timing of the soil moisture deficit or surplus and can be employed at various spatial scales. S (mm) is the average volumetric moisture content minus the average of the three lowest readings; t_1 and t_2 are usually start and end of growing seasons; l_1 and l_2 are the soil depths over which integration takes place, l_1 is the soil surface; and l_2 represents the rooting depth, which depends on the crop type and stage of growth.	Isard et al. (1995)
		Soil moisture index - SMI: $SMI = -5 + 10\frac{\theta - \theta_{WP}}{\theta_{FC} - \theta_{WP}}$	The SMI is defined as the proportion of the difference between the current soil moisture and the permanent wilting point to the field capacity and the permanent wilting point. The SMI values range from -5 to 5 with -5 indicating extreme dry conditions and 5 indicating extreme wet conditions. When $\frac{\theta-\theta_{WP}}{\theta_{FC}-\theta_{WP}}$ (fraction of available water) is 0.5 (after Baier, 1969) the value of SMI is zero. Thus, a SMI value of 0.0 separates the stress versus non-stress situations. θ is measures or modelled volumetric water content, averaged over defined time period (e.g. growing season) and over the defined area (e.g. field, farm, catchment) θ_{WP} is the volumetric soil water content at the wilting point; θ_{FC} is the volumetric soil water content at field capacity	Hunt et al. (2009)

Soil erosion	Soil loss per ha of agricultural land [kg/ha]	Erosion rate in the catchment [kg/ha/year]	Focusing on soil erosion by water. It is possible to restrict the calculation to defined period of time, when the reduction of soil erosion is crucial/most important	Eurostat online publication
Nutrient loss	Loss of nutrients [kg/year] Nutrient inputs [kg/year]	Nutrient loss ratio [-]	Ratio of nutrient loss from the field and nutrient input to the field In some CS it can be more relevant to relate to other specific periods, e.g.: hydrological year, growing season; etc.	MCDonald, (2019)
Catchment scale environmental indicators				
Nutrient's concentrations and loads in the stream/river	P concentrations [mg/L] P loads [kg/year]	P concentrations [mg/L] P area specific loads [kg/ha/year]	Phosphorus yearly/seasonally average concentration and total loads in the river/stream, measured or modelled at the outflow from the catchment. P loads are calculated based on daily average values of water flow and concentrations. Measured/modelled daily flows are multiplied by estimated daily concentrations to obtain daily loads, which can be summarized to monthly, seasonally or annual loads (depending on the needs). Area specific loads (kg/ha) are calculated by dividing the load by the catchment area. NOTE: depending on a CSs specific setup it is possible to focus on different fractions of phosphorus.	Refer to the desired ecological status of the waterbodies (Čerkasova and Idzelyte, 2021)
	N concentrations [mg/L] N loads [kg/year]	N concentrations [mg/L] N area specific loads [kg/ha/year]	Nitrogen yearly/seasonally average concentration and total loads in the river/stream, measured or modelled at the outflow from the catchment. N loads are calculated based on daily average values of water flow and concentrations. Measured/modelled daily flows are multiplied by estimated daily concentrations to obtain daily loads, which can be summarized to monthly, seasonally annual loads (depending on the needs). Area specific loads (kg/ha) are calculated by dividing the load by the catchment area. NOTE: depending on a CSs specific setup it is possible to focus on different fractions of nitrogen	

Discharge at the outlet	Discharge at the outlet [m^3]	Discharge at the outlet: $Q_{tot;}$ Q_{aver} Q ratio: Q_{max}/Q_{min}	Ratio between maximum and minimum discharge (Qmax/Qmin) is known as coefficient of river regime and it provides initial indication of seasonal variability. When the value is close to 1, seasonal variability is small, but when the value is above 1, seasonality increases, and seasonal variability is high. This ration can be calculated for any specific period (e.g. annual, seasonal, growing season). NOTE: there might be a need to adjust this depending on the related (main) challenge in the CSs, drought vs, flooding.	Laraque et al. (2007); Pantouw et al. (2013)
Suspended sediment concentration and loads in the stream/river	SS concentrations [mg/L] SS loads [kg/year]	SS concentrations, SS area loads level	Suspended sediment yearly/seasonally average concentration and total loads in the river/stream, measured or modelled at the outflow from the catchment. SS loads are calculated based on daily average values of water flow and concentrations. Measured/modelled daily flows are multiplied by estimated daily concentrations to obtain daily loads, which can be summarized to monthly, seasonally annual loads (depending on the needs). Area specific loads (kg/ha) are calculated by dividing the load by the catchment area.	Refer to the desired ecological status of the waterbodies (Čerkasova and Idzelyte, 2021)

*The “direction of change” and “magnitude of change” will be estimated based on scenario runs (WP4) and the baseline for comparison is built on available monitoring data in CS (WP3) and modelling results (WP4)

As indicated by many CSs, the drought and flood related indicators are also very important in specific CS. While in some case the drought issues can be addressed by soil moisture related indicators (Table 10), in other cases it is important to look for dedicated indicators. To star with it is necessary to look at the definitions of floods and droughts:

- floods:
  - **Fluvial floods** (river floods) - occurs when the water level in a river, lake or stream rises and overflows onto the surrounding banks, shores and neighbouring land. The water level rise could be due to excessive rain or snowmelt.
  - **Pluvial flooding** (flash floods and surface water) - A pluvial flood occurs when an extreme rainfall event creates a flood independent of an overflowing water body.

  Note: at the field scale we are considering only pluvial floods, whereas at catchment scale we would be looking into river flood. Indicators reflecting flood related issues can be further discussed, based on previous work of, e.g., Wang et al. (2015)

- droughts (Figure 6; NDMC)
  - **Meteorological drought** - is defined usually on the basis of the degree of dryness (in comparison to some "normal" or average amount) and the duration of the dry period. Definitions of meteorological drought must be considered as region specific since the atmospheric conditions that result in deficiencies of precipitation are highly variable from region to region.
  - **Agricultural drought** - links various characteristics of meteorological (or hydrological) drought to agricultural impacts, focusing on precipitation shortages, differences between actual and potential evapotranspiration, soil water deficits, reduced groundwater or reservoir levels, and so forth.
  - **Hydrological drought** - is associated with the effects of periods of precipitation (including snowfall) shortfalls on surface or subsurface water supply (i.e., streamflow, reservoir and lake levels, groundwater).

Some soil moisture related indicators can be used when addressing drought and floods issues (Table 10 and Schyns et al, 2015), after adjusting definition of 'drought' to the region and plan specific conditions. Accordingly, it is needed to set the region-specific thresholds to detail the subsequent calculation process.

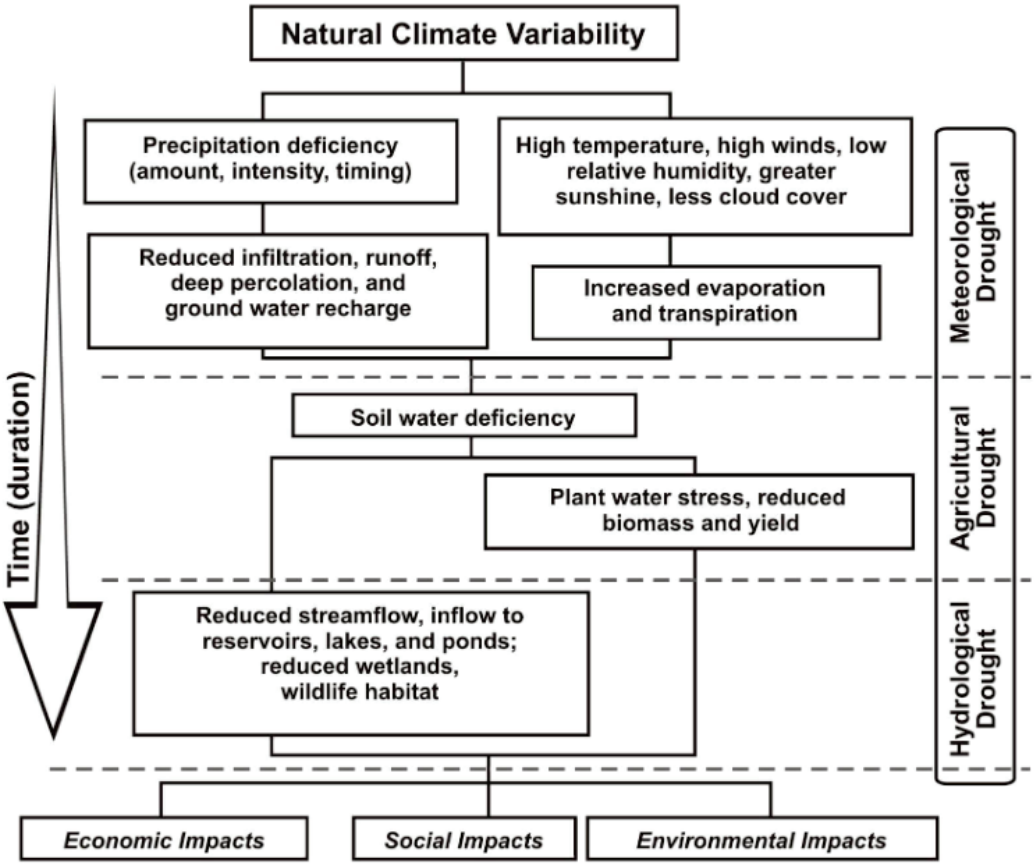

Figure 6: Sequence of drought occurrence and impacts for commonly accepted drought types. All droughts originate from a deficiency of precipitation, but other types of drought and impacts cascade from this deficiency. (Source: NDMC)

Further discussions are needed on the indicators listed in Table 9 when it comes to scenario modelling (WP4) and when running the optimisation tool CoMOLA (WP5).

5.2.2. Further specification of SPIs

In the case of socio-economic indicators, it must be pointed out that they are not the result of any prior modelling approach (SWAT+ or field-level models), though partly stemming from such outputs (see annex #2 for more information). For this reason, they require specific quantification or estimation methods that shall be adjusted to each relevant measure, local conditions, allocation constraints and scenarios.

Based on the feedback from the CS, we ended up considering the top-four overall prioritized indicators. A strong overlap between the proposed SPIs at farm and catchment level can be observed (table 9). This indicates cross commonalities of current problems between scales and across contexts, though from diverse biogeographical regions. Priority challenges concern the economic sustainability of NSWRMs implemented to address current problems, as well as the amelioration of environmental and societal conditions. As such, the set of set of common indicators proposed refers to measure-specific and impact-related aspects, as briefly described hereinafter.

Measure-specific indicators

- **Implementation costs** of a NSWRMs [€/unit] are the set of costs sustained for the material, equipment and infrastructure to realize a measure, including the possible additional or management costs if a change in current production factors (e.g., new machinery needed, land acquisition) is expected.
- **Maintenance costs** are the annual costs [€/unit] incurred for maintaining existing or new assets and measures (or their combination) in good functioning order until the end of their useful life, or to keep a measure/facility running.

Regarding the quantification of both cost categories, it is important to make use of available and reliable data. Given the differences in the selected NSWRMs, in the locations of case study areas and in the local agricultural systems, cost categories mentioned shall be tailored according to the possible locations of measures within the catchment and to the prevalent farming types operating in the study sites. In order to reflect such differences, we aim to source standard data from international database (e.g., FADN, EUROSTAT) and existing documentation platforms (e.g., WOCAT, nwrm.eu) in relation to each measure of interest.

Impact-related indicators

- **Gross margin** of agricultural and/or forestry production [€/ha] - equals the accounting for crops and other agricultural products at diverse territorial units, under different use of production factors and technical means. From an analytical point of view, the gross margin is calculated as the difference between the gross income from agricultural and/or forestry production and the variable costs sustained to obtain that production. Such a definition provides indications about the profitability of agricultural activities at farm level and in the entire agricultural catchment. As defined, it varies according to the farmland use and agricultural practices conducted on the field, and its quantification shall be tailored to land and cropland use patterns. As a consequence, it is directly affected by the current and potential scenarios of NSWRMs, their type and possible combinations and allocations. In this respect, we can hypothesize different directions of change. We can expect that a wider take-up or the newly implementation of structural measures – e.g., hedges and rows, but also retention/detention basins or other built-up structures – may determine a decrease in the current gross margin, because of the potential lower or lost revenues following the conversion of agricultural land into non-productive land. When adopting agricultural management measures (e.g., crop rotation, minimum tillage) the gross margin is basically affected by the overall costs sustained through a different use of production factors (e.g., need of investments in new machinery, higher use of pesticides), crops cultivated and the respective yield that can be obtained.
  For instance, a wider take-up of low-till agriculture may involve a larger array of crops with different yields, market prices, and production costs. The calculation of the gross margin - or of its variation in comparison to the "Business As Usual" scenario, if found relevant - shall make use of crop- and farming type-specific standard data from international database (e.g. FADN, EUROSTAT), to be rather tailored to local conditions. On the other hand, the newly implementation of such

measure may in practice require farmers to invest in new machinery and incur in a different use of production factors. Under these hypotheses, we plan to calculate the respective gross margin considering agricultural production operation and costs already recorded (e.g., standard data, technical reports, literature), for existing experiences, in contexts and/or farming types similar to those in the study areas.

- **Increased/decreased vulnerability to natural/extreme event hazards**. The possibility to implement NSWRMs to solve/mitigate environmental problems determines a lower risk of environmental disasters, such as – among others - severe flooding events on agricultural fields, along watercourses and in urban areas nearby rivers. This can result in manifold benefits, from avoiding yield losses due to excess water, to the abatement of costs to be sustained for restoring the conditions prior to the flooding event. The economic assessment of these benefits either in urban or rural/agricultural areas means the implementation of estimation and appraisal techniques (e.g., avoided costs method, hedonic price method, contingent valuation) based on the use of standard data from local sources.
- **Water quality improvement.** A number of NSWRMs are recognized to exercise benefits on the quality of water, reducing or avoiding nutrient and/or sediment losses and the treatment costs for water re-utilization. The economic assessment of this environmental benefit can also be addressed by estimation and appraisal techniques (typically the avoided costs method) that make use of standard data.

5.3. Case Study specific indicators – 2nd MARG meeting

Parallel to the activities described in section 5.1, guidelines for the 2nd MARG workshop have been prepared to support the CS in the organisation of it, focusing especially on the exercise about tailoring and prioritising the EPI and SPI (see the last version of the guidelines in Annex #4). The guidelines included practical hints for organizing workshops, a suggested agenda for the workshop and a detailed description of every agenda point.

The 2nd series of MARG workshops (originally planned for months 14-16) was delayed due to COVID-19 implications and the decision to include the scenario discussion within the 2nd workshops. The MARG workshops are now planned between months 19-22 (April – July 2022) and will include a discussion about tailoring and prioritizing of indicators to be used as EPIs and SPIs.

Tables 11 - 14 present the first feedback received from the ongoing 2nd series of MARG workshops. The tables show the ranking of indicators within case studies, scaled from 1 to 5, where 1 means highest importance/relevance.

The size of the MARG in the six presented CSs vary from 6 to 15 people representing different actors' groups:

- **CS01** – Germany- 2nd MARG meeting had 13 participants in total: 6 local authorities; 3 agri-advisors and 4 researchers.
- **CS03b** - Hungary - Felso-Valicka, 2nd MARG meeting had 10 participants in total: 5 local authorities and 5 agriculture consultants. This CS expressed priorities for a larger number of indicators, based on the comprehensive list in initially provided.

For brevity and comparison purposes, the figures include the corresponding SPIs from the "Shortlist" only.

- **CS09** - Italy - this meeting had 6 participants in total: 1 farmer's association representative, 2 representatives of fisherman's association, 2 policy makers and 1 local water manager.
- **CS10** – Norwegian - the 2nd MARG meeting had 8 participants in total: 2 farmers, 6 local authorities, 1 researcher and 1 other.
- **CS11** - Hungary – Tetves - the 2nd MARG meeting had 15 participants in total: 8 farmers, 5 local authorities, 1 agricultural company representative and 1 local agricultural consultant. This CS expressed priorities for a larger number of indicators, based on the comprehensive list in initially provided. For brevity and comparison purposes, the figures include the corresponding SPIs from the "Shortlist" only.
- **CS12 -** Czech - the 2nd MARG meeting had 9 participants in total: 4 farmers, 2 river basin authorities and 3 municipality representatives.

Tabell 11: *First feedback from 2nd MARG meeting about most relevant/tailored environmental indicators at the farm scale. Ranking ranges from #1 –most votes (most important) to #5 – lest votes (least important).*

Challange/Problem		Indicator	CS01	CS02	CS03a	CS03b	CS04	CS05	CS06a	CS06b	CS07	CS08	CS09	CS10	CS11	CS12	CS13	CS14
*Water retention**		Soil moisture (surface and subsurface)				1								4	2	4		
		Surface runoff	1			2								1	3	2		
		Groundwater level/depth				5									5	4		
		Soil temperature													5			
		Drainage outflow														5		
		Water harvesting																
Flooding – Improve resilience towards adverse events		Timing of flooding				4							1		4	4		
		Frequency of flooding				5							1	3	5			
		Duration of flooding				4							2		4			
		Intensity of flooding				3								3	2			
Drought – Improve resilience towards adverse events		Timing of drought				2							1		3			
		Frequency of drought				1							2		2	3		
		Duration of drought				4							3		4			
*Water quality**	Surface runoff	Suspended sediment concentration and loads												2				
		Nutrient's concentration and loads	2											2		5		
	Groundwater	Nutrient's concentration and loads																
	Drainage water:	Nutrient's concentration and loads																
*Other**		Soil erosion	1			1								1	1	1		
		Crop production				1							1	3	1	5		
		Biomass yield				5									5			
		Nutrient loss												1				
Additional - added to the shortlisted EPI by CS team		Flooded area											1					
		Drought intensity											3					
		GHG emissions																

Tabell 12: First feedback from 2nd MARG meeting about most relevant/tailored environmental indicators at the catchment scale. Ranking ranges from #1 –most votes (most important) to #5 – lest votes (least important).

Challange/Problem		Indicator	CS01	CS02	CS03a	CS03b	CS04	CS05	CS06a	CS06b	CS07	CS08	CS09	CS10	CS11	CS12	CS13	CS14
*Water retention **		Soil moisture (surface and subsurface)	3			2									3	3		
		Surface runoff	1			3								1	1	2		
		Water distribution in the catchment				4							3	4		2		
		Discharge at the outlet	2			5							1		3	4		
		Groundwater level/depth				2										5		
		Soil temperature				2									3			
		Drainage outflow																
		Water harvesting																
Flooding – Improve resilience towards adverse events		Timing of flooding				3									2			
		Frequency of flooding				4							1		4	3		
		Duration of flooding				2									5			
		Intensity of flooding				4							1	3	4	3		
Drought – Improve resilience towards adverse events		Timing of drought				2							1		2			
		Frequency of drought				2							1		1			
		Duration of drought				3							1			1		
*Water quality**	*River/streams (at the outlet):*	Suspended sediment concentration and loads				1							1	2	5	3		
		Nutrient's concentration and loads	1			1							2	2				
	Surface runoff:	Suspended sediment concentration and loads	1															
		Nutrient's concentration and loads																
	Groundwater:	Nutrient's concentration and loads																
	Drainage water:	Nutrient's concentration and loads																
*Other**		Soil erosion	2			1								1	1	2		
		Crop production	2			1								1	3	4		
		Biomass yield				4							1		5			
Addiational - added to the shortlisted EPI by CS team		Drought severity/intensity				3							5					
		Flodded area																

Tabell 13 First feedback from 2nd MARG meeting about most relevant/tailored socio-economic indicators at the farm scale. Ranking ranges from #1 –most votes (most important) to #5 – lest votes (least important).

Challange/Problem	Indicator	CS01	CS02	CS03a	CS03b	CS04	CS05	CS06a	CS06b	CS07	CS08	CS09	CS10	CS11	CS12	CS13	CS14
Economic convenience of water/nutrienst management solutions	Implementation costs											1	2		2		
	Maintenance/operating/management costs	2			2							1	2	1	1		
Economic sustainability of farming activities	Total output value											1	1				
	Gross margin											1			3		
	Factor productivity														4		
	Gross or net value added				5									2	3		
Quality of landscape and natural resources	Land use intensity														4		
	Total land economic score																
	Soil quality improvement														4		
	Water quality improvement														2		
	Air quality improvement																
	Value of C sequestration																
	Value of avoided CO_2 emissions																
	Greater local economic activity																
Quality of life in urban and rural areas	Increased/decreased environmental or disaster risk				1									3	5		
	Increased/decreased vulnerability to climate change				1								4	3	5		
	Value of reduced flood damage and hazard				1							2	3	3	5		
Additional - added to the shortlisted SPI by CS team	Product diversity																
	Opportunity costs																
	Grain equivalent of overall harvest	1															

Tabell 14: First feedback from 2nd MARG meeting about most relevant/tailored socio-economic indicators at the catchment scale. Ranking ranges from #1 –most votes (most important) to #5 – lest votes (least important).

Challange/Problem	Indicator	CS01	CS02	CS03a	CS03b	CS04	CS05	CS06a	CS06b	CS07	CS08	CS09	CS10	CS11	CS12	CS13	CS14
Economic convenience of water/nutrienst management solutions	Implementation costs											2	1		3		
	Maintenance/operating/management costs				2							2	2	1	2		
Economic sustainability of farming activities	Total output value											1					
	Gross margin																
	Factor productivity																
	Gross or net value added				4									5			
Quality of landscape and natural resources	Land use intensity												1				
	Total land economic score																
	Soil quality improvement														3		
	Water quality improvement											4			1		
	Air quality improvement																
	Value of C sequestration																
	Value of avoided CO_2 emissions																
	Greater local economic activity												1				
Quality of life in urban and rural areas	Increased/decreased environmental or disaster risk				1							3		4	4		
	Increased/decreased vulnerability to climate change				1								3	2	4		
	Value of reduced flood damage and hazard				1							3			5		
Additional - added to the shortlisted SPI by CS team	Grain equivalent of overall harvest	1															
	Nr of landscape elem. and their distribution	2															

The analysis of the feedback from CS MARG members is challenging, both in terms of the timing of the 2nd MARG meeting, but also regarding the diversity of first responses. Even though the aggregation of the 2nd MARG feedbacks is not yet achievable, the examples presented here provide valuable hints to all CS how to handle further communication within the case studies, e.g. what are the most important issues that stakeholders want to hear and discuss about, etc. This knowledge will support both the internal project communication between CS and modellers (WP4), assist the case study specific modelling and optimisation tasks (WP4 and WP5), and foster the communication of the project results outside of the project consortium, which is also of advantage for the OPTAIN Learning Environment (WP7).

6. Final statement and Outlook

The aim of tailored, case-specific, Performance Indicators (PI) is to support the harmonized approach of OPTAIN by establishing a common language across project members and activities, to favour the understanding and the comparison of modelling results across case study sites (WP4 and WP5), as well as to facilitate the knowledge sharing with stakeholders and the wider dissemination of project results (WP7). This will increase the current knowledge and characterization of selected NSWRMs and contribute to add further details to document them into existing platforms (see task/deliverable 2.1).

The involvement of case study teams and MARG members in a process of selecting and tailoring the most relevant and understandable performance indicators for each case study is crucial to set a common base for mutual understanding and effective communication between all actors, including researchers. Moreover, by involving partners across the WPs (WP3, WP4, WP5) early in the process, all data needs have been communicated early within the project, which provides the baseline to further develop the tailored indicators into performance indicators (adding the direction and magnitude of change).

Further work, related to the performance indicators, will include:

- Further specification of "common indicators across CS" (Table 10, section 5.2)
- Specification of indicators covering floods and drought issues – further cooperation with WP4 and WP5 (sections 5.2.1 and 5.2.2)
- Gathering and further analysing the feedback from 2nd MARG meeting (section 5.3).

This will be done as integral part of WP4, WP5 and WP7.

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Annex#1: Description of shortlisted indicators, to be used as EPIs

Problem to address/	Indicators		What to measure/model?	Scale of relevance	Model input/ output	
	Parameter	Direction of change			Field scale	Catchment scale
Water retention in the catchment	Soil moisture (surface and/or subsurface)	↓ or ↑	Surface soil moisture[m^3/m^3]: seasonal $\Theta_{average}$, Θ_{min}, Θ_{max}	Field & Catchment	H; SP; CS;	SWAT+
		↓ or ↑	Sub-surface soil moisture [m^3/m^3] seasonal $\Theta_{average}$, Θ_{min}, Θ_{max}	Field & Catchment	H; SP; CS;	SWAT+
	Surface runoff	↓ or ↑	Surface runoff [mm/season], [mm/year]	Field & Catchment	H; SP;	SWAT+
	Soil erosion	↓	Soil loss per ha of agricultural land [kg/ha/year]	Field & Catchment	H;	SWAT
	Water distribution in the catchment		Water balance elements for different spatial units [m^3/year]	Catchment		SWAT+
	Discharge	↓ or ↑	Yearly discharge at the outlet of the catchment, presented in two ways: - Discharge at the outlet, Q_{annual} [m^3] - Q_{max}/Q_{min} - to reflect on changes in time	Catchment		SWAT
	Groundwater level/depth	↓ or ↑	- In selected locations [m] - Average in the catchment [m]	Field & Catchment	H; SP; CS;	SWAT
	Soil temperature	↓ or ↑	Soil temperature at different depths [°C]	Field & Catchment	H; SP; CS;	SWAT+
	Drainage outflow	↓ or ↑	Flow [mm/season]; [mm/year]	Field & Catchment	H; SP;	SWAT+
	Water harvesting	↑	Collection of surface runoff for different spatial units [m^3/year]	Catchment		SWAT+
Flooding – Improve resilience towards adverse events	Timing of flooding		Start date and end date (dd/mm/yyyy)	(Field &) Catchment		Possible to extract
	Frequency of flooding	↓	Nr of flooding events	(Field &) Catchment		Possible to extract
	Duration of flooding	↓	Nr of days when production area was flooded	(Field &) Catchment		Possible to extract
	Flooding intensity	↓	For example (after Wang et al. 2015): - peak flows (annual maximum floodwater discharge); - maximum water level (floodwater height in a river); - maximum daily volume (maximum amount of water recorded within the first 24 h of a flood event); - maximum 3 days volume (maximum volume of water within 72 h);	(Field &) Catchment		Possible to extract

			- total volume of floodwater (volume of floodwater that inundates the floodplain).			
Drought – Improve resilience towards adverse events	Timing of drought	↓	Start date and end date [dd/mm/yyyy]	Field & Catchment	Possible to extract	Possible to extract
	Frequency of drought	↓	Nr of drought periods	Field & Catchment	Possible to extract	Possible to extract
	Duration of drought	↓	Nr of days with drought conditions	Field & Catchment	Possible to extract	Possible to extract
Water quality	Stream/river	↑	Concentration and loads of suspended sediment in the river (outflow from the catchment); [g/L], [kg/ha/year]	Catchment		SWAT+
			Phosphorus concentration and loads at the outflow from the catchment; [g/L], [kg/ha/year]	Catchment		SWAT+
			Nitrogen concentration and loads at the outflow from the catchment (TN, NO3, etc); [g/L], [kg/ha/year]	Catchment		SWAT+
	Surface runoff	↑	Suspended sediment and nutrient concentration in the surface runoff; [g/L]	Field & Catchment	H	??
	Subsurface:		Suspended sediment and nutrient concentration in the surface runoff; [g/L]	Field & Catchment	H	??
	Ground water quality	↑	Suspended nutrient concentration in groundwater; [g/L]	Field & Catchment		
	Water from drainage system	↑	Suspended sediment and nutrient concentrations and loads in the runoff from drainage system; [g/L], [kg/ha/year]	Field & Catchment	H; SP	??
Other	Soil erosion	↓	Soil loss per ha of agricultural land [kg/ha/year]	Field & Catchment		
	Crop production	↑	Yield [t/ha/year] **Assuming continuation of current crop type as a main crop production*	Field & Catchment	H; SP; CS	SWAT+
	Fresh /dry biomass yield	↑	Yield [t/ha/year] **Assuming continuation of current crop type as a main crop production*	Field & Catchment		
	Nutrient loss	↓	Ratio of nutrient loss from the field and nutrient input to the field [-]	Field & Catchment	SP;	SWAT+

H – Hydrus; SP- SWAP; CS – CropSys

Annex#2 Description of shortlisted indicators to be used as SPIs

Challenge-driven indicators	Brief description	Unit of measure	Scale of relevance
Implementation costs	Costs sustained for the material, equipment and infrastructure to realize a NSWRM	Unit cost, depending on the NSWRM (€/m, €/ha, €/m3)	Farm, catchment
Maintenance/operating/management costs	Annual costs incurred for maintaining existing or new assets and measures (or their combination) in good functioning order until the end of their useful life, or to keep a measure/facility running	Unit cost, depending on the NSWRM (€/m, €/ha, €/m^3)	Farm, catchment
Total output value	Weighted quantity aggregate of agricultural and/or forestry marketable production obtained from the current or alternative land uses	€/ha or €/t output	Farm, catchment
Gross margin	The gross margin of agricultural production equals the accounting for crops and other agricultural products at diverse territorial units, under different use of production factors and technical means	€/ha or €/t output	Farm, (catchment)
Factor productivity	Ratio of gross outputs to single inputs to denote the input use efficiency of agricultural/forestry farms or systems for crop production	Ratio	Farm, (catchment)
Gross or net value added	Difference at basic prices between the value of output and the value of intermediate inputs	€/ha or €/t output	Farm, (catchment)
Land use intensity	Amount of economic output per existing areal unit of agricultural/forestry land use.	€/ha	Farm, catchment
Total land economic score	Net Present Value of marketed goods (and services) from the landscape for a given land use pattern	€/ha	Farm, catchment
Soil quality improvement	Soil quality improvement compared to a baseline scenario, owing to the capacity of newly implemented or restored NSWRMs to enhance nutrient retention in soils, compensate/mitigate run-off and sedimentation.	Unit value, tbd	Farm, catchment

Water quality improvement	Water quality improvement compared to a baseline scenario, owing to the capacity of newly implemented or restored NSWRMs to compensate/mitigate the contamination of waters from pollutants.	Unit value, tbd	Farm, catchment
Air quality improvement	Air quality improvement compared to a baseline scenario owing to the capacity of plant material to uptake a number of pollutants during its growing season.	Unit value, tbd	Farm, (catchment)
Value of C sequestration	Direct carbon sequestration of plant material and reduced CO_2 emissions (compared to a baseline scenario) owing to the presence of NSWRMs	Unit value, tbd	Farm, catchment
Value of avoided CO_2 emissions			(Farm) catchment
Greater local economic activity	Enforcement of local economic activities in rural and agricultural areas other than agriculture owing to the implementation or restoration of NSWRMs	Unit value, tbd	(Farm) catchment
Increased/decreased environmental or disaster risk	(Socio-)economic benefits (or costs) that may result from impacts on resource, environment and society from adopting (or not) NSWRMs	Unit value, tbd	(Farm) catchment
Value of reduced flood damage and hazard			(Farm) catchment
Increased/decreased vulnerability to climate change	Socio-economic benefits (or costs) that may result from impacts on resource, environment and society from adopting (or not) NSWRMs and affecting their resilience to climate change effects.	Unit value, tbd	(Farm) catchment

Annex#3: Survey among CS teams

The survey sent to Case Study Teams as a part of the process of tailoring and prioritising EPIs and SPIs

This small request is coming in connection with Task 2.2 and in preparation for the 2nd MARG meeting. We want to use this survey as a first step to "Tailoring and Adapting the performance indicators (EPI and SPI) to the Case Study needs". This is **also a good start when preparing for the 2nd MARG meeting** (exercise #1), **where we advise to focus on pre-selected indicators** (and the pre-selection should be done by each the case study team)

Therefore, we ask **all Case Study Leaders** to fill in the table below. This is to get your opinion, feedback about the which are the "most important/commonly used" indicators

STEPS TO FOLLOW:

1. Scan through the "short list of EPI and SPI":
   https://nc.ufz.de/s/KA9Cr2bbtALGMHr?path=%2FWPs%20%26%20Tasks%2FWP2%2FStakeholder%20Involvment_%202ndMARG%2FMaterial%2F01_Lists%20of%20EPI%20and%20SPI
   and list the ones that are most relevant in your case study. NOTE: if you think of other indcicator(s), not listed, you can aslo add it to your list.

2. Rank the indicators (both EPI and SPI) by assigning a 'rank' to them, **where 1 is the most important and 5 is the least important**. NOTE: **you can have several indicators with the same "importance"/rank**

3. Additionally, **think of a group of 5-7 indicators (EPI and SPI separately) that should be considered in all study sites** - please include them in your list with comment "for all CS"

4. Send the excel document back to: dominika.krzeminska@nibio.no and federica.monaco@unimi.it

IMPORTANT:

The choice of indicators (mainly) depends on the Case Study problem/challenges and what is perceived important by the actors. Ideally, the Case Study challenge/problem should drive the identification of both measures (done within Task 2.1) and indicators (to be done here, within Task 2.2). Therefore we would like you to focus on **Case Study problem driven set of indicators.**

However, if you feel that **'problem driven indicators' do not fully reflect the effect of particular measure(s) selected for your Case Study feel** free to **include measure-specific indicators**, with clear annotation about it in the 'comment' column.

Case study number and name:

List of challenges in the Case Study:

1.
2.
3.
4.

List of measures selected in the Case Study (that target listed challenges):

1.
2.
3.
4.
5.
6.

Environmental performance indicators (EPI)						
Scale	**Field level**			**Catchment level**		
	Indicator	**Ranking**	**comments**	**Indicator**	**Ranking**	**comments**

Socio economical performance indicators (SPI)						
Scale	**Field level**			**Catchment level**		
	Indicator	**Ranking**	**comments**	**Indicator**	**Ranking**	**comments**

Annex#4: Guidelines for 2nd MARG meeting

OPTAIN

Optimal Strategies to Retain Water and Nutrients

2nd MARG meeting – guidelines

Tailoring and adjusting EPIs and SPIs and potential placement of measures

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March 2022

Foreword

The main purpose of this document is to provide a common, shared (and agreed) protocol for its use during the 2nd multi-actor reference groups (MARG) meeting at the 14 case study (CS) sites to **tailor and adjust** the proposed **environmental** (EPIs) **and socio-economic** (SPIs) **performance indicators** to case-specific conditions and selected relevant NSWRMs. It directly relates to OPTAIN ***Task 2.2 "Measures and indicators"*** and represents the related ***Milestone: "Common protocol for tailoring and adjusting indicators during workshops"*** (MS5, delivered m13 - September 2021).

This guideline is based on a methodology developed by the Centre for Development and Environment (CDE), University of Bern, Switzerland, as part of the EU FP6 project DESIRE (http://www.desire-project.eu). The corresponding original DESIRE guideline is available at https://www.wocat.net/fileadmin/user_upload/documents/DESIRE/GuidelinesPart3Selection.pdf and has been modified by NIBIO and UMIL to suit the needs of the EU FP7 project OPTAIN (https://www.optain.eu/).

Abbreviations

CS	Case study
CSL	Case study leader
EPIs	Environmental Performance Indicators
MARG	Multi-Actor Reference Group
NSWRMs	Natural Small Water Retention Measures
SPIs	Socio-Economic Performance Indicators
WP	Work Package

1. Introduction

1.1. WP2 involvement

WP2 has a particular interest in the MARG workshops provided in the first two years of the OPTAIN project. The first MARG meetings paid particular attention to the identification of current and potential NSWRMs; at the beginning of the second year of the project, stakeholder involvement is intended to cover and deepen the main aspects of NSWRMs addressed by WP2 as well as to enlarge the current relevant knowledge. The core topic of the **2nd MARG workshop** will be a more detailed discussion about measures and indicators, including first hypotheses on scenarios (i.e., NSWRMs combination and allocation) development. As such, the workshop will/shall consist of three main parts:

Part 1: Further discussion on measures (connected to Task 2.1)
Part 2: Tailoring and adjusting EPIs and SPIs (connected to Task 2.2)
Part 3: Starting scenario discussion (connected to Task 2.3)

In order to help and prepare CSL and/or MARG moderators for a fruitful meeting and knowledge co-creation, this document is meant to provide fit-for-purpose **guidelines for 2nd MARG workshop.**

1.2. Objectives of the MARGs

Together with local stakeholders, the 2nd MARG workshop aims to outline tailored lists of environmental (EPIs) and socio-economic (SPIs) indicators to be used in each case study, taking into account local context and main actors' perceptions. The workshop is intended to bridge the gap between scientists and practitioners in agricultural and water management sectors, by creating, sharing, and enforcing knowledge on the topics of interest. In particular, the following specific objectives will be pursued:

- related to indicators:
  - Introduce the MARG participants to the concept of *"indicators"*, especially as conceived in the OPTAIN project;
  - Illustrate the multiple impacts of best practices and other NSWRMs on natural capital and agricultural production systems;
  - Gain new or improve the knowledge on stakeholders' perceptions and expectations for NSWRMs, also based on their every-day-life and practical experiences;
  - Better understand the needs and the priorities of different categories of stakeholders in relation to water/nutrient management challenges and sustainability (from environmental, economic and social points of view) commitments.

- related to location of the measures:

- to discuss possible locations of selected NSWRMs within the given watershed;
- to verify/define structural, natural, and agricultural characteristics of the area as well as social conditions that must be considered for a possible measure allocation;
- to discuss possible combinations of different NSWRMs within the watershed.

2. Methodology

Likewise in the 1st MARG Workshop, the methodology to approach and organize the 2nd meeting is based on participatory principles (see *WP2_Guideline_OPTAIN_virtual_workshop_1*). The moderator of the workshop guides the group of participants through a series of consecutive steps that assist the stakeholders to voice and exchange their ideas on which indicators are most promising to be used at their site.

2.1. Workshop settings

Local teams should capitalize on the experience of the 1st MARG workshop (and/or other stakeholders engagement events) and adjust the suggested guidelines to minimize organizational difficulties and exploit stakeholders' involvement at the best. The document *WP2_Guideline_OPTAIN_virtual_workshop_1* can be consulted for general information and practical hints in this sense. Though, some other hints and key points are here recalled.

Scheduling. The 2nd MARG workshops shall be conducted in each of the 14 CS of the OPTAIN Project (note: one of the catchments covers to countries, meaning there will be 15 workshops organised). It was originally planned for the end of 2021. However, the timing was adjusted to fit other OPTAIN activities and now the 2nd MARG workshop is planned for spring 2022. Each local team is free to select the most suitable period to hold the meeting any time before summer 2022; nonetheless, we acknowledge that availability of participants (especially land users) is a driving force for the timing of MARGs workshop, and thus we encourage local organizers to carefully take this into account when scheduling the workshop.

Duration: We assume a duration of about 180 min for the complete 2nd MARG workshop (see also section "Schedule for the 2nd MARG workshop" below). The time needed for the workshop will differ in each case study, as this depends on the level of stakeholders' involvement in the project, their interest and active cooperation, their experience, attitudes and other specific circumstances. Each CSL can adapt workshop program and timing accordingly.

Venue: Experience shows that it is much easier to create a relaxed and trustful working atmosphere if the workshop takes place in the community itself, where local participants feel at home.

Reporting: The CSL and the research team of the CS share the responsibility for documenting the workshop results and writing a workshop report. Please note that the results of 2nd MARG Workshop will provide central input for WP2, WP4 and WP5. Therefore, a good documentation is important. Reports on the different parts of the workshop (part 1, 2, and 3) has to be produced and delivered to reference WP.

In particular, a summary report has to be submitted to:

- Dominika Krzeminska (Dominika.Krzeminska@nibio.no)
- Monaco Federica (federica.monaco@unimi.it)
- Tatenda Lemann (tatenda.lemann@unibe.ch)
- Petr Fučík (fucik.petr@vumop.cz)

A format for the English summary report is available at UFZ cloud

Requirements for moderators: The moderator of the meeting can be the CSL, someone from CS research team or an external moderator. At this stage of the project, the CSL or moderator of the 2nd MARG workshop, should

- have good knowledge of the CS and be familiar with local conditions (socio-cultural, bio-physical, land use, land degradation and conservation, etc.);
- have expert knowledge on the NSWRMs actually and potentially applied in CS;
- be familiar with the proposed lists of indicators;
- have a trustful relationship with involved stakeholder groups;
- know potential conflicts that can raise during the discussion and have some ideas how to deal with it.

Participants: Which stakeholders' groups have to be invited?

The group of participants is ideally composed of approximately 20 stakeholders, plus the moderator(s). Ideally, it would be expected to continue with participants from the 1st MARG Workshop. This is especially interesting for Part 1.

The discussion about indicators (prioritization/selection) is meant to be performed with all stakeholder categories/groups; henceforth, backgrounds and interests of workshop participants should be as diverse as possible to ensure that they reflect the various facets of sustainable land management decisions to be taken. A stronger focus should be given to ***local stakeholders*** (land users, farmers, representatives of local authorities, local NGOs), but other subjects based on individual case study interest ("***external stakeholders***") can also be involved (i.e., researchers and development professionals from NGOs/GOs working in rural environments, with various degrees of professional expertise on environmental and development issues).

2.2. About this guideline/protocol

The present protocol/guideline is a working instrument for use in moderating the 2nd MARG workshop within the OPTAIN project.

The protocol is designed **to support the moderators** in guiding the processes of mutual reflection and exchange by workshop participants. At the same time, it is a baseline document to be used in the self-training of the meeting moderators (CSL or external moderators).

The guideline suggests a **basic structure for the workshop as a whole** and a series of consecutive steps that will help to reach the workshop objectives. It mainly deals with the technical steps to be performed to reach a group decision, rather than looking into content-specific issues.

Since the workshop builds on the discussions started at the 1st MARG event, it would be ideal to have the same stakeholders participating in both of the workshops. The group of participants is ideally composed of approximately 20 stakeholders, plus the moderator(s).

Remember: Log this workshop in the WP1 activity log 😊

Schedule for the 2nd MARG workshop

Preparations for 2nd MARG (to be made by the moderators): 0,5 day

- Methodological preparations
- Preparation of the workshop venue

Program components	Duration (min)
Introduction to the workshop	15
Part 1: More about measures (Task 2.1)	25
Part 2: Working with indicators (Task 2.2)	60
Part 3: Scenario discussion (Task 2.3)	60-90
Summary and closing	15
Total:	135-165

Next steps:

Use the outcomes in:
- WP2 Task 2.3
- WP4 Task 4.5 (development of economic model and objective functions definition)
- WP5
- WP7

3. Preparatory work

3.1. Moderators and materials

The moderator needs to be prepared for facilitating the stakeholder workshop. Besides organisational preparations it is important to take enough time to get familiar with the workshop guidelines, with the local context, and think about how you are going to address the topical issues of the workshop.

Following documents should be available to local teams before the workshop:

- List of selected NSWRMs in own case study site (MS4. Description of all relevant NSWRMs including a pre-selection of most promising NSWRMS - available at OPTAIN cloud);
- WOCAT documentations of the measures (a draft version of each selected measure);
- (Latest) Lists of candidate indicators (MS5. Initial list of indicators - available at OPTAIN cloud)

A suggested time of one or two days may have to be spent for preparation of the workshop. Make sure you have the support of some of your case study site team before as well as during the workshop.

3.2. Methodological preparations for the workshop

Read the workshop guidelines and try to envision the workshop procedure step by step.

Think about how each step is related to the objectives of the workshop, and about the expected results of each step.

Think about material that might help you to introduce a step, or to explain or illustrate specific aspects. The 2nd MARG Workshop is a follow-up to the first one (1st MARG workshop) and will build on discussions and results held at that time. Therefore, some visualisations of the 1st MARG workshop outcome will be used as a starting point.

Consider preparing some visualisation materials (slides, posters, photos, leaflets, etc.) showing:

- OPTAIN general flyer and Case study specific flyer
- Case study area (photos from field visits, photos of implemented measures, etc.)
- Challenges identified in the case study area
- Outline the importance of stakeholder's feedback within OPTAIN

Get familiar with NSWRMs listed as most relevant in the case study area (output from 1st MARG, and Task 2.1)

Prepare posters and post-its (in case of physical meeting) or on-line white board (in case of online meeting):

- poster for the group work under Step 2 – see Annex 1
- pre-selected lists of indicators

Make the necessary preparations in the workshop venue:

- Install a laptop, projector, and a colour printer, and check whether the light can be dimmed such that the projection is clear and readable.
- Check whether enough chairs and tables are available, also enough power outlets and extension cables, etc.
- Make sure that working material is available such as whiteboard(s), paper sheets, tape, markers, (red dot) voting stickers, scissor, glue, pins, etc.

Please note: The workshop relies on all materials used and produced being visible to all stakeholders all of the time. Make sure that the room you are using has enough wall space to hang the posters, or – if this is not the case – bring sufficient poster boards.

3.3. WP1 related issues

Survey questions to address perspectives on meaningful engagement

The role of WP1 in the OPTAIN project is to facilitate establishment of multi-actor reference groups (MARG) for the lifetime of OPTAIN, *by providing for meaningful engagement.* An important part of the OPTAIN project approach are co-creation processes by means of involving stakeholder categories during relevant and important steps of the project cycle. It can be argued that the degree that this approach will be successful will depend on whether engagement processes are seen to be meaningful, by the MARG stakeholder members, and by the project researchers.

WP1 has in line with this objective developed a short questionnaire to address the degree that MARG participants experience the MARG workshops as meaningful. We also add a question to get feedback on preferences for virtual or physical meetings. See this questionnaire in Annex 4. This questionnaire needs to be translated and provided to the MARG members in the beginning of workshop, to be collected after the workshop.

4. Workshop protocol

Introduction to the workshop

Objectives	- Inform participants on the objectives and programme of the workshop - Prepare the ground for a good working atmosphere	
Duration	1. Welcome participants 2. Introduction to OPTAIN 2nd MARG Workshop 3. Workshop objectives and programme 4. "Rules of the game" and intended working spirit	c.a. 5 min c.a. 4 min c.a. 4 min c.a. 2 min
	Total	**c.a. 15 min**
Preparations and material required	- Brief presentation on where 2nd MARG is as part of the OPTAIN project - 2nd MARG Workshop programme	
Methodology	Plenary session	
Procedure	1. The moderator welcomes participants, introduces himself/herself and asks participants to briefly introduce themselves (do not spend too much time on this as the majority of participants is expected to be the same as in 1st MARG workshop). 2. Briefly recall the OPTAIN project and its objectives. Repeat the importance of MARG for the project. Show where information on the project can be found. Explain the purpose of the 2nd MARG workshop within the whole programme. 3. Present the workshop programme and the objectives. 4. For a good working atmosphere, recall the 'rules of the game' (e.g., rules of communication, commitment to attend, etc.).	
Expected results	- The participants are clear about objectives, the procedure and programme of the workshop. - Agreement upon 'rules of the game'	

Part 1: More about measures

Preparations to be made before the workshop (optionaly)	- Case study posters (e.g. the posters of the Leipzig and Warsaw plenary meetings) - Photos from the case studies showing implemented measures - Print WOCAT summaries (draft of published) of your documented NSWRMs to distribute or show to stakeholders (depending on documentation language)

Objectives	- To recall and refresh main discussions and results from 1st MARG workshop - To present the selected NSWRMs including the selection criteria - To highlight available and missing information for the selected NSWRMs	
Duration	1. Recall main results from 1st MARG meeting 2. Presentation of selected NSWRMs including selection criteria 3. Discussion of available and missing information	15 min 5 min 5 min
	Total	**c.a.25 min**
Preparations	Presentation showing main results and impressions from 1st MARG meeting: - list main challenges in the case study area - list the measures discussed with MARG - indicate the measures selected as most promising in local context by MARG - indicate the measures selected to be prioritised by OPTAIN including the selection criteria (stakeholders preference, model implementation, expert judgment, experience within CS, etc) - indicate information missing for the WOCAT documentation **NOTE:** during the workshop we can discuss all measure relevant for case study, depending on time and willingness of the stakeholders	
Methodology	Plenary session	
Procedure	1. The moderator recalls the main findings and results from the 1st MARG meeting exercises. Make clear what are the main challenges in the area and what are the existing and potential NSWRM for the case study. 2. Present the selected NSWRMs and the reason for the selection (prioritisation based on the interests of stakeholders, Case Study leader, or OPTAIN project) 3. To keep the stakeholders updated and included, briefly introduce what you are currently doing: i. where you stand with the documentation of NSWRMs and what kind of information is	

	missing; ii. talk about data collection/model set-up/policy survey etc. Optionally the WOCAT summary (draft or published) of the NSWRMs can be shared with the participants.
Expected results	- The participants are clear about main challenges in the case study area - The participants are clear about NSWRM to be prioritize by OPTIAN in the case study area - Identified sources of missing information for the documentation of the selected NSWRMs

Part 2: Tailoring and adjusting EPI and SPI

Preparations to be made before the workshop	- Posters/ Flipchart (physical of virtual) (Annex 1) must be prepared before the workshop. - Make a **pre-selection of indicators** considering your local context. Select c.a 10 EPI and c.a 10 SPI to work only with the most relevant ones, and thus facilitate fruitful the discussion among stakeholders. - Ask researchers involved in Case Study to rank/prioritise the indicators in advance (for comparison and discussion) **Note:** please be sure to use the most updated version of "Initial list of indicators" - Moderator needs to get familiar with terminology connected to indicators (Annex 2) - In case of a virtual meeting, consider the need to arrange multiple links for the group work (each group will participate in a different session, with moderator(s) switching between them) - Decide about the format of exercise, that fit best to your CS MARG. The form of the exercise must be decided in each CS depending on the experience/feedback from the 1st MARG meeting. There are two options:

Objectives	- Agree on set of indicators relevant for local context (local problems and challenges, current NSWRMs and potential solutions) - Assign a hierarchy to the indicators, depending on the stakeholders group.	
Duration	1. Introduction, definition of "*indicator*" 2. Presentation of the exercise #1/group work and its objectives 2. Exercise # 1 3. Discussion and summary	5 min 10 min 30 min 15 min
	Total	**c.a. 60 min**
Materials (optionally)	- Posters/Flipchart (physical or virtual) with the list of challenges (Annex1) and selected/relevant NSWRMs - Initial lists of indicators (Annex3)	
Methodology	Plenary & (group) work/exercise	
Procedure	1. Introduction (plenary): presentation explaining the concept and the idea of "*indicators*" within OPTAIN. It should be clear that indicators will help us to see/evaluate/estimate the "visual/real" effect of measures and that they will serve for easier communication of modelling results.	

2. Presentation of exercise # 1 (plenary): introduction by CSL/moderator to the group work and its objectives. Participants will be explained what the group work consists of and instructed on how to provide their inputs (also based on the option chosen by organizers to collect target information)

3. Exercise #1 (parallel sessions or plenary discussion):

The setting may depend on the number of workshop participants, number of stakeholders representing different groups, team energy and willingness to share the opinion. The moderator can choose ether to make it a group work or plenary session)

Preparation (in charge of CSL/moderator):

1. Group work (*if group work is chosen*)

Form few small groups of stakeholders (ideally 2-4 groups with 3-5 stakeholders each, but the number and the dimension may vary depending on the number of participants and OPTAIN researchers). Depending on the number of stakeholders and number of represented groups, try to get two different perspectives on indicators: (i) indicators important for the local context and (ii) indicators important at a larger scale.

2. Plenary discussion

Open discussion with all the participants

Tailoring/Adjusting the indicators:

- Distribute the posters among the participants
- Ask the groups/plenary to think/discuss about the connection between NSWRMs and challenges in the case study area. Use poster as starting point for discussion. Ask participates to draw the connections between measures and challenges.
- Ask groups/individuals to think of possible indicators showing the effect of listed NSWRMs on natural capital and agricultural production systems. Ask participants to fill in the table in the posters.

Note: *you can ask/list some questions to stimulate the discussion:*

- *How would you describe the effect of (specific)measures?*
- *What is that you observe at the field/catchment/regional level?*
- *How do you understand the term "indicator"?*
- *Try to come up with you list of indicators?*

	- Distribute the initial lists of indicators adjusted by CSL. - Ask groups/individuals to reflect on the lists submitted and give them the possibility to complete the lists with other/new indicators. - Ask the groups to rank/prioritise set of indicators developed. Separate ranking should be done for EPIs and SPIs. We are interested to know the 5-10 most important indicators in each category. ***Note:*** *you can decide how to do the ranking based on the experience from 1st MARG workshop. For example:* *a) If a good discussion within the groups is expected, an agreement on the ranking might be easily and "directly" achievable* *b) It is possible to ask everyone in the group to make their own ranking and then combine it in one. E.g.: You can give participants 5 "votes" in each category and count the votes.* 4. Discussion and summary (plenary): moderator ask groups to reflect about the exercise and report their results. Moderator presents the rank/prioritisation of indicators done within case study research group (if available). Explain that we will try to use selected indicators in communicating of project modelling results for more "user friendly" communication.
Expected results	- The participants are clear of the role of indicators - We have a list of indicators relevant for most important challenges in case study area and addressing NSWRMs - Identified the most important indicators for different stakeholder categories

Part 3: Introduction of scenarios and discussion

Preparations to be made before the workshop	- **Poster/slides** with overview of all NSWRMs for the CS (can be slides from Part 1, priority ranking from 1st MARG workshop) - **List of NSWRM** selected to be modelled and documented within the case study - For each NSWRM you are planning to model (only for those!), prepare **printouts** with bullet point briefly explaining how you mapped/plan to map the potential areas of implementation (e.g. data sources, bio-physical and legal criteria, GIS workflow) – NOTE: this is for group exercise, it should be possible to be presented and visible for ca. 4 people during the discussion "around the table" – see Annex 2 - Prepare a poster(s) with a **map(s)** for the selected NSWRMs and their possible allocations in the case study catchment (guidelines in Annex 3)

Objectives	Objective of this part are: - to discuss possible locations of selected NSWRMs within the given watershed (Case Studies). - to verify/define structural, natural and agricultural characteristics of the area as well as social conditions that must be considered for a possible measure allocation. - to discuss possible combinations of different NSWRMs within the watershed. The final maps are the basis for stakeholder-based scenarios of NSWRM allocations and combinations to be used in WP4 and WP5.	
Duration	1. Introduction (Plenary) 2. Exercise #2 (for the pre-selected NSWRMs) (Group work) 3. Discussion and summary (Plenary)	10 min 40-60 min 10-20- min
	Total	**60-90 min**
Methodology	Plenary & work/exercise (discussion)	
Procedure	**1. Introduction** The presentation should include: - briefly summary of the outputs from Part I (pre-selection of NSWRMs by MARG and by OPTAIN) - Importance of looking at the catchment scale when implementing the measures - The need to discuss possible location of measures in the catchment	

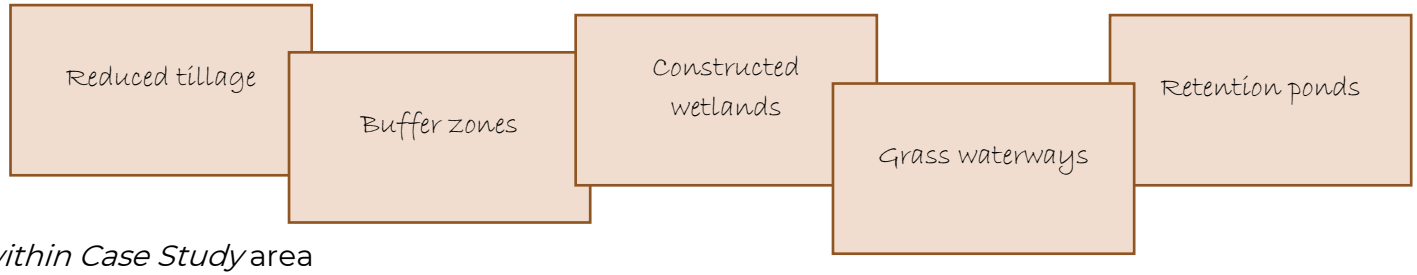
	- Introduction to Exercises#2 **2. Exercise #2** <u>Create the working groups:</u> Each group should have in minimum 4 members. If there are more than 8 participants, form two (or more) groups with a similar distribution of stakeholder (groups should be defined in advance). Each group needs to have a moderator who stimulates the discussion and takes notes/records. Each group only has to discuss 2-3 measures (each group can have different measures to save the time). <u>Group discussions:</u> - For each measure, briefly explain how you mapped/plan to map the potential areas of implementation (e.g. data sources, bio-physical and legal criteria, GIS workflow) – use the prepared printouts with bullet point showing the steps to follow. NOTE: Suggestion for presentation (ppt or printouts): - point out some features on the map. Give example of possible location or barriers for measures based on your current experience. - it may be helpful to have the digital maps (or e.g. Google Earth ready) ready to zoom in if you need to see more details during the discussions. - ask for feedback of the mapping approach o Are the data sources and criteria suitable? o What else should have been considered? - Present your maps (see annex XXX) and get the stakeholders perspective on where the location of measures is possible (but also where it is not possible at all). o Are there important/suitable locations they know about that have not been captured by the mapping approach? o Which areas (suggested by your mapping approach) are not relevant based on their knowledge? o Who can be contacted later for further questions/confirmation of the mapping? <u>3. Discussion and summary (plenary)</u> - Summarize the results/discussion for each measure. (suggestions for an improved mapping approach; map discussions) - Ask the stakeholders if they see possible combinations/synergies of measures or measures which exclude each other
Expected results	The expected outcome that should be extracted by moderators/Case Study leaders from the exercise and discussions:

	- agreement on the methodology for mapping the potential locations for each (type of) measure - maps with marked areas where it is possible/effective/doable to locate the measures - marked areas where placement of measures is not possible due to some specific conditions and comments about these conditions

Annex 1 – for exercise #1

Example o of poster/flipchart for Group Work in Part 2: Tailoring and adjusting EPI and SPI

Selected measures



Challenges within Case Study area

Indicators:

EPI	Field scale	Catchment scale

SPI	Field scale	Catchment scale

Annex 2 – for Exercise #2

Example of printouts explaining the briefly explaining how you mapped/plan to map the potential areas of implementation.

NOTE: consul it with modellers within your case study. There were some discussions within modelling WP/tasks about how to map the potential location of the measures.

Reduced tillage – no-tillage in autumn
Procedure to look for location of the measure: - look at the DEM map - look at the fields map - look at the land use map → no-till measures can be implemented on every crop field with a slope >5-10% Comments from the group: - - - -

Grassed waterways
Procedure to look for location of the measure: - look at soil erosion risk map - look at the land use map → grassed waterways can be established in the location of possible gully erosion **Comments from the group:** - - -

Annex 3 – for Exercise #2

PREPARACTION OF THE MAP for map-based part of the Exercise #3

Step 0. Meet with the modelers in the case study

The modellers had already several discussions about creating the maps with possible location of the measures. See what the status is of creating such maps in your case study (refer to modellers meeting from February 2022 and do the "working document" that is under preparation within Task 2.3).

From there, to ways of actions are possible:

> CASE 1 – if you already have ready maps with potential location of your measures use them!! And go to directly to → **Step 2**
>
> CASE 2- if you do not have yet ready maps with potential location of your measures start with → **Step 1**

Step 1: Map preparation

- think of the level of details needed for stakeholders to define possible locations and barriers of the measures in your catchment, depending on NSWRM selected for your Case Study
- try to keep the map(s) as simple as possible
- consider using different map for different measures, as the different measures may need different information to be included in the map (different constrains, regulations, etc.)
- consider preparing the map in the size "big enough" for the needed information to be visible. Note that in some cases it could be useful to zoom to the areas of greased interest and maybe not need to have a map of whole catchment.

NOTE: try to think of keeping the map(s) as simple as possible while still having necessary information included. For example, if DEM information is crucial/needed, please think of the best way to include this information: shadowing, contour lines.

Example:

the map for discussion about location of **any kind of grass covered areas**
(buffer zones, grassed waterways, grass cover in the flood prone areas, etc.):

Basic map:

- Map of the catchment (min A0), with orthophoto or land use background.
- Location of rivers and streams, selected settlements

- *(optional)*Location of current measures (depending on what is available – better location can be specified with stakeholders during the workshop
- *(optional)*Location of potential barriers for the implementation of measures

Specific map (depending on the measures and the available material within case studies)

- Location of gullies/areas prone to gully erosion / sheet erosion categorisation (soil erosion maps/classes) – to look at the location of grassed waterways
- Location of areas prone to flooding – to look at the potential location of grass cover on flood prone areas
- (optional) Field blocks
- (optional) basic DEM (e.g. 2 m)

Other maps that can be of useful DEPENDING on the Case Study setup (specific condition in the case study AND measures to be discussed):

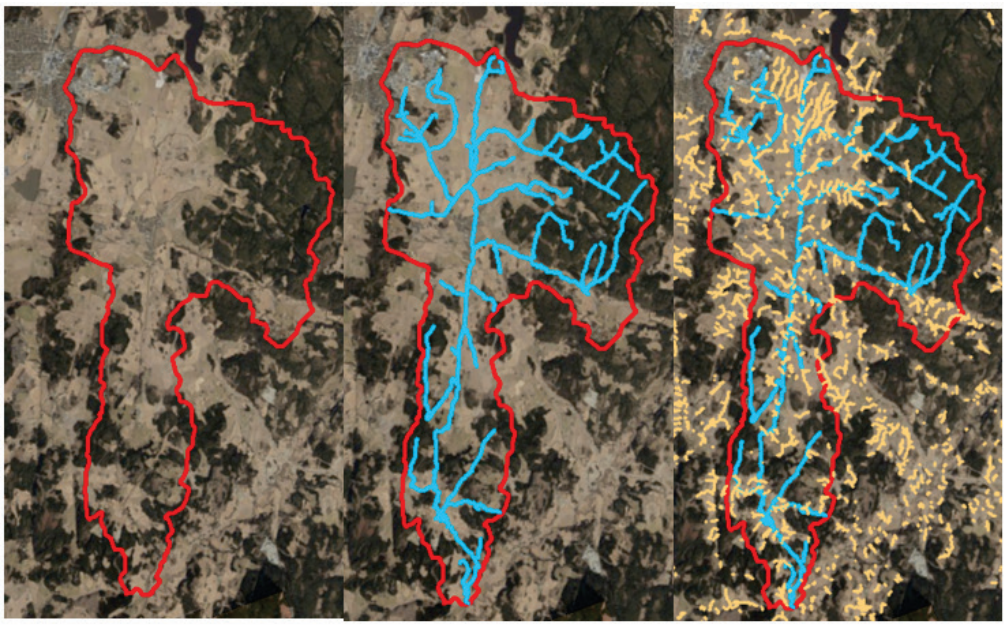
- Generalized soil map (if related to the specific measures, e.g. hydrological groups etc.) -
- Land owner / user map (or as an example for a part of the catchment)
- Allocation of Land drainage / Irrigation
- Nature protection areas
- Drinking water protection zones
- 

Figure 1. Example maps from GIS maps for Kråkstad catchment

Step 2: Material preparation

a. Print map(s) at in the large format (e.g. A0) for the discussion with stakeholders.

b. Print the maps in a small format (e.g. A3) for your notes and possible locations or barriers of measures.

c. Print some extra printouts with bullet point briefly explaining how you mapped/plan to map the potential areas of implementation (see Annex 2)

NOTE: From our experience it seems that farmers and local authorities know about the constraints. However, it is good to have them printed out, as a good reminder.

d. Prepare post it cards, markers, pins etc. for stakeholders to be able to make note and place them on the maps.

They should have all the tools to suggest the location of particular measures, be able to make a comment about particular location (i.e. problems, challenges, barriers etc.)

The concept of the map-based exercise is showed in Figure 2 and the photos from similar exercise done within Sabicas project are showed in Figure 3

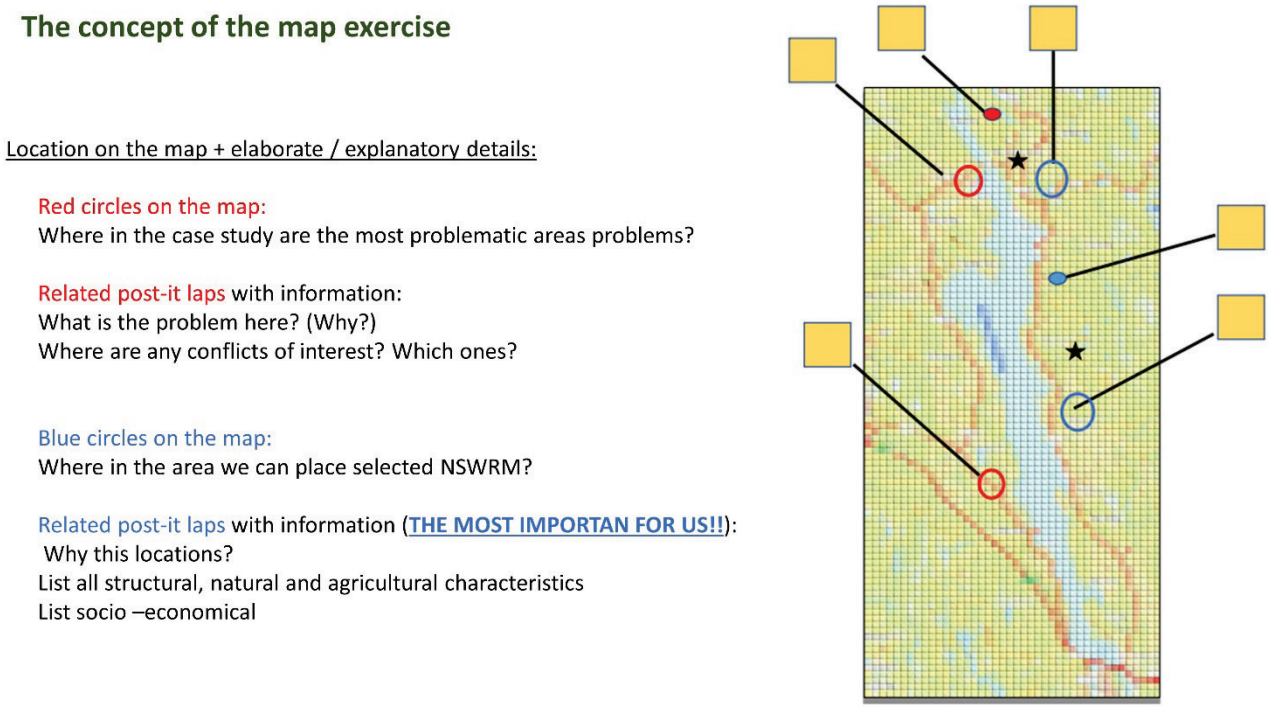


Figure 2: The concept of the map-based exercise
(Source: https://www.sabicas.no/_files/ugd/75a007_8f742bd4739a4402bc7c8f170d000578.pdf)

Figure 3: Some photos from similar meetings and discussions with stakeholders from SABICAS project (copied from https://www.sabicas.no/

Annex 4 – WP1: Survey questions to address perspectives on meaningful engagement

Attendants MARG workshops

Below we have included a few simple questions for monitoring participation in the project. We hope that you will fill in this questionnaire that will be collected after this meeting. The intention is to ask you to fill in these questions after every MARG workshop to monitor and evaluate development or changes in attendants perspectives.

Thank you from WP1 in the project.

1. Do you think that flooding, drought, nutrient runoff and/or erosion is a problem in your catchment?

	Very relevant	Somewhat relevant	Not relevant at all
Flooding			
Drought			
Nutrient runoff			
Erosion			

2. Is it useful for you to identify optimal measures for water retention and reduced runoff?

	Very relevant	Somewhat relevant	Not relevant at all
Water retention			
Reduced runoff			

3. Do you think the project can contribute to problem solving in your area?

Yes	To some degree	I don't know	No

4. Do you think the project will provide you with access to new information?

Yes	To some degree	I don't know	No

5. Do you think you can influence the project approach?

Yes	To some degree	I don't know	No

6. Do you think you will be able to contribute to the project objectives?

Yes	To some degree	I don't know	No

About virtual or physical meetings, what do you prefer?

- Highly prefer physical meetings .....
- A combination is good .....
- Virtual meetings is mostly preferred .....

- How many meetings have you attended? .....
- How many physical meetings?.....
- How many virtual meetings? .....

Date....., Place, Country.....

Are you a farmer?.....

Do you represent authorities (national, regional or local level)?.....

Or another role.....